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SMITHSONIAN CONTRIBUTIONS TO ANTHROPOLOGY • NUMBER 54

Contextualizing Museum Collections at the Smithsonian Institution

The Relevance of Collections-Based Research in the Twenty-First Century

Edited by
Maria M. Martinez,
Erin L. Sears, and Lauren E. Sieg

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ABSTRACT

Martinez, Maria M., Erin L. Sears, and Lauren E. Sieg, editors. Contextualizing Museum Collections at the Smithsonian Institution: The Relevance of Collections-Based Research in the Twenty-First Century. *Smithsonian Contributions to Anthropology*, number 54, viii + 208 pages, 65 figures, 16 tables, 2022. — "Old" museum collections are a valuable and sustainable resource for conducting archaeological investigation. In the past decade, a revitalization in collections-based research has occurred within the discipline of anthropology, more specifically within the subdiscipline of archaeology. This renewed interest stems from a variety of familiar and more recent trends in archaeology. The most substantial trends are the ongoing curation crisis, the lack of funding opportunities for large-scale excavation projects, evolving ethical standards, the return of anthropologists into museum settings, and academia finally allowing M.A. and Ph.D. theses to be based on existing collections. Additionally, archaeometric techniques have assisted in giving value to existing museum collections by creating original data sets for new interpretations. Collections-based research has many benefits compared to field research. The collections that are under the care of museums allow researchers to better contextualize field data from recent excavations, enable comparisons of broader sets of objects than can be obtained from excavations alone, and provide the opportunity to study rare objects that are encountered infrequently during field work. Research on collections generates object biographies that include provenance, manufacture, use, repairs, and detection of outright forgeries. Collections offer an opportunity for collaboration and engagement by community members and can lead to a repatriation of knowledge, if not a repatriation of the items themselves. This edited volume contributes a comprehensive approach to collections-based research using anthropological collections housed at the Smithsonian Institution's National Museum of the American Indian and National Museum of Natural History, Department of Anthropology. Additionally, the volume will serve as a pedagogical manual for conducting collections-based research within current museum milieus.

Cover image: Detail from Figure 1 (row 6) in the essay by Ostapkowicz et al.: petaloid stone celts from Mayaguana and New Providence, Bahamas. Photo by Joanna Ostapkowicz.

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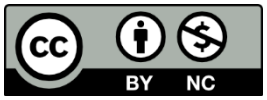

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Dedications

To all the Native and Indigenous peoples who have shown me new perspectives on the importance of archaeology.

—Maria M. Martinez

In appreciation of Dr. Lambertus van Zelst, former director of the Smithsonian Center for Materials Research and Education (currently the Smithsonian Museum Conservation Institute). For all his endeavors in bringing together archaeological sciences and technical studies in art history, and for his continued support of scholars exploring cultural property within a museum environment.

—Erin L. Sears

In appreciation to the collections for the multitude of stories they share and the connections they create, and in recognition of the community members, scholars, and artists who seek to understand them.

—Lauren Sieg

Contents

Acknowledgments

This publication grew out of a 2018 Society for American Archaeology conference session on collections-based research at the Smithsonian. The conference session was organized and chaired by Dr. Maria Martinez and Dr. Risa Diemond Arbolino of the National Museum of the American Indian (NMAI). Many people assisted with the planning and organization of the conference, and we would like to recognize Emily Kaplan (NMAI) for her assistance in identifying and corresponding with researchers. We thank the Society for American Archaeology for including this session in its program and for its continued advocacy of responsible and ethical collections-based research. The contributions in this volume offer just a glimpse of the recent and ongoing research on the archaeologically focused collections at the NMAI and National Museum of Natural History (NMNH). There was an enthusiastic response to the invitation to participate in the conference, and it was unfortunate that we could not include all of the outstanding scholarship because of the limitations on the session length. We regret that we were not able to accommodate all of the interested researchers and thank them for their willingness to present. We also want to recognize the following scholars, whose work made the session so inspiring and informative: Harriet "Rae" Beaubien, Klinton Burgio-Ericson, Kimberly Cullen Cobb, Allison Curley, Gareth Davies, Davide Domenici, Maria Galban, Jennifer Giaccai, Ainslie Harrison, Ellen Howe, Edward Jolie, Rosemary Joyce, Emily Kaplan, Alice Knaf, Vernon Knight, Joanna Ostapkowicz, Esther Rimer, Ann Rowe, Erin Sears, Alyson Thibodeau, and Cara Tremain.

Following the session, there were immediate calls for publication of the papers. We agreed that this was an important next step to share the research more widely. Not all of the presentations were available for inclusion in this volume, and their presence is sorely missed. Fortunately, other researchers generously agreed to fill in some of the missing gaps. We extend our deepest gratitude to all the contributors for offering their work to be included in this volume and for their patience throughout the editorial process. Because the holdings of the Smithsonian are so large, we do not (and could not) offer a comprehensive volume on the wide range of important research being done with the collections. Perhaps, the next volume will contribute new knowledge concerning the linguistic material in the archives, the research conducted by contemporary Native artists, and how digital access is changing relationships between Smithsonian staff and Indigenous communities.

Finally, this volume would not be possible without the work of the staff at the Smithsonian Institution Scholarly Press, NMAI, and NMNH. At the NMAI, the staff of the Collections Management, Archive Center, Collections Information, and Conservation

departments provided access to the collections and expertise on the holdings of the NMAI to the volume contributors. At the NMNH, the staffs of the Department of Anthropology Collections and National Anthropological Archives generously offered their assistance with access to the extensive collections at the NMNH and shared their equally extensive knowledge of them with the volume contributors. They are unsung heroes who care for the collections while simultaneously ensuring the Smithsonian fulfills its purpose of "the increase and diffusion of knowledge," and we thank them for their unceasing efforts. Most importantly, we also thank our reviewers for their thoughtful comments and Ginger Minkiewicz, Myka Bangert, Meredith McQuoid-Greason, and Tshawna Byerly of Smithsonian Institution Scholarly Press for making this publication possible.

Introduction

Maria M. Martinez,[1,2] Lauren Sieg,[3] and Erin L. Sears[4]*

As the Smithsonian Institution celebrates its dodransbicentennial (175th) anniversary in the midst of global crises (COVID-19, racial inequality, and climate change), its strategic planning is centered on race, equity, social justice, decolonization, Indigenization, truth telling, and reconciliation. Reckoning with our own past as an instrument of colonization and racialization is just one of many inward-facing responsibilities of the staff of the Smithsonian Institution (Smithsonian Institution, 2020a). The recommended actions related to collections research include "uncovering the origins of the Smithsonian's collections, research, and facilities through the lens of restorative history and decolonization" and publications that catalyze this type of work (Smithsonian Institution, 2020a:35). These efforts are part of a paradigm shift that took hold in many museums in the late twentieth century and are still ongoing (see Yellowhorn, 1996:27; Clifford, 1997; Deloria, 1988; Mithlo, 2004; Philips, 2005; Smith, 2006:276–298; Lonetree and Cobb, 2008; Boast, 2011; Lonetree, 2012; Ronan, 2014; Shannon, 2014; Colwell, 2017; Balachandran and McHugh, 2019; Chavez-Lamar, 2019; McMullen and Galban, 2020).

This moment of institutional reckoning about collections is an opportunity to discuss research at the Smithsonian Institution, particularly research involving anthropological collections. It has now been more than 20 years since the Smithsonian Institution Press (now the Smithsonian Institution Scholarly Press) published an edited volume concerning interpretations of anthropological holdings. In 1997, Amy Henderson and Adrienne Kaeppler compiled 12 essays that explored the custodial care of exhibiting objects that created "dilemmas" of meaning, memory, and representation (see also Karp and Lavine, 1991; Karp et al., 1992; Greene, 1996). A more recent publication in 2016, *Engaging Smithsonian Objects through Science, History, and the Arts*, edited by Mary Jo Arnoldi, examined the diversity and breadth of mostly nonanthropological collections at the Smithsonian to bridge the interpretation gap between different subject specialists (curators) and analytical techniques. Their work illustrates the multiple ways of knowing single objects and collections through interdisciplinary inquiry.

This volume seeks to put forth the recent studies of Indigenous archaeological heritage housed at the Smithsonian Institution's National Museum of the American Indian (NMAI) and National Museum of Natural History (NMNH) to explore significant questions about the past and present. We promote and advocate for collections-based research

[1] Amerind Foundation, Inc., Post Office Box 400, 2100 North Amerind Road, Dragoon, Arizona 85609, USA.

[2] Department of Anthropology, The University of Texas at Austin, 2201 Speedway Stop C3200, Austin, Texas 78712, USA.

[3] National Museum of the American Indian, Smithsonian Institution, 4220 Silver Hill Road, Suitland, Maryland 20746-2863, USA.

[4] Department of Anthropology, National Museum of Natural History, Smithsonian Institution, Post Office Box 37012, MCR 010, Room 153, Washington, D.C. 20013-7012, USA.

* Correspondence: mmar@utexas.edu

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and collections access. Contributors have focused on the tangible cultural heritage of Indigenous tribes, nations, communities, and *pueblos Indígenas* (or *pueblos originarios*) throughout the Americas and the Caribbean. The authors have added provenance biographies that expand the character and diasporic histories of archaeological collections (Berger et al.; Domenici; Harrison et al.; Joyce; and Tremain, all of this volume) and connect the deep and recent past with contemporary Indigenous communities (Bishop et al.; Burgio-Ericson and Seowtewa; Martinez et al.; and Norman et al., all this volume). Their work demonstrates the many ways in which to approach archaeological belongings in museums and emphasizes the value of various analytical techniques and collaborative interdisciplinary approaches (e.g., Ostapkowicz et al. and Sears et al., both this volume). Additionally, rare items in collections that are unlikely to be recovered from excavations today have tremendous potential for gaining a deeper understanding of the past (Harrison et al. and Joyce, both this volume). Most importantly, this project illustrates that the breadth and vastness of anthropological collections at the Smithsonian Institution require a supplementary museum research model that includes external researchers, museum professionals, and source communities committed to collections-based research.

In this introduction, we present a short narrative about museums and anthropology and delve into the histories of the Smithsonian Institution, the NMNH, and the NMAI and the collections under their stewardship. We provide a discussion of the identification and characterization of archaeological museum collections and the implications of these taxonomies for Indigenous peoples. Next, we briefly explore ethical, sustainable, and practical issues associated with archaeological collections-based research. Last, we outline the volume content and conclude with future prospects for community-centered research and scholarship with archaeological heritage applying the principles of Indigenous archaeology.

MUSEUMS AND ANTHROPOLOGY

To contextualize collections-based research at the Smithsonian, it is necessary to review the history of anthropology collections in the United States. Many of the large museums in the United States with considerable anthropological collections emerged during the "museum age" (1860–1920), most notably the "big three": New York City's American Museum of Natural History, Chicago's Field Museum, and the Smithsonian Institution (Stocking, 1985; Jacknis, 2008; Bell, 2017). Anthropology was also professionalized during this period; incidentally, the first Ph.D. in anthropology in the United States was awarded to A. F. Chamberlain in 1892 under the auspices of Clark University (Collier and Tschopik, 1954). The bulk of museum collections was assembled during the late nineteenth and early twentieth centuries, a period guided by a salvage paradigm and "collection frenzy," primarily for the purposes of expropriation and preservation of objects, rather than research (Stocking, 1985:5; Bennett, 1988; Clifford, 1988; Bench, 2014:57). Believing that Native and Indigenous peoples and their traditional lifeways would inevitably succumb to the social, political, and economic pressures of hundreds of years of colonization, museums amassed large collections of items and documentation to preserve material culture, language, and information about cultural practices (see Parezo, 1987). This took place within the context of cultural, spiritual, and physical genocide of Native American and Indigenous peoples on a global scale (Atalay, 2006:281).

Although there are many reasons behind the immense number of understudied archaeological collections in museums and other types of repositories, one of the central reasons is related to a shift in the organizational foundations of these newly created anthropology museums. Throughout the late nineteenth and early twentieth centuries, many large museums became repositories for some of the largest anthropological collections, as well as the locus of innovative research, academic teaching, publication, and large exhibition programs for public education (see Collier and Tschopik, 1954; Jacknis, 2008). The museum, in a sense, was the "institutional homeland" of anthropology (Lurie, 1981:184). By the 1930s, however, many anthropologists were absorbed into expanding university departments and accompanying museums, leaving many institutional museums on a singular trajectory of educating the public through large exhibition formats (Collier and Tschopik, 1954; Lurie, 1981:184; Bennett, 1988).

This academic vacuum left millions of anthropological items, particularly archaeological cultural heritage, on museum shelves, where they remained enigmatic. For many museums, these large accumulations of collections were left for study for the indefinite future, and it was not until the 1960s that researchers began to regain interest (Jacknis, 2008:522; see also Winters, 1981). More recently, there has been a shifting perception about the robustness of theory in museum work within the discipline of anthropology (see Jones, 1993), along with the conceptualization "that in fact museums are major social forces, defining social categories and shaping people's perceptions of themselves and others" (Greene, 1996:268). These recent revelations contributed to what has been termed "museum anthropology" (Greene, 2015). There are now more anthropologists conducting research beyond exhibits in museum settings; however, this trend often concerns ethnographic rather than archaeological cultural heritage.

The Smithsonian Institution

The Smithsonian Institution was established by an act of Congress in 1846. From its inception, the institution was intended for research and education. The early collections of the institution were legacy collections; they were generated through the efforts of the Patent Office, War Department, National Institute (a private, national research organization), federally sponsored activities such as the 1838 U.S. Exploring Expedition, and private individuals. Publication was an important component

of the Smithsonian's research activities, and the first scientific volume was Squier and Davis' 1848 tome *Ancient Monuments of the Mississippi Valley: Comprising the Results of Extensive Original Surveys and Explorations*, which continues to be widely used and referenced.

Currently, the Smithsonian Institution receives 62% of its funding from the federal government (a combination of congressional appropriation and federal grants and contracts), and the remaining funding is attributed to trust and nonfederal funds (e.g., endowments, donations from private individuals, corporations, foundations, and memberships) as well as revenues from business ventures through Smithsonian Enterprises (Smithsonian Institution, 2020b). The federal funding permits the museums at the Smithsonian to steward and manage the collections throughout the year, even during times of emergency. For example, while many museums had to lay off many of their staff members during the COVID-19 pandemic, the collections staff at the Smithsonian were able to continue their work caring for and managing the collections. The trust funding provides an opportunity to pursue innovative programs such as Recovering Voices.

National Museum of Natural History

The ability to build, house, and maintain the physical collections of the Smithsonian quickly surfaced as a key problem without a subsidiary unit and facility that could serve as a repository for books, manuscripts, scientific specimens, cultural items, and artwork. In 1875, the United States National Museum (USNM) was created. The museum was designed to provide adequate storage, exhibit, and research space and to fulfill the Smithsonian's goal of research and education. The publication series of the museum began immediately, and the museum continued to accept legacy collections such as the notable collection that was amassed for and displayed at the U.S. Centennial Exposition. Within the museum, the anthropological collections were organized according to three categories: "prehistoric anthropology," "ethnology," and "oriental antiquities" (True, 1897:336).

As construction on the USNM was begun, the Bureau of American Ethnology (BAE) was formed. In its early years, the BAE's research was conducted in conjunction with large geological surveys; the BAE was seen as a useful information-gathering entity by the federal government as it colonized new territories and established Indian reservations. The BAE expeditions were notable for their extensive collection of linguistic information in addition to ethnological and archaeological items. Throughout its history, the BAE focused on ethnological and linguistic research, with the notable exception of the archaeological projects of the River Basin Survey, which began in 1946 (Woodbury and Woodbury, 1999).

In 1909, the Department of Anthropology was created at the USNM. The staff of the department conducted archaeological and physical anthropological studies in addition to linguistic and ethnological work. In 1964, the BAE was formally moved to the USNM and subsumed within the Department of Anthropology in 1970. That same year, the museum changed its name to the National Museum of Natural History and National Museum of Man. Today, the mission of the NMNH is "understanding the natural world and our place in it." The collections of the NMNH are "held in trust for research, exhibition, education, and public enjoyment now and for future generations" (NMNH, 2017). The NMNH places a strong emphasis on research, including collections-based research. The collections of the Department of Anthropology include more than 3 million objects, 10,000 linear feet (3,048 m) of field notes and manuscripts, nearly 650,000 photographs, more than 11,000 sound recordings, and more than 8 million feet (243,840 m) of original film and video (Department of Anthropology, NMNH, 2020). The collections originate from locations throughout the world but are largely from the United States.

National Museum of the American Indian

In 1989, the U.S. Congress passed the National Museum of the American Indian Act (20 U.S.C. § 80q). This legislation established the NMAI as the eighteenth museum within the Smithsonian Institution and enacted the transfer of approximately 750,000 items (254,000 catalog records) from the former private Museum of the American Indian, Heye Foundation (MAI), New York, to this newly founded institution.[1] The act includes repatriation provisions that predate the Native American Graves Protection and Repatriation Act (NAGPRA) and continues to be used within the Smithsonian Institution. The collections were physically moved to the NMAI's Cultural Resources Center (CRC), located in Suitland, Maryland, between 1999 and 2004, where they are currently housed and curated. Additionally, relevant photographs, archives, and books amounting to 324,000 images, 1522 linear feet (463.9 m) of paper archives, and 12,000 items of media archives were split between the NMAI Archive Center and the Rare and Manuscript Collections of the Cornell University Library in Ithaca, New York (McMullen and Galban, 2019).

Although the NMAI does not recognize itself as an anthropology museum, the history of the collection mirrors that of the big three collecting institutions. George Gustav Heye, the founder and director of the MAI until his death on 20 January 1957, began his collecting activities in 1897. He officially chartered the MAI in 1916, and the museum itself opened in New York City in 1922 after the end of World War I (McMullen, 2009). Heye was not a trained anthropologist, but he employed professional anthropologists and archaeologists whose practices were entrenched within the discipline of anthropology, and his collection strategies followed those of other large museums of the early twentieth century (McMullen, 2009). His position as a collector, rather than an academic, likely exacerbated his lack of interest in original field documentation. Unlike most anthropology collections that were housed in museums of natural history, which included items from around the world, Heye concentrated his collecting efforts solely on the American continents.

The museum's most prolific collecting took place in the 1920s, a period regarded as the museum's heyday. His private funding significantly declined during the Great Depression and World War II, reducing possibilities for acquisitions and expeditions.

Although Heye collected both ethnographic and archaeological items, he had an affinity for and interest in archaeological collections and the deep history of Native and Indigenous societies (Jacknis, 2008; McMullen, 2009). Most of the MAI archeological collections were generated through sponsored expeditions led by prominent and amateur archaeologists, with the most notable excavations taking place between 1916 and 1930 (Jacknis, 2008). Items from the United States constitute a large part of the archeological collections. Heye sponsored excavations in New York, Vermont, New Jersey, Georgia, Arkansas, Nevada, New Mexico, Texas, and Mississippi. Excavations also took place in various countries throughout Latin America, for example, in what are now Guatemala, Honduras, Costa Rica, Ecuador, the Bahamas, Jamaica, and the Virgin Islands (see McMullen, 2009). Many legacy and orphaned collections (see Voss, 2012; King, 2016; Allen et al., 2019:14–15) and individual items were also integrated through exchanges with public and private museums and independent collectors. After Heye's death in 1957, the MAI began to acquire contemporary art pieces.

Currently, the NMAI stewards more than 864,000 items (269,411 catalog records) that represent more than 1,500 Native and Indigenous nations, tribes, communities, and pueblos Indígenas from throughout the Americas. The collections comprise objects from the Arctic to Tierra del Fuego, with the majority representing archaeological items. The collections are partitioned according to traditional museum categories (Table 1).

The NMAI's current acquisition practices are dedicated to contemporary art rather than ethnographic and archeological collections. This intentionality serves as a means to shatter the anachronistic anthropological and museum narratives of contemporary Indigenous and Native peoples, as well as a way to promote, support, and illustrate their resilience and their cultural resurgence. The NMAI's current mission is to work "in partnership with Native peoples and their allies, the National Museum of the American Indian fosters a richer shared human experience through a more informed understanding of Native peoples" (Smithsonian Institution, 2021).

TABLE 1. The object collections of the National Museum of the American Indian.

Collection type	Catalog records	Percentage of total
Archaeological	146,441	55
Ethnographic	104,327	43
Modern and contemporary	18,643	2

DEFINING ANTHROPOLOGICAL MUSEUM COLLECTIONS

Museum professionals often identify, classify, and organize items under the taxonomy rubric that grew out of emerging natural history museums and the newly minted discipline of anthropology in the late nineteenth century (Kirshenblatt Gimblet, 1991; Jenkins, 1994; Greene, 2016). The NMNH Department of Anthropology and the NMAI acquired cultural objects through a wide range of collecting practices, and both museums have similar cataloging systems for classifying collection items under two main categories: ethnographic and archeological; additionally, the NMAI has a contemporary and modern category. Archaeological collections can encompass stone tools, pottery, basketry, and architectural elements, as well as nonartifactual items, such as soil samples, floral and faunal remains, and manuports (see Murdock, 2001). Such items are recovered through excavations, surveys, or other types of field work. Associated records are prepared or assembled in connection with the survey, excavation, or other studies and can consist of field notes, maps, digital data, site reports, photographs, and publications. These are typically designated as the archival records in most institutions.[2] Nonfederal intuitions may use different terminology and/or categories to define archaeological material and associated records. In the United States, federal collections are defined according to the regulations for Curation of Federally-Owned and Administered Archeological Collections (36 CFR 79).

Distinctions made between archaeological, ethnographic, and contemporary collections are mostly chronological in nature. However, not all museum items fit within these established chronologies, particularly archaeological objects (see Hicks, 2013). For example, contemporary items can also be part of the archaeological record. An excellent case of this idea originates from the activities of the Tucson Garbage Project, which focused on applying archaeological methodology to contemporary items in order to understand recent human consumptive activity (Rathje and Murphy, 2001). Epistemological biases related to an interest in validating the evolutionary stages of Indigenous societies also contributed to the misattribution of archaeological and ethnographic items. An illustration of this problem is stone items from the Smithsonian Institution, Bureau of Ethnology 1880s expeditions led by "Colonel" James Stevenson and his wife, Matilda Cox Stevenson, in the Southwest that were generally assigned to the Smithsonian Division of Prehistoric Archaeology (Lawson, 2003:7, 11, 103). As a consequence, many of these types of artifacts that should have been designated as ethnographic are not inventoried in the *Summary of Ethnological Objects* (Smythe and Helweg, 1995). Additionally, the sheer volume of cultural heritage being removed from the Southwest during that time must have caused a lot of misattributions when objects were processed in the field and museum, in addition

to willful neglect of Indigenous cultural heritage (Parezo, 1987:17). The Zuni Cultural Resources Advisory Team (see Burgio-Ericson and Seowtewa, this volume) most certainly had to contend with this challenge when working with their community belongings.

In other cases, objects with incomplete or missing museum provenance and provenience (Barker, 2012; Flexner, 2016b) cannot be clearly assigned to either archaeological or ethnological categories (e.g., Martinez et al., this volume). This permeability also exists where items have been modified or reused after they were removed from their archaeological context. A recent example of this museum classification conundrum is the contemporary use of Neolithic urns that the artist Ai Weiwei transformed after multiple auction purchases. He dunked variously sized intact painted ancient urns with brightly hued industrial paint, then sold them on the contemporary art market (see San Francisco Museum of Modern Art, 2020).

Hicks (2013:4) suggests assigning items on the basis of the disciplinary approach used in their collection and curation. Namely, the label "archeological" is based on methods and practices "through which the items have been assembled, rather than simply from the contexts in which objects were made or used" (Hicks, 2013:4). Table 2 illustrates the different classification categories used by most museums and institutions with anthropological holdings. This scheme uses terms and concepts that emerged from the purely Western lens of late nineteenth century museums and anthropology practices (see Stocking, 1985; Jenkins, 1994; Bennett et al., 2017).

As museums embark on current decolonization and Indigenization movements (Lonetree, 2009, 2012), we need to consider "epistemic delinking" (Mignolo, 2011), or what Quijano (1991) called *desprendimiento*, in order to allow for a model of Indigenous stewardship that incorporates Native epistemologies, ontologies, and cosmovision (see Atalay, 2020). It is particularly important to move to classification systems that incorporate Indigenous knowledge systems of classification when such information is available to share (Greene, 2016; Turner, 2020). For example, Indigenous peoples have used the term "cultural patrimony" or "heritage" in place of "cultural resources." Yellowhorn (1996:42) explains that Indigenous heritage should not be managed under the cultural resource model or seen as a "resource" because resources are meant to be consumed, and the term promotes the concept of "resource extraction." Additionally, the universal prehistory/history division archaeologists and museums use to classify, organize, and study not only is inaccurate but also dismisses Indigenous oral histories, acts as an explicit denial of deeper identities, and falls outside of the Native way of conceptualizing history (see Lightfoot, 1995; Yellowhorn, 2002; Schmidt and Mrozowski, 2014). By design, Western classification systems and time can create barriers between contemporary Native people and their deep past, adding another layer that disconnects, dispossesses, and alienates them from their archaeological cultural patrimony (Yellowhorn, 1996; Watkins, 2003). We make a small attempt in Table 2 to help reconceptualize the terms "prehistory" and "historical" as "deep past" and "recent past" to indicate continuity and connect Indigenous peoples with their archaeological heritage.

TABLE 2. Classification system for anthropological collections from the Americas.

Classification	Recovering history	Time frame	Definition
Archaeological	Through archaeological methods or looting	Deep past to contemporary; often classified as "prehistoric" (before invasion in the Americas) and "historical" (after invasion in the Americas)	Items recovered through authorized excavations and surveys or illicit looting since colonial times
Ethnographic	Directly from source communities, which are often Indigenous societies	Recent past to contemporary; often classified as "historical" (after the European invasion in the Americas)	Items obtained from source communities via direct contact from ethnographers or collectors, as well as illicitly acquired; can include objects from the deep and recent past reused by Indigenous peoples
Archaeological and ethnographic	Unknown or not present	Deep past to contemporary	Any object for which provenience and/or provenance information is not available
Modern and contemporary	From modern and contemporary artists	Modern to contemporary	Modern and contemporary art; also concerns items from the deep or recent past or objects reinterpreted as modern art

DIFFERENTIATING PROVENIENCE, PROVENANCE, AND CONTEXT

We often use concepts such as provenance and provenience when working with and interpreting archeological museum collections. These terms have very distinct meanings within the disciplines of archaeology and museology. In archaeology, for example, "provenance" pertains to the location(s) from which an object's raw materials originate and is considered a geological term (Joyce, 2012:57–58). In contrast, for art historians and museum specialists "provenance" refers to "all associations of an artifact with individuals, collections, and institutions from the time of its discovery" (Barker, 2012; Joyce, 2012; Flexner, 2016b:169). In archaeology, "provenience" refers to an object's location when it was exposed, removed, or documented—for example, coordinates *x*, *y*, and *z* of an object's location recorded during excavation—or where the object was manufactured as determined through modern analytical techniques (Barker, 2012; Joyce, 2012; Flexner, 2016b:169). In archaeology, the term "context" "is often defined more precisely as the matrix, provenience, and associations of any objects. It is this bundle of associations that makes provenience so important for archeologists and distinguishes it from provenance" (Joyce, 2012:52). Joyce (2012:56) notes, however, that these two terms are connected when one considers the history of an item since its creation prior to when its archaeological provenience is created. In this respect, provenience would be part of the provenance chain of places the object has been. Joyce (2012) and Joyce and Gillespie (2015) view this combination as a biographical approach to understanding objects.

Investigating the Challenge of Poor Provenience Records

Inevitably, there are caveats connected to the use of museum-collected or donated anthropological objects for research purposes, and many museum collections, both old and recently excavated, remain neglected because exploring the in situ field record is favored over the examining the old collections. This neglect mostly stems from the misconception that inadequate provenience and quantitative control make such collections useless for academic research (Boone, 1993:330; Coe, 1993; Voss, 2012). Museum-sponsored expeditions during the early half of the twentieth century did not employ the excavation methods or record-keeping standards present in today's research designs. Additionally, legacy collections acquired through exchanges with other institutions, large-scale donor collections, and long-term loans often have little or no context. Barker (2012:243–25) expresses grave concern that museum items and collections lacking provenience and provenance have a high potential of being misattributed to a particular time and place. His concerns are valid and derive from the fact that archaeology's intellectual framework is based on the "proper placement and contextualization of those objects from the past surviving into the present" (Barker, 2012:24).

The advancement of new and old scientific analytical techniques has thrust the discipline of archaeology into what has been coined the "third science revolution" (Lidén and Eriksson, 2013; Kristiansen, 2014; Larsson, 2014). As will be seen, even objects without provenience can yield important temporal and spatial information through the use of appropriate analytical methods (Berger et al., this volume; Martinez et al., this volume; Ostapkowicz et al., this volume). Many of the contributions demonstrate that the application of nondestructive and destructive archaeometric techniques can be used to answer questions once thought to be feasible only with freshly excavated items.[3] With the use of such scientific practices, collections with little or no provenience information can become renewed sources of information, especially when they contribute to a large data set that can be used for future investigations (Ostapkowicz et al., this volume; Sears et al., this volume).

ETHICAL CONCERNS IN COLLECTIONS RESEARCH

Ethics, a constant thread within the museum world, have played a role in why some scholars have excluded archaeological museum collections from their discourse. Many researchers have avoided museum collections because of concerns about the antiquities market, looting, and unprovenienced collections. American archaeologists have expressed concern about their inadvertent impact on looting activity and the illicit antiquities trade as a by-product of bringing attention to archaeological collections, particularly from the American Southwest and the Maya region (see Coggins, 1969, 1995; Wiseman, 1984; Boone, 1993; Lynott, 1997; Elia, 2007). A startling example occurred during the armed conflict in Guatemala from the 1960s to 1990s: many ancient Maya objects were removed and are now managed in private museums and collections (see Paredes Maury and Krempel, 2020:62). A 2020 volume by Tremain and Yates, *The Market for Mesoamerica: Reflections on the Sale of Pre-Columbian Antiquities*, revisits past and current trends concerning the sale of unprovenienced antiquities from Mesoamerica. Their volume explores topics centered around creating new policy and legislation that correspond to new forms of marketing, particularly how to control the online realm used for the sale and trade of illicit antiquities. Additionally, their volume contributes key works in collections-based research that reconstruct object and collection biographies and cultural contexts.

Levine and Martínez de Luna (2013:264) consider the abandonment of presumably looted or unprovenienced collections a "double-loss" and illustrate through an extensive multiscale study the value in consulting these items. Likewise, this volume, through a multidisciplinary perspective, hopes to incentivize and revitalize the importance of responsible research with existing unprovenienced collections. Much of this research can serve to unmask collection biographies that would otherwise remain unknown and provide museums and institutions alike with object and collection histories needed to implement national and

international stewardship standards and codes of ethics, including repatriation, exhibition, care, and access (e.g., American Alliance of Museums, 2000; Barker, 2012:25–28; Levine and Martínez de Luna, 2013; Paredes and Krempel, 2020). For example, in this volume, Berger et al., Bishop et al., Burgio-Ericson and Seowtewa, Martinez et al., and Norman et al. illustrate the importance of this work for reconnecting ancestral heritage with descendant Indigenous communities (also see Berger, 2020).

Overcoming Colonial Legacies: Indigenous Archaeology in Museums

An additional ethical concern in museum collections research is the colonial legacy of museums as institutions; as a result of this history, Indigenous values, concerns, and ideas have largely been excluded in museum practices. There are multiple reasons—historical, cultural, and spiritual—why Indigenous people typically do not consult museum collections, particularly archaeological collections. Although archaeological collections are a direct, tangible connection to the past with the potential for continued meaningful research by members of Indigenous communities (see Cojti Ren, 2006; Neller, 2019), their study is fraught with potential for harm. For example, Burgio-Ericson and Seowtewa (this volume) discuss the negative impact some items may have on community members and the emotional labor and potential trauma of working with sacred heritage.

The ethical use of archaeological collections in research can, perhaps, be accomplished through the extension of the practice of Indigenous archaeology to museum settings. Over two decades, the methodological, conceptual, and philosophical aspects of Indigenous archaeology have grown, but they are applied largely to fieldwork practices within the United States and Canada (e.g., Yellowhorn, 1996, 2002; Watkins, 2000, 2003; Bruchac, 2005; Harris, 2005; Million, 2005; Atalay, 2006, 2008, 2010; Gonzalez et al., 2006; Hunter, 2008; Bruchac et al, 2010; Colwell-Chanthaphonh et al., 2010; Nicholas, 2010; Gnecco and Ayala, 2016). Furthermore, the integration of Indigenous and "historical" archaeologies and oral traditions (see Echo-Hawk, 2000) can create continuity and dialogue between the deep past and the present to provide Native and Indigenous peoples with knowledge that was purposefully erased during the first colonial invasion, particularly through physical and spiritual landscape displacement (see Quijano, 2007).

Although traditionally practiced in the field, Indigenous archaeology can also be applied to collections-based research to enable descendant community members, especially displaced and diasporic communities, to reconnect with, manage, and interpret their deep heritage beyond NAGPRA compliance (Watkins, 2000:170–173). Incorporating Indigenous archaeology as part of collections-based research will require consultation that can hopefully mature into collaborative partnerships (see Indian Arts Research Center, 2019), an approach that is practiced by Bishop et al., Burgio-Ericson and Seowtewa and Norman et al. (all this volume). Increasingly, museums are requiring letters of permission for working with Indigenous heritage, particularly items deemed sensitive. For example, the NMAI currently has an interim policy that requires a letter(s) of permission from descendant tribe(s) for accessing archaeological items identified as unassociated funerary and/or sacred (NMAI, 2020). For nascent scholars not already engaged with community members, determining how and whom to contact can seem like daunting experience. Resources include repatriation departments in museums and universities, and tribal or community websites and organizations such as the National Association of Tribal Historic Preservation Officers (THPOs) have online directories with current THPOs (see National Association of Tribal Historic Preservation Officers, 2021). THPOs, unfortunately, are already overburdened with their workload (e.g., Sanger et al., 2020), which is also often the case for community members. Burgio-Ericson and Seowtewa (this volume) provide an excellent discussion of the challenges that come with collaborative work.

Consultation can be even more difficult to manage when one is working with heritage that originates from Latin America. The cultural heritage from Middle and South America belongs to the various nations, and many pueblos Indígenas do not have control or any say over their heritage. Although the NMAI has the privilege to engage with Indigenous communities in the United States and Canada under the nation-to-nation governmental model, in Latin America, some Indigenous peoples do not even have the right to citizenship, let alone sovereignty in their own homelands. Therefore, at the moment, most consultation takes place with cultural governmental agencies and other national museums. In Latin America, there seems to be a new level of recognition for Indigenous peoples; for example, the president of Mexico, Andrés Manuel López Obrador, recently apologized to pueblo Maya for all the harm the colonial and current governments have inflicted upon them (Domínguez, 2021). Furthermore, globally, an incredible amount of displacement has led to many modern diasporas of Native people. The situation in Latin America may be a matter of revising governmental policies and working with colonial period experts who can assist in identifying the movements and displacements of pueblos Indígenas. Although this consultative aspect of our work can, at times, seem overwhelming, these obstacles can be significantly diminished with a research design that incorporates more time and funding into the project or dissertation timeline (see McMullen, 2008).

Collections-Based Research: Future Connections between Archaeology and Collections Stewardship

Although collections-based research may have some inherent ethical challenges, it also has some ethical advantages over continued fieldwork. It creates additional opportunities for understanding the past and connecting visitors with a range of heritage and can be considered a logical extension of fieldwork. Sullivan and Childs (2003) promote the idea that continuous collections management

of cultural materials is an essential final part of the archaeological fieldwork process. By creating storage facilities, museums and publicly funded repositories provide opportunities for material to be ready in the wait for better analytical techniques, access for academic research, and a zone of heritage for Indigenous community involvement (Sullivan and Childs, 2003:109). However, museums and curation repositories (federal, state, and university) now grapple with an ongoing "curation crisis" of archaeological collections (Marquardt et al., 1982; Childs, 1995, 2004; Sullivan and Childs, 2003; Johnson, 2009; King, 2016). According to Marquardt et al. (1982) and Sullivan and Childs (2003), this crisis can be characterized by the lack of funding, unstable collections storage conditions, lack of proper collections and/or preservation of field documentation, loss of contextual information, and the lack of storage space. This crisis transpired because of a rapidly expanding volume of archaeological collections generated through large-scale salvage excavations (i.e., field work resulting from legislation to protect and recover cultural heritage in advance of urban and industrial development since the 1960s) and the lack of resources to curate those collections, which ended up in different facilities (see Marquardt et al., 1982; Sullivan and Childs, 2003).

Recent scholarship has developed innovative solutions that combine museum curation, field practices, and collections-based research to study legacy and orphaned archaeological collections that have been neglected for decades (see Voss, 2012; King, 2016; Allen et al., 2019). In the process of studying old collections and legacy donations, researchers are creating a deeper understanding of the cultural practices of curation and collection management in hope of improving curation research (Friberg and Huvila, 2019). Additionally, academic research programs can take decades to generate large collections; by contrast, salvage excavations can create expansive amounts of material remains with the potential for valuable research if properly curated (e.g., see Thiessen and Roberts, 2009, on the value of the River Basin Survey collection). Graduate students could potentially work with local salvage archaeology projects for dissertation projects; an excellent example of such a collaboration is Maria Franklin's and Nedra Lee's work with the Ransom and Sarah Williams Farmstead Project in Travis County, Texas (see Lee, 2014).

The discipline of archaeology recognizes that the physical act of removing an object from its archaeological context through field methods and techniques is a destructive endeavor. Lipe (1974) expressed his concerns for the conservation and preservation of archaeological resources nearly 50 years ago. Although the destruction of archaeological sites is mostly a result of development, looting, and vandalism, it is also the case for academic field work. The archeological record is finite, nonrenewable, unique, irreplaceable, and threatened (see Lipe, 1974; Salwen, 1981; Dunnell, 1984; Surovell et al., 2017); every new generation of archaeologists should consider this fact and also be provided with alternative solutions (for example, Gonzalez, 2016). However, archaeological sites may be some of the few places where a colonial footprint has not altered a Native place, and as such, they should be protected (Forsman, 1997:109).

The inherently destructive nature of archeological field work, coupled with the curation crisis and difficulty in obtaining funding opportunities for large-scale excavation projects, makes collections-based research an appealing alternative, particularly to graduate students and scholars starting their academic careers (see Sullivan and Childs, 2003:108). Collections-based research does not entail any further destruction of archaeological sites; research can be conducted, at times, with less cost than a new excavation, and unlike fieldwork, investigation of an object can be repeated as methods and analytical techniques improve. Anthropology and archaeology departments are finally recognizing the importance of collections-based research for postgraduate training and theses. Despite this appeal, academic archaeology programs and granting agencies widely favor field research over collections research, with the former perceived as the primary source of "original" research. Although funding for collections-based research can be difficult to obtain, this research requires much less money and time than excavation fieldwork, particularly for international projects.

We are not advocating for the end to academic field excavations, however. Just as analytical techniques assist in bridging information for unprovenienced museum collections, new scientific techniques have changed the scope of archaeological research. For example, recent interpretations based on lidar data in the Maya region (Canuto et al., 2018; Garrison et al., 2019) indicate a tenfold increase in the number of residential structures near ceremonial precincts within a dense rain forest environment compared with what was previously recorded in surveys of the same sites using traditional techniques such as tape and compass or digital theodolite mapping techniques. Because of this new scientific application, settlement pattern studies have revived questions of field investigations reconsidering known large Maya sites and connected regional areas by documenting potential trade pathways and agricultural modifications. The new computer-generated maps show a multitude of undocumented habitational zones that need to be confirmed through ground confirmation and future excavations.

VOLUME CONTENT

The present volume was inspired by the conference session "Contextualizing Object Collections at the Smithsonian Institution" presented in 2018 at the 83rd Annual Meeting of the Society for American Archaeology in Washington, D.C. The session, organized by Maria M. Martinez and Risa Diemond Arbolino, focused on the overall importance of collections-based research to the discipline of archaeology and to increasing awareness of the scope of the archaeological collections under the stewardship of the Smithsonian Institution. Our goals were also to inform the archaeological community that these collections are publicly available for research and to illustrate how scholars from various disciplines accessed these archaeological museum collections to explore and answer questions about the deep and more recent histories of Native and Indigenous peoples from throughout the Americas.

The work presented here builds upon and advances the growing corpus of collections-based research within the disciplines of anthropology, archaeology, and museology. An exponential resurgence in collections-based research is evidenced by recent journal articles, special volumes, books, and conference sessions dedicated exclusively to this endeavor (Voss, 2012; Flexner, 2016a; King, 2016; Frieman and Janz, 2018; Allen and Ford, 2019; Childs and Warner, 2019; St. Amand et al., 2020). The outcome of this scholarship provides a template for multidisciplinary studies and encourages researchers, in particular archaeologists and anthropologists, and museums to actively engage in this crucial academic shift. This compilation illustrates the potential of museum collections for advancing our understanding of Indigenous societies and the creation of alternative connections and innovative interpretations of museum items.

The contributors tackle issues using the large and often unique collections under the stewardship of the NMAI and NMNH and correlating objects from other international collections (see Berger et al., this volume; Domenici, this volume; Harrison et al., this volume; Joyce, this volume). They bring a range of approaches from within the disciplines of anthropology, archaeology, art history, museum conservation, and museology to their case studies. The authors demonstrate that collections-based research can contextualize archaeological museum collections with little or no provenience or provenance. Certain studies interweave recently excavated archaeological collections as a comparative data set and demonstrate how practical technical approaches can enhance the scale of interpretations. Although many of these works intersect, we have synthesized the papers into two thematic points of interest: "Collections-Based Research: Ethical Considerations" and "Generating Original Data Sets with Museum Collections."

COLLECTIONS-BASED RESEARCH: ETHICAL CONSIDERATIONS

Collections-based research has been an important part of anthropological work since the early twentieth century. Archaeologists have grappled with the ethical implications of collections-based research, including protocols for analyses, community engagement and reciprocity, and the effect of research on the looter's market. The authors in this volume demonstrate that ethical research and museum collections are not diametrically opposed and address such criticisms both directly and indirectly in their analyses.

This section of the volume begins with a particularly appropriate metaphor for the expansive potential for collections-based research, the "rubber-sided museum." Burgio-Ericson and Seowtewa explore the intricacies, challenges, and mutual benefits of research projects that include a high degree involvement with descendent community members. They challenge scholars to think beyond collaborations and embrace partnership as the standard for research.

Joyce directly addresses the importance and value of museum collections as a source of data in their own right as well as a complementary data set for ongoing field research. She demonstrates the relevance of museum collections to contemporary archaeology from the early stages of research design to publication of site reports and artifact analyses. Joyce eloquently expresses the view that many approaches must be employed and many voices must be understood when engaging in collections-based research and that doing so makes for exceptional archaeology.

Like the previous authors, Norman et al. stress the importance of collaboration at all stages of a research project. They openly acknowledge the ethical challenges of research on collections from archaeological expeditions that were undertaken without any consideration for Indigenous communities and their spiritual and traditional beliefs, particularly those in which graves were exhumed. The authors address this concern by regular engagement with those communities at all stages of their projects and make a convincing case that even highly sensitive research like paleogenomics can be conducted in a manner that is mutually beneficial. As they point out, community collaborators not only improve current research; they also provide invaluable inspiration and suggestions for future studies.

Ahead of their time, Bishop et al. worked with a source community to conduct a highly technical analysis of pottery while also providing an avenue to reengage with their ancestral materials. Following a research-sparking discussion with a scientist from the community, they developed a collaborative project involving the youth from the community, who traveled to Washington, D.C., to study the construction of a distinctive and unique pottery type that had not been produced for centuries. This information was brought back to the community, where the pottery continued to be of significance and interest. The research highlights the importance of building reciprocity into a project at its inception.

In the concluding essay of this section, Berger et al. discuss the ethical implications and imperatives of working with unprovenienced collections, especially those that are believed to have been looted. Like Norman et al., they encourage a transparent and open acknowledgement of the problematic collecting practices of the past as a first step in addressing them rather than remaining complicit in the unethical or illegal activities that led to their placement in museums. They argue for the necessity of research and publications on those collections to bring them into the open, where potentially affected descendant communities can learn about them and where museums can more fully understand the legal and ethical considerations of their stewardship. They also demonstrate the value of collaborative work, both in this essay and in its relation to work that follows in the next section.

GENERATING ORIGINAL DATA SETS WITH MUSEUM COLLECTIONS

Through the application of various archaeometric and analytical techniques, anthropological collections that have been sitting on the shelf for many years can relate information to assist with the overall understanding of ancient behavior and

community practices. These papers illustrate the benefit of applying nondestructive and destructive analyses to create original data sets from which to draw new interpretations.

Continuing the research of Berger et al., Domenici examines collections associated with Mesoamerican mosaic and painted masks with little provenience data. He demonstrates that they can be given context and meaning through careful museum research, including the study of looters, collectors, and dealers. By studying this context, Domenici is able to assign items a time period as well as to associate them with each other and situate them within cultural and religious practices. The ability to create a novel data set of time, space, and culture for these collections shows that even poorly provenienced or unprovenienced items in museums are valuable sources of data.

Ostapkowicz et al. examine a collection with provenience data, although it lacks the high level of specificity available through modern field methods. Their research is dependent on museum collections; the materials that are the focus of their study are rarely encountered in excavations today because they were largely destroyed through mining by the late twentieth century. Through robust, multiple analytical techniques, they are able to reconstruct trade routes and determine preferred stone sources for different objects from the Bahamas and Turks and Caicos Islands. They make a compelling argument that large museum collections are extremely valuable because they are large enough to generate statistically significant results. Their contribution also highlights the extreme care that must accompany any destructive research techniques.

Martinez et al. utilize unprovenienced items, Mesoamerican obsidian "mirrors," for their research. With just a fragment of archival data available, they establish their original context by employing various analyses that include raw material provenance studies, techno-morphological investigations, and historical sources. Through their research, they transform a corpus of materials that are poorly understood and often misinterpreted into a corpus with a clear spatial, temporal, and cultural context. In the process, they challenge the simplistic hegemonic narrative of postconquest cultural replacement with a far more nuanced and accurate picture of agency, history, adaptation, and the survivance of Indigenous peoples of western Mexico.

The research of Harrison et al. provides a good example of the many stories inherent in a collection. To research gold and resin objects from Panama, they studied archival records and conducted materials analysis. In the course of their work, they were able to determine more details about their provenience and provenance than were currently available. The archival research revealed new information on common forms of repairs and cleaning undertaken by collectors, dealers, and museums. Finally, their analysis indicates the technology involved in the manufacture of these objects and the raw material sources. The multiple lines of inquiry that emerged from their study of just a small set of items in the museum's collection underscores the vast potential for this type of research.

Tremain approaches the question of provenance through multiple forms of analyses. By studying Mayan vases through methods that range from simple visual examination to microscopy and ultraviolet light, she is able to determine which items have been restored and which are forgeries. She demonstrates the importance of verifying provenance and provenience information in museum records through careful and critical analysis of the items themselves.

The final contribution to the volume, by Sears et al., merges analysis of museum collections with current field research. Their study utilizes collections from the site of Tres Zapotes, Oaxaca, Mexico, that were assembled by different individuals over more than 50 years. Although the collections vary in the amount of associated provenience data, all were appropriate for study using instrumental neutron activation analysis. Through this work, the authors were able to determine compositional groups that provide evidence for local manufacture as well as regional interactions. The large sample sizes made possible by the museum collections provide a robust data set that enhances and adds new dimensions to samples obtained through more recent excavation.

CONCLUDING REMARKS

This compilation is premised on the philosophy proposed by Flexner (2016a) and others (Voss, 2012; Levine and Martínez de Luna, 2013; King, 2016; Frieman and Janz, 2018), which presents a more optimistic side of collections-based research—a viewpoint that museum collections are an invaluable and sustainable source of information with boundless potential. As this current collaboration reveals, archaeological collections can assist with the creation of multiple narratives and counternarratives to past archaeological interpretations. Museums now hold compulsory roles as active "contact zones," which should be inclusive and consultative spaces where engagements between descendent communities and museum collections are actively supported (Pratt, 1992:6–7; Clifford, 1997; Peers and Brown, 2003; Phillips, 2005, 2007).[4] The NMAI's foundation is set on such principles, and some even suggest that its practices fall within the "new Indian museology" or "Indigenous museology" (Rosoff, 2003:72; Reimer/Yumks, 2004; Lonetree and Cobb-Greetham, 2008; Ronan, 2014; Shannon, 2014). The NMNH plays an active role in this practice as well, particularly with their Recovering Voices Community Research Program and other ongoing community-based projects (Hollinger et al., 2013; Bell, 2015, 2017).[5] These community engagements, however, mostly entail research with the ethnographic and archival collections and less frequently with archaeological material.

The contributions provide valuable approaches to collections-based research. They present methodologies and ethical considerations that will have applicability and relevance into the future and can be expanded upon in other collections-based research. For example, museums should always be facilitators for Indigenous peoples to reestablish connections with and promote

ways to interpret the deep past using Native ontologies and epistemologies (e.g., youth programs, digital access, and Native/Indigenous scholarship). As such, Native and Indigenous communities should be given the opportunity to formulate their research priorities, establish cultural guidelines for the continued care and access of collections, and actively participate in the exhibition of and narratives about their archaeological heritage (McMullen, 2008; Shannon, 2014; Goff, 2019; Goff et al., 2019). Many museums with archaeological collections will benefit from this alternative model of cultural heritage management—both NMNH and NMAI have become stronger institutions because of this type of collaboration. We have great hope that future efforts will create protocols for working with Indigenous groups from Latin America that are currently within our nation, so that they may continue to sustain an identity even though their ancient homeland is far from our national border.

NOTES

1. See Ronald W. Force's (1999) Politics and the Museum of the American Indian: The Heye and the Mighty for the history of the MAI and the NMAI Act.
2. In some large museums, such as the Smithsonian Institution, research results related to exhibitions, accession records and other archival data, and analytical data can be housed in other departments, for example, curatorial, registration, and conservation.
3. It should be pointed out that many museums require formal requests for conducting scientific analyses. For example, at the NMAI such requests can take up to six to nine months to process, but some institutions allow analyses to take place on the spot. Ytterberg (2016) presents a quantitative and qualitative study for gaining permission to conduct scientific analysis in museum settings.
4. See Boast (2011) and Krmpotich and Peers (2013) for a critique on the concept of museums as "contact zones."
5. For more information about the Recovering Voices Community Research Program (nongovernment funds support this program), see their website, https://naturalhistory.si.edu/research/anthropology/programs/recovering-voices (15 October 2020).

REFERENCES

Allen, Rebecca, and Ben Ford, eds. 2019. *New Life for Archaeological Collections*. Lincoln: University of Nebraska Press. https://doi.org/10.2307/j.ctvcwnz28

Allen, Rebecca, Ben Ford, and J. Ryan Kennedy. 2019. Introduction: Reclaiming the Research Potential of Archaeological Collections. In *New Life for Archaeological Collections*, ed. Rebecca Allen and Ben Ford, pp. 14–39. Lincoln: University of Nebraska Press. https://doi.org/10.2307/j.ctvcwnz28.6

American Alliance of Museums. 2000. AAM Code of Ethics for Museums. https://www.aam-us.org/programs/ethics-standards-and-professional-practices/code-of-ethics-for-museums/ (accessed 5 July 2021).

Arnoldi, Mary Jo, ed. 2016. *Engaging Smithsonian Objects through Science, History, and the Arts*. Washington D.C.: Smithsonian Institution Scholarly Press.

Atalay, Sonya. 2006. Indigenous Archaeology as Decolonizing Archaeology. *American Indian Quarterly* 30:280–310. https://doi.org/10.1353/aiq.2006.0015

Atalay, Sonya. 2008. Multivocality and Indigenous Archaeologies. In *Evaluating Multiple Narratives: Beyond Nationalist, Colonialist, and Imperialist Archaeologies*, ed. Junko Habu, Claire Fawcett, and John M. Matsunaga, pp. 29–44. New York: Springer.

Atalay, Sonya. 2010. *Community-Based Archaeology: Research with, by, and for Indigenous and Local Communities*. Berkeley: University of California Press.

Atalay, Sonya. 2020. Indigenous Science for a World in Crisis. *Public Archaeology* 19:1–16. https://doi.org/10.1080/14655187.2020.1781492

Balachandran, Sanchita, and Kelly McHugh. 2019. Respectful and Responsible Stewardship: Marinating and Renewing the Cultural Relevance of Museum Collections. In *Preventative Conservation: Collections Storage*, ed. Lisa Elkin and Christopher A. Norris, pp. 3–24. New York: Society for the Preservation of Natural History Collections.

Barker, Alex. 2012. Provenience, Provenance, and Context(s). In *The Future of Our Pasts: Ethical Implications of Collecting Antiquities in the Twenty-First Century*, ed. Michael A. Adler and Susan B. Bruning, pp. 19–30. Santa Fe, N.M.: School for Advanced Research Press.

Bell, Joshua A. 2015. A View from the Smithsonian: Connecting Communities to Collections. *Practicing Anthropology* 37:14–16. https://doi.org/10.17730/0888-4552-37.3.14

Bell, Joshua A. 2017. A Bundle of Relations Collections, Colleting, and Communities. *Annual Review of Anthropology* 46:241–259. https://doi.org/10.1146/annurev-anthro-102313-030259

Bench, Raney. 2014. *Interpreting Native American History and Culture at Museums and Historic Sites*. Lanham, Md.: Rowman and Littlefield.

Bennett, Tony. 1988. The Exhibitionary Complex. *New Formations* 4:73–102.

Bennett, Tony, Fiona Cameron, Nélia Dias, Ben Dibley, Rodney Harrison, Ira Jacknis, and Conal McCarthy. 2017. *Collecting, Ordering, Governing: Anthropology, Museums, and the Liberal Government*. Durham, N.C.: Duke University Press. https://doi.org/10.1515/9780822373605

Berger, Martin. 2020. "From a Cave near Tehuacán": An Attempt to Reassemble Post-Classic Mesoamerican Ritual Deposits Separated by the Art Market. In *The Market for Mesoamerica: Reflections on the Sale of Pre-Columbian Antiquities*, ed. Cara G. Tremain and Donna Yates, pp. 112–135. Gainesville: University Press of Florida. https://doi.org/10.2307/j.ctvx0738n.11

Boast, Robin. 2011. Neocolonial Collaboration: Museum as Contact Zone Revisited. *Museum Anthropology*. 34:56–70. https://doi.org/10.1111/j.1548-1379.2010.01107.x

Boone, Elizabeth Hill. 1993. *Collecting the Pre-Columbian Past: A Symposium at Dumbarton Oaks, 6th and 7th October 1990*. Washington, D.C.: Dumbarton Oaks Research Library and Collection.

Bruchac, Margaret M. 2005. Earthshapers and Placemakers: Algonkian Indian Stories and the Landscape. In *Indigenous Archaeologies: Decolonizing Theory and Practice*, ed. Claire Smith and Hans Martin Wobst, pp. 77–99. London: Routledge. https://doi.org/10.4324/9780203009895-16

Bruchac, Margaret, Siobhan Hart, and Hans Martin Wobst, eds. 2010. *Indigenous Archaeologies: A Reader on Decolonization*. London: Routledge.

Canuto, Marcello, Francisco Estrada-Belli, Thomas G. Garrison, Stephen D. Houston, Mary Jane Acuña, Milan Kováč, Damien Marken, Phillippe Nodédéo, Luke Auld-Thomas, Cyril Castenet, David Chatelain, Carlos R. Chiriboga, Tomáš Drápela, Tibor Lieskovsky, Alexandre Tokovinine, Antolín Velazquez, Juan C. Fernández-Díaz, and Ramesh Shrestha. 2018. Ancient Lowland Maya Complexity as Revealed by Airborne Laser Scanner of Northern Guatemala. *Science* 361(6409):1–17. https://doi.org/10.1126/science.aau0137

Chavez-Lamar, Cynthia. 2019. A Pathway Home: Connecting Museum Collections with Native Communities. *Arts* 8: 1–8. https://doi.org/10.3390/arts8040154

Childs, S. Terry. 1995. Curation Crisis – What's Being Done? *Federal Archaeology* 7:11–15.

Childs, S. Terry. 2004. *Our Collective Responsibility: The Ethics and Practice of Archaeological Collections Stewardship*. Washington, D.C.: Society for American Archaeology.

Childs, S. Terry, and Mark S. Warner, eds. 2019. *Using and Curating Archaeological Collections*. Washington, D.C.: SAA Press.

Clifford, James. 1997. Museums as Contact Zones. In *Routes: Travel and Translation in the Late Twentieth Century*, ed. James Clifford, pp. 188–219. Cambridge: Harvard University Press.

Clifford, James. 1988. *The Predicament of Culture: Twentieth-Century Ethnography, Literature and Art*. Cambridge: Harvard University Press. https://doi.org/10.2307/j.ctvjf9x0h

Coe, Michael D. 1993. From Huaquero to Connoisseur: The Early Market in Pre-Columbian Art. In *Collecting the Pre-Columbian Past: A Symposium at Dumbarton Oaks, 6th and 7th October 1990*, ed. Elizabeth Hill Boone, pp. 271–290. Washington, D.C.: Dumbarton Oaks Research Library and Collection.

Coggins, Clemency Chase. 1969. Illicit Traffic in Pre-Columbian Antiquities. *Art Journal* 29:94–98. https://doi.org/10.1080/00043249.1969.10794675

Coggins, Clemency Chase. 1995. A Licit International Traffic in Ancient Art: Let There be Light. *International Journal of Cultural Property* 1:61–80. https://doi.org/10.1017/S0940739195000051

Cojti Ren, Avexnim. 2006. Maya Archaeology and the Political Cultural Identity of Contemporary Maya in Guatemala. *Archaeologies* 2:8–19. https://doi.org/10.1007/s11759-006-0003-4

Collier, Donald, and Harry Tschopik Jr. 1954. The Role of Museums in American Anthropology. *American Anthropologist* 56:769–779. https://doi.org/10.1525/aa.1954.56.5.02a00040

Colwell, Chip. 2017. *Plundered Skulls and Stolen Spirits: Inside the Fight to Reclaim Native America's Culture*. Chicago: University of Chicago Press. https://doi.org/10.7208/chicago/9780226299044.001.0001

Colwell-Chanthaphonh, Chip, T. J. Ferguson, Dorothy Lippert, Randall H. McGuire, George P. Nicholas, Joe E. Watkins, and Larry J. Zimmerman. 2010. The Premise and Promise of Indigenous Archaeology. *American Antiquity* 75:228–238. https://doi.org/10.7183/0002-7316.75.2.228

Deloria, Vine, Jr. 1988 [1969] *Custer Died for Your Sins*. Norman: University of Oklahoma Press.

Department of Anthropology, National Museum of Natural History (NMNH). 2020. Collections Overview. https://naturalhistory.si.edu/research/anthropology/collections-overview, accessed April 3, 2020.

Domínguez, Pedro. 5 July 2021. Gobierno de México pide perdón al pueblo maya por abusos cometidos en su contra. *Milenio*. https://www.milenio.com/politica/gobierno-mexico-pide-perdon-pueblo-maya-abusos-cometidos

Dunnell, Robert. 1984. The Ethics of Archaeological Significance Decisions. In *Ethics and Values in Archaeology*, ed. Ernestine Green, pp. 62–74. New York: Free Press.

Echo-Hawk, Roger C. 2000. Ancient History in the New World: Integrating Oral Traditions and the Archaeological Record in Deep Time. *American Antiquity* 65:267–290. https://doi.org/10.2307/2694059

Elia, Ricardo J. 2007. Comment on "Irreconcilable Differences?": Scholars for Sale. *Papers from the Institute of Archaeology* 18:16–18. https://doi.org/10.5334/pia.297

Flexner, James L. 2016a. Introduction: Dark and Bright Futures for Museum Archaeology. *Museum Worlds: Advances in Research* 4:1–3. https://doi.org/10.3167/armw.2016.040101

Flexner, James L. 2016b. Archaeology and Ethnographic Collections: Disentangling Provenance, Provenience, and Context in Vanuatu Assemblages. *Museum Worlds: Advances in Research* 4:167–180. https://doi.org/10.3167/armw.2016.040113

Force, Roland W. 1999. *Politics and the Museum of the American Indian: The Heye and the Mighty*. Honolulu, Hawaii: Mechas Press.

Forsman, Leonard A. 1997. Straddling the Current: A View from the Bridge over Clear Salt Water. In *Native Americans and Archaeologists: Stepping Stones to Common Ground*, ed. Nina Swidler, Kurt E. Dongoske, Roger Anyon, and Alan S. Downer, pp. 105–111. Walnut Creek: AltaMira.

Friberg, Zanna, and Isto Huvila. 2019. Using Object Biographies to Understand the Curation Crisis: Lessons Learned from the Museum Life of an Archaeological Collection. *Museum Management and Curatorship* 34:362–382. https://doi.org/10.1080/09647775.2019.1612270

Frieman, Catherine J., and Lisa Janz. 2018. A Very Remote Storage Box Indeed: The Importance of Doing Archaeology with Old Museum Collections. *Journal of Field Archaeology* 43:257–268. https://doi.org/10.1080/00934690.2018.1458527

Garrison, Thomas, Stephen Houston, and Omar Alcover Firpi. 2019. Recentering the Rural: Lidar and Articulated Landscapes amongst the Maya. *Journal of Anthropological Archaeology* 53:133–146. https://doi.org/10.1016/j.jaa.2018.11.005

Gnecco, Cristóbal, and Patricia Ayala, eds. 2016. *Indigenous Peoples and Archaeology in Latin America*. New York: Routledge. https://doi.org/10.4324/9781315426655

Goff, Sheila. 2019. Care, Access, and Use: How NAGPRA Has Impacted Collections Management. In *Using and Curating Archaeological Collections*, ed. S. Terry Childs and Mark S. Warner, pp. 27–37. Washington, D.C.: Society of American Archaeology Press.

Goff, Sheila, Betsy Chapoose, Elizabeth Cook, and Shannon Voirol. 2019. Collaborating Beyond Collections: Engaging Tribes in Museum Exhibits. *Advances in Archaeological Practice* 7:224–233. https://doi.org/10.1017/aap.2019.11

Gonzalez, Sara L. 2016. Indigenous Values and Methods in Archeological Practice: Low-Impact Archaeology through the Kashaya Pomo Interpretive Train Project. *American Antiquity* 81:533–549. https://doi.org/10.1017/S000273160000398X

Gonzalez, Sara L., Darren Modzelewski, Lee M. Panich, and Tsim D. Schneider. 2006. Archaeology for the Seventh Generation. *American Indian Quarterly* 30:388–415. https://doi.org/10.1353/aiq.2006.0023

Greene, Candace. 1996. Discovering the Audience: A Reorientation in Museum Analysis. *Reviews in Anthropology* 24:267– 276. https://doi.org/10.1080/00988157.1996.9978135

Greene, Candace. 2015. Museum Anthropology. In *Emerging Trends in the Social and Behavioral Sciences: An Interdisciplinary, Searchable and Linkable Resource*, ed. Robert Scott, Stephen Michael Kosslyn, and Marlis Buchmann, pp. 1–15. Hoboken, N.J.: John Wiley & Sons. https://repository.si.edu/handle/10088/31432 (accessed 5 March 2021).

Greene, Candace. 2016. Material Connections: "The Smithsonian Effect" in Anthropological Cataloguing. *Museum Anthropology* 39:147–162. https://doi.org/10.1111/muan.12121

Harris, Heather. 2005. Indigenous Worldviews and Ways of Knowing as Theoretical and Methodological Foundations for Archaeological Research. In *Indigenous Archaeologies: Decolonizing Theory and Practice*, ed. Claire Smith and H. Martin Wobst, pp. 33–41. London: Routledge.

Henderson, Amy, and Adrienne L. Kaeppler. 1997. *Exhibiting Dilemmas: Issues of Representation at the Smithsonian*. Washington, D.C.: Smithsonian Institution Press.

Hicks, Dan. 2013. Characterizing the World Archaeology Collections of the Pitt Rivers Museum. In *World Archaeology at the Pitt Rivers Museum: A Characterization*, ed. Dan Hicks and Alice Stevenson, pp. 1–5. Oxford, UK.: Archaeopress. https://doi.org/10.2307/j.ctv17db2mz.7

Hollinger, R. Eric, Edwell John Jr., Harold Jacobs, Lora Moran-Collins, Carolyn Thome, Johnathan Zastrow, Adam Metallo, Gunter Waibel, and Vince Rossi. 2013. Tlingit-Smithsonian Collaborations with 3D Digitization of Cultural Objects. *Museum Anthropology Review* 7:201–253.

Hunter, Andrea A. 2008. A Critical Change in Pedagogy: Indigenous Cultural Resource Management. In *Collaborating at the Trowel's Edge: Teaching and Learning in Indigenous Archaeology*, ed. Stephen W. Silliman, pp. 165–187. Tucson: University of Arizona Press.

Indian Arts Research Center. 2019. Guidelines for Collaboration. Facilitated by Landis Smith, Cynthia Chavez Lamar, and Brian Vallo. Santa Fe, N.M.: School for Advanced Research. https://guidelinesforcollaboration.info/ (accessed 21 April 2019).

Jacknis, Ira. 2008. A New Thing? The National Museum of the American Indian in Historical and Institutional Perspective. In *The National Museum of the American Indian: Critical Conversations*, ed. Amy Lonetree and Amanda J. Cobb-Greetham, pp. 3–42. Lincoln: University of Nebraska Press.

Jenkins, David. 1994. Object Lessons and Ethnographic Displays: Museum Exhibitions and the Making of the American Anthropology. *Journal for the Comparative Study of Society and History* 32:242–270. https://doi.org/10.1017/S0010417500019046

Johnson, Jessica S. 2009. Sharing Ideas for Improved Preservation and Access. *SAA Archaeological Record* 9:8.

Jones, Anna Laura. 1993. Exploding Canons: The Anthropology of Museums. *Annual Review of Anthropology* 22:201–220. https://doi.org/10.1146/annurev.an.22.100193.001221

Joyce, Rosemary A. 2012. From Place to Place: Provenience, Provenance, and Archaeology. In *Provenance: An Alternate History of Art*, ed. Gail Feigenbaum and Inge Reist, pp. 50–62. Los Angeles: Getty Research Institute Publications Program.

Joyce, Rosemary A., and Susan D. Gillespie. 2015. *Things in Motion: Object Itineraries in Anthropological Practice*. Santa Fe, N.M.: School for Advanced Research Press.

Karp, Ivan, Christine Mullen Kreamer, and Steven D. Lavine, eds. 1992. *Museums and Communities: The Politics of Public Culture*. Washington, D.C.: Smithsonian Institution Press.

Karp, Ivan, and Steven Lavine, eds. 1991. *Exhibiting Cultures: The Poetics and Politics of Museum Display*. Washington, D.C.: Smithsonian Institution Press.

King, Julia A. 2016. Comparative Colonialism and Collections-Based Archaeological Research. *Museum Worlds: Advances in Research* 4:4–17. https://doi.org/10.3167/armw.2016.040102

Kirshenblatt Gimblet, Barbara. 1991. Objects of Ethnography. In *Exhibiting Cultures: The Poetics and Politics of Museum Display*, ed. Ivan Karp and Steven D. Lavine, pp. 386–443. Washington, D.C.: Smithsonian Institution Press.

Kristiansen, Kristian. 2014. Toward a New Paradigm? The Third Science Revolution and Its Possible Consequences in Archaeology. *Current Swedish Archaeology* 22:11–34. https://doi.org/10.37718/CSA.2014.01

Krmpotich, Cara, and Laura Peers. 2013. *This Is Our Life: Haida Material Heritage and Changing Museum Practice*. Vancouver, B.C., Canada: UBC Press.

Larsson, Stefan. 2014. The Third Science Revolution and Its Possible Consequences in Archaeology: A Personal Reflection. *Current Swedish Archaeology* 22:53–56. https://doi.org/10.37718/CSA.2014.05

Lawson, Michael J. 2003. Baskets, Pots, and Prayer Plumes: The Southwest Ethnographic Collections of the Smithsonian Institution. PhD. diss., Arizona State University, Tempe.

Lee, Nedra Kristina. 2014. Freedom's Paradox: Negotiating Race and Class in Jim Crow Texas. Ph.D. diss., University of Texas at Austin, Austin.

Levine, Marc N., and Lucha Martínez de Luna. 2013. Museum Salvage: A Case Study of Mesoamerican Artifacts in Museum Collections and on the Antiquities Market. *Journal of Field Archaeology* 38:264–276. https://doi.org/10.1179/0093469013Z.00000000053

Lidén, Kerstin, and Gunilla Eriksson. 2013. Archaeology vs. Archeological Science: Do We Have a Case? *Current Swedish Archaeology* 20:11–50. https://doi.org/10.37718/CSA.2013.01

Lightfoot, Kent G. 1995. Culture Contact Studies: Redefining the Relationship between Prehistoric and Historical Archaeology. *American Antiquity,* 60:199–217. https://doi.org/10.2307/282137

Lipe, William D. 1974. A Conservation Model for American Archaeology. *Kiva* 39:213–245. https://doi.org/10.1080/00231940.1974.11757792

Lonetree, Amy. 2009. Museums as Sites of Decolonization: Truth Telling in National and Tribal Museums. In *Contesting Knowledge: Museums and Indigenous Perspectives*, ed. Susan Sleeper-Smith, pp. 322–337. Lincoln: University of Nebraska Press.

Lonetree, Amy. 2012. Decolonizing Museums: Representing Native America. In *National and Tribal Museums*. Chapel Hill: University of North Carolina Press.

Lonetree, Amy, and Amanda J. Cobb-Greetham, eds. 2008. *The National Museum of the American Indian: Critical Conversations*. Lincoln: University of Nebraska Press.

Lurie, Nancy O. 1981. Museumland Revisited. *Human Organization* 40:180–187. https://doi.org/10.17730/humo.40.2.233x2q1866554972

Lynott, Mark. 1997. Ethical Principles and Archaeological Practice: Development of an Ethics Policy. *American Antiquity* 62:589–599. https://doi.org/10.2307/281879

Marquardt, William H., Anta Montet-White, and Sandra C. Scholtz. 1982. Resolving the Crisis in Archaeological Collections Curation. *American Antiquity* 47:409–418. https://doi.org/10.1017/S0002731600061308

McMullen, Ann. 2008. The Currency of Consultation and Collaboration. *Museum Anthropology Review* 2:54–87.

McMullen, Ann. 2009. Reinventing George Heye: Nationalizing the Museum of the American Indian and Its Collections. In *Contesting Knowledge: Museums and Indigenous Perspective,* ed. Susan Sleeper-Smith, pp. 65–105. Lincoln: University of Nebraska Press.

McMullen, Ann, and Maria Galban. 2019. Lost and Found: Re-establishing Provenance for an Entire Museum Collection. In *Collecting and Provenance: A Multidisciplinary Approach*, ed. Jane Milosch and Nick Pearce, pp. 229–242. Lanham, Md.: Rowman & Littlefield.

Mignolo, Walter D. 2011. Epistemic Disobedience and the Decolonial Option: A Manifesto. *Transmodernity: Journal of Peripheral Cultural Production of the Luso-Hispanic World* 1:44–66. https://doi.org/10.5070/T412011807

Million, Tara. 2005. Developing an Aboriginal Archaeology: Receiving Gifts from White Buffalo Calf Woman. In *Indigenous Archaeologies: Decolonizing Theory and Practice*, ed. Claire Smith and H. Martin Wobst, pp. 43–55. London: Routledge.

Mithlo, Nancy Marie. 2004. "Red Man's Burden": The Politics of Inclusion in Museum Settings. *American Indian Quarterly* 28:743–763. https://doi.org/10.1353/aiq.2004.0105

Murdock, Cynthia. 2001. Curatorial Care of Archaeological Objects. In *Museum Handbook*. Part 1, Appendix I. Washington, D.C.: National Park Service.

National Association of Tribal Historic Preservation Officers. 2021. THPO Directory. https://www.nathpo.org/thpo-search (accessed 1 April 2021).

National Museum of the American Indian (NMAI). 2020. National Museum of the American Indian, Smithsonian Institution, Collections Management Policy. Washington, D.C.: National Museum of the American Indian.

National Museum of Natural History (NMNH). 2017. National Museum of Natural History, Smithsonian Institution, Collections Management Policy. Washington, D.C.: National Museum of Natural History. https://naturalhistory.si.edu/sites/default/files/media/file/nmnh-collections-management-policy-12-13-2017-final.pdf (accessed 3 April 2020).

Neller, Angela. 2019. Tribal Voices on Archaeological Collections. In *Using and Curating Archaeological Collections*, ed. S. Terry Childs and Mark S. Warner, pp. 15–26. Washington, D.C.: Society for American Archaeology Press.

Nicholas, George P., ed. 2010. *Being and Becoming Indigenous Archaeologists*. Walnut Creek, Calif.: Left Coast Press.

Paredes Maury, Sofía, and Guido Krempel. 2020. There and Back Again: Looting, Trafficking Culture, and the Management of Cultural Heritage in Guatemala. In *The Market for Mesoamerica*, ed. Cara G. Tremain and Donna Yates, pp. 61–86. Gainesville: University Press of Florida. https://doi.org/10.2307/j.ctvx0738n.9

Parezo, Nancy J. 1987. The Formation of Ethnographic Collections: The Smithsonian Institution in the American Southwest. *Advances in Archaeological Method and Theory*, 10:1–47. https://doi.org/10.1016/B978-0-12-003110-8.50004-9

Peers, Laura, and Alison Brown, eds. 2003. *Museums and Source Communities*. London: Routledge.

Phillips, Ruth B. 2005. Re-placing Objects: Historical Practices for the Second Museum Age. *Canadian Historical Review* 86:83–110. https://doi.org/10.3138/CHR/86.1.83

Phillips, Ruth B. 2007. The Museum of Art-Thropology: Twenty-First Century Imbroglios. *Research* 52:9–19. https://doi.org/10.1086/RESv52n1ms20167734

Pratt, Mary Louise. 1992. *Imperial Eyes: Travel Writing and Transculturation*. London: Routledge.

Quijano, Aníbal. 1991. Coloniadad y modernidad/racionalidad. *Perú indígena* 29:11–20.

Quijano, Aníbal. 2007. Coloniality and Modernity/Rationality. *Cultural Studies* 21:168–178. https://doi.org/10.1080/09502380601164353

Rathje, William L., and Cullen Murphy. 2001. *Rubbish!: The Archaeology of Garbage*. Tucson: University of Arizona Press.

Reimer/Yumks, Rudy. 2004. Indigenous Archaeology at the 69th Annual Meeting of the Society of American Archaeology. *Midden* 36:12–13.

Ronan, Kristine. 2014. Native Empowerment, the New Museology, and the National Museum of the American Indian. *Museum and Society* 12:132–147.

Rosoff, Nancy B. 2003. Integrating Native Views into Museum Procedures: Hope and Practice at the National Museum of the American Indian. In *Museums and Source Communities*, ed. Laura Peers and Alison Brown, pp. 72–79. London: Routledge.

Salwen, Bret. 1981. Collecting Now for Future Research. In *The Research Potential of Anthropological Museum Collections*, ed. Anne-Marie E. Cantwell, James B. Griffin, and Nan A. Rothschild. *Annals of the New York Academy of Sciences* 376:567–574.

Sanger, Matthew C., Samuel Bourcy, Gavin Donathan, Jaclyn Galdun, Leah Heglas, Laura Klingman, Lexie Lowe, Theresa Lmbriolo, Kathryn Maupin, Xavier Neal-Carson, Scott Ferrara, Mauree Folk, Katharine Nusbaum, Samantha Russello, Douglas S. Riethmuller, and Clara M. Summa. 2020. What Do Tribes Really Want from Archaeologists? *SAA Archaeological Record* 20: 26–32.

San Francisco Museum of Modern Art. 2020. Ai Weiwei, *Colored Vases*, 2007. Collection Record 2016.75.1-10. https://www.sfmoma.org/artwork/2016.75.1-10/ (accessed 6 April 2020).

Schmidt, Peter R., and Stephen A. Mrozowski, eds. 2014. *The Death of Prehistory*. Oxford, U.K.: Oxford University Press.

Shannon, Jennifer A. 2014. *Our Lives: Collaboration, Native Voice, and the Making of the National Museum of the American Indian*. A School for Advanced Research Resident Scholar Book. New Mexico: SAR Press.

Squier, Ephraim G., and Edwin H. Davis. 1848. *Ancient Monuments of the Mississippi Valley: Comprising the Results of Extensive Original Surveys and Explorations*. Smithsonian Contributions to Knowledge, No. 1. Washington, D.C.: Smithsonian Institution.

Smith, Laurajane. 2006. *The Uses of Heritage*. New York: Routledge. https://doi.org/10.4324/9780203602263

Smithsonian Institution. 2020a. New Normal Committee: Final Report and Committee Findings. Washington, D.C.: Smithsonian Institution.

Smithsonian Institution. 2020b. The Smithsonian Institution Fact Sheet. https://www.si.edu/newsdesk/factsheets/smithsonian-institution-fact-sheet (accessed 2 April 2021).

Smithsonian Institution. 2021. National Museum of the American Indian: About the Museum. https://americanindian.si.edu/about/vision-mission (accessed 5 July 2021).

Smythe, W. Charles, and Priya Helweg. 1995. Summary of Ethnological Objects in the National Museum of Natural History Associated with the Taos Culture. Repatriation Office, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

St. Amand, Frankie, S. Terry Childs, Elizabeth J. Reitz, Sky Heller, Bonnie Newsom, Torben C. Rick, Daniel H. Sandweiss, and Ryan Wheeler. 2020. Leveraging Legacy Archaeological Collections as Proxies for climate and Environmental Research. *Proceedings of the National Academy of Sciences of the United States of America* 117:8287–8294. https://doi.org/10.1073/pnas.1914154117

Stocking, George W., ed. 1985. *Objects and Others: Essays on Museums and Material Culture*. Madison: University of Wisconsin Press.

Sullivan, Lynne P., and S. Terry Childs. 2003. *Curating Archaeological Collections: From the Field to the Repository*. Lanham, Md.: AltaMira Press.

Surovell, Todd A., Jason L. Toohey, Adam D. Myers, Jason M. LaBelle, James C. M. Ahern, and Brian Reisig. 2017. The End of Archaeological Discovery. *American Antiquity* 82:288–300. https://doi.org/10.1017/aaq.2016.33

Thiessen, Thomas D., and Karin M. Roberts. 2009. The River Basin Surveys Collections: A Legacy for American Archeology. *Plains Anthropologist* 54:121–136. https://doi.org/10.1179/pan.2009.54.210.004

Tremain, Cara G., and Donna Yates, eds. 2020. *The Market for Mesoamerica: Reflections on the Sale of Pre-Columbian Antiquities*. Gainesville: University Press of Florida. https://doi.org/10.2307/j.ctvx0738n

Turner, Hannah. 2020. Cataloging Culture: Legacies of Colonialism in Museum Documentation. Vancouver, B.C., Canada: UBC Press.

True, Frederick W. 1897. The United States National Museum. In *The Smithsonian Institution, 1846–1896: The History of Its First Half Century*, ed. George B. Goode, pp. 303–366. Washington, D.C.: Smithsonian Institution.

Voss, Barbara L. 2012. Curation as Research: A Case Study in Orphaned and Underreported Archaeological Collections. *Archaeological Dialogues* 19:145–169. https://doi.org/10.1017/S1380203812000219

Watkins, Joe E. 2000. *Indigenous Archaeology: American Indian Values and Scientific Practice*. Walnut Creek, Calif.: AltaMira Press.

Watkins, Joe E. 2003. Beyond the Margin: American Indians, First Nations, and Archaeology in North America. *American Antiquity* 68:273–285. https://doi.org/10.2307/3557080

Winters, Howard. 1981. Excavating in Museums: Notes on Mississippian Hoes and Middle Woodland Copper Gouges and Celts. In *The Research Potential of Anthropological Museum Collections*, ed. Anne-Marie Cantwell, James B. Griffin, and Nan A. Rothschild. *Annals of the New York Academy of Sciences*, 376:17–34. https://doi.org/10.1111/j.1749-6632.1981.tb28160.x

Wiseman, James.1984. Scholarship and Provenience in the Study of Artifacts. *Journal of Field Archaeology* 11:67–77. https://doi.org/10.1179/jfa.1984.11.1.67

Woodbury, Richard B., and Nathalie F. S. Woodbury. 1999. The Rise and Fall of the Bureau of American Ethnology. *Journal of the Southwest* 41:283–296.

Yellowhorn, Eldon. 1996. Indians, Archaeology and the Changing World. *Native Studies Review* 11:23–50.

Yellowhorn, Eldon. 2002. Awakening Internalist Archaeology in the Aboriginal World. Ph.D. diss., McGill University, Montreal, QC, Canada.

Ytterberg, Niklas. 2016. Analyzing Museum Collections in Scandinavia. *Museum Worlds: Advances in Research* 4:126–137. https://doi.org/10.3167/armw.2016.040110

Collections-Based Research: Ethical Considerations

Partnerships in Collections-Based Research: Zuni Voice and the Hendricks–Hodge Collections at the National Museum of the American Indian

Klinton Burgio-Ericson[1]* *and Octavius Seowtewa*[2]

INTRODUCTION

In 1918, expedition sponsor Harmon Hendricks wrote to anthropologist Frederick Webb Hodge about his excavations at the Zuni ancestral ruins of Hawikku Pueblo in western New Mexico. With attempted humor, Hendricks foreshadowed the modern curation crisis of museums and repositories lacking sufficient storage, saying, "I do not know what they are going to do with all the material that you are finding . . . and if you keep on being as successful . . . we will have to put up rubber sides to the Museum." In this peculiar image exposing the expedition's acquisitive motives, Hendricks reimagines the fledgling Museum of the American Indian, Heye Foundation (MAI; Figure 1) as an elastic structure ballooning with growing collections. These excavations were part of a massive accumulation of Zuni materials by anthropologists in the late nineteenth and early twentieth centuries, shipping tens of thousands of objects east for display to non-Native urban publics while rendering them inaccessible to their source community.[1]

Archaeological repositories abound in such legacy collections—the old and underused remnants of prior stages in the discipline—that early anthropologists and museum workers accumulated under very different conditions that often left insufficient documentation but also retain value for study and use by source communities. As the other authors of this volume likewise attest, revisiting legacy collections can be an effective research practice as methodologies change, technologies develop, and new questions arise. They are recurrent presences, not static facts, refining and reshaping conceptions of the past over generations. Furthermore, their presence offers potential for sustained relationships with descendent stakeholders, who often see ancestral materials in animate terms, as entities with finite life spans but persistent relationships to their communities. Although repatriation is appropriate and desirable in some cases, other legacy collections can become foundations for sustained relationships, enabling their use and even cocuration by source communities (Harrison, 2013:14; Hays-Gilpin and Lomatewama, 2013). Along with other authors in this volume, we believe that the value of collections increases when

[1] Maxwell Museum/Museum Studies Program, University of New Mexico, MSC 01 1050, 500 University Boulevard NE, Albuquerque, New Mexico 87131, USA.

[2] Zuni Cultural Resources Advisory Team, Post Office Box 344, Zuni, New Mexico 87327, USA.

* Correspondence: kburgioericson@unm.edu

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FIGURE 1. Albumen print of the Museum of the American Indian, Heye Foundation at 155th and Broadway, New York. National Museum of the American Indian (NMAI P02982), Smithsonian Institution. (Photo by Nathaniel Livermore Stebbins, 1921.)

museums and researchers share the research design and process with constituents who hold a special interest in such materials.

This essay explores the value of revisiting legacy collections, which was the process of one of the authors (Klinton Burgio-Ericson) in conducting interdisciplinary dissertation research with the Smithsonian Institution's Zuni collections at the National Museum of the American Indian (NMAI) and National Museum of Natural History (NMNH). This work drew upon underused materials from the Hendricks–Hodge excavations to study the artistic expressions and cultural negotiations of everyday life among the diverse inhabitants of Hawikku's seventeenth century Spanish mission. Over the years, the descendent community of Zuni Pueblo has proactively engaged outside researchers and museums, and in the course of the dissertation project, opportunities arose for renewed engagement through the Zuni Cultural Resources Advisory Team (ZCRAT), led by coauthor Octavius Seowtewa. This essay reflects upon the opportunities of working together to create new, mutually beneficial relationships around legacy collections, as well as the challenges that accompany them (Figure 2).

FIGURE 2. The ZCRAT team members inspecting ceramic jars recovered from the Hawikku excavations at the NMAI. From left to right: front, Curtis Quam, Raylan Edaakie, Eldred Quam, and Octavius Seowtewa; back, Klinton Burgio-Ericson and Gwyneira Isaac. (Photo by Judith Andrews, 23 September 2016.)

REVISITING HAWIKKU'S PURÍSIMA CONCEPCIÓN MISSION

In AD 1540, when Francisco Vásquez de Coronado first described the town of Hawikku, it spread over a low promontory about 12 miles (19 km) southwest of present-day Zuni Pueblo, with 600 to 1,000 residents (Figure 3; Kintigh, 1985:75;

Ferguson, 1996:43). Its houses formed seven distinct blocks of pueblo-style apartments around an irregular open plaza on the hill and its southeast slope (Smith et al., 1966:11–12). In AD 1629, Spanish Franciscans initially established a mission nearby, which Apache raids destroyed in AD 1672. Zuni residents relocated to a more secure refuge during the Pueblo Revolt of AD 1680, and although they continued to revisit Hawikku over the years, they never rebuilt the town.

Starting in 1917, the Hendricks–Hodge Archaeological Expedition uncovered 370 rooms, exhumed about 1,000 burials, and collected as many as 1,700 pots and thousands of other artifacts from Hawikku (Smith et al., 1966; Elliott, 1995). Initially, a joint project of Smithsonian and the MAI, George Gustav Heye's New York museum soon predominated in archaeological excavations lasting seven years, despite Zuni resistance (Burgio-Ericson, 2018:203–218).

In a context of new market pressures and federal assimilationist policies seeking to eradicate Native cultures, anthropologists working in a salvage paradigm took advantage of their resources to gain unprecedented access to Zuni culture, removing this material history for the benefit of distant non-Native museum audiences. From an archaeological perspective, the value of these excavations remains their large scale and the extensive legacy collection that they produced (Burgio-Ericson, 2020), comprising a crucial resource for comparative study, including many intact examples of otherwise underrepresented artifacts, which is also true of other Smithsonian legacy collections (Joyce, this volume).

Hodge published little of this work during his lifetime, passing off the task to Watson Smith, who worked with coauthors Richard B. Woodbury and Nathalie F. S. Woodbury to compile a posthumous report of Hodge's work at Hawikku, which they published in 1966. Their volume included an overview of Hawikku's archaeology and architecture, as well as a discussion of its pottery, burials, and Franciscan mission (a contribution by Ross G. Montgomery, 1966). At the time, the authors could not draw upon Hawikku collections themselves, and their report included almost no analysis of its artifacts. The disorderliness of the collections, scattered documentation, and transformation of the MAI to the NMAI subsequently prevented further research. Interest among Zuni tribal employees and community members encouraged Burgio-Ericson to undertake a museum-based research project focusing on Hawikku's missionization. Not unlike the archival reconstructions of other authors in this volume (Berger et al.; Domenici), this work required widespread archival research to reassemble documentation, recover the mission's structural history, and analyze associated artifacts during a Smithsonian Peter Buck Fellowship from 2013 to 2016.

From the start, working with Zuni Pueblo was important to this dissertation project and included official meetings with the tribal council and relevant employees but also more personal connections with community historians and educators to recover archival information for their use. From the practice-based perspective of this research, the lead author found engaging this source community to be both richly rewarding and frequently challenging. His training as an art historian offered little opportunity to learn about working collaboratively, and he found many scholars suspicious of community influence on supposedly "pure" scholarship. Relying upon interpersonal relationships as part of research also raises the stakes and risk of potential missteps; one must constantly earn trust, and even when all parties desire to work well together, successful outcomes do not necessarily follow. Source communities are diverse entities, and factional disagreements, personality conflicts, and divergent or changing motives can impede effective research partnerships (Isbell, 2000; Joseph, 2002; Marshall, 2002:215; Watkins and Ferguson, 2005). Negotiating these political and interpersonal dynamics is often a delicate process. Being aware of political contexts and building a variety of relationships throughout the community helps scholars avoid unintentional cooption in

FIGURE 3. Panorama of the excavated ruins of Hawikku's mission (foreground) and town (background), 1920 or later. National Museum of the American Indian (NMAI N07211-N07213), Smithsonian Institution. (Photos attributed to Frederick Webb Hodge, panorama digitally reconstructed by Klinton Burgio-Ericson.)

disputes in which outside researchers do not belong, keeping the focus on appropriate areas of mutual interest.

Numerous authors describe growing relationships of mutual respect as the most rewarding part of collaboration (Peers and Brown, 2003:8–9; Colwell-Chanthaphonh and Ferguson, 2008:13; La Salle, 2010:407, 409–410), but such personal relationships can also be fraught if collaborators become disappointed in the work. Setbacks may result from miscommunication, poor planning, or changing perspectives and goals of individuals over time. Community-based projects do not always achieve their full potential or satisfy everyone, and the needs of the researcher are not the same as those of community members. Personal and academic research projects are often less valuable to an overstudied source community than knowledge of archives and professional networks, which can serve in diverse ways. In this case, Burgio-Ericson found that working with Zuni Pueblo led to more accurate and relevant research and contributed to ongoing relationships as well as the value of Smithsonian collections.

ZUNI MATERIAL HISTORY AND THE SMITHSONIAN INSTITUTION

The Smithsonian's implication in Zuni history began well before Hawikku's excavation, with an 1879 Bureau of Ethnology expedition under James Stevenson, after which a small cohort of Smithsonian anthropologists collected there over the next three decades. Stevenson and his wife, Mathilda Coxe Stevenson, returned each year until his death in 1888, and she continued until 1910 (Isaac, 2005). As a young curator, Frank Hamilton Cushing accompanied the 1879 expedition and stayed to learn the Zuni language, becoming one of the first anthropologists to employ participant observation while adding significantly to Smithsonian collections. Finally, the brothers Victor and Cosmos Mindeleff visited Zuni during their eight-year documentation of Pueblo architecture, also collecting ethnological materials (Green, 1979, 1990; Parezo, 1985; Nabokov, 1989; Ladd, 1994; Fowler, 2000; McFeely, 2001). These early American anthropologists acquired the NMNH's Zuni holdings through purchase, trade, and theft, justifying their actions in the mistaken, ethnocentric belief that Native communities such as Zuni would soon succumb to assimilation and disappear. When Congress created the NMAI in 1989, the ancestral Zuni archaeological materials from Hawikku came to augment the Smithsonian's holdings, together comprising probably the largest museum collection of Zuni material culture anywhere.

Renewal of Smithsonian-Zuni relations began in 1970, when Zuni Governor Robert E. Lewis requested removal from display of replica Zuni masks associated with sacred Shalako ceremonies. By 1977, Zuni was requesting repatriation of *Ahayu:da* figures from numerous American museums, including the Smithsonian (Merrill et al., 1993; Ferguson et al., 2000). Commonly, but inaccurately, called "war gods" by non-Zunis, the open shrines of these wooden twin protectors had proven to be easy targets for looting. This repatriation campaign gradually achieved success and set precedent for legislation such as 1990's Native American Graves Protection and Repatriation Act (NAGPRA; Trope et al., 2000).

Other important Zuni community visits to Smithsonian included a 1997 delegation to repatriate Spanish religious artworks from the pueblo's Nuestra Señora de Guadalupe mission (Ferguson et al., 2000:256–257) and visits preceding the 2001 return of artifacts comprising the *Hawikku: Echoes from Our Ancestors* exhibit at the A:shiwi A:wan Museum and Heritage Center in Zuni Pueblo (AAMHC; Kennedy, 2001; Mahkee, 2001; Isaac, 2007:156–163; Kennedy and Simplicio, 2009). Revisiting legacy collections is not only a productive research approach; it has also allowed Zuni Pueblo to periodically reaffirm connections with distant ancestral materials (Figure 2).

Commentators argue that museums have undergone a "consumer revolution" that began in the late twentieth century, in which their primary focus has become service to diverse publics, supplanting the warehousing function that once predominated. In addition to the general museum-going public, many museums now recognize source communities as primary constituencies with special connections to the collections representing them (Ames, 1992:12; Wiel, 1999). Institutional histories implicating museums in the lives of source communities can become foundations for developing new engagements with descendants, but they also imply responsibility and even obligation to these special constituents through stewardship of their ancestral materials (Clifford, 1997:92–193; Stanton, 2003; Tapsell, 2003; Harrison, 2013:14). The Smithsonian's collecting history and extensive holdings of Zuni heritage are a prime example of intertwining institutional and community histories, presenting opportunities for continued cooperation among its museums and the pueblo.

RESEARCH METHODOLOGIES AND WORKING TOGETHER

Since 1990, NAGPRA has mandated museum engagement with descendants and tribes, leading to increased interest in collaboration (Peers and Brown, 2003; Golding and Modest, 2013; Silverman, 2015; Herman, 2018). The concept of collaboration exists in tension with *consultation*, a term with specific legal connotations stemming from the passage of 1966's National Historic Preservation Act and subsequent regulations (Silliman and Ferguson, 2010; Boast, 2011:57). Consultation generally implies outside mandates to meet with Native community representatives, seeking or delivering information in a one-directional manner, with planning coming from outsiders and benefits largely accruing to their initiatives.

In contrast, as recent museological and archaeological literature describe it, *collaboration* is a mode of researchers and community members working together to develop programs of mutual benefit. The motivating ideal is an ethical sharing of

authority over the past to bring real-world benefits to source communities while improving scholarship's accuracy and relevance (Peers and Brown, 2003:2; Atalay, 2006; Colwell-Chanthaphonh and Ferguson, 2008:7; Smith and Jackson, 2008:196; Silliman and Ferguson, 2010). In his "Museum Collaboration Manifesto," Jim Enote (2015) eloquently expresses this ideal as the "spirit of pure collaboration," of "reaching out and enlightening on equal terms," which can lead to a decentralization of power and "allow objects and people to speak."

"Pure collaboration" may be a motivating ideal, but in practice most engagements fall somewhat short of this objective. Flexibility is necessary to address the concerns of diverse stakeholders, and collaborative relationships most often emerge through a gradual development of trust and respect (Silliman and Ferguson, 2010). Colwell-Chanthaphonh and Ferguson (2008:10–13) argue that collaboration is part of a continuum of interactive relationships: from antagonistic resistance at one extreme to ideal collaborations, cooperation, trust, and common interests at the other end of the continuum.[2] They believe that collaboration rarely exists from the start but that it develops and guides relationships over time. As our fellow authors concur (Norman et al., this volume), scholars and museums must participate in long-term commitments with particular source communities to build trust; initial consultations can eventually lead to more thoroughly collaborative relationships.

Although contemporary museum and archaeology projects often invoke the ideal of collaboration, this concept also generates skepticism. La Salle (2010) argues that the feel-good rhetoric of archaeological collaboration often masks more conservative practices and exploitative relations with Indigenous communities. Although Boast (2011) supports collaborative museology, he is similarly concerned that these relationships often fall short of their rhetoric and structurally induce source community members to add content to the universal archive of museums, effectively continuing neocolonial extractive dynamics, despite the sincere best intentions of the individuals involved. In critiquing museum exhibitions, Lonetree (2012) argues that collaborative displays such as the Mille Lacs Indian Museum (Onamia, Minnesota) and the NMAI's *Our Peoples: Giving Voice to Our Histories* also fail to achieve decolonizing objectives because they do not truthfully address histories of genocide and neither aid in healing processes nor provoke honest reckoning among non-Native beneficiaries of colonial structures.

The terminology of collaboration itself deserves critical assessment, too. According to Phillips (2003:166), museum collaborations must negotiate the new languages that colonization imposes on Native peoples as part of larger systems managing Indian relations with governing institutions. These new languages and terms are problematic indicators of persistent inequality. For example, Boast and Enote (2013:110) observe that the Zuni language lacks a word for "repatriation": the taking of a sacred object by a non-Zuni person or museum and its subsequent return; NAGPRA forces Zuni Pueblo to participate in a foreign system of ownership and knowledge transmission, and it has created significant challenges in conveying these new meanings to Zuni religious leaders and elders. Although Zuni efforts to repatriate the *Ahayu:da* preceded NAGPRA, the bill's writers never consulted Zuni leaders to learn from their experiences. The NAGPRA has done much to reshape relations among Indigenous communities and museums, but it also forces descendent communities to provide information to justify their claims to ancestral materials, whereas museums retain the power of extracting information, judging claims, and determining cultural affiliation.

Cultural resource management consultation likewise imposes foreign terms and concepts on Zuni people. For example, after assessing the impact of proposed projects, federal legislation requires mitigation measures to decrease adverse consequences (Fowler, 1982). *Mitigation* might include survey and recording; altering the project to minimize its impact; partial or complete salvage excavation; restoration, preservation, or compensation; or, in some cases, project relocation. Yet this central role for mitigation is foreign to Zuni ways of thinking. Zunis do not come to ancestral sites seeking to destroy, harm, or develop them and had no need for words such as mitigation in the past because it lies beyond their conception of caring for and protecting the land. Often, mitigation seems to offer mere tokens of cultural recognition in exchange for more destructive actions against ancestral lands, a dynamic of continued colonial relations that Glen Sean Coulthard (2014) critiques as the "politics of recognition."

As with repatriation and mitigation, collaboration is a foreign word with positive rhetoric but no directly corresponding concept in the Zuni language. Despite the ideal of laboring together, all too often, museums and outsiders are the ones who design research programs and call the shots in supposed collaborations. Collaborations too frequently fall short, and for this reason, *partnership* may be a better term to describe relationships that live up to the ideals of equality, cooperation, shared authority of the past, and mutual benefit. This ideal is expressed in the Zuni term *i:willi*, which means "together," such as in the phrase *hon' i:willi lesnu'kya*, meaning "we did it together." The concept of togetherness lies at the heart of partnerships, better describing long-term, interpersonal relationships in which museum professionals and community members work closely with each other and in which Zunis are an essential part of determining the project's goals and procedures. Partnership's simplicity, accuracy, and plain language meaning of equality best suit the ideals that lie at the heart of ongoing working relations between Zuni Pueblo and Smithsonian researchers.

THE SMITHSONIAN–ZCRAT RECOVERING VOICES PROJECT

Legacy collections are potential foundations for developing reciprocal relations among museums and source communities, as partnerships develop over time with sustained commitment to one another (Hays-Gilpin and Lomatewama, 2013:281–282). The breadth of the Smithsonian's Zuni collections and established

history with the pueblo offer great potential for working together toward the interests of the community today, but histories of coercive pressures by which they came to the Institution also burden these collections. The extensive scope of the Smithsonian's Zuni holdings and its particular record in relation to the pueblo dictate that it should be a focal point for the development and dissemination of accurate information about Zuni culture and the community's efforts to maintain its identity. Even the smallest Zuni artifact carries specific meanings, and partnering with proper community authorities who can visit the collections in person to examine and give informed knowledge about them is essential to ensure the accuracy of the Smithsonian's interpretation of Zuni cultural history.

In September 2016, the authors were part of a weeklong visit to the Smithsonian's Zuni collections, along with two other religious leaders and a tribal educator from ZCRAT. With funding from the Smithsonian's Recovering Voices Program, this trip continued the history of Zuni visitations to Smithsonian while also indicating changing interests in museum collections. This initial opening came through Burgio-Ericson's dissertation research: after he presented it to the Zuni Tribal Council in 2013, councilmembers asked how his knowledge of archives and museum collections could facilitate the pueblo's goals of intergenerational cultural education. With a focus on sustaining Indigenous knowledge, the Recovering Voices Program was an ideal supporter, and as the project developed, it became evident that ZCRAT was the proper working partner, with Seowtewa taking the organizing role. The pueblo established ZCRAT in 1991 to meet federal requests for consultation on Zuni traditional cultural properties outside of the present reservation (Mills and Ferguson, 1998:35), but it also works with museums and other non-Zuni organizations. One of the team's primary goals was to evaluate the Smithsonian's collections for use by Zuni community members as more Zuni students enter professions related to cultural heritage and visit museums on their own (Figure 4). From these concerns, the plans for the 2016 visit developed, with Smithsonian staff arranging logistics but Zuni team members setting the priorities.

In response to the Recovering Voices framework, the ZCRAT team described this visit as an opportunity to give Zuni voice to materials that museums had removed from the community under social, political, and economic duress. They articulated four goals:

1. *Giving objects a Zuni voice*: Noting that museum records are often inaccurate, the team felt it was important for the proper religious authorities to provide accurate and appropriate information about culturally sensitive materials. Zuni culture has been the subject of anthropological studies for 140 years, but this information almost always entered the record through secondhand mediation rather than directly from a Zuni perspective. In past generations, Zuni consultants often withheld information to protect it, unintentionally resulting in misuse or damage of important cultural resources by administering agencies and museums. Therefore, the accuracy of collection records is a priority for Zuni's religious leaders today.
2. *Collections management*: The team focused primarily on religious and esoteric materials, taking advantage of their expertise as religious leaders. Since many sensitive items are the purview of specific societies or families, they prepared notes and photographs to share with pertinent caretakers upon returning home. The team identified a handful as potential repatriation requests but, more importantly, developed guidelines for storing, curating, and viewing sensitive materials.
3. *Guidance for Zuni museum work*: As museums have become more open, an increasing number of Zuni artists, museum workers, and community members have accessed Smithsonian materials. The ZCRAT team members expressed appreciation for the educational value of these collections and the museum's conservation of them but also concern

FIGURE 4. The ZCRAT team members privately discussing culturally sensitive materials in the anthropology collections of the NMNH. From front to back: Eldred Quam, Raylan Edaakie, Curtis Quam, and Octavius Seowtewa. (Photo by Judith Andrews, 22 September 2016.)

regarding the many, often unmarked, esoteric materials scattered throughout. Zunis believe that many powerful objects can potentially affect community members negatively if they are improperly exposed to them. The team developed storage instructions to prepare Smithsonian collections for more intensive use and to protect Zunis who might work with them. Developing educational materials to prepare younger Zunis for museum jobs and cultural management tasks that might expose them to such ancestral materials continues to be an ongoing goal of our partnership.

4. *Educational materials*: Several of the ZCRAT team members are directly involved in educational initiatives within the pueblo and took photos and notes for use in their presentations. The group discussed selected materials in short, topical video recordings for classroom use (Figure 5).

The 2016 visit made substantial headway toward these objectives, but the scope of the collections left much work incomplete, and many parts received only cursory inspection. Plans are ongoing for follow-up visits to continue this work. The Smithsonian has also benefitted, learning how to better care for these collections and improving records with more accurate ethnographic information from proper tribal authorities. The ZCRAT team not only provided factual data such as the significance of woven patterns and colors in Zuni textiles but also enriched understanding through their own subjective responses. Their expertise allowed for reuniting items such as altar components separated over the years and identifying replicas of Zuni spiritual beings (*kokko*) that were not properly constructed or authentic.

Genuine *kokko* (which may be called masks) are produced in specific ways and are ceremonially entrusted to their proper caretakers, whereas inauthentic replicas and fakes are incorrectly made and lack the rituals investing them with sacredness. Most apparent masks in museum collections are actually inauthentic reproductions, made for sale or display. Even these replicas are culturally sensitive, however, and the team developed guidelines for their care, including restricted storage with warning labels and screened ventilation to allow them to breath, as well as prohibitions against photography and offerings of cornmeal and turquoise such as authentic *kokko* might receive. The team emphasized that Zuni visitors to museum collections should not give offerings to replicas and fakes, which has sometimes happened in the past. In effect, giving offerings to replicas is to authenticate them, as well as to increase the risk of attracting insects to sensitive museum collections. Religious leaders have developed a protocol for when they encounter a real *kokko* mask in museum collections: they feed it in a separate room, offering cornmeal that they subsequently wrap in paper for removal outside, where they make an additional offering.

The Recovering Voices visit was not without difficulties. Planning took two years, with misunderstandings and shifting expectations along the way. Each of the Zuni participants remarked upon the emotional toll, sadness, and shock of encountering

FIGURE 5. Curtis Quam and Octavius Seowtewa, ZCRAT team members, discussing a planting stick from the NMAI collections and the significance of heritage variety seeds to the continuance of Zuni cultural practices as part of recording educational videos. (Photo by Judith Andrews, 23 September 2016.)

highly sensitive cultural items in museum storage. The first day at the NMNH was particularly difficult, when opening the first cabinet revealed a highly sensitive figure of *Kolowitsi*, a serpent who traditionally appeared only during periodic initiation ceremonies. The serpent no longer makes these appearances in the pueblo and has not done so within the lifetime of some ZCRAT team members because information regarding the proper duties pertaining to it are no longer retained within the community. Although the Smithsonian team had attempted to inspect all the cabinets beforehand to avoid any surprises, they had accidently overlooked the *Kolowitsi* cabinet, which ZCRAT team members described as heartbreaking to encounter. After lengthy discussion among themselves, the team made a number of recommendations to prevent any Zunis from similar accidental exposures, including rehousing the figure in a closed box with handling and storage restrictions since even Zunis themselves are not allowed to see this powerful being.

Despite the best of intentions, the inflexibility of the Smithsonian's bureaucratic structures also created significant logistical problems, most notably preventing prompt and full dispersal of funds to team members. Finally, the closure of the AAMHC in late 2016 stymied some of the educational goals since it was the planned means for disseminating teaching materials, with museum technician Curtis Quam participating as part of the ZCRAT team. The AAMHC has since reopened under tribal administration, creating the potential for these initiatives to go forward again, but subsequent conditions of the COVID-19 pandemic have continued to disrupt full implementation of the team's goals.

Hopefully, more effective planning based on the 2016 visit and experience working together will prevent some of these difficulties in the future. In April 2019, a Zuni delegation briefly revisited NMNH collections to check on the care of materials viewed in 2016, as well as consider future objectives. Planning for additional visits is in process, with the purpose being completing the assessment of culturally sensitive collections, more robust corrections to terminology in the Smithsonian's catalogs, exploration of connections to other pueblo communities and their shared knowledge embodied in material culture, and opportunities for Zuni artists to work hands-on with the extensive holdings of Zuni pottery.

CONCLUSIONS

Legacy collections are crucial intersections among museums, researchers, and source communities, exerting a gravity that can raise contention but can also bring people together in new partnerships, more equitable relations, and shared authority. Recent interdisciplinary research among Hawikku collections and the ZCRAT Recovering Voices project argue for the continued value of old and underused collections for new research initiatives, as well as revitalized relationships with source communities. The presence of archaeological and ethnological materials in museum collections can lead to new partnerships working to meet descendant concerns and interests (Fitzhugh, 1997:239). Robust investment in resources and staffing to support collections-based research empowers these kinds of projects, as does recognition that collections are not merely accumulations of objects but living embodiments of history and traces of entangled relations among museums and source communities.

In 1918, when Hendricks conjured the mental picture of a rubber-sided MAI, he was hoping that excavations would procure as many artifacts as they could. This acquisitive indulgence was possible because of coercive federal assimilationist policies then affecting Native communities such as Zuni Pueblo. In concluding, however, it is possible to read his rhetorical image in another way. The novelty of the rubber-sided museum is its elastic and malleable structure, which allows not only balloon-like expansion but also flexible reconfigurations in response to the tremors of new paradigms in museum practices. Revisiting overlooked legacy collections offers the potential for creative new interdisciplinary approaches, as well as the flexibility to accommodate the previously unheard voices, objectives, and curatorial guidance of source community members, through shared authority and sustained partnerships. This is surely a worthier mission than the inflated aspirations of the universal museum that Hendricks and Heye envisioned more than a century ago.

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NOTES

1. The term "source community" refers to groups from whom museums collected materials in the past and their descendants today (Peers and Brown, 2003:2). The concept of legacy collections as we use it comes from the work of Lea S. McChesney (2015:68).
2. For an alternative model, see Bryony Onciul (2013), who adapts Sherry Arnstein's (1969) "ladder of participation" to categorize levels and forms of engagement in museum projects. This ladder model has many commonalities with the "collaborative continuum" but is ordered in a vertical, hierarchal ladder that privileges citizen power as the ideal mode of participation, perhaps equivalent to the self-representation that occurs in tribal museums and community centers, as a step beyond the collaborative continuum of Colwell-Chanthaphonh and Ferguson (2008).

REFERENCES

Ames, Michael M. 1992. *Cannibal Tours and Glass Boxes: The Anthropology of Museums,* 2nd ed. Vancouver, B.C., Canada: UBC Press.

Arnstein, Sherry R. 1969. A Ladder of Citizen Participation. *Journal of the American Institute of Planners*, 35:216–224. https://doi.org/10.1080/01944366908977225

Atalay, Sonya, ed. 2006. Special Issue: Decolonizing Archaeology. *American Indian Quarterly*, 30(3/4): 269–503. https://doi.org/10.1353/aiq.2006.0015

Boast, Robin. 2011. Neocolonial Collaboration: Museum as Contact Zone Revisited. *Museum Anthropology*, 34:56–70. https://doi.org/10.1111/j.1548-1379.2010.01107.x

Boast, Robin, and Jim Enote. 2013. Virtual Repatriation: It Is Neither Virtual nor Repatriation. In *Heritage in the Context of Globalization: Europe and the Americas*, ed. by Peter F. Biehl and Christopher Prescott, pp. 103–113. New York: Springer. https://doi.org/10.1007/978-1-4614-6077-0_13

Burgio-Ericson, Klinton. 2018. Living in the Purísima Concepción: Architectural Form, Cultural Negotiation, and Everyday Practice in a Seventeenth-Century New Mexico Mission among the Zuni Indians. Ph.D. diss., University of North Carolina at Chapel Hill, Chapel Hill.

Burgio-Ericson, Klinton. 2020. "Plainly Read, Like a Book": The Place of the Hendricks–Hodge Expedition in Archaeological History. *New Mexico Historical Review*, 95:129–158.

Clifford, James. 1997. Museums as Contact Zones. In *Routes: Travel and Translation in the Late Twentieth Century*, ed. James Clifford, pp. 188–219. Cambridge, Mass.: Harvard University Press.

Colwell-Chanthaphonh, Chip, and T. J. Ferguson. 2008. Introduction: The Collaborative Continuum. In *Collaboration in Archaeological Practice: Engaging Descendent Communities*, ed. Chip Colwell-Chanthaphonh and T. J. Ferguson, pp. 1–32. Lanham, Md.: AltaMira Press. https://doi.org/10.1111/j.1548-1379.2009.01047.x

Coulthard, Glen Sean. 2014. *Red Skin, White Masks: Rejecting the Colonial Politics of Recognition*. Minneapolis: University of Minnesota Press. https://doi.org/10.5749/minnesota/9780816679645.001.0001

Enote, Jim. 2015. Museum Collaboration Manifesto. Paper presented at the International Conference of Indigenous Archives, Libraries, and Museums, Washington, D.C.

Elliott, Melinda. 1995. *Great Excavations: Tales of Early Southwestern Archaeology, 1888–1939*. Santa Fe, N.M.: School of American Research Press.

Ferguson, T. J. 1996. *Historic Zuni Architecture and Society: An Archaeological Application of Space Syntax*. Tucson: University of Arizona Press.

Ferguson, T. J., Roger Anyon, and Edward J. Ladd. 2000. Repatriation at the Pueblo of Zuni: Diverse Solutions to Complex Problems. In *Repatriation Reader: Who Owns American Indian Remains*, ed. Devon A. Mihesuah, pp. 239–265. Lincoln: University of Nebraska Press.

Fitzhugh, William M. 1997. Ambassadors in Seal Skins: Exhibiting Eskimos at the Smithsonian. In *Exhibiting Dilemmas: Issues of Representation at the Smithsonian*, ed. Amy Henderson and Adrienne L. Kaeppler, pp. 206–245. Washington, D.C.: Smithsonian Institution Press.

Fowler, Don D. 1982. Cultural Resources Management. *Advances in Archaeological Method and Theory*, 5:1–50. https://doi.org/10.1016/B978-0-12-003105-4.50006-6

Fowler, Don D. 2000. *A Laboratory for Anthropology: Science and Romanticism in the American Southwest, 1846–1930*. Albuquerque: University of New Mexico Press.

Golding, Viv, and Wayne Modest, eds. 2013. *Museums and Communities: Curators, Collections, and Collaboration*. London: Bloomsbury Academic.

Green, Jesse. 1979. Introduction. In *Zuñi: Selected Writings of Frank Hamilton Cushing*, ed. Jesse Green, pp. 3–34. Lincoln: University of Nebraska Press.

Green, Jesse. 1990. *Cushing at Zuni: The Correspondence and Journals of Frank Hamilton Cushing, 1879–1884*. Albuquerque: University of New Mexico Press.

Harrison, Rodney. 2013. Reassembling Ethnographic Museum Collections. In *Reassembling the Collection: Ethnographic Museums and Indigenous Agency*, ed. Rodney Harrison, Sarah Byrne, and Anne Clarke, pp. 3–35. Santa Fe, N.M.: School for Advanced Research Press.

Hays-Gilpin, Kelly, and Ramsom Lomatewama. 2013. Curating Communities at the Museum of Northern Arizona. In *Reassembling the Collection: Ethnographic Museums and Indigenous Agency*, ed. Rodney Harrison, Sarah Byrne, and Anne Clarke, pp. 259–283. Santa Fe, N.M.: School for Advanced Research Press.

Hendricks, H. 1918. Letter to Frederick. W. Hodge, 14 August 1918. Frederick W. Hodge/Harmon Hendricks Correspondence. 1917–1923. MS.7.HHE.1.7. Frederick Webb Hodge Manuscript Collection, Braun Research Library Collection, Autry Museum of the American West, Los Angeles, Calif.

Herman, R. Douglas K., ed. 2018. *Giving Back: Research and Reciprocity in Indigenous Settings*. Corvallis: Oregon State University.

Isaac, Gwyniera. 2005. Re-observation and the Recognition of Change: The Photographs of Matilda Coxe Stevenson (1879–1915). *Journal of the Southwest*, 47:411–455.

Isaac, Gwyniera. 2007. *Mediating Knowledges: Origins of a Zuni Tribal Museum*. Tucson: University of Arizona Press.

Isbell, William H. 2000. What We Should Be Studying: The "Imagined Community" and the "Natural Community." In *The Archaeology of Communities: A New World Perspective*, ed. Marcello A. Canuto and Jason Yaeger, pp. 243–266. London: Routledge.

Joseph, Miranda. 2002. *Against the Romance of Community.* Minneapolis: University of Minnesota Press.

Kennedy, T. 2001. Kivas to Bring Hawikku Pottery Back to Zuni. *Shiwi Messenger*, 29 June.

Kennedy, Tom R., and Dan Simplicio. 2009. First Contact at Hawikku (Zuni): The Day the World Stopped. In *Telling New Mexico: A New History*, ed. Marta Weigle, Francis Levine, and Louise Stiver, pp. 63–71. Santa Fe: Museum of New Mexico Press. https://doi.org/10.1080/03017600308413469

Kintigh, Keith W. 1985. *Settlement, Subsistence, and Society in Late Zuni Prehistory*. Tucson: University of Arizona Press.

Ladd, Edmund J. 1994. Cushing among the Zuñi: A Zuñi Perspective. *Gilcrease Journal*, 2(2):20–35.

La Salle, Marina J. 2010. Community Collaboration and Other Good Intentions. *Archaeologies: Journal of the World Archaeological Congress*, 6:401–422. https://doi.org/10.1007/s11759-010-9150-8

Lonetree, Amy. 2012. *Decolonizing Museums: Representing Native America in National and Tribal Museums*. Chapel Hill: University of North Carolina Press.

Mahkee, Wells, Jr. 2001. Hawikkuh Pottery Comes to Zuni. *Shiwi Messenger*, 27 July.

Marshall, Yvonne. 2002. What Is Community Archaeology? *World Archaeology*, 34:211–219. https://doi.org/10.1080/0043824022000007062

McChesney, Lea. S. 2015. Museums and Antiquarian Anthropology: Past, Present, and Future. *Practicing Anthropology*, 37:66–68. https://doi.org/10.17730/0888-4552-37.3.66

McFeely, Emily, 2001. *Zuni and the American Imagination*. New York: Macmillan.

Merrill, William L., Edmund J. Ladd, T. J. Ferguson, Elizabeth Cruwys, Alan S. Downer, Christian F. Feest, Charlotte J. Frisbie, Joyce Herold, Schuyler. Jones, Robert Layton, and Larry J. Zimmerman. 1993. The Return of the Ahayu: da: Lessons for Repatriation from Zuni Pueblo and the Smithsonian Institution. *Current Anthropology*, 34:523–567. https://doi.org/10.1086/204205

Mills, Barbara J., and T. J. Ferguson. 1998. Preservation and Research of Sacred Sites by the Zuni Indian Tribe of New Mexico. *Human Organization*, 57:30–42. https://doi.org/10.17730/humo.57.1.k22560377478330h

Montgomery, Ross Gordon. 1966. Functional Interpretations of the Church and Friary. In *The Excavation of Hawikuh by Frederick Webb Hodge: Report of the Hendricks–Hodge Expedition, 1917–1923*, by Watson Smith, Richard B. Woodbury, and Nathalie F. S. Woodbury, pp. 126–133. New York: Museum of the American Indian Heye Foundation.

Nabokov, Peter. 1989. Introduction. In *A Study of Pueblo Architecture in Tusayan and Cibola*, ed. Victor Mindeleff, pp. ix–xli. Reprint, Washington, D.C.: Smithsonian Institution Press. [First published 1891.]

Native American Graves Protection and Repatriation Act. 1990. Public Law 101–601, 25 U.S. Code § 3001 et seq.

Onciul, Bryony. 2013. Community Engagement, Curatorial Practice, and Museum Ethos in Alberta, Canada. In *Museums and Communities: Curators, Collections, and Collaboration*, ed. Viv Golding and Wayne Modest, pp. 79–97. London: Bloomsbury Academic.

Parezo, Nancy J. 1985. Cushing as Part of the Team: The Collecting Activities of the Smithsonian Institution. *American Ethnologist*, 12:763–774. https://doi.org/10.1525/ae.1985.12.4.02a00120

Peers, Laura, and Alison K. Brown, eds. 2003. *Museums and Source Communities: A Routledge Reader.* London: Routledge.

Phillips, Ruth. 2003. Community Collaboration in Exhibits: Introduction. In *Museums and Source Communities: A Routledge Reader*, ed. Laurel Peers and Alison K. Brown, pp. 155–170. London: Routledge.

Silliman, Stephen W., and T. J. Ferguson. 2010. Consultation and Collaboration with Descendent Communities. In *Voices in American Archaeology*, ed. Wendy Ashmore, Dorothy T. Lippert, and Barbara J. Mills, pp. 113–127. Washington, D.C.: Society for American Archaeology Press. https://doi.org/10.1111/j.1548-1433.2011.01387_3.x

Silverman, Raymond A., ed. 2015. *Museum as Process: Translating Local and Global Knowledges*. London: Routledge. https://doi.org/10.4324/9781315766935

Smith, Claire, and Gary Jackson. 2008. The Ethics of Collaboration: Whose Culture? Whose Intellectual Property? Who Benefits? In *Collaboration in Archaeological Practice: Engaging Descendent Communities*, ed. Chip Colwell-Chanthaphonh and T. J. Ferguson, pp. 171–199. Lanham, Md.: AltaMira Press.

Smith, Watson, Richard B. Woodbury, and Nathalie F. S. Woodbury. 1966. *The Excavation of Hawikuh by Frederick Webb Hodge: Report of the Hendricks–Hodge Expedition, 1917–1923*. New York: Museum of the American Indian Heye Foundation.

Stanton, John E. 2003. Snapshots on the Dreaming: Photographs of the Past and the Present. In *Museums and Source Communities: A Routledge Reader*, ed. Laura Peers and Alison K. Brown, pp. 136–151. London: Routledge.

Tapsell, Paul. 2003. Afterword: Beyond the Frame. In *Museums and Source Communities: A Routledge Reader*, ed. Laura Peers and Alison K. Brown, pp. 242–251. London: Routledge.

Trope, Jack F., Walter R. Echo-Hawk, and Devon A. Mihesuah. 2000. *The Repatriation Reader: Who Owns American Indian Remains?* Omaha: University of Nebraska Press.

Watkins, Joe, and T. J. Ferguson. 2005. Working with and Working for Indigenous Communities. In *Handbook of Archaeological Methods*, vol. 2, pp. 1371–1405. Walnut Creek, Calif.: AltaMira Press.

Wiel, Stephen E. 1999. From Being about Something to Being for Somebody: The Ongoing Transformation of the American Museum. *Daedalus*, 128:229–258.

When the Field Site Is the Museum: Archaeological Opportunities and Challenges

*Rosemary A. Joyce**

INTRODUCTION

Archaeology in the United States is undergoing a series of transformations, involving emphasizing community-engaged scholarship, developing new research questions of contemporary relevance dealing with such things as resilience and production of historical identity, and shifting toward noninvasive methods and intensive analyses of smaller samples with limited or no new excavation. Yet the normative vision of archaeological research still is of new excavation of a site selected purposively to answer a question primarily of interest to academics, with the site sampled by predetermined strategies to enable generalization of results. This vision of research places the archaeologist firmly back in the position of dictating what questions are important and how they can be answered. Implicitly, it asserts that only certain kinds of knowledge are worthwhile, marginalizing such things as the sensory impacts that things continue to have in their current lives, the aesthetic appreciation of objects made in the past, and the political importance sites and the materials that make them up have to living people. When archaeology is equated with excavation, all the thorny aspects of power involved in excavation as a singular mode of knowing, a practice modeled on the hierarchy and command of military campaigns (Joyce and Preucel, 2002), reemerge, often without being critically examined.

Research with previously collected materials, especially those in older museum collections, is usually not presented as a normative option for archaeological theses and dissertations. Yet on multiple grounds, an argument can be made that turning to museums as sites of research is an ethically responsible practice that should be pursued as a normative way of conducting research.

I make this argument as a practitioner of both kinds of archaeological research. My own experience encompasses settlement survey, excavation, and materials analyses of newly excavated samples. Yet I identify as a museum anthropologist, recognizing the importance of research on collections whose genesis I did not control. I have always made use of curated collections in my work. In some cases, previously excavated collections are the only evidence for occupation of a site or occupation during a particular time period. As a result, avoiding research on museum collections can systematically privilege certain periods and places and leave others less well understood.

Department of Anthropology, University of California, Berkeley, Anthropology and Art Practice Building, Berkeley, California 94720-3710, USA.
* Correspondence: rajoyce@berkeley.edu
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In addition, as norms of fieldwork have shifted to emphasize more limited and slower excavation, using finer-grained methods of recovery, smaller samples are produced by new excavations. Older collections often include larger samples that can help contextualize more precise, but limited, data gathered in contemporary research.

Finally, perhaps my most radical argument, working with curation facilities is a good way for archaeologists to learn how to propose research that is not based on being in the position of control. Museum research will be subject to review and approval by others, representing multiple interests in the same things. As other essays in this volume show, museum-based research has been a fruitful way for legitimate engagement with source communities to take place and expand (see Bishop et al., this volume; Burgio-Ericson and Seowtewa, this volume).

Researchers working in museum contexts cannot fall into the trap of thinking of the materials as subject to only their decision-making and asserting that academic archaeological questions are automatically sufficient grounds to justify research. Especially when methods that might involve damage to materials are contemplated, standard museum procedures require well-reasoned arguments that the research will produce information justifying the loss. Museum-based research, in other words, promotes an ethic of stewardship as a collective practice of responsibility to others with interests in material traces of the past, the kind of ethic that Alison Wylie (2005) argued archaeologists needed to develop as they moved away from making blanket claims to be the best people to make decisions about archaeological materials. Having to explain what archaeological expertise can contribute to knowledge actually is helpful in becoming clearer about what interests experts have that should be considered in managing curated collections.

In this essay, I illustrate these advantages of using museum collections and make an argument for foregrounding museum-based research in contemporary archaeological practice as normative and even as a model for more of the future of archaeology. To do this, I describe highly productive research on Honduran archaeology made possible by the preservation and management of the collections of the Smithsonian Institution's National Museum of the American Indian (NMAI). I emphasize the kinds of questions that the museum collections allowed me to address that were not feasible without its holdings or that might not have occurred to me and my collaborators if we had not been engaging with museum specialists. Throughout, I also try to show how working with museum collections raises ethical questions about power and privilege that might be evaded in doing new fieldwork but cannot be left aside when you enter an archival facility.

I begin with a case study of one archaeological site in northern Honduras. Known as Farm Two in the records of the earliest archaeologists to work there in the 1930s, it was called Campo Dos when colleagues and I recorded it under threat of development in the 1980s and when students working with us participated in excavations as active destruction was proceeding in the 1990s. Although these excavations were productive, their potential was markedly expanded when colleagues and I began research on the museum collection from Farm Two at the NMAI in 2005–2006.

CAMPO DOS/FARM TWO: LESSONS FROM MUSEUM RESEARCH

My case study juxtaposes knowledge gained from analysis of excavated materials produced by field projects I participated in or directed between 1979 and 1993 with ideas based on study of collections made in 1932 by Gregory Mason near La Lima, Cortés, Honduras (Figure 1), now in the NMAI.

The town of La Lima is located adjacent to the international airport for San Pedro Sula, the second-largest city in Honduras. San Pedro sits on the western edge of the floodplains of the Ulúa and Chamelecón Rivers, tropical rivers that drain a large proportion of the Honduran interior. Prior to the late sixteenth century, the Ulúa and Chamelecón came together to form a single river at a point near La Lima (Pope, 1985). The site of village life based on agriculture before 1500 BC (Joyce and Henderson, 2007), the extensive, rich, well-watered tropical plains of these rivers were one of the original zones developed for commercial banana cultivation starting in the late nineteenth century (Euraque, 1993). By 1930, independent banana companies started by Hondurans had been consolidated under U.S. ownership (Soluri, 2000). One of these companies, today known as United Fruit, established headquarters in La Lima and divided the surrounding land into fields for agricultural exploitation, including fruit production and cattle ranching. On United Fruit Company's map, the area where Mason worked in the 1930s was named Farm Two.

Mason was one of many agents who assembled systematic collections for George Gustav Heye's Museum of the American Indian (MAI). As Ann McMullen (2013) notes, Heye employed both trained archaeologists and archaeologically interested individuals with other backgrounds who produced collections through original fieldwork that were intended to be of scholarly utility. Mason began his involvement in archaeology as a journalist in the 1920s while covering the Mexican revolution in Yucatán. He accompanied professional archaeologists from the University of Pennsylvania to sites in Guatemala and Belize, writing journal articles and popular books about his experiences. His seriousness about archaeology culminated in the completion of a doctoral degree in 1938, with a dissertation on the archaeology of Colombia.

The collections Mason made in Honduras for the MAI came from 31 distinct localities. Although these include places where he purchased items (also a practice of the academic archaeologists of the time), Mason also undertook excavations of his own that he wrote about in general terms in a popular book (Mason, 1940:123–137). Between 2006 and 2010, I reviewed and recorded more than 650 individual items now in the collection of the NMAI, described in 420 catalog entries, that Mason

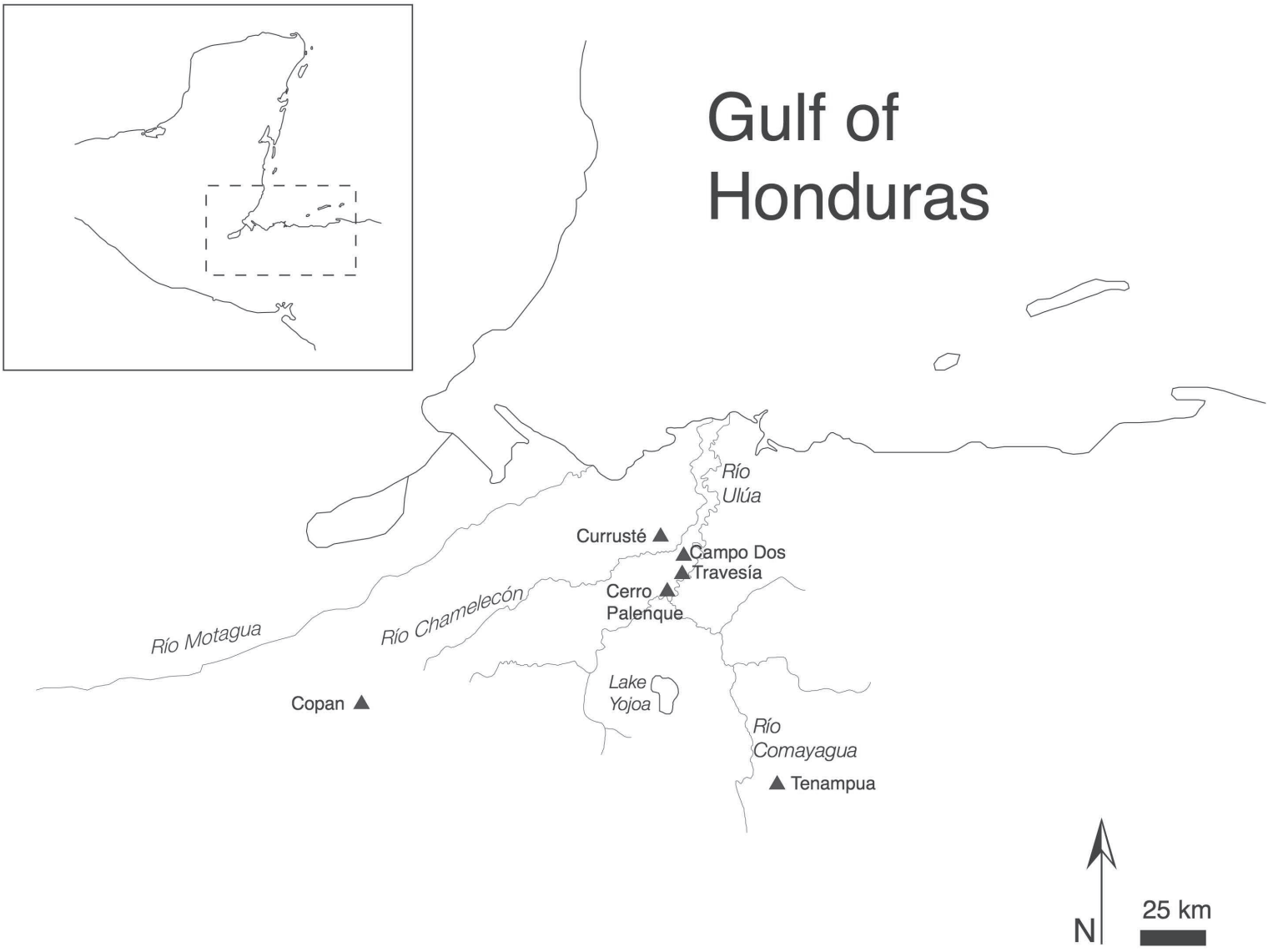

FIGURE 1. Map showing locations of archaeological sites mentioned.

excavated at Farm Two. He described the area around La Lima, including Farm Two, as "covered with mounds," saying "many are burial mounds and are generally small. Others are large, flat mounds which served to support buildings long since fallen" (Mason, 1940:124). Although today we understand that there were not separate burial mounds in these villages, where the ancestors were laid to rest under the floors of the houses of their descendants (Lopiparo, 2003), Mason's description of the site topography matches that produced in modern surveys.

The area Mason called Farm Two had been included in a project I participated in from 1979 to 1983, directed by John S. Henderson, to document ancient settlement patterns. The goal of this project, organized by the Honduran Institute of Anthropology and History, was to provide a baseline registry of archaeological resources in the San Pedro Sula hinterland to allow management of cultural resources under cultural heritage laws that protected sites from destruction in an area where development was projected (Henderson et al., 1982). Recording the effects of the international traffic in antiquities that led to local subsistence digging and site destruction emerged as an important part of the project as it continued (Luke and Henderson, 2006).

In all, we recorded more than 500 archaeological sites, using a combination of systematic survey using stereo air photos, pedestrian survey of probabilistic sample tracts, and purposive survey around previously reported sites. One of the tracts that was selected for recording using walking survey and mapping

[1]

extended east from the town of La Lima and included United Fruit Company's Farm Two. The site we recorded there was detectable as a series of low earthen rises in a cattle pasture along the main road from La Lima. Similar low platforms were continuously distributed along stream courses visible in 1:20,000 scale air photos taken in the early 1970s (Sheptak, 1982). These low platforms included sites along the modern Quebrada Cazenave, which occupied an old course of the Chamelecón River south of the Farm Two platforms (Pope, 1985).

Already in 1979, when our survey began, many of the cattle pastures that dotted the tract east of La Lima were being transferred from the banana company to new owners, part of a national process of expropriation and redistribution of land deemed underused as a result of land reform legislation passed in 1972 and 1975 (Ruhl, 1984:40–41, 49–50, 55–56). Initially, the new owners of these fields were peasant cooperatives the government expected to grow sugar cane, bananas, or other cash crops (Ruhl, 1984:51–54). By the late 1970s, land was being acquired by companies with plans to develop *maquilas*, industrial plants that would assemble products using imported materials, then export them in new free trade zones authorized by legislation in 1976 (Pine, 2008:137–139). These developments expanded after 1987 in response to legislation following new import-export agreements with the United States in 1984, threatening many of the sites that our survey project had recorded.

Fieldwork on the site survey project was completed by 1983, ending with the production of three doctoral dissertations and a publication by a postdoctoral researcher that placed sites located by survey in chronological and regional context (Wonderley, 1984; Joyce, 1985; Pope, 1985; Robinson, 1989). Building on the settlement survey, in the late 1980s John Henderson and I initiated a new field project in the central part of the valley where the increase in development was threatening sites. Our goals were to explore household dynamics through excavations in sites purposively selected as under threat of destruction (Joyce, 2018). As part of this project, in 1993, we undertook excavations at the location of Farm Two, now known as Campo Dos, where bulldozers were in the process of leveling the site for a *maquila*.

From the perspective of normative archaeological practice, the data produced by our survey and excavations would be considered more useful than anything that could be developed using the older Mason collection, with its lack of precise provenience within Farm Two and its emphasis on collecting things rather than describing the depositional context of those things. Following similar assumptions, it is common for archaeologists working at sites with older curated collections to make limited use of such materials. What I want to explore in the remainder of this essay is the enrichment of understanding that came about as a result of using the museum collection as a research site, without assuming it would have less value than the collections excavated in the 1990s.

Three distinct insights were possible as a result of using this collection as a research resource. The true length of occupation of the site was recognized as being longer than would have been thought from the more recent projects, with consequences for understanding cultural continuity and identity. The impression of relatively modest wealth given by the modern excavations was challenged by the materials recovered by Mason, entailing a deepened understanding of the site as part of a sustainable social system of "wealthy farmers" that persisted for centuries, a stark contrast to contemporary precarity experienced by farmers in the same zone. Finally, a detailed analysis of social relations that foregrounded the agency of women was made possible, transforming understanding of the modern research results.

Getting to these insights required adjusting our research strategies to build on the strengths of both assemblages, one resulting from the more extensive, if less carefully documented, work of Mason, the other stemming from scrupulously documented, but more limited, recent excavations. The strategies employed are not specific to this site or these assemblages; they can form a model for using museum collections, alone or in conjunction with recently excavated materials, in ways that can go beyond what would otherwise be possible, addressing broader and diverse interests in the process. Nor do they exhaust the potential for the museum collection to add to knowledge; our research on the NMAI collection identified several specific questions that could be addressed through materials analyses that have not yet been carried out. The combination of work accomplished and potential future research exemplifies how continued curation of older museum collections could transform the practice of archaeology.

Seeing Continuous Histories

The vessel that is my first point of reference for this discussion (Figure 2) is diagnostic of the late fourteenth to early sixteenth century AD. The style is best known through excavations at the site of Naco in a small upland valley to the west, where it was named Nolasco Bichrome (Wonderley, 1986). This is one of five vessels of similar date that Mason excavated at Campo Dos, including three in the Nolasco Bichrome style, along with at least one other object securely dating to the same time, a fishing net weight. Together, these materials indicate that residents dwelled at Farm Two during the period of European expansion into Honduras. In contrast, none of the excavations in the 1990s encountered material identified as being of such late date.

The fifteenth to sixteenth centuries constitute a time period critical for connecting contemporary Indigenous peoples of Honduras with histories that extend back before European colonialization. In most research on Honduras, a sharp break is projected into this period of time, with occupants living before European invasion described as "prehistoric," artificially separated from those living under colonial regimes (Joyce and Sheptak, 2014). The appearance of a break is deepened by an overwhelming emphasis in archaeology on the period from AD 250 to 800, when the Classic Maya city Copán was at its peak of power. As the historian Darío Euraque has demonstrated, the

FIGURE 2. Nolasco Bichrome vessel from Farm Two. National Museum of the American Indian (NMAI 18/3209).

archaeological emphasis on the Classic period, and the Maya culture in particular, has the effect of overwriting the specific histories of many other Honduran Indigenous groups with an idealized Maya identity that is simultaneously represented as vanished and thus open to nationalist appropriation (Euraque, 1998). The break promotes contestation of Indigenous assertions of rights by calling contemporary identifications with the valued past into question.

The identification of a late assemblage at Campo Dos is thus consequential, pointing to the presence of Indigenous people at this place in the sixteenth century. Remarkably, few archaeological sites have been securely identified for this period, despite the reported density of Indigenous towns described in early Spanish documents (Sheptak, 2013). In the floodplain of the Ulúa River, only one archaeological site from this time period, Ticamaya, has been extensively excavated (Blaisdell-Sloan, 2006). Two others, Despoloncal and El Remolino, were subject to limited excavations in 1983 as part of the last phase of the site survey project (Wonderley, 1984).

More than simply adding to the universe of sites occupied at this critical moment in history, however, the inclusion of these things in the Farm Two assemblage challenges the impression of *discontinuity* of occupation given by results of more recent problem-oriented archaeological work. On the basis of surface-collected materials and samples from excavations, the settlement survey concluded that most of the 500 registered archaeological sites ceased to be occupied after AD 850–950. Combined with the limited number of sites dating to the sixteenth century that have been identified, this conclusion contributes to creating a sense that the period from AD 500 to 1000 was the cultural apogee in the region. It makes it harder to correct the impression of the Ulúa valley as culturally or socially marginal when efforts to establish European political domination began.

The identification of evidence in older curated museum collections of later occupation in a site primarily considered to be part of the earlier history of the region is not unique to Campo Dos and the NMAI. Museum collections raise the same challenge to understanding of an even more prominent site in the central valley, Travesía. Travesía has been the focus of intensive archaeological work throughout the twentieth century and is seen as one of the major centers of the period from AD 500 to 1000 (Hendon et al., 2014:101–138). Yet previous excavations failed to identify evidence of occupation there later than AD 1200. My review of a museum collection excavated at Travesía, deposited in 1898 in Berlin's Ethnological Museum, identified three Nolasco Bichrome vessels, along with another example of a diagnostic late fishing net weight.

The museum collections from Campo Dos and Travesía are dominated numerically by material from the earlier and better-understood period of occupation, like collections more recent academic archaeology has produced. It could be tempting to describe the late components curated in these museums as unrelated to the more abundant earlier materials, reinstating the sense of discontinuity that is suggested by more recent archaeological fieldwork. This potential resolution of the presence of the late components found only in the museums can be countered by comparing the history of occupation of these two sites to that of Ticamaya, the most extensively excavated sixteenth century site in the Ulúa valley, located downriver on what was at the time the Ulúa river bank (see Figure 1). Here, careful excavations by Kira Blaisdell-Sloan identified late materials as part of continuous histories of occupation extending back to at least the twelfth century AD and probably earlier (Blaisdell-Sloan, 2006:151–167).

Unlike Campo Dos and Travesía, features from occupation at Ticamaya were rapidly buried by the river. This depositional situation produced a distinctive form of chronological testimony, a deep sequence of vertically superimposed strata that clearly demonstrate continuity in occupation of this location. The identification of earlier occupation at Ticamaya would have been difficult without the careful documentation of stratigraphic superposition because of the lack of examples of easily identifiable diagnostic types of artifacts dating to the centuries from AD 950 to 1250.

The most distinctive ceramic type from this period, Las Vegas Polychrome, is rarely found in the Ulúa valley (Joyce, 2019). As a result, sites occupied during this period are recognized primarily through superposition over earlier villages. At sites like Travesía and Campo Dos, the local watercourses were lower-volume streams running in older river courses abandoned by the Ulúa and Chamelecón Rivers by the tenth century (Pope, 1985). Alluvial deposition at these sites did not cover earlier occupation, and later residents lived within the boundaries of

earlier settlements, their presence detected only by chance when excavations sampled the areas where later people lived, and then only if they produced visually distinctive objects.

Without the impetus of understanding how the later component at Campo Dos was historically connected to the earlier one, I would not have even considered the possibility of continuity of occupation. With this question, posed by the Mason collection, facing me, I was able to identify at least two, and possibly as many as four, vessels from Campo Dos that likely were produced during the transitional time period from AD 950 to 1250, although not the most distinctive Las Vegas Polychrome. Rather than see the Classic and sixteenth century components at Campo Dos as disconnected, I was led by the extended record from the site offered by the Mason collection to view residence in the flood plain of the Ulúa valley as continuing, even as wealthy families saw their influence and ability to patronize production or acquisition of visually striking cultural artifacts decline. Campo Dos, from this perspective, offers a particularly interesting example of a phenomenon that is less considered than the familiar story of collapse and abandonment of the highly unequal hierarchical societies of western Honduras, like Copán, that archaeology has emphasized. This is a story of the resilience and stability of a less hierarchical society of wealthy farmers who contained the growth of inequality within less disruptive boundaries.

Seeing Histories of Sustainability

The concept of a society of wealthy farmers is one that John Henderson and I developed in the 1990s as we continued our excavations in sites under threat of development (Luke and Henderson, 2006; Joyce, 2013). We found repeated examples of two linked phenomena: much deeper histories of occupation than we originally anticipated and much richer assemblages of objects than might be expected, given the modest and largely undifferentiated nature of house features detected in survey. Prior to undertaking our excavations, our understanding was that most of the sites with surface-visible features developed in the centuries equivalent to the Maya Early Classic, locally equivalent to AD 200–600. These inhabited places, we thought, continued to be occupied until sometime between AD 800 and 1000. Our first major excavations, at a site called Puerto Escondido, instead showed stable occupation that extended from before 1500 BC to at least the eighth century AD (Joyce and Henderson, 2007).

The Mason collection from Farm Two suggests a similar early history at Campo Dos, untouched in our excavations in the 1990s. More than 170 items in the Mason collection can be identified as dating to the period from 1000 to 200 BC. Again, the curated collection in Berlin from Travesía parallels this, with more than 80 items likely made before 200 BC, including some that were produced before 1000 BC. In a third museum-curated collection, in the National Museum of Denmark, from less precisely located excavations in banana company fields east of La Lima, I also identified objects dating from as early as 1400–1100 BC to 200 BC.

The museum collections allow us to assume that continuity of occupation from a very early period was more common than our survey and excavations had led us to understand. The circumstances that gave us the opportunity to excavate the very early levels of Puerto Escondido were highly unusual; the site had been bulldozed for a development before we began our work, so the ground surface where we began excavations was a cut into the foundations of houses dating between AD 400 and 600 (Joyce and Henderson, 2007; Joyce, 2019). We began our excavations at a level dating 400 to 600 years earlier than would normally be the case in these long-occupied sites, allowing us to reach much older levels using the scrupulous approaches of contemporary archaeology. Our window into the earliest period of residence at Puerto Escondido, before 1500 BC, was very limited, coming from a single 2 × 1 m excavation at the base of our excavations. We would have needed to continue excavations for many more seasons to document the overlying strata and reach the deepest levels over the wider areas that we examined for the later periods.

The limitations imposed by contemporary research methods make older museum collections that were products of less precise methods important resources for recognizing rare or low-volume materials. The identification of both early and late components at Campo Dos represented in the museum but absent from the more recent excavations is an example. There is no evidence that Mason understood that the ceramics he collected dated to a significantly earlier or significantly later occupation. It appears simply that his excavation methods resulted in his processing a larger volume of the site, in some places reaching more deeply buried levels, than is common in contemporary, more precise, and therefore slower and less spatially extensive excavations.

The potential older museum collections offer for finding less common materials also had another effect on our understanding of Campo Dos: it testified to practices, use of materials, and long-distance connections that were not otherwise evident. The museum collection from Farm Two did not just parallel, and thus support our generalizing to a wider area, the long-term continuity of occupation evident in the carefully dissected excavations at Puerto Escondido. It also presented us with an assemblage testifying to a high level of wealth during the period from AD 400 to 800 that our own excavations at Campo Dos did not document.

The Classic period settlement at Campo Dos included at least 10 large, low earthen platforms (Hendon et al., 2014:57–76). In the 1990s, our project excavated in two of these, as well as in a ballcourt located at the southern edge of the site. Two students completed senior honors theses based on materials we excavated in 1993, one analyzing the ballcourt excavations and the other defining evidence of a ceramic workshop.

Ceramic production was proposed on the basis of results from excavations in an area 24 × 24 m in extent that documented clay processing and firing features in use around AD 800–900 (Lopiparo, 1994). Remains of two perishable buildings on either side of an open workspace were delineated. In one area, numerous obsidian blades and ground stone artifacts were adjacent to three shallow clay basins. Nearby refuse deposits contained

fragments of molds for the production of ceramic vessels and figurines, along with fragments of figurines and mold-made bowls.

Twelve 2 × 2 m excavation units placed in the ballcourt, recognizable as a pair of long, parallel structures framing a central playing court, identified two episodes of use before AD 750, preceding the construction of identifiable ballcourt features (Swain, 1995). These may be remains of residential occupation in this area because they included possible hearths and burials of adults and children (Hendon et al., 2014:69). In the second episode, the area was ornamented with plaster, which would have modestly distinguished residents from those in nearby locations like the household associated with the ceramic workshop area.

None of the residential buildings detected at Campo Dos were built of materials like cut stone or at grand scale. On the surface, they resemble hundreds of other platforms in this part of the valley. Yet the Mason collection shows that the people living in these relatively modest houses of earthen construction enjoyed access to imported rarities and locally produced luxuries, beginning at least by the early part of the Classic period.

The NMAI collection includes two Ixcanrio Orange Polychrome dishes, rare vessels of a style produced around AD 250 in Belize or adjacent Guatemala (Reese-Taylor and Walker, 2002:106–108). Four chert bifaces in the collection match the diagnostic appearance of brown, banded, and gray chert tools produced in Belize, although the forms present could date as late as the period from AD 650 to 850 (Shafer and Hester, 1983). Four fragments of Ulúa marble vases are in the NMAI collection from Farm Two as well. These were locally produced in the Ulúa valley after AD 600 and considered a luxury whose consumption was restricted, produced in a limited number of workshops around Travesía (Luke, 2002; Luke and Tykot, 2007). At least some people at Campo Dos had access to jade, raw material imported from Guatemala, and marine shell, used for beads that would have formed part of personal jewelry.

Perhaps the most distinctive object in the Farm Two collection is a fragment of an obsidian mirror. The only other example of such an object from the Ulúa valley was excavated at Puerto Escondido from a burial dating between AD 400 and 650, placed in a disused storage pit in an otherwise unremarkable household. Obsidian mirrors were worn as part of regalia of political or religious office in Mexico starting before 1000 BC and continuing to the period of European invasion (Gallaga and Blainey, 2016). They figure as parts of costume and titles of Classic Maya nobles. Their rarity in Honduras suggests that they were badges of office or marks of status there as well for individuals who played socially prominent roles. Understanding the origins of the raw material could help us understand the networks of interaction through which this item was adopted and the kinds of understandings of status that it might have brought with it.

The more extensive collections made by Mason, like those of other early excavators, were more likely to include such singular or rare objects. These are predictably likely to be absent in more limited excavations, like those undertaken by modern archaeologists driven by an ethic of conservation to do as little excavation as possible and by advances in techniques to work slowly as they convert everything, including the soil matrix, into data. By juxtaposing the holdings of museums with those contemporary excavations, researchers have the potential to understand unusual activities better to avoid mistakenly characterizing the actual richness of sites that might, at first glance, appear to be relatively modest. This is especially important in an area like the Ulúa valley, where local people maintained a relatively low level of economic inequality for long periods of time. Without being reminded that these people actually did have access to luxuries and imported goods, it would be tempting to imagine people living very much like rural farmers in the region today, who struggle to survive in the same environment. Yet what the archaeology should tell us is that this modern struggle is not a natural result of the rigors of farming, but a reflection of highly unequal access to land and greater demands in support of a hierarchical state that are unlike what the ancestral residents of this territory experienced. That contrast leads to my final example of how the museum collection helps us to better understand social relations at Campo Dos during the centuries when hierarchy was minimal but the residents enjoyed connections to a very wide cosmopolitan network providing luxuries for personal use: rebuilding models of society from the ground up.

Seeing Histories of Social Action

One of the undergraduate researchers who worked at Campo Dos, Jeanne Lopiparo, went on to complete a doctoral dissertation analyzing evidence for ceramic production at a regional scale (Lopiparo, 2003). She related variation in the imagery on fragmented ceramic figurines at Campo Dos and other sites in the Ulúa valley to relationships between neighboring villages. Newly excavated samples were critical for her analysis, as they provided contextual information confirming that figurines were produced and used in multiple villages.

Lopiparo also included curated collections that had only site-specific provenience in her study, taking the presence of molds as an indication that figurine production likely took place in these sites. Observing that figurines were produced within individual villages and that frequencies of different headdresses depicted in each village varied, Lopiparo argued that specific headdresses likely signified localized identities, displayed during ceremonies in which people visited each other's settlements.

Excavations provided the basis to understand the use and disposal of figurines, including in deposits that resulted from rituals. Complete objects were not usually found, limiting understanding of the ceremonies in which they played active roles before being broken and discarded. Julia Hendon and I turned to museum collections to extend excavation-based understanding of figurines. In their essay in this volume, Erin Sears, Christopher Pool, and Ronald Bishop also combine the study of older curated collections with more recent excavation data. Their study uses the power of larger samples, even when

they include less precisely provenienced pieces, for analysis of compositional variation. Hendon, Lopiparo, and I used the museum collections for distinct purposes: to understand the full social context of events at the site, illustrating the multiplicity of goals such combined research can accomplish.

Our starting point was a figurine collected by Mason at Campo Dos (Figure 3). Showing a pair of human persons, this object was singled out in a defining publication on Maya figurines (Butler, 1935). It lacks the kind of precise context that we can use to understand excavated materials from more recent projects, but it provides more information as a complete piece than the fragments we recovered in our contemporary work. It became the centerpiece of a book that integrated data from recent excavations with studies of more complete objects and larger collections in museums (Hendon et al., 2014).

Our use of the collection began with a visit to the museum by Hendon, who carefully recorded details of the individual figurine that were not well represented in the original journal article, in which it was treated as a generic example of a category of things, assigned to the Ulúa region. Hendon's research had shown that this kind of figurine, with a male and female figure together, was unusual (Hendon et al., 2014:24, fig. 2.1). Although there were multiple examples from the site of Copán, only two others from Honduras had been illustrated, one from the site of Tenampua and the object from the NMAI described as coming from the Ulúa valley. Hendon showed that although the imagery on the Copán and Tenampua figurines was identical (with the figurines varying in size, implying multiple episodes of manufacture), the one from Farm Two in the Ulúa valley was strikingly different.

Inspection of the object at the NMAI reinforced this conclusion and allowed us to see signs of distinction that gave greater prominence to the woman than the man. In contrast to the other known examples, in which the male figure actively grasps the female's arm, the woman on the Campo Dos figurine reaches out to grasp the wrist of the male. Her jewelry, well-preserved face painting, and teeth modification all signify her higher status. We saw this as evidence of the active role of women in Ulúa valley society, something we then followed up using other lines of evidence (Hendon et al., 2014:156–160).

One of the challenges researching this object set us was understanding the circumstances surrounding its collection to confront the limitations they might place on our interpretation. We needed to explore the work of the journalist-turned-archaeologist who produced the collection for the MAI. Although Mason did not provide detailed three-dimensional provenience within his excavations, that was hardly the norm for his contemporaries with professional training either. His comments on the low earthen mounds near La Lima showed a capacity for interpretation that escaped many of his contemporaries, who often overlooked the existence of these features. His narratives based on his work provided additional insights that went beyond those of his contemporaries.

Mason, as a popular writer, was motivated to imagine the lives of the people who had produced the things he was collecting. That led him to think of the landscape around Farm Two as populated with people of different sexes and ages and to recognize that the objects they used exercised their own degree of agency. He put these insights into a much more evocative, poetic text that might encourage archaeologists today to avoid dry and distancing language. In fact, he voiced it as a very contemporary-sounding critique, writing,

> It is strange how the archaeologist, if he plies his peculiar profession very long, is inclined to forget what pottery stands for. Pottery stands for the big bowl of *posol* they use at christenings when the baby is kicking and the women adoring it, while the old men with dirty beards are probably saying to themselves, "It will turn out no better than I have." Pottery represents the five-

FIGURE 3. Figurine from Farm Two. National Museum of the American Indian (NMAI 18/3201).

> year-old boy getting his first prize for shooting the bow and arrow, the little girl of eight getting her first prize for mixing a clever concoction of intoxicating *chicha*. Pottery represents the pompous old men who get together in the evening and admit their follies when they are out of sight of their youngers. Pottery represents the young bride, worrying about her prenuptial preparations, thrilling over her flowers and feathers, and wondering whether the maize beer has enough of a wallop or not. And it represents the bridegroom, conscious of the diagonal crease in his *maxtli*, or apron, and the old aunts and uncles hanging in the background, pretending to be cheerful when they are really unhappy because they are not in the limelight (Mason, 1940:129).

Although we can take issue with aspects of this text, especially the projection of gender roles into a far distant time and place, it succeeds as little archaeological writing does in making clear that the things we excavate are the residues of social relations. The final way that working on museum collections transforms archaeological research is similar: because museums have an inherent mission to communicate to broader publics, research in museum settings makes it harder to stay within the discourse of the academy.

In our work, this manifested itself in several ways. We decided to include narratives in the books we wrote based on our research on museum collections (Hendon et al., 2014; Joyce, 2017). We decided that we needed to relate these works to the contemporary experiences of ordinary Hondurans living in the same environment, often struggling to achieve even modest levels of subsistence. We recovered a sense of the motivating force of beauty, which we argue is part of the rationale for use of a complex manufacturing technique for figurines that is more elaborate than strictly needed but ensured that images produced by makers of different skill levels are equally well executed. Finally, our own sensory encounters with these modest things changed our level of attention to them. By virtue of being preserved in a museum, they were elevated beyond the masses of excavated artifacts we routinely counted, drew, and photographed. We had to treat them as worthy of care and, in the process, noted features that in our field practice of classification and counting we never saw: the way hand-modeled pieces were applied to create features, for example, emphasizing the individuality of each figurine.

Research Avenues to Explore

The potential offered by museum collections, with the commitment institutions make to preserve them, exceeds any single or even collaborative research agenda. At several points in our museum research, objects that were uncommon or absent in the more recent excavations at Campo Dos were identified in the Farm Two collection. Because they are conserved in a museum, they offer the potential for additional materials analyses that could greatly add to the understanding of life in ancient Honduras. I end by considering some of these avenues of possible future research, as they illustrate one of the more exciting ways old collections become active today.

The first item to consider from this perspective is the unique pair figurine. Although it is highly likely on stylistic grounds that it came from the Ulúa valley, technical analysis of the clay composition could confirm that and might, through comparison to the highly variable clay compositions Lopiparo (2003) has documented in the valley, help to confirm a locality of origin or the sphere of distribution of objects of related manufacture within this 2400 square km area. This would provide a parallel to the study of regalia worn by figures that pointed to networks of social relations (Lopiparo, 2003). Ideally, this kind of study would include a larger sample of figural artifacts and molds, both of which are present in the Mason collection.

Multiple fragments of Ulúa marble vases are a second example of materials that could support additional analyses. The chemical profile of known marble quarries and their products has been established by Christina Luke (2002). Testing of the Farm Two fragments would allow confirmation of which quarry they match. The results might be of particular importance because of the presence in the Mason collection of two chunks of marble, suggestive of by-products of marble vase production, possibly indicating that the site hosted a marble workshop distinct from the ones proposed for Travesía (Luke and Tykot, 2007).

Finally, the suspected exotic stone imports in the collection could be chemically analyzed to compare composition to known obsidian and chert resources. If confirmed, the presence of chert objects originating in Belize would strengthen the understanding of people living in sites like Campo Dos—relatively modest villages—as being directly engaged in social relations with Maya nobles. Identifying the original source of the material used for the almost-unique obsidian mirror might help identify a distinct connection to Maya sites in other locations, given that Belize is not a source of this material.

The potential for studies of material composition based on museum collections is a common theme in this volume. The incorporation of museum objects in an expansive regional study of circulation of fine stone items in the Caribbean (Ostapkowicz et al., this volume), like Honduras, an understudied region, emphasizes the potential museum-based studies have to balance historical emphases of scholarship. The study of obsidian plaques in the NMAI registered as mirrors (Martinez et al., this volume) draws on the scope of museum collections to provide necessary wider context for items that were originally rare. These two corrective emphases—providing representation to the underrepresented and contextualizing that which is truly rare by redefining the scope of analysis—are fundamental research potentials awaiting mobilization in many museums.

CONCLUSION

This is a story about one museum assemblage and how it enhanced research on one archaeological site. Multiply it by dozens, if not hundreds, and the true potential of museum-based archaeological research may finally become visible.

Undertaking museum research requires accepting that data recorded at different scales can be usefully interpreted in combination. Within-site precision is the hallmark of contemporary archaeology, but sites and the settlements they represent were real arenas of social life. When precise modern archaeology provides chronological control, museum collections often can provide the context of whole objects, reanimating enigmatic fragments recovered as trash or fill in excavations. Although by the standards of today's archaeology the volumes excavated with little or no detailed recording can be seen as an irretrievable loss of fine-grained information, they provide as compensation assemblages large enough that rare and unusual things might be captured.

To take advantage of these potentials, museum archaeologists need to learn to be historians of science, understanding each collector's motivation, knowledge, and bias. They need to become experts at archival research, tracking down correspondence, news articles, and personal journals, in which relevant context may be waiting to be revealed. They need to be creative scholars who can shift between humanistic and social science perspectives and employ the methods of art history and of materials science together. And they need to do all this while attending to the perspectives of others who have interests in the same collections, whether these are source communities or museum specialists charged with the interpretation of collections for the public.

In other words, to be a museum archaeologist, you have to be the best archaeologist that contemporary training demands. The rewards will far outweigh the additional investments.

REFERENCES

Blaisdell-Sloan, Kira. 2006. An Archaeology of Place and Self: The Pueblo de Indios of Ticamaya, Honduras (1300–1800 AD). Ph.D. diss., University of California, Berkeley.

Butler, Mary. 1935. A Study of Maya Mouldmade Figurines. *American Anthropologist*, 37:636–672. https://doi.org/10.1525/aa.1935.37.4.02a00080

Euraque, Darío. 1993. Modernity, Economic Power and the Foreign Banana Companies in Honduras: San Pedro Sula as a Case Study, 1880s–1945. *Essays in Economic and Business History*, 11:49–65.

Euraque, Dario A. 1998. Antropólogos, arqueólogos, imperialismo y la mayanización de Honduras: 1890–1940. *Yaxkin*, 17:85–101.

Gallaga M., Emiliano, and Marc G. Blainey, eds. 2016. *Manufactured Light: Mirrors in the Mesoamerican Realm*. Boulder: University Press of Colorado. https://doi.org/10.5876/9781607324089

Henderson, John S., Ricardo Agurcia F., and Thomas A. Murray. 1982. El Proyecto Arqueológico Sula: Metas, estrategías y resultados preliminares. *Yaxkin*, 1:82–95.

Hendon, Julia A., Rosemary A. Joyce, and Jeanne Lopiparo. 2014. *Material Relations: The Marriage Figurines of Prehispanic Honduras*. Boulder: University Press of Colorado.

Joyce, Rosemary A. 1985. Cerro Palenque, Valle de Ulua, Honduras Terminal Classic Interaction on the Southern Mesoamerican Periphery. Ph.D. diss., University of Illinois at Urbana-Champaign, Urbana.

Joyce, Rosemary A. 2013. Surrounded by Beauty: Central America Before 1500. In *Revealing Ancestral Central America*, ed. Rosemary A. Joyce, pp. 13–22. Washington, D.C.: Smithsonian Latino Center and National Museum of the American Indian.

Joyce, Rosemary A. 2017. *Painted Pottery from Honduras: Object Itineraries and Lives*. Leiden: Brill.

Joyce, Rosemary A. 2018. Accidentally Digging Central America's Earliest Village. In *Engaging Archaeology: 25 Case Studies in Research Practice*, ed. Stephen Silliman, pp. 141–148. Hoboken: John Wiley & Sons. https://doi.org/10.1002/9781119240549.ch16

Joyce, Rosemary A. 2019. Honduras in Early Postclassic Mesoamerica. *Ancient Mesoamerica*, 30:45–58. https://doi.org/10.1017/S0956536118000196

Joyce, Rosemary A., and John S. Henderson. 2007. From Feasting to Cuisine: Implications of Archaeological Research in an Early Honduran Village. *American Anthropologist*, 109:642–653. https://doi.org/10.1525/aa.2007.109.4.642

Joyce, Rosemary A., and Robert W. Preucel. 2002. Writing the Field of Archaeology. In *The Languages of Archaeology: Dialogue, Narrative, and Writing*, ed. Rosemary Joyce, pp. 18–38. Oxford, U.K.: Blackwell. https://doi.org/10.1002/9780470693520.ch2

Joyce, Rosemary A., and Russell N. Sheptak. 2014. History Interrupted: Doing "Historical Archaeology" in Central America. In *The Death of Prehistory*, ed. Peter Schmidt and Steve Mrozowski, pp. 161–182. Oxford, U.K.: Oxford University Press. https://doi.org/10.1093/acprof:osobl/9780199684595.003.0008

Lopiparo, Jeanne. 1994. Stones and Bones at Home: Reconstructing Domestic Activities from Archaeological Remains in a Terminal Classic Residence, Ulua Valley, Honduras. Senior honors thesis, Harvard University, Cambridge, Mass.

Lopiparo, Jeanne. 2003. Household Ceramic Production and the Crafting of Society in the Terminal Classic Ulua Valley, Honduras. Ph.D. diss., University of California, Berkeley.

Luke, Christina. 2002. Ulua Style Marble Vases. Ph.D. diss., Cornell University, Ithaca, N.Y.

Luke, C., and John S. Henderson. 2006. The Plunder of the Ulua Valley, Honduras and a Market Analysis for Antiquities. In *Archaeology, Cultural Heritage and the Antiquities Trade*, ed. Neil Brodie, Morag Kersel, Christina Luke, and Kathryn Walker Tubb, pp. 147–172. Gainesville: University Press of Florida. https://doi.org/10.5744/florida/9780813029726.003.0008

Luke, Christina, and Robert H. Tykot. 2007. Celebrating Place Through Luxury Craft Production: Travesia and Ulua Style Marble Vases. *Ancient Mesoamerica*, 18:315–328. https://doi.org/10.1017/S095653610700020X

Mason, Gregory. 1940. *South of Yesterday*. New York: Henry Holt.

McMullen, Ann. 2013. A New Dream Museum. In *Revealing Ancestral Central America*, ed. Rosemary A. Joyce, pp. 70–71. Washington, D.C.: Smithsonian Latino Center and National Museum of the American Indian.

Pope, Kevin O. 1985. Paleoecology of the Ulua Valley, Honduras: An Archaeological Perspective. Ph.D. diss., Stanford University, Stanford, Calif.

Pine, Adrienne. 2008. *Working Hard, Drinking Hard: On Violence and Survival in Honduras*. Berkeley: University of California Press. https://doi.org/10.1525/9780520941625

Reese Taylor, Kathryn, and Deborah Walker. 2002. The Passage of the Late Preclassic into the Early Classic. In *Ancient Maya Political Economies*, ed. Marilyn Masson and David Freidel, pp. 87–122. Walnut Creek, Calif.: AltaMira.

Robinson, Eugenia J. 1989. The Prehistoric Communities of the Sula Valley, Honduras: Regional Interaction in the Southeast Mesoamerican Frontier. Ph.D. diss., Tulane University, New Orleans, La.

Ruhl, J. Mark. 1984. Agrarian Structure and Political Stability in Honduras. *Journal of Interamerican Studies and World Affairs*, 26:33–68. https://doi.org/10.2307/165506

Shafer, Harry J., and Thomas R. Hester. 1983. Ancient Maya Chert Workshops in Northern Belize, Central America. *American Antiquity*, 48:519–543. https://doi.org/10.2307/280559

Sheptak, Russell N. 1982. Fotos aereas y el patron de asentamiento de la zona central del valle de Sula. *Yaxkin*, 5:89–94

Sheptak, Russell N. 2013. Colonial Masca in Motion: Tactics of Persistence of a Honduran Indigenous Community. Ph.D. diss., University of Leiden, Leiden, Netherlands.

Soluri, John. 2000. People, Plants, and Pathogens: The Eco-social Dynamics of Export Banana Production in Honduras, 1875–1950. *Hispanic American Historical Review*, 80:463–501. https://doi.org/10.1215/00182168-80-3-463

Swain, Eleanor E. 1995. The Ball's in *Whose* Court? Ballgames, Interaction and Identity on the Southeast Mesoamerican Frontier. Senior honors thesis, Amherst College, Amherst, Mass.

Wonderley, Anthony. 1984. Test Excavations of the Naco (Late Postclassic) Phase. In *Archaeology in Northwestern Honduras: Interim Reports of the Proyecto Arqueológico Sula*, vol. 1, ed. John S. Henderson, pp. 27–66. Ithaca, N.Y.: Archaeology Program and Latin American Studies Program, Cornell University.

Wonderley, Anthony. 1986. Material Symbolics in Pre-Columbian Households: The Painted Pottery of Naco, Honduras. *Journal of Anthropological Research*, 42:497–534. https://doi.org/10.1086/jar.42.4.3630106

Wylie, Alison. 2005. The Promise and Perils of an Ethic of Stewardship. In *Embedding Ethics*, ed. Lynn M. Meskell and Peter Pels, pp. 47–68. Oxford, U.K.: Berg. https://doi.org/10.4324/9781003085249-4

Ethical Aspects of Community-Based Paleogenomic Research Using Museum Samples

*Lauren E. Y. Norman,[1] Christopher E. Barrett,[1] Sarah Unkel,[1] Anne M. Jensen,[2] Dennis H. O'Rourke,[1] and Jennifer Raff [1]**

INTRODUCTION

The increasing pace and visibility of genetic research in historical studies have provoked necessary and intensive discussions about ethical practices. This "ancient DNA revolution" has been discussed in the academic literature, at conferences, and in the media. These discussions move genetic anthropology, archaeology, and biological anthropology forward and push researchers to conduct more ethical and, often, more collaborative work. The need to do better work is especially important in places like the Americas, where ancient genetic studies affect descendant communities on whose lands archaeological and genetic research are conducted (Layton, 1994; Ferris, 2003; Atalay, 2006, 2012).

Indigenous and non-Indigenous archaeologists and biological anthropologists have established theoretical and methodological frameworks for collaborative projects (Watkins, 2000; Guilfoyle and Hogg, 2015; Bardill et al., 2018; Claw et al., 2018; Malhi and Bader, 2019; Tackney and Raff, 2019). These frameworks integrate legal requirements, professional recommendations, and ethical practices developed over years of research and attention to values of Indigenous communities. Although we also work in other places, most of our work—including with Smithsonian collections—is within the United States, particularly Alaska. We therefore focus our discussion on the rules and regulations from the United States. Despite the flexibility built into these frameworks, collaboration is often still difficult, with projects still replicating the power structures these practices mean to challenge (Burgio-Ericson and Seowtewa, this volume).

Our practices have evolved over the years, and we continue to work toward full collaboration with communities, as defined by the communities themselves (Tackney and Raff, 2019). This is especially important and, often more complicated, when the remains of individuals we study are housed in museums. We are engaged in research on two projects using museum collections, and these projects are at different positions on a "collaborative continuum" (Colwell-Chanthaphonh and Ferguson, 2008:1), ranging from full collaboration or partnerships, as described by Burgio-Ericson and Seowtewa (this volume), to participation (Colwell-Chanthaphonh and Ferguson, 2008:11), with support solicited and some voice for participants.

[1] Department of Anthropology, University of Kansas, 622 Fraser Hall, 1415 Jayhawk Boulevard, Lawrence, Kansas 66045-7556, USA.

[2] University of Alaska, Museum of the North, 1962 Yukon Drive, Fairbanks, Alaska 99775-6960, USA; Department of Anthropology, University of Alaska Fairbanks, Post Office Box 757720, Fairbanks, Alaska, 99775, USA; and Post Office Box 750, Utqiaġvik, Alaska 99723, USA.

* Correspondence: jennifer.raff@ku.edu

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Our genetic analysis of human remains within collections is based on long-term relationships with communities and archaeologists to establish multivocal interpretations of the past. To do this, we focus on how the genetic story fits into local and regional archaeological context and oral historic or traditional knowledge and how communities view and use this information to enhance, complement, or challenge their histories. In this way, we contribute to larger stories of peopling, migration, and dispersal events in the Arctic.

HISTORY OF RESEARCH

Our work involves anthropological geneticists, archaeologists, and community members, and we bring this diversity of experience to each of our research projects. The deep history of work with descendant groups in both biological anthropology and archaeology provides us with a base on which to build that also complicates matters in several ways. This is especially true in Alaska.

Anthropological and biological research in Alaska has a fraught history, with both successful collaborations and unethical investigations. Many of the early (1930s to 1950s) archaeological and biological anthropological excavations exhumed skeletal material, often with little recording of context (e.g., those of James A. Ford, Aleš Hrdlička, Henry B. Collins). None of this early work proceeded within the contemporary framework of collaboration, partnership (see Burgio-Ericson and Seowtewa, this volume), or even consultation. Some individuals may have been buried only a generation or two before excavation, and excavators often had little regard for the Native Alaskan people's views on exhumation. Many of the collections currently housed in museums include individuals unearthed by these early researchers. Two of our current research projects utilize collections from the Smithsonian Institution's National Museum of Natural History (NMNH) and involve the study of some of these remains.

As with archaeological work in the United States, working with human remains has different requirements depending on the context. The overarching federal law is the Native American Graves Protection and Repatriation Act (NAGPRA), enacted in 1990 to protect the cultural and biological remains of Indigenous peoples in the United States. This law concerns all items and individuals found on federal or tribal lands or controlled by institutions that receive federal funding. The NAGPRA built on and extended the requirements of the National Museum of the American Indian Act (NMAI Act). Enacted in 1989, the NMAI Act requires museums of the Smithsonian to inventory, identify, and repatriate human remains and funerary objects when requested by descendant communities or individuals. These U.S.-based laws were preceded by agreements between countries under the United Nations Educational, Scientific and Cultural Organization to protect cultural heritage. These laws and agreements provide the broad outline for minimally ethical anthropological work on human remains. Professional standards provide more detail in the form of guidelines and position statements. The American Association of Physical Anthropologists[1] has issued multiple position statements on NAGPRA and other laws, rules, and regulations (e.g., American Association of Physical Anthropologists, 2007). These provide biological anthropologists and other researchers with detailed descriptions of implementation of these policies. Individual researchers are responsible for initiating consultation and dialog to form partnerships with communities and develop individualized actions and agreements for each project (Malhi and Bader, 2019; Sjöberg et al., 2019; Tackney and Raff, 2019).

Despite "the ambivalent legacy of anthropologists' relations with local communities" in Alaska (Clifford, 2004:5), opportunities exist for continued genetic research with museum collections. These opportunities arise from long-term collaborative relationships, such as those initiated by O'Rourke in communities around the state. Open, reciprocal relations also foster collaborative opportunities among archaeologists, ethnologists, and local communities. Our research team continues to build these types of relationships with local communities in multiple ways, including directing large projects, managing field excavations, and analyzing collected material.

Relationships, connections, and communication channels often exist long after a project is finished among researchers in the south, communities in the north, and museums that house ancestral remains. These methods of communication facilitate sharing, inquiries, and interpretation of results throughout the year and engage individuals who may not be present for community meetings. Within these long-term relationships, collaboration goes beyond analysis to answer questions of interest to science to developing knowledge of genetic analyses and what they can add to stories about the past (Joyce, this volume). Building such capacity allows individuals and communities to be active partners in research, asking questions of interest to them and directing research in new avenues. This deep investment in local community questions and collaboration provides much needed time depth, reciprocity, and trust in presenting and working on new projects using human remains (Tackney and Raff, 2019).

Here we describe two research projects that use NMNH collections. These projects follow similar broad strokes but involve different collaborations with their respective groups (Figure 1). Both projects build upon earlier research with the communities and are in the preliminary data collection stages, so we outline the background, goals, research questions, and community collaborations for each one.

FIGURE 1. Case study regions in Alaska. (A) North Slope region, showing locations of Birnirk sites from which we sampled individuals. (B) Aleutian Islands, showing where individuals in our study were located in the western islands.

CASE STUDIES OF COMMUNITY-BASED COLLECTIONS RESEARCH

The Genetic History of the Unangax̂

Questions surrounding the scientific understanding of population history in the Aleutian Island region and the cultural dynamics and conditions of initial settlement are long-standing areas of anthropological investigation (Dall, 1877; Jochelson, 1925, 1933; Hrdlička, 1945; Laughlin and Marsh, 1951; Laughlin, 1980). The earliest archaeological evidence of human occupation on the islands dates to around 9,000 years ago in the eastern islands of the archipelago (Laughlin, 1975; Davis and Knecht, 2010; Davis et al., 2016). These early inhabitants already possessed the unique maritime adaptation necessary for life on the islands, a condition that distinguishes Unangax̂ history from that of mainland Alaska. Over millennia, Unangax̂ (Aleuts/Unangan/Unangas) spread throughout the islands and differentiated culturally, linguistically, and biologically from the people on the mainland. Current archaeological evidence indicates people expanded from the eastern islands and reached the central islands by 4500 BC (Savinetsky et al., 2012) and occupied the westernmost island groups (Near Islands) by 1550 BC (Spaulding, 1962; West et al., 1999; Corbett et al., 2010; Corbett and Yarborough, 2016; see Figure 1B).

Beyond this broad framework of occupation history, archaeological and genetic models of the Aleutian Islands have proposed different migration, occupation, and abandonment events. Recent genetic studies have complicated this history further, with evidence showing a close genetic relationship between Unangax̂ and other Arctic groups (Reich et al., 2012). New genetic evidence challenges Hrdlička's model of population replacement that argued for culturally and biologically distinct Neo-Aleut people moving into the Aleutian Islands around AD 950, instead suggesting that all ancient and contemporary Unangax̂ are genetically similar (Hayes, 2002; Hayes et al., 2003; Coltrain et al., 2006; Smith et al., 2009; Raghavan et al., 2015; Flegontov et al., 2019). These genetic findings support the archaeological evidence for overall population continuity in the Aleutian Islands (Laughlin, 1980; Davis et al., 2016). The degree of cultural and genetic isolation during 9,000 years of occupation remains an open question for which combined genetic and archaeological data are needed. For example, coalescence dates from new genetic studies place the emergence of the Unangax̂ as a genetically distinctive group only at 3050 BP (Flegontov et al., 2019), 4,000 years after direct archaeological evidence of settlement on the islands. In addition to the mismatch between archaeological and genetic evidence of occupational history in the Aleutians, these new genetic analyses answer only limited questions with previously available data, and they provide only broad-stroke migration models using limited genetic data. Genetic analyses of individuals from precolonial periods can help nuance questions of genetic history and will potentially resolve disparities between archaeological and genetic evidence.

As part of a larger project aimed at modeling the genetic history of the Unangax̂ from initial migration to the present day using genomic methods, we focus here on specific research questions that aim to model the precolonial population history of the Aleutian Islands. The project aims (1) to investigate the ancestry of past Unangax̂ populations and their genetic relationships to the First Peoples (ancestral to Indigenous peoples of the Western Hemisphere, except the Inuit) and (2) to examine past populations' adaptations to the Arctic maritime environment of the island chain.

Researchers previously addressed these questions using genomic-wide data from contemporary Unangax̂ and uniparental markers from precolonial individuals from the Alaskan Peninsula and eastern Aleutian Islands. To clarify population history, the current project collected bone samples from individuals' remains buried in the western island groups and housed at the Smithsonian Institution's NMNH. By combining these samples with previously acquired data from precolonial individuals of the Alaskan Peninsula and eastern Aleutian Islands, we will have genomic data spanning the 1,900 km archipelago. Many of the ancestral remains from these islands come from early expeditions, during which large-scale, unsystematic excavations often resulted in only partial reporting and analysis of results. Collection of buried individuals now housed at the NMNH began in the late 1800s, with Hrdlička and his field assistant Alan May collecting most of the individual burials between 1936 and 1938 (Dall, 1877; Hrdlička, 1945; Krutak and Dudar, 2015; Powell et al., 2015). Few, if any, contextual notes or summaries accompany these collections.

In 2001, the Aleutian Pribilof Islands Association (APIA) submitted a repatriation request to the NMNH for the individuals and funerary objects from these excavations. A series of four reports was completed that confirmed the direct affiliation of the remains to the communities in the Aleutians, some of which have already been repatriated to communities in the eastern and central islands (Wolff et al., 2011; Krutak, 2013; Krutak and Dudar, 2015; Powell et al., 2015). On the basis of a long history of collaboration between the APIA and researchers at the University of Kansas (West et al., 2010) and newly initiated partnerships, the APIA and Native Village of Atka granted permission to sample the remains held at the NMNH prior to repatriation.

This project builds upon many years of research and collaboration with the communities of the Aleutian Islands. Beginning in 1998, O'Rourke, then at the University of Utah, and M. H. Crawford at the University of Kansas initiated a combined project examining genetic diversity in both contemporary and ancient individuals of the eastern Aleutians. That year they met with the leadership of The Aleut Corporation (TAC) and the APIA to explain the scientific intent of the project and seek permission to proceed. Following discussion and response to questions, both pan-Aleutian entities were supportive and granted permission to conduct the research

project, subject to approval by local communities for both contemporary genetic sampling and ancient genetic (aDNA) analysis from museum-curated remains (O'Rourke et al., 2005). Subsequently, O'Rourke and Crawford met with elders and the leadership of the Chaluka Corporation and the village corporation of Nikolski, which had been affiliated with archaeologically removed human remains in the region. Melvin Smith of TAC and University of Alaska Anchorage archaeologist Douglas Veltre, who had been conducting research on Umnak Island for many years and was well acquainted with the local community, facilitated this meeting. Initial community concerns regarding aDNA analyses focused on the age of material to be studied and the extent of destructive analysis. Once assured that all individuals were truly precolonial and that only small skeletal samples were used in the analysis and that none of the research would impede repatriation requests, formal support and permission were granted for the aDNA portion of the project (O'Rourke et al., 2005). With these multiple discussions and levels of local support in hand, funding for the project was sought and granted. The principal investigators of the project traveled to Alaska at least once or twice each year of the project to provide updates and reports of progress and results. All publications were filed with TAC and APIA to make them available to anyone in the region. Following completion of the project, both Crawford and O'Rourke continued to be in contact with the community of Nikolski, TAC, and APIA to provide continued updates on any new analyses or results that continued to flow from the original project.

The genesis of the current project in the Aleutian Islands began in 2017 when Raff and O'Rourke spoke at a meeting of the board of directors of the APIA in Anchorage to explain our interest in continuing studies in the archipelago and to request their support of the project and permission to proceed. We responded to the board's questions, clarified issues attendant to the project, and provided detailed explanations of methods, data curation, and return of results to communities. The board was supportive and approved the project. Raff and O'Rourke then met separately and in person with the community leader of Atka, the community affiliated with the human remains from the central and western islands, which had filed a repatriation request for those remains. The community leader was supportive and offered to take our request for approval to the community of Atka for discussion. The community of Atka subsequently also approved the project. In 2019, Raff and O'Rourke received National Science Foundation funding for this project. The initial work, which began in summer 2019, characterizes these ancestors genetically. Although the COVID-19 pandemic has significantly delayed the project's timeline, moving forward we will share all work, progress, and reports as they become available to solicit community interpretation, both with the Unangax̂, through presentations and discussions at the APIA shareholder's meeting, and with Atka, through visits by the principal investigators.

Genetic Characterization of Birnirk Inuit from the North Slope of Alaska

Birnirk people occupied the shores of the Chukchi Sea from Cape Baranov, Russia, to the Mackenzie Delta, Canada, from approximately AD 650 to 1300. Despite the coastal extent of the Birnirk culture, sites and assemblages have undergone limited analyses until recently, with only a few sites excavated and analyzed in the early and mid-twentieth century (Ford, 1959; Stanford, 1976; Giddings and Anderson, 1986; Dneprovsky, 2002). Some of the sites with the most excavation in Alaska and Siberia have never been analyzed and/or published extensively (but see Okladnikov and Beregovaya, 1971; Bronshtein and Dneprovsky, 2002; Dneprovsky, 2002, 2006). Recent genetic analyses confirm the biological relationships between the Thule Inuit, who appeared around AD 950–1100, and the contemporary Iñupiat, Yupik, and Inuit (Raghavan et al., 2014; Tackney et al., 2019). However, only one study using individuals from one house at a single site in Siberia has provided genetic data for analysis of Birnirk individuals to date (Raghavan et al., 2014).

Our research goal is to characterize the genetic variation of the people affiliated with the Birnirk cultural tradition. To investigate this, we will (1) test the hypothesis of a Birnirk ancestral component in Thule Inuit, (2) assess the relation of the Birnirk people to the contemporary Iñupiat of the North Slope of Alaska, and (3) determine how the Birnirk people fit genetically in the overall Inuit tradition. Our expectation is that genetically, the Birnirk individuals will closely resemble Thule Inuit (Tackney et al., 2019) and the contemporary North Slope Iñupiat (Raff et al., 2015; Flegontov et al., 2019). Work has started on these individuals (Unkel et al., in press), and we will continue to apply molecular methods to answer these research questions.

Despite limited archaeological analyses, Van Valin, Hopson, and Ford in the 1930s and 1950s exhumed individuals associated with the Birnirk culture (Ford, 1959) now curated at the NMNH (Hollinger et al., 2004) from sites around Utqiaġvik (see Figure 1A). Only Ford (1959) published contextual information. In 1993, the North Slope Borough Planning Department requested repatriation under the provisions of the NMAI Act of "any remains from settlements associated with the Arctic Slope Regional Corporation" (Hollinger et al., 2004:ii). Using morphological analyses, researchers concluded that the Birnirk people are affiliated with the Inuit of western Greenland, not the Iñupiat of Utqiaġvik (Hollinger et al., 2004:iii); therefore, the individuals and objects affiliated with the Birnirk culture remained at the NMNH. The distinction between Birnirk and Thule/contemporary Iñupiat is noted in ethnographic works and is expressed by people today. Observations by local Iñupiat during excavations at Kugusugaruk, a Birnirk burial site, stated that the burials belonged to "*innuit ulta*—other people" (Van Valin, 1941:230), potentially a "tribe way inland" (Hopson, 1929:2). These conclusions diverge from archaeological narratives that

suggest Birnirk people are the cultural ancestors of Thule Inuit, who are direct genetic and cultural ancestors of the contemporary Iñupiat and Inuit throughout the North American Arctic.

Our current project originated in the Cape Espenberg Birnirk Project (principal investigators Claire Alix and Owen K. Mason), a multidisciplinary collaboration to excavate Birnirk and Thule Inuit sites at Cape Espenberg on the Seward Peninsula and maternally characterize Birnirk individuals from the North Slope. In order to answer the research questions above, we requested permission from the community of Utqiaġvik to sample the individuals held at the NMNH, all of whom derive from several archaeological sites on the north coast of Alaska (see Figure 1). The O'Rourke laboratory has had long-standing partnerships with Iñupiat communities of the North Slope through collaborations with archaeologist Anne Jensen (Jensen, 2009, 2012; Tackney et al., 2019). For years, the spit of Point Barrow had been eroding, but in recent decades, changing storm patterns and intensities due to global climate change have resulted in many burials associated with the historic village of Nuvuk eroding into the Beaufort Sea. Jensen, senior scientist for Ukpeaġvik Iñupiat Corporation (UIC) Science, undertook identification of burials near the village of Nuvuk before any more eroded (Jensen 2009, 2012). O'Rourke was invited by Jensen to participate in the recovery process and provide biological analyses of the remains rescued prior to reburial. Over the course of 18 months, Jensen and O'Rourke met with the Native Village of Barrow, the Senior Advisory Council (Elders), the Cultural Heritage Center in Barrow, and UIC to secure permission for aDNA analyses. All groups provided support and written permission to conduct the proposed research. Indeed, one of the elders suggested a genetic study of the contemporary population should also be pursued. With this suggestion, funding was sought and awarded for a multiyear genetic study of the history of the North Slope populations. The project was completed in 2013 (Raff et al., 2015; Tackney, 2016; Tackney et al., 2019). Researchers with the project traveled to Utqiaġvik at least once a year, often two or three times per year, to provide public lectures, updates, and project results to communities.

When O'Rourke elected to continue to study Thule origins by examining genetic diversity among the Birnirk with funding from the Cape Espenberg Birnirk Project, Jensen again facilitated the permission process. After having spoken to them about the project, she put O'Rourke in touch with the relevant local authorities. When O'Rourke contacted the officials by phone and email, the support and permission to pursue the project with museum individuals were quickly forthcoming. The community signed letters of agreement and provided permissions for sampling the remains at the NMNH. Our agreement is to share our findings with the community and solicit culturally appropriate interpretations of the results prior to publication.

COLLABORATION WITH THE SMITHSONIAN INSTITUTION

Both projects described here sampled remains of individuals held at the NMNH, where researchers and curators actively support and promote community engagement and external research. As with other collaborations, the relationship between the researchers, the communities, and the museum builds on successful long-term investment in projects. In previous research, O'Rourke analyzed material from the NMNH collections with approval from both the museum and local communities. Subsequently, museum staff and curators reached out periodically to inquire about, and encourage, additional collaborative work. They also tried to arrange meetings between our research group and community members during visits to the museum and worked actively to promote community and researcher dialogues. Scheduling conflicts and timing issues prevented in-person meetings prior to collection, but conversations among the museum staff, our research group, and community members are ongoing.

Open connections with museums can benefit both communities and researchers. Museum professionals have provided historical accounts of the material through the years and often curate different interpretations of the material from previous researchers, community members, and their own analysis. Like archaeologists, museum researchers and curators provide access to contextual literature, reports, and databases not available publicly. This was the case for both of our projects, during which Eric Hollinger readily shared the repatriation reports (Mudar et al., 1995; Hollinger et al., 2004; Wolff et al., 2011; Krutak, 2013; Krutak and Dudar, 2015; Powell et al., 2015) with our group to provide more background and contextual information for our analyses.

DISCUSSION

These case studies highlight several opportunities and challenges when working with museum collections to do ethical, collaborative genetic work. Genetic research relies on archaeological context to situate analytical results in both time and place. Limited contextual information is one of the major challenges for both projects and often for museum collections in general (Luby et al., 2013; Domenici, this volume; Martinez et al., this volume; Ostapkowicz et al., this volume). When published articles are not available, archaeologists and museum professionals can and do help with uncovering the reports, field notes, and other gray literature (i.e., nonpublished site reports and other cultural resource reports), like what occurred with the North Slope Birnirk project. Sometimes, as is the case with the Unangax̂ project, the lack of gray literature directly related to the removal of ancestral remains makes contextualization more difficult.

Close collaboration with archaeologists, museum curators, and descendant community leaders can help mitigate this challenge by acting as a check on genetic inference. If inferences from genetic analyses are inconsistent with the understanding of population

history derived from archaeology, traditional knowledge, or oral history, which may be the case with the North Slope project, then the genetic analyses and inferences require careful consideration.

Although archaeologists and communities typically have years of experience working together, with members of both groups spending long seasons at field sites, biological anthropologists and geneticists are increasingly establishing long-term relationships with communities as well, as evidenced by our work on both the North Slope and Aleutian Islands in Alaska. These long-term relationships lead to stronger collaborative partnerships, something researchers should be working toward as a discipline standard.

In addition to building research frameworks that not only avoid harm but also benefit the communities (Nicholas, 2010), one of the challenges we face with both projects is confronting harms done to the communities in the past as a result of the practices used in building the collections by earlier generations of field researchers. One way we have started to deal with these issues is, first, to acknowledge that they happened and, second, to take concrete steps to ensure that collection and research without community approval never happen again. In most cases, legal frameworks prevent such regressions. However, in some cases, legal protections do not apply; a code of ethical best practices, such as the one recommended by Bardill et al. (2018), is therefore needed.

The structure of a project needs to go beyond a general ethical and legal framework, incorporating practices specific to a community's interests. This requires extensive consultation and conversation. In these two projects, we built upon long-standing relationships between researchers and communities. Previous research by the Laboratory of Biological Anthropology at the University of Kansas with contemporary populations from the Aleutian Islands led directly to the current Aleutian project (Hayes, 2002; Hayes et al., 2003; Zlojutro et al., 2006, 2009; Crawford, 2007, 2009; West et al., 2007; Smith et al., 2009; Crawford et al., 2010; Rubicz et al., 2010). Anne Jensen was key in facilitating the North Slope project collaboration, building on earlier work done with the O'Rourke laboratory (Raff et al., 2015; Tackney et al., 2019). Both projects build upon work initiated by O'Rourke, collaborating archaeologists, and local communities and continued by both Raff and O'Rourke in new communities using different archaeological collections. Previous successful collaborations with archaeologists, museums, and descendant communities in both regions provided open lines of communication for initiating these new projects.

Both projects involved discussions of sampling methods for aDNA extraction. One of the ways our group has implemented less intrusive aDNA research is by using less informative skeletal elements for analysis. Elements such as ribs, without pathologies, contain less morphological information than other elements such as the cranium or dentition. We never break or cut craniums or mandibles to obtain skeletal samples for molecular analysis; DNA extractions from teeth come from only loose teeth unless the community has approved other methods of removal. We developed these general practices in consultation with local communities initially. Other communities often welcome these general practices, although we always discuss sampling procedures during consultations as each community has its own views from which we can learn, adjust, and accommodate to local standards. Cognizant that other researchers and communities may want to pursue future research, we take samples only if there is sufficient skeletal material for additional research. Developing individualized methods of sampling, analysis, and interpretation that a community finds appropriate is necessary for every new project.

A challenge to collections-based research in a community framework may also be an opportunity. The implementation and rollout of NAGPRA unsurprisingly created some divided responses. Some researchers and community members want human remains returned, but others make the case that those remains are not part of the cultural patrimony and therefore cannot be returned. Molecular analyses may be able to clarify biological relationships among these groups. Some recognize that this new research may challenge previous inferences and may influence future decisions on repatriation and research. Communities may consider this potential outcome in their choice to support or not support particular projects. For example, the community of Utqiaġvik initially requested the remains from all individuals exhumed on the North Slope, but morphometric research suggested that the people from Birnirk sites might not be ancestral to the contemporary people of the region (Hollinger et al., 2004, 2009). Although our work is still ongoing, the working null hypothesis is that Birnirk people are ancestral to Thule Inuit and thus ancestral to contemporary Iñupiat, including the community of Utqiaġvik (Unkel et al., in press). Both dating and genetic analyses of these remains and those from the Aleutians will provide more data for evaluating the relationships between these early people and those who currently occupy the land.

Another challenge that is also an opportunity arises when groups of people interpret data in a variety of ways. This is especially true when working with groups who have different ways of seeing the world (ontologies). Differences in interpretation are nothing new to scientists, so recognizing that science is only one way of making sense of the world allows space for alternative interpretations, which often enhance the stories we tell with our data. As anthropologists, we recognize that multivocal interpretations strengthen our constructions of the past and enable us to engage with the communities in which we work (Claw et al., 2018). These multivocal constructions of the past often help contextualize the genetic research of population history. Individual community members and their lived experiences provide details and information not recorded in the notes or reports with which geneticists work. Establishing and maintaining effective community dialog provide important contextual and historical information. Sometimes, the genetic and archaeological evidence, oral histories, and traditional knowledge provide different constructions of the past, and it is from these differences that new research questions emerge. These variable interpretations provide robust hypotheses to test and suggest possible ways new data may add to the existing narratives. When scientific and traditional knowledge systems provide different narratives, we believe that we as

scientists should acknowledge this difference respectfully without denigrating traditional knowledge as merely "myth." Becoming fluent in multivocal ways of interpreting the past does not diminish scientific approaches, but rather allows them to exist more harmoniously with traditional understandings, perhaps creating space for scientific research in places where it may not have been welcome before. By actively engaging in collaboration, anthropological geneticists can work toward building capacity for ethical and empathetic research.

CONCLUSION

Genetic analyses of museum collections can—and should—contribute greater resolution to our understanding of the past. Studying ancestral human remains within collections comes with a specific set of ethical and legal obligations to their contemporary descendants (as well as the ancestors themselves).

Although each project and each interaction is different (e.g., O'Rourke et al., 2005), we outlined the challenges and opportunities we face with two current projects using ancestral remains curated by the NMNH. Long-standing, respectful, and individual collaborations with communities, archaeologists, and museum researchers can be beneficial to Indigenous communities as well as contribute knowledge coproduced by researchers and communities that benefits the field of anthropology (Bardill et al., 2018). We find that focusing on how the genetic part of the story fits with the local and regional archaeological context and how this knowledge can enhance or complement community histories grounds our broader research questions.

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NOTE

1. As of the 2021 annual meeting, the membership has agreed to call itself the American Association of Biological Anthropologists (AABA). This name change is pending approval from the state of Kansas, where the organization is incorporated.

REFERENCES

American Association of Physical Anthropologists. 2007. American Association of Physical Anthropologists Position Statement on the Department of the Interior's Proposed Rule for the Disposition of Culturally Unidentifiable Human Remains. https://physanth.org/about/position-statements/native-american-graves-repatriation-act-nagpra/ (accessed October 2019).

Atalay, Sonya. 2006. Indigenous Archaeology as Decolonizing Practice. *American Indian Quarterly*, 30:280–310. https://doi.org/10.1353/aiq.2006.0015

Atalay, Sonya. 2012. *Community-Based Archaeology: Research with, by, and for Indigenous and Local Communities*. Berkeley: University of California Press.

Bardill, Jessica, Alyssa C. Bader, Nanibaá A. Garrison, Debora A. Bolnick, Jennifer A. Raff, Alexa Walker, Ripan S. Malhi, and Summer Internship for Indigenous Peoples in Genomics (SING) Consortium. 2018. Advancing the Ethics of Paleogenomics. *Science*, 360:384–285. https://doi.org/10.1126/science.aaq1131

Bronshtein, Mikhail M., and Kiril A Dneprovsky. 2002. The Northeastern Chukchi Peninsula during the Birnirk and Early Punuk Periods. In *Archaeology in the Bering Strait Region: Research on Two Continents*, ed. Don E. Dumond and Richard L. Bland, pp. 153–166. Anthropological Papers, No. 59. Eugene: University of Oregon.

Claw, Katrina G., Matthew Z. Anderson, Rene L. Begay, Krystal S. Tsosie, Keolu Fox, Nanibaa' A. Garrison, and Summer Internship for Indigenous Peoples in Genomics (SING) Consortium. 2018. A Framework for Enhancing Ethical Genomic Research with Indigenous Communities. *Nature Communications*, 9:2957. https://doi.org/10.1038/s41467-018-05188-3

Clifford, James. 2004. Looking Several Ways: Anthropology and Native Heritage in Alaska. *Current Anthropology*, 45:5. https://doi.org/10.1086/379634

Coltrain, Joan Brenner, M. Geoffery Hayes, and Dennis H. O'Rourke. 2006. Hrdlička Aleutian Population-Replacement Hypothesis: A Radiometric Evaluation. *Current Anthropology*, 47:537–548. https://doi.org/10.1086/504169

Colwell-Chanthaphonh, Chip, and T. J. Ferguson. 2008. Introduction: The Collaborative Continuum. In *Collaboration in Archaeological Practice: Engaging Descendant Communities*, ed. Chip Colwell-Chanthaphonh and T. J. Ferguson, pp. 1–32. Lanham, Md.: AltaMira Press. https://doi.org/10.1111/j.1548-1379.2009.01047.x

Corbett, Debra, and Michael Yarborough. 2016. The Aleutian Tradition: The Last 4000 Years. In *The Oxford Handbook of the Prehistoric Arctic*, ed. T. Max Friesen and Owen K. Mason, pp. 607–629. Oxford, U.K.: Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199766956.013.31

Corbett, Debra, Christine Lefèvre, and Dixie L. West. 2010. Chronology and Settlement Patterns: Shemya and the Semichi Islands. In *The People at the End of the World: The Western Aleutians Project and the Archaeology of Shemya Island*, ed. Debra Corbett, Dixie L. West, and Christine Lefèvre, pp. 197–207. Aurora, Vol. 8: Alaska Anthropological Association Monograph Series. Anchorage: Alaska Anthropological Association.

Crawford, Michael H. 2007. Genetic Structure of Circumpolar Populations: A Synthesis. *American Journal of Human Biology*, 19:203–217. https://doi.org/10.1002/ajhb.20631

Crawford, Michael H. 2009. Settlement of the Aleutian Islands and Its Genetic Sequelae. *Estudios de Antropología Biológia*, 14(1):223–241.

Crawford, Michael H., Rohina C. Rubicz, and Mark Zlojutro. 2010. Origins of Aleuts and the Genetic Structure of Populations of the Archipelago: Molecular and Archaeological Perspectives. *Human Biology*, 82:695–717. https://doi.org/10.3378/027.082.0511

Dall, William H. 1877. On Succession in the Shell-Heaps of the Aleutian Islands. *Contributions to North American Ethnology*, 1:93–106.

Davis, Richard S., and Richard A. Knecht. 2010. Continuity and Change in the Eastern Aleutian Archaeological Sequence. *Human Biology*, 82:507–524. https://doi.org/10.3378/027.082.0503

Davis, Richard, Richard Knecht, and Jason Rogers. 2016. First Maritime Cultures of the Aleutians. In *The Oxford Handbook of the Prehistoric Arctic*, ed. T. Max Friesen and Owen K. Mason, pp. 279–302. Oxford, U.K.: Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199766956.013.18

Dneprovsky, Kiril A. 2002. Ekven House H-18: A Birnirk- and Early Punuk-Period Site in Chukotka. In *Archaeology in the Bering Strait Region: Research on Two Continents*, ed. Don E. Dumond and Richard L. Bland, pp. 166–206. Eugene: University of Oregon.

Dneprovsky, Kiril A. 2006. A Late Birnirk House at Paipelghak in Northern Chukotka: A Preliminary Report Based on the Excavations from 2002–2004. *Alaska Journal of Anthropology*, 4:34–53.

Ferris, Neal. 2003. Between Colonial and Indigenous Archaeologies: Legal and Extra-legal Ownership of the Archaeological Past in North America. *Canadian Journal of Archaeology/Journal Canadien d'Archeologie*, 27:154–190.

Flegontov, Pavel, N. Ezgi Altınışık, Piya Changmai, Nadin Rohland, Swapan Mallick, Nicole Adamski, Deborah A. Bolnick, Nasreen Broomadkhosbackt, Francesca Candillo, Brenden J. Culleton, Olga Flegontova, T. Max Freisen, Choongwan Jeong, Thomas K. Harper, Denise Keating, Douglas J. Kennett, Alexander M. Kim, T. C. Laminidis, Ann Marie Lawson, Iñigo Olalde, Jonas Oppenheimer, Ben A. Potter, Jennifer Raff, R. A. Sattler, Pontus Skoglund, Kristin Stewardson, Edward J. Vajda, Sergey Vasilyev, Elizaveta Veselovskaya. M. Geoffery Hayes, Dennis H. O'Rourke, Johannes Krause, Ron Pinhasi, David Reich, and Stephan Schiffels. 2019. Palaeo-Eskimo Genetic Ancestry and the Peopling of Chukotka and North America. *Nature*, 570:236–240. https://doi.org/10.1038/s41586-019-1251-y

Ford, James A. 1959. *Eskimo Prehistory in the Vicinity of Point Barrow, Alaska*. Anthropological Papers of the American Museum of Natural History, Vol. 47: Part 1. New York: American Museum of Natural History.

Giddings, James L., and Douglas D. Anderson. 1986. *Beach Ridge Archaeology of Cape Krusenstern: Eskimo and Pre-Eskimo Settlements around Kotzebue Sound, Alaska*. Washington, D.C.: National Park Service, U.S. Department of the Interior.

Guilfoyle, David R., and Erin A. Hogg. 2015. Towards an Evaluation-Based Framework of Collaborative Archaeology. *Advances in Archaeological Practice*, 3:107–123. https://doi.org/10.7183/2326-3768.3.2.107

Hayes, M. Geoffery. 2002. *Paleogenetic Assessment of Human Migration and Population Replacement in North American Arctic Prehistory*. Salt Lake: University of Utah Press.

Hayes, M. Geoffery, Joan B. Coltrain, and Dennis H. O'Rourke. 2003. Mitochondrial Analyses of Dorset, Thule, Sadlermiut, and Aleut Skeletal Samples from the Prehistoric North American Arctic. In *Mummies in a New Millennium: Proceedings of the 4th World Congress on Mummy Studies*, ed. Nils Lynnerup, Claus Andreasen, and Joel Berglund, pp. 125–128. Copenhagen: Danish Polar Center.

Hollinger, R. Eric, Elizabeth Eubanks, and Stephen Ousley. 2004. *Inventory and Assessment of Human Remains from the Point Barrow Region, Alaska in the Collections of the National Museum of Natural History, Smithsonian Institution*. Washington, D.C.: Smithsonian Institution.

Hollinger, R. Eric, Stephen Ousley, and Charles Utermohle. 2009. The Thule Migration: A New Look at the Archaeology and Biology of the Point Barrow Region Populations. In *The Northern World AD 900–1400*, ed. Herbert D. G. Maschner, Owen K. Mason, and Robert McGhee, pp. 131–154. Salt Lake City: University of Utah Press.

Hopson, Alfred H. 1929. Letter to J. Alden Mason, August 29, 1929. Box 5: Hopson excavations, The University Museum Archives, University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia.

Hrdlička, Ales. 1945. *The Aleutian and Commander Islands and Their Inhabitants*. Philadelphia: Wistar Institute of Anatomy and Biology.

Jensen, Anne M. 2009. Nuvuk: Point Barrow, Alaska: The Thule Cemetery and Ipiutak Occupation. Ph.D. diss., Bryn Mawr College, Bryn Mawr, Pa.

Jensen, Anne M. 2012. Culture and Change: Learning from the Past through Community Archaeology on the North Slope. *Polar Geography*, 35:211–227. https://doi.org/10.1080/1088937X.2012.710881

Jochelson, Waldemar. 1925. *Archaeological Investigations in the Aleutian Islands*. Washington, D.C.: Carnegie Institution of Washington. https://doi.org/10.5962/t.166068

Jochelson, Waldemar. 1933. *History, Ethnology, and the Anthropology of the Aleut*. Washington, D.C.: Carnegie Institution of Washington.

Krutak, Lars. 2013. *Inventory and Assessment of Human Remains and Funerary Objects from the Vicinity of Unga, Alaska, in the Collections of the National Museum of Natural History*. Washington, D.C.: Smithsonian Institution.

Krutak, Lars, and J. Christopher Dudar. 2015. *Inventory and Assessment of Human Remains and Funerary Objects from Amchitka, Kiska, and Little Kiska Islands in the Aleutian Archipelago of Alaska in the Collections of the National Museum of Natural History, Smithsonian Institution*. Washington, D.C.: Smithsonian Institution.

Laughlin, William S. 1975. Ecosystem, Holocene History, and Siberian Origin. *Science*, 189:507–515. https://doi.org/10.1126/science.189.4202.507

Laughlin, William S. 1980. *Aleuts: Survivors of the Bering Land Bridge*. New York: Holt, Rinehart, and Winston.

Laughlin, William S., and Gordon H. Marsh. 1951. A New View of the History of the Aleutians. *Arctic*, 4:75–88. https://doi.org/10.14430/arctic3937

Layton, Robert. 1994. Introduction. In *Who Needs the Past: Indigenous Values and Archaeology*, ed. Robert Layton, pp. 1–20. London: Routledge.

Luby, Edward M., Kent G. Lightfoot, and Victoria Bradshaw. 2013. Archaeological Curation and the Research Value of Archaeological Collections: A Case Study of California. *Collections: A Journal for Museum and Archives Professionals*, 9:255–282. https://doi.org/10.1177/155019061300900303

Malhi, Ripan S., and Alyssa C. Bader. 2019. Human Paleogenomic Research in the Americas: A Look at Current Data and Vision for More Inclusive Practices Now and into the Future. *SAA Archaeological Record*, 19:16–20.

Mudar, Karen, Ericka Bubniak-Jones, and Stuart Speaker. 1995. *Inventory and Assessment of Human Remains and Associated Funerary Objects from Wainwright, Alaska in the National Museum of Natural History*. Washington, D.C.: Smithsonian Institution.

Nicholas, George P. 2010. Introduction. In *Being and Becoming Indigenous Archaeologists*, ed. George P. Nicholas, pp. 9–18. Walnut Creek, Calif.: Left Coast Press.

Okladnikov, Alexsei P., and Nina A. Beregovaya. 1971. *The Early Sites of Cape Baranov* trans. R. L. Bland. Anchorage, Ala.: Shared Beringian Heritage Program, National Park Service, U.S. Department of Interior.

O'Rourke, Dennis H., M. Geoffery Hayes, and Shawn W. Carlyle. 2005. The Consent Process and aDNA Research: Contrasting Approaches in North America. In *Biological Anthropology and Ethics: From Repatriation to Genetic Identity*, ed. Trudy R. Turner, pp. 231–240. Albany: State University of New York Press.

Powell, M. S., J. Christopher Dudar, and S. Damm. 2015. *Inventory and Assessment of Human Remains from the Near Islands of the Aleutian Islands, Alaska, in the Collections of the National Museum of Natural History, Smithsonian Institution*. Washington, D.C.: Smithsonian Institution.

Raff, Jennifer A., Margarita Rzhetskaya, Justin Tackney, and M. Geoffery Hayes. 2015. Mitochondrial Diversity of Iñupiat People from the Alaskan North Slope Provides Evidence for the Origins of the Paleo- and Neo-Eskimo Peoples. *American Journal of Physical Anthropology*, 157:603–614. https://doi.org/10.1002/ajpa.22750

Raghavan, Maanasa, Michael DeGiorgio, Anders Albrechtsen, Ida Moltke, Pontus Skoglund, Thorfinn S. Korneliussen, Bjarne Grønnow, Martin Appelt, Hans Christian Gulløv, T. Max Freisen, William Fitzugh, Helena Malmström, Simon Rassmusseun, Jesper Olsen, Linea Melchior, Benjamin T. Fuller, Simon Fahrni, Thomas Stafford Jr., Vaughan Grimes, M. A. Priscilla Renouf, Jerome Cybulski, Neils Lynnerup, Marta Mirazon Lahr, Kate Britton, Rick Knecht, Jette Arneborg, Mait Mestspalu, Omar E Cornejo, Anna-Sapfo Malspinas, Yong Wang, Morten Rasmussen, Vibha Raghavan, Thomas V. O. Hansen, Elza Khusnutdinova, Tracey Pierre, Kiril Dneprovsky, Claus Andreasen, Hans Lange, M. Geoffery Hayes, Joan Coltrain, Victor A. Spitsyn, Anders Götherström, Ludovic Orlando, Tooma Kivisild, Richard Villems, Michael H. Crawford, Finn C. Nielsen, Jørgen Dissing, Jan Heinemeier, Morten Meldgaard, Carlos Bustamante, Dennis H. O'Rourke, Mattias Jakobsson, M. Thomas P. Gilbert, Rasmus Neilsen, and Eske Willerslev. 2014. The Genetic Prehistory of the New World Arctic. *Science*, 345:1255832. https://doi.org/10.1126/science.1255832

Raghavan, Maanasa, Matthias Steinrucken, Kelley Harris, Stephan Schiffels, Simon Rasmussen, Michael DeGiorgio, Anders Albrectsen, Christina Valdisera, María C. Ávila-Arcos, Anna S. Malaspinas, Anders Eriksson, Ida Moltke, Mait Metspalu, Julian R. Homburger, Jeff Wall, Omar E. Cornejo, J. V. Moreno-Mayar, Thorfinn S. Korneliussen, Tracey Pierre, Morten Rasmussen, Paula F. Campos, Peter de Barros Damgaard, Morten E Allentoft, John Lindo, Ene Metspalu, Ricardo Rodríguez-Varela, Josefina Mansilla, Celeste Henrickson, Adaine Seguin-Orlando, Helena Malmström, Thomas Stafford Jr., Suyash S. Shringapure, Andrés Moreno-Estrada, Monica Karmin, Kriistina Tambets, Anders Bergström, Yali Xue, Vera Warmuth, Andrew D. Friend, Joy Singarayer, Paul Valdes, Francois Balloux, Ilán Leboreiro, Jose Luis Vera, Hector Rangel-Villalobos, Davide Pettener, Donata Luiselli, Loren G. Davis, Evelyne

Heyer, Christopher P. E. Zolikofer, Marcia S. Ponce de León, Colin I. Smith, Vaughan Grimes, Kelly-Anne Pike, Michael Deal, Benjamin T. Fuller, Bernardo Arriaza, Vivien Standen, Maria F. Luz, Francois Ricaut, Niede Guidon, Ludmila Osipova, Mikhail I .Voevoda, Olga. L. Posukh, Oleg Balnovsky, Maria Lavryashina, Yuri Bogunov, Elza Khusnutdinova, Marina Gubina, Elena Balanovska, Sardan Fedorova, Sergey Litinov, Boris Marlyarchuk, Marislava Lavryashina, M. J. Mosher, David Archer, Jerome Cybulski, Barbara Petzelt, Jocelynn Mitchell, Rosita Worl, Paul J. Norman, Peter Parham, Brian M. Kemp, Toomas Kivisild, Chris Tyler-Smith, Manjinder S. Sandhu, Michael Crawford, Richard Villems, David Glenn Smith, Michael R. Waters, Ted Goebel, John R. Johnson, Ripan S. Malhi, Matthias Jakobsson, David J. Meltzer, Andre Manica, Richard Durbin, Carlos D. Bustamante, Yun S. Song, Rasmus Neilsen, and Eske Willerslev. 2015. Genomic Evidence for the Pleistocene and Recent Population History of Native Americans. *Science*, 349:aab3884. https://doi.org/10.1126/science.aab3884

Reich, David, Nick Patterson, Desmond Campbell, Arti Tandon, Stéphan Mazieres, Nicolas Ray, Maria V. Para, Winston Rojas, Constanza Duque, Natalia Mesa, Luis F. García, Omar Triana, Silvia Blair, Amanda Mestre, Juan C. Dib, Claudio M. Bravi, Graciela Bailliet, Daniel Corach, Tábita Hünemeier, Maria Cátira Bortolini, Francisco M. Salzano, María Luiza Petzl-Erler, Victor Acuña-Alonzo, Carlos Aguilar-Salinas, Samuel Canizales-Quinteros, Teresa Tusié-Luna, Laura Riba, Maricela Rodríguez-Cruz, Mardia Lopez-Alarcón, Ramón Coral-Vazquez, Thelma Canto-Cetina, Irma Silva-Zolezzi, Juan Carlos Fernandez-Lopez, Alejandra V. Contreras, Gerardo Jimenez-Sanchez, Maria José Gómez-Vázquez, Julio Molina, Ángel Carracedo, Antoion Salas, Carla Gallo, Giovanni Poletti, David B. Witonsky, Gorka Alkorta-Aranburu, Rem I. Sukernik, Ludmila Osipova, Sardana A. Fedorova, René Vasquez, Mercedes Villena, Claudia Moreau, Ramiro Barrantes, David Pauls, Laurent Excoffier, Gabriel Bedoya, Francisco Rothhammer, Jean-Michel Dugoujon, Georges Larrouy, William Klitz, Damian Labuda, Judith Kidd, Kenneth Kidd, Anna Di Rienzo, Nelson B. Freimer, Alkes L. Price, and Andrés Ruiz-Linares. 2012. Reconstructing Native American Population History. *Nature*, 488:370–374. https://doi.org/10.1038/nature11258

Rubicz, Rohina, Phillip E. Melton, Victor Spitsyn, Guangyun Sun, Ranjan Deka, and Michael H. Crawford. 2010. Genetic Structure of Native Circumpolar Populations Based on Autosomal, Mitochondrial, and Y Chromosome DNA Markers. *American Journal of Physical Anthropology*, 143:62–74. https://doi.org/10.1002/ajpa.21290

Savinetsky, Arkady B., Dixie L. West, Z. A. Antipushina, B. F. Khassanov, Nina K. Kiseleva, Olga A. Krylovich, and Andrei Pereladov. 2012. The Reconstruction of Ecosystems History of Adak Island (Aleutian Islands) during the Holocene. In *The People Before: The Geology, Paleoecology and Archaeology of Adak Island, Alaska*, ed. Dixie West, Virginia Hatfield, Elizabeth Wilmerding, and Christine Lefèvre, pp. 75–106. Oxford, U.K.: Archaeopress.

Sjöberg, Ylva, Sarah Gomach, Evan Kwiatkowski, and Mathilde Mansoz. 2019. Involvement of Local Indigenous Peoples in Arctic Research — Expectations, Needs and Challenges Perceived by Early Career Researchers. *Arctic Science*, 5:27–53. https://doi.org/10.1139/as-2017-0045

Smith, Silvia E., M. Geoffery Hayes, Graciela S. Cabana, Chad Huff, Joan B. Coltrain, and Dennis H. O'Rourke. 2009. Inferring Population Continuity Versus Replacement with aDNA: A Cautionary Tale from the Aleutian Islands. *Human Biology*, 81:407–426. https://doi.org/10.3378/027.081.0402

Spaulding, Albert C. 1962. *Archaeological Investigations on Agattu, Aleutian Islands*. Ann Arbor: Museum of Anthropology, University of Michigan. https://doi.org/10.3998/mpub.11396747

Stanford, Dennis J. 1976. *The Walakpa Site, Alaska: Its Place in the Birnirk and Thule Cultures*. Washington, D.C.: Smithsonian Institution Press. https://doi.org/10.5479/si.00810223.20.1

Tackney, Justin. 2016. *Arctic Prehistory through Ancient DNA*. Salt Lake: University of Utah Press.

Tackney, Justin, Anne M. Jensen, Caroline Kisielinski, and Dennis H. O'Rourke. 2019. Molecular Analysis of an Ancient Thule Population at Nuvuk, Point Barrow. *American Journal of Physical Anthropology*, 168:303–317. https://doi.org/10.1002/ajpa.23746

Tackney, Justin, and Jennifer A. Raff. 2019. A Different Way: Perspectives on Human Genetics from the Arctic. *SAA Archaeological Record*, 19:20–25.

Unkel, Sarah L., Lauren E. Y. Norman, Justin Tackney, Anthony M. Krus, Anne M. Jensen, Claire Alix, Owen Mason, and Dennis H. O'Rourke. In press. Genetic Analysis of Birnirk Inuit from the Alaskan North Slope. *Arctic*.

Van Valin, William B. 1941. *Eskimoland Speaks*. Caldwell, Idaho: The Caxton Printers, Ltd.

Watkins, Joe. 2000. *Indigenous Archaeology*. Walnut Creek, Calif.: AltaMira Press.

West, Dixie, Michael Crawford, and Arkady B. Savinetsky. 2007. Genetics, Prehistory and the Colonisation of the Aleutian Islands. *Earth and Environmental Science Transactions of the Royal Society of Edinburgh*, 98:47–57. https://doi.org/10.1017/S1755691007000023

West, Dixie, Christine Lefèvre, and Debra G. Corbett. 1999. Radiocarbon Dates for the Near Islands, Aleutian Islands, Alaska. *Current Research in the Pleistocene*, 16:83–85.

West, Dixie, Dennis O'Rourke, and Michael H. Crawford. 2010. Introduction: Origins and Settlement of the Indigenous Populations of the Aleutian Archipelago. *Human Biology*, 82:481–486. https://doi.org/10.3378/027.082.0501

Wolff, C. B., J. Christopher Dudar, and S. Feinstein. 2011. *Inventory and Assessment of Human Remains Requested for Repatriation by the Aleut Community of St. Paul Island, Alaska, in the Collections of the National Museum of Natural History*. Washington, D.C.: Smithsonian Institution.

Zlojutro, Mark, Rohina Rubicz, and Michael H. Crawford. 2009. Mitochondrial DNA and Y-Chromosome Variation in Five Eastern Aleut Communities: Evidence for Genetic Substructure in the Aleut Population. *Annals of Human Biology*, 36:511–526. https://doi.org/10.1080/03014460903103947

Zlojutro, Mark, Rohina Rubicz, Eric J. Devor, Victor A. Spitsyn, Sergei V. Makarov, Kristin Wilson, and Michael H. Crawford. 2006. Genetic Structure of the Aleuts and Circumpolar Populations Based on Mitochondrial DNA Sequences: A Synthesis. *American Journal of Physical Anthropology*, 129:446–464. https://doi.org/10.1002/ajpa.20287

Exploring Hopi Pottery with Hopi Teens: Intersecting Cultural Realms of Knowledge

Ronald L. Bishop,[1] Veletta Canouts,[2] and Suzanne P. De Atley[3]*

INTRODUCTION

In this essay we describe what was initially a straightforward research project that began in 1985 to address possible relationships between regional clays and a distinctive type of Hopi pottery, Sikyatki Polychrome, developed in the eastern villages of the Native American Hopi circa AD 1375 (Smith, 1971) or circa AD 1385 (LaMotta, 2006). The clays in question had been collected from locations around the Hopi villages that lie at the southern part of the mountainous land mass called Black Mesa in northern Arizona (Figure 1).

Sikyatki Polychrome pottery was a major technological achievement in firing, form, and finish, the latter achieved by the combination of the local clays being fired to high temperature and a long soak period to produce a distinctive pale-yellow surface color (Figure 2). Sikyatki appears to have developed out of the Hopi Jeddito Yellow Ware tradition but has decorative elements relating to influences from the Rio Grande Valley to the east, perhaps brought by Puebloans who took up residence along the eastern Hopi Mesas. The primary production loci of Sikyatki were at sites along the western side of Antelope Mesa and the eastern side of First Mesa, especially at the site named Sikyatki. Although these sites are considered to be culturally Hopi, questions about the multicultural and linguistic make-up of the populations are still being examined.

The site of Sikyatki on First Mesa, famous for the yellow-firing pottery that bears its name, was destroyed by residents of nearby Walpi prior to the arrival of the Spanish in AD 1540. The residents of the large site of Awatovi on Antelope Mesa, another major Sikyatki Polychrome producer, allowed the Spanish, who brought with them their own preferences in ceramics, into their village and permitted them to establish a mission in AD 1629. The Spanish were expelled in the Pueblo Uprising of 1680, only to return a short time later. In the autumn of AD 1700 or early 1701, Hopi from other villages attacked Awatovi, killed the residents, and destroyed the site by burning it (Fewkes, 1898:596; Montgomery et al., 1949; Rushforth and Upham, 1992:102–107).

Events that transpired following the Spanish invasion of the Hopi lands led to population relocations as Hopi moved to more defensible locations atop the mesas. During the Spanish upheaval, other Puebloans from the Rio Grande relocated to the Hopi Mesas.

[1] 27898 Old Village Road, Mechanicsville, Maryland 20659, USA; formerly with Smithsonian Institution, National Museum of Natural History, Department of Anthropology, MRC 112, Post Office Box 37012, Washington, D.C. 20013-7012, USA.

[2] Canouts Consulting, LLC, 3690 West Speedway, Tucson, Arizona 85745, USA.

[3] 7142 Mt. Meeker Road, Longmont, Colorado 80503, USA.

* Correspondence: bishopr@si.edu

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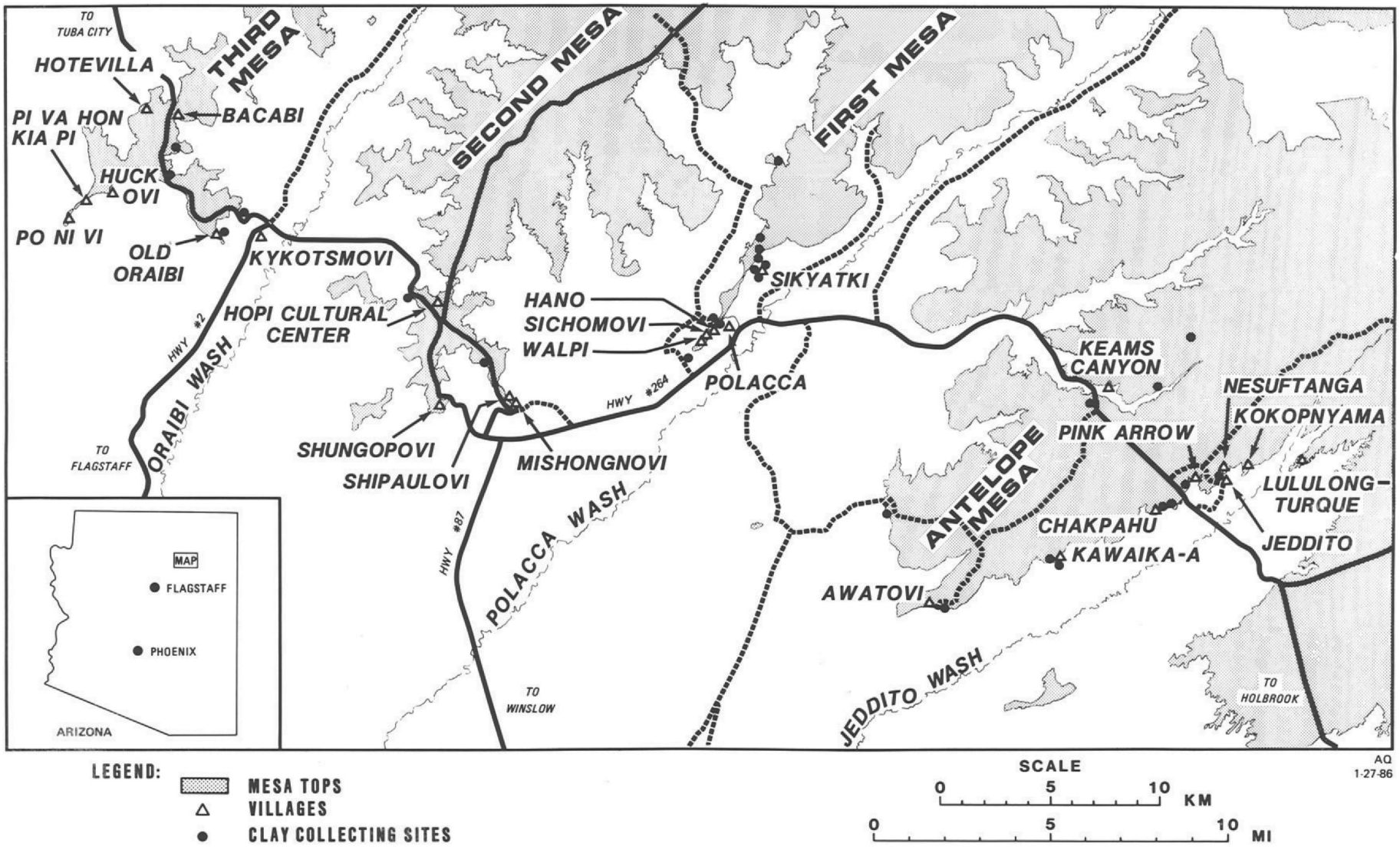

FIGURE 1. Locations of Hopi sites indicated with arrows. Clays from near the villages were analyzed using neutron activation to determine their chemical constituents. Map created by Alfred Qöyawayma.

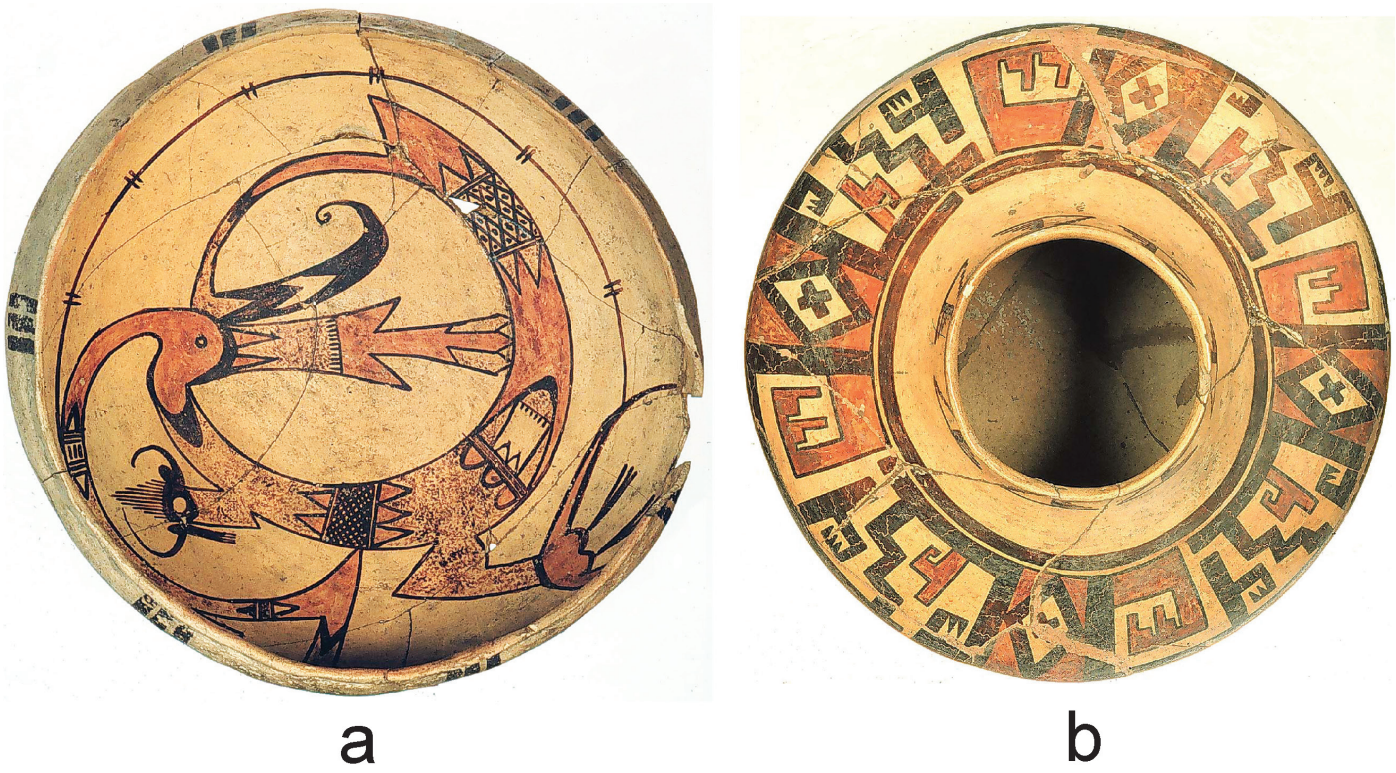

FIGURE 2. Examples of Sikyatki Polychrome vessel design. (a) analytical sample HPS057. Squat incurved bow. National Museum of Natural History, Smithsonian Institution (accession no. 155479). (Photograph by C. W. "Todd" Aikins.) (b) analytical sample HPS059. Squat jar with steeply raked shoulders. National Museum of Natural History, Smithsonian Institution (accession no. 155673). (Photograph by C. W. "Todd" Aikins.)

They brought with them new ceramic forms, surface finishes, and, among other influences, preferences for firing pottery with sheep dung (Wade and McChesney, 1981:8). An end date for the coal-fired yellow-surfaced Sikyatki Polychrome is suggested to be AD 1625, acknowledging Spanish-influenced ceramic preferences that preceded the establishment of the Awatovi mission (Hays-Gilpin, 2014:178). Whether through conflict with other villages or because of Spanish preferences in ceramic form manufacture and use, Hopi cultural knowledge necessary for (or interest in) producing the forms and finishes of Sikyatki Polychrome was no longer sufficient for it to be sustained. Although a Sikyatki revival among Hopi potters in the twentieth century involved the copying of pre-Hispanic designs, technological knowledge necessary to produce the distinctive Sikyatki yellow-firing slipped surface or to create the low, sharply shouldered seed jars had faded.

In a manner similar to many research projects, our "Sikyatki project" expanded quickly beyond the original sample to include hundreds of fragments and whole vessels from several national and state collections. We included orange-firing as well as yellow-firing Hopi pottery to better understand the compositional variation between the color classes. The geographic focus expanded as well by including ceramic from locations off as well as on the mesas. Information about the technical components of Hopi pottery was obtained that provided an objective platform for comparing the decorative designs. Increasingly, project members sought a means of communicating research findings to descendants of the Hopi pottery makers or users. But how was this to be done when different knowledge sets, Hopi traditional and historical Euro-Western, were involved?

We have learned subsequently that this issue is central to what has been defined as intercultural cinema, in which "meaningful knowledge" is located in different cultural regimes (Marks, 2000). Although in a less nuanced manner than Marks, we knew that we were not going to present our research findings to the Hopi as part of their history—they know their history (as we were frequently informed). Rather, we opted to focus on the technical aspects of Sikyatki and related ceramics whose cultural knowledge had been lost and to juxtapose the analytical findings with information on form, color, and design elements. Our target for transmission was a group of Hopi high school students, individuals who were already living an intercultural experience. Our vehicle for presentation was to team teach a semester course in

1989 at the Hopi Junior/Senior High School and, later, to serve as guides for students who attended a research workshop at the Smithsonian Center for Materials Research and Education in Suitland, Maryland. We first provide an overview of the research project and its various analytical components. For a detailed discussion of project findings and their archaeological importance, see Bishop et al. (1988) and Canouts and Bishop (1995, 2003). We then describe how we sought to communicate the research findings to the Hopi community through our educational involvement with Hopi high school students.

THE RESEARCH PROJECT

Our research using Hopi yellow-firing pottery began in 1985 when Hopi potter and engineer Al Qöyawayma was in the audience at a conference where Bishop was discussing the use of neutron activation analysis in his work with Maya pottery. For several years Qöyawayma had collected clays (Figure 1) and broken ceramic fragments from various mesa locations where the Hopi have resided atop a thick sequence of sedimentary structures for centuries. He had collected more than 100 clay samples from the mesa tops and wanted to know if any of the samples were a match to Sikyatki pottery recovered through archaeological excavations on the mesas.

In order to investigate his question, the authors formed an interdisciplinary team, including Al Qöyawayma, to study aspects of Hopi ceramic production and exchange. The analyses focused on the (1) the geochemical properties of clays used in ceramic manufacture, that is, *a neutron activation analysis*; (2) the characteristics of the clays, pastes, and textures during ceramic manufacturing and firing stages, *a petrographic analysis*; and (3) the painted motifs relative to the behavioral relationships of the potters and the larger Hopi community, *a design analysis*. An academic paper, published in 1988, set forth the methodology and research results to date (Bishop et al., 1988). Early on, it was obvious that we needed to assemble an analytical database that went far beyond the initial sample of ceramics and clays provided by Qöyawayma.

Hopi Ceramics: The Collections

The exploration and expansion of the United States to the Pacific coast in the nineteenth century was relentless. Diverse objectives of establishing U.S. sovereignty over new lands and over the Native Americans who occupied that land were combined with dreams of scientific discovery. In the mid-1800s the role of the individual explorer lessened as the Southern Pacific Railroad, established in 1865, made the Southwest accessible to the Eastern establishment and, by the end of century, enabled the collection of Native American artifacts that would fill the shelves of the nation's great museums.

Regrettably, the collection of artifacts was most often carried out in ignorance and with insensitivity to Native Americans' religious feelings. Burials were dug into, and bones were scattered as ceramic vessels of outstanding technical and stylistic accomplishment were removed along with other "goods" (see, for example, Fewkes, 1898:593, 618–619). Nevertheless, these museum objects still offer a valuable source for research, education, and entertainment—and, frequently, Native American displeasure. The ceramics that were the subject of our investigation using physical science techniques and stylistic analysis allowed us to glean information on Hopi pottery production and exchange. In time, the project took on an educational component that endeavored to communicate project findings to descendants of the Hopi artisans. Whether or not our project had an entertainment value is left to reviews by filmmakers and Native Americans of Victor Masayesva's film about the project, discussed herein.

Studying objects in their physical and cultural context enables researchers to bring a number of discrete disciplines and oral traditions together to elicit a more holistic understanding than any one approach or single analysis can provide. Yet our ability to find and explain patterning found in the analyses depends upon the scope and integrity of the objects sampled. We expanded beyond Qöyawayma's samples, focusing initially on archaeological collections of Sikyatki Polychromes recovered from Antelope Mesa, in particular from the sites of Awatovi and Kawaika-a, and from First Mesa, the site of Sikyatki. The collections from these three sites are curated at the museums that originally funded the early expeditions. The Peabody Museum of Archaeology and Ethnology, Harvard University, excavated Awatovi in the 1930s; the Museum of Natural History at the University of Colorado Boulder curates the Earl H. Morris collection of Southwestern pottery, which includes pottery excavated from Kawaika-a in the late 1920s; and the Smithsonian Institution excavated Sikyatki in the late 1890s.

Although these samples are comparable in terms of pottery type and forms, that is, whole bowls and jars, large fragments, and smaller sherds, they are also quite diverse in terms of excavation methods and curation practices then and now (see Joyce, this volume). In order to overcome some of these problems, the sampling was later expanded to include a substantial number of sites on the Hopi Mesas that had collections of Hopi pottery ranging in time from AD 1300 to 1800. The final sample also included Hopi pottery types found in archaeological sites located off the mesas, for example, the Homolovis and Chavez Pass (Nuvakwewtaqa). The larger sample has provided an expanded informational matrix to probe for temporal trends in the manufacturing process and exchange networks used by Hopi potters.

Archaeologists sometimes trace historic people's travels by pottery sherds found on the landscape. An in-depth analysis, however, shows the complexities involved in determining whether these sherds are comparable in their makeup or whether they are even contemporaneous. On the basis of archaeological dating techniques, Sikyatki Polychrome began to appear in the early fourteenth century and was replaced with different colors, forms, and designs at the beginning of the Spanish Entrada early in the fifteenth century. Many Southwest archaeologists believe

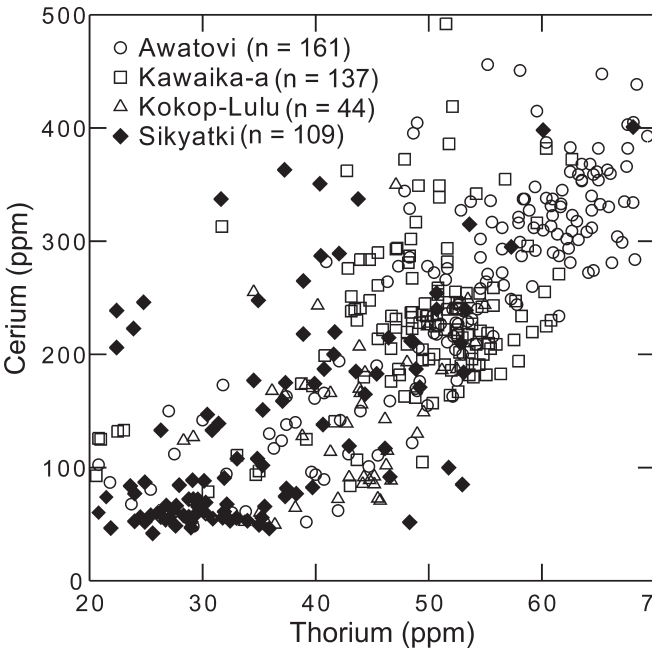

FIGURE 3. Example of chemical variation among yellow-firing pottery from Hopi sites on Antelope Mesa and First Mesa relative to their thorium and cerium values. Awatovi samples show the highest values that reflect enrichment of the two elements. High values likely reflect the greater number of *moissanite* particles, which tend to have elevated amounts of light rare earth elements (La, Ce, Sm, Eu, and Lu) and thorium, influenced by the uranium-rich sediments. In the bottom left corner are the majority of the Sikyatki samples, illustrating the strong difference in composition of the pottery from theFirst Mesa site of Sikyatki from the pottery of Antelope Mesa sites.

that Sikyatki Polychromes were made only on the Hopi Mesas because of the nature of the clays used and the need to fire with coal, which is easily found in the Hopi Mesa (Hack, 1942).

Instrumental Neutron Activation Analysis

Neutron activation is an excellent analytical choice because of its high sensitivity and analytical precision (Bishop et al., 1990). Additionally, one needs to extract only a relatively small, but representative, bulk sample, and the analyses can be carried out instrumentally without chemical separation using instrumental neutron activation analysis (INAA). Almost immediately, in our analysis three site groups emerged from the data matrix. These were compositional groups and subgroups that corresponded to the sites of Sikyatki, Awatovi, and Kawaika-a, all of which are contemporaneous and located on the Hopi Mesas. An example of between-village compositional variation is shown relative to the concentrations of thorium and cerium in Figure 3.

The sites of Awatovi, Kawaika-a, Kokopnyama extend south to north along the southeastern side of Antelope Mesa. The site of Sikyatki, located on First Mesa, lies west of the other villages (see Figure 1). The two elements shown in the bivariate graph are only 2 out of 15 that we used in the data analysis. With the feasibility study using ceramic fragments and clays carried out successfully, the research project was extended to include whole vessels within museum collection.

Sampling whole-vessel museum collections involved the extraction of a small quantity (i.e., 100–200 mg) of the ceramic paste, which was half of what was obtained when sampling pottery fragments. Ceramic sherds are quite numerous relative to the number of whole vessels. However, the whole vessels display complete designs (Bernardini, 2013). Our chemical analysis enables an objective bridge to be built between both types of collections. The INAA has great sensitivity for many of the constituent elements in the ceramic paste, some of which are present in quantities of less than one part per million. The technique is also capable of very good precision, and data can be routinely produced with several elemental determinations having less than 5% error (Bishop et al., 1990; Blackman and Bishop, 2007:327, table 2). Both of these characteristics are essential to differentiate among ceramics made from clay beds, ponds, and layers that are geographically close and to identify vessels made with the same raw material resources but varying manufacturing recipes (Bishop et al., 1988). High analytical sensitivity and precision are essential for attributing pottery to specific manufacturing locales, understanding patterned compositional variation among products from a particular workshop, and determining the directionality of trading networks.

At first blush, the yellow-firing ceramics would seemingly be ideal for seeking inter- and intravillage patterns using neutron activation. Binocular examination and more detailed petrographic analysis have shown the ceramics rendered as Sikyatki Polychrome are finely textured with few nonplastic inclusions, not all that different from the textural variation found in the extensively weathered and variably sorted clays of the region. Clays carried by ancient rivers and floodplains have been deposited in often thick beds that may show little vertical compositional variation. In other cases, clays formed in pods or ponds can have individually distinct compositions.

Our analysis was carried out on a bulk sample without separation, frequently making it difficult to know whether we were subsequently modeling the basic composition of the clay or the weighted impact of fine, nonplastic components. Nevertheless, the neutron activation provided a characteristic structure against which petrographic, color, form, and stylistic data could be juxtaposed, allowing us to infer variation in potting recipes among the Hopi villages, changes in potting behavior through time, and movements of pottery onto and off of the Hopi Mesas.

Petrography and Color Analyses

The Sikyatki and Jeddito yellow-firing ceramics produced in the Hopi villages in the fourteenth to seventeenth centuries represented a pinnacle of technological craftsmanship. On a macrolevel the technological development of the fine-paste Sikyatki Polychromes broke with tradition in at least two significant ways. Although the Sikyatki Polychromes are a subtype of a ceramic ware, that is, Jeddito Yellow Ware, which appeared 100 years prior, and although these wares were fired to a yellow color, the potters added tempering agents when forming the earlier pottery. Depending on the nature of the added temper and firing temperatures, the potters had less control over the final outcome in terms of surface smoothness and the color of the pottery.

Clay extraction, processing, and forming recipes combined with firing at a high temperature imparted the distinctive clarity of color and hardness of the Sikyatki pottery. The attainment of yellow-firing pottery remains elusive today (save for the contemporary, nontraditional addition of an antimony compound to impart a yellow cast to the clay body). Although no single technological step appears to be responsible for the surface color of Sikyatki Polychrome and Jeddito Black-on-Yellow Ware, control of an oxidizing, coal-based firing is involved. Since both coal and sheep dung can reach a maximum temperature of around 1,000°C, it may be that a long soaking period in coal firing may be important (Figure 4).

Human perception of color can be highly subjective. Using the chemical data as a framework, we were interested in how a more objective characterization of color would vary across our chemically formed groups. In what might have been the first such archaeological application (mid-1980s), the color of a ceramic's yellow surface was recorded using a Minolta chroma meter CR-121. The instrument's sensors correspond roughly to the cones of the eye, thus providing a "natural" vision numerical assessment of color recorded according to the *X*, *Y*, and *Z* tristimulus values or converted to the L*a*b* color system (Hunter and Harold,1987; Ohta and Robertson, 2006). The data were also converted to the comparative color system of Munsell ordered according to chroma, value, and hue (Munsell, 1905), which is more familiar to archaeologists (see Houston, et al., 2009, for a thoughtful, nonobjective discussion of color on Maya pottery).

Design Analysis

The Sikyatki Polychromes also broke with tradition on a behavioral level in relation to the painted designs. Until the fourteenth century, the designs on Hopi pottery were entirely geometric in nature. The interior designs of the bowls and outside designs of the jars were laid out symmetrically. Motifs, painted within the layouts, were usually rendered with straight lines forming outlines of triangles, rectangles, circles, and other geometric forms that were either filled with paint or left blank, showing the surface color of the vessel. Jeddito Yellow Ware is distinctive for the narrow black band with a small open space painted just under the interior rim of bowls and the exterior rim on jars.

Sikyatki Polychromes are notable for their naturalistic and recognized motifs appearing on the interior of bowls and on jar forms with acutely angled diameters that allow viewers to view the painted designs from above. Motifs include kachinas, full figures and faces; hands; dancers; birds, dragonflies and other fanciful insects; feathered lizards; and sweeping feature designs. A characteristic paint-spattered layer, the result of the potter flicking or blowing paint, often outlines or serves as a background on bowls' interior surfaces.

The break with the geometric design tradition was not a singular phenomenon. Other ceramic assemblages from essentially the same time period, such as (1) Casas Grandes yellow polychromes from northern Mexico, (2) Salado reddish polychromes from central Arizona, (3) Rio Grande yellow glazed ware from

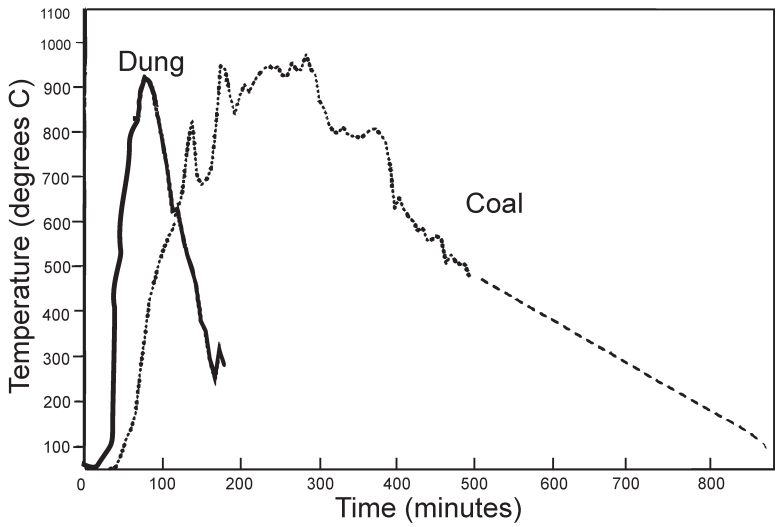

FIGURE 4. Graph of the relative firing curves achieved from open-pit firing using coal and sheep dung. Three thermocouples were placed in the pit, one of which was in the center, immediately adjacent to the vessel being fired. The dashed line for the coal firing represents time that was not monitored prior to extracting the fired vessel. Readings were recorded at one-minute intervals with an Omega data logger.

northern New Mexico, and (4) buff Zuni Matsaki Polychromes from northwest New Mexico, also display naturalistic designs painted on light-colored backgrounds.

Archaeologists have hypothesized that the ceramic designs are the epiphenomena of the Kachina Cult, which appeared in the Southwest in the thirteenth century (see, for example, Schaafsma and Schaafsma, 1974; Adams, 1991; Schaafsma, 2000). Similar designs were painted on underground kiva walls. Kivas are a central underground room in which ceremonial and spiritual activities related to the Kachina Cult occurred. The symbolism has been investigated across different media, that is, stationary walls and portable pottery, but no in-depth analyses have been conducted across pottery assemblages or even within the same type of pottery assemblage to note structural similarities in the design. Fewkes's (1919) report on the Sikyatki designs is still one of the best references about the underlying structure of the Sikyatki designs to date (see also Hays-Gilpin, 2014).

Design analysis may or may not help us understand the behavioral context of the potters. This uncertainty can be illustrated by the comparison of bowls with specific fired clay groups based on INAA used in the Smithsonian's research. Two groups of pots, one containing two bowls and the other containing four bowls, recovered from Sikyatki are almost identical in paste composition but differ in design layout and the use of design elements. The two groups were distinct in color and form, yet each group of pots was undoubtedly painted by the same potter's hand (Bishop et al., 1988:326–327). In another example, Hannah Huse (1976), analyzing Sikyatki Polychromes from the site of Kawaika-a, identified the work of 32 potters or potters' groups on the basis of design, form, and color. She used burial provenience data to help define her groups. Comparing the pottery in the Huse groups with the INAA data, however, suggested that potters represented within a single group used different clays in making their pottery (Bishop et al., 1988:326). From these two analyses, the interrelationships of design, form, clay sources, and kin groupings appear to crosscut one another. Often, archaeologists use only one type of analysis to identify and interpret the behavioral context of pottery production and exchange, but sociocultural relationships involved in these activities are much more elusive.

We believe that the meaning of the designs for Hopi is Hopi dependent. That is, each Hopi generation interprets the meaning of the designs on the basis of their own cultural awareness imparted by their Hopi elders about the religious underpinnings of life events. When we were asked whether a design that looked like a line of Hopi female dancers represented a particular ceremony, the best answer we could offer was "If it has meaning for you, then it depicts your interpretation of your own culture."

Because every generation interprets their natural and sociocultural environment within their own historical perspective, the process of interpretation and reinterpretation does not flow smoothly. Misinformation, missing information, different outside sources of information, and similar distortions impact each generational interpretation. An extreme example of this type of effect corresponds to the Spanish Entrada in the AD 1500s, which included new types of disease that decimated Native populations; the spread of Catholicism, which drove Native beliefs underground, both literally and symbolically; and the movement of Native populations seeking to escape these disasters (Adams, 1989).

The arrival of the Spanish also had profound impacts on ceramic technology and artistic expression, among other aspects of society. The expulsion of the Spanish missionaries from Awatovi and subsequent intervillage warfare on Antelope Mesa and First Mesa resulted in significant population reduction. When the Spanish reestablished their presence in the Hopi villages, Rio Grande–inspired ceramics, with new forms and production techniques, including the use of sheep dung as a firing fuel and mutton stew bowls of the Payupki assemblage, rose in frequency. The forms and technology of the yellow-firing wares had been lost, and designs that once appeared on Sikyatki Polychromes were no longer in evidence. New designs and forms introduced by migrating Native groups and new designs depicting some of the old-world religious symbols dominated pottery production and exchange in the Hopi historic period. By the 1800s, the major Hopi pottery form was an orange-fired, white-slipped stew bowl with arabesque designs painted around the rims. The arabesque elements reflect the Renaissance period's Islamic art, introduced into Spain by the Maghreb (aka Moors), who inhabited the Iberian Peninsula for several centuries. Islamic art, which consists of surface renderings of repeating, interlocking scrolls and similar flowing design elements, was incorporated into the secular and Christian art of Spain and crossed the Atlantic with the Spanish missionaries.

The next significant change in Hopi pottery production was the revival of certain Sikyatki Polychrome forms and designs. Nampeyo, a Native potter living in the Tewa village of Hano on First Mesa near the abandoned site of Sikyatki, copied the designs appearing on pottery excavated by Fewkes (Kramer, 2003). Other potters followed suit as more excavations occurred on Antelope Mesa in the early 1900s. Some potters even focused on particular designs that became a family tradition. The "Bat Wing" appears over and over on pottery painted by Nampeyo and her descendants. This pottery became a constant in the acquisition of Southwestern pottery by early tourists and today's visitors.

HOPI TEENS: HOPI CERAMICS IN THE CLASSROOM

Hoping to involve Hopi in the project, the authors contacted the Hopi Cultural Preservation Office, the Bureau of Indian Affairs, and the Smithsonian Institution's educational and legal departments to help develop a semester course for Hopi youth to learn about past and present generations of Hopi potters. We conceived of this course as strictly an outreach project, disseminating the results of our research to the source community. This approach is in contrast to the cooperative research ventures

that have grown more popular and that seek mutual benefit for the researchers and the community such as the one described by Burgio-Ericson and Seowtewa (this volume).

Six high school juniors (five girls and one boy) were selected by the faculty and attended the 1989 spring semester class on Hopi Pottery at the Hopi Junior/Senior High School in Keams Canyon, Arizona. The focus of the student outreach was the study of Hopi pottery. Instead of presenting separate classes covering different subjects, as classic educational models do, all the subject matter was integrated, applied, and interpreted in the context of pottery. Classroom instruction over 17 weeks included philosophy, history, and subfields of science; research design; ceramic science and technology; clay and engineering considerations (e.g., step processes, formation thresholds, outgassing shrinkage); pyrotechnology and measurement; ceramic microstructure; compositional characterization; design analysis and pattern recognition; shape grammars and symmetry; and ceramic creation through learning, imitation, and innovation. The study of pottery was also enhanced by introducing the students to modern cultural and sociopolitical issues surrounding the study of Native American collections.

All of the students were able to attend the follow-up summer workshop at the Smithsonian Institution in Washington, D.C. A Hopi cinematographer, Victor Masayesva, and Tewa potter, Madeline Sahneyah, worked with the students, filming a story centered around a contemporary Hopi, pottery-making grandmother, her granddaughter, and a group of Hopi teenagers. The involvement of the Hopi teens is summarized here.

Student familiarity with Hopi pottery making was not extensive. They were vaguely familiar with the pottery revival of the Sikyatki Polychrome colors, forms, and designs (see Blair and Blair, 1999; Kramer, 2003). They saw the revival pieces sold by Hopi potters, Indian traders, and retailers specializing in Native American arts and crafts. But they did not know the history of the technology and exchange patterns involving the original Sikyatki Polychromes. Certainly, today, conditions have changed. Some Hopi potters now buy clay from peddlers, use electric kilns or fire the pottery in their kitchen ovens, and even share the tasks of forming and painting the designs on bowls and jars with other potters.

Hopi filmmaker Victor Masayesva Jr., from the village of Hotevilla, filmed the involvement of the Hopi teens following two threads. The first thread was the story of a fictional Hopi grandmother potter who did not permit her teenage granddaughter to go to the Smithsonian Institution in Washington, D.C., in the summer. The other thread documented the teens who worked with the Hopi pottery and laboratory instrumentation to delve more deeply into the composition of the pottery through the use of high-tech instrumentation (Masayesva, 1991).

At the laboratory, the students were introduced to the application of neutron activation analysis: from the sampling and the irradiation of the sample tubes of fired clay to the statistical results of the parts per million of elemental constituents. They were able to use the scanning electron microscope to look at microscopic inclusions and their abundance and sorting in the ceramic pastes, and they were able to contribute to the growing data base of color measurements by using the tristimulus chromometer (Figure 5).

Although other researchers had previously noted that Jeddito Yellow Ware became lighter over time (Nobles, 1978), our preliminary findings were statistically significant in demonstrating the color change, and the readings taken by the teens in the laboratory continued to support this trend (Figure 6). For distinct color differences, the teen operators had to average

FIGURE 5. Hopi Junior/Senior High School juniors Anjanette Tenakhongva (left) and Francine Honie (right) acquiring color measurements from Sikyatki Polychrome fragments as part of the workshop at the former Conservation Analytical Laboratory of the Smithsonian Institution. (Photograph by Ronald Bishop previously published in *The Torch*, a monthly newspaper of the Smithsonian Institution, August 1988, no. 88-8.)

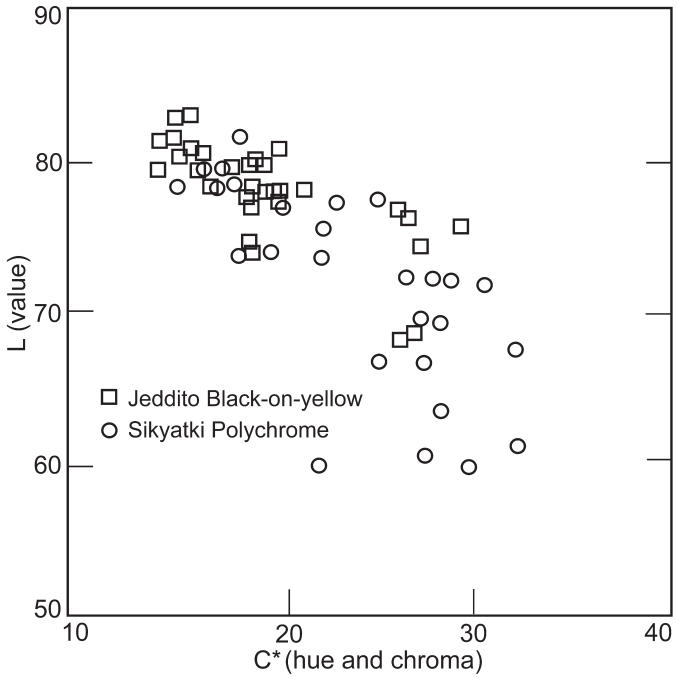

FIGURE 6. Example of colorimetric data for Jeddito Bichromes and Sikyatki Polychromes from Kawaika-a on Antelope Mesa. Colorimetric values were obtained using a Minolta chroma meter plotted relative to L*A*B* color space. Note that the Sikyatki readings are generally lighter and paler, having less hue and chroma than the Jeddito Bichrome pottery.

samples taken from multiple areas. The data from the colorimeter analysis showed that the yellow colors became lighter over time (Canouts and Bishop, 2003:140, fig. 4). (For some color determinants, pastes with obvious, abundant iron inclusions were not included in the samples pulled for comparison.)

The teens were also able to visit the Smithsonian collections to see the diversity of pottery forms, colors, and designs excavated from the site of Sikyatki. On an interesting note, one of the acute-angled, shouldered large jars from the site of Sikyatki had been overpainted by a talented Hopi potter and artist. The original design was worn and hard to make out, and a former curator had allowed the Hopi potter to reconstruct the design. For the most part, reconstruction of an original piece is not encouraged, but one has only to look at the restoration of famous art pieces to understand the role played in bringing an original "back to life." In this case, the Hopi artist not only may have had similar painting skills but also had the cultural understanding of what the design may have represented as handed down through generations.

The students' story was not limited to studies involving science and art. Like other visitors flocking to Washington, D.C., they toured the monuments, and like teens everywhere, they spent time sleeping on the bus as they were ferried not only to historical sites but also to recreational sites (the roller coaster at Kings Dominion in Virginia was a big hit).

The teens met with one of Arizona's legislators in the U.S. House of Representatives, Jon Kyl (1987–1995; U.S. senator, Arizona, 1995–2013). They also visited with U.S. Supreme Court judge Sandra Day O'Conner, who grew up in Arizona and had become the first woman appointed to the Supreme Court just eight years before (1981–2006). While meeting with the Hopi students, Kyl and O'Conner talked about their lives in Arizona and current challenges, as seen from their specific venues. Smithsonian staff, especially James Early, former director of cultural heritage policy, offered further conversation about the role played by the Smithsonian in social issues and power politics involving Native Americans and their collections. During this period, a national conversation about the appropriate use of Native American collections in museums was already well underway. Stances taken by different groups—Native American leaders, archaeologists, the Smithsonian Institution, and federal governmental agencies that manage museum collections—created confrontational scenes that would be played out over the next 10 years as these groups learned to work together. These issues would become part of ongoing discussions when the National Museum of the American Indian opened its doors in Washington, D.C., in 2004 (Smith, 2005).

Victor Masayesva produced a one-hour film about the Hopi pottery project with the teens' input; it was subsequently cut to a 30-minute video for distribution (Masayesva, 1991). As mentioned, the storylines set the teens apart from one of their friends who was not allowed to attend the high school class or travel to Washington, D.C. The film was as much emotive as informative. As a prime example of intercultural cinema, it was not strictly a documentary, but an alternative form of it. Instances of on-mesa dialog were spoken in Hopi, making the statement that some things are not open to understanding by all. It brought alive many of the naturalistic designs of dragonflies and birds, showing animals on the Hopi landscape, which reflects the Hopi's oneness with their environment. In keeping with our one-way outreach concept, Masayesva was free to film, organize, and present what he considered of interest to the Hopi community without any editorial oversight, ownership, or subsequent control by the Smithsonian Institution.

But what did the students learn? At the end of the summer session, the teens were asked to summarize their findings and experience in their own voice.

Evaluation

When we began the outreach segment of our project, our goal was simply to give back information. Did we do it? If so, how well? The mechanisms through which we attempted to place information back into the community were not as simple as they might first appear. The information we drew upon was reshaped in the process of "giving it back." The students did

not initially seem interested in what we were interested in, that is, chasing down technological and social organizational clues through scientific investigation. Even working with clay to make pottery was not really exciting. Trying to reach out to spark their interest was made more difficult by not knowing more about their backgrounds. What in their community was interesting to them? That we did reach them can be demonstrated by some of their own comments. In the final two days, we introduced them to our computer word processing system and left them alone to write up their impressions:

> **Voice 1:** In the eyes of many people today, a pottery vessel is good as long as the formation and design is done neatly and carefully. In the scientific analysis that I've done with clay, I feel a vessel is good not only by the formation and design but also by the durability of the vessel. . . . I've tested the clays itself, and found what clays were good and bad. . . . The information I've gathered from these experiments is what I'd like to contribute to my community. I realize many potters aren't able to do scientific analysis on their clay, so from this point, they will have to continue with the same process they've used for finding a good type of clay, which has been the only process since the history of pottery.
> **Voice 2:** I have been studying pictures of whole pottery vessels and putting them into little groups according to their similarities. . . . Some of my colleagues worked with either the scanning electron microscope, the x-ray diffractometer or Hopi legends and history. . . . With all this information we gather we all get together and try to make something of it. . . . The [data] prove a lot of things that supposedly happened in Hopi history that up to now, have not really been taken seriously; like split-ups between villages and intermarriages between different tribes.
> **Voice 3:** My experience in Washington D. C. was unique. I enjoyed working in the Smithsonian Support Center [Conservation Analytical Laboratory]. It makes me feel as if I was doing something to change the world. Actually, I am doing something for my people, preserving our heritage. It was fun, interesting, and sometimes, somewhat confusing. I am glad I had this opportunity.

With the advantage of hindsight, we can say that the learning process came together in Washington, D.C. During the semester, our special course had competed against their own study hall time, time they needed to plan activities, such as the prom, or meet in assemblies. The students themselves recommended that a more structured curriculum with after school activities would have been more complementary to their own lives on the Hopi Mesas.

We believe that our teaching experience was a unique combination of people, place, and time. The project was made possible by a grant from the Smithsonian Educational Outreach Fund, administered by Ralph Rinzler and supported by the Smithsonian's Conservation Analytical Laboratory (later renamed the Smithsonian Center for Materials Research and Education and now the Museum Conservation Institute). The financial and institutional support provided for our team of researchers to travel to the Hopi Mesas, provided for internships at the Smithsonian, and provided for a video production, the totality of which is probably not within the reach of most outreach programs today. We have sought to present a model, however, not a formula. The model relates to the intercultural exchange that may suggest new ways to communicate about our work.

At the Smithsonian, high school internships are available only to graduating high school seniors, and we taught high school juniors. The senior internships are longer and more structured, with dormitory housing. Few of our students had ever been so far away from home, and the shorter time and group living situation proved to be ideal. In terms of our goal to disseminate our results to the source community, because they were juniors, these students had another year of school in which to talk to others about their experiences.

Vernon Masayesva, an educator and then Hopi tribal vice chairman, looked upon our efforts with considerable interest. He provided thoughtful comments about the need to teach students using objects and concepts that are familiar within the community. He stressed the need for interdisciplinary analyses capable of yielding structural and functional descriptions of items, using corn as an example. Traditional knowledge of this staple and its dietary and ceremonial purposes could be an integral part of the classroom presentation. Although children are initiated into religious societies and can observe their parents labor, the transmission of this information is highly variable. For example, although it is true that pottery is produced primarily by the Hopi-Tewa community on First Mesa, even students with potters in their families still know little about the craft.

We did not approach the teaching of Native American students as a casual activity. In another generation, it is likely that ethnic and racial minorities will comprise the majority of college-age students, especially in the Southwest. The importance of melding different epistemologies into a working whole cannot be overemphasized (see, for example, Burgio-Ericson and Seowtewa, this volume). More than understanding Western science, students must also be able to bring traditional knowledge to bear in the solution of problems. The integration of folk medicine and Western medicine in some developing nations suggests that this trend is widespread and, upon closer inspection, also suggests that traditional technologies, whether in medicine or some other field, are not directly translatable into Western scientific technologies. Rather, they are complementary. If we are to solve problems, we must be able to tap various kinds of information and recombine them in new ways.

In keeping with this observation, we conclude that by giving back what we have learned, we have presented only part of the picture. What we have done, however, is allow the Hopi the opportunity to actively participate in a synthetic process. The students took the classroom experience and combined it with their upbringing to come to a new appreciation of the "old myths." Victor Masayesva took his artistry and knowledge of Hopi and

Hopi-Tewa culture to translate our information into a medium that will reach a wider audience (see, for example, Leuthold, 2001:66–67; Marks, 2000:37–39). What the Hopi internalize when they listen to their children and when they view the film will carry the synthesis forward.

The Hopi grandmother and potter in Masayesva's film, after being informed about what the teens had experienced in the Smithsonian collections and workshop, said to her granddaughter, "I'm sorry I didn't let you go . . . but I'm glad they did tell you what they saw. . . . [The pottery] is precious . . . and not to be taken anywhere . . . it is a sad thing." Her response may leave the reader unsettled, and this is the most obvious takeaway we can relay. The Hopi will judge how our scientific results are incorporated into their own narrative today and for generations in the future.

ACKNOWLEDGMENTS

The Hopi Ceramics Project was possible only with the cooperation of many individuals; among these are Lambertus van Zelst, former director of the Conservation Analytical Laboratory (later renamed the Smithsonian Center for Materials Research and Education and now the Museum Conservation Institute); Alfred Qöyawayma, Hopi potter and bronze sculptor (and mechanical engineer); Carroll L. Riley (deceased), ethnologist, archaeologist and historian; Charles Wesley "*Todd*" *Aikins* Jr. (deceased), president of Thunderbird Drilling, Wichita, Kansas, and project volunteer photographer. In the Hopi Nation, the cooperation of Victor Masayesva (internationally recognized video filmmaker and photographer), Vernon Masayessva (Hopi educator, former tribal chairman, and executive director of the Black Mesa Trust), and Madeline Sahneyah (Tewa potter) were critical to our outreach efforts. And not least, we thank the numerous administrators, curators, and conservators who allowed their collections to be included in our project.

REFERENCES

Adams, E. Charles. 1989. Passive Resistance: Hopi Responses to Spanish Contact and Conquest. In *Archaeology of the Spanish Borderlands: The Greater American Southwest*, ed. David Hurst Thomas, pp. 77–91. Washington, D.C.: Smithsonian Institution Press.

Adams, E. Charles. 1991. *The Origin and Development of the Pueblo Kachina Cult*. Tucson: University of Arizona Press. https://doi.org/10.2307/j.ctv1gwqrjz

Bernardini, Wesley. 2013. The Non-diagnostic Sherd Problem: Lessons from Jeddito Yellow Ware Typology. *Kiva*, 79:205–227. https://doi.org/10.1179/0023194014Z.00000000020

Bishop, Ronald, Veletta Canouts, Patricia Crown, and Suzanne DeAtley. 1990. Sensitivity, Precision, and Accuracy: Their Roles in Ceramic Compositional Data Bases. *American Antiquity*, 55:537–546. https://doi.org/10.2307/281283

Bishop, Ronald L., Veletta Canouts, Suzanne P. DeAtley, and Alfred Qöyawayma. 1988. The Formation of Ceramic Analytical Groups: Hopi Pottery Production and Exchange, A.C. 1300–1600. *Journal of Field Archaeology*, 15:317–337. https://doi.org/10.1179/009346988791974439

Blackman, M. James, and Ronald L. Bishop. 2007. Smithsonian–NIST Partnership: Application of Instrumental Neutron Activation Analysis to Archaeology. *Archaeometry*, 49:321–343. https://doi.org/10.1111/j.1475-4754.2007.00304.x

Blair, Mary Ellen, and Laurence R. Blair. 1999. *The Legacy of a Master Potter: Nampeyo and Her Descendants*. Tucson, Ariz.: Treasure Chest Books.

Canouts, Veletta, and Ronald L. Bishop. 1995. A Hopi Tradition: Yellow Firing Ceramics. *JOM*, 47:58–59. https://doi.org/10.1007/BF03221257

Canouts, Veletta, and Ronald L. Bishop. 2003. Modern Measures of Traditional Hopi Pottery: Physical and Behavioral Sources of Variation in Hopi Pottery Production and Exchange: A.D. 1300–2000. In *Patterns and Process: A Festschrift in Honor of Dr. Edward V. Sayre*, ed. Lambertus van Zelst, pp. 135–156. Suitland, Md.: Smithsonian Center for Materials Research and Education.

Fewkes, Jesse Walter. 1898. Archeological Expedition to Arizona in 1895. In *Seventeenth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1895–1896*, pp. 519–744. Washington, D.C.: Government Printing Office.

Fewkes, Jesse Walter. 1919. Designs on prehistoric Hopi pottery. In *Thirty-third Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1911-1912:207-284*. Washington, D.C.: Government Printing Office.

Hack, John T. 1942. *Prehistoric Coal Mining in the Jeddito Valley, Arizona*. Papers of the Peabody Museum of American Archaeology and Ethnology, No. 35, pt. 2. Reports of the Awatovi Expedition, No. 2. Cambridge, Mass.: Harvard University.

Hays-Gilpin, Kelley. 2014. Sikyatki Polychrome: Style, Iconography, Cross-Media Comparisons, and Organization of Production. *Kiva*, 79:175–204. https://doi.org/10.1179/0023194014Z.00000000019

Houston, Stephen, Claudia Brittenham, Cassandra Mesick, Alexandre Tokovinine, and Christina Warinner. 2009. *Veiled Brightness: A History of Ancient Maya Color*. Austin: University of Texas Press.

Hunter, Richard S., and Richard W. Harold. 1987. *The Measurement of Appearance*. 2nd ed. New York: John Wiley & Sons.

Huse, Hannah. 1976. Identification of the Individual in Archaeology: A Case Study from the Prehistoric Site of Kawaika-a. Ph.D. diss., University of Colorado, Boulder.

Kramer, Barbara. 2003. *Nampeyo and Her Pottery*. Austin: University of Arizona Press. https://doi.org/10.1093/gao/9781884446054.article.T060840

LaMotta, Vincent M. 2006. Zooarchaeology and Chronology of Homol'ovi I and Other Pueblo IV Period Sites in the Central Little Colorado River Valley, Northern Arizona. Ph.D. diss., University of Arizona, Tucson.

Leuthold, Steve. 2001. Rhetorical Dimensions of Native American Documentary. *Wicazo Sa Review*, 16: 55–73. https://doi.org/10.1353/wic.2001.0022

Masayesva, Victor, Jr., dir. 1991. *Siskyavi: The Place of Chasms*. New York: Electronic Arts Intermix. Video, 28 min.

Marks, Laura U. 2000. *The Skin of the Film: Intercultural Cinema, Embodiment, and the Senses*. Durham, N.C.: Duke University Press. https://doi.org/10.1515/9780822381372

Montgomery, Ross Gordon, Watson Smith, and John Otis Brew 1949. *Franciscan Awatovi*. Reports of the Awatovi Expedition, No. 1. Cambridge, Mass.: Peabody Museum, Harvard University.

Munsell, Albert H. 1905. *A Color Notation*. Boston: George H. Ellis.

Ohta, Noboru, and Alan Robertson. 2006. *Colorimetry: Fundamentals and Applications*. New York: John Wiley & Sons. https://doi.org/10.1002/0470094745

Nobles, Anne. 1978. A Preliminary Analysis of Firing Temperatures and Selected Paints and Slips of Historic Hope Pottery. B.A. Honors thesis. Harvard College, Cambridge, Mass.

Rushforth, Scott, and Steadman Upham. 1992. *A Hopi Social History*. Austin: University of Texas Press.

Schaafsma, Polly. 2000. *Kachinas in the Pueblo World*. Salt Lake City: University of Utah Press.

Schaafsma, Polly, and Curtis F. Schaafsma. 1974. Evidence for the Origins of the Pueblo Katchina Cult as Suggested by Southwestern Rock Art. *American Antiquity*, 39:535–545. https://doi.org/10.2307/278903

Smith, Claire. 2005. Decolonizing the Museum: The National Museum of the American Indian in Washington DC. *Antiquity*, 79:424–439. https://doi.org/10.1017/S0003598X00114206

Smith, Watson. 1971. *Painted Ceramics of the Western Mound at Awatovi*. Papers of the Peabody Museum of Archaeology and Ethnology, No. 38. Cambridge, Mass.: Harvard University Press.

Wade, Edwin L., and Lea S. McChesney. 1981. *Historic Hopi Ceramics: The Thomas V. Keam Collection of the Peabody Museum of Archaeology and Ethnology, Harvard University.* Cambridge, Mass.: Harvard University.

Reconnecting Collections: Provenance, Material Analysis, and Iconographic Study of Mesoamerican Turquoise Mosaics and Related Pieces

Martin E. Berger,[1] Christophe Moreau,[2] and Serge Lemaitre[3]*

INTRODUCTION

As the editors of this book state in their introduction, collections-based research has received renewed interest over the past decade. Archaeologists working with orphaned or legacy collections have been able to restore research potential to objects that had been sitting on museum shelves for decades. Much of this work has focused on the (re) analysis of excavation material that was unearthed during archaeological projects, be they academic, commercial, or some other type (e.g., King, 2016; Mulrooney et al., 2016; Frieman and Janz, 2018). In these studies, one of the most significant challenges was reconstructing the context of the material within the site or feature in which it was found. In some cases, excavation reports that included photos, drawings, and feature numbers were available (e.g., Voss, 2012); in others, even this basic information was lacking. Still, even in the most precarious of these cases, there was often at least some certainty about when the collections had been unearthed, where they came from, and who may have been involved in their excavation.

The situation is markedly different when one turns to collections of pre-Columbian art in European and North American museums. It is fair to say that most pieces of pre-Columbian art on display in European and North American museums derive from undocumented contexts. Although a minor percentage of this material consists of pieces that were traded, stolen, or looted during the European invasion of the Americas—and are therefore, in a way, closer to ethnographic pieces than to archaeological material—the overwhelming majority derives from undocumented excavations (i.e., looting) and was acquired on the art market, either by the museums themselves or by the donors or sellers who gave or sold them to the museums. Many of these pieces were acquired in the second half of the twentieth century, when the market for pre-Columbian art exploded, and museums around the world—but especially in the United States—started to acquire pre-Columbian pieces at an unprecedented rate (Coggins, 1969; Boone, 1993; Alva, 2001; Tremain and Yates, 2019).

Naturally, all of the pieces acquired on the market lack any information about their provenience and can often be attributed to only a certain culture, time, or region through art historical comparison or material analysis. Paired with the ethical considerations discussed in more detail below, this lack of any documented provenience is probably one

[1] Faculty of Archaeology, Leiden University, Einsteinweg 2, 2333CC, Leiden, Netherlands.

[2] Laboratoire de Mesure du Carbone 14 - LMC14, Bâtiment 450 - Porte 4E, Commissariat à l'Énergie Atomique et aux Énergies Alternatives (CEA)/ Saclay, 91191 Gif-sur-Yvette, France.

[3] Musée Art & Histoire, 10 Parc du Cinquantenaire, 1000 Brussels, Belgium.

* Correspondence: m.e.berger@arch.leidenuniv.nl

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of the reasons that very little collections-based research of the kind proposed by King (2016), Voss (2012), and others has been performed on collections of pre-Columbian art (see Levine and Martínez de Luna, 2013). Of course, this is not to say that these pieces have not been used as objects of research. However, this research often focuses more on art historical questions or questions of authenticity and authentication (e.g., Kelker and Bruhns, 2010; Berger, 2013; Jennings and Sellen, 2018) than on attempts to reconstruct the original context of the pieces.

In this essay we attempt to restore research value and recontextualize two collections housed at the National Museum of the American Indian (NMAI). An important question here is how to conduct research on collections that lack information on their provenience and that also lack any direct comparison to professional excavations. Both collections were looted by unknown persons. One came to the museum by way of a private collector in the beginning of the twentieth century; the other was donated to the museum by a notorious art dealer in the early 1970s, the heyday of the commercialization of pre-Columbian art. Although both collections contain similar material, their institutional histories are totally different. The earlier collection contains one of the best-known and most widely illustrated pieces of pre-Columbian Mesoamerican art (Figure 1); the later collection, in contrast, was never exhibited and has received only very sparse research attention in the 50 years that it has been at the museum. This disparity in attention highlights an issue raised by Frieman and Janz (2018:257), who stress the need to look beyond the "shiny examples" in museum displays and consider both "the beautiful objects that inspire the public and the boxes of dusty materials that are never displayed." Together, both the aesthetic highlights and the seemingly mundane fragments can create an understanding of the original context of these pieces that would never be reached when studying them in isolation.

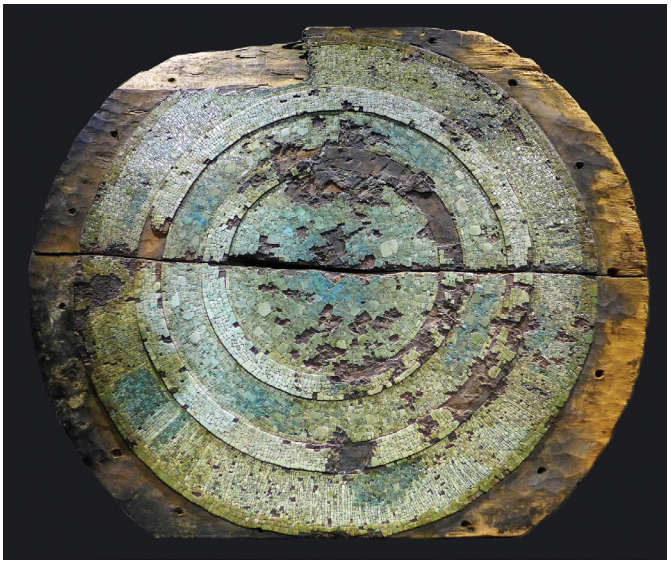

FIGURE 1. The centerpiece of the RMAH turquoise collections. Royal Museums of Art and History, AAM.68.11. (Photo courtesy of Julia Montoya.)

The work on these collections is divided into two parts. This essay focuses on the collections histories, material analyses, and provenance research on these collections; Domenici's work (this volume) is concerned with placing these materials in their original cultural context. The combined aim of these two essays is to create a better understanding of these pieces, not only to attempt to reconstruct their original context and significance but also to examine how they help us understand collection policies of museums and the ways in which museums interacted with art dealers and the market in the past.

THE NMAI COLLECTIONS

The Purpus Collection

In 1922, George Gustav Heye acquired a collection of Mixtec turquoise-decorated masks and shields for the soon to be opened Museum of the American Indian, Heye Foundation (MAI). The purchase was made by Marshall H. Saville, who acted as an adviser to Heye and the MAI, and was bought from Carl Albrecht Purpus, a German botanist based in Mexico. Heye (1920b) described the collection as "undoubtedly the most marvelous collection of Mexican objects in existence. . . . The acquisition of this collection would mean that we would not alone lead any museum in this country in Mexican material, but undoubtedly would be the pre-eminent one of the world in this line." In their correspondence, Heye repeatedly urges Purpus to send him information on the collection so that it can be acquired as swiftly as possible because the pieces would be one of the highlights of the future museum (Heye, 1920a, 1920c).

According to the original agreement, the collection acquired from Purpus consisted of "mosaics (16 pieces), 2 atlatls, and 1 mosaic reed (cachimba) for $20,000 American money" (Saville, 1920). It is unclear how these pieces came into Purpus's possession. In his first letter to Heye, in which he offers the pieces to the museum, Purpus claims that the collection had been sold to the Ethnological Museum in Berlin before the start of World War I (Purpus, 1920a). However, because of the financial situation of the Berlin museum after the war, it was no longer able to afford the collection. In his letters to Heye, Purpus does not say where and when the pieces were looted. Since he repeatedly makes mention of a person he refers to as "my collector," it is probable that he did not find the pieces himself, but rather bought them from someone who acquired collections for him. It is likely that Purpus himself was unaware of where exactly these pieces were found. The only information available on the collection's provenience comes from the work of Saville, who says that the pieces were found "in a cave in the mountains of the Mixteca region of the State of Puebla" (Saville, 1922:47). In the only article that

Purpus himself published on his archaeological collections, he stated that they "come from caves, of which there are quite a few in this Sierra, and where they are chanced upon by locals" (Purpus, 1926:61).[1] Purpus's assertion that the pieces come "from caves" (plural) suggests that the pieces in his collection may not have been found in the same location.

Although the purchase was concluded in November of 1920, the pieces did not arrive in New York until almost a year later because of issues with customs and transport. Because of their uniqueness and value, Purpus feared that the authorities would not allow the pieces to leave the country. Heye, likewise, was concerned with the legal implications of bringing the pieces out of Mexico, as evidenced by his insistence to Purpus that "you will get it out of Mexico, as we would not, in any circumstances, be connected with its transportation" (Heye, 1920a). To circumvent trouble at customs, Purpus's first idea was to pack the mosaics with biological specimens that he had collected for other museums. He wrote to Heye, "I think I will send the mosaics as insects. I have a collection of beetles and butterflies which were collected for the Zoological Museum at Berlin. I pack those insects on top of the box and have them sent to you, not the museum. If you write again to me, please use a plain envelope not one you are using" (Purpus, 1920b). This plan fell through when the boxes were opened for inspection by customs, and they refused to let the objects leave the country (Purpus, 1921a). After repeatedly trying to convince the German consul and ambassador that the pieces should be sent through diplomatic post, so that they would not be seized, he resigned himself to the option originally proposed by Heye—to send the pieces to the museum in the sealed trunk of a "trustworthy person" aboard a steam liner from Veracruz to New York. The person selected for this job was Purpus's neighbor in Zacuapam, Norbert Grohmann, a Swiss national living in Mexico (Purpus, 1921b), who finally managed to bring the collection to New York without alerting customs.

After the collection arrived in New York, Saville showed it to Manuel Gamio, at that time inspector of museums and director of anthropology in Mexico and one of the most influential archaeologists of the country. Gamio was a former student of Saville's, and the latter thought that it would be "best to show him the mosaics so that he would not learn about them from the outside" (Saville, 1921). Saville stressed that Gamio "knows *nothing* about from whom we acquired them; this I think is important, but he promised to say nothing in Mexico about our having possession of them" (Saville, 1921). Nonetheless, a few days after the opening of the new museum, two articles appeared in the Mexican newspaper *El Universal*, written by the archaeologists Enrique Juan Palacios and Leopoldo Batres, who vehemently protested the sale of these Mexican treasures to a foreign museum (Scott, 2006a). In spite of this polemic, however, a request for the repatriation of the pieces was never submitted, and no record of any attempt at securing repatriation exists in Mexico's National Museum of Anthropology (Scott, 2006b).

The Stolper Collection

Since its acquisition by the museum, Purpus's collection has been extensively published and displayed (e.g., Pasztory, 1983; McEwan et al., 2006; McMaster and Trafzer, 2004). The centerpiece of the collection, a mosaic-decorated shield (Domenici, this volume, fig. 4e), has been part of traveling exhibitions the world over and was most recently on display in the *Golden Kingdoms* exhibition shown at the J. Paul Getty Museum and the Metropolitan Museum of Art in 2017–2018 (Pillsbury et al., 2017).

In contrast, a different collection of similar material has never been on display. This collection was acquired by the MAI in 1971 and has languished in storage ever since. These pieces were offered to Frederik Dockstader, director of the MAI from 1960 to 1975, by Robert Stolper, a notorious art dealer who traded primarily in pre-Columbian and Native American material. The collection consisted of "more than a hundred fragments of Mixtec wood masks of all shapes and sizes," which were found together by a looting expedition in an unknown location (Stolper, 1970). In his correspondence with Dockstader, Stolper specified the masks were found at different times in 1967 and 1968 in a cave in the vicinity of Tehuacán, although he did not know which cave exactly. He also mentioned that this cave was surveyed by the Tehuacán Valley Project, an archaeological project under the direction of Richard S. MacNeish and Frederick A. Peterson (Stolper, 1971a).

In his correspondence with Dockstader, Stolper claimed that he acquired all the mask fragments from Socorro Navarrete, a Mexican-based art dealer. They represented the complete cache, with the exception of two masks that sold separately for $4,000 each (Stolper, 1971b). After acquiring them, Stolper shipped the masks to the Rautenstrauch-Joest Museum in Cologne, Germany, where a conservator attempted to piece the fragments back together, undoubtedly to raise their commercial value (Stolper, 1971b). When this endeavor proved to be too complicated and expensive, Stolper decided to donate the pieces to the MAI as a (tax deductible) gift with a value of $2,500. Dockstader accepted the gift, which he referred to as "the Mosaic Jigsaw" (Dockstader, 1971a) and as a "marvelous research collection" (Dockstader, 1971b).

Despite this characterization as a research collection, however, it seems no one ever took up the challenge to complete this jigsaw. Even though Stolper mentioned the existence of more than a hundred fragments, currently, the NMAI holds only around 45 complete and fragmentary masks. An examination of the pieces by Berger in 2014 showed that this reduction in numbers was not because pieces had been fitted back together. What happened to the missing fragments remains unclear. As far as we have been able to tell from archival research, the collection remained in storage without any kind of research attention until Sue Scott took an interest in the collection in the early 2000s. Scott was the first person to work on these two NMAI collections in conjunction and signaled the importance of studying them together. Sadly, she passed away before the project was

finished and left only one published article (Scott, 2010) in addition to several unpublished works and archival material (Scott, 2001, 2003, 2004).

In the following, we aim to continue the work started by Scott, using a multidisciplinary approach to collections-based research that aims to recontextualize these pieces. In order to do so, we first briefly sketch the broader corpus of which these collections are part and then present some preliminary results of material analysis performed on similar pieces. As mentioned, the final part of the recontextualization—that of creating an understanding of the original cultural significance of these pieces—is reported in the work of Domenici (2016, this volume).

A WORD ON ETHICS

In Latin American archaeology, the looting and commercialization of archaeological material have been recognized as a major problem for decades (e.g., Coggins, 1969; Alva, 2001). Since this essay primarily concerns collections that were unearthed by looting archaeological sites and were illegally exported, it is pertinent to add some ethical reflections at this point. The ethical codes of all professional archaeological associations rightly prohibit their members from engaging in activities that facilitate the looting of archaeological material, as well as the commercialization of archaeological objects. The Archaeological Institute of America, for instance, asks its members to "refuse to participate in the trade in undocumented antiquities and refrain from activities that enhance the commercial value of such objects" (Archaeological Institute of America, 1997). The Society for American Archaeology (SAA), likewise, cautions its members to "carefully weigh the benefits to scholarship of a project against the costs of potentially enhancing the commercial value of archaeological objects" (SAA, 1996). Similarly, the European Association of Archaeologists' (EAA) Code of Practice states that "archaeologists will not engage in, or allow their names to be associated with, any form of activity relating to the illicit trade in antiquities" (EAA, 2009).

Likewise, the journals that these organizations publish are hesitant to include material that derives from this market. The EAA is most stringent in its Publications Ethics Policy, stating that "Archaeological material knowingly obtained illegally from unprovenanced sources should not be published in the EJA" (EAA, 2009). The SAA, which publishes several of the highest-impact journals in the field of archaeology, is slightly more nuanced in its editorial policy but still actively discourages the publication of looted material. Article 1.1.8 (SAA, 2018) reads as follows:

> SAA strives to balance the goal of generating and disseminating knowledge about the past and the archaeological record with the goal of not adding commercial value to archaeological, ethnographic, or historical-period objects that (1) have been obtained without systematic descriptions of their context, (2) have been recovered in such a manner as to cause unscientific destruction of sites or monuments, or (3) have been exported in violation of the national laws of their country of origin. . . . Authors may be asked to remove these items as a condition of publication. Specifically, SAA will not knowingly publish manuscripts that provide the first descriptions of such objects. In the case of LAQ, the editors are particularly wary of publishing images of looted artifacts that are in private collections or held by museums, whether or not they have been previously published.

Clearly, on the basis of these guidelines, the present essay would likely be rejected by all EAA and SAA journals, especially *Latin American Antiquity* (LAQ), its most likely venue for publication. The concern that publication and research inevitably enhance the value of such objects lies at the basis of this refusal to publish looted material. Additionally, one could argue that publishing material that was acquired in an illegal manner could in a way legitimatize or glorify the pieces involved while glossing over the problematic histories that brought the objects to their current locations. In the end, the publication and popularization of these artifacts—in academic literature, but especially in museum exhibitions and catalogs—might spur further looting, as these objects become seen as desirable art.

The issue is that if one equates publishing and doing research on illicitly obtained collections with enhancing the value of these pieces, a status quo exists that precludes any productive use of these collections. Not only does this exclude archaeologists from working with these collections, but a more severe consequence is that a lack of publication and research deprives descendant communities and source communities of any possible knowledge of the existence of these collections, precluding any possible attempts at repatriation, restitution, or reparations—or the kind of collaborative work proposed in this volume by Burgio-Ericson and Seowtewa. As one of us has argued elsewhere (Berger, 2019), it is doubtful whether a nonpublication policy is the most productive (and ethical) long-term strategy to pursue when attempting to right historical wrongs. As Levine and Martínez de Luna (2013:264) have argued, ignoring "artifacts in museum collections without contextual information amounts to a double-loss." Not only has the original context of the pieces been willfully destroyed for financial gain, but the objects are also excluded from academic research because of their problematic status. Considering the fact that nonpublication and nonresearch also imply depriving source and descendant communities of the potential to repatriate these collections, one could even speak of a "triple-loss."

What we argue for, then, is to turn upside down the ethical paradigm that unprovenienced collections from the art market should best be avoided. Rather, we would argue that it is an ethical imperative to study these collections, to make them available to descendant communities, as well as the archaeological community, and to openly engage in discussions on how these collections should be treated and where they eventually belong. Critically looking at the historical acquisition policies and

practices of museums and other collecting institutions should be an integral part of this work, all the while maintaining a critical stance toward the antiquities trade and the commercialization of objects that should not have a monetary value in the first place. As Rosemary Joyce (2019:14) has argued, when trying to curtail the art market and stop the looting of archaeological sites, "our greatest challenge will be to clearly explain why owning objects should not be a desirable goal." As long as there is a demand, there will be market, and it is only if we are able to stop the demand—including the demand from the side of museums—that we might be able to stop the looting.

THE BROADER CONTEXT

As Adam Sellen has argued, objects that potentially come from the same deposits should be studied as a coherent whole, rather than as loose parts. A focus on individual pieces "violates the character of the artifacts, which should be considered together, as a whole, from the perspective of core beliefs in indigenous worldview and ritual practice" (Sellen, 2019:143). Apart from this ethical imperative to study these pieces as a coherent religious or ritualistic whole, it is clear that much more can be learned from an object seen in a comparative context than from one in isolation. As Julia King (2016:6) has noted, "for archaeology, comparison is essential for identifying analogies, constructing inferences, and addressing questions of social and cultural difference. Meaningful comparative research depends on adequate samples, reasonable scales of analysis, and well-organized primary and secondary data sets."

An issue that hinders comparative research in the case of the Purpus and Stolper collections at the NMAI is that virtually no similar material has been found in controlled contexts (similar to the corpus described by Martinez et al., this volume). This forms a marked contrast to the material discussed in some other contributions in this volume (e.g., Joyce, this volume; Tremain, this volume), for which contextualized finds are more readily available for comparison. However, as Ostapkowicz et al. (this volume) point to in their work on Lucayan stone artifacts, in some regions of the world, museum collections are "an integral component when looking at the wider archaeological context" for the simple fact that material from a documented context is not otherwise available. Although hundreds of turquoise and related objects are stored in museum collections around the world, only a limited number of similar items have been found in a documented context. Primary among these in situ finds is the discovery by speleologists of a large number of turquoise-decorated masks, shields, and other items in a cave near Santa Ana Teloxtoc, Puebla, in the 1980s (Vargas, 1989). Although this find was published by archaeologists, it should be noted that much of the material from this excavation was removed by a speleological expedition and that no excavation actually took place. Similar shields were found by archaeologists at the Mexica Templo Mayor (Velázquez Castro et al., 2012) and the Palacio Quemado at Tula (Meehan and Magar, 2012). Related material was also found in tombs in Coixtlahuaca (Bernal, 1949) and Zaachila (Gallegos, 1963), with the latter masks being more similar in style to the NMAI material. Bernal (1951) excavated, but did not illustrate, two masks in Acapulco that he said were very similar to the Coixtlahuaca material. Additionally, similar material was salvaged by archaeologists from looters' debris (Moser, 1975; González Licón and Marquez Morfín, 1994; Steele and Snavely, 1997). Although these latter pieces also lack an archaeological context, at least in these cases it is clear where they come from.

A much larger corpus for comparative study is available when looking at other museum collections. These collections include some of the most famous pieces of Mesoamerican art, such as the turquoise pieces of the British Museum (Carmichael, 1970; McEwan et al., 2006) and the Weltmuseum (Feest, 2012), which probably came to Europe very early in the colonial period. The majority of this comparative corpus, however, consists of pieces that were looted and traded through the market for pre-Columbian antiquities in the second half of the twentieth century. Berger (2019) has discussed the acquisition histories of these pieces in depth elsewhere (see also Domenici, this volume). A conclusion to that work was that much, if not all, of this material was probably looted in the area around Tehuacán in the 1960s. This widespread looting campaign may well have been sparked by the Tehuacán Valley Project, which surveyed caves containing archaeological material around the city of Tehuacán (MacNeish, 1972). Since only a few U.S.-based art dealers seem to have been involved in the trade in these items, it is possible that all of this material was collected at the same time, possibly even from the same location, by a local looter and later dispersed across the market by U.S.-based dealers. The Stolper material at the NMAI is also part of this corpus of material that was looted in the 1960s. Another conclusion of Berger (2019) was that some of these collections may have been looted "on order" by art dealers with a sale to a museum as a "research collection." The presence of a lot of material that would not be considered valuable on the art market (such as corncobs, fiber strings, and small fragmentary pieces of wood and ceramics) led to this conclusion.

All the pieces in this corpus are clearly stylistically related (see Domenici, this volume). This is the case not only for the turquoise mosaic items—masks, shields, ear plugs, and zoomorphic representations—but also for other miscellaneous items that are part of these collections, such as *amate* paper "banners," textiles, and ceramic vessels. This similarity enabled Domenici to construct a convincing iconographical analysis of these pieces. In the remainder of this essay, we present the preliminary results of material analyses of a collection of similar objects from the Royal Museums of Art and History in Brussels, Belgium. Because of the overlap of these collections with those of the NMAI, the information gained can also help us better understand the NMAI material.

THE MATERIAL ANALYSES

What we present here are the results of analyses carried out on material from the Royal Museums of Art and History (RMAH) in Brussels, Belgium. Techniques used included X-ray fluorescence (XRF), particle-induced X-ray emission (PIXE), gas chromatography–mass spectrometry (GC-MS), and radiocarbon dating. Eight pieces from the RMAH collections were analyzed with XRF and PIXE; five of them were also sampled for GC-MS analysis. They were selected on the basis of material (presence of wood/greenstone/*amate* paper/adhesive) and iconographic representation (mask, shield, zoomorphic greenstone figurine). Naturally, this group is only a very minor part of the corpus, but considering the clear stylistic-iconographic resemblances of pieces across the corpus, these objects were deemed to be representative. Fortunately, some material analysis work was done on the NMAI collections, much of which remains unpublished. This analysis allows for a database against which to compare the Brussels results.

The RMAH collection was acquired in 1968 from Emile Deletaille, a Brussels-based art dealer specializing in pre-Columbian art. Deletaille claimed that the collection represented the complete contents of two tombs or funerary caves located in the vicinity of Tehuacán. These were referred to as "Tomb 1" and "Tomb known as Cueva del Tigre" (Cave of the Tiger) by Deletaille. The collection consists of a wide range of material, including ceramic vessels and figurines, woven textiles, fiber baskets, and jade beads, as well as wooden disks and masks decorated with turquoise (see Montoya, 2017, for the full corpus). The research focused on questions of material characterization, identification of the adhesive, and dating of the pieces.

Material Characterization

Material characterization was carried out on several pieces of the Brussels collection at the Centre de recherche et de restauration des musées de France (C2RMF) laboratory (Paris) under the supervision of Dr. Thomas Calligaro. The aim of this work was to get a better understanding of the choice of materials employed by the artist who made the shield. Additionally, material characterization could highlight the inclusion of any modern materials that may have been used during (undocumented) restorations of the pieces. Earlier work on mosaics from the British Museum found that a wide range of materials—including turquoise, malachite, pyrite, flint, lignite or jet, mother of pearl, oyster, and shell—was used, with turquoise being by far the most prominent (McEwan et al., 2006). The XRF analysis of tesserae from mosaics found at the Mexica Templo Mayor showed that 95% of the material was turquoise, with other greenstone materials being notably absent (Laclavetine et al., 2014, 2015).

In the Brussels material there was an interesting division in the use of turquoise and chrysocolla. For instance, on the large shield or sun disk (AAM.68.11; see Figure 1) the outer ring of the mosaic was created entirely from chrysocolla tesserae. This is comparable to NMAI shield 10/8708, on which a different material was used for the outer ring of the mosaic. In the case of the NMAI shield, this material was amazonite or nephrite (Beaubien, 2006).[2] Although not much can be said at this time about the actual cultural significance of the use of nonturquoise materials on the outer rings of shields, it seems significant that this pattern would be found in more than one example.

Moreover, material characterization of other pieces from the RMAH collection, notably a mosaic-decorated frog, found that the mosaic on these consisted of only chrysocolla and contained no turquoise. Again, it is too early at this point to make any definitive statements about the cultural significance of this choice, but it should be noted that turquoise is a material associated with the sun and heat (Izeki, 2008; Taube, 2012). Frogs, on the contrary, are animals explicitly associated with rain, water, and fertility. Hence, the use of a turquoise mosaic on a frog seems not to make much sense following cultural logic. Although, to our knowledge, no research exists on the cultural significance of chrysocolla, it is clear that Mesoamerican artisans were able to distinguish between these materials and that they made conscious choices to use either chrysocolla or turquoise in specific places. It could be that chrysocolla was a material related to water and fertility, rather than to heat and the sun. This hypothesis might explain its use on the frog mosaic and possibly even its use on the outer parts of the sun disks (where there would be less heat). It is clear in both pieces that the chrysocolla is part of the original mosaic; it is embedded in the original layer of adhesive.

An XRF cartography of the mosaic shield/disk indicated that a clear distinction exists between the raw materials used for the larger and smaller tesserae. Although all the tesserae are turquoise, the larger pieces are significantly richer in zinc than the smaller ones. The homogeneity of this difference indicates that the larger tesserae were probably cut from a different original block. Additionally, since the larger pieces are seamlessly integrated in the mosaics, it seems that no conceptual or ritual difference existed in the use of turquoise from different sources. Interestingly, turquoise rich in zinc was also found on shield 10/8708 of the NMAI (Museum Conservation Institute, 2006). Further analysis of these pieces could provide clues about a possible shared provenience.

Apart from the mosaic, a characteristic trait in the iconography of the masks in this corpus is the red and black paint that is used on the temples, eyelids, and mouths. The PIXE and XRF analyses of the red paint showed that it primarily consists of iron, indicating the use of hematite. This finding is in line with pieces from the British Museum, in which cinnabar, ochre, and hematite were found (McEwan et al., 2006). An XRF examination of the red paint on the NMAI masks also showed the use of hematite. The same XRF examination of the black temple spots on the NMAI masks were inconclusive, but Domenici (this volume) suggests the use of carbon black. Our PIXE analysis of the black pigment on the Brussels material, however, indicated that it was of organic nature. Montoya (2017) has suggested that rubber may have been used to paint textiles and *amate* paper. It may also have been used to decorate the masks.

Adhesive

Visual inspection of the NMAI and the RMAH pieces shows that several different types of adhesives were used. One type used mostly on higher-quality pieces such as NMAI shield 10/8708 and RMAH shield AAM.68.11 consists of a thick layer of red-brown opaque adhesive, quite similar to that seen on many of the British Museum turquoise mosaics. Fourier transform infrared spectroscopy and GC-MS analysis of this type of adhesive on the NMAI shield showed that it is a conifer resin (Newman, 2002), in line with results from the British Museum (McEwan et al., 2006:41). Another type consists of hard to identify gritty material, which seems to be a combination of sand, clay or stone, and adhesive (Figure 2). This material is found on almost all of the Stolper pieces. In many cases, it substitutes for a mosaic proper and is the main "decoration" of masks (see also Saville, 1922:76–77; Domenici, this volume). Although the exact composition of this material has not been identified thus far, it is relevant to note that analyses of samples taken from the Coixtlahuaca masks indicated that the adhesive consisted of "a mixture of beeswax, natural resins (probably gum copal) and Campeche's wax blended with a very fine sand" (Montero, 1968:102).

A third type of adhesive is almost the same color as the underlying wood and has a very different texture than the pine/conifer resin found on the shield. Fourier transform infrared spectroscopy and GC-MS analysis suggested that these samples were primarily inorganic in nature, containing significant amount of silica, possibly sand, and no resin (Newman, 2002). This adhesive is found on quite a few pieces from the Purpus collection, including elaborately decorated masks (NMAI 10/8709, 10/8710), which necessitate strong adhesive to support the greenstone decoration, and also a shield with a more basic pattern of decoration (NMAI 10/8703). The last type of adhesive, which was identified through material analysis carried out by Richard Newman of the Scientific Research Laboratory of the Boston Museum of Fine Arts, contains a mixture of inorganic material, conifer resin, and a lipid-containing material (Newman, 2002). It may be a mixture similar to the one found on the Coixtlahuaca masks.

Unfortunately, the results of GC-MS analysis of samples from the RMAH material were not available in time to be included in this publication. However, visual inspection shows that the range of materials used is similar, if not the same. An interesting observation is that the adhesive used on the two centerpieces of the respective collections (shields 10/8708 of the NMAI and AAM.68.11 of the RMAH) looks exactly the same under visual inspection. This material was found to be pine resin at the NMAI. Analyses of the turquoise mosaics of the British Museum also showed the primary use of pine resin in many of those pieces (McEwan et al., 2006; Stacey et al., 2006).

FIGURE 2. A mask from the NMAI Stolper collection, showing the gritty material. Inventory number 246070, National Museum of the American Indian. (Photo by Berger.)

The variability in the types of adhesive shows that different techniques were used to create the pieces in this corpus. Whether this difference is due to the personal preference of the craftsman, the cultural significance of the pieces, their moment of creation, or some other reason is unclear at this point. Frances Berdan (2007) has examined the functional qualities of different types of pre-Columbian Mesoamerican adhesives through experimental archaeology. Berdan and colleagues found that "different adhesives were customarily chosen to bond different types of materials, based on the recognized qualities of the adhesives" (Berdan, 2007:15). In the case of these mosaics, however, both the substrate and applied material are the same across the corpus (wood and stones). Therefore, it seems improbable, in this case, that the choice of adhesive would have been dictated by the materials. What is clear, however, is that the variability of adhesives used in mosaics is larger than suggested in earlier work.

Dating

Several studies of material characterization and adhesives of pieces within this corpus exist. However, to our knowledge, none of this material was ever radiocarbon dated. It has always been assumed that all this material was created in the (Late) Postclassic era (AD 1250–1521 [or 1250–1521 CE]) for stylistic reasons and because of comparisons with excavated material. To test this, samples were taken from various pieces from the RMAH collection. Pieces were selected on the basis of material, iconography, and comparability with pieces from other museums. Eleven objects were tested, including three wooden shields (AAM.68.11, AAM.68.10.4, AAM.68.10.35), two mask fragments (AAM.68.10.12, AAM.68.12.9), two woven reed baskets (AAM.68.10.33, AAM.68.10.34), a woven reed mat (*petate*, AAM.68.12.23), an *amate* paper and reed frame (AAM.68.12.37), an unmodified corn stalk (AAM.68.12.63), and earth/mud collected from the inside of a human skull (AAM.68.12.3).

Chemical preparation and measurement of the samples was carried out at the Laboratoire de Mesure du Carbone 14 (LMC14), Laboratoire des Sciences du Climat et de l'Environnement/Institut Pierre Simon Laplace, Commissariat à l'Énergie Atomique et aux Énergies Alternatives–Centre national de la recherche scientifique–Université de Versailles Saint-Quentin-en-Yvelines, Université Paris-Saclay, France. The chemical preparation of the adhesive and earth samples was done using the light organic matter protocol (acid treatment only). For the other samples, the classic protocol (acid-alkali-acid treatment) routinely used by the LMC14 team was applied (Dumoulin et al., 2017). The radiocarbon dating was performed on the Artemis accelerator mass spectrometer facility (Moreau et al., 2013, 2020).

The use of wood for the radiocarbon analysis of artworks is not ideal because the well-known "old wood" effect can affect the interpretation of radiocarbon dating results, causing the wood to appear older than it is. Nonetheless, radiocarbon dates from wood can supply useful information (*terminus post quem*) and, if used with other dated material from the same work or correlated with it, can help to validate and constrain the data set.

Table 1 summarizes the results of the radiocarbon analysis. On the basis of the radiocarbon dates, the pieces from the Cueva del Tigre collection (AAM.68.10.x) fall roughly into two clusters. One group falls into the expected Late Postclassic time bracket and consists of an undecorated wooden disk (AAM.68.10.35), a wooden disk decorated with turquoise (AAM.68.10.4), and a mask fragment (AAM.68.10.12). In the case of AAM.68.10.4, the suggested date for the adhesive sample was possibly influenced because it is difficult to imagine that the adhesive would predate the wood that it lies on by nearly 300 years. Another confusing combination of dates comes from the adhesive and wood of AAM.68.11. Although the analysis for the wooden support indicates a manufacture in the Late Postclassic period, the analyses suggest that the adhesive quite probably dates to the Colonial period, possibly even the seventeenth century. Whether this discrepancy indicates a Colonial manufacture of the piece, a restoration of the mosaic in Colonial times, or a possible contamination of the sample is unclear at the moment.

For the mask fragment, however, the overlap between the adhesive and wood indicates a narrow time frame in which this piece may have been made. Another cluster within the Cueva del Tigre collection consists of two reed baskets, which predate the other pieces by almost two millennia. Although it is clear that this difference in time means that the pieces were not deposited all at the same moment, it does not necessarily imply that they do not come from the same location (i.e., the Cueva del Tigre). The continuous ritual use of caves is a common occurrence in Oaxaca. For instance, in Blade Cave, located some 100 km to the southeast of Tehuacán, material was found that suggested a continued use from around AD 1 until the Postclassic period (Steele, 2005). In some cases, the use of these caves continues up to the present day (Holland and Weitlaner, 1960; Steele and Snavely, 1997). At the start of this work, the hypothesis was that the lower-quality disks and masks in the corpus—those that are not decorated with turquoise, only with paint, and are less carefully carved—could have been deposited during Colonial times, when locals no longer had access to the trade networks that supplied expensive exotic materials. Considering the suggested dates for AAM.68.10.35a (Figure 3), it is unclear whether this is the case. Although the disk most likely dates to the Late Postclassic period, there is a chance that it may also date to the late sixteenth or early seventeenth century. It is important to note that growth rings were not apparent on any of the pieces sampled. As a result, it is unclear whether the samples were taken from heartwood or sapwood. Because of this issue, the dates given for the wood are useful as a tool to relatively date pieces against each other but are not definitive (considering the old wood effect). Nonetheless, the fact that all the wood has a Late Postclassic date seems to confirm the Late Postclassic manufacture of these pieces.

The pieces from the so-called Tomb 1 collection are less clearly clustered. The only mask from this collection that was tested (AAM.68.12.9) also dates to the Late Postclassic and is in line with the dates found for the other wood samples. A corn stalk, which, considering its completeness, was probably deposited as part of a ritual, dates to around the same period. The two other pieces analyzed, somewhat surprisingly, both date to the Classic period. The reed mat, or *petate*, was probably made in the Late Classic period. This mat may have been used to wrap secondary burials, a practice evidenced in the Cueva Cheve, located in the Cuicatlán Cañada to the southeast of Tehuacán (González Licón and Márquez Morfín, 1994; Steele and Snavely, 1997). If so, these secondary burials must have taken place in the Classic period, rather than the Postclassic. The dating of earth collected from the only human remains in the collection gave an age in the Classical period, younger than the mat. A renewed attempt to directly date the skull could indicate a possible temporal association between the skull and the mat.

Most surprising was the date of the piece of bark paper (Figure 4). These pieces are the most enigmatic in the corpus and, to our knowledge, have never been found in professional

TABLE 1. Results of radiocarbon sampling of the Cueva del Tigre collection.[a]

LMC14 sample reference	Sample name	Material	Calendar age[b]	Probability (%)
SacA 56601	AAM.68.11, front	Adhesive	1526–1556 calAD	16.3
			1632–1666 calAD	75.8
			1784–1794 calAD	3.3
SacA 56602	AAM.68.11, back	Wood (disk)	1288–1322 calAD	38.6
			1347–1393 calAD	56.8
SacA 56603	AAM.68.10.4, front	Adhesive	1035–1165 calAD	95.4
SacA 56604	AAM.68.10.4, back	Wood (disk)	1317–1354 calAD	46.1
			1389–1421 calAD	49.3
SacA 56605	AAM.68.10.35a, front	Wood (undecorated disk)	1446–1520 calAD	76.7
			1592–1620 calAD	18.7
SacA 56606	AAM.68.10.12, front	Adhesive	1432–1486 calAD	95.4
SacA 56607	AAM.68.10.12, back	Wood (mask fragment)	1400–1440 calAD	95.4
SacA 56608	AAM.68.10.33	Reed (basket)	767–509 calBC	95.4
SacA 56609	AAM.68.10.34	Reed (basket)	765–477 calBC	93.3
			463–456 calBC	0.7
			445–431 calBC	1.5
SacA 56610	AAM.68.12.23	Reed (*petate*)	777–793 calAD	7.0
			802–845 calAD	11.9
			856–970 calAD	76.5
SacA 56611	AAM.68.12.9	Wood (mask)	1302–1368 calAD	71.7
			1382–1408 calAD	23.7
SacA 56612	AAM.68.12.37	*Amate* (bark paper)	338–430 calAD	92.9
			495–508 calAD	1.9
			522–526 calAD	0.5
SacA 56613	AAM.68.12.63.1	Corn	1264–1295 calAD	95.4
SacA 56614	AAM.68.12.3	Earth	1050–1083 calAD	12.5
			1126–1135 calAD	1.6
			1151–1220 calAD	81.2

[a] Radiocarbon dates were calibrated with OxCal version 4.3.2 (Bronk Ramsey, 2017), using the IntCal13 atmospheric curve (Reimer et al., 2013).
[b] Abbreviations: calAD = calibrated age expressed in the Gregorian calendar in Anno Domini year; calBC = calibrated age expressed in the Gregorian calendar in the year Before Christ.

excavations. Their exact original use is unclear. Domenici (this volume) has suggested that they may have been inserted as banners in *ñuhu* bundles. Montoya (2017) has similarly argued that these pieces represent *amateteuitl*, banners that were burned or offered during rain-petitioning ceremonies. However, the dating of the *amate* piece suggests that it is *not* contemporary with the deposit of turquoise mosaic artifacts. Further analysis of other bark paper pieces in the corpus is needed to confirm these dates, but for now, it seems reasonable to assume that any iconographic analysis of the corpus should treat the *amate* and the masks/disks as different entities, deposited at different times. Furthermore, if the *amate* indeed dates to the (Early) Classic period, it represents some of the oldest material of this kind known to date (see Benz et al., 2006, for the oldest *amate*). This collection offers a lot of potential for studying the ways in which this material was manufactured and used during this period. Because it includes dozens of *amate* pieces (primarily in the collections of the RMAH, the Milwaukee Public Museum, the Textile Museum in Washington, D.C., and the Nelson-Atkins Museum), this corpus is undoubtedly the largest source of Classic period *amate* available.

In all, the results of the radiocarbon dating indicate that these pieces were not all deposited at the same time. This, however, does not mean that the seller's claim that all these pieces were found in the same location is necessarily false. Archaeological research in other caves in the region has shown that the long-term use of ritual spaces is quite common. The results do caution against creating a unified iconographical analysis of all the pieces in the corpus. Domenici's analysis of some of these pieces as components of *ñuhu* bundles is not contradicted by these results,

FIGURE 3. Undecorated shield. Royal Museums of Art and History, AAM.68.10.35. (Photo courtesy of Julia Montoya.)

however. One could even speculate (although it would be entirely hypothetical at this point) that the Postclassic offering of *ñuhu* bundles in caves that were used in the Classic period would not be surprising since the *ñuhu* were associated with the Classic to Postclassic transition after the fall of the Classic period Monte Albán (Byland and Pohl, 1994; Jansen and Pérez Jimenez, 2005, 2007; Domenici, this volume).

Similar research on pieces in other museums would, of course, greatly enrich the comparative value of this work. However, even without the analysis of any non-RMAH pieces, these results can be productively used in the study of other pieces. In fact, many of the objects presented here have direct correlates in other collections. The RMAH mask fragment, for example, is nearly identical to a mask fragment from the Stolper collection at the NMAI (24/6089; Figure 5). The RMAH disks/shields are extremely similar to material from the Milwaukee Public Museum (Gredell, 2007), as well as the Berlin Ethnologisches Museum. The *amate* frames/banners are similar in the Milwaukee Public Museum and RMAH collections.

CONCLUSIONS

Despite their lack of documentation, a lot can be learned from these collections. Material characterization showed that artisans made conscious choices about when to use turquoise and when to use other blue-green stones (i.e., chrysocolla, amazonite), both within one mosaic and across different types of mosaics. This finding questions the usefulness of the concept of "cultural turquoise" (Weigand et al., 1977; see also Velázquez Castro et al., 2012; Laclavetine et al., 2014). A study of adhesives indicated the use of different blends of materials to attach mosaics to wood, including the use of materials that were not described in Spanish chronicles and had not been identified in other pieces. Furthermore, radiocarbon dating confirmed the Late Postclassic date for the mosaic pieces, which had been proposed on a stylistic basis. It also showed that not all the items in this corpus were deposited at the same time, despite the fact that they were said to be the complete contents of a tomb or cave.

Additionally, an iconographic analysis reconstructed the possible original cultural significance of these pieces (Domenici, this volume). Other minor conclusions on provenance and provenience could also be drawn on the basis of iconographic study. For example, all the shields identified as part of this corpus had been broken in half, potentially during ritual reenactments. The only shield to remain intact is the turquoise mosaic shield in the collections of the Weltmuseum Wien, which would seem to confirm the assumption that this shield came to Europe during the Early Colonial period, possibly with Cortes's AD 1519 shipment (Feest, 2012), since the shield would have been given to the Spaniards (or taken by them) before it could be ritually broken. The break on the British Museum shield (McEwan et al., 2006) might also imply that conversely, this particular shield, which was acquired in the nineteenth century and is broken in half, was not directly acquired from Indigenous people in the Early Colonial period.

Last, a study of the provenance of these pieces and the way they moved from dealers to museums created more insight into how the market for pre-Columbian antiquities split up collections that originally belonged together (Berger, 2019). This work was essential in order to trace the potential provenience of these collections and to better understand the way these collections related to each other originally. As shown by Berger (2019), many of these collections may have once been part of the same ritual deposits. Reconstructing the original relations between collections in different museums was only possible by tracing their itineraries through the hands of different dealers and collectors. Again, this research highlights the importance of archival work for fully understanding the context of museum collections (see also Harrison et al., this volume).

According to Julia King (2016:4), "by now, it's a truism that collections-based archaeological research is a good thing." Although this is, indeed, true for the study of legacy collections, in the case of objects acquired on the art market, this is not necessarily so. As we have discussed, research on and, especially, publication of material that was looted and traded through the market for pre-Columbian antiquities have been considered ethically problematic—even though there seems to be a noticeable difference between art historical and archaeological approaches. We hope that the work presented in this essay (paired with that of Domenici, this volume; see also Berger, 2019) shows that research on these collections can be fruitful and ethically responsible. It not only provides useful insights into the way these

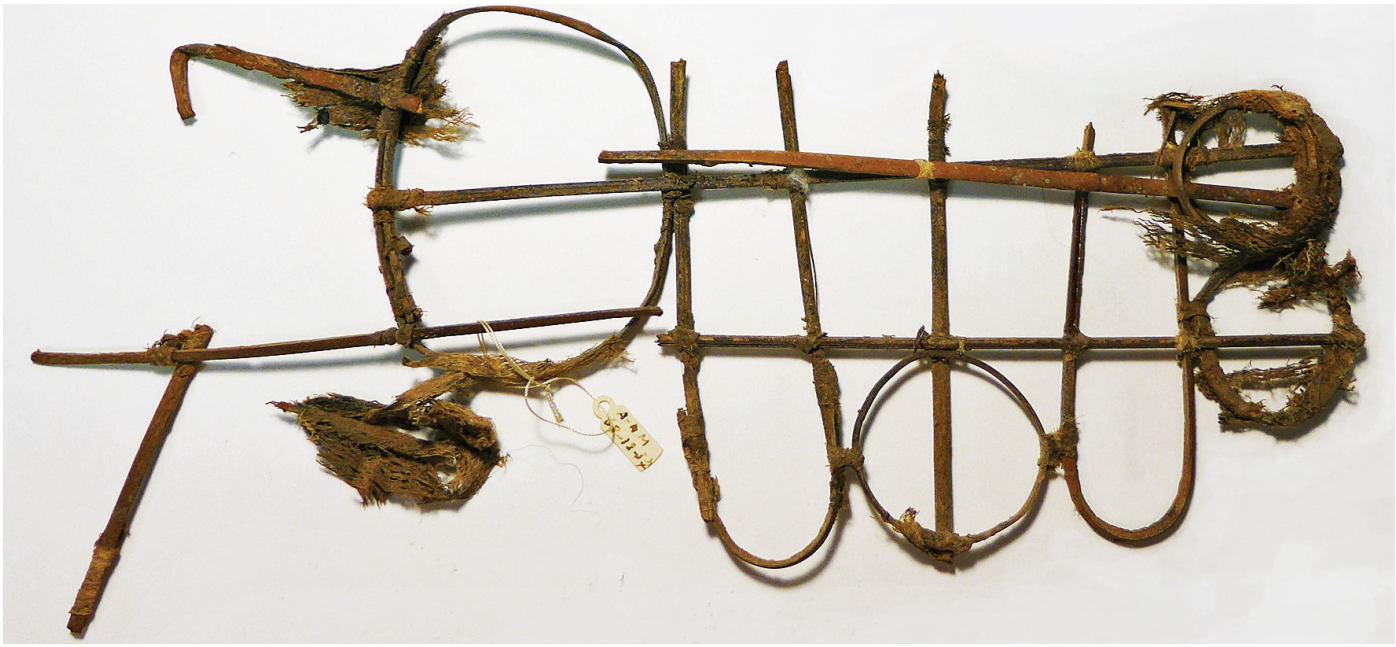

FIGURE 4. *Amate* bark paper banner. Royal Museums of Art and History, AAM.68.12.37. (Photo courtesy of Julia Montoya.)

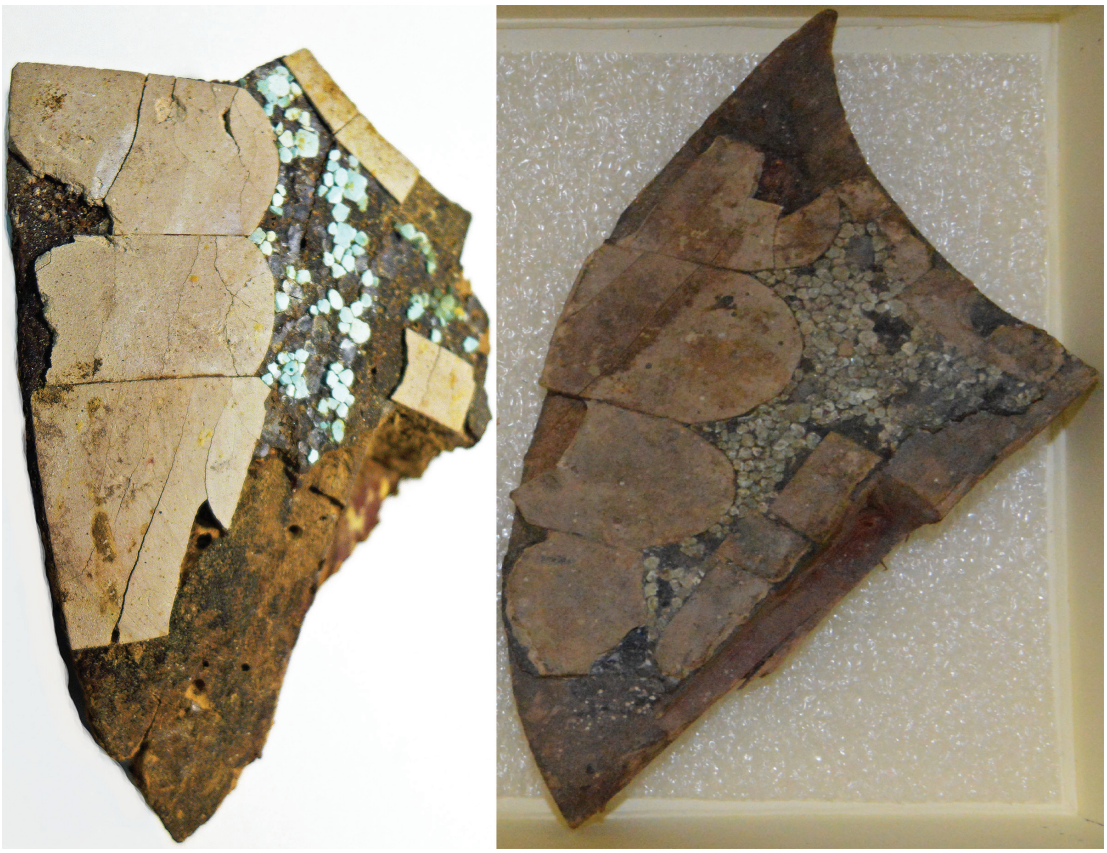

FIGURE 5. Comparison of mask fragments from the RMAH (68.10.12, left) the NMAI (24/6089, right). (Left photo courtesy of Julia Montoya; right photo by Berger.)

objects were created and used in the relatively distant past, but it also shows us how professional archaeology, museums, and the world of dealers and collectors were intertwined in the more recent past.

Naturally, this kind of work comes with numerous challenges. Foremost among these is the difficulty identifying the pieces that make up the corpus. Large data sets are essential for doing productive comparative research. Except for some of the most aesthetically appealing examples, however, these pieces are hardly ever published; therefore, it is not easy to create a data set. For example, the Milwaukee Public Museum collection, one of the largest collections of this kind, was not identified by Berger (2019) and was included in this study only thanks to Domenici (this volume). The only way to identify pieces is by connecting correspondence in archives of different institutions, combined with trawling through online catalogs, if they exist. A significant part of the corpus presented here was assembled through Google searches for terms like "Mixtec turquoise" and "turquoise mosaics." Another issue, not necessarily restricted to research on collections from the market, is that of access. Since these collections are spread over multiple continents, it is hard, if not financially impossible, to personally examine all the pieces. As a result, one is dependent on photographs supplied by museums, which can often be of underwhelming quality, exactly because these collections are not counted among the highlights of these institutions. A last issue is that of funding. Naturally, this is a perennial concern for those working in academia. As Barbara Voss (2012:166) has argued, archaeological funding has traditionally prioritized excavation over collections-based research. As a result, hardly any funding bodies provide funds for visiting these collections, sampling them, and performing material analysis.

Despite these challenges, however, collections-based research on the tens of thousands of objects that were looted and illegally exported from Mesoamerica in the twentieth century is a necessity. The only way to come to terms with the implications of holding enormous collections of undocumented material is by performing research, being transparent as an institution, and creating a deeper understanding of the twentieth century market and its actors. In the end, these pieces are the inevitable products of a "Mesoamerican art world" (Joyce, 2019), which created the category of "Mesoamerican art" in the interplay between professional archaeologists, museum curators, dealers, and collectors. Only if we recognize and accept the fundamental ways in which our disciplines and our institutions were implicated in the creation of undocumented and illicitly excavated collections will we be able to move forward.

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NOTES

1. Translated by Berger from the original German: "stammen aus Höhlen, deren es eine ganze Anzahl in dieser Sierra gibt, und wo sie zufällig von Eingeborenen aufgefunden und herausgebracht worden sind."
2. Amazonite was also found to be the primary material used in the mosaic on the máscara de Malinaltepec (Martínez del Campo, 2010).

REFERENCES

Alva, Walter. 2001. The Destruction, Looting and Traffic of the Archaeological Heritage of Peru. In *Trade in Illicit Antiquities: the Destruction of the World's Archaeological Heritage*, ed. Neil Brodie, Jennifer Doole, and Colin Renfrew, pp. 89–96. Cambridge, UK: MacDonald Institute for Archaeological Research.

Archaeological Institute of America. 1997. AIA Code of Ethics. https://www.archaeological.org/pdfs/AIA_Code_of_EthicsA5S.pdf (accessed 18 July 2019).

Beaubien, Harriet F. 2006. Technical Study/Conservation Report, MCI6049: 26 September. Museum Conservation Institute, Smithsonian Institution, Suitland, Maryland.

Benz, Bruce F., Lorena López Mestas, and Jorge Ramos de la Vega. 2006. Organic Offerings, Paper, and Fibers from the Huitzilapa Shaft Tomb, Jalisco, Mexico. *Ancient Mesoamerica*, 17:283–296. https://doi.org/10.1017/S0956536106060196

Berdan, Francis F. 2007. The Technology of Ancient Mesoamerican Mosaics: An Experimental Investigation of Alternative Super Glues. Foundation for the Advancement of Mesoamerican Studies. http://www.famsi.org/reports/06015/06015Berdan01.pdf (accessed September 5, 2019).

Berger, Martin E. 2013. Real, Fake or a Combination? Examining the Authenticity of a Mesoamerican Mosaic Skull. In *Creating Authenticity: Authentication Processes in Ethnographic Museums*, ed. Alexander Geurds and Laura Van Broekhoven, pp. 11–37. Leiden: Sidestone Press.

Berger, Martin E. 2019. "From a Cave near Tehuacán": An Attempt to Reassemble Post-Classic Mesoamerican Ritual Deposits that were Separated by the Art Market. In *The Market for Mesoamerica: Reflections on the Sale of Pre-Columbian Antiquities*, ed. Cara G. Tremain and Donna Yates, pp. 112–135. Gainesville: University Press of Florida. https://doi.org/10.2307/j.ctvx0738n.11

Bernal, Ignacio. 1949. Exploraciones en Coixtlahuaca, Oaxaca. *Revista Mexicana de Estudios Antropológicos*, 10:5–76.

Bernal, Ignacio. 1951. Nuevos Descubrimientos en Acapulco. In *The Civilizations of Ancient America: Selected Papers of the XXIXth International Congress of Americanists*, ed. Sol Tax, pp. 52–56. Chicago: University of Chicago Press.

Boone, Elizabeth H., ed. 1993. *Collecting the Pre-Columbian Past*. Washington, D.C.: Dumbarton Oaks Research Library and Collection.

Bronk Ramsey, Christopher. 2017. Methods for Summarizing Radiocarbon Datasets. *Radiocarbon*, 59:1809–1833. https://doi.org/10.1017/RDC.2017.108

Byland, Bruce, and John M. D. Pohl. 1994. *In the Realm of Eight Deer: The Archaeology of Mixtec Codices*. Norman: University of Oklahoma Press.

Carmichael, Elizabeth. 1970. *Turquoise Mosaics from Mexico*. London: British Museum Press.

Coggins, Clemency C. 1969. Illicit Traffic in Pre-Columbian Antiquities. *Art Journal*, 29:94–98. https://doi.org/10.1080/00043249.1969.10794675

Dockstader, Frederick. 1971a. Letter to Robert Stolper, 7 August 1971. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 312, Folder 18, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Dockstader, Frederick. 1971b. Letter to Robert Stolper, 20 June 1971. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 312, Folder 18, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Domenici, Davide. 2016. Máscaras, scudos y tablas con mosaicos de turquesa en Puebla y Oaxaca. *Arqueología Mexicana*, 141:44–49.

Dumoulin, J.-P., C. Comby-Zerbino, E. Delqué-Količ, C. Moreau, I. Caffy, S. Hain, M. Perron, B. Thellier, V. Setti, B. Berthier, and L. Beck. 2017. Status Report on Sample Preparation Protocols Developed at the LMC14 Laboratory, Saclay, France: From Sample Collection to ^{14}C AMS Measurement. *Radiocarbon*, 59:713–726. https://doi.org/10.1017/RDC.2016.116

European Association of Archaeologists (EAA). 2009. EAA Code of Practice. https://www.e-a-a.org/EAA/About/EAA_Codes/EAA/Navigation_About/EAA_Codes.aspx?hkey=714e8747-495c-4298-ad5d-4c60c2bcbda9#practice (accessed 18 July 2019).

Feest, Christian. 2012. Mexican Turquoise Mosaics in Vienna. In *Turquoise in Mexico and North America: Science, Conservation, Culture and Collections*, ed. Jonathan C. H. King, Max Carocci, Caroline Cartwright, Colin McEwan, and Rebecca Stacey, pp. 117–134. London: Archetype.

Frieman, Catherine J., and Lisa Janz. 2018. A Very Remote Storage Box Indeed: The Importance of Doing Archaeology with Old Museum Collections. *Journal of Field Archaeology*, 43:257–268. https://doi.org/10.1080/00934690.2018.1458527

Gallegos, Roberto. 1963. Zaachila: The First Season's Work. *Archaeology*, 16:226–233.

González Licón, Ernesto, and Lourdes Márquez Morfín. 1994. Rito y cerimonial prehispánico en las cuevas de la Cañada, Oaxaca. In *Mixteca-Puebla: Discoveries and Research in Mesoamerican Art and Archaeology*, ed. Henry B. Nicholson and Eloise Quiñones Keber, pp. 223–234. Culver City, Calif.: Labyrinthos.

Gredell, Erin B. 2007. The Research Potential of Poorly Provenienced Museum Collections: A Case Study of a Mexican Cave Assemblage at the Milwaukee Public Museum. M.S thesis, University of Wisconsin–Milwaukee, Milwaukee.

Heye, George G. 1920a. Letter to Carl A. Purpus, 25 June 1920. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 310, Folder 1, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Heye, George G. 1920b. Letter to F. K. Seward, 10 November 1920. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 310, Folder 1, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Heye, George G. 1920c. Letter to Carl A. Purpus, 29 November 1920. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 310, Folder 1, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Holland, William, and Robert J. Weitlaner. 1960. Modern Cuicatec Use of Prehistoric Sacrificial Knives. *American Antiquity*, 25:392–396. https://doi.org/10.2307/277522

Izeki, Mutsumi. 2008. *Conceptualization of 'Xihuitl': History, Environment, and Cultural Dynamics in Postclassic Mexica Cognition*. Bar International Series. London: Bar Publishing. https://doi.org/10.30861/9781407303468

Jansen, M. E. R. G. N., and Gabina A. Pérez Jiménez. 2005. *Codex Bodley: A Painted Chronicle from the Mixtec Highlands, Mexico*. Oxford, UK: Bodleian Library, University of Oxford.

Jansen, M. E. R. G. N., and Gabina A. Pérez Jiménez. 2007. *Encounter with the Plumed Serpent: Drama and Power in the Heart of Mesoamerica*. Boulder: University of Colorado Press. https://doi.org/10.26530/OAPEN_625247

Jennings, Justin, and Adam Sellen. 2018. *Real Fake: The Story of a Zapotec Urn*. Toronto: Royal Ontario Museum.

Joyce, Rosemary. 2019. Making Markets for Mesoamerican Antiquities. In *The Market for Mesoamerica: Reflections on the Sale of Pre-Columbian Antiquities*, ed. Cara G. Tremain and Donna Yates, pp. 1–16. Gainesville: University Press of Florida. https://doi.org/10.2307/j.ctvx0738n.6

Kelker, Nancy L., and Karen O. Bruhns. 2010. *Faking Ancient Mesoamerica*. Walnut Creek, Calif.: Left Coast Press.

King, Julia A. 2016. Comparative Colonialism and Collections-Based Archaeological Research. *Museum Worlds: Advances in Research*, 4:4–17. https://doi.org/10.3167/armw.2016.040102

Laclavetine, Kilian, Jose Luis Ruvalcaba-Sil, Christian Duverger, and Emiliano R. Melgar Tísoc. 2014. Les «turquoises culturelles» et la caractérisation par fluorescence de rayons X (XRF) in situ du disque de mosaïque de l'offrande 99 du Templo Mayor de México-Tenochtitlán. *ArchéoSciences*, 38:205–218. https://doi.org/10.4000/archeosciences.4269

Laclavetine, Kilian, Jose Luis Ruvalcaba-Sil, and Emilano Melgar. 2015. Caracterización no destructiva in situ de turquesas del Templo Mayor de México-Tenochtitlan por XRF. *In Nuevos aportes de las técnicas de arqueometría en el estudio y caracterización del Patrimonio Cultural, ed*. Rodrigo Esparza López, pp. 251–272. Zamora, Mexico: El Colegio de Michoacán.

Levine, Marc N., and Lucha Martínez de Luna. 2013. Museum Salvage: A Case Study of Mesoamerican Artifacts in Museum Collections and on the Antiquities Market. *Journal of Field Archaeology*, 38:264–276. https://doi.org/10.1179/0093469013Z.00000000053

MacNeish, Richard S., ed. 1972. *The Prehistory of the Tehuacan Valley*. Volume 5: *Excavations and Reconnaissance*. Austin: University of Texas Press.

Martínez del Campo, Sofia, ed. 2010. *La Máscara de Malinaltepec*. Mexico City: Instituto Nacíonal de Antropología y Historia.

McEwan, Colin, Andrew Middleton, Caroline Cartwright, and Rebecca Stacey. 2006. *Turquoise Mosaics from Mexico*. Durham, N.C.: Duke University Press.

McMaster, Gerald, and Clifford E. Trafzer, ed. 2004. *Native Universe: Voices of Indian America*. Washington, D.C.: National Museum of the American Indian, Smithsonian Institution.

Meehan, Patricia, and Valerie Magar. 2012. Conservation of a Turquoise Mosaic Disk from Tula, Mexico. In *Turquoise in Mexico and North America: Science, Conservation, Culture and Collections*, ed. Jonathan C. H. King, Max Carocci, Caroline Cartwright, Colin McEwan, and Rebecca Stacey, pp. 117–134. London: Archetype.

Montero, Sergio. 1968. Restoration of Turquoise Masks from Coixtlahuaca and Zaachila, Oaxaca. *Studies in Conservation*, 13:102–104. https://doi.org/10.1179/sic.1968.008

Montoya, Julia. 2017. Textiles y otros materiales arqueológicos del Valle de Tehuacán, México, en los Museos Reales de Arte e Historia (MRAH), Bruselas. In *Pre-Columbian Textile Conference VII / Jornadas de Textiles PreColombinos VII*, ed. Lena Bjerregaard and Anne Peters, pp. 104–131. Lincoln: University of Nebraska. https://doi.org/10.13014/K27D2S9P

Moreau, C., I. Caffy, C. Comby, E. Delqué-Količ, J.-P. Dumoulin, S. Hain, A. Quiles, V. Setti, C. Souprayen, B. Thellier, and J. Vincent. 2013. Research and Development of the Artemis 14C AMS Facility: Status Report. *Radiocarbon, 55*(2):331–337. https://doi.og/10.1017/S0033822200057441

Moreau, C., C. Messager, B. Berthier, S. Hain, B. Thellier, J., Dumoulin, I. Caffy, M. Sieudat, E. Delqué-Količ, S. Mussard, M. Perron, V. Setti, and L. Beck. 2020. Artemis, The 14C AMS Facility of the LMC14 National Laboratory: A Status Report on Quality Control and Microsample Procedures. *Radiocarbon,* 62(6):1755–1770. https://doi.org/10.1017/RDC.2020.73

Moser, Christopher L. 1975. Cueva de Ejutla: Una cueva funeraria Póstclasica? *Boletín del INAH*, 14:25–37.

Mulrooney, Mara A., Charmaine Wong, Kelley Esh, Scott Belluomini, and Mark D. McCoy. 2016. Integrating Research and Collections Management: The Ho'omaka Hou Research Initiative at the Bishop Museum. *Museum Worlds: Advances in Research*, 4:51–62. https://doi.org/10.3167/armw.2016.040105

Museum Conservation Institute. 2006. Technical Study/Conservation Report MCI 6049. 26 September 2006. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Newman, R. 2002. Email to Emily Kaplan, 18 September 2002. Object file for catalog no. 10.8708. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Pasztory, Esther. 1983. *Aztec Art*. New York: Harry N. Abrams.

Pillsbury, Joanne, Timothy Potts, and Kim N. Richter. 2017. *Golden Kingdoms: Luxury Arts in the Ancient Americas*. Los Angeles: J. Paul Getty Museum.

Purpus, Carl A. 1920a. Letter to George G. Heye, 3 June 1920. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 310, Folder 1, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Purpus, Carl A. 1920b. Letter to George G. Heye, 6 November 1920. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 310, Folder 1, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Purpus, Carl A. 1921a. Letter to George G. Heye, 10 May 1921. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 310, Folder 1, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Purpus, Carl A. 1921b. Letter to George G. Heye, 28 June 1921. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 310, Folder 1, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Purpus, Carl A. 1926. Ruinen, Höhlen und Gräberfunde in der östlichen Sierra de la Mixteca. *Baessler-Archiv*, 10:50–61.

Reimer, Paula J., Edouard Bard, Alex Bayliss, J. Warren Beck, Paul G. Blackwell, Christopher Bronk Ramsey, Caitlin E. Buck, Hai Cheng, R. Lawrence Edwards, Michael Friedrich, Pieter M. Grootes, Thomas P. Guilderson, Haflidi Haflidason, Irka Hajdas, Christine Hatté, Timothy J. Heaton, Dirk L. Hoffmann, Alan G. Hogg, Konrad A. Hughen, K. Felix Kaiser, Bernd Kromer, Sturt W. Manning, Mu Niu, Ron W. Reimer, David A. Richards, E. Marian Scott, John R. Southon, Richard A. Staff, Christian S. M. Turney, and Johannes van der Plicht. 2013. Intcal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years Cal BP. *Radiocarbon*, 55:1869–1887. https://doi.org/10.2458/azu_js_rc.55.16947

Saville, Marshall H. 1920. Letter to Carl A. Purpus, 4 November 1920. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 310, Folder 1, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Saville, Marshall H. 1921. Letter to Carl A. Purpus, 22 November 1921. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 310, Folder 1, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Saville, Marshall. 1922. *Turquois Mosaic Art in Mexico*. New York: Museum of the American Indian, Heye Foundation. https://doi.org/10.5479/sil.359668.39088016090177

Scott, Sue. 2001. La turquesa encontrada en la region de Puebla/Oaxaca: su lugar de probable origen y su papel en la vida ritual de la época posclásica. Paper presented at the XXVI Mesa Redonda de la Sociedad Mexicana de Antropología, Zacatecas, Mexico.

Scott, Sue. 2003. Mosaic Masks from Mexico in the CRC Collection. Memo to Ron Bishop. Unpublished report. NMAI-CRC Archives, Suitland, Md.

Scott, Sue. 2004. Addenda June 2004 to Mosaic Masks from Mexico in the CRC Collection, Memo to Ron Bishop, p. 10. Unpublished report. NMAI-CRC Archives, Suitland, Md.

Scott, Sue. 2006a. Letter to Kristine McGee, 13 January 2006. Object file for catalog no. 10.8708. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Scott, Sue. 2006b. Letter to Patricia Nietfeld, 2 February 2006. Object file for catalog no. 10.8708. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Scott, Sue. 2010. La máscara de Malinaltepec y sus compañeras. In *La máscara de Malinaltepec*, ed. Sofia Martínez del Campo Lanz, pp. 65–109. Mexico City: Instituto Nacional de Antropología e Historia.

Sellen, Adam. 2019. Ancient Zapotec Material Culture and the Antiquities Market. In *The Market for Mesoamerica: Reflections on the Sale of Pre-Columbian Antiquities*, ed. Cara G. Tremain and Donna Yates, pp. 136–150. Gainesville: University Press of Florida. https://doi.org/10.2307/j.ctvx0738n.12

Society for American Archaeology (SAA). 1996. Principles of Archaeological Ethics. https://www.saa.org/career-practice/ethics-in-professional-archaeology (accessed 18 July 2019).

Society for American Archaeology (SAA). 2018. Editorial Policy, Information for Authors, and Style Guide. https://documents.saa.org/container/docs/default-source/doc-publications/style-guide/saa-style-guide_english_updated_2021_final08023c15928949dabd02faafb269fb1c.pdf?sfvrsn=c1f41c1b_2 (accessed 16 November 2021).

Stacey, Rebecca, Caroline Cartwright , and Colin McEwan. 2006. Chemical Characterization of ancient Mesoamerican "Copal" Resins: Preliminary Results. Archaeometry 48(2):323 – 340.

Steele, Janet F. 2005. Pre-Hispanic Rain Ceremonies in Blade Cave, Sierra Mazateca, Oaxaca, Mexico. In *In the Maw of the Earth Monster: Mesoamerican Ritual Cave Use*, ed. Jim Brady and Keith Prufer, pp. 91–116. Austin: University of Texas Press.

Steele, Janet F., and Ralph Snavely. 1997. Cueva Cheve Tablet. *Journal of Cave and Karst Studies*, 59:26–32.

Stolper, Robert. 1970. Letter to Frederick Dockstader, 4 November 1970. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 312, Folder 18, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Stolper, Robert. 1971a. Letter to Frederick Dockstader, 28 June 1971 Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 312, Folder 18, NMAI.AC.001.. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Stolper, Robert. 1971b. Letter to Frederick Dockstader, 25 August 1971. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 312, Folder 18, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Taube, Karl. 2012. The Symbolism of Turquoise in Ancient Mesoamerica. In *Turquoise in Mexico and North America: Science, Conservation, Culture and Collections*, ed. Jonathan C. H. King, Max Carocci, Caroline Cartwright, Colin McEwan, and Rebecca Stacey, pp. 117–134. London: Archetype.

Tremain, Cara G., and Donna Yates, eds. 2019. *The Market for Mesoamerica: Reflections on the Sale of Pre-Columbian Antiquities*. Gainesville: University Press of Florida. https://doi.org/10.2307/j.ctvx0738n

Vargas, Ernesto. 1989. *Las máscaras de la cueva de Santa Ana Teloxtoc*. Mexico City: Universidad Nacional Autónoma de México.

Velázquez Castro, Adrian, Mariá E. Marín Benito, Emliano R. Melgar Tísoc, Reyna Beatriz Solís Ciriaco, and Jose Luis Ruvalcaba. 2012. The Turquoise Disk from Offering 99 at the Templo Mayor in Tenochtitlan. In *Turquoise in Mexico and North America: Science, Conservation, Culture and Collections*, edited by, Jonathan C. H. King, Max Carocci, Caroline Cartwright, Colin McEwan, and Rebecca Stacey, pp. 117–134. London: Archetype.

Voss, Barbara L. 2012. Curation as Research. A Case Study in Orphaned and Underreported Archaeological Collections. *Archaeological Dialogues*, 19:145–169. https://doi.org/10.1017/S1380203812000219

Weigand, Phil C., Garman Harbottle, and Edward V. Sayre. 1977. Turquoise Sources and Source Areas in Mesoamerica and the Southwestern USA. In *Exchange Systems in Prehistory*, ed. Timothy K. Earle and Jonathon E. Ericson, pp. 15–34. New York: Academic Press. https://doi.org/10.1016/B978-0-12-227650-7.50008-0

Generating Original Data Sets with Museum Collections

The Gaze of the *Ñuhu* Bundles: An Interpretation of Mesoamerican Mosaics at the National Museum of the American Indian

Davide Domenici

INTRODUCTION

The National Museum of the American Indian (NMAI) holds an important collection of Mesoamerican mosaic-encrusted masks and shields, which were accessioned by the museum at two different moments. The first lot, including eight whole or fragmented masks, eight whole or fragmented shields, one hourglass-shaped earplug, a smoking tube, some small pieces of gum (incense?) tied with bark cloth (*amate*), and two carved wooden atlatls, was bought in 1922 by George Gustav Heye from Carl Albert Purpus, a German-born botanist who traveled and lived in Mexico (Scott, 2001; Domenici, 2018; Berger et al., this volume).[1] Marshall Saville, who since 1920 played an important role in the negotiations between Heye and Purpus, published photos and detailed descriptions of the mosaic-covered artifacts in his book *Turquois Mosaic Art in Ancient Mexico* (Saville, 1922), in which he presented the new acquisition of the Museum of the American Indian.[2] According to the information that Saville obtained from Purpus, the objects were found by an "Indian . . . in a cave in the mountains of the Mixteca region of the State of Puebla" (Saville, 1922:47). In NMAI's archival records the cave is said to be in the vicinities of the town of Acatlán, southwest of Tehuacán, Puebla, an area of the Mixteca Baja that Purpus had repeatedly visited in 1907–1908 (Souza Sánchez, 1969:5; Figure 1). Unfortunately, in a published paper, Purpus was very generic in his description of the provenance of the masks, shields, and atlatls—briefly mentioned at the end of the text—stating only that they were found in "caves of which there are many in this Sierra [Mixteca]," together with "*amate* and copal balls wrapped in *amate*" (Purpus, 1926:61). The fact that Purpus did not describe their archaeological contexts in an article aimed at describing archaeological sites he had visited suggests that he obtained the objects from other persons, maybe on a later date, so we cannot know whether all the materials came from the same cave.[3] In 1919, Seler viewed photos of the objects when they were still in Mexico and briefly mentioned them in 1923 (Seler, 1961:368–369). The second NMAI lot, including at least 43 whole or fragmented masks, was given to the museum in 1971 by Robert L. Stolper; its materials were recorded as proceeding "from a cave just outside of the city of Tehuacan," where they were looted in 1967–1968 (Berger, 2019; Berger et al., this volume).[4]

Department of History and Cultures, University of Bologna, Piazza San Giovanni in Monte 2, 40124 Bologna, Italy.
Correspondence: davide.domenici@unibo.it
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The materials of the two NMAI lots, especially the outstanding shield numbered 10/8708, have often been discussed and described in various publications, too many to be systematically reviewed here and often building on Saville's detailed description of Purpus's lot (e.g., Pazstory, 1983; Izeki, 2008; Scott, 2010). Striking formal similarities between the objects in the two lots, as well as the similar geographic provenance, suggest that they were looted from caves containing similar archaeological assemblages. In this essay, developing arguments I put forward before (Domenici, 2010, 2016, 2018, 2020), I will try—by means of a comparative analysis with similar objects held in other collections, as well as on the basis of iconographic, ethnohistoric, and ethnographic data—to reconstruct their original archaeological contexts in order to provide a hypothesis on the symbolism and ritual function of the masks, shields, and associated artifacts.[5]

THE COMPARATIVE CORPUS

Masks and shields similar to those at the NMAI were recovered by professional archaeologists in three caves, namely, Santa Ana Teloxtoc (Puebla), Ejutla (Oaxaca), and Cueva Cheve (Oaxaca); less similar, but still related, masks were also detected in Zaachila, Oaxaca (Figure 1). An astounding amount of strictly related artifacts, including not only masks and shields but also a host of other associated materials, has been detected in in the following collections: Milwaukee Public Museum (MPM; Milwaukee, Wisconsin),[6] Textile Museum (TM; Washington, D.C.),[7] Saint Louis Art Museum (SLAM; Saint Louis, Missouri),[8] Denver Art Museum (DAM; Denver, Colorado),[9] Nelson-Atkins Museum (Kansas City, Kansas),[10] San Antonio Museum of Art (SAMA; San Antonio, TX),[11] Musées Royaux d'Art et d'Histoire (MRAH; Brussels, Belgium),[12] Ethnologisches Museum of Berlin (Berlin, Germany),[13] Musée international du Carnaval et du Masque (MICM; Binche, Belgium),[14] Museum of Ethnography of Budapest (Budapest, Hungary),[15] and various art galleries and auction houses.[16] Thanks to painstaking research, Martin Berger, who also made a fundamental contribution to composing most of the comparative corpus (Berger, 2019: table 1), has been able to show that most of these unprovenanced objects share a common collection history and that they were probably looted from one or more caves in the Tehuacán region in the late 1960s, maybe as a consequence of the interest sparked by the then recent results of the Tehuacán Valley Project (Berger, 2019; Berger et al., this volume).

Archaeological and stylistic elements suggest the materials discussed herein should be assigned to the Late Postclassic period (AD 1250–1521), even if continued use into colonial times cannot be ruled out (Saville, 1922:64; Vargas, 1989:98; see also Berger et al., this volume); their attribution to a specific ethnic/linguistic group will be tackled in the final part of this essay. A detailed description of the several hundred items included in the corpus would require much more space, but it is still useful to provide a general overview of the main types. Many of the objects at the NMAI and in related collections are anthropomorphic masks, usually ranging from 15 to 19 cm in height and 11 to 15 cm in width (Figures 2, 3).

Even if some of them do show suspension holes on the margins, their shape suggests that they were not actually intended to be worn on the face. All the masks show at least one of a series of physiognomic traits, including black circles on the temples[17]; multicolored, banded "skin"; almond-shaped eyes with black-painted eyelids; red (or, rarely, black) painted areas below the nostrils; and a red-painted and fanged mouth with (usually stone) teeth attached on an inset upper "gum."[18] The empty eye sockets of the masks were often meant to hold inlaid eyes (mostly made out of pottery), as can be seen in NMAI mask 24/6075 and in a specimen found at Santa Ana Teloxtoc (Vargas, 1989:124–125, lámina 33, pl. 1; Melgar Tisoc et al., 2018: catalogue 47).[19] These elements do not always co-occur and are represented through varying technical means (i.e., mosaic, painting, etc.), but they can be considered a polythetic group of traits meant to express the identity of the beings represented by the masks.[20]

The degree of similarity among the masks of the corpus is variable. In general terms, a core group, represented at the NMAI and in most of the abovementioned collections and apparently deriving from the Tehuacán region (Puebla), shows a high degree of formal and technical homogeneity, with a higher co-occurrence of the abovementioned physiognomic traits (Figures 2a–i, 3a–b,e). A few masks contextually associated with the core group do not fit the common pattern so far described and clearly represent different extrahuman beings. The NMAI mask 10/8713 (Saville, 1922: pl. XIII), for example, shows the usual fanged mouth and mosaic frame, but it lacks black circles; on the other hand, it displays face painting in the form of a reddish line horizontally crossing the forehead, encircling the eyes, and reaching the sides of the nose. As first noticed by Seler (1988 [vol. 2]:187) and then extensively discussed by Mikulska (2020), this is a common "solar" facial paint in Nahua iconography, possibly related to dawn sunlight. Another example is one of the Santa Ana Teloxtoc masks (Vargas et al., 1989:128, fig. 37, pl. 2) representing the mouth of a serpent from which protrudes a human face with a stepped nose ornament. It is devoid of any mosaic but, as already noted by Scott (2003:8), is almost identical to a famous mosaic mask now in the Museo delle Civiltà (formerly Museo Nazionale Preistorico Etnografico Luigi Pigorini) in Rome that had previously been part of the Medici collection in Florence since the sixteenth century (Domenici, 2020: pl. 13). Another unusual example is in the MRAH collection (AAM.68.10.1), showing a face with round, goggled eyes and dots on the cheeks (Montoya, 2017: cuadro 4); its circular eyes do resemble those of two other masks, one from Santa Ana (Vargas, 1989: fig. 32) and the other in the Dallas Museum of Art collection.

A smaller group of more eccentric specimens, contextually unrelated to the core group and in most cases deriving from more southern areas of Oaxaca, is stylistically more diverse and heterogeneous, but still, these specimens clearly

represent the same beings as the core group masks. Good examples of this group are the SAMA (97.1.18), DAM, and Musée du Carnaval et du Masque masks (Figure 3c,d,f), as well as those found in Zaachila, Oaxaca (Melgar Tisoc et al., 2018: láminas 43–45).

The surface of most masks is covered with some kind of mosaic, a term that must be intended in a loose sense: in addition to some masks covered by proper turquoise mosaics, many of the ones in the core group are actually covered by a gritty paste composed of an organic resin or gum, mixed with small stone fragments, grit, or sand.[21] Some wooden masks are simply painted, with no mosaic whatsoever. In the same group, most of the mosaic masks also show a "frame" composed of tesserae made out of a fine-grained, light-colored material lining the mask's edges and delineating facial elements such as the eyebrows. This frame and the gritty paste are lacking in the eccentric items of the corpus, which are usually covered by a more "standard" turquoise mosaic.[22] Most of the masks with black circles on the temples usually display banded skin and a darker area on the forehead, a trait I called elsewhere "enhanced forehead" that is shared with most of the known Nahua and Mixtec mosaic masks (Domenici, 2020:18–19). The skin bands can be defined by different color shades of the mosaic tesserae or by the varying granulometry of the gritty paste; they are especially evident on the cheeks of a rather unique example from Cueva de Ejutla (Moser, 1975: fig. 5).

A subset of masks, contextually associated with the core group in the NMAI and TM collections, is composed of thin, flat or slightly convex wooden plates, with the usual physiognomic traits (black circles on the temples, black eyelids, and red

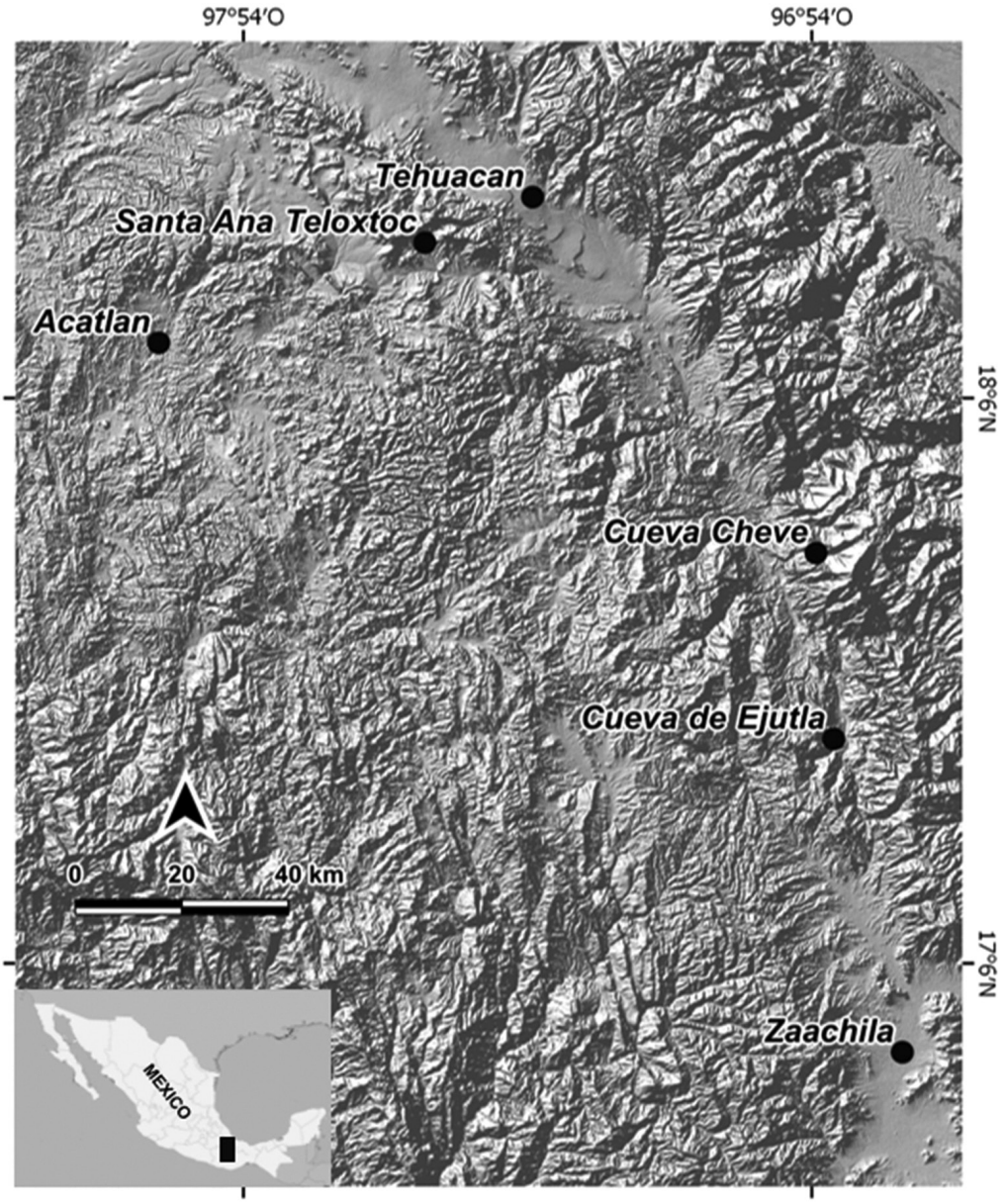


FIGURE 1. Approximate location of the main archaeological sites mentioned in the text. Map by Michaela De Giglio.

FIGURE 2. Masks from C. Purpus's and R. Stolper's lots at the National Museum of the American Indian: (a) 10/8709, (b) 10/8710, (c) 10/8711, (d) 10/8712, (e) 10/8714, (f) 10/8715, (g) 24/6070, (h) 24/6062, and (i) 24/6068. Images not to scale.

FIGURE 3. Masks from various locations: (a) Saint Louis Art Museum (505:1981a,b), (b) Museum of Ethnography of Budapest (74.2.9), (c) San Antonio Museum of Art (97.1.18), (d) Denver Art Museum (1979.330), (e) Milwaukee Public Museum (57053a,b), (f) Musée international du Carnaval et du Masque (87/1064), (g) Milwaukee Public Museum (A_56947), and (h) Textile Museum (1978_28_5). Images not to scale.

fangs) roughly painted in black and red but without suspension holes (Figures 2i, 3g,h); in a few instances (e.g., NMAI 24/6066, 23/8365), they show the remains of gritty paste covering some areas, especially the forehead. Even if they are poor versions of the proper, mosaic-encrusted masks, these painted masks are extremely interesting because with their "synthetic" iconography, they indicate that black circles, black eyelids, and fangs were perceived as the key physiognomic traits identifying the represented being.

As also noticed by Scott (2003:6), the black circles on the temples represent the hole drilled in the skull to attach it to a skull rack, or *tzompantli*, a convention that characterizes human skulls on codices Cospi and Borgia and entails the idea of sacrificial death.[23] A similar meaning can be attributed to the black eyelids and red mouth areas: these traits are typical of the Mimixcoa in the Nahua sacred histories, marking them as transgressors and thus sacrificial victims par excellence (Olivier, 2018:351–353). The black paint on the eyes could also have a second, related meaning: according to a Nahua narrative recorded in the *Anales de Cuauhtitlan*, Mixcoatl killed Itzpapalotl ("Obsidian Butterfly"), and then he and the other Mimixcoa blackened their eye sockets with the ashes of her burnt body (Bierhorst 1992:23); as a consequence, in Mixtec codices Nahua individuals are represented with blackened eyes, an allusion to the expression *sami nuu*, "burnt eye," the Mixtec name for Nahuatl speakers (Anders et al., 1992a:189; Pohl, 1994:95; Hermann Lejarazu, 2006:56). Thus, the blackened eyelids of the masks could qualify the portrayed sacrificial victims as Nahua or, more generally, outsiders or strangers.

The great majority of the masks with black circles (the percentage is lower among the painted, poorer ones) show a common breakage pattern, being vertically split in two halves.[24] For this reason, in some instances, old restorations were carried out using metal plaques to keep the two halves together.[25]

As far as materials are concerned, the masks (as well as the shields that I describe below) are realized with various kinds of wood and are covered by mosaics of turquoise, amazonite, malachite,[26] lignite, gritty paste, shell, and the abovementioned light-brown material, which, at least in one instance, has been identified as turtle plastron (Melgar Tisoc et al., 2018:54)[27]. X-ray fluorescence (XRF) and X-ray diffraction analyses identified turquoise and amazonite tesserae on NMAI shield 10/8708 (Museum Conservation Institute, 2006:4); Pb and Sr isotopic measurements of some turquoise tesserae from the Purpus lot suggested a Mexican origin rather than an import from the American Southwest (Thibodeau et al., 2018). Preliminary testing of the adhesive indicated the presence of conifer resin (Newman, 2002).[28] The painted elements are traced with (carbon?) black and hematite red.[29] All the wooden shields (whole or fragmented) are flat, wooden roundels with varying diameters, many of them around 38 cm (Figure 4).

The great majority of the shields show a mosaic and gritty paste decoration in the form of concentric bands. In most cases the central circle (and, at times, the outer bands, as in Figure 4b,f) shows a radiating design that could entail solar symbolism, as also noted by Izeki (2008:134–135); a similar solar symbolism is carried by the trilobated sunrays of NMAI 10/8706 (Figure 4g). On the other hand, NMAI 10/8704 (Figure 4f) bears the image of what seems to be a sectioned conch shell, very similar to the one marking the costume of a warrior on Codex Vaticanus A, folio 58r. One of the Santa Ana shields displays a serpentine motif (Vargas, 1989:117, pl. 26). A famous shield at the NMAI (10/8708, Figure 4e) displays a complex scene, including a deity descending from the sky, two flanking human figures, and a toponym in the form of a mountain with a bent summit, that is, Colhuacan of the Nahuas. This shield is so unusual within the corpus that it could even be an import from the Basin of Mexico or neighboring regions; interestingly enough, on the other hand, a shield clearly pertaining to the corpus here analyzed was found in Offering 48 at Templo Mayor (Melgar Tisoc et al., 2018:54,78–82), thus confirming the fact that shields were somehow moved between the two areas (Domenici, 2020:40–41).

Various shields at NMAI and MPM do show bands of bark cloth glued along the margin, probably the base of some kind of decoration, which is also true for the perforations along the edge of some specimens. The rear side is usually sculpted in a quite coarse way, with no holding implements, suggesting that the shields were never actually intended to be held by a warrior, much less on the battlefield, but rather were meant to be observed from a purely frontal view.

All the shields and shield fragments—with the sole exception of NMAI 10/8708 (and maybe the one found in Templo Mayor Offering 48)—show the same breakage pattern as the masks, being split in (at least) two halves. In some cases, old restorations were carried out by drilling holes and tying the two halves of a shield together with a metal wire; arguably, these restorations involving the use of iron wire are coeval with the ones visible on the masks. Besides masks and shields, the comparative corpus—especially the extensive collections of the TM, MRAH, and MPM—also includes a set of different miscellaneous artifacts clearly deriving from the same archaeological contexts of the core group masks and shields.

These miscellaneous artifacts include hourglass-shaped and mosaic-decorated wooden earspools (NMAI, SLAM, TM, and Cueva de Ejutla)[30] and mosaic-encrusted wooden rings, some of which are attached to the temples of masks (MPM and MRAH; Figure 5a–e). Various zoomorphic pectorals (at TM, MRAH, and SLAM; Figure 5f–h), at first glance resembling felines, actually represent dogs, as also noticed by Berger (2019), and are thus related to the Nahua ornament known as *xolocozcatl*, or "dog jewel," made out of turquoise or painted paper and depicted in codices Borbonicus (folio 71), Tudela (folio 55r), and Magliabechiano (folio 72r), where it is attached to the "empty" bundle (that is, with no body inside) of a warrior whose memory is being celebrated.[31] A related pectoral, with two doglike animals, was found in Santa Ana (Vargas, 1989:122, fig. 30, pl. 7). Greenstone figurines and beads (Figure 5i–k) are represented in the MPM, MRAH, and TM collections and were also excavated

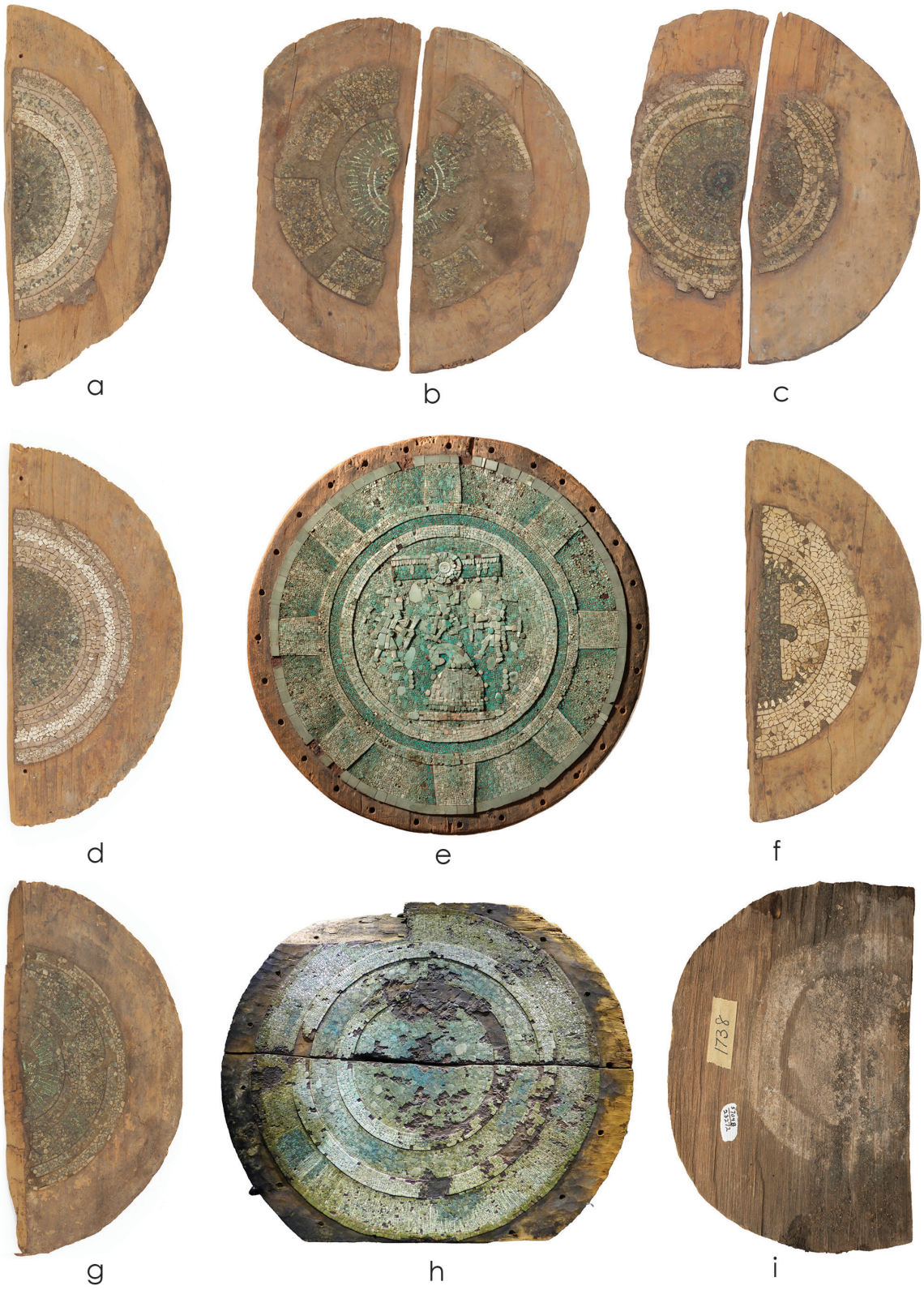


FIGURE 4. Shields from various locations: (a)–(g) National Museum of the American Indian (10/8701, 10/8703, 10/8707, 10/8705, 10/8708, 10/8704, 10/8706, respectively), (h) Musées Royaux d'Art et d'Histoire, Brussels (AAM.68.11), and (i) Milwaukee Public Museum (A_57048). Images not to scale.

a b c

d e f

g h

i j k

FIGURE 5. (*Opposite*) Miscellaneous artifacts. (a) Earspool in the NMAI collection (10/8718). (b) Earspools in the MRAH collection (AAM.68.10.6, AAM.68.10.8). (c) Earspool in the TM collection (1978_28_23). (d) Mosaic-encrusted circle in the MRAH collection (AAM.68.12.19a/b). (e) Mosaic-encrusted circle in the MPM collection (A_57019). (f) Dog pectoral in the MRAH collection (AAM.68.10.10a). (g) Dog pectoral in the MRAH collection (AAM.68.10.2a). (h) Dog pectoral in the TM collection (1978_28_35). (i) Greenstone beads in the MPM collection (A_57022). (j) Greenstone beads in the MRAH collection (AAM.68.10.22). (k) Greenstone figurine in the MRAH collection (AAM.68.12.7). Images not to scale.

from Cueva de Ejutla; in the latter, the beads were threaded on knotted fiber strings whose diameter is too reduced to be worn as bracelets.

"Banners" of bark cloth mounted on frames of vegetal sticks are abundant in the TM, MRAH, and MPM (Figure 6a–d) collections. Their shape is variable, as are their complex black decorations, which are usually geometric but also include a serpentine being and a year-sign (Figure 6c).

Of special interest is the large array of textiles and bark cloth preserved in the MRAH and TM collections, which were thoroughly analyzed by Montoya (2013, 2017; Figure 6g–m). Vegetal fiber artifacts in the same collections (and at MPM) include small sandals (Figure 6i), mats, cords, and many enigmatic artifacts composed of tied grasses and reeds (Figure 6f).

Miscellaneous artifacts of more diverse kinds (sometimes not even securely attributable to the same original contexts) include a smoking tube, obsidian blades, pottery, gourds, and corncobs. The TM, MPM, and MRAH collections also contain a few human remains, including some adult skulls, one adult mandible, and the tibia of a child.

ICONOGRAPHIC INTERPRETATION: THE *ÑUHUS* AND THE WAR WITH EARTH, WAR WITH RAIN

My iconographic analysis must start from the beings represented in the masks, characterized by fanged mouths, banded skin, and sacrificial attributes such as black eyelids, red mouths, and black circles on the temples. Fanged mouths and banded skin are among the distinguishing traits of the *ñuhus*, or "stone men," whose Mixtec name means "earth," "god," "spirit," "land," and "sun" (Smith, 1973:69; Byland and Pohl, 1994:114). Commonly represented in Mixtec codices, the *ñuhus* are small anthropomorphic extrahuman beings born from the center of the Earth. Their "stony" essence is expressed by their multicolored, diagonally banded skin (probably alluding to the geological strata), as well as by the small bilobated scrolls that identify stony objects in Mesoamerican iconography (Figure 7a,b).

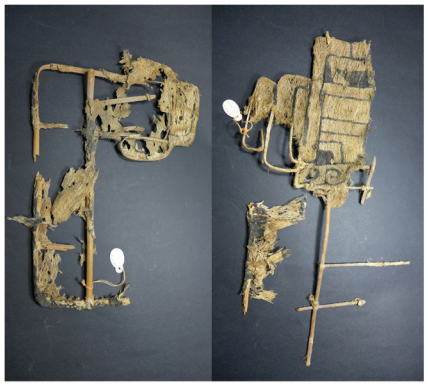
In the masks in the comparative corpus, besides the banded skin, the stone mosaics and gritty pastes would have further expressed their stony quality.[32] The *ñuhus*' visual appearance is very similar to that of the rain god Ñuhu Dzahui, who is the paramount ñuhu, a kind of relationship that mirrors that of their Nahua counterparts, Tlaloc and the *tlaloques*.

The *ñuhus* represented in Mixtec codices do not show black circles on the temples[33] or black eyelids, but their role as "stranger" enemies and sacrificial victims is paramount in the narrative of the War with Earth, War with Rain (also known as the War of Heaven), a primeval conflict in which Mixtec lords of a lineage born from a tree in Apoala/Yuta Tnoho defeated the *ñuhus* and conquered their land. Scenes of this war—which also portray the Mixtecs opposed to a group of "cloudy" beings whose red-striped bodies mark them as warriors and potential sacrificial victims (Olivier, 2004:320)—are represented on Codex Zouche-Nuttall/Tonindeye (plates 3–4, 20–21; Figure 7a,b) and Codex Bodley/Ñuu Tnoo-Ndisi Nuu (plates, 3–4, 34–36). The defeat of the *ñuhus* and the taking of their land established the original Covenants with Earth and Rain, also depicted on Codex Vindobonensis/Yuta Tnoho (plates 27–26), initiating a mutual relationship of nourishment in which the *ñuhus* provide food and drink to humans and, in exchange, humans give them offerings and the bodies of their dead, as in the widespread Mixtec saying "We eat the Earth and the Earth eats us."[34]

The War with Earth, War with Rain is also alluded to in the *Arte en lengua mixteca* by Antonio de los Reyes, a Dominican friar who wrote that the Mixtec lords of Apoala "believed that before these lords conquered this land there were some villages there whose inhabitants were called *tay nuhu*, l. *nanuhu*, l. *tay nisino*, l. *tai nisai nuhu* and they were said to have come out of the center of the Earth that they called *anuhu*, and they had no descent from the lords of Apoala, but rather had appeared upon the Earth and taken possession of it, and these were the real and true Mixtecs, the masters of the tongue that they presently speak" (Reyes, 1593:ii; Smith, 1973:68–69).[35] References to the *ñuhus* can also be found in modern ethnographies, where they are described as "owners of the land" that bring rain and fertility, as well as caretakers of the natural environment; significantly, they are at times described as warlike beings who were defeated by the First Sunrise (Jansen, 1979:166, 1982; Byland and Pohl, 1994:12–13, 114; Monaghan, 1995).[36] In pre-Hispanic representations, the Mixtec lords fighting against the *ñuhus* vary according to the different narratives, suggesting that like what happens with other common tropes of Mesoamerican native historiography, the episode (where Lord 9 Wind, the Mixtec version of Ehécatl-Quetzalcóatl, played a key role) provided a template to narrate the foundation of different Mixtec dynasties and the establishment of their power in newly conquered lands.

a

b



c

d

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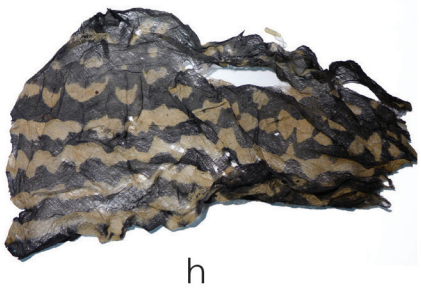
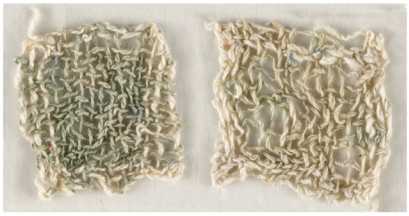
g

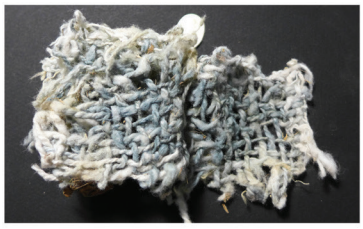


h

i



j



k

l

m

FIGURE 6. (*Opposite*) Miscellaneous fiber and textile artifacts. (a) *Amate* banner in the TM collection (1978_28_27). (b) *Amate* banner in the MRAH collection (AAM.68.12.31). (c) *Amate* banners in the MRAH collection (AAM.68.12.40, AAM.68.12.43). (d) *Amate* banner in the MRAH collection (AAM.68.12.33). (e) *Amate* items in the MRAH collection (AAM.68.10.40a,b,c). (f) Fiber artifact in the TM collection (1978_28_8). (g) Painted *amate* cloth in the TM collection (1978_28_2). (h) Painted *amate* cloth in the MRAH collection (AAM.68.12.28). (i) Sandals in the MRAH collection (AAM.68.10.37a,b,c). (j) Textile in the TM collection (1978_28_36; 1978_28_37). (k) Textile in the MRAH collection (AAM.68.10.39). (l) Textile in the TM collection (1978_28_43s). (m) Textile in the MRAH collection (AAM.68.10.36). Images not to scale.

It is worth noting here that Codex Zouche-Nuttall/Tonindeye (plate 3; Figure 7b) represents Mixtec Lord 7 Movement sacrificing a *ñuhu* by hearth extraction in Yucu Yusi, "the Mountain of Jade and Feathers," the Mixtec name of Acatlán, Puebla, also identified by Jansen as the place conquered by a *ñuhu* on carved bone 203b from Monte Albán Tomb 7 (Jansen, 2012:46–52). Thus, the Acatlán region of the Mixteca Baja, the very place of origin of most of the objects in the comparative corpus, was perceived as one of the main places where the War with Earth, War with Rain took place.

Pre-Hispanic and Colonial codical images of *ñuhus* also appear in scenes not explicitly related to the War with Earth, War with Rain. Besides their usual physiognomic traits, the *ñuhus* are often characterized by a bundle-like bodily shape (with no legs), paper "ties" or "bibs" (a trait shared with mortuary bundles in Mixtec iconography), and conical earspools (Figure 7c).[37] Pohl (2012) identified a representation of a *ñuhu* on an Aztatlan pottery vase at the Metropolitan Museum of Art.

Some of the *ñuhus* painted in Mixtec codices merit further attention. On Codex Selden/Añute, various *ñuhu* masks with a diagonal line crossing the cheek are attached or juxtaposed to ritual bundles (Figure 7d), which also happens with rain god masks; in four instances (plates 3-IV, 8-II, 11-IV, 12-II; Figure 7e,f) the *ñuhu* masks are associated with arrows and shields, a compound that Jansen and Pérez Jiménez (2017:173, 207, 242, 244) call "the *ñuhu* of the weapons." The bundles are kept in temples, called *huahi ñuhu*, literally "House of the Ñuhu," in Mixtec.[38] Ethnohistorical documents record that bundled "idols," at times explicitly described as being linked with water, fertility, and sustenance, were also kept in caves (Burgoa, 1934; Jímenez Moreno, 1940:45); indeed, on plate 18 of Codex Bodley/Ñuu Tnoo-Ndisi Nuu, a *ñuhu* is depicted within a cave.

The *ñuhus* were thus strictly related to the ample use of sacred bundles in ancient Mixtec society, in which they were associated with kinship groups and perceived "as the chief focus of social unity" (Pohl, 1994:26); *ñuhu* bundles, which often contained greenstone figures of the kind known as *penates*, received specific cults as "ídolo del pueblo" and were linked to agricultural rituals and to the legitimation of royal power (Hermann Lejarazu, 2008a:84–86; Pohl, 1994:23–32; Terraciano, 2001:261–265). Mixtec priests were often caretakers of sacred bundles, as shown by the locution *dzutu sandidzo ñuhu*, "priest who carries the bundle" (Alvarado, 1962:185b); sacred bundles were carried during migrations, and they were the focus of ritual acts, which often included incense burning and bloodletting. Apparently, *ñuhu* bundles were perceived as materializations of a general class of primeval ancestors, as shown by depiction of *ñuhus* emerging from Earth in a pose typical of the first ancestors (e.g., Codex Selden/Añute, plate 14-IV); according to Pohl (1994:41), the *ñuhu* bundles were not linked to "specific ancestors, but rather with more generalized culture heroes or spirits."[39]

CONTEXTUAL INTERPRETATION: *ÑUHU* BUNDLES IN CAVE RITUALS

In the cave of Santa Ana Teloxtoc, in the Zapotitlán Valley (Puebla), more than 50 whole or fragmented wooden masks (most of them of them of the *ñuhu* kind, broken in halves) were found together with 10 broken wooden shields, 4 wooden tablets, and various other wooden objects, including an anthropomorphic head and a zoomorphic pectoral, 3 obsidian knives, 1 chert knife, an arrow shaft, fire drills, various gourds, pottery sherds, faunal remains, and a single human remain; the objects were deposited on the surface of the two main cave branches, with no clear evidence of looting (Vargas, 1989).[40]

Cueva de Ejutla, in the Cuicatlán (or Tomellín) Cañada of Oaxaca, was explored by Christopher Moser in 1966–1967 (Moser, 1975, 1976, 1983). Unfortunately looted long before scientific exploration, the cave contained approximately 45 masonry structures, both squared and rounded, interpreted as containers for bundled corpses. Among the remains left by looters, Moser found abundant food remains, textiles, mats, fiber artifacts, fire drills, a cane arrow shaft, bird feathers, *amate* paper fragments sprinkled with rubber, greenstone beads tied to *amate* strips, various wooden implements, spindle whorls, sandals, and wooden artifacts covered with mosaics, namely, a biconical earspool, various mosaic-encrusted wooden rings, and half of a *ñuhu* mask with an especially evident banded skin, whose similarity to those of the NMAI collection was noticed by Moser himself (Moser, 1975:32, fig. 5). The only human remains were those of a small child, approximately one year old.

Cueva Cheve, also in the Cañada de Cuicatlán (Oaxaca), was excavated in 1991 by a salvage archaeological project following accidental discovery, revealing an impressive

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e

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FIGURE 7. (*Opposite*) Images of *ñuhus*. (a) and (b) Codex Zouche-Nuttall/Tonindeye, plates 21 and 3, respectively; in (b), Lord 7 Movement sacrifices a *ñuhu* in Yucu Yusi, "the Mountain of Jade and Feathers," now Acatlán. (c) Codex Vindobonensis/Yuta Tnoho, plate 27, with a bundle-like *ñuhu* with paper "bib" and earspool. (d) Codex Selden/Añute, plate 5-II, with a *ñuhu* bundle. (e) and (f) Codex Selden/Añute, plates 3-IV and 12-II, respectively, with *ñuhu* masks with shields and darts associated with sacred bundles.

archaeological assemblage (González Licón, 1991a; González Licón and Márquez Morfin, 1994; Steele, 1997; Steele and Snavely, 1997). In Chamber 1, an altar-like stone platform was associated with the remains of a large number of Late Postclassic secondary burials, most of them bundled in mats, deposited between layers of grass, and associated with obsidian blades and greenstone beads. On the same platform, fragments of a wooden mask covered with mosaic were found; unfortunately not illustrated in publications, the mask is said to be "very similar to the one found in Ejutla Cave" (González Licón and Márquez Morfin, 1994:232). Two broken mosaic tablets were found in the same chamber (Steele and Snavely, 1997; Domenici, 2016). One of them, with a (solar?) shield superimposed on four darts, resembles the two Santa Ana Teloxtoc wooden tablets with shield-like elements. The other tablet bears a complex imagery depicting a battle that takes place around three possible toponyms (a ballcourt, a maize-sprouting mountain, and a temple) associated with calendric glyphs. The winners, most of them larger than their opponents, wear headdresses in the form of eagles, jaguars, and alligators. Most of the defeated individuals display diagonal bands on their faces.[41] In the upper section, a figure descends from a celestial band, diving toward a sun. Although hard to interpret in its minute details, the scene may well represent the War with Earth, War with Rain.

A final archaeological context, very different but still worth mentioning, is Zaachila (Oaxaca) Tomb 1, dated to the Late Postclassic, where various turquoise masks were found. Although stylistically very different from the core group—hardly surprising in light of the location of Zaachila in the Central Valleys, very far from the Acatlán region—at least three of the masks, now on display at the National Museum of Anthropology in Mexico, clearly represent fanged beings with black circles on the temples (Gallegos, 1963; Montero, 1968; Angulo Villaseñor, 2008: figs. 1.1, 1.2; Melgar Tísoc et al., 2018: pls. 43–45). None of them was found on the face of the tomb's occupant (who wore another wooden mask); they were, rather, deposited in other areas of the crypt, in one case over a tripod bowl.

Apart from the Zaachila tomb, all of the above-discussed archaeological contexts are inside caves, a fact that matches the scanty information associated with the specimens in museum collections and that is hardly surprising, given the amount of ethnohistoric and archaeological data attesting the relevance that caves as ritual spaces had all over Mesoamerica and in the Mixtec region (Burgoa, 1934:337–341; Jímenez Moreno, 1940; Moser, 1975, 1976, 1983; Winter, 1984; González Licón, 1991a; González Licón and Márquez Morfin, 1994; Hapka and Rouvinez, 1996; Steele, 1997, 2005; Rincón Mautner, 2005; Urcid, 2005). Nevertheless, the specific character of the Santa Ana, Ejutla, and Cueva Cheve assemblages, often vaguely dubbed "ceremonial" or "ritual" (Scott, 2003:3; Gredell, 2007:100), is still elusive. Moser (1975:36) interpreted the Ejutla mask as being part of a funerary bundle of a high-rank individual; such a funerary function is apparently confirmed by Cueva Cheve secondary burials, as well as by ethnohistorical information stating that the mummified bodies of deceased kings were left in caves, at times with turquoise masks, becoming the focus of ritual and oracular practices (Burgoa, 1934:338–339, 372; Herrera y Tordesillas, 1945:169; Jiménez Moreno, 1940:45). A proper funerary function of the masks, also suggested by Markman and Markman (1989:94–95) and Gredell (2007:99, 105–106), is, nevertheless, at odd with various archaeological data: In Cueva Cheve a single mask was found, not even in direct association with the secondary burials. In Santa Ana a single human scapula was found, in contrast to the huge amount of masks (Vargas, 1989:176). In Cueva de Ejutla only the remains of a single child were found, and in Zaachila, even if in a clearly funerary context, the masks were not located on the face of the buried individual but, rather, as part of the funerary assemblage. Moreover, human remains are also scarce in the mentioned museum collections. Although the reason could be their reduced economic value for the looters, their rarity actually fits with the reduced number of human bones in scientifically explored contexts, in which it is hard to imagine looting activities that extracted human remains but left turquoise masks and shields. Indeed, the scarcity of human remains led Vargas (1989:176) to propose that the Santa Ana Teloxtoc cave could have hosted "dramas and dances."

On the basis of the abovementioned iconographic interpretation, I suggest that most of the artifacts in the corpus, including those from Santa Ana, Cueva de Ejutla, and Cueva Cheve, were parts of *ñuhu* bundles similar to those represented in codices, originally kept in sacred caves.[42]

Besides the obvious correspondence between *ñuhu* masks and shields and the images of *ñuhu* bundles on Codex Selden/Añute, various other elements in the comparative corpus seem to support my hypothesis. First of all, arrow shafts were found in both Ejutla and Santa Ana together with fire drills, items also associated with Mixtec and Nahua sacred bundles (Hermann Lejarazu, 2008a:81–82). Also significant are the greenstone figurines, or *penates*, at MRAH (e.g., AAM.68.12.7), which according to Pohl (1994), could have been contained in bundles; the same can be said about the strung greenstone beads from Cueva de Ejutla (Moser, 1975) and the MPM collection (Gredell, 2007: fig. 2.23) because they

strongly recall the descriptions of Nahua bundles of "dead gods" that according to the Franciscan friar Gerónimo de Mendieta, contained a notched wooden object to which greenstone beads, representing the "hearths" of the bundles, were tied.[43] Finally, the huge amount of textiles and *amate* paper in the TM and MRAH collections could well be part of the original bundles, and a cross-like fiber artifact in the former (Figure 6f) could have been inserted in the bundle to make it stand in vertical position. Several *amate* paper strips sprinkled with rubber from Ejutla, as well as various *amate* artifacts at the MPM, can be interpreted as the paper ties or bibs hanging from the neck of the bundled *ñuhus*.[44] Admittedly, the pre-Sunrise character of the *ñuhus* could be at odds with the solar symbolism of the shields and earspools, as well as with the facial paint of NMAI mask 10/8713, but I would suggest that such symbolism could have marked the *ñuhus* as defeated solar warriors, belonging to a previous era, or sun.

If my hypothesis is correct, the sacred bundles with fanged and banded stony masks, earplugs, shields, arrows, and dog pectorals (and maybe sandals, *amate* banners, etc.) would have represented the bundled and armed corpses of dead *ñuhu* warriors defeated in the War with Earth, War with Rain; the black circles on the temples and the black eyelids would have signified them as sacrificed strangers. The sacred history that served as a narrative template of the hypogeal assemblage would have been further made explicit by items such as the Cueva Cheve mosaic tablet with a representation of the War with Earth, War with Rain. The paradigmatic defeat of the *ñuhus* could also explain the consistent pattern of breakage observed on most of the masks and shields in museums' collections. Even if we cannot discard the hypothesis that the objects were broken during one of the many destructions of idols carried out by Christian missionaries in early colonial times (see Burgoa, 1934:337–341; Jiménez Moreno, 1940:39; Terraciano, 2001:262, 264, 280–281), the consistency of the pattern lets us guess that the objects could have been intentionally struck during ritual reenactments of the War with Earth, War with Rain.

Despite having been defeated, the *ñuhus* maintained their control of the forces of earthly fertility, so they required appeasement with offerings to release their bountiful gifts. For instance, abundant remains of food offerings, also included in some museum collection, were found in both Ejutla and Santa Ana Teloxtoc, where at least nine turkeys were recovered (Valadez Azúa, 1989:143).[45] As already mentioned, the cult of the *ñuhus* also involved bloodletting, and obsidian blades that could have been used in such rituals are part of the MPM assemblage. Moreover, remains of children found in Ejutla (one year old) and in the MPM assemblage (two to three years old) could suggest the performance of child sacrifices, ritual acts mostly related to rain and fertility petitions and often performed inside caves (Domenici, 2014). The ritual exchange with underwordly extrahuman beings could well have also included the deposition of dead individuals in caves that were perceived as the realm of forefathers and ancestors (Byland and Pohl, 1994:119), where their burial would have been understood as a form of paying the debt established by the original Covenants with Earth and Rain. Significantly, modern Nuyootecos speak of the death of people as the result of the feeding of the *nu ñuhu* and *ñuhu savi* (Bellas, 1997:51). The disposal of dead bodies as offerings to the Earth seems to be confirmed by the fact that the secondary burials in Cueva Cheve were deposited under grass layers. For instance, Olivier (2006) demonstrated that in Aztec ritual practices the grass or *zacate* materialized the Earth as offering receiver, as in the case of the *zacatapayolli*, the grass ball in which the bloody thorns used in autosacrifice were inserted. For the Mixtec area, a similar practice of bloodletting over grass is described in the Inquisition trials of Yanhuitlán (Jiménez Moreno, 1940:38).[46]

Through deposition in caves, deceased ancestors were transformed into landscape elements and agricultural offerings receivers, mirroring the fact that their bodies were originally created and constituted from the landscape itself (Bellas, 1997:89). In this light, the opposition between *ñuhu* bundles and funerary bundles becomes blurred: Antonio de los Reyes (1593:19) lists the word *ñu* for "dead person," stating that it is an abbreviation of *ñuhu*, "earth," and citing the expression *nicuvui ñuhundeyeta*, literally translated as "the dead became earth" ("*hizose tierra su defuncto*"); the prefix *ñu* also appear in glosses translating the names of dead ancestors in Codex Muro (Caso, 1960:126; Smith, 1973:58n11; Pohl, 1994:26). Jansen (1982:324) similarly suggested that lineage founders could have been perceived as *ñuhus* in their association with natural forces, a point also reiterated by Terraciano (2001:264).

CONCLUSION

On the basis of iconographic, archaeological, ethnohistorical, and ethnographic data, I propose that the masks and shields held in the NMAI—as well as all the other artifacts in the comparative corpus—could be parts of *ñuhu* bundles similar to those represented in Mixtec codices. The caves where they were found would have been sacred spaces devoted to the *ñuhu* cult, where offering disposal and ritual reenactments of the War with Earth, War with Rain were performed as expressions of a typically Mesoamerican form of engagement with the landscape (sensu Ingold, 2000).

Both archaeological and archival information suggest that the core group of the comparative corpus derives from a series of caves located in the Mixteca Baja region of Acatlán (Puebla), not by chance one of the key locations of the War with Earth, War with Rain. The similarity among the various collections (especially among those of the NMAI's Stolper lot, TM, MRAH, and MPM) could even suggest that some of these materials derive from a single cave, but other data rather indicate the existence of a very consistent and homogenous ritual pattern, repeated in various caves of the area. Other specimens of the corpus reflect similar facets of the *ñuhu* cult in the Cañada de Cuicatlán (Cueva de Ejutla and Cueva Cheve), with the eccentric funerary assemblage of Zaachila Tomb 1 representing a rather extreme

variation in terms of both style and context of deposition. It is worth remembering that the Tehuacán valley and the Cañada de Cuicatlán lie relatively near Quiahteopan and Yoaltepec, the two provinces that according to Codex Mendoza, provided turquoise as a tribute to the Aztec empire (Berdan and Anawalt, 1992).

The Mixtec origin of most of the iconographic and ethnohistorical data that were useful for my interpretation suggests that the artifacts themselves should be attributed to the Mixtec tradition. The (mostly eastern) Nahua origin of other iconographical traits, such as the black circles on the temples, the solar face painting, and even the iconography of NMAI shield 10/8708, could be a symptom of the extremely complex ethnolinguistic landscape of the southern Puebla/northwestern Oaxaca region, an area where sustained Nahua–Mixtec cultural interaction produced hybrid cultural manifestations. In such a context, marked by interethnic marriages and exchanges, essentialist interpretations of material culture should be carefully avoided (Pohl, 2003; Rincón Mautner, 2015).[47] That said, because the ritual contexts of the core group could be the result of actual Mixtec military expansion in the Tehuacán–Acatlán region, defying eastern Nahua groups that had settled the area around the twelfth century is a possibility; this hypothesis could also be supported by the burnt eyes of the masks, indicating Nahuatl-speaking people. In a similar vein, González Licón (1991b:203) related the deposition of Mixtec objects in Cueva Cheve to a possible Late Postclassic Mixtec occupation of the southern Cañada region, inhabited by Cuicatecs and Mazatecs; a similar explanation could also be valid for the Ejutla assemblage. Similarly, Rivera Guzmán et al. (2016:218) suggested that the *ñuhus* could represent the Classic inhabitants of the Mixteca Baja, defeated during the Mixtec expansion at the end of the Classic period. Indeed, according to various scholars, the War with Earth, War with Rain was a metaphorical statement of conflict used in Postclassic Mixtec sacred histories to refer to the reordering of the political landscape following the collapse of the Classic Monte Alban power sphere and the subsequent Mixtec expansion (Byland and Pohl, 1994:113–114; Jansen and Pérez Jímenez, 2005:56, 2007:133–141).

Military conquests in the southern Puebla/northwestern Oaxaca region seem to have been narrated as historical instantiations of the prototypical War with Earth, War with Rain, or, to borrow Sahlins's (1981:1) powerful title phrasing, as "historical metaphors of mythical realities." Indeed, the deposition of *ñuhu* bundles in the caves of a newly conquered land, as well as the cyclical ritual reenactment of their primeval defeat, would have been powerful claims to the possession of the land, following a pattern well attested in Mesoamerican political culture (Oudijk, 2002). The possibility that the hypogeal creation of ritual assemblages associated with the *ñuhu* cult followed actual phenomena of colonization could be supported by the fact that despite the pervasiveness of *ñuhu* imagery in Mixtec manuscripts from the Mixteca Alta, such hypogeal assemblages are so far known only in outlying areas such as the Tehuacán–Acatlán region and the Cañada de Cuicatlán, where actual Mixtec conquests could have taken place.

If so, these military deeds would have been narrated by means of the cosmological lexicon of the War with Earth, War with Rain and cyclically reenacted through ritual performances. In the words of Appadurai (1996:183),

> All locality building has a moment of colonization, a moment both historical and chronotypic, where there is a formal recognition that the production of a neighborhood requires deliberate, risky, even violent action in respect to the soil, forests, animals, and other human beings. A good deal of the violence associated with foundational ritual . . . is a recognition of the force that is required to wrest a locality from previously uncontrolled peoples and places. . . . The anxiety that attends many rituals of habitation, occupation, or settlement is a recognition of the implicit violence of all such acts of colonization. Some of this anxiety remains in the ritual repetition of these moments, long after the foundational event of colonization.

My analysis of museum collections whose provenance from looted caves stripped them of most contextual information allowed me to reconstruct their original contexts, as well as to reach a deeper understanding of a specifically Mesoamerican version of this widespread cultural phenomenon.

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and commented on my drafts but also provided continuous encouragement over the years, generously sharing their knowledge with me; their contribution to this research has been crucial. Despite all this, the responsibility for any error or misinterpretation is solely mine.

NOTES

1. The objects in this lot are recorded at the NMAI with accession numbers 10/8701–10/8724.
2. The two atlatls were later published by Saville in his *Wood-Carvers Art in Ancient Mexico* (Saville, 1925:44–49, pls. I, VII, VIII; see also Rincón Mautner, 2019). When Saville's book on turquoise arrived in Mexico, it caused the resentment of Mexican archaeologists Enrique Juan Palacios and Leopoldo Batres, who published two letters in *El Universal* (15 November 1922) complaining about the theft of the archaeological treasures from the country (Scott, 2006).
3. Souza Sánchez (1969:13) asserts that Purpus obtained the objects ("a collection of mosaics," according to Purpus himself) in 1917–1918. Nevertheless, his description of Purpus's sale to Heye is rather confusing and hardly believable since he states that Purpus brought the object (singular) "under his shirt," that he sold it for US$40 (he actually got US$19), and that he sent it to the United States via a person who brought it "inside a pastry." Most importantly, the 1917–1918 date is in contrast to the fact that Purpus himself, in a letter to Joseph Nelson Rose dated 12 April 1920, stated that he offered the objects to the Berlin Museum before World War I. The actual date on which Purpus obtained the objects is thus unclear. Interestingly, in the same letter Purpus mentions the existence of a person that he calls "my collector," most likely a person in charge of finding archaeological items for him.
4. The objects in this lot are recorded at NMAI with the following accession numbers: 23/8365, 24/6061–24/6068, 24/6070–24/6089.
5. It is important to acknowledge here that since 2001 Sue Scott and Frances Berdan had planned a detailed study of the NMAI lots, which was also meant to include scientific testing of the materials. The project was unfortunately interrupted by Scott's death. Her scholarly interests, insights, and efforts to study the NMAI collection are recorded by conference papers and articles (Scott, 2001, 2010), as well as by a host of documents in the NMAI archive, including unpublished reports (Scott, 2003) and correspondence. I want to thank Emily Kaplan for giving me access to these materials and Frances Berdan for providing important information on their project.
6. The MPM collection, thoroughly discussed and illustrated by Gredell (2007), was donated in 1973 by William W. Brill and Mrs. Dorothy Robbins and said to proceed from the Tehuacán Valley. It contains 115 inventory entries, which correspond to a higher number of items, including 99 wooden mask fragments (both actual masks and flat, painted ones), 26 fragments of wooden shields, and 137 ear ornaments, as well as stone beads, pottery fragments, a gourd bowl, bone implements, shells, obsidian blades, *amate* cloth and fiber artifacts (including black-painted *amate* cloth mounted on fiber frames), faunal remains, and a few human remains (Gredell, 2007:116–121). Although not considered by Berger (2019), the collection is obviously related to the materials he discusses, with its marketing history also involving Everett Rassiga (Gredell, 2007:115).
7. The TM collection, split into two lots (1966 and 1978), contains hundreds of items and is unpublished. I had the opportunity to study it in May 2017. The 1966 lot contains 21 inventory entries (numbered 1966.56.n), including the fragments of at least four flat, painted masks; three stone figurines; one conch shell; two stone beads; four sandals; various fragments of textiles and *amate* cloth; fiber artifacts; and one human adult mandible. The larger 1978 lot contains 43 inventoried items, including four flat, painted masks; one wooden earspool; one dog pectoral; one spindle whorl; and a huge array of textile, *amate*, and vegetal fiber artifacts.
8. The SLAM collection includes fragments of masks, shields, a dog pectoral, and four ear ornaments (see Berger, 2019; Parsons, 1980).
9. As far as I know, the outstanding DAM mask, which has a very unusual mouth area, is unpublished. I thank Victoria Lyall for calling my attention to the mask and sending me pictures of it.
10. The Nelson-Atkins Museum materials, including mosaics, pottery, and fiber artifacts, are mentioned in Berger (2019), and they are said to derive from a cave named La Tambour or El Tambor, a name that according to Berger, could be related to Cerro Tambor in the vicinity of Tehuacán.
11. The SAMA mask (97.1.18), formerly owned by Elizabeth Huth Coates, can be seen in Justin Kerr's portfolio at http://research.mayavase.com/kerrportfolio.html (8882).
12. The MRAH collection, described by J. Montoya (Montoya and Holsbeke, 2010; Montoya, 2013, 2017), was acquired in 1968; the materials are said to derive from two tombs or caves in the region around Tehuacán, known as "Tomb 1" and "Cueva del Tigre." The materials from Tomb 1 include nine fragments of masks, one pottery eye, five ear ornaments, jadeite beads, two greenstone figurines, one rain god censer, a large amount of textiles, *amate* and fiber materials, corncobs, one copal cone, and three adult skulls and a mandible (Montoya, 2017: cuadros 1–3). Materials from Cueva del Tigre include three shields, at least four masks, four eyes made out of clay, copper and shell, four ear ornaments, four zoomorphic pectorals, various pottery artifacts and vessels (including censers with effigies of rain gods), a chert knife, two baskets, three miniature sandals, and various textile, *amate*, and fiber artifacts (Montoya, 2017: cuadros 4–5).
13. The materials in the Ethnologisches Museum of Berlin, including a mask, six shields, and earplugs, are said to derive from a "cave near Tehuacán" (Berger, 2019).
14. The unusual skull-shaped mask at the MICM can be seen on the cover of Revelard (1992).
15. The Budapest museum holds an extremely beautiful and well-preserved mask (see Gyármati, 2008; Berger, 2019).
16. Martin Berger (2019) identified various specimens in art galleries and auction house catalogs, which at times also included some information on their area of origin, variously described as Tehuacán (Sotheby's, 1981) or southern Puebla (Merrin Galleries, 1966; Sotheby's, 1983); in other instances, only general cultural attributions were given (Parke-Bernet Galleries, 1966, 1968; Sotheby's, 1987). The mask auctioned by Sotheby's in 1983 was previously in the possession of the Adeon Galley (Chicago); after being bought by Jay C. Leff, it was exhibited at the Brooklyn Museum and, more recently, auctioned by the Artemis Gallery (Erie, Colorado); its similarity to the NMAI masks was already noticed by Scott (2004). Another mask is in the collection of the Theatrum Mundi Gallery (Arezzo, Italy).
17. Mask 10/8709 in the NMAI (Figure 2a), which also displays unusual curls on the eyebrows (maybe a reptilian trait; Izeki, 2008:128) and some kind of mouthpiece, has black squares instead of circles.
18. The complete, fanged mouth can be seen in various examples form Santa Ana Teloxtoc (Vargas, 1989: fig. 33, pl. 1); Stolper's lot at the NMAI includes two loose fangs of this kind (NMAI 24/6089).
19. Sue Scott (2003:5–6) noticed that one pottery eye is among other materials sold by Purpus to Heye (12/1383). Fifty-one of these pottery eyes are in the MPM collection (Gredell, 2007:35, fig. 3.4), and three of them are in the MRAH collection, which also includes one copper and two shell eyes that could have been mounted on masks (Montoya, 2017:127, cuadros 1, 4).
20. An interesting example is the mask at the MICM (Figure 3f): although it is unique because it represents a human skull, the black

circles on the temple, the nose ornament, and the pattern of the mosaic clearly show that it, nevertheless, belongs to the same general group that I am discussing here.

21. This paste is also used as the adhesive to affix the mosaic tesserae in both masks and shields. In other instances, erroneously interpreted as unfinished mosaics (Scott, 2003:4–5), it is mixed with sand, grit, or stone fragments and actually constitutes the actual "mosaic," as Saville (1922:76–77) had noticed. The same paste is sometimes used instead of the black color to paint eyelids and circles on the temples.
22. I herein employ the term "turquoise" in the sense of "cultural turquoise," thus referring to a variety of blue-green minerals (e.g., turquoise, amazonite, malachite, chrysocolla, and azurite) collectively known as *xihuitl* in Nahuatl.
23. A unique case is the mask published by Sotheby's (1987), in which the black elements on the temples assume the form of two protruding anthropomorphic faces.
24. It is not possible for me to ascertain the breakage pattern in masks that I did not have the opportunity to examine and that are often heavily restored (such as the SAMA, DAM, and MICM masks).
25. Portable XRF analysis carried out by Emily Kaplan revealed that the metal is iron (with 10% tin), ruling out a pre-Columbian origin and pointing to an unknown colonial or later date. Admittedly, the timing and purpose of these "restorations," which could be related to the ritual use of the objects until relatively recent times, constitutes an intriguing open problem. It is worth noting that archival documents from the 1539 inquisitorial process against Don Carlos Ometochtzin of Texcoco mentions the use of gold and copper to "restore" a smashed pre-Hispanic image of Tlaloc (Hamann, 2019:29).
26. A bright-green copper-bearing mineral, probably malachite, can be seen on the forehead of NMAI masks 10/8713 and 10/8714.
27. Shell is often mentioned among the materials of the mosaics, especially referring to the abovementioned, light-colored material on their edges (e.g., Scott, 2003:1), also variously described as "shale," "silex," or "onyx" (see Scott, 2003:1, 6). It is not clear whether its identification as turtle plastron on the Templo Mayor shield (Melgar Tísoc et al., 2018:54) would also apply to all the other specimen of the corpus. Actually, the use of shell seems to be quite rare; two examples can be seen on NMAI 10/8711 and MPM 57053a,b, probably employing *Spondylus* tesserae.
28. Newman analyzed adhesive samples from NMAI mask 10/8713 and shield 10/8708. Previous Fourier transform infrared spectroscopy analysis of the gritty paste (mask NMAI 20/6475) revealed only the presence of a siliceous material (sand); a white efflorescence on mask NMAI 24/6075 was identified as a by-product of urine, most likely deriving from the cave environment where the object was deposited (Museum Conservation Institute, 2006:3, 5, and appendixes).
29. During my visit to the Cultural Resources Center in 2019, Emily Kaplan performed portable XRF measurements on some painted areas of the masks, revealing the presence of iron in the red color, thus confirming that the paint is composed of iron oxides, that is, hematite; the results obtained from the black areas were less clear, but it is reasonable to assume that it is carbon black.
30. See Izeki (2008: Appendix 2) for similar earspools in other collections.
31. According to Berger (2019), another similar pectoral is at the Israel Museum in Jerusalem. Karl Taube, who also commented on the SLAM pectoral (Taube, 2012:131), observed that similar pectorals are worn by "Toltec" warriors represented in reliefs at Chichén Itzá (Taube, 1994:233, figs. 28–29).
32. I recently discovered that Lee Parsons had previously interpreted the SLAM mask as a *ñuhu*, thus anticipating my own interpretation (Parsons, 1980).
33. A turquoise mask with a red circle on the temple is represented on Codex Vindobonensis/Yuta Tnoho (plate 29).
34. Among the many texts commenting on codical representations of this war, see Caso (1960:28, 57), Smith (1973:68–70), Rabin (1979), Monaghan (1990, 1995), Anders et al. (1992:90–95, 130–134), Byland and Pohl (1994:11–16, 109–119), Pohl (1994:116), Bellas (1997:46–47; 82-89), Hamann (2002), Jansen and Pérez Jímenez (2005, 2007), Hermann Lejarazu (2008b:18–21, 54–57), Williams (2009), and Joyce (2010:258–260).
35. "Creian que antes que los dichos señores conquistasen esta tierra auia en ella unos pueblos y a los moradores de ellos llamavan tay nuhu, l. nanuhu, l. tay nisino, l. tai nisai nuhu y estos dezian aver salido de el centro de la tierra que llaman anuhu, sin descendenca de los señores de Apoala, sino que auian parecido sobre la tierra y apoderadose de ella, y que estos eran os meros y verdaderos Mixtecos y señores de la lengua que agora se habla" (Reyes, 1593:ii). The English translation in the text is taken from Bellas (1997:71).
36. This characterization of the *ñuhus* as pre-Sunrise beings fixed in stone and forced into caves by the First Sunrise is mirrored in their identification with rocky blocks (Jansen, 1982), ancient ruins, and with pre-Hispanic stone heads with large round eyes and fanglike teeth sometimes unearthed in Mixtec country (Byland and Pohl, 1994:11–12; Josserand, cited in Byland and Pohl, 1994:13; Pohl, 1994:30; Monaghan, 1995:32; Hamann, 2002).
37. See Codex Vindobonensis/Yuta Tnoho, plates 26–27, 52; Codex Vaticanus B, plates 12, 72; and Codex Sánchez-Solís, page 20. In the former manuscript, on plate 27, a *ñuhu* with a maize plant sprouting from his head is a clear allusion to the essential relationship linking the *ñuhus* with the fertility of the Earth (Smith, 1973:67–68; Monaghan, 1990; Dupey García et al., 2020).
38. Significantly, *Vehe Ñuhu*, "House of the Ñuhu," is the contemporary Mixtec name for "church" (Jansen, 1979:166).
39. Javier Urcid (Brandeis College, Waltham, Mass., personal communication, 2010), noting that some of the bundles mentioned in the Proceso Inquisitorial de Yanhuitlán seem to be addressed by their calendrical names, suggests that some bundles could well refer to specific ancestors.
40. Interestingly, two of the Santa Ana masks (Vargas et al., 1989:122–123, pls. 31–32) show two knob-like elements on top of their heads that could represent the typical feminine hairstyle; as also noted by Scott (2003:8), these same elements appear on a wooden fanged *ñuhu* held in the collection of the Natural History Museum Vienna that despite displaying male genitalia, is represented giving birth to a Mixtec king (Saville, 1922: pl. 37; Pohl, 1994:29), a feature that according to Javier Urcid (pers. comm., 2010), could refer to the dual-gendered nature of *ñuhus*. One of the two Santa Ana masks shows a strong resemblance to an unprovenanced Mixtec mask held in the Dallas Museum of Art, both of them having large, rounded eyes (also a distinguishing feature of the *ñuhus*) and a flat, rectangular nose; large and rounded eyes, encircled by concentric mosaic bands, are also displayed on a mask in the MRAH collection (Montoya, 2017: cuadro 4). It is possible that the two Santa Ana masks, along with those of the Dallas Museum of Art and the MRAH, none of which have black circles on the temples, embody a different set of *ñuhu* representations that is related, but not identical, to the one I discuss in this essay.
41. In the upper right section of the mosaic, two "banded men" are represented with their limbs twisted to form an "*ollin*," a feature distinguishing extrahuman beings who in some codex scenes are significantly associated with the *ñuhus*, as in the case of the various 9 Wind manifestations on plate 58 of Codex Vindobonensis/Yuta Tnoho.
42. My interpretation would thus conflate two of the three possibilities put forward by Izeki (2008:74), who wrote about "water-fertility cults" and "commemorational rituals of the achievements of ancestors"; Izeki's third hypothesis was the funerary one. I elsewhere proposed that most of the famous Aztec turquoise mosaics held in

European collections could also have been attached to sacred bundles (Domenici, 2020:27, 36, and references therein).

43. Mendieta (1980:79–80) states, "Y estos devotos ó servidores de los dichos dioses muertos envolvían estas mantas en ciertos palos, y haciendo una muesca o agujero al palo, le ponían por corazón unas pedrezuelas verdes y cuero de culebra y tigre, y á este envoltorio le decían *tlaquimilolli*, y cada uno le ponía el nombre de aquél demonio que le había dado la manta, y este era el principal ídolo que tenían en mucha reverencia, y no tenían en tanta como á este los bestiones ó figuras de piedra ó de palo que ellos hacían" (see also Torquemada, 1976, 3:122).
44. Significantly, *amate* paper items sprinkled with rubber were a common feature in Aztec rituals linked to Tlaloc and the *tlaloques* (see Arnold, 1995; 2001:159–161); the Proceso Inquisitorial de Yanhuitlán also describes the use of rubber in rituals related to the Mixtec rain god (Jiménez Moreno, 1940:45–46). Another interesting class of objects is the pyramid-like fiber artifacts found in Ejutla and interpreted by Moser (1975:34) as "cages"; indeed, they are similar to a Late Classic cotton textile artifact excavated in Cueva del Lazo (Chiapas), where it was associated with the remains of sacrificed children; the artifact contained only raw cotton and was independently interpreted by Sánchez Valenzuela as a kind of ritual bundle or container (Domenici and Sánchez Valenzuela, 2017).
45. See Steele (1997:5) for exhaustive bibliographical references concerning ethnographical cases of turkey offerings in Oaxaca.
46. In the excavation of Cueva del Lazo (Chiapas), the bundled remains of sacrificed children were enclosed between grass layers that I elsewhere interpreted on the basis of a similar earthly symbolism (Domenici, 2014).
47. Interestingly enough, a *ñuhu* is depicted on the repainted plate 72 of Codex Vaticanus B, displaying various Mixtec-like themes (Dupey García et al., 2020). Rincón Mautner (2019) related the iconography of the two NMAI atlatls to the Colossal Bridge on the Ndaxagua River and to the Tolteca–Chichimeca kingdom of Coixtlahuaca, a possible area of origin of Nahua elements in the Mixteca Alta. Nevertheless, there is no clear evidence that the atlatls were found together with the materials discussed in this paper. Moreover, it is not clear to me how this presumed relationship between the atlatls and the Colossal Bridge fits with Purpus's statement that they were found in a cave in the Sierra Mixteca region of Puebla, well to the north of the Coixtlahuaca Basin.

REFERENCES

Alvarado, Francisco de. 1962. *Vocabulario en lengua mixteca*. Reprint, Mexico City: Instituto Nacional Indigenista and Instituto Nacional de Antropología e Historia.

Anders, Ferdinand, M. E. R. G. N. Jansen, and Gabina A. Pérez Jiménez. 1992. *Crónica mixteca. El rey 8 Venado, Garra de Jaguar, y la dinastía de Teozacualco-Zaachila. Libro explicativo del Códice Zouche-Nuttall*. Graz, Austria: Akademische Druck- und Verlagsanstalt.

Angulo Villaseñor, Jose. 2008. Intercambio étnico y cultural en algunos asentamientos prehispánicos de Oaxaca. In *La pintura mural prehispánica en México: Oaxaca*, Volume 3, ed. Beatrice de la Fuente, pp. 17–57. Mexico City: Universidad Nacional Autónoma de México.

Appadurai, Arjun. 1996. *Modernity at Large: Cultural Dimensions of Globalization*. Minneapolis: University of Minnesota Press.

Arnold, Philip P. 1995. Paper Ties to Land: Indigenous and Colonial Material Orientations to the Valley of Mexico. *History of Religions*, 35:27–60. https://doi.org/10.1086/463406

Arnold, Philip P. 2001. *Eating Landscape: Aztec and European Occupation of Tlalocan*. Boulder: University Press of Colorado.

Bellas, Monica. 1997. The Body in the Mixtec Codices: Birth, Purification, Transformation and Death. Ph.D. diss., University of California, Riverside.

Berdan, Francis F., and Patricia R. Anawalt. 1992. *The Codex Mendoza*. Berkeley: University of California Press.

Berger, Martin. 2019. "From a Cave Near Tehuacán": An Attempt to Reassemble Post-Classic Mesoamerican Ritual Deposits That Were Separated by the Art Market. In *The Market for Mesoamerica: Reflections on the Sale of Pre-Columbian Antiquities*, ed. Cara G. Tremain and David Yates, pp. 112–135. Gainesville: University Press of Florida. https://doi.org/10.2307/j.ctvx0738n.11

Bierhorst, John. 1992. *History and Mythology of the Aztecs: The Codex Chimalpopoca*. Tucson: University of Arizona Press. https://doi.org/10.2307/j.ctv1h7zmrs

Burgoa, F. de. 1934. *Geográfica descripción*. Mexico City: Archivo General de la Nación.

Byland, Bruce, and John M. D. Pohl. 1994. *In the Realm of Eight Deer: The Archaeology of Mixtec Codices*. Norman: University of Oklahoma Press.

Caso, Alfonso. 1960. *Interpretation of the Codex Bodley 2858*. Mexico City: Sociedad Mexicana de Antropología.

Domenici, Davide. 2010. Interacting with the *ñuhus*. Paper presented at the Society of American Archaeology 75th Annual Meeting, St. Louis, Mo. [Manuscript in possession of the author.]

Domenici, Davide. 2014. *Cueva del Lazo: Child Sacrifice or Special Funerary Treatment? Discussion of a Late Classic Context from the Zoque Region of Western Chiapas (Mexico)*. In *The Bioarchaeology of Space and Place: Ideology, Power, and Meaning in Maya Mortuary Contexts*, ed. Gabriel Wrobel, pp. 39–75. New York: Springer. https://doi.org/10.1007/978-1-4939-0479-2_3

Domenici, Davide. 2016. Máscaras, escudos y tablas con mosaicos de turquesa en Puebla y Oaxaca. *Arqueología Mexicana*, 141:44–49.

Domenici, Davide. 2018. An Underground Home for Earthly Beings. Reconstructing the Archaeological Context of a lot of Mesoamerican Artifacts in the National Museum of the American Indian Collections. Paper presented at the Society of American Archaeology 83rd Annual Meeting, Washington D.C. [Manuscript in possession of the author.]

Domenici, Davide. 2020. Mesoamerican Mosaics from Early European Collections. Style, Provenance and Provenience. *Estudios de Cultura Náhuatl*, 59:7–65.

Domenici, Davide, and Gabriela M. Sánchez Valenzuela. 2017. Classic Textiles from Cueva del Lazo (Chiapas, Mexico). Archaeological Context and Conservation Issues. In *Pre-Columbian Textile Conference VII*, *Center of Textile Research, University of Copenhagen, 2016*, ed. Lena Bjerregaard and Anne Pollard Rowe, pp. 68–103. Lincoln: University of Nebraska Press. https://doi.org/10.13014/K2C24TMP

Dupey García, Élodie, Jamie Forde, and Saeko Yanagisawa. 2020. Los palimpsestos del Códice Vaticano B. In *El Códice Vaticano B. Edición facsimilar y estudios*, ed. Katarzyna Mikulska, pp. 123–174. Mexico City: Universidad Nacional Autónoma de México.

Gallegos, Roberto. 1963. Zaachila: The First Season's Work. *Archaeology*, 16:226–233.

González Licón, Ernesto. 1991a. Salvamento arqueológico de la Cueva Cheve. *Boletín del Consejo de Arqueología*, 1991:124–127.

González Licón, Ernesto. 1991b. *Tremila anni di civiltà precolombiana: Zapotechi e Mixtechi*. Milan: Jaca Book.

González Licón, Ernesto, and Lourdes Márquez Morfín. 1994. Rito y cerimonial prehispánico en las cuevas de la Cañada, Oaxaca. In *Mixteca-Puebla: Discoveries and Research in Mesoamerican Art and Archaeology*, ed. Henry B. Nicholson and Eloise Quiñones Keber, pp. 223–234. Culver City, Calif.: Labyrinthos.

Gredell, Erin B. 2007. The Research Potential of Poorly Provenienced Museum Collections: A Case Study of a Mexican Cave Assemblage at the Milwaukee Public Museum. M.S thesis, University of Wisconsin–Milwaukee, Milwaukee.

Gyármati, Janos, ed. 2008. *Taking Them Back to My Homeland . . .: Hungarian Collectors—Non-European Collections of the Museum of Ethnography in a European Context*. Budapest: Neprajzi Museum.

Hamann, Byron. 2002. The Social Life of Pre-Sunrise Things: Indigenous Mesoamerican Archaeology. *Current Anthropology*, 43(3):351–382. https://doi.org/10.1086/339526

Hamann, Byron E. 2019. Producing Idols. *Latin American and Latinx Visual Culture*, 1(1):23–47. https://doi.org/10.1525/lavc.2019.000004

Hapka, Roman, and Fabienne Rouvinez. 1996. Prospection archéologique des grottes du Cerro Rabón, Sierra Mazateca, Oaxaca, Mexico. In *Proyecto Cerro Rabón 1990–1994, Oaxaca, Mexico*, pp. 57–69. Basel: Speleo Projects.

Hermann Lejarazu, Manuel A. 2006. Códice Nuttall. Lado 1: La vida de 8 Venado. *Arqueología Mexicana, Edición Especial Códices*, 23.

Hermann Lejarazu, Manuel A. 2008a. Religiosidad y bultos sagrados en la Mixteca prehispánica. *Desacatos*, 27:75–94.

Hermann Lejarazu, Manuel A. 2008b. Códice Nuttall. Lado 2: La historia de Tilantongo y Teozacoalco. *Arqueología Mexicana, Edición Especial Códices*, 29.

Herrera y Tordesillas, A. de. 1945. *Historia general de los hechos de los castellanos en las islas y tierra firme de Mar Océano*. Buenos Aires: Editorial Guarania.

Ingold, T. 2000. *The Perception of the Environment: Essays on Livelihood, Dwelling and Skill*. London: Routledge.

Izeki, Mutsumi. 2008. *Conceptualization of 'Xihuitl'. History, Environment, and Cultural Dynamics in Postclassic Mexica Cognition*. Bar International Series. London: Bar Publishing. https://doi.org/10.30861/9781407303468

Jansen, M. E. R. G. N. 1979. Apoala y su importancia para la interpretación de los códices Vindobonensis y Nuttall. In *Actes du XLII Congrés International des Américanistes*, pp. 161–172. Paris: Société des Américanistes.

Jansen, M. E. R. G. N. 1982. *Huisi Tacu. Estudio interpretativo de un libro mixteco antiguo: Codex Vindobonensis Mexicanus I*. Amsterdam: Centro de Estudios y Documentación Latinoamericanos.

Jansen, M. E. R. G. N. 2012. Un Oráculo Mixteco en Monte Albán. Nueva lectura de los textos pictóricos de la Tumba 7. In *Monte Albán y la Memoria Mixteca: Informe preliminar sobre investigaciones en proceso*, pp. 23–79. Leiden: University of Leiden.

Jansen, M. E. R. G. N., and Gabina A. Pérez Jiménez. 2005. *Codex Bodley: A Painted Chronicle from the Mixtec Highlands, Mexico*. Oxford, U.K.: Bodleian Library, University of Oxford.

Jansen, M. E. R. G. N., and Gabina A. Pérez Jiménez. 2007. *Encounter with the Plumed Serpent: Drama and Power in the Heart of Mesoamerica*. Boulder: University of Colorado Press. https://doi.org/10.26530/OAPEN_625247

Jansen M. E. R. G. N., and Gabina A. Pérez Jiménez. 2017. *Historia, literatura e ideología de Ñuu Dzaui: El códice Añute y su contexto histórico-cultural*. Oaxaca, Mexico: Colegio Superior para la Educación Integral Intercultural de Oaxaca.

Jímenez Moreno, Wigberto. 1940. Ambiente histórico del códice. In *Códice de Yanhuitlán*, pp. 2–51. Mexico City: Instituto Nacional de Antropología e Historia.

Joyce, Arthur A. 2010. *Mixtecs, Zapotecs, and Chatinos: Ancient Peoples of Southern Mexico*. Chichester, U.K.: Wiley-Blackwell. https://doi.org/10.1002/9781444314946

Kerr, Justin. 2021. Pre-Columbian Portfolio. http://research.mayavase.com/kerrportfolio.html (accessed 22 November 2021).

Markman, Roberta H., and Peter T. Markman. 1989. *Masks of the Spirit: Image and Metaphor in Mesoamerica*. Berkeley: University of California Press. https://doi.org/10.1525/9780520375963

Melgar Tísoc, Emiliano R., Reyna B. Solís Ciriaco, and Hervé V. Monterrosa Desruelles. 2018. *Piedras de fuego y agua: Turquesas y jades entre los nahuas*. Mexico City: Instituto Nacional de Antropología e Historia.

Mendieta, Gerónimo de. 1980. *Historia Eclesiástica Indiana*. Mexico City: Editorial Porrúa.

Merrin Galleries. 1966. *Pre-Columbian Art*. New York: Merrin Galleries.

Mikulska, Katarzyna. 2020. Los dioses y sus nombres: el caso de los dioses solares. In *El Códice Vaticano B. Edición facsimilar y estudios*, ed. Katarzyna Mikulska, pp. 509–553. Mexico City: Universidad Nacional Autónoma de México.

Monaghan, John. 1990. Sacrifice, Death, and the Origins of Agriculture in the Codex Vienna. *American Antiquity*, 55(3):559–569. https://doi.org/10.2307/281286

Monaghan, John. 1995. *The Covenants with Earth and Rain: Exchange, Sacrifice, and Revelation in Mixtec Sociality*. Norman: University of Oklahoma Press.

Montero, Sergio. 1968. Restoration of Turquoise Masks from Coixtlahuaca and Zaachila, Oaxaca. *Studies in Conservation*, 13(2):102–104. https://doi.org/10.1179/sic.1968.008

Montoya, Julia. 2013. Verborgen Schatten uit de Koninklijke Musea voor Kunst en Geschiedenis, Brussel. *Instituut voor Amerikanistiek, vzw. Tijdschrift*, 2:3–20.

Montoya, Julia. 2017. Textiles y otros materiales arqueológicos del Valle de Tehuacán, México, en los Museos Reales de Arte e Historia (MRAH), Bruselas. In *Pre-Columbian Textile Conference VII, Center of Textile Research, University of Copenhagen, 2016*, ed. Lena Bjerregaard and Ann Peters, pp. 104–131. Lincoln: University of Nebraska. https://doi.org/10.13014/K27D2S9P

Montoya, Julia, and Mirelle Holsbeke. 2010. Los textiles precolombinos en las colecciones del MRAH, Bruselas y del Museo Etnográfico/MAS, Amberes, Bélgica. In *Actas de las V Jornadas Internacionales de Textiles Precolombinos*, ed. by Victoria Solanilla Demestre, pp. 427–431. Barcelona: Grup d'Estudis Precolombins-Universitat Autónoma de Barcelona.

Moser, Christopher L. 1975. Cueva de Ejutla: una cueva funeraria posclásica? *Boletín del INAH*, 14:25–36.

Moser, Christopher L. 1976. Cueva de Ejutla: A Postclassic Burial Cave? *Katunob*, 9:23–26.

Moser, Christopher L. 1983. A Postclassic Burial Cave in Southern Cañada. In *The Cloud People: Divergent Evolution of the Zapotec and Mixtec Civilization*, ed. Ken Flannery and Joyce Marcus, pp. 270–272. New York: Academic Press.

Museum Conservation Institute. 2006. Technical Study/Conservation Report MCI 6049. 26 September 2006. National Museum of the American Indian–Cultural Resources Center, Suitland, Md.

Newman, R. 2002. Email to Emily Kaplan, 18 September 2002. Suitland, Md.: National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Olivier, Guilhem. 2004. De flechas, dardos y saetas: Mixcoatl y el simbolismo de las flechas en las fuentes nahuas. In *De historiografía lingüística e historia de las Lenguas*, ed. Juan M. Lope Blanch, Ignacio Guzmán Betancourt, Pilar Máynez, and Ascención H. de León-Portilla, pp. 309–324. Mexico City: Universidad Nacional Autónoma de México.

Olivier, Guilhem. 2006. El simbolismo de las espinas y del zacate en el México central postclásico. In *Arqueología e historia del Centro de México: Homenaje a Eduardo Matos Moctezuma*, ed. Leonardo López Luján, David Carrasco, and Lourdes Cué, pp. 407–424. Mexico City: Instituto Nacional de Antropología e Historia.

Olivier, Guilhem. 2018. Relics, Divination, and Regeneration: The Symbolism of Ashes in Mesoamerica. In *Smoke, Flames, and the Human Body in Mesoamerican Ritual Practice*, ed. Vera Tiesler and Andrew. K. Sherer, pp. 347–378. Washington, D.C.: Dumbarton Oaks.

Oudijk, Michel. 2002. La toma de posesión: Un tema mesoamericano para la legitimación del poder. *Relaciones Estudios de Historia y Sociedad*, 91:95–131.

Parke-Bernet Galleries. 1966. *Pre-Columbian Art, Auction of 26 April 1966*. New York: Parke-Bernet Galleries.

Parke-Bernet Galleries. 1968. *African, Oceanic, American Indian & Pre-Columbian Art from the Collection of Allan Frumkin (New York)*. New York: Parke-Bernet Galleries.

Parsons, Lee A. 1980. *Pre-Columbian Art: The Morton D. May and the St. Louis Art Museum Collections*. New York: Harper and Row.

Pasztory, Ester. 1983. *Aztec Art*. New York: Harry N. Abrams.

Pohl, John M. D. 1994. *The Politics of Symbolism in the Mixtec Codices*. Nashville, Tenn.: Vanderbilt University.

Pohl, John M. D. 2003. Royal Marriage and Confederacy Building among the Eastern Nahuas, Mixtecs, and Zapotecs. In *The Postclassic Mesoamerican World*, ed. Michael E. Smith and Francis Berdan, pp. 243–248. Salt Lake City: University of Utah Press.

Pohl, John M. D. 2012. The Odyssey of the Plumed Serpent. In *Children of the Plumed Serpent: The Legacy of Quetzalcoatl in Ancient Mexico*, ed. John M. D. Pohl, Virginia M. Fields, and Victoria I. Lyall, pp. 95–107. Los Angeles: Los Angeles County Museum of Art.

Purpus, Carl A. 1920. Letter to Joseph Nelson Rose, 3 June 1920. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 310, Folder 1, NMAI.AC.001. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Purpus, Carl A. 1926. Ruinen, Höhlen und Gräber. Funde in der östlichen Sierra de la Mixteca. *Baessler-Archiv*, 10:50–61.

Rabin, Emily. 1979. The War of Heaven in Codices Zouche-Nuttall and Bodley: A Preliminary Study. In *Actes du XLII Congrés International des Américanistes*, pp. 173–182. Paris: Société des Américanistes.

Revelard, Michel, ed. 1992. *Sur les traces de Christophe Colomb: Fêtes et masques du Nouveau Monde*. Binche, Belgium: Musée International du Carnaval et des Masques.

Reyes, Antonio de los. 1593. *Arte en lengua mixteca*. Mexico City: Pedro Balli.

Rincón Mautner, Carlos. 2005. Sacred Caves and Rituals from the Northern Mixteca of Oaxaca, Mexico: New Revelations. In *In the Maw of the Earth Monster: Studies of Mesoamerican Ritual Cave Use*, ed. James E. Brady and Keith M. Prufer, pp. 117–152. Austin: University of Texas Press.

Rincón Mautner, Carlos. 2015. Pluri-Ethnic Coixtlahuaca's Longue Durée. In *Bridging the Gaps: Integrating Archaeology and History in Oaxaca, Mexico*, ed. Daniel Zborover and Peter C. Kroefges, pp. 157–207. Boulder: University Press of Colorado. https://doi.org/10.5876/9781607323297.c008

Rincón Mautner, Carlos. 2019. Mixcoatl-Tezcatlipoca's Atlatls from the Coixtlahuaca Basin, Oaxaca, Mexico. *Mexicon*, 41:35–39.

Rivera Guzmán, Angel I., M. E. R. G. N. Jansen, and Gemima A. Pérez Jiménez. 2016. Searching for the Sanctuary of Lady 9 Reed: Huajuapan, Ring of Stones. In *Places of Power and Memory in Mesoamerica's Past and Present: How Sites, Toponyms and Landscapes Shape History and Remembrance*, ed. Daniel Graña-Behrens, pp. 199–232. Berlin: Gebr. Mann Verlag.

Sahlins, Marshall. 1981. *Historical Metaphors and Mythical Realities: Structure in the Early History of the Sandwich Islands Kingdom*. Ann Arbor: University of Michigan Press. https://doi.org/10.3998/mpub.6773

Saville, Marshall. 1922. *Turquois Mosaic Art in Ancient Mexico*. New York: Museum of the American Indian, Heye Foundation. https://doi.org/10.5479/sil.359668.39088016090177

Saville, Marshall. 1922. *The Wood-Carvers Art in Ancient Mexico*. New York: Museum of the American Indian, Heye Foundation. https://library.si.edu/digital-library/book/woodcarversartin00savi

Scott, Sue. 2001. La turquesa encontrada en la region de Puebla/Oaxaca: su lugar de probable origen y su papel en la vida ritual de la época posclásica. Paper presented at the XXVI Mesa Redonda de la Sociedad Mexicana de Antropología, Zacatecas, Mexico.

Scott, Sue. 2003. Mosaic Masks from Mexico in the CRC Collection. Memo to Ron Bishop. Unpublished report. NMAI-CRC Archives, Suitland, Md.

Scott, Sue. 2004. Addenda June 2004 to Mosaic Masks from Mexico in the CRC collection, Memo to Ron Bishop, p. 10. Unpublished report. NMAI-CRC Archives, Suitland, Md.

Scott, Sue. 2006. Email to K. Marconi McGee, 13 January 2006. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Scott, Sue. 2010. La máscara de Malinaltepec y sus compañeras. In *La máscara de Malinaltepec*, ed. Sofia Martínez del Campo Lanz, pp. 65–109. Mexico City: Instituto Nacional de Antropología e Historia.

Seler, Edward. 1961 [1923]. Uber szeniche desterlungen auf altemexikanischen. In *Gesammelte abhandlungen und altertumskunde*. Volume 4. Reprint, Graz, Austria: Akademische Druck Verlagstanstalt.

Seler, Edward. 1988 [1904–1906]. *Comentarios al Códice Borgia*. Reprint, Mexico City: Fondo de Cultura Económica.

Smith, Michael E. 1973. A Study of Some Personal Names in Codices Muro and Sánchez Solís. In *Mesoamerican Writing Systems*, ed. Elizabeth Benson, pp. 47–98. Washington D.C.: Dumbarton Oaks.

Sotheby's. 1981. *Pre-Columbian Art, Auction 24/25 February, 1981*. New York: Sotheby's.

Sotheby's. 1983. *Important Pre-Columbian Art, May 12 and 13, 1983*. New York: Sotheby's.

Sotheby's. 1987. *Pre-Columbian Art, 18 November 1987*. New York: Sotheby's.

Souza Sánchez, Mario. 1969. *Las colecciones botánicas de C.A. Purpus en México: Período 1898–1925*. Berkeley: University of California Press.

Steele, Janet F. 1997. Cave Rituals in Oaxaca, Mexico. Paper presented at the Society for American Archaeology Meeting, Nashville, Tenn.

Steele, Janet F. 2005. Pre-Hispanic Rain Ceremonies in Blade Cave, Sierra Mazateca, Oaxaca, México. In *In the Maw of the Earth Monster: Studies of Mesoamerican Ritual Cave Use*, ed. James E. Brady and Keith M. Prufer, pp. 91–116. Austin: University of Texas Press.

Steele, Janet F., and Ralph Snavely. 1997. Cueva Cheve Tablet. *Journal of Cave and Karst Studies*, 59(1):26–32.

Taube, Karl. 1994. The Iconography of Toltec Period Chichen Itza. In *Hidden among the Hills: Maya Archaeology of the Northwest Yucatan Peninsula,* ed. Hans Prem, pp. 212–246. Möckmühl, Germany: Verlag von Flemming.

Taube, Karl. 2012. The Symbolism of Turquoise in Ancient Mesoamerica. In *Turquoise in Mexico and North America: Science, Conservation, Culture and Collections*, ed. J. C. H. King, Max Carocci, Caroline Cartwright, Colin McEwan, and Rebecca Stacey, pp. 117–134. London: Archetype.

Terraciano, Kevin. 2001 *The Mixtecs of Colonial Oaxaca: Ñudzahui History, Sixteen through Eighteenth Centuries*. Stanford, Calif.: Stanford University Press.

Thibodeau, Alison, Leonardo López Luján, David J. Killick, Francis F. Berdan, and Joaquin Ruiz. 2018. Was Aztec and Mixtec Turquoise Mined in the American Southwest? *Science Advances*, 4:1–8. https://doi.org/10.1126/sciadv.aas9370

Torquemada, Juan de. 1976. *Monarquía Indiana*. Mexico City: Universidad Nacional Autónoma de México.

Troike, Nancy. 1978. Fundamental Changes in the Interpretation of Mixtec Codices. *American Antiquity*, 43:553–568. https://doi.org/10.2307/279489

Urcid, Javier. 2005. Sacred Landscapes and Social Memory: The Ñuiñe Inscriptions in the Ndaxagua Natural Tunnel, Tepelmeme, Oaxaca. FAMSI Research Report. http://www.famsi.org/reports/03068/03068Urcid01.pdf (accessed 24 October 2018).

Valadez Azúa, Raul. 1989. Restos animales encontrados en la cueva de Santa Ana Teloxtoc. In *Las máscaras de la cueva de Santa Ana Teloxtoc*, ed. Ernesto Vargas, pp. 143–150. Mexico City: Universidad Nacional Autónoma de México.

Vargas, Ernesto, ed. 1989. *Las máscaras de la cueva de Santa Ana Teloxtoc*. Mexico City: Universidad Nacional Autónoma de México.

Vargas, Ernesto, and Fernando Cortés de B. 1989. Arqueología de la cueva. In *Las máscaras de la cueva de Santa Ana Teloxtoc*, ed. Ernesto Vargas, pp. 97–106. Mexico City: Universidad Nacional Autónoma de México.

Vargas, Ernesto, Sergio Suarez, and Fernando Cortés de B. 1989. El material: Máscaras, escudos, cuchillos y jícaras. In *Las máscaras de la cueva de Santa Ana Teloxtoc*, ed. Ernesto Vargas, pp. 107–141. Mexico City: Universidad Nacional Autónoma de México.

Williams, Robert L. 2009. *Lord Eight Wind of Suchixtlan and the Heroes of Ancient Oaxaca: Reading History in the Codex Zouche-Nuttall*. Austin: University of Texas Press.

Winter, Marcus C. 1984. La cueva de Tenango, descubrimientos arqueologicos en la Sierra Mazateca de Oaxaca. Paper presented at the Symposium Oaxaca, Guadalajara, Mexico.

Smithsonian Collections, Lucayan Histories: The Research Potential of Legacy Collections from The Bahamas and Turks and Caicos Islands

Joanna Ostapkowicz,[1] Alice C. S. Knaf,[2,3] and Gareth R. Davies[2]*

INTRODUCTION

The collections of the Smithsonian Institution's National Museum of the American Indian (NMAI) and National Museum of Natural History (NMNH) collectively hold nearly 900 prehistoric ceramic, shell, and stone artifacts from The Bahamas and Turks and Caicos Islands (TCI), constituting some of the largest concentrations of Lucayan[1] material culture held outside the two island nations. The Lucayans were the Indigenous cultures inhabiting the archipelago of more than 700 islands and cays when Columbus made his landfall on Guanahani (San Salvador) on 12 October 1492; their histories have been relegated to little more than a footnote in the accounts of European expansion in the New World, before more "profitable" cultures were encountered and exploited. The Lucayans are thought to have disappeared entirely from the region by circa AD 1520 because of slave raids and the spread of old-world diseases—although like their neighbors to the south, some may have survived beyond that period (Berman et al., 2013:275; Schulting et al., 2021). Once slaving expeditions could find no islanders to fulfil their quotas, the beautiful, but harsh, limestone archipelago held little interest to the Spanish, and the islands were only sparsely resettled by European immigrants and African slaves from the seventeenth century, and indeed, many remain sparsely inhabited today.

As settlements increased in the nineteenth century and entrepreneurial ventures, including guano mining, gained momentum, Lucayan material culture—including large wooden *duhos* (ceremonial chairs), celts, and monolithic axes—was recovered, largely from caves, spurring interest in the archaeology of the region. The earliest documented collections of Lucayan "antiquities" were made in the 1880s, some of which eventually entered the collections of George Gustav Heye, the founder of what is now the NMAI. The first professional archaeologist to visit the region in 1911, Theodoor de Booy, was in Heye's employ by 1912, and he also donated some of his excavated material to the U.S. National Museum (now the NMNH). Through various donors the two sister institutions continued to acquire Lucayan artifacts until around 1960. Given their history, these are among the most important holdings from the region, with several unparalleled examples of the region's artistry. Until recently, however, they have rarely been displayed and have not been the subject of detailed study.

[1] School of Archaeology, University of Oxford, 36 Beaumont Street, OX1 2PG, UK.

[2] Faculty of Science, Geology and Geochemistry Cluster, Vrije Universiteit Amsterdam, De Boelelaan 1081, W & N Building, 1081 HV Amsterdam, Netherlands.

[3] Currently at Institute for the Preservation of Cultural Heritage, 300 Heffernan Drive, Building 900, West Haven, Connecticut 06516, USA.

* Correspondence: Joanna.Ostapkowicz@arch.ox.ac.uk

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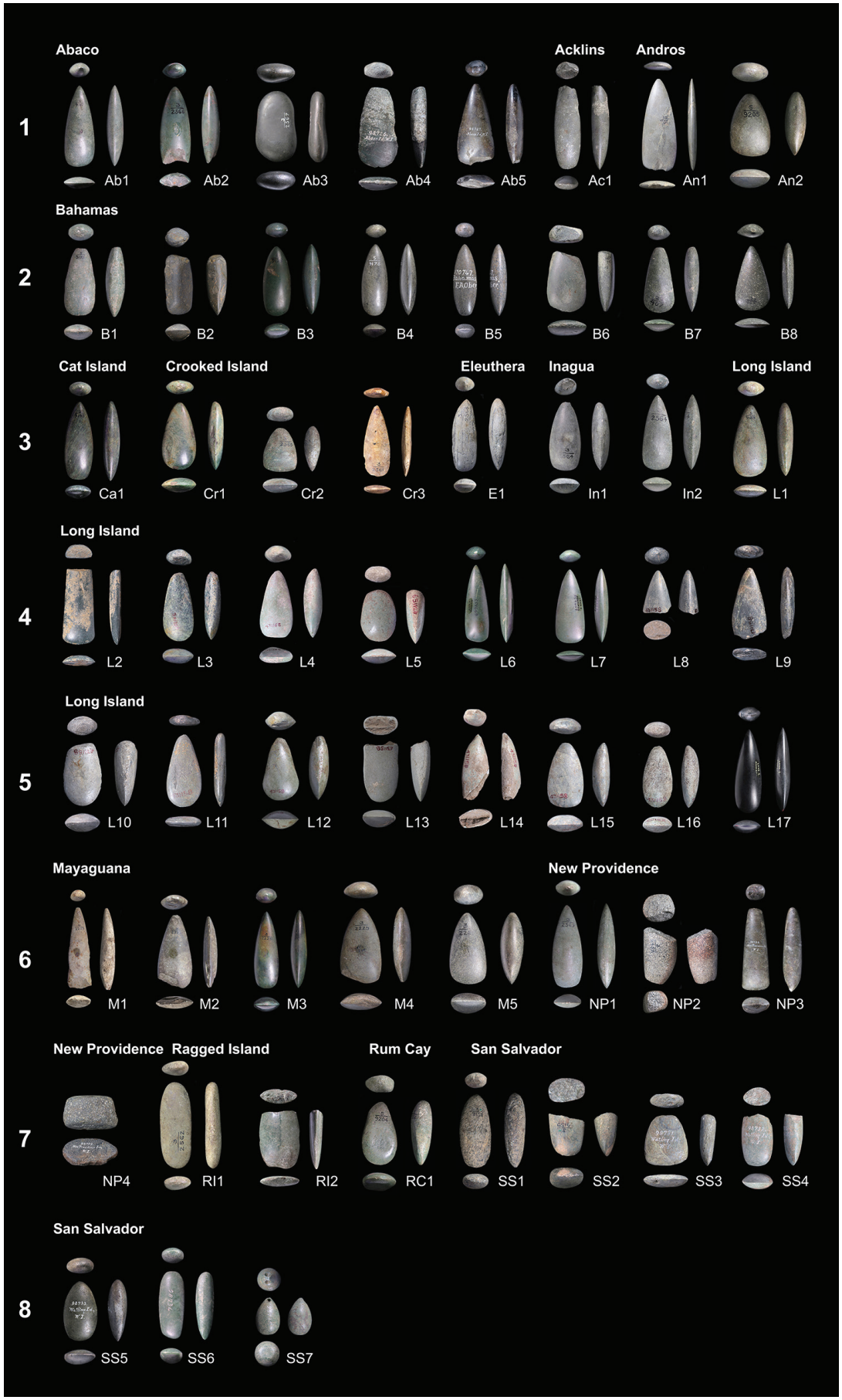
1
Abaco
Ab1
Ab2
Ab3
Ab4
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Acklins
Ac1
Andros
An1
An2
2
Bahamas
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B2
B3
B4
B5
B6
B7
B8
3
Cat Island
Ca1
Crooked Island
Cr1
Cr2
Cr3
Eleuthera
E1
Inagua
In1
In2
Long Island
L1
4
Long Island
L2
L3
L4
L5
L6
L7
L8
L9
5
Long Island
L10
L11
L12
L13
L14
L15
L16
L17
6
Mayaguana
M1
M2
M3
M4
M5
New Providence
NP1
NP2
NP3
7
New Providence
NP4
Ragged Island
RI1
RI2
Rum Cay
RC1
San Salvador
SS1
SS2
SS3
SS4
8
San Salvador
SS5
SS6
SS7

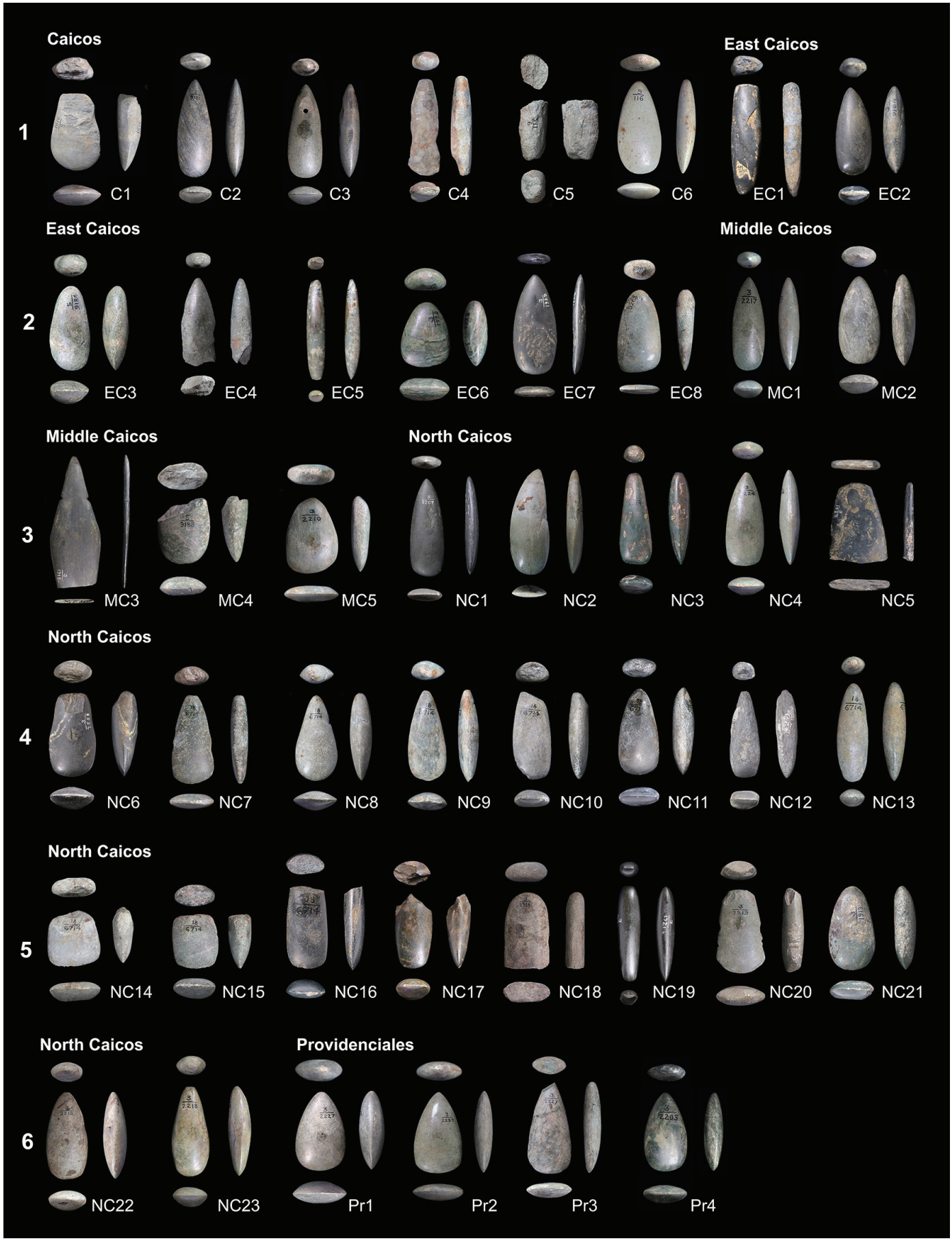
FIGURE 1. (*Opposite*) Bahamian stone celts and tools listed in alphabetical order by island; artifacts not to scale. Codes listed (e.g., Ab1) for individual artifacts correspond to details in Table 1 (measurements, materials, etc.). **Row 1: Abaco:** Ab1, NMAI 059187; Ab2, NMAI 032566; Ab3, NMAI 032567; Ab4, NMNH A098726; Ab5, NMNH A098727. **Acklins:** Ac1, NMAI 032559. **Andros:** An1, NMAI 059201; An2, NMAI 059205. **Row 2: Bahamas:** B1, NMAI 059175A; B2, NMAI 059175B; B3, NMAI 059175C; B4, NMAI 059175D; B5, NMNH A170747; B6, NMAI 059176. B7, NMAI 220407A; B8, NMAI 220407B. **Row 3: Cat Island:** Ca1, NMAI 059198. **Crooked Island:** Cr1, NMAI 059200.00; Cr2, NMAI 032560; Cr3, NMAI 032561. **Eleuthera:** E1, NMAI 032568. **Inagua:** In1, NMAI 032564A; In2, NMAI 032564B. **Long Island:** L1, NMAI 059189. **Row 4:** L2, NMNH A431165A; L3, NMNH A431165B; L4, NMNH A431165C; L5, NMNH A431159; L6, NMNH A554668; L7, NMNH A554669; L8, A431158A; L9, NMNH A431158B. **Row 5:** L10, NMNH A431158C; L11, NMNH A431158D; L12, NMNH A431158E; L13, NMNH A431158F; L14, NMNH A431158G; L15, NMNH A431158H; L16, NMNH A431158I; L17, NMNH A0554667. **Row 6: Mayaguana:** M1, NMAI 032229A; M2, NMAI 032229B; M3, NMAI 032229C; M4, NMAI 032229D; M5, NMAI 032229E. **New Providence:** NP1, NMAI 032569; NP2, NMAI 036458.00; NP3, NMNH A098728. **Row 7:** NP4, NMNH A098729. **Ragged Island:** RI1, NMAI 032562; RI2, NMAI 032563. **Rum Cay:** RC1, NMAI 059204. **San Salvador:** SS1, NMAI 059158; SS2, NMAI 059159; SS3, NMNH A098731; SS4, NMNH A098732. **Row 8:** SS5, NMNH A098733; SS6, NMNH A098734; SS7, NMNH A098735. Photos by Ostapkowicz, courtesy of the institutions listed.

This essay explores the research potential of but one aspect of the Lucayan collections: the stone artifacts, particularly the petaloid celts[2] made of igneous and metamorphic rock (Figures 1–3). As part of project SIBA (Stone Interchanges within the Bahama Archipelago), all stone artifacts attributed in museum records to The Bahamas/TCI underwent detailed documentation, photography, and a variety of analyses in an effort to better understand their morphology, petrology, and, ultimately, their geological source (origin, or provenience, as opposed to their subsequent history, or provenance). The resulting total of 115 celts and other hard-stone objects (26 [17 jadeite–omphacite jades] from the NMNH collections, 89 [56 jadeite–omphacite jades] from the NMAI)[3] comprise roughly one-third of the approximately 350 artifacts in SIBA's entire corpus, which spans eight international museums, including the national museums of The Bahamas and TCI. The study's premise is simple: in an entirely limestone environment like The Bahamas/TCI, all hard stone had to be imported, and our objective is to determine the source of these exotics. Integrating studies that combine the arts with both traditional (portable X-ray fluorescence spectrometry [pXRF], electron probe microanalyzer/scanning electron microscopy [EPMA/SEM]) and state-of-the-art minimally invasive laser ablation sampling for trace element and isotope analyses (Knaf et al., 2017), we aim to address the wider social, political, and economic connections between the archipelago and its wider Caribbean setting. Early museum collections offer a unique opportunity to study artifacts that are now rarely encountered in the archaeological record; in The Bahamas, such artifacts were mainly deposited in caves that were largely cleared during guano mining in the nineteenth century. As Krieger (1937:96) noted in the 1930s, "The removal of cave deposits consisting of bat guano and a reddish compact clay for use as fertilizer has been instrumental in destroying much archaeological data in the form of pottery and skeletal material." Museum collections are therefore an integral component when looking at the wider archaeological context for these islands: without them, we lose connection to a large and important body of material.

Below we explore some of the histories of the Smithsonian Bahamian/TCI collections and introduce how these artifacts reflect the stone resources imported into the region. Although some of the analyses are still underway (inductively coupled plasma–mass spectrometry [ICP-MS] and EPMA/SEM) and thus beyond the remit of this essay, the material identifications (Tables 1–3) together with the pXRF results (Appendix) presented here contribute not only to the documentation of important museum holdings but, ultimately, to building a better understanding of the people who inhabited the Lucayan archipelago and how they traded and communicated across the wider Caribbean.

LUCAYAN STONE ARTIFACTS IN SMITHSONIAN COLLECTIONS: HISTORIES AND PROVENANCE

The Smithsonian collections of Lucayan stone material culture[4] were accessioned between 1886 and 1961; see Ostapkowicz (2015) for earlier acquisitions of Lucayan wood carvings, such as the *duho* donated by W. M. Gabb in 1877. George Heye both acquired private, legacy collections, such as that of Lady Edith Blake, purchased in 1917, and supported expeditions into The Bahamas/TCI, such as de Booy's survey of the Lucayan archipelago;[5] both served the ultimate aim of enhancing the holdings of the Museum of the American Indian, Heye Foundation (MAI), the precursor to the NMAI. The U.S. National Museum (now NMNH) benefited from the government-sponsored expeditions, such as that of the U.S. Commission of Fish and Fisheries (USFC) *Albatross*, which traveled through The Bahamas in 1886, acquiring natural history specimens, conducting archaeological excavations, and purchasing artifacts. Herbert Krieger's excavated materials, from fieldwork carried out in 1936/1937 across several Bahamian islands and in 1947 on Long Island and Exuma, were transferred to the NMNH's Division of Archaeology in 1961. Smaller collections were acquired via donations or purchases, such as a celt (NMNH A170747; Figure 1, Table 1, B5) from "The Bahamas" via Frederick A. Ober, who wrote *In*


Caicos
East Caicos
1
C1
C2
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C5
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EC1
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East Caicos
Middle Caicos
2
EC3
EC4
EC5
EC6
EC7
EC8
MC1
MC2
Middle Caicos
North Caicos
3
MC3
MC4
MC5
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NC2
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NC5
North Caicos
4
NC6
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NC9
NC10
NC11
NC12
NC13
North Caicos
5
NC14
NC15
NC16
NC17
NC18
NC19
NC20
NC21
North Caicos
Providenciales
6
NC22
NC23
Pr1
Pr2
Pr3
Pr4

FIGURE 2. (*Opposite*) Turks and Caicos stone celts and tools listed by island in alphabetical order; artifacts not to scale. Codes listed (e.g., C1) for individual artifacts correspond to details in Table 2 (measurements, materials, etc.). Note that NMAI 031922A was not photographed and is omitted from this composite image; for artifact details, see Table 2. **Row 1: Caicos:** C1, NMAI 059181A; C2, NMAI 059181B; C3, NMAI 059181.001; C4, NMAI 059182; C5, NMAI 090115; C6, NMAI 090116. **East Caicos:** EC1, NMAI 059183; EC2, NMAI 059184. **Row 2:** EC3, NMAI 051984.001; EC4, NMAI 031917; EC5, NMAI 031918; EC6, NMAI 031920; EC7, NMAI 031922B; EC8, NMAI 059203. **Middle Caicos:** MC1, NMAI 032217; MC2, NMAI 031914. **Row 3:** MC3, NMAI 031915; MC4, NMAI 059188; MC5, NMAI 032210. **North Caicos:** NC1, NMAI 059207; NC2, NMAI 060000; NC3, NMAI 032224A; NC4, NMAI 032224B; NC5, NMAI 031923. **Row 4:** NC6, NMAI 032558; NC7, NMAI 186714A; NC8, NMAI 186714B; NC9, NMAI 186714C; NC10, NMAI 186714D; NC11, NMAI 186714E; NC12, NMAI 186714F; NC13, NMAI 186714G. **Row 5:** NC14, NMAI 186714H; NC15, NMAI 186714I; NC16, NMAI 186714J; NC17, NMAI 032226; NC18, NMAI 031916; NC19, NMAI 031921; NC20, NMAI 032219; NC21, NMAI 031919. **Row 6:** NC22, NMAI 032218A; NC23, NMAI 032218B. **Providenciales:** Pr1, NMAI 032227A; Pr2, NMAI 032227B; Pr3, NMAI 032227C; Pr4, NMAI 032205. Photos by Ostapkowicz, courtesy of the institutions listed.

FIGURE 3. Carved ornamental and ceremonial stone artifacts recovered from The Bahamas and Turks and Caicos Islands. Further details are given in Table 3. (a) Anthropomorphic celt, Great Inagua, NMAI 113518. (b) Anthropomorphic celt, Betsy Bay, Mayaguana, NMAI 032228. (c) Monolithic axe, Conch Bar Caves, Middle Caicos, NMAI 059138. (d) Monolithic axe, Juba Point, Providenciales, NMAI 031913. (e) Anthropomorphic pendant, Kew, North Caicos, NMAI 032200. (f) Anthropomorphic pendant, Caicos, NMAI 059238. (g) Anthropomorphic pendant, Bimini, NMAI 059139. (h) Stone bird's head, New Providence, NMAI 032565. (i) Coral bird/skull carving, Eastern Plana Cay, Acklins, NMAI 032230. Photos by Ostapkowicz, courtesy of the institutions listed.

TABLE 1. History and material overview of Bahamian stone celts and implements held in the collections of the National Museum of the American Indian (NMAI) and National Museum of Natural History (NMNH). The codes (e.g., Ab1) align with the respective artifact images in Figure 1. Because of space restrictions, the NMAI accession numbers have been abbreviated to the first six digits, dropping the ".000" suffix (unless it is distinguished by a unique number). Collector USFC = U.S. Commission of Fish and Fisheries. The detailed visual descriptions are by Gareth Davies and Alice Knaf. Abbreviations in parentheses indicate specific testing methods used: EPMA/SEM = electron probe microanalysis/scanning electron microscopy; LA = laser ablation; all artefacts listed underwent pXRF (= portable X-ray fluorescence), with the data presented in Table A2.

Code	Institution	Accession no.	Provenance	Artifact	Collector, accession date	Dimensions (L × W × D, mm)	Visual description
Ab1	NMAI	059187	Cedar Cove, Cedar Harbour, Little Abaco	Celt	Lady Edith Blake, 1917	150 × 55 × 32	**Omphacite jade:** homogeneous equigranular texture, omphacite overgrowing jade; 60% omphacite, 40% jadeite, 3% iron oxides. (LA)
Ab2	NMAI	032566	Cedar Cove, Cedar Harbour, Little Abaco	Celt fragment	Theodoor de Booy, 1912	83 × 33 × 20	**Omphacite jade:** 70% omphacite, medium to fine grained, equigranular. (LA, EPMA/SEM)
Ab3	NMAI	032567	Cedar Cove, Cedar Harbour, Little Abaco	Abrader	Theodoor de Booy, 1912	99 × 56 × 27	**Omphacite jade:** fine-grained black color, omphacite rich, heterogeneous replacement of omphacite by jadeitite (25%), and local vein texture.
Ab4	NMNH	A098726	Abaco	Reworked celt?	USFC, 1886	122 × 60 × 25	**Omphacite jade:** dark-green color, equigranular, with 2% white mica; weak fabric; 10% of remnant pyroxenes preserved from protolith; 65% omphacite, 25% jadeite, <1% iron oxides/sulfide. (LA), pXRF conducted on omphacite-poor and -rich regions.
Ab5	NMNH	A098727	Abaco	Celt	USFC, 1886	154 × 70 × 33	**Meta-dolerite:** metamorphosed dolerite.
Ac1	NMAI	032559	Spring Point, Acklins	Celt fragment	Theodoor de Booy, 1912	197 × 63 × 42	Jadeitized tuff: texture of fine-grained matrix containing poorly sorted grains overprinted.
An1	NMAI	059201	Long Bay Cays, South Andros	Celt	Lady Edith Blake, 1917	125 × 46 × 13	**Blueschist:** granular, brown-gray color, medium to fine grained and foliated; garnet bearing, bands of glaucophane and jadeite overprinting a garnet-bearing blueschist? (LA)
An2	NMAI	059205	Mangrove Cay, Andros	Celt	Lady Edith Blake, 1917	57 × 37 × 19	**Jadeitized meta-tuff:** jadeite and omphacite bearing, medium grained with accessory amphibole + plagioclase + micas, tuffaceous texture jadeitized.
B1	NMAI	059175A	Bahamas	Celt	Lady Edith Blake, 1917	91 × 41 × 26	**Jadeite jade:** gray-brown color; weak fabric defined by omphacite and pyroxene; groundmass is 70% jadeite, 30% omphacite. (LA)
B2	NMAI	059175B	Bahamas	Celt	Lady Edith Blake, 1917	62 × 26 × 19	**Metaba-salt:** dark-gray, fine-grained meta-basalt with original ophitic textured overgrown by greenschist metamorphic minerals.

TABLE 1. (*Continued*)

Code	Institution	Accession no.	Provenance	Artifact	Collector, accession date	Dimensions (L × W × D, mm)	Visual description
B3	NMAI	059175C	Bahamas	Celt	Lady Edith Blake, 1917	69 × 28 × 18	**Omphacite jade:** well-polished elongated celt: gray-green color, fine to medium grained, intergrowth of jadeite and omphacite; 70% omphacite. (LA)
B4	NMAI	059175D	Bahamas	Celt	Lady Edith Blake, 1917	58 × 22 × 14	**Jadeite jade:** highly polished gray-brown rock with a fabric and bands of black pyroxene; groundmass medium grained; 60% jadeite, 40% pyroxene, being 50:50 omphacite and black phase. (LA)
B5	NMNH	A170747	Bahamas	Celt	Frederick A. Ober, 1895	60 × 20 × 14	**Omphacite-bearing jadeite jade with residual meta-magmatic texture:** medium-grained light-gray high-pressure/low-temperature meta-magmatic rock; weak fabric to equigranular; fabric caused by black pyroxene/amphiboles in thin veins, 20% remnant pyroxenes, possibly up to 30% jadeite overprinting; up to 10% iron oxides + sulfides; exact protolith unclear.
B6	NMAI	059176	Bahamas	Celt	Lady Edith Blake, 1917	94 × 58 × 24	**Omphacite jade:** homogeneous rock; medium grained with weak fabric; omphacite-rich groundmass surrounding jadeite grains. (LA, EPMA/SEM)
B7	NMAI	220407A	Bahamas	Celt	Dr. Edgar Bruke, M. M. Schwab, and A. B. Lee, 1952	117 × 55 × 28	**Omphacite-jadeite jade:** medium- to coarse-grained granular impure jade with no fabric; 50% omphacite, 50% jadeite. (LA)
B8	NMAI	220407B	Bahamas	Celt	Dr. Edgar Bruke, M. M. Schwab, and A. B. Lee, 1952	156 × 83 × 28	**Meta-gabbro:** greenschist facies medium- to coarse-grained mafic gabbro.
Ca1	NMAI	059198	Cat Island	Celt	Lady Edith Blake, 1917	113 × 41 × 24	**Omphacite jade:** highly deformed, banded, omphacite-rich (<70%) jade; medium to fine grained, generally equigranular texture despite strong fabric. (LA)
Cr1	NMAI	059200	Crooked Island	Celt	Lady Edith Blake, 1917	71 × 37 × 17	**Omphacite-jadeite jade:** extremely heterogeneous fabric, varies from omphacite rich (>75%) to 70% jadeite. (LA)
Cr2	NMAI	032560	Cripple Hill, Crooked Island	Celt	Theodoor de Booy, 1912	71 × 54 × 26	**Omphacite-jadeite jade:** deformed, locally mylonitic, foliated medium grained, intergrowth of omphacite and jadeite with 10% white mica; 60% omphacite, 30% jadeite. (LA)
Cr3	NMAI	032561	Fairfield, Crooked Island	Celt	Theodoor de Booy, 1912	82 × 31 × 11	**Carbonate/limestone:** calcite, maybe coral, certainly organic origin.

TABLE 1. (*Continued*)

Code	Institution	Accession no.	Provenance	Artifact	Collector, accession date	Dimensions (L × W × D, mm)	Visual description
E1	NMAI	032568	Spanish Wells, Saint Georges Island, Eleuthera	Celt	Theodoor de Booy, 1912	101 × 34 × 25	**Jadeitized blueschist:** fine- to medium-grained, strongly foliated, partially jadeitized (15%) blueschist.
In1	NMAI	032564A	Northeast Point, Great Inagua	Celt	Theodoor de Booy, 1912	113 × 52 × 30	**Omphacite-jadeite jade:** medium to coarse grained, omphacite rich (70%), 25% jadeitite; weak fabric.
In2	NMAI	032564B	Northeast Point, Great Inagua	Celt	Theodoor de Booy, 1912	99 × 40 × 23	**Meta-dolerite/gabbro:** metamorphosed dolerite/gabbro, partially jadeitized, original pyroxenes partially preserved.
L1	NMAI	059189	Long Island	Celt	Lady Edith Blake, 1917	99 × 47 × 23	**Jadeite omphacite jade:** medium to coarse grained, weak fabric; replacement textures of jadeite and omphacite replacing plagioclase (25%); 5% iron oxides, 50% jadeite, 20% omphacite. (LA)
L2	NMNH	A431165A	Long Island	Chisel/adze	Herbert W. Krieger, 1961	111 × 48 × 18	**Meta-magmatic rock:** dark blue/gray, medium-grained granular texture; strong metamorphic overprint causes diffuse grain boundaries, black pyroxene/omphacite groundmass, feldspar and quartz recrystallizing to omphacite, 2%–3% iron oxides/sulfides.
L3	NMNH	A431165B	Long Island?	Celt	Herbert W. Krieger, 1961	86 × 38 × 20	**Omphacite jade:** fine- to medium-grained omphacite-rich (75%) jade; weakly banded, contains 2% remnant pyroxenes, 2%–3% iron oxides/sulfides; texture is generally granular. (LA)
L4	NMNH	A431165C	Long Island	Celt	Herbert W. Krieger, 1961	95 × 47 × 26	**Meta-tuff:** fine-grained, metamorphosed tuff, pale-green color, local patchy development of jadeite veinlets, no fabric.
L5	NMNH	A431159	Long Island	Celt	Herbert W. Krieger, 1961	78 × 54 × 26	**Jadeite jade:** granular fine-grained rock, weak fabric, jadeite replacing omphacite, 70% jadeite, no sulfides/iron oxides. (LA)
L6	NMNH	A554668	Long Island	Celt	Herbert W. Krieger, 1961	106 × 33 × 19	**Omphacite jadeite jade:** omphacite rich (~70%) rock; fine grained, dark-green color, band of dark omphacite, some fractures, weak fabric, jadeite overprinting omphacite. (LA)
L7	NMNH	A554669	Long Island	Celt	Herbert W. Krieger, 1961	83 × 33 × 16	**Omphacite-jadeite jade:** dark-green color, fine to medium grained, 50% jadeite, 50% omphacite, equigranular with three to four bands of omphacite. (LA)
L8	NMNH	A431158A	Hamilton Cave, Long Island	Celt	Herbert W. Krieger, 1961	57 × 38 × 27	**Omphacite jade:** fine grained, dark gray, omphacite rich (75%), with weak fabric, overprinted by patches of medium-grained jadeite.

TABLE 1. (*Continued*)

Code	Institution	Accession no.	Provenance	Artifact	Collector, accession date	Dimensions (L × W × D, mm)	Visual description
L9	NMNH	A431158B	Hamilton Cave, Long Island	Celt	Herbert W. Krieger, 1961	89 × 43 × 18	**Omphacite jade:** dark gray, weak fabric, fine to medium grained, generally equigranular; development of omphacite (70%) and jadeite in veins and patches.
L10	NMNH	A431158C	Hamilton Cave, Long Island	Celt	Herbert W. Krieger, 1961	63 × 38 × 23	**Meta-tuff:** brown/gray, metamorphosed tuff, patches of fine and medium grained, diffuse grain boundaries.
L11	NMNH	A431158D	Hamilton Cave, Long Island	Celt	Herbert W. Krieger, 1961	66 × 32 × 10	**Omphacitite:** dark gray, very omphacite rich (~80%); strong fabric, fine to medium grained. (LA)
L12	NMNH	A431158E	Hamilton Cave, Long Island	Celt	Herbert W. Krieger, 1961	82 × 48 × 26	**Meta-siltstone:** light-green, metamorphosed siltstone, polished surface, fine grained, 5% iron oxides/sulfides, iron staining on weathered surface.
L13	NMNH	A431158F	Hamilton Cave, Long Island	Celt	Herbert W. Krieger, 1961	78 × 45 × 26	**Greenschist:** gray/beige, granular, fine to medium grain size with no clear fabric but includes small veinlets; majority of rock is a mix of multiple generations of amphiboles; possible gray jadeite between gray-green amphiboles. (LA, EPMA/SEM)
L14	NMNH	A431158G	Hamilton Cave, Long Island	Celt	Herbert W. Krieger, 1961	85 × 34 × 24	**Omphacite-jadeite jade:** jadeite, with some chrome-rich green omphacite; medium- to coarse-grained equigranular texture despite a weak fabric; 50% jadeite; 50% omphacite; green chrome diopside area has higher titanium, chrome, manganese; and iron compared to the rest of the rock. (LA, EPMA/SEM)
L15	NMNH	A431158H	Hamilton Cave, Long Island	Celt	Herbert W. Krieger, 1961	64 × 36 × 18	**Jadeite jade:** fabric of omphacite veins, patches that are enriched in jadeite; later very thin veins crosscutting filled with amphibole or pyroxenes; overall, 60% jadeite. (LA)
L16	NMNH	A431158I	Hamilton Cave, Long Island	Celt	Herbert W. Krieger, 1961	67 × 33 × 20	**Omphacite jade:** equigranular, with very weak fabric; 60% omphacite, local overprint of black amphiboles, patches up to 2 mm. (LA)
L17	NMNH	A554667	Long Island	Celt	Herbert W. Krieger, 1961	139 × 45 × 27	**Omphacite jade:** fine-grained black jade, equigranular but with a clear fabric, jadeite uniformly distributed throughout but omphacite and dark pyroxene rich (70%).
M1	NMAI	032229A	Betsy Bay, Mayaguana	Celt	Theodoor de Booy, 1912	154 × 46 × 27	**Jadeitite:** equigranular texture, 90% jadeite, locally retains metamorphic pyroxenes from protolith (2%–3%).

TABLE 1. (*Continued*)

Code	Institution	Accession no.	Provenance	Artifact	Collector, accession date	Dimensions (L × W × D, mm)	Visual description
M2	NMAI	032229B	Betsy Bay, Mayaguana	Celt	Theodoor de Booy, 1912	138 × 66 × 27	**Jadeitite:** no fabric, equigranular medium-grained, jadeitite with 20% omphacite. (LA)
M3	NMAI	032229C	Betsy Bay,	Celt	Theodoor de Booy, 1912	109 × 36 × 24	**Omphacitejade:** dark green, omphacite rich (60%), fine to medium grained, generally equigranular with weak fabric; heterogeneous with variation in pyroxene composition from more Cr-rich diopside (locally up to 50%) to almost black omphacite and pale jadeitite; highly polished. (LA)
M4	NMAI	032229D	Betsy Bay, Mayaguana	Celt	Theodoor de Booy, 1912	83 × 45 × 21	**Omphacite-jadeite jade:** Pale-brown color, medium-grained, generally equigranular but weak fabric defined by dark omphacite; 50% jadeite, 50% omphacite.
M5	NMAI	032229E	Betsy Bay, Mayaguana	Celt	Theodoor de Booy, 1912	59 × 31 × 19	**Omphacite-jadeite jade:** equigranular texture of jadeite overprinting omphacite (50% jadeite, 50% omphacite); fabric defined by omphacite bands.
NP1	NMAI	032569	New Providence	Celt	Theodoor de Booy, 1912	133 × 49 × 30	**Jadeitite:** medium grained, equigranular with no fabric; jadeite rich (>80%). (LA)
NP2	NMAI	036458	New Providence	Mano/ grinding stone fragment	Benjamin W. Arnold, 1914	146 × 80 × 86	**Diorite:** quartz diorite, coarse grained, minor greenschist overprinting.
NP3	NMNH	A098728	New Providence	Celt/hoe	USFC, 1886	193 × 63 × 45	**Meta-tuff:** metamorphosed and silicified tuff/siltstone.
NP4	NMNH	A098729	New Providence	Rubbing stone	USFC, 1886	68 × 99 × 51	**Diorite:** medium-grained diorite with plagioclase porphyroclasts.
RI1	NMAI	032562	Ragged Island	Abrader	Theodoor de Booy, 1912	92 × 33 × 17	**Meta-rhyolite:** metamorphosed fine-grained rhyolite, groundmass = fine to medium grained, rounded pyroxenes (20%), no fabric.
RI2	NMAI	032563	Ragged Island	Celt fragment	Theodoor de Booy, 1912	125 × 87 × 30	**Omphacite jade:** heterogeneous intergrowth of jade and omphacite, ~60% omphacite, 3% mica, 30% jadeite, 3% iron oxides. (LA, EPMA/SEM)
RC1	NMAI	059204	Rum Cay	Celt	Lady Edith Blake, 1917	62 × 25 × 19	**Omphacitite:** heterogeneous with two halves: (1) extremely fine grained intergrown jadeite + omphacite, (2) massive omphacite, fine grained, some black pyroxenes? survived from protolith. (LA)
SS1	NMAI	059158	San Salvador	Celt	Lady Edith Blake, 1917	99 × 43 × 27	**Gabbro:** coarse-grained deformed gabbro.

TABLE 1. (*Continued*)

Code	Institution	Accession no.	Provenance	Artifact	Collector, accession date	Dimensions (L × W × D, mm)	Visual description
SS2	NMAI	059159	San Salvador	Celt fragment	Lady Edith Blake, 1917	35 × 31 × 20	**Omphacite-jadeite jade:** equigranular rock with replacement textures of jadeite (35%) overprinting omphacite >60%; thin (1–2 mm) jadeitite vein. (LA, EPMA/SEM)
SS3	NMNH	A098731	San Salvador	Celt	USFC, 1886	55 × 48 × 16	**Omphacite-jadeite jade:** rock with some chrome rich omphacite; medium- to coarse-grained equigranular texture despite weak fabric; 50% jadeite, 50% omphacite; green chrome diopside area has higher titanium, chrome, manganese, and iron compared to the rest of the rock. (LA)
SS4	NMNH	A098732	San Salvador	Celt	USFC, 1886	62 × 38 × 23	**Omphacite jade:** shaft broken off; fine to medium grained, omphacite rich; equigranular texture with weak fabric; jadeite replacing omphacite + omphacite veins; 70% omphacite. (LA, EPMA/SEM)
SS5	NMNH	A098733	San Salvador	Celt	USFC, 1886	69 × 39 × 21	**Meta-tuff?:** light gray, fine to medium grained, mottled equigranular texture, remnant pyroxenes (>10%), local jade overprinting (<20%) metamorphosed tuff or impure siltstone.
SS6	NMNH	A098734	San Salvador	Chisel	USFC, 1886	51 × 20 × 13	**Omphacitite:** medium-grained omphacite-rich (80%) jade, equigranular, fabric caused by jadeite-rich patches, extensive replacement textures, minor fracturing, <1% iron oxides/sulfide. (LA)
SS7	NMNH	A098735	San Salvador	Pendant?	USFC, 1886	31 × 20 × 20	**Omphacite jade:** fine- to medium-grained, equigranular rock, 60% omphacite, weak fabric defined by omphacite replacement textures; well-polished, 3% iron oxides/sulfide. (LA)

TABLE 2. History and material overview of the Turks and Caicos Islands (TCI) stone celts and implements held in the collections of the National Museum of the American Indian (NMAI). The codes (e.g., C1) align with the respective artifact images in Figure 2. Note that the N/P code listed for NMAI 031922A is a reference to the celt not undergoing photography; it is omitted from Figure 2 but its details are provided here. Because of space restrictions, the NMAI accession numbers have been abbreviated to the first six digits, dropping the ".000" suffix (unless it is distinguished by a unique number). The detailed descriptions are by Gareth Davies or Alice Knaf. Abbreviations are the same as in Table 1.

Code	Accession no.	Provenance	Artifact	Collector, accession date	Dimensions (L × W × D, mm)	Detailed description
C1	059181A	TCI	Celt	Lady Edith Blake, 1917	54 × 35 × 16	**Meta-volcanic rock:** broken hilt: weak fabric, granular texture, fine to medium grained, partially (~10%) jadeitized, volcanic rock with blueschist remnants.
C2	059181B	TCI	Celt	Lady Edith Blake, 1917	94 × 33 × 18	**Blueschist:** fine- to medium-grained, strongly foliated retrogressed garnet blueschist; local banding and veins, with green pyroxene possible kosmochlor; partially jadeitized. (LA)
C3	059181.001	TCI	Celt	Lady Edith Blake, 1917	76 × 28 × 17	**Jadeite-omphacite jade:** equigranular, medium grained with a replacement fabric; 5% black pyroxenes within groundmass of 65% jadeite, 30% omphacite. (LA)
C4	059182	TCI	Celt fragment	Lady Edith Blake, 1917	133 × 43 × 29	**Meta-tuff:** very fine grained greenschist facies meta-tuff.
C5	090115	Caicos	Maul/hammer head	Mrs. Theodoor de Booy, 1919	48 × 28 × 22	**Omphacite-jadeite jade:** foliated, 50% omphacite, 50% jadeite, 5% white mica, medium to fine grained, equigranular. (LA, EPMA/SEM)
C6	090116	Caicos	Celt	Mrs. Theodoor de Booy, 1919	74 × 35 × 14	**Jadeite-omphacite jade:** fine-grained equigranular intergrowth of jadeite (70%) + omphacite. (LA)
EC1	059183	Breezy Point, East Caicos	Abrader/ grinding stone	Lady Edith Blake, 1917	96 × 26 × 15	**Eclogite?:** dark-gray color, medium-grained equigranular texture, very weak fabric, omphacite rich (85%), possible garnets.
EC2	059184	Breezy Point, East Caicos	Celt	Lady Edith Blake, 1917	58 × 24 × 15	**Omphacitite:** dark gray/black, omphacite rich (80%), equigranular with very weak fabric. (LA)
EC3	059184.001	Breezy Point, East Caicos	Celt	Lady Edith Blake, 1917	53 × 25 × 17	**Omphacitite:** heterogeneous dark gray/black, omphacite rich (>80%); generally equigranular despite weak fabric.
EC4	031917	Flamingo Hill, East Caicos	Celt fragment	Theodoor de Booy, 1912	149 × 56 × 36	**Meta-sandstone:** greenschist facies impure sandstone, mix of angular fragments, poorly sorted, includes coarse grains; possible volcanic tuff.
EC5	031918	Flamingo Hill, East Caicos	Celt	Theodoor de Booy, 1912	101 × 19 × 16	**Tuff:** fine-grained silica-rich tuff, mottled appearance due to patches of greenschist overprinting.
EC6	031920	Flamingo Hill, East Caicos	Celt	Theodoor de Booy, 1912	35 × 26 × 12	**Omphacite-jadeite jade:** foliated-banded, omphacite rich; medium grained, varies from 90% omphacite to 50% jadeite. (LA)

TABLE 2. (*Continued*)

Code	Accession no.	Provenance	Artifact	Collector, accession date	Dimensions (L × W × D, mm)	Detailed description
N/P	031922A	Flamingo Hill, East Caicos	Celt	Theodoor de Booy, 1912	99 × 50 × 28	**Omphacite-jadeite jade:** black, fine grained equigranular but mineralogy defines with weak foliation and banding; varies from >80% omphacite to 50% jadeite. (LA)
EC7	031922B	Flamingo Hill, East Caicos	Celt	Theodoor de Booy, 1912	80 × 36 × 11	**Omphacitite jade:** dark gray/black, omphacite rich (80%), fine grained equigranular, weak fabric, 20% jadeite.
EC8	059203	Jacksonville, East Caicos	Celt	Lady Edith Blake, 1917	75 × 40 × 17	**Jadeite-omphacite jade:** fine to medium grained equigranular with jadeite (40%) overprinting omphacite (35%) and igneous/metamorphic pyroxenes (25%); weak fabric.
MC1	032217	Bambara, Middle Caicos	Celt	Theodoor de Booy, 1912	69 × 24 × 16	**Jadeite-omphacite jade:** equigranular jadeitized replacement textures with weak fabric, 30% omphacite, 70% jadeitite. (LA)
MC2	031914	Indian Hill, Lorimers, Middle Caicos	Celt	Theodoor de Booy, 1912	122 × 98 × 54	**Dolerite/gabbro:** medium grained equigranular but heterogeneous mineral distribution, weak fabric, meta-dolerite/gabbro; recrystallized minerals replaced by jadeite and omphacite
MC3	031915	Lorimers, Middle Caicos	Pointed object fragment	Theodoor de Booy, 1912	142 × 54 × 7	**Gabbro:** fine-grained deformed mafic gabbro, local Cr-diopside, partially overprinted by omphacite.
MC4	059188	Lorimers, Middle Caicos	Celt	Lady Edith Blake, 1917	48 × 41 × 19	**Omphacite jade:** foliated, medium grained, bands of jadeite (30%), crosscutting omphacite groundmass, white mica in patches (10% in total), 60% omphacite.
MC5	032210	Lorimers, Middle Caicos	Celt	Theodoor de Booy, 1912	56 × 38 × 14	**Omphacite jade:** foliated, medium grained, bands of pale jadeite (35%), crosscutting green omphacite groundmass, mainly equigranular texture despite foliation; 65% omphacite. (LA)
NC1	059207	North Caicos	Celt	Lady Edith Blake, 1917	99 × 35 × 14	**Omphacite jade:** fine grained dark gray with jadeite (25%) randomly overgrowing a weak fabric, 75% omphacite. (LA)
NC2	060000	North Caicos	Hafted axe	Lady Edith Blake, 1917	153 × 57 × 19	**Jadeite-omphacite jade:** light-gray-green colored, foliated fine to medium grained with layering defined by apple-green omphacite (30%) with jadeite (70%) showing replacement textures. (LA)
NC3	032224A	Belmont, North Caicos	Celt	Theodoor de Booy, 1912	83 × 29 × 20	**Omphacitite:** dark-green/blue-gray color with weak fabric, fine- to medium-grained equigranular texture; 85% omphacite. (LA)
NC4	032224B	Belmont, North Caicos	Celt	Theodoor de Booy, 1912	77 × 32 × 17	**Jadeite-omphacite jade:** equigranular, medium grained, no fabric, 60% jadeite, 30% omphacite, 10% dark pyroxenes? (LA)

TABLE 2. (*Continued*)

Code	Accession no.	Provenance	Artifact	Collector, accession date	Dimensions (L × W × D, mm)	Detailed description
NC5	031923	Bottle Creek, North Caicos	Celt fragment	Theodoor de Booy, 1912	80 × 59 × 10	**Omphacitite:** dark-gray color with weak fabric, fine-grained equigranular texture; 85% omphacite.
NC6	032558	Bottle Creek, North Caicos	Celt fragment	Theodoor de Booy, 1912	64 × 36 × 20	**Omphacitite:** dark gray/black, fine to medium grained, omphacite rich (>75%) with well-developed foliation defined by jadeite veins.
NC7	186714A	Bottle Creek, North Caicos	Celt	B. B. Duncanson, 1934	110 × 52 × 22	Omphacite jade: dark-gray green, equigranular, medium grained, weak fabric, 65% omphacite. (LA)
NC8	186714B	Bottle Creek, North Caicos	Celt	B. B. Duncanson, 1934	91 × 46 × 23	**Omphacite jade:** medium grained equigranular with weak fabric; omphacite rich (~75%); fine-grained jadeite in groundmass. (LA)
NC9	186714C	Bottle Creek, North Caicos	Celt	B. B. Duncanson, 1934	87 × 37 × 19	**Omphacite-jadeite jade:** medium- to coarse-grained impure jade, white mica, fabric with banding and foliation, 65% omphacite, 35% jade. (LA)
NC10	186714D	Bottle Creek, North Caicos	Celt	B. B. Duncanson, 1934	80 × 34 × 18	**Jadeite jade:** medium-grained jadeite-rich equigranular groundmass, overprinting mafic minerals: dark grains, irregular-shaped pyroxene, 70% jadeite, 20% pyroxene, and 10% omphacite. (EPMA/SEM)
NC11	186714E	Bottle Creek, North Caicos	Celt	B. B. Duncanson, 1934	76 × 35 × 18	**Omphacitite:** fine to medium grained, dark gray, equigranular, omphacite rich (80%); weak fabric.
NC12	186714F	Bottle Creek, North Caicos	Celt	B. B. Duncanson, 1934	80 × 28 × 19	**Omphacitite:** foliated black fine- to medium-grained equigranular rock, veins of jadeitite, 90% omphacite.
NC13	186714G	Bottle Creek, North Caicos	Celt	B. B. Duncanson, 1934	73 × 23 × 12	**Omphacite-jadeite jade:** equigranular medium grained, heterogeneous distribution of jadeite and omphacite (overall, ~40:60). (LA)
NC14	186714H	Bottle Creek, North Caicos	Celt	B. B. Duncanson, 1934	42 × 41 × 16	**Tuff:** fine-grained tuff/siltstone.
NC15	186714I	Bottle Creek, North Caicos	Celt	B. B. Duncanson, 1934	51 × 43 × 21	**Omphacite-jadeite jade:** massive dark gray, medium grained equigranular, 5% white mica, 50% omphacite, 50% jadeite, weak fabric and thin (1 mm) jadeite veins. (LA, EPMA/SEM)
NC16	186714J	Bottle Creek, North Caicos	Celt	B. B. Duncanson, 1934	54 × 27 × 14	**Omphacite jade:** dark-gray medium-grained granular omphacite-rich jade, partially replacing pyroxenes.
NC17	032226	Kew, North Caicos	Celt fragment	Theodoor de Booy, 1912	62 × 31 × 21	**Jadeite and/or omphacite jade:** repaired with broken surface, heterogeneous foliated with bands of jadeite and omphacite, equigranular texture, 60% jadeite, 40% omphacite; locally, jadeite overgrows omphacite. (LA, EPMA/SEM)

TABLE 2. (*Continued*)

Code	Accession no.	Provenance	Artifact	Collector, accession date	Dimensions (L × W × D, mm)	Detailed description
NC18	031916	Sandy Point, North Caicos	Mano/grinding stone fragment	Theodoor de Booy, 1912	90 × 55 × 24	**Meta-tuff:** greenschist/amphibolite facies meta-tuff or sandstone.
NC19	031921	Sandy Point, North Caicos	Celt	Theodoor de Booy, 1912	70 × 17 × 14	**Omphacitite:** massive black, fine grained equigranular but with weak foliation; >80% omphacite.
NC20	032219	Smith's, North Caicos	Celt	Theodoor de Booy, 1912	73 × 43 × 19	**Jadeitite jade;** fractured light-gray meta-volcanic rock partly jadeitized with some remaining dark pyroxenes, locally maximum 60% jadeite, 20% omphacite.
NC21	031919	Whitby, North Caicos	Celt	Theodoor de Booy, 1912	57 × 31 × 15	**Omphacite-jadeite jade:** fine to medium grained, dark green, equigranular with general banding; heterogeneous with omphacite-rich cutting end and jadeite-rich hilt; overall, 60% omphacite. (LA)
NC22	032218A	Windsor, North Caicos	Celt	Theodoor de Booy, 1912	100 × 48 × 27	**Jadeite-omphacite jade:** medium grained, buff colored, equigranular with weak fabric; ~20% omphacite defines a weak lineation in a jadeite matrix. (LA)
NC23	032218B	Windsor, North Caicos	Celt	Theodoor de Booy, 1912	68 × 28 × 17	**Jadeite-omphacite jade:** fine grained, foliated and banded, green (omphacite) and buff (jadeite) colored, cut by later dark irregular omphacite veins; omphacite (40%) and jadeite (60%). (LA)
Pr1	032227A	Blue Hills, Providenciales	Celt	Rev. Thomas Huckerby, 1910	64 × 41 × 18	**Omphacite-jadeite jade:** dark-blue/gray medium-grained complex intergrowth of omphacite and jadeite, ~50:50, locally mafic pyroxenes? preserved and development of small chrome diopsides/kosmochlor?; weak fabric. (LA)
Pr2	032227B	Blue Hills, Providenciales	Celt	Rev. Thomas Huckerby, 1910	71 × 42 × 16	**Omphacite-jadeite jade:** light green/green, fine grained with weak fabric, 50% jadeite and 50% omphacite. (LA)
Pr3	032227C	Blue Hills, Providenciales	Celt	Rev. Thomas Huckerby, 1910	93 × 45 × 19	**Jadeite-omphacite blueschist jade:** equigranular, dark-gray to brown color, partly jadeitized blueschist. Omphacite and glaucophane pyroxenes make up 60%, retrogressed garnets? (LA, EPMA/SEM)
Pr4	032205	Kingston, Providenciales	Celt	Theodoor de Booy, 1912	58 × 32 × 14	**Omphacite-jadeite jade:** heterogeneous, fine to medium grained, dark green, foliated with jadeite patches and replacement veins; mixture of 60% omphacite, 40% jadeite. (LA)

TABLE 3. Carved (ornamental or ceremonial) artifacts from The Bahamas and Turks and Caicos Islands (TCI) in the collections of the National Museum of the American Indian (NMAI). Because of space restrictions, the NMAI accession numbers have been abbreviated to the first six digits, dropping the ".000" suffix. The detailed descriptions are by Gareth Davies or Alice Knaf. Abbreviations are as in Table 1.

Code	Accession no.	Provenance	Artifact	Collector, accession date	Dimensions (L × W × D, mm)	Detailed description
Figure 3a	113518	Great Inagua, Bahamas	Anthropomorphic celt	Charles A. Sargent, 1922	250 × 112 × 52	**Amphibolite:** greenschist/amphibolite facies meta-basalt, fine to medium grained, no fabric.
Figure 3b	032228	Betsy Bay, Mayaguana, Bahamas	Anthropomorphic axe head	Theodoor de Booy, 1912	139 × 70 × 44	**Meta-tuff:** volcanic tuff or siltstone/fine sandstone, greenschist metamorphosis, larger amphiboles, iron oxides, pyroxenes.
Figure 3c	059138	Conch Bar Caves, Conch Bar, Middle Caicos, TCI	Monolithic axe	Lady Edith Blake, 1917	197 × 87 × 23	**Amphibolite:** foliation, gray green, fine grained, dark-green minerals, altered pyroxenes and amphiboles plagioclase and quartz-bearing amphibolite.
Figure 3d	031913	Juba Point, Providenciales, TCI	Monolithic axe	Theodoor de Booy, 1912	191 × 91 × 23	**Jadeitized meta-siltstone:** gray-green, fine-grained heterogeneous meta-siltstone, strong fabric rotates larger grains into foliation, locally jadeitized, granular. (LA)
Figure 3e	032200	Kew, North Caicos, TCI	Anthropomorphic pendant	Stanley Jones, 1913	116 × 44 × 55	**Diorite:** plagioclase-rich diorite, 35% pyroxene, greenschist overprint, partly turns pyroxene to chlorite, plagioclase recrystallized.
Figure 3f	059238	Caicos, TCI	Anthropomorphic pendant	Lady Edith Blake, 1917	96 × 33 × 35	**Meta-magmatic rock:** dioritic quartz veins, feldspar + pyroxenes, medium/coarse grained, minor metamorphic overprint.
Figure 3g	059139	Bimini, Bahamas	Anthropomorphic pendant	Lady Edith Blake, 1917	69 × 33 × 23	**Sandstone:** massive medium- to fine-grained calcareous-rich immature sandstone.
Figure 3h	032565	New Providence, Bahamas	Bird head effigy	Theodoor de Booy, 1912	66 × 59 × 77	**Basalt:** fine-grained alkali-rich basalt with ~2% phenocrysts of pyroxene and plagioclase.
Figure 3i	032230	Eastern Plana Cay, Acklins, Bahamas	Carving	Theodoor de Booy, 1912	47 × 35 × 36	**Coral:** organic limestone/carbonate.

the Wake of Columbus (Ober, 1893) and was instrumental in securing archaeological materials for Chicago's World Columbian Exposition in 1893. B. B. Duncanson's collection of 10 stone celts and ceramics from Bottle Creek, North Caicos, was acquired in 1934 by the MAI (Figure 2, Table 2, NC7–16). Further, several stone artifacts from private collections were sent to the U.S. National Museum for assessment and for casting, including a hafted celt from North Caicos sent in 1877, with the original eventually entering the collection of the MAI via Lady Edith Blake (cast: NMNH A30248-9 [see Mason, 1877]; artifact: NMAI 060000 [see Figure 5]), and a bird-shaped maul owned by Gerrit S. Miller Jr., sent in 1924 (NMNH A326757). The collections span the archipelago—from Grand Bahama and Abaco in the north to East Caicos in the south (Figure 4). Some of the larger collections are discussed below to give select background on the development of archaeological investigation in the region.

Lady Edith Blake (Active: ~1884–1897; NMAI Collections)

The NMAI holds among the earliest and most important collections of Lucayan material culture, acquired between 1884 and 1897 by Lady Edith Blake (b. 1846, d. 1926), wife of Henry Arthur Blake, governor of The Bahamas (1884–1887) and governor of Jamaica (1888–1897, when the TCI were a dependency of Jamaica). Lady Blake had a keen interest in the prehistory of the islands (Howard, 1956:45) and was "most enthusiastic and indefatigable [in her studies] . . . She herself visited a small cave in the interior of the island of New Providence and had superintended the excavations which resulted in the discovery of the fragments of two Lucayan skeletons" (Brooks, 1887:216).[6] She visited many of the islands, including Rum Cay, where she compiled the first descriptions and illustrations of the Hartford Cave petroglyphs (Smithsonian Archives, image MAH-3572; [Mallery, 1893]). While in The Bahamas, Lady Blake "made exhaustive collections of Indian relics . . . industriously collecting Indian antiquities" (Ober, 1894:284). Indeed, Frederic Ober (1893:77) lamented that between the 1886 visit of the U.S. *Albatross* expedition, which "found many antiquities of value," and Sir H. Blake's (i.e., Lady Blake's) "thorough exploration of every island of his extensive province" when governor of The Bahamas, he "could entertain but little hope of finding anything of importance, following in their wake." But even when she was in Jamaica—where she published articles on Jamaican archaeology (Blake, 1890) and inspired, with her support and enthusiasm, the work of J. E. Duerden (1897) and Frank Cundall of the Institute of Jamaica (Howard, 1956:45)—she maintained an interest in Lucayan prehistory. She undoubtedly had a hand in helping to organize the first archaeological exhibition of Turks and Caicos materials as part of the Jamaica Exhibition of 1891 (Gibbs, 1878). This exhibition featured artifacts from George J. Gibbs's collection, many of which "were found in the Caicos caves, when these were excavated for guano manure. . . . The principal item was a *duho* of hard red wood found in the Caicos in July 1887. Several stone [celts] were also available as well as a Lucayan idol in the form of an iguana . . . [and] items of pottery, . . . shell necklaces and sling shot stone balls" (Sadler, 1997:29). Lady Blake's connections to the region's major collectors, including Gibbs, a Grand Turk resident (whose collection was later acquired by New York's American Museum of Natural History), enabled her to keep abreast of Lucayan findings, and her prominence in this field, together with her husband's administration of TCI from Jamaica, may have spurred continued donations of "finds" to her, even when she was resident in Jamaica. Her active years of collecting Lucayan material are here assumed to also span the Jamaican years, hence 1884–1897.

In addition to the remarkable wood carvings that formed part of her collection (see Ostapkowicz, 1998, 2015; Ostapkowicz et al., 2012), including a complete hafted celt with wooden handle (Figure 5),[7] Lady Blake's collection features 30 stone artifacts relevant to the SIBA project. They range from two anthropomorphic stone pendants to 25 celts (both complete and fragmentary), two hoes, and one monolithic "axe." Their provenance extends throughout the archipelago, ranging from Bimini in the western extreme of The Bahamas to Andros and Abaco in the north and Long Island in the south. Although she is known to have visited many of the islands personally, it is not clear whether any of the artifacts in her collection were acquired in investigations she conducted (given her active role in excavations in both The Bahamas and Jamaica) or whether they were offered as gifts from collectors during her tours of the region or at her residence in Nassau, where official visitors were entertained. Archaeological material from the Turks and Caicos was sent to the Jamaica Exhibition of 1891, and indeed, one of the pieces featured there—the hafted celt—must have been offered to Lady Blake by Mr. Murphy, an entrepreneur and resident of Grand Turk, whose workmen found it in 1877 in a cave during commercial guano mining excavations (Gibbs, 1878). Interestingly, the TCI material is the best documented, referencing specific sites, including Jacksonville and Breezy Point in East Caicos and Lorimers and Conch Bar Cave in Middle Caicos. Jacksonville and Breezy Point, the source of four petaloid celts, housed the employees of the East Caicos Sisal Company from 1891. Guano mining and sisal plantations were the main economic activities for TCI during the late nineteenth and early twentieth centuries; with considerable manpower invested in working both caves and land, it is not surprising that many archaeological discoveries were made at this time. It is equally unsurprising that entrepreneurs, aware of Lady Blake's interest in archaeology, sent her artifacts as gifts, perhaps in efforts to garner support for their ventures. Such politicized exchanges of pre-Columbian artifacts were certainly known elsewhere in the Caribbean (Ostapkowicz et al., 2013; Ostapkowicz, 2015).

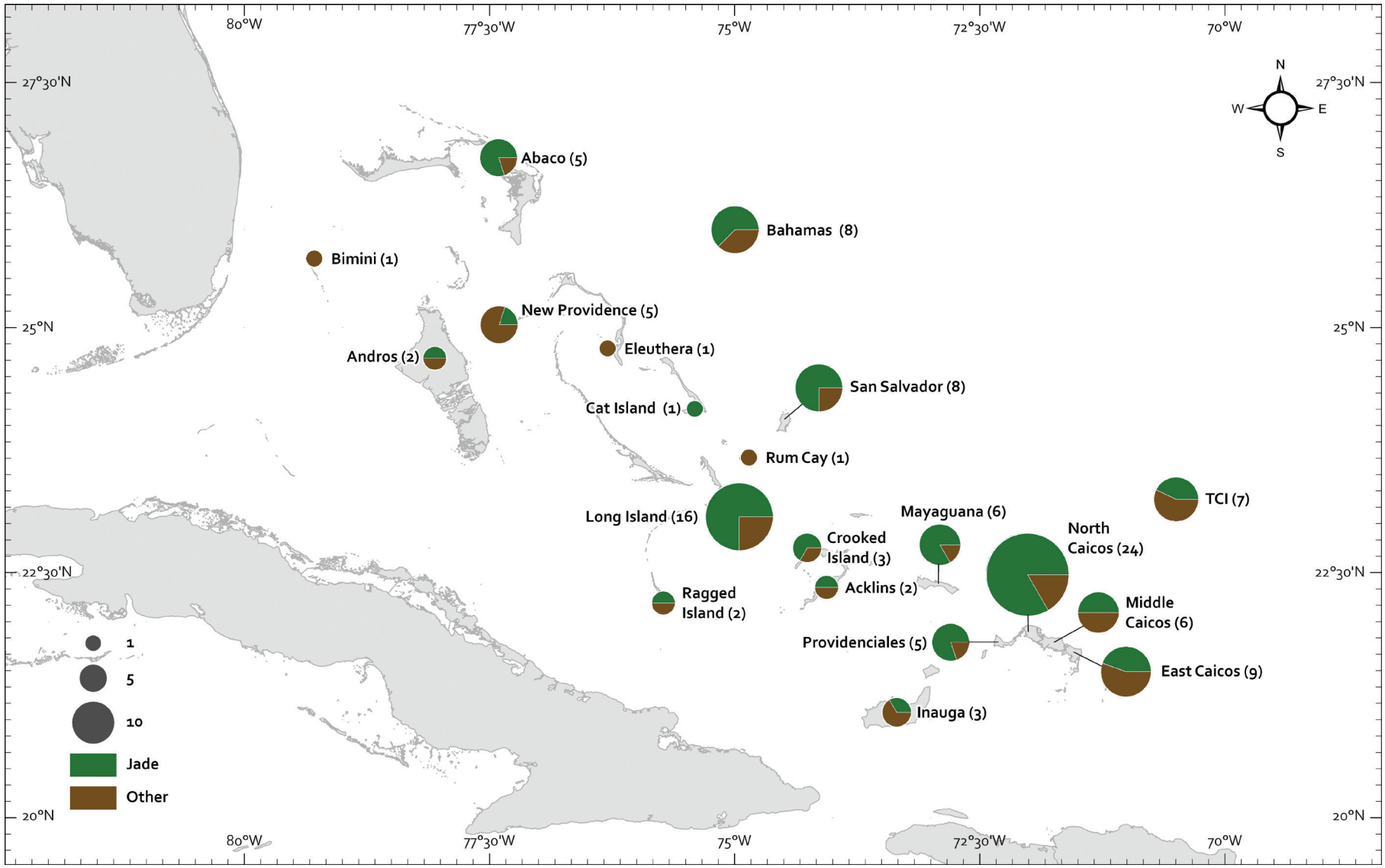

FIGURE 4. Distribution of selected stone materials from the Lucayan archipelago in the Smithsonian collections by island (see Figures 1–3, Tables 1–3). Map courtesy of John Pouncett.

FIGURE 5. Hafted celt, originally part of the Murphy collection, found "in a cave at The Caicos Islands" with the handle "broken, but the wood however is a good state of preservation" (George J. Gibbs to Smithsonian Secretary, Joseph Henry, 1 March 1877; 30 April 1877, National Anthropological Archives, MS.7173). *Guaiacum* sp., calAD 1029–1160 (calibrated years AD; OxA-19172 [Oxford Radiocarbon Accelerator unit]; Ostapkowicz et al., 2012). Length: 555 mm; width: 60 mm; depth: 55 mm Photo by Ostapkowicz, courtesy of the National Museum of the American Indian, NMAI 060000.

USFC *Albatross* Expedition to The Bahamas (1886; NMNH Collections)

The USFC made several expeditions to document the fisheries of various nations (Stevenson, 1903:597), including The Bahamas. Between 27 February and 9 March 1886, part of the expedition team was left on San Salvador to carry out fieldwork, including the excavation of a cave where human remains were recovered, now accessioned into the NMNH collections and part of a separate study (Schulting et al., 2021). They also acquired celts, most likely through purchase: "We procured a number of stone implements during our stay. These the negroes call thunderbolts, believing that they fall with the lightening, and are very loath to part with them" (Lee, 1889:661).

A week later, they visited Nassau and were hosted by the Blakes: "Mrs. Blake had a very fine collection of stone implements, from various islands, and a lignum-vitae stool [*duho*] from a cave on Rum Cay" (Lee 1889:662). Here, too, they acquired two stone implements—one a rubbing stone and the other a hoe—again, most likely through purchase or perhaps gift. Two further celts were acquired from Abaco. In total, nine stone artifacts from The Bahamas were acquired by the Smithsonian after the expedition: five from San Salvador (four of which are jadeite- and omphacite-rich jades and are undergoing laser ablation sampling and trace element analyses; see Figure 1, Table 1, SS3–4, SS6–7), two from Abaco (both jadeite- and omphacite-rich jades, one of which has been selected for laser ablation sampling and trace element analyses; Figure 1, Table 1, Ab4), and two from New Providence. One of these, a celt fragment, has been selected for EPMA/SEM (Figure 1, Table 1, SS4).

Theodoor de Booy (Active: 1911–1912; NMAI and NMNH Collections)

Theodoor de Booy (b. 1882; d. 1919) was an influential early Caribbean archaeologist whose interest in prehistory was spurred by his visit to the Turks and Caicos in 1911, where he devoted "much time to the exploration of . . . numerous caves and mounds" (Saville, 1919:182; Curet 2018:6). Although his professional background up to that point is not clear, his time in the Caicos, specifically his interest in what was at this stage a completely unknown archaeological region, served as a starting point for his career. His work in 1911 (de Booy, 1912) and his subsequent return to The Bahamas for six months from June 1912 (de Booy, 1913), under the sponsorship of George Heye, are recognized as the first "professional" archaeological survey of the region. Archaeology as a science was in its infancy at this time, its overriding goal being to secure interesting and aesthetically pleasing specimens with little regard to stratigraphy or context (e.g., Curet, 2018:27). But although de Booy's investigation secured some remarkable single finds (e.g., a canoe paddle from Mores Island), he did not neglect to describe the context of grouped objects, like the monolithic axe from a cave near Juba Point, Providenciales[8] (now TCI's most inhabited island with historic and modern development irrevocably damaging pre-Columbian sites). De Booy and his contemporaries Jesse Walter Fewkes and Mark Raymond Harrington were highly regarded for the work they undertook in the Caribbean and elsewhere on behalf of their

respective institutions—although not everyone agreed with their approach to finds. The geologist John A. Bullbrook, the first Caribbean researcher to emphasize the relevance of stratigraphy during his excavations at the Trinidad site of Palo Seco in 1919, had worked with Fewkes and de Booy when they visited Trinidad in 1914 and 1915, respectively. In a letter to Irving Rouse in 1945, he recalled that there was "too much mere specimen hunting and too little science" in their work and that "neither of these researche[r]s was strictly scientific in their method. Among other factors there seems to be no systemised method of excavation and no survey of the excavations . . . also there would seem to have been no attempt to correlate finds – either with mutual position or in relation to depth and area" (Nero and Baptiste, 2015:4). But de Booy was a product of the time; North American archaeology was at the cusp of a significant change in methodology, and his approach—and that of his contemporaries—would quickly fall out of favor. This, however, does not diminish the quite literarily "ground-breaking" work that de Booy did, excavating sites that remain among the most important (in terms of scale and significance) in the region. Nor does it diminish the importance of the collections that are now part of the Smithsonian Institution.

Shortly after his return from TCI in 1911, de Booy donated 15 ceramic sherds from the Caicos and southern Bahamas to the U.S. National Museum (NMNH A263329–38, A271008–12). His work in TCI and subsequent publication (de Booy, 1912) likely brought him to the attention of George Heye, who in 1912 purchased a significant part of de Booy's Caicos collection, and in June of that year de Booy was embarking on six months of fieldwork in The Bahamas on behalf of the Heye Foundation. Whatever his previous profession, his Caicos work changed the trajectory of his life, and he entered the archaeological field full time—something that would keep him busy in Jamaica (fieldwork in 1913), the Dominican Republic (1913, 1914, 1916), Cuba (1914), Trinidad (1915), Puerto Rico (1916), Martinique (1916), and Venezuela (1915, 1918) until his resignation from the MAI in 1918, shortly before his premature death in 1919 of influenza (Saville, 1919; Curet and Galban, 2019).

In total, more than 400 artifacts from The Bahamas/TCI were acquired by the NMAI via de Booy, both directly from his excavations and through his connections (Curet and Galban, 2019). Highlights relevant to SIBA include 34 stone celts and the monolithic Juba Point axe (Figure 3d), all acquired by Heye in 1912 (a small number of objects, including two more celts, was donated to the museum after de Booy's death by his widow in 1919, bringing the total to 36). All are well provenanced, and several can be linked directly to the excavations he documented in his 1912 article. For example, he notes finding "one stone knife of very dark-green jadeite with a cutting edge and highly polished . . . and on which can be seen two small nicks by which to secure a lashing" with 5 fragments of Meillacan ornamented and 12 unornamented sherds at "Indian mounds" 4 miles (ca. 6.4 km) southwest of Lorimers, Middle Caicos (de Booy, 1912:101; Figure 2, Table 2, MC3, NMAI 031915). At neighboring Indian Hill, he found "one exceptionally large stone implement of green jadeite" (Figure 2, Table 2, MC2, NMAI 031914), together with what he considered to be ceramics of "greater antiquity" than any other pottery he had found on the Caicos islands (these appear to be Meillacan-style ceramics, circa AD <800–1500; de Booy, 1912:102). In Sandy Point, North Caicos, he found "one of the most symmetrical and beautiful prehistoric stone implements known to me," a highly polished black chisel (Figure 2, Table 2, NC19, NMAI 031921) in a deposit consisting of a group of turtle bones, both decorated and undecorated sherds, and one brown flint axehead. At Flamingo Hill, East Caicos, several stone celts were found together with ceramics (de Booy, 1912:104; Figure 2, Table 2, EC4–7), including a very fine "jadeite chisel, highly polished, with a cutting edge" (EC5, NMAI 031918), and, from another mound, "a stone implement of light-green jadeite" (EC4, NMAI 031917).

There is also mention of de Booy purchasing a celt in North Caicos (Figure 2, Table 2, NC17, NMAI 032226), and it is possible that he may have purchased others during his surveys. For example, he notes "obtaining a fairly good specimen of Indian implement, made of jadeite and quite well polished" in Whitby, North Caicos (de Booy 1912:96; NC21, NMAI 031919). He clearly had local guides (de Booy, 1912:89), and undoubtedly, word got around that he was interested in local "curiosities." He mentions, for example, "I was told of the finding of stone implements, or 'thunderbolts,' in the neighborhood of a colored settlement called Blue Hills on the northern coast of Providenciales" (de Booy, 1912:93). He acquired an anthropomorphic celt (Figure 3b) from a local farmer in Betsy Bay, Mayaguana, who had given it to his infant daughter as a toy, "with the inevitable result that it was broken" (de Booy, 1913:7). The large (11.5 cm high) figural pendant from Kew, North Caicos (Figure 3e), was acquired in 1913 by Heye from Grand Turk resident W. Stanley Jones—undoubtedly a result of it featuring prominently in de Booy's (1912: pl. VI) publication. De Booy (1916:25) would later call it the "finest example of Antillean stone carving known."

De Booy clearly had an appreciation for indigenous artistry, highlighting the aesthetic qualities of historically documented canoes and *duhos* and stating that "in addition to their high development in ceramics, the implements of the Lucayan people show graceful outlines, some of the jadeite chisels particularly being extremely symmetrical in shape" (de Booy, 1912:87). He proposed a variety of future projects in the region, although, unfortunately, his commitments took him beyond the archipelago; his continued contributions to the archaeology of this region would undoubtedly have yielded important results, particularly at a time when development was irrevocably destroying many archaeological sites.

Herbert W. Krieger (Active: 1936–1947; NMNH Collections)

Herbert Krieger's (b. 1889; d. 1970) first foray into the Bahamian archaeology was in 1936 when he conducted three and a half months of fieldwork (October 1936 to February 1937) on Andros, Berry Islands, New Providence, Eleuthera, Cat Island, Long Island, San Salvador, and Inagua. His fieldwork included an archaeological survey of the archipelago and excavations of prehistoric village sites. He subsequently returned to the Caribbean (the Dominican Republic, Cuba, and The Bahamas) in 1947, when he spent more than four months (January to May) searching for early contact period sites, particularly Christopher Columbus's landfalls. In The Bahamas, he undertook excavations near Glenton, Long Island, and the material he collected was eventually (from 1954 until 2002) displayed in Hall 11 at the U.S. National Museum/NMNH (Figure 6). Apart from a very brief report published in the Smithsonian's *Explorations and Field-work* (Krieger, 1937) and summary overviews for the Smithsonian's Board of Regents (Smithsonian Institution, 1938, 1947), very little is known about Krieger's modus operandi. To date, no field notes or archival information have come to light to better understand his excavation techniques or, indeed, his findings—only a small portion of which appear to have been deposited in the NMNH.[9] Despite Krieger being curator of ethnology between 1924 and 1957 and continuing his affiliation in an honorary capacity into 1963 (Smithsonian Institution, 1964:xi), the "Krieger collection" was not passed to the Division of Archaeology for accessioning until 1961, with the only accompanying data noted on "a slip in each drawer giving the island where it was collected, and in one case, the site on the island" (NMNH accession 142084), something apparently not unusual for material acquired via Krieger (NMNH accession 174999). The absence of relevant documentation for Krieger's Bahamian collections is not an isolated occurrence; Krieger had a reputation for not keeping detailed notes or documenting his finds (e.g., Davis and Oldfield, 2003:1; and not just for his Caribbean work, see Schulting, 1994:196), making assessments of his surviving collection particularly challenging and any understanding of his work in the region now nearly impossible.

The situation is further compounded by the fact that Krieger refused to engage with some Caribbean archaeologists who approached him in efforts to learn more about his work and finds, among them Irving Rouse and Julian Granberry. Rouse, for example, was denied access to the U.S. National Museum (NMNH)'s Haitian collections, which Krieger curated, when he was writing *Prehistory in Haiti* (Rouse, 1939:98; Weeks et al., 1994:81). Among Rouse's archived notes, held at Yale's Peabody Museum of Natural History, is a brief reference to Krieger's 1936/1937 Bahamian fieldwork, simply saying that Krieger "has not described what he found," something echoed by several contemporary and subsequent researchers: "no details were given," "no description," "not enough data," and "no further information available" are repeated comments about Krieger's work (e.g., Granberry, 1955:108, 113, 125, 142, 143, 156). Granberry, who in 1950 started work on his M.A. thesis, "Survey of Bahamian Archaeology" (1955), made several attempts to engage Krieger on his 1936/1937 and 1947 fieldwork seasons. His letters went unanswered over the course of two years, until finally, in 1952, he received a rather terse reply from Krieger indicating that busy museum staff did not answer "personal" letters and that the ethics involved precluded any sharing of data prior to publication by Krieger. Simply put, "my material will not be available until I write my report," a report that has never emerged (Krieger to Granberry, 21 October and 22 October 1952, Herbert William Krieger Papers). Krieger made clear that his Bahamian collection had not been turned over to the Division of Archaeology and hence was still, in essence, his—despite the work being undertaken under the auspices of the U.S. National Museum (indeed, the 1936 fieldwork was funded by a Smithsonian grant; Smithsonian Institution, 1938:28), in contradiction to the institution's standards of filing reports in a timely manner and making fieldwork collections accessible.

A detailed review of the Krieger documents held at the National Anthropology Archives (NAA) yields very little additional information to help contextualize the collections. In the case of the celts from Hamilton's Cave, Long Island, recovered in 1936/1937—the only artifacts with a specific site location—we unfortunately have no information on context. The only (vague) reference to finds at the cave were noted in Krieger's letter to John M. Goggin on 22 May 1952 (Herbert William Krieger Papers, NAA), in which he notes that "a diligent search always yields something. Hamilton's Cave, for example, had several Lucayan artifacts secreted on a ledge, far in the interior." Krieger repeatedly uses the terms "excavated" and "sieved," so some archaeological standards must have been present during the course of his work. For example, he mentions that his Bahamian sites were "all in the interior with the exception of an extensive cave deposit that I excavated and sieved in the backyard of a home in Nassau." He also excavated Hamilton's Cave and Deadman's Key district, Long Island, and Pond Hill, Inagua, and in 1947 he "did considerable excavating at the site near Pratt's Reef in northern Long Island . . . the site of the first Indian village discovered by Columbus [Burnt Ground]."[10] Last, he "recovered materials from so-called banana holes on several islands, [some of which] were used by the Lucayans for burials. The most productive banana holes were on Acklins Island" (Krieger to Goggin, 22 May 1952, Herbert William Krieger Papers, NAA). Unfortunately, the only materials attributed to Krieger's Bahamian work now in the NMNH—a total of 146 artifacts—have a Long Island provenance, with the exception of a single potsherd from "Caicos"; no artifacts are documented as coming from his excavations on Inagua, New Providence, or Acklins Island. Conversely, there are human remains from other islands, such as those collected from the "extreme southern end of Exuma," which are not mentioned in either the 1936/1937 or 1946 expedition report (NMNH accession history for 381747).

Ironically, Krieger (1937:93) seems to have dismissed the excavations conducted by de Booy (1912, 1913) and Froelich Rainey (1934) in The Bahamas/TCI, noting that prior to his work in 1936/1937, "there had been no previous systematic

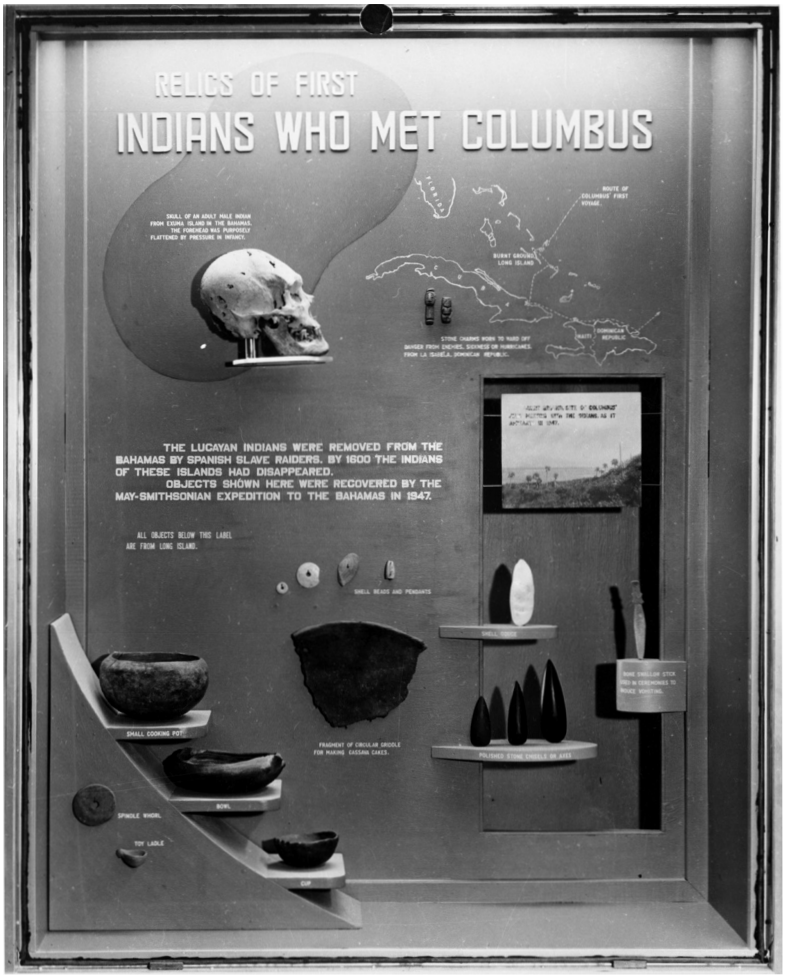

FIGURE 6. Displays of Lucayan artifacts and human remains (left) and a diorama of Columbus's first landfall in The Bahamas (below), organized by Herbert W. Krieger circa 1954 for the U.S. National Museum (now NMNH). The displays, installed more than seven decades ago and taken down in 2002, should be viewed within their historic context; such a display, exhibiting a cranium as if it were an artefact, is no longer considered appropriate by the NMNH. Courtesy of the National Museum of Natural History, Department of Anthropology and National Anthropological Archives.

archaeological work done [in the region]," aside from "sporadic cave finds." Given the comparatively detailed information associated with de Booy's and Rainey's studies—indeed, both could be called "responsible, active, (and) dedicated" researchers who quickly published excavation reports (Curet, 2018:9, reviewing de Booy's contributions)—the comment more aptly applies to Krieger's own lack of systematic effort, following through from excavation to publication. Nevertheless, the artifacts themselves can still provide considerable information. Krieger's nine celts from Hamilton's Cave, for example, have all undergone pXRF as part of this study; five are jadeite–omphacite-rich jades, five of which were selected for laser ablation sampling (L11, L13, L14–16, Figure 1, Table 1). Two broken celts were also selected for the EPMA/SEM study (L13–14, Figure 1, Table 1).

MATERIALS AND METHODS: PRELIMINARY OVERVIEW

Our initial visit to the NMAI (one of two over the course of the project) and our study of the NMNH collections included assessments of rock type by Davies and Knaf based on visual inspection and pXRF analyses. This assessment was followed by minimally invasive laser ablation sampling of jadeite- and omphacite-rich rocks and select blueschists and, for a small number of broken artifacts, sampling for EPMA/SEM (undertaken by Antonio Garcia-Casco, University of Granada). This section provides an overview of the material identifications based on visual inspection and pXRF, as well as an introduction of the laser ablation sampling and the subsequent low-blank geochemical analyses aimed at sourcing the artifacts. Where we use the term jade, we are referring to jadeite and omphacite jade, excluding nephrite jade.

Of the 115 Lucayan stone artifacts in the Smithsonian collections, 106 are celts and implements (Figures 1, 2; for discussion of "ceremonial" carvings, see below). Of these, a total of 74 (the majority celts) are jadeitites and jadeite–omphacite-rich rocks: 6 identified as jadeitites sensu stricto [>90 vol % jadeite] or sensu lato [>75–90 vol % jadeite] and 68 identified as jadeite–omphacite-rich rocks). The remaining 32 celts and functional implements comprise a variety of materials: meta-tuff/tuff (n = 9), meta-gabbro/dolerite (n = 6), meta-volcanic (n = 5), omphacitite (n = 3), blueschist (n = 3), diorite (n = 2), and single examples of each of carbonate/limestone, eclogite, meta-sandstone, and siltstone (Tables 1, 2; Figure 7).

In contrast, none of the nine sculptural (ornamental, ceremonial) artifacts (Figure 3) are made of jade, including anthropomorphic celts (n = 2), monolithic axes (n = 2), anthropomorphic/zoomorphic pendants (n = 3), and small-scale carvings (n = 2). The anthropomorphic celts are carved from amphibolite (Figure 3a, NMAI 113518) and meta-tuff (Figure 3b, NMAI 032228); the monolithic axes are carved from amphibolite (Figure 3c, NMAI 059138) and jadeitized meta-siltstone (Figure 3d, NMAI 031913). The pendants are made of meta-magmatic rock (Figure 3f, NMAI 059238), plagioclase-rich diorite (Figure 3e, NMAI 032200 [not, as often thought, serpentine; de Booy, 1916:27; Dockstader, 1964:249]), and sandstone (Figure 3g, NMAI 059139). The final two carvings are fine-grained basalt (Figure 3h, NMAI 032565) and soft coral (Figure 3i, NMAI 032230).

Jadeitites and jadeite–omphacite-rich rocks constitute roughly 65% of the Smithsonian Bahamian/TCI stone corpus. Although most are a shade of green, there is a wider range of hues and colors (Figure 8), suggesting that selection was likely based on the material's mechanical properties of strength and durability rather than on color alone. Although we have yet to fully understand the criteria used to select certain materials for

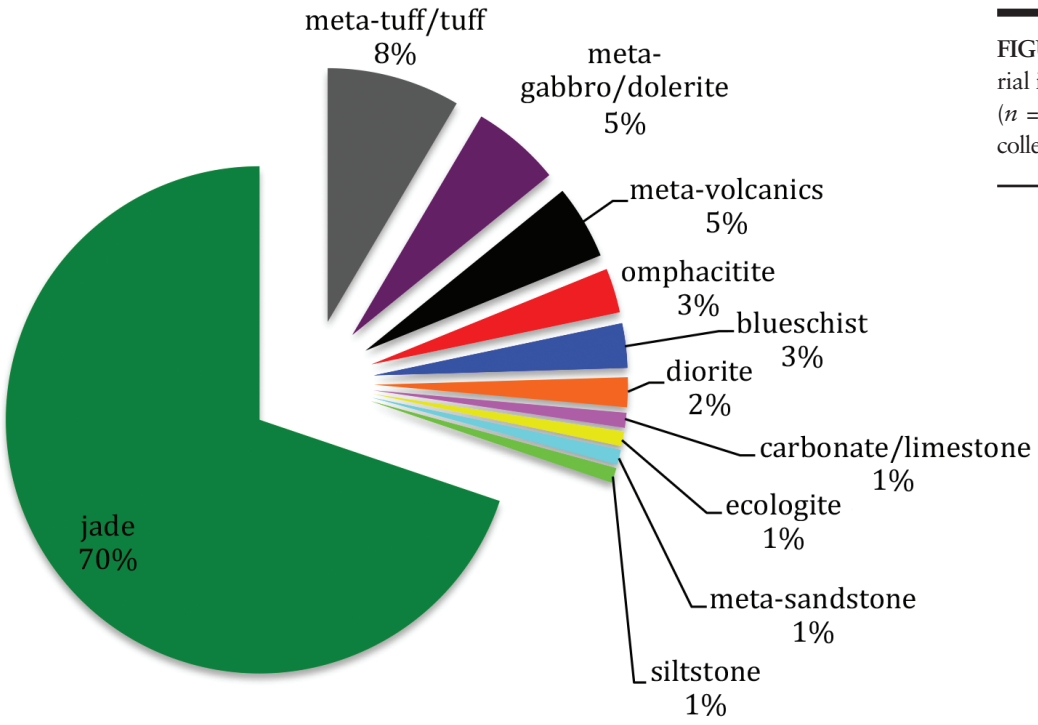

FIGURE 7. Pie chart showing the material identification of celts and implements (n = 106) in the Smithsonian Institution collections. Seventy-four artifacts are jade.

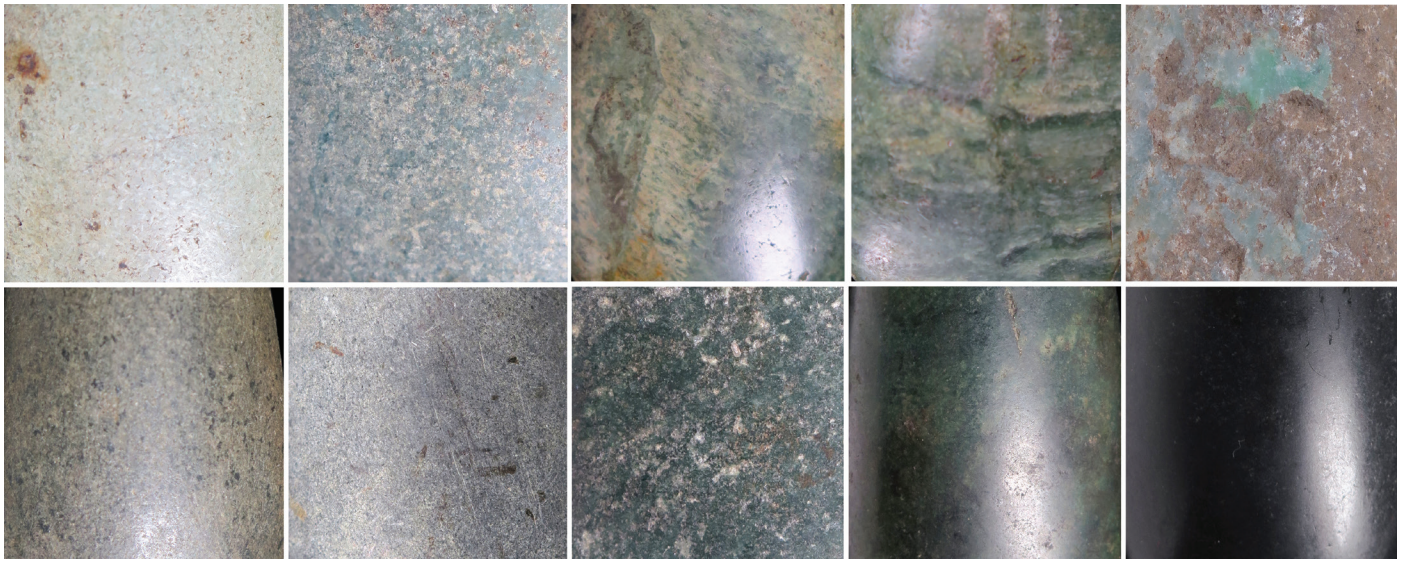

FIGURE 8. Color range of jades: top row, left to right: C6 (NMAI 090116), SS4 (NMNH A098732), Cr1 (NMAI 059200), EC6 (NMAI 031920), and L14 (NMNH A431158G); bottom row, left to right: C3 (NMAI 059181.001), In1 (NMAI 032564A), Ab4 (NMNH A098726), M3 (NMAI 032229C), and L17 (NMNH A0554667). Photos by Ostapkowicz, courtesy of the institutions listed.

certain tasks, it is clear from this corpus that jadeite jade and omphacite jade were overwhelmingly preferred for the manufacture of celts. Whether this was a choice made directly by Lucayans or whether it was made for them via the down-the-line exchange routes that brought the objects (most likely in finished form) to them is difficult to gauge, but this question is beginning to be explored within the wider project.

The term "jade" is widely used in the context of jewelry and archaeological artifacts but with different meanings. Three different minerals can make up the monomineralic rock described as jade. Jadeite is a sodium-rich pyroxene with the composition $NaAlSi_2O_6$ and, for example, forms much of the jade found in Burma (Myanmar) that was and is widely used in Chinese jewelry (jadeite jade). Recently, a second pyroxene, omphacite [$(Ca,Na)(Mg,Fe^{2+},Al)Si_2O_6$], was also officially recognized as a jade (omphacite jade). The third mineral is nephrite, a calcium-, magnesium-, and iron-rich amphibole [$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$]. Nephrite jade occurs in many locations worldwide, for example, in Japan, New Zealand, Russia, and Canada's Pacific Northwest. Despite the different compositions, all three minerals can be pale green in color, but changes in composition, most notably the amount of iron, led to variable color from almost white to lilac to dark green to black. All three minerals are hard and dense, and distinguishing between them simply by eye can be difficult. Jadeite jade and omphacite jade, both present in the Caribbean, are harder and denser and so are generally more suitable for use as durable implements and are likely to have been highly prized.

High-pressure/low-temperature metamorphism (>30 km depth) is required to form all three types of jade. These conditions are generally limited to areas of the planet where one tectonic plate is forced beneath another, referred to as subduction zones (Tsujimori and Harlow, 2012). Jadeite–omphacite jade forms in subduction zones when fluids (e.g., marine pore waters or fluid from the breakdown of hydrous minerals) are released from the subducting oceanic crust. Jadeitite and jadeite–omphacite-rich sources in the Greater Caribbean are all associated with a former subduction zone that was active from the Early Cretaceous (120 Ma) to the Paleogene (55 Ma). As a consequence, all Caribbean sources have similar tectonic settings and formation ages and share many geochemical similarities. Caribbean jades occur as tectonic blocks in serpentinite mélanges in the northern Dominican Republic (Río San Juan Complex; Schertl et al., 2012; Hertwig et al., 2016) and in the Sierra del Convento Mélange, eastern Cuba (García-Casco et al., 2009). The most extensive jade source in the greater Caribbean region occurs north and south of the Motagua Fault Zone (MFZ) in Guatemala (Foshag and Leslie, 1955; Harlow, 1994). Despite general geological similarities among the three sources (four, if one considers two sources in Guatemala, namely, south and north of the MFZ), slightly different ages, protoliths, pressure-temperature conditions of jade formation, and (re) mobilization of different fluid compositions offer the potential to geochemically discriminate sources.

All three types of jade have been reported as artifacts in the Caribbean, but geological sources are limited to jadeitite, jadeite jade, omphacite jade, and omphacitite in Guatemala, Cuba, and the Dominican Republic. In these localities jadeite jade and omphacite jade often occur together, and most artifacts in the study contain various proportions of both minerals. Importantly, geochemical and isotopic studies (Knaf et al., 2021, 2022) have recognized geochemical

distinctions between the three source regions, potentially enabling the determination of the provenience of the jade.

Visual inspection suggested that none of the Bahamian/TCI artifacts under study were formed of nephrite, but analysis was conducted using pXRF to confirm this observation. The data also provide information about the variability of the different lithologies and include an analysis of artifacts made of eclogite and blueschists. The pXRF was used to obtain a general idea about the bulk composition because it can quickly provide a semiquantitative indication of the major chemical components of the sample (for a comparative approach, see Martinez et al., this volume). A Bruker Tracer III-SD supplied by the Museum Conservation Institute was used for the analysis and was operated with a vacuum pump to improve the detection level of MgO. The pXRF was also applied to artifacts for which a clear rock type was not obvious from visual inspection. In most cases in which a lithology could not be assigned visually, the reason was surface weathering obscuring the mineralogy.

The benefits of the pXRF technique are that it (1) is quick (~60 s), (2) is nondestructive, and (3) allows analyses of the sample in situ without any sample preparation. The pXRF method does, however, have major limitations and cannot detect light major elements (e.g., Na and Mg detection is limited even when the instrument is operated with a vacuum pump; Shackley, 2011). In addition, trace elements are difficult to detect unless they are above several hundred parts per million. Moreover, pXRF has a larger error and hence lacks precision in comparison with other methods such as ICP-MS. This lack of precision is caused by the technique's sensitivity to grain size variations, surface flatness, surface roughness, and sample heterogeneity as well as the increase in error when elemental concentrations approach the limit of detection (Shackley, 2011). The relatively low power of the instrument also means that surface coatings and the weathering of samples can partially shield the interior, leading to analyses biased in favor of the surface composition. Despite these limitations the technique is extremely useful for providing at least semiquantitative data for confirmation (or contradiction) of visual identifications.

Six jade standards comprising different proportions of jadeite and omphacite were measured during each sampling session at the Smithsonian collection facilities in order to calibrate the pXRF. Only four standards were utilized during sampling at some of the other facilities, as some standard compositions are similar. The composition of these standards was determined on powdered whole-rock samples at the Vrije Universiteit Amsterdam with a conventional XRF (see Appendix: Table A1, Figure A1). The variation in the standard data produced using different Bruker instruments in different sampling locations is shown in Figure A1, where Al_2O_3 is plotted against SiO_2. The raw data were processed using PyMca software developed by the European Synchrotron Radiation Facility. A calibration was made focusing on the elements that are likely to be most abundant in jadeite–omphacite jade and nephrite jade (Mg, Si, Al, and Ca). The data are presented in Table A2 (see Appendix).

The majority of the artifacts visually identified as jadeite and omphacite jade have low MgO (<5%) and 15%–25% Al_2O_3, confirming the visual identification. A limited number of samples were shown to be highly SiO_2 rich and were correctly identified as quartz-rich sediments. Low Al_2O_3 and the presence of MgO in a sample might indicate that the sample contains nephrite instead of jadeite. However, on the basis of petrographic studies, the limited number of samples that have a higher MgO% were interpreted as ultramafic-rich rocks rich in serpentine and containing Mg-rich varieties of pyroxenes such as omphacite and diopside. Consequently, it is concluded that none of the fine-grained "greenstones" are nephrite jade. An overview of the data based on rock type is presented in Figure 9.

In addition to the pXRF, a new integrated trace elemental and isotopic composition provenience methodology was applied to selected artifacts, using a portable "noninvasive" pulsed laser ablation sampling technique (Knaf et al., 2017, 2021, 2022) analysis is still ongoing and is not reported here. Sampling was performed on location at the conservation facilities of the NMAI and NMNH. Ablated material was deposited onto inert Teflon filters and returned for analysis at the clean laboratory of the Vrije Universiteit Amsterdam. Ablation pits, invisible to the naked eye and approximately the size of a human hair (~120 µm in width and depth), removed 2.5–4.0 µg per ablation of material (Figure 10). To obtain a representative sample and sufficient material for isotope composition analyses, jadeite and omphacite jades were ablated 20 times. Reproducibility and potential contamination were monitored by multiple sampling of the U.S. Geological Survey BHVO-2G basalt glass standard and blank measurements. Isotope compositions coupled with the trace element data are designed to provide highly effective multivariant discrimination for material provenience.

DISCUSSION AND CONCLUSIONS

Although much of the detailed observational and analytical work on these collections is still underway, some aspects can already be explored. The first, and perhaps the most important one to highlight, particularly in this volume, is that we cannot ignore the wealth of material culture in museum collections; doing so would be to dismiss an entire corpus of Lucayan prehistory that has been removed from the archaeological record because of a variety of historic and natural factors—from sites damaged or destroyed by historic development (guano mining) to the encroachment of ever-expanding settlements and tourist resorts, to the rise in sea levels (many coastal Lucayan sites are actively eroding or underwater). Heritage legislative safeguards did not come into effect until The Bahamas' National Trust Act (1959) and had no real bite until 1998, when the Antiquities, Monuments and Museums Act was implemented—as a result, many heritage resources were lost to foreign investment and development because their protection was not mandated by law until relatively recently (Pateman, 2011:4). These are the realities that impact the diminishing prehistoric archaeological record in the

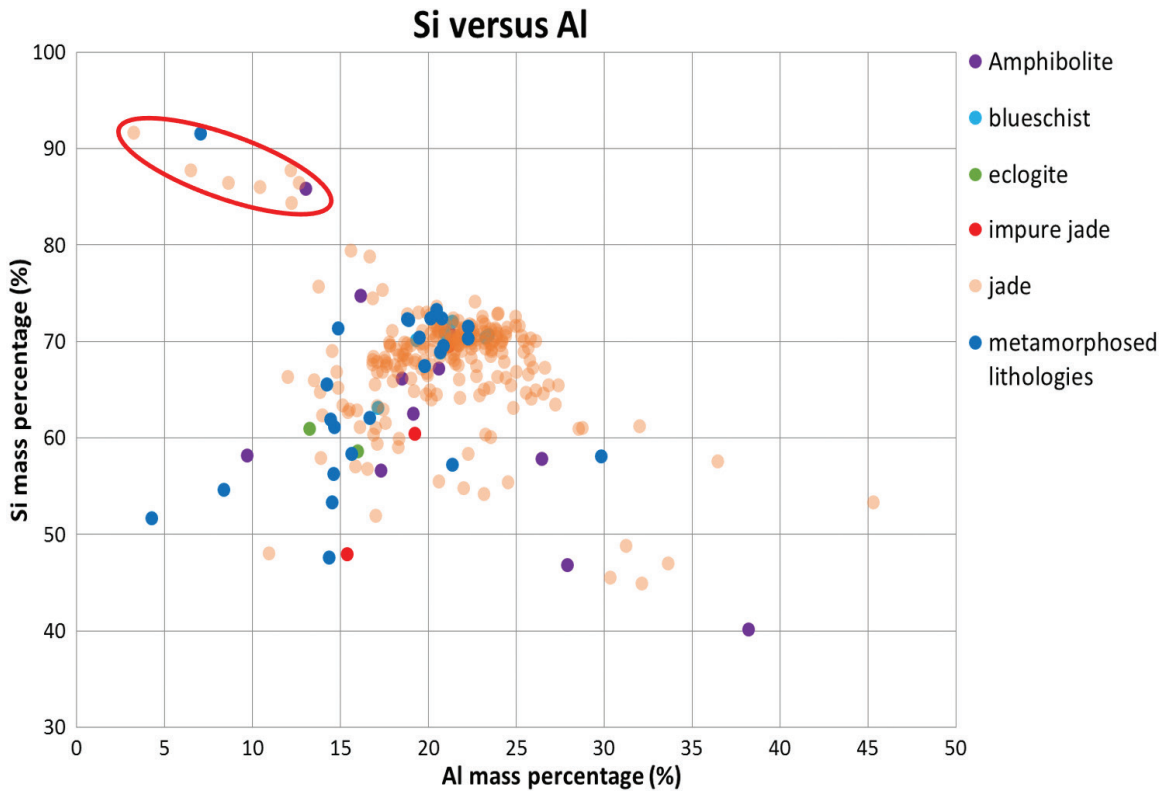

FIGURE 9. Graph of the pXRF data showing weight percent SiO_2 versus Al_2O_3 for different rock types. Highlighted samples are quartz-rich samples correctly identified visually as sediments and meta-tuffs (Tables 1–3), for example, 031913 in Figure 3d. Such artifacts were not sampled by laser ablation. The majority of jade samples have ~70% SiO_2 and 20% Al_2O_3. Impure jades contain less than 70% of either jadeite or omphacite. Note that some amphibolite and metamorphosed lithologies have compositions comparable to jades, stressing that pXRF analysis alone cannot be used to identify jades.

region and have done so since the late 1800s. To put this into context, in contrast to the 106 celts and implements (e.g., hoes, chisels) discussed in this essay, only 15 stone celts or fragments thereof have been recovered from archaeological investigations in the past six decades (at least those that have been reported).[11] Nine of these were chance or surface finds and, as such, have about as much contextual information as artifacts currently held in museums (i.e., an island or site provenance). These more recent findings reflect roughly 14% of the Smithsonian corpus, and only 4% of the 350 stone artifacts known from The Bahamas and TCI in museum collections. Further, rarer artifact forms, such as effigy celts and monolithic axes, have not been replicated in recent findings. Although archaeological survey and excavation methods have become ever more sophisticated over the past few decades—and new finds are accompanied by a wealth of contextual information—our picture of the Lucayan past would be very limited if we solely focused on findings post-1970s.

We also cannot forget that these artifacts had long lives, including historic reinterpretations as "thunderstones" and amulets. Some even bear burn scars showing that they had been tested to investigate whether they were "true" thunderstones (de Booy, 1915:80). The procedure was that the celt, tied with a string, was placed in a fire, and if the fire did not burn the string, the celt would be deemed a true "thunderbolt" (Goggin, 1939:23). As such, they were highly coveted, and as many early collectors and archaeologists repeatedly pointed out, those who owned them were loath to part with them (perhaps on the assumption that their luck or health would be adversely affected). Such beliefs likely placed some restrictions on the movements of thunderstones; that is, they remained in close proximity to where they were found, in the hands of those who recovered them, some for upward of 50 years (Goggin, 1939:23), and as such the provenance that many museum specimens now bear is likely a true reflection of their location of discovery.

Some of these artifacts became part of large, private collections prior to being acquired by the Smithsonian. Some were established on the islands, such as in the capitals of Cockburn Town, Grand Turk, TCI, and Nassau, New Providence, The Bahamas, and displayed in the homes of company owners who were in the guano mining or sisal growing business. Employees of their companies came into contact with archaeological sites during the

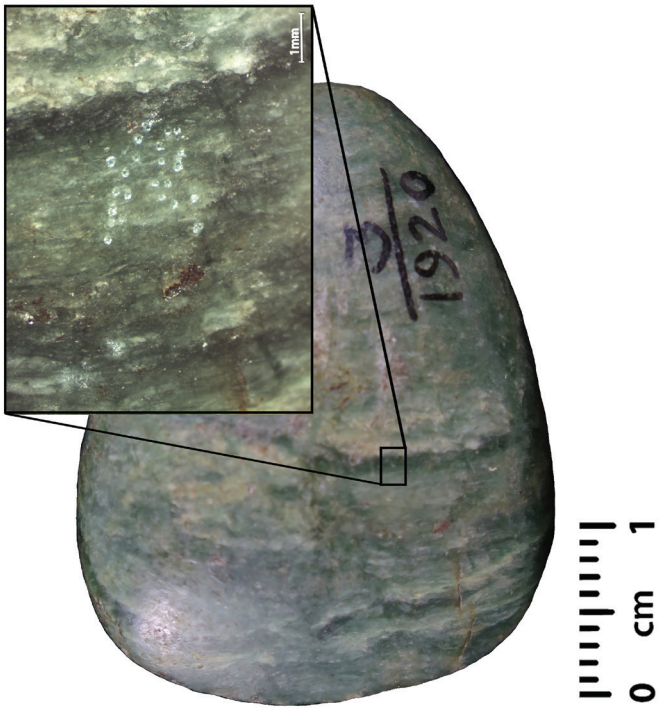

FIGURE 10. Laser ablation sampling of celt NMAI 031920. Multiple (~20) ablation pits are visible in the enlargement. Ablation pits have a diameter of ~100 µm. Some material is deposited around the ablation pit, leaving a slight white deposit, which cleaning with water will remove, reducing further the visibility of the ablation process. Photos by Ostapkowicz, courtesy of the National Museum of the American Indian.

course of their work, in many cases turning their finds over to their line managers. Such discoveries caused a great deal of local—and in some instances international—interest, to the extent that in many cases provenance was well known and widely discussed (Gibbs, 1878). Such artifacts were sometimes offered as gifts, perhaps for leverage in business affairs, or were used as diplomatic currency—as perhaps was the case with the hafted celt discovered by Mr. Murphy in 1877 and later acquired by Lady Blake. Even when artifacts changed hands in this way, many still retained their provenance details; for example, in a letter to de Booy, Lady Blake clearly recalls that the small anthropomorphic figurine came from Bimini—the western extreme of The Bahamas (Blake, 1913). De Booy's descriptions of recovering artifacts from a Juba Point cave, Providenciales, in 1911 are quite clear on context and association. The point is that the provenance information for many items in legacy collections is, in some instances, as good as, if not better than, more recent archaeological data (e.g., compare the de Booy collection information with that from Richard Rose's 1980s Pigeon Creek excavations on San Salvador; Harlow et al., 2019: table 1). This is not to downplay the issues of misattributions in museum records but to make clear that the information that does exist in accession records cannot simply be dismissed as being less accurate than that from excavations.

Even the preliminary results reported here overturn some established ideas about the materials used in the region. For example, celts are not, as often assumed for the region, primarily manufactured from serpentine (Mason, 1885; Ober, 1894:276; Goggin, 1939:23; Granberry, 1955:225), but rather, well over half of the Smithsonian Bahamian/TCI corpus is jade (jadeite- and/or omphacite-rich), with the remainder comprising a wide range of other materials, from omphacitite to meta-tuff. Indeed, within the wider context of the SIBA project, for which a further ~200 artifacts from The Bahamas/TCI were studied and an additional corpus of more than 700 celts from the wider Caribbean region were consulted within the NMAI collections alone for comparative purposes, none have been identified as serpentinite. Serpentine minerals are formed from the low-temperature hydration of olivine, usually within peridotites brought to the surface from the Earth's mantle by major tectonic processes. Serpentinite is almost always fine grained and soft. Amphibole-rich rocks containing tremolite and actinolite are another product of peridotite alteration. In some cases serpentine can be coarse grained and relatively hard and so potentially of use for the manufacture of ornaments, but because of its strong cleavage it is totally unsuitable for use for durable tools and implements. Rather, our study establishes that the most common rock type for petaloid celts in The Bahamas/TCI, given its ultimate sources in the wider region, is jadeite and omphacite jade. Other studies (e.g., Harlow et al., 2006, 2019) have also addressed material identifications, although these have been restricted to the relatively few objects found in particular excavations. Museum collections, by contrast, are much larger and derive from a much greater range of locations and so permit more detailed questions to be addressed with a sounder statistical basis.

Other artifacts have also been misclassified over the years. The Kew anthropomorphic pendant (Figure 3e) was identified variously as serpentinite (de Booy, 1916:27; Dockstader 1964:249) and jadeite jade (Kerchache 1994:66); it is, in fact, diorite (see Berman, 2011:117). The Mayaguana anthropomorphic celt (Figure 3b) was identified by de Booy (1913:6) as a "green, slate-like stone," which turned into "greenstone" in later publications (Berman, 2011:116); it is, in fact, not green at all, but rather a light tan brown, and is made from meta-tuff (Table 3). Unfortunately, these identifications, as well intentioned as they are, lead to misinformation that then gets circulated in the literature as fact (see discussion in Rodríguez Ramos, 2011:120).

One critical question is how people in the past conceived of what now is defined as jade through our continually refined categorizations. The corpus suggests that clear choices were being made regarding which materials were selected, encompassing a variety of practical, tactile, and aesthetic criteria. The generic term "greenstone," often used to refer to hard-stone artifacts in the region, presupposes that stones were selected for their green tones. The reality is that jades come in a variety of hues and

colors ranging from vibrant, almost turquoise green to matte browns and grays through to black (Figure 8). Other materials are also in evidence in the Lucayan artifacts (Tables 1, 2). It is clear that the stones used in petaloid celts were not selected simply for their colors and aesthetic qualities (although undoubtedly, these were important considerations), but rather a variety of factors, including the strength and homogeneity of the material itself as well as its availability both at geological sources and as river and beach pebbles, which are known to have been used as blanks at workshops (Knippenberg, 2012; Knippenberg et al., 2012). Indeed, the variety of hard-stone materials that were imported into the Bahama region is considerable (Figures 1–3) and certainly not limited solely to greenstones. Softer materials—coral, sandstone, meta-tuff—with fine-grained (<0.02 mm), relatively homogeneous texture, an absence of fractures, and a fabric with mineral alignment (foliation) were selected for more detailed stone carvings, whereas petaloid celts were made from harder, more serviceable stones (although even some coarser-grained jades can fracture easily because of fabric or internal breaks, so "function" may have had a wide remit of meaning—from practical to ceremonial). The question of who was doing the selecting of material at what stage is still an open one; there were undoubtedly various stages of selection in the life of an artifact—and various hands involved—from the in-field collecting and processing to the transfer of the artifact to the final end user in these northern isles. Did the Lucayans demand certain stones, or were these what the Taíno, their neighbors to the south, preferred to exchange?

Other stone materials, particularly for ornaments, are also represented in the Bahamian/TCI corpus. Diorite, for example, has a long history of use in the circum-Caribbean region, often selected for the manufacture of large, cylindrical beads, the dramatic contrast of the black-and-white patterning enhancing the finished product. Cronista accounts from Hispaniola indicate that such beads were the prerogative of *caciques* (chiefs), who valued them highly and used them as bride price in marriage contracts (Boomert and Rogers, 2007:286). Diorite was a relatively frequent material in the lapidary sites of Tecla, Puerto Rico; Sorcé, Vieques; Royall, Elliot, and PA-15, Antigua; Trants, Montserrat; Golden Grove, Tobago, and Gare Maritime, Guadeloupe (Queffelec et al., 2018:285, table 2). Boomert and Rogers (2007:286–287) noted the following:

> Beads made of diorite appear to have been the major category of bodily ornaments which were manufactured and exchanged from the beginning of early ceramic times until the end of prehistory throughout the Caribbean. This suggests that these beads had symbolic properties which were sufficiently attractive to the Amerindians of the West Indies to the extent that their manufacture, use and general distribution were able to survive over an extended period of time . . . [possibly because they were thought to] possess particular powers which can be used . . . for healing purposes.

Whether such a conclusion can be made for the impressive diorite anthropomorphic pendant from Kew (Figure 3e) will likely never be known, but a detailed iconographic study is currently underway that might provide further insights into its possible meanings.

As to the crucial question of provenience, or the origin of the selected stones, our work on this is still ongoing, but a few comments on recent discussions in the literature are relevant to set the context for The Bahamas/TCI specifically. Rodríguez Ramos (2007, 2011, 2013) argued on the basis of contextual, iconographic, and technological evidence as well as characterization studies (particularly Harlow et al., 2006; sensu Harlow [unpublished 2007 work] and Mendoza et al. [unpublished 2009 work] as cited in Rodríguez Ramos, 2011) that jade finds in Antillean contexts predating AD 500–700 are sourced to the MFZ, Guatemala; however, the decline of the long-distance circulation of MFZ jades after AD 700 increased the exploitation of jade sources in Cuba and Hispaniola (Rodríguez Ramos, 2011:126; 128–130). Rodríguez Ramos (2011:128) suggested that it is Cuban- and Dominican-sourced material that after AD 850, entered The Bahamas; given the law of probabilities, this is a reasonable assumption, one well represented in Bahamian/TCI research (Keegan, 1997:59, 2007:78, 81; Berman et al., 2013:268). However, recent work by Harlow et al. (2019) on three stone artifacts from sites on San Salvador, Bahamas, dating to post-AD 1000 suggests that jade sources of artifacts from the Lucayan archipelago may extend to as yet unknown quarries. One artifact suggests a source from Sierra del Convento, Cuba, whereas the other two, although consistent with materials from the Río San Juan Complex, Dominican Republic, have sufficiently distinctive characteristics to suggest an as yet unknown quarry. Although this degree of detail is possible with rare jades, work on these is still in the early phases. We have yet to explore the other stone materials, which have a much wider distribution within the circum-Caribbean region and thus are currently indistinguishable to specific source.

Further, Rodríguez Ramos (2011:127–128) notes that jade celts form a rather small portion of celt assemblages in Puerto Rico. Moreover, on the basis of visual inspections, in the past many researchers have interpreted a large proportion of Caribbean greenstones as serpentinites. In contrast, we have found that the great majority of the Smithsonian's Bahamas/TCI corpus is composed of jade celts, and our examinations of other Bahamian and Caribbean collections at project partner institutions (e.g., Peabody Museum of Natural History) have led to similar conclusions. It is only through detailed investigations that span a variety of techniques that such details can be brought to light and quantified—something that for The Bahamas/TCI will be explored over the course of the project's next phase. And it is museum collections that can offer the artifact numbers necessary to give statistically robust data sets. They hold artifact classes that, in some instances, have not been found subsequently. In addition, their collections derive from some islands that have had few to no subsequent archaeological investigations. To better understand the region's prehistory, they are a deep reservoir of information.

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NOTES

1. Diagnostic "Lucayan" material culture emerged from about AD 800, marked by the presence of a ceramic style unique to the islands (Palmetto Ware). However, the region was also a seasonal home to preceding (Ostionoid) and contemporary (Meillacoid, Chicoid—or Taíno) groups from the southern islands of Hispaniola (Dominican Republic/Haiti) and Cuba. The artifacts from The Bahamas/TCI held by the Smithsonian reflect these varied cultures and their interaction with each other.
2. The term "petaloid" refers to the celt resembling the shape of a flower petal.
3. Jadeite- and omphacite-rich rocks are here highlighted because they are the targeted material for detailed analyses (ICP-MS and EPMA/SEM); they are rare in the circum-Caribbean region, with currently only four known sources (two in the Caribbean—Cuba and the Dominican Republic—and two in Guatemala). A large body of work has been undertaken to identify the distinguishing characteristics of each source (e.g., Harlow et al., 2003; Garcia-Casco et al., 2009; Knaf et al., 2021a, 2021b), resulting in a comparative dataset against which the results of the project can be compared. The petrological characteristics of many other rocks are not sufficiently distinctive enough or have not as yet been studied in sufficient detail to distinguish between the possible sources.
4. These collections refer solely to archaeological material; ethnographic artifacts were cataloged separately. There are, for example, baskets from Long Island, dolls (E398447-0) and headdresses (E398446-0) from San Salvador, and Black Seminole basketry from Andros (e.g., E419650-0; E419644), donated by William C. Sturtevant.
5. Heye's first forays into financing archaeological investigation were in the Caribbean: he supported Frank D. Utley's visit to Puerto Rico in 1904, where a *duho*, several stone collars, and various stone artifacts were recovered (Pepper, 1916:406).
6. Lady Blake's collection extended to human remains: she donated a collection of human remains "from the Island of Eleuthera" to London's Natural History Museum in 1886, shortly before Sir. Henry's role as governor of The Bahamas came to an end.
7. The celt was on display at the Museum of the American Indian as early as 1922, considered a highlight of the Bahamian collections alongside the *duhos* and monolithic axes: "Best of all is a fine petaloid celt with its wooden handle still intact, found in a cave on North Caicos Island. That this was the usual method of hafting these stone axes may be seen from a monolithic hatchet from Grand Caicos carved from a single piece of stone to represent a petaloid stone celt in a similar wooden handle. A similar but ruder one was found in Providenciales" (Hodge, 1922:24).
8. "This implement was found, together with some burned wood and two or three conch-shells, beneath about eighteen inches of cave-earth. The majority of the potsherds were of plain ware, but three fragments show ornamentation by incision" (de Booy, 1912:91). The NMAI collection holds the ceramics from Juba Point, so it is possible to reconstruct the material he excavated from this site.
9. The material Krieger "excavated" from Pond Hill, Inagua, for example, is not among the NMNH collections. Apart from nine celts reportedly from Hamilton's Cave, the collections hold no artifacts from other sites and areas he worked on, including Deadman's Key, Long Island, Acklins, and New Providence. Further, Krieger mentions finding "several . . . wooden seats in . . . caves" ("Indians Who Met Columbus," in 377th Science Service program transcript, p. 8, Herbert William Krieger Papers, NAA), but no further information exists about these pieces.
10. For information about Krieger's 1946 excavations at what he called Burnt Ground, we must turn to an in-house diorama brief, in which he notes, "The site of this former Lucayan village, the subject of our diorama, was visited in January and February, 1947 by the Ernest N. May-Smithsonian Expedition to Historical Indian Village Sites Associated with the First Voyage of Christopher Columbus. On the slopes of the coastal ridge within 300 feet of the shore were recovered pottery fragments. Through excavations made at the site, a series of Lucayan artifacts were recovered, including portions of pottery vessels, earthenware cooking griddles, polished greenstone axe heads (celts) brought from Cuba or Hispaniola, implements and utensils of worked conch shell, stone and shell beads, amulets of worked shell (zemi), a decorated wooden seat from nearby Hamilton's Cave, also a bundle of palm wood spear heads and skeletal material, including an artificially flattened Lucayan Indian skull, were recovered from potholes, locally known as 'banana holes.'" However, of the artifacts currently in the collection bearing a Long Island provenance, none have more detailed site documentation, and it is unclear whether these are from his 1936/1937 excavations at Deadman's Key or his 1946 excavations

near Pratt's Reef village and Adderley's. Nor are there any shell cemis or wooden seats linked to the Krieger accession.

11. These recent celt finds include five from the site of MC6, Middle Caicos (Sullivan, 1981; Morsink, 2012); three fragments from Long Island (William Keegan, Curator, Florida Museum of Natural History, personal communication, 2019); two from Pigeon Creek Dune 1 (Rose, 1987; Harlow et al., 2019:3); one each from Donna Cay, Providenciales (Michael Pateman, Director, Turks and Caicos National Museum, personal communication, 2018); GT-3, Grand Turk (Keegan, 1997); Burial Ground, New Providence (Turner, 2017:139); CI-4, Cat Island (MacLaury, 1970); and Pink Wall, New Providence (Saunders and Bohon, 2000).

REFERENCES

Berman, Mary J. 2011. Good as Gold: The Aesthetic Brilliance of the Lucayans. In *Islands at the Crossroads: Migration, Seafaring and Interaction in the Caribbean,* ed. Antonio L. Curet and Mark W. Hauser, pp. 104–132. Tuscaloosa: University of Alabama Press.

Berman, Mary J., Perry L. Gnivecki, and Michael P. Pateman. 2013. The Bahama Archipelago. In *The Oxford Handbook of Caribbean Archaeology*, ed. William F. Keegan, Corinne L. Hofman, and Reniel Rodríguez Ramos, pp. 264–280. Oxford, U.K.: University of Oxford Press.

Blake, E. 1890. The Norbrook Kitchen Midden. *Victoria Quarterly*, 2(4):26–33.

Blake, Edith. 1913. Letter to Theodoor de Booy, 22 February 1913. Museum of the American Indian/Heye Foundation Records, 1890–1989, Box 202, Folder 15. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Boomert, A., and C. T. Rogers. 2007. Troumassoid Stone Artifacts in Tobago: Rock Types and Source Areas. In *Proceedings of the 21st Congress of the International Association for Caribbean Archaeology*, ed. Basil Reid, Henri Petitjean Roget, and Antonio Curet, Volume 1, pp. 284–294. Trinidad: University of West Indies, St. Augustine.

Brooks, W. K. 1887. On the Lucayan Indians. *Memoirs of the National Academy of Sciences*, 4:213–223.

Curet, Antonio L. 2018. Theodoor de Booy in Puerto Rico: An Untold Story in the History of Caribbean Archaeology. *Caribbean Studies*, 46:3–32. https://doi.org/10.1353/crb.2018.0000

Curet, L. Antonio, and Maria Galban. 2019. Theodoor de Booy: Caribbean Expeditions and Collections at the National Museum of the American Indian. *Journal of Caribbean Archaeology,* 19:1–50.

Davis, Dave, and Kevin Oldfield. 2003. Archaeological Reconnaissance of Anegada, British Virgin Islands. *Journal of Caribbean Archaeology*, 4:1–27.

de Booy, Theodoor. 1912. Lucayan Remains on the Caicos Islands. *American Anthropologist,* 16:81–105. https://doi.org/10.1525/aa.1912.14.1.02a00050

de Booy, Theodoor. 1913. Lucayan Artifacts from the Bahamas. *American Anthropologist*, 15:1–7. https://doi.org/10.1525/aa.1913.15.1.02a00020

de Booy, Theodoor. 1915. Certain West-Indian Superstitions Pertaining to Celts. In *Contributions from The Museum of the American Indian, Heye Foundation*, 2(3):78–82. https://doi.org/10.5479/sil.451249.39088016090680

de Booy, Theodoor. 1916. Certain Similarities in Amulets from the Northern Antilles. In *W. Holmes Anniversary Volume: Anthropological Essays Presented to William Henry Holmes in Honor of his Seventieth Birthday*, ed. Frederick Hodge, pp. 24–30. Washington, D.C.: J. W. Bryan Press.

Dockstader, Frederick J. 1964. *Indian Art in Middle America*. New York: New York Graphic Society.

Duerden, J. E. 1897. Aboriginal Indian Remains in Jamaica. *Journal of the Institute of Jamaica*, 2:1–51.

Foshag, William F., and Robert Leslie. 1955. Jadeite from Manzanal, Guatemala. *American Antiquity*, 21:81–83. https://doi.org/10.2307/276111

García-Casco, A., A. Rodríguez Vega, J. Cárdenas Párraga, M. A. Iturralde-Vinent, C. Lázaro, I. Blanco Quintero, Y. Rojas Agramonte, A. Kröner, K. Núñez Cambra, G. Millán, R. L. Torres-Roldán, and S. Carrasquilla. 2009. A New Jadeitite Jade Locality (Sierra del Convento, Cuba): First Report and Some Petrological and Archeological Implications. *Contributions to Minerology and Petrology*, 158:1–16. https://doi.org/10.1007/s00410-008-0367-0

Gibbs, George J. 1878. A Correspondence Relative to Ancient Stone Implements etc., etc., . . ., circa 1874–1878. Manuscript 7173. National Anthropological Archives, Smithsonian Institution, Suitland, Md.

Goggin, John M. 1939. An Anthropological Reconnaissance of Andros Island, Bahamas. *American Antiquity*, 5:21–26. https://doi.org/10.2307/275965

Granberry, Julian. 1955. A Survey of Bahamian Archaeology. M.A. thesis, University of Florida, Gainesville.

Harlow, George E. 1994. Jadeitites, Albatites and Related Rocks from the Motagua Fault Zone, Guatemala. *Journal of Metamorphic Geology*, 12:49–68. https://doi.org/10.1111/j.1525-1314.1994.tb00003.x

Harlow, George E., Mary J. Berman, Juan Cárdenas Párraga, Andreas Hertwig, Antonio García-Casco, and Perry L. Gnivecki. 2019. Pre-Columbian Jadeitite Artifacts from San Salvador Island, Bahamas and Comparison with Jades of the Eastern Caribbean and Jadeitites of the Greater Caribbean Region. *Journal of Archaeological Science: Reports*, 26:101830. https://doi.org/10.1016/j.jasrep.2019.04.019

Harlow, George E., Reg Murphy, David J. Hozjan, Christy de Mille, and Alfred A. Levinson. 2006. Pre-Columbian Jadeite Axes from Antigua, West Indies: Description and Possible Sources. *Canadian Mineralogist*, 44:305–321. https://doi.org/10.2113/gscanmin.44.2.305

Harlow, George E., Virginia Sisson, Hans G. Avé Lallemant, Sorena Sorenson, and Russell Seitz. 2003. High-Pressure Metasomatic Rocks along the Motagua Fault Zone, Guatemala. *Ofioliti*, 28:115–120.

Hertwig, Andreas, William C. McClelland, Kouki Kitajima, Hans-Peter Schertl, Walter V. Maresch, Klaus Stanek, John W. Valley, and Sergey Sergeev. 2016. Inherited Igneous Zircons in Jadeitite Predate High-Pressure Metamorphism and Jadeitite Formation in the Jagua Clara Serpentinite Mélange of the Rio San Juan Complex (Dominican Republic). *Contributions to Mineralogy and Petrology*, 171:48. https://doi.org/10.1007/s00410-016-1256-6

Hodge, Frederick W., ed. 1922. *Guide to the Collections from the West Indies*. Indian Notes and Monographs. New York: Museum of the American Indian, Heye Foundation.

Howard, Robert R. 1956. The Archaeology of Jamaica: A Preliminary Survey. *American Anthropologist*, 22:45–59. https://doi.org/10.2307/276166

Keegan, William F. 1997. *Bahamian Archaeology: Life in The Bahamas and Turks and Caicos Before Columbus*. Nassau, Bahamas: Media Publishing.

Keegan, William F. 2007. *Taíno Indian Myth and Practice: The Arrival of the Stranger King*. Gainesville: University Press of Florida.

Kerchache, Jacques. 1994. *L'art Taïno: L'art des sculpteurs Taïnos Chefs-D'oevre des Grandes Antilles Precolombiennes*. Paris: Musées de la Ville de Paris.

Knaf, Alice C. S., Catarina Guzzo Falci, Habiba, Casper J. Toftgaard, Janne M. Koornneef, Annelou van Gijn, Ulrik Brandes, Corinne L. Hofman, and Gareth R. Davies. 2022. A Holistic Provenance and Microwear Study of Pre-Colonial Jade Objects from the Virgin Islands: Unravelling Mobility Networks in the Wider Caribbean. Journal of Archaeological Science: Reports, 40PB, p. 103223.

Knaf, Alice. C. S., Habiba, Termeh Shafie, Janne M. Koornneef, Andreas Hertwig, Juan Cárdenas-Párraga, Antonio García-Casco, George E. Harlow, Hans-Peter Schertl, Walter V. Maresch, A. L. Belando, and Corinne L. Hofman. 2021. Trace-Elemental and Multi-Isotopic (Sr-Nd-Pb) Discrimination of Jade in the Circum-Caribbean: Implications for Pre-Colonial Inter-Island Exchange Networks. *Journal of Archaeological Science*, 135:105466.

Knaf, Alice C. S., J. M. Koornneef, and Gareth R. Davies. 2017. "Non-invasive" Portable Laser Ablation Sampling of Art and Archaeological Materials with Subsequent Sr-Nd Isotope Analysis by TIMS Using 10^{13} Ohm Amplifiers. *Journal of Analytical Atomic Spectrometry*, 32:2210–2216. https://doi.org/10.1039/C7JA00191F

Knippenberg, Sebastiaan. 2012. Jadeitite Axe Manufacture in Hispaniola: A Preliminary Report on the Lithics from the Playa Grande Site, Northern Dominican Republic. Leiden, Netherlands: Leiden University.

Knippenberg, Sebastiaan, Reniel Rodríguez Ramos, Hans-Peter Schertl, William V. Maresch, Andreas Hertwig, A. García-Casco, George E. Harlow, E. López, and Corrine L. Hofman. 2012. The Manufacture and Exchange of Jadeitite Celts in the Caribbean. [Presentation and Abstract.] In *The European Mineralogical Conference 2012, Vol. 1*, EMC2012-400. Frankfurt: EMC. https://meetingorganizer.copernicus.org/EMC2012/EMC2012-400.pdf (accessed 3 December 2021).

Krieger, Herbert W. 1937. The Bahamas Islands and Their Prehistoric Population. In *Explorations and Field-work of the Smithsonian Institution in 1936,* pp 93–98. Washington, D.C.: Smithsonian Institution.

Krieger, Herbert William. Papers. National Anthropological Archives, Smithsonian Institution, Suitland, Md.

Lee, Thomas. 1889. Report on the Work for the US Fish Commission Steamer Albatross for the Year Ending Dec 31, 1886. In *United States Commission of Fish and Fisheries, Report of the Commissioner for 1886,* Part 14, ed. Z. L. Tanner, pp. 605–692. Washington, D.C.: Government Printing Office.

MacLaury, James C. 1970. *Archaeological Investigations on Cat Island, Bahamas*. Contributions of the Florida State Museum, Social Sciences, No. 16. Gainesville: University of Florida.

Mallery, G. 1893. *Picture Writing of the American Indians*. In *Tenth Annual Report of the Bureau of American Ethnology 1888–1889*. Washington, D.C.: Smithsonian Institution. https://doi.org/10.5479/sil.789861.39088012443370

Mason, Otis. 1885. *The Guesde Collection of Antiquities in Pointe-a-Pitre, Guadeloupe, West Indies*. In *Annual Report of the Board of Regents of the Smithsonian Institution for the Year 1884*, pp. 731–837. Washington, D.C.: Government Printing Office.

Mason, Otis. 1877. Jadite Celts from Turks and Caicos Islands, Also Two Wooden Stools. *American Naturalist*, 11:626.

Morsink, Joost 2012. The Power of Salt: A Holistic Approach to Salt in the Prehistoric Circum-Caribbean Region. Ph.D. diss., University of Florida, Gainesville.

Nero, Lorraine M., and Aisha Baptiste. 2015. Breaking New Ground: John A. Bullbrook's Contribution to Precolonial Archaeology of Trinidad. *Archaeology and Anthropology*, 19:1–15.

Ober, Frederick A. 1893. *In the Wake of Columbus*. Boston: D. Lothrop.

Ober, Frederick A. 1894. Aborigines of the West Indies. *Proceedings of the American Antiquarian Society*, 9:270–313. https://doi.org/10.1038/scientificamerican11101894-15719bsupp

Ostapkowicz, Joanna. 1998. Taíno Wooden Sculpture: Duhos, Rulership and the Visual Arts in 12th–16th Century Caribbean. Ph.D. diss., University of East Anglia, Norwich, U.K.

Ostapkowicz, Joanna. 2015. "Either a Piece of…Domestic Furniture of the Indians or One of Their Gods": The Study of Lucayan Duhos. *Journal of Caribbean Archaeology*, 15:62–101.

Ostapkowicz, Joanna, Christopher Bronk Ramsey, Fiona Brock, Caroline Cartwright, Rebecca Stacey, and Mike Richards. 2013. Birdmen, *Cemís* and *Duhos*: Material Studies and AMS ^{14}C Dating of Pre-Hispanic Caribbean Wood Sculptures in the British Museum. *Journal of Archaeological Science*, 40:4675–4687. https://doi.org/10.1016/j.jas.2013.07.015

Ostapkowicz, Joanna, Christopher Bronk Ramsey, Fiona Brock, Tom Higham, Alex C. Wiedenhoeft, Erica Ribechini, Jeannette J. Lucejko, and Samuel Wilson. 2012. Chronologies in Wood and Resin: AMS ^{14}C dating of pre-Hispanic Caribbean Wood Sculpture. *Journal of Archaeological Science*, 39:2238–2251. https://doi.org/10.1016/j.jas.2012.01.035

Pateman, Michael. 2011. The Bahamas. In *Protecting Heritage in the Caribbean*, ed. Peter E. Siegel and Elizabeth Righter, pp. 1–8. Tuscaloosa: University of Alabama Press.

Pepper, George Hubbard. 1916. The Museum of the American Indian, Heye Foundation. *Geographical Review*, 2:401–418. https://doi.org/10.2307/207511

Queffelec, Alain, Pierrick Fouére, Celine Paris, Christian Stouvenot, and Ludovic Bellot-Gurlet. 2018. Local Production and Long-Distance Procurement of Beads and Pendants with High Mineralogical Diversity in an Early Saladoid Settlement of Guadeloupe (French West Indies). *Journal of Archaeological Science: Reports*, 21:275–288. https://doi.org/10.1016/j.jasrep.2018.07.011

Rainey, Froelich G. 1934. Diary beginning January 22, 1934, upon arrival in Port Au Prince, Haiti. Manuscript. Peabody Museum of Natural History, New Haven, Conn.

Rodríguez Ramos, Reniel. 2007. Puerto Rican Precolonial History Etched in Stone. Ph.D. diss., University of Florida, Gainesville.

Rodríguez Ramos, Reniel. 2011. The Circulation of Jadeitite Across the Caribbeanscape. In *Communities in Contact: Essays in Archaeology, Ethnohistory and Ethnography of the Amerindian Circum*-Caribbean, ed. Corinne L. Hofman and Anne van Duijvenbode, pp. 117–136. Leiden, Netherlands: Sidestone Press.

Rodríguez Ramos, Reniel. 2013. Isthmo-Antillean Engagements. In *The Oxford Handbook of Caribbean Archaeology*, ed. William F. Keegan, Corinne L. Hofman, and Reniel Rodríguez Ramos, pp. 155–170. Oxford, U.K.: University of Oxford Press.

Rose, Richard. 1897. Lucayan Lifeways at the Time of Columbus. In *Proceedings of the First San Salvador Conference: Columbus and his World*, ed. Donald T. Gerace, pp. 321–340. Fort Lauderdale, Fla.: CCFL Bahamian Field Station.

Rouse, Irving. 1939. *Prehistory in Haiti: A Study in Method*. Yale University Publications in Anthropology, No. 24. New Haven, Conn.: Yale University Press.

Sadler, H. E. 1997. *Turks Islands Landfall: A History of the Turks and Caicos Islands*. Kingston, Jamaica: United Cooperative Printers.

Saunders, R. A., and K. Bohon. 2000. Excavation at the Pink Wall Site, New Providence, Bahamas. Report. Nassau, Bahamas: Antiquities, Monuments and Museum Corporation.

Saville, Marshall H. 1919. Theodoor de Booy. *American Anthropologist*, 21:182–185. https://doi.org/10.1525/aa.1919.21.2.02a00060

Schertl, Hans-Peter, Walter V. Maresch, Klaus P. Stanek, Andreas Hertwig, Martin Krebs, Rauno Baese, and Sergey S. Sergeev. 2012. New Occurrences of Jadeitite, Jadeite Quartzite and Jadeite–Lawsonite Quartzite in the Dominican Republic, Hispaniola: Petrological and Geochronological Overview. *European Journal of Mineralogy*, 24:199–216. https://doi.org/10.1127/0935-1221/2012/0024-2201

Schulting, Rick. 1994. An Investigation of Mortuary Variability and Socioeconomic Status Differentiation on the Northwest Plateau. M.A. thesis, Simon Fraser University, Vancouver, B.C., Canada.

Schulting, Rick J., Christophe Snoeck, John Pouncett, Fiona Brock, Christopher Bronk Ramsey, Thomas Higham, Thibaut Devièse, Kelly Delancy, Michael Pateman, William Keegan, and Joanna Ostapkowicz, 2021. Six Centuries of Adaptation to a Challenging Island Environment: AMS ^{14}C Dating and Stable Isotopic Analysis of Pre-Columbian Human Remains from the Bahamian Archipelago Reveal Dietary Trends. *Quaternary Science Reviews*, 254:106780. https://doi.org/10.1016/j.quascirev.2020.106780

Shackley, M. Steven. 2011. *X-Ray Fluorescence Spectrometry (XRF) in Geoarchaeology*. New York: Springer. https://doi.org/10.1007/978-1-4419-6886-9

Smithsonian Institution. 1938. *Annual Report of the Board of Regents of the Smithsonian Institution Showing the Operations, Expenditures and Condition of the Institution for the Year Ended June 30, 1937*, pp. 28–29. Washington, D.C.: U.S. Government Printing Office.

Smithsonian Institution. 1947. *Annual Report of the Board of Regents of the Smithsonian Institution Showing the Operations, Expenditures and Condition of the Institution for the Year Ended June 30, 1947*, pp. 16–17. Washington, D.C.: U.S. Government Printing Office.

Smithsonian Institution. 1964. *Annual Report of the Board of Regents of the Smithsonian Institution Showing the Operations, Expenditures and Condition of the Institution for the Year Ended June 30, 1963*, p. xi. Washington, D.C.: U.S. Government Printing Office.

Stevenson, Charles H. 1903. The United States Fish Commission. *The North American Review*, 176(April):593–601.

Sullivan, Shaun D. 1981. Prehistoric Patterns of Exploitation and Colonization in The Turks and Caicos Islands. PhD diss., University of Illinois at Urbana–Champaign. University Microfilms, Ann Arbor, Mich.

Tsujimori, Tatsuki, and George Harlow. 2012. Petrogenetic Relationships between Jadeitite and Associated High-Pressure and Low-Temperature Metamorphic Rocks in Worldwide Jadeitite Localities: A Review. *European Journal of Mineralogy*, 24:371–390. https://doi.org/10.1127/0935-1221/2012/0024-2193

Turner, Grace. 2017. *Honoring Ancestors in Sacred Space: The Archaeology of an Eighteenth-Century African-Bahamian Cemetery*. Gainesville: University Press of Florida. https://doi.org/10.5744/florida/9781683400202.001.0001

Weeks, John M., Peter J. Ferbel, and Ing. V. Ramirez Zabala. 1994. Herbert W. Krieger y la practica de la arqueologia 'colonial' en la Republica Dominicana. *Buletin del Museo del Hombre Dominicano*, 26:77–89.

APPENDIX

Provided as supplementary material, the appendix provides an overview of our pXRF data on the stone artefacts from The Bahamas and Turks and Caicos Islands in the National Museum of Natural History and the National Museum of the American Indian, Smithsonian Institution.

Table A1 summarizes the elemental concentrations of jadeitite–omphacite-rich jade standards measured by conventional X-ray fluorescence spectroscopy. Figure A1 provides an overview of the standard data obtained using different Bruker instruments at three different museums (NMAI, PMNH and PMAE). Table A2 provides the measured and normalized contents of the main elements found in the jade artefacts from The Bahamas/TCI as well as comparative material from the wider Caribbean region also held in the NMNH and NMAI. The large range of major element compositions reflects the diversity of rock types analyzed, including magmatic, sedimentary, and metamorphic rocks. For example, quartz-rich sediments are characterized by elevated SiO_2contents. The fundamental observation that can be made from the composition of the jade samples is that none have low Na_2O and Al_2O_3, which would be indicative of a high nephrite content. These data therefore agree with the visual identification of the jade samples comprising a mixture of jadeite and/or omphacite.

TABLE A1. Elemental concentrations (weight percent) of jadeite–omphacite-rich jade standards measured by conventional X-ray fluorescence spectrometry.

Fe_2O_3	MnO	TiO_2	CaO	K_2O	P_2O_5	SiO_2	Al_2O_3	MgO	Na_2O	BaO
1.22	0.03	0.20	2.09	0.98	0.05	60.20	22.54	1.35	11.82	0.16
1.72	0.03	0.44	4.45	0.18	0.12	59.37	20.81	1.16	12.56	0.02
2.18	0.08	0.26	24.36	0.74	0.01	41.56	27.53	3.01	0.94	0.02
8.29	0.10	0.01	0.01	0.00	0.00	47.31	0.92	43.28	0.00	0.00
10.44	0.13	0.06	0.39	0.00	0.00	44.39	3.06	41.64	0.00	0.00
2.96	0.04	1.24	6.27	2.80	0.09	54.28	22.34	2.91	6.98	0.30

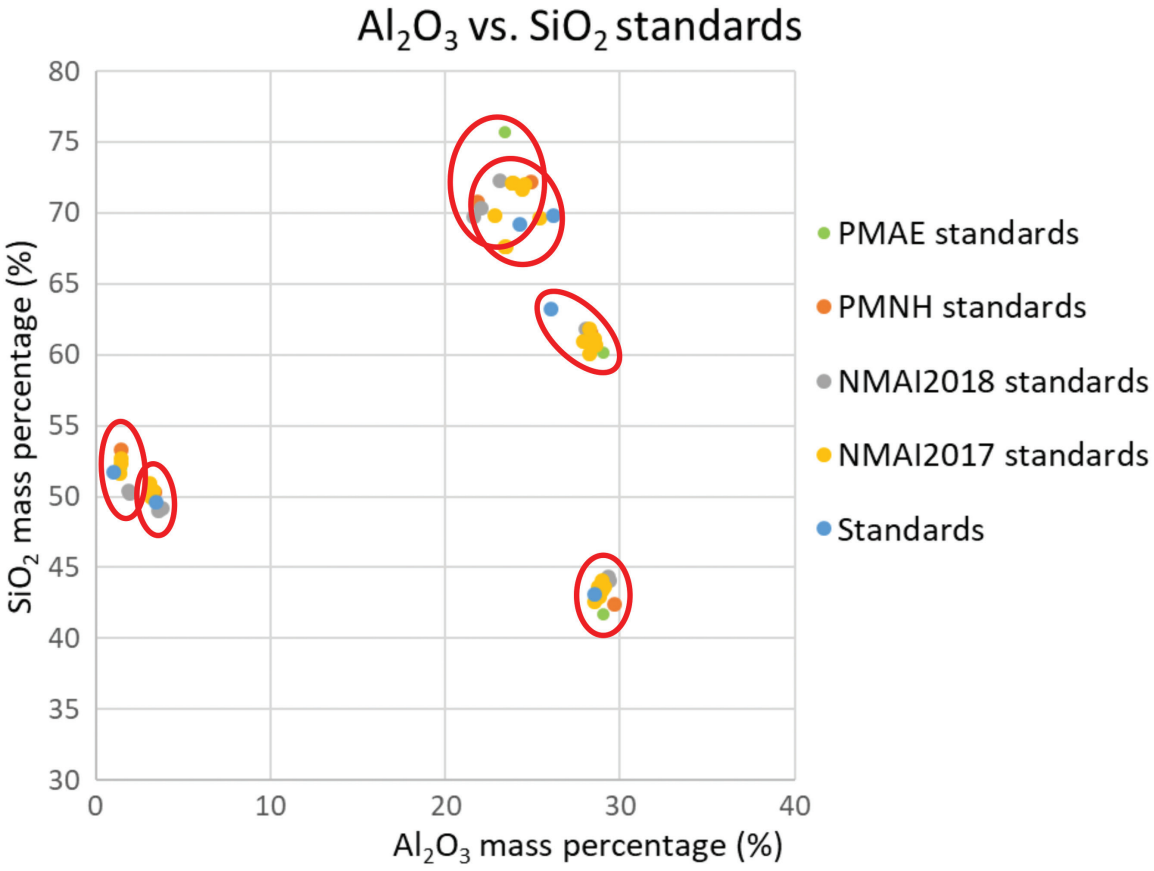

FIGURE A1. Standard data obtained using different Bruker instruments at the NMAI; Peabody Museum of Natural History (PMNH), New Haven, Connecticut, USA; and Peabody Museum of Archaeology and Ethnology (PMAE), Cambridge, Massachusetts, USA.

TABLE A2. Measured and normalized (norm) contents of the main elements found in jades. Analytical totals are color coded according to the key above the table to indicate values that were too high or low prior to normalization. Some elements cannot be measured accurately by the portable X-ray fluorescence spectrometer. These limitations, coupled with irregular surfaces and the applied correction factors, can cause the total mass percentage that is calculated to be higher or lower than 100%. All values are therefore normalized to 100%. To assess the heterogeneity of coarse-grained artifacts, several were measured multiple times (e.g., diorite NMAI 032200, 6 wt % difference in SiO_2). Selected fine-grained artifacts were measured on different dates. These data are shown to be reproducible (e.g., NMAI 059238, <1 wt % difference in SiO_2). Provenance refers to the location where the artefact was found, as documented in museum records; provenance abbreviations are as follows: BWI = British West Indies; DR = Dominican Republic; PR = Puerto Rico; TCI = Turks and Caicos Islands. Values are in weight percent (wt % [= mass %]). In this table, the term 'jadeite and/or omphacite jade' is used to cover all eventualities. This is because the amount of jadeite and omphacite varies in many samples and can be locally 100% omphacite and elsewhere 100% jadeite.

Color Key:	Total too low	30	45	70	90	120	140	Total too high

Sample no.	Provenance	Lithology	MgO	Al_2O_3	SiO_2	CaO	Total	Mg norm	Al norm	Si norm	Ca norm
NMAI 059138	TCI	Amphibolite	2.83	11.93	55.26	3.95	73.98	3.83	16.13	74.7	5.35
NMAI 113518	Bahamas	Amphibolite	8.84	11.48	19.25	1.55	41.12	21.5	27.92	46.82	3.76
NMAI 059175B	Bahamas	Basalt	1.73	16.7	36.93	–0.52	54.84	3.15	30.45	67.33	–0.94
NMNH A554668	Bahamas	Blueschist	1.48	16.99	51.42	3.19	73.08	2.03	23.25	70.36	4.36
NMAI 032226	TCI	Jadeite and/or omphacite jade	2.03	11.98	39.87	4.06	57.94	3.51	20.68	68.81	7.01
NMAI 036458	Bahamas	Diorite	1.53	16.2	66.14	3.66	87.53	1.75	18.51	75.56	4.18
NMAI 059238	TCI	Diorite	1.43	27.27	38.88	15.57	83.16	1.73	32.79	46.75	18.73
NMAI 059238-II	TCI	Diorite	1.3	27.19	37.01	15.12	80.62	1.61	33.73	45.91	18.75
NMAI 031914	TCI	Gabbro	2.16	11.7	42.35	9.29	65.5	3.31	17.86	64.65	14.19
NMAI 059158	Bahamas	Gabbro	3.06	15.45	37.36	12.47	68.35	4.48	22.61	54.66	18.25
NMAI 031915	TCI	Gabbro	4.19	17.3	47.05	9.06	77.6	5.4	22.29	60.63	11.68
NMAI 031917	TCI	Greenschist	5.08	8.97	36.18	11.47	61.7	8.23	14.54	58.64	18.59
NMAI 059182	TCI	Greenschist	4.77	12.1	49.77	9.6	76.25	6.25	15.88	65.28	12.59
NMAI 031916	TCI	Greenschist	2.07	6.72	40.92	16.76	66.47	3.11	10.11	61.56	25.22
NMAI 220407B	Bahamas	Greenschist gabbro	4.86	18.11	56.71	11.84	91.51	5.31	19.79	61.97	12.94
NMAI 053464	BWI	Igneous rock	1.37	21.4	54.51	8	85.27	1.6	25.09	63.92	9.38
NMAI 186714D	TCI	Jadeite and/or omphacite jade	2.13	15.01	47.61	5.21	69.97	3.05	21.45	68.05	7.45
NMAI 059198	Bahamas	Jadeite and/or omphacite jade	1.74	14.39	48.47	4.3	68.89	2.52	20.89	70.35	6.24
NMNH A098726	Bahamas	Jadeite and/or omphacite jade	2.3	21.07	56.37	4.6	84.35	2.73	24.98	66.83	5.46

[a]SiO2 rich.

TABLE A2. (*Continued*)

Color Key:	Total too low	30	45	70	90	120	140	Total too high

Sample no.	Provenance	Lithology	MgO	Al_2O_3	SiO_2	CaO	Total	Mg norm	Al norm	Si norm	Ca norm
NMAI 059200	Bahamas	Jadeite and/or omphacite jade	2.74	18.02	59.67	5.79	86.22	3.17	20.9	69.21	6.72
NMAI 031919	TCI	Jadeite and/or omphacite jade	3.34	15.33	56.58	6.48	81.72	4.09	18.76	69.23	7.92
NMAI 032229B	Bahamas	Jadeite and/or omphacite jade	4.46	9.23	38.49	14.27	66.45	6.71	13.9	57.92	21.47
NMAI 186714J	TCI	Jadeite and/or omphacite jade	3.67	20.68	66.27	4.55	95.17	3.86	21.73	69.63	4.78
NMNH A098731	Bahamas	Jadeite and/or omphacite jade	1.75	20.7	59.83	3.64	85.91	2.03	24.09	69.64	4.23
NMNH A431158B	Bahamas	Jadeite and/or omphacite jade	6.9	18.71	61.1	15.26	101.97	6.76	18.34	59.92	14.97
NMAI 033944	DR	Jadeite and/or omphacite jade	1.61	30.49	35.9	–0.68	67.32	2.39	45.29	53.33	–1.01
NMAI 045773	Cuba	Jadeite and/or omphacite jade	6.23	15.56	50.37	5.39	77.54	8.03	20.07	64.95	6.94
NMAI 153341.003-1.22	PR	Jadeite and/or omphacite jade	2.33	15.22	105.21	1.92	124.68	1.87	12.21	84.38[a]	1.54
NMAI 059189	Bahamas	Jadeite and/or omphacite jade	1.3	14.61	44.09	3.12	63.12	2.06	23.15	69.84	4.95
NMNH A431158I	Bahamas	Jadeite and/or omphacite jade	1.57	17.2	54.76	2.96	76.5	2.06	22.49	71.59	3.87
NMNH A098729	Bahamas	Plagioclase rich diorite	2.54	15.35	39.21	8.16	65.26	3.89	23.52	60.08	12.5
NMAI 059176	Bahamas	Jadeite and/or omphacite jade	1.49	16.26	55.44	4.62	77.8	1.91	20.9	71.26	5.94
NMNH A098726	Bahamas	Jadeite and/or omphacite jade	2.18	18.98	51.5	5.09	77.75	2.81	24.41	66.24	6.54
NMNH A431165B	Bahamas	Jadeite and/or omphacite jade	3.87	15.87	58.13	5.59	83.46	4.63	19.02	69.65	6.7
NMAI 059204	Bahamas	Jadeite and/or omphacite jade	2.25	18.56	64.04	4.65	89.5	2.52	20.73	71.55	5.19
NMAI 179051	PR	Jadeite and/or omphacite jade	1.36	3.32	94.53	3.95	103.17	1.32	3.22	91.63[a]	3.83
NMAI 186714A	TCI	Jadeite and/or omphacite jade	3.56	24.76	61.56	4.91	94.79	3.76	26.12	64.94	5.18
NMAI 003800	PR	Jadeite and/or omphacite jade	7.12	13.39	54.45	11.89	86.85	8.19	15.42	62.7	13.69
NMAI 032227A	TCI	Jadeite omphacite jade	3	15.65	79.72	1.97	100.34	2.99	15.6	79.45	1.96
NMAI 032560	Bahamas	Jadeite and/or omphacite jade	2.31	19.77	50.25	7.31	79.65	2.9	24.82	63.1	9.18
NMAI 031913	TCI	Jadeitized siltstone	1.3	10.91	90.11	2.41	104.73	1.24	10.42	86.04[a]	2.3
NMNH A098735	Bahamas	Jadeite and/or omphacite jade	2.57	37.68	101.11	3.04	144.39	1.78	26.09	70.03	2.1
NMAI 153341.003-2.4	PR	Jadeite and/or omphacite jade	7.07	13.72	55.72	11.97	88.48	8	15.5	62.97	13.53
NMAI 032210	TCI	Jadeite and/or omphacite jade	1.6	26.28	55.8	7.69	91.37	1.75	28.76	61.07	8.42

TABLE A2. (*Continued*)

Color Key:	Total too low	30	45	70	90	120	140	Total too high

Sample no.	Provenance	Lithology	MgO	Al_2O_3	SiO_2	CaO	Total	Mg norm	Al norm	Si norm	Ca norm
NMAI 031922B	TCI	Jadeite and/or omphacite jade	2.81	20.82	65.36	4.24	93.22	3.01	22.33	70.11	4.54
NMAI 059159	Bahamas	Jadeite and/or omphacite jade	2.29	13.44	51.69	9.87	77.29	2.96	17.39	66.87	12.77
NMAI 032229E	Bahamas	Jadeite and/or omphacite jade	2.64	22.73	70.23	4.42	100.03	2.64	22.72	70.22	4.42
NMAI 186714G	TCI	Jadeite and/or omphacite jade	1.72	20.12	59.56	2.65	84.05	2.04	23.94	70.86	3.15
NMNH A431158E	Bahamas	Jadeite and/or omphacite jade	5.69	15.26	56.59	11.85	89.39	6.36	17.07	63.31	13.26
NMAI 090116	TCI	Jadeite and/or omphacite jade	1.3	19.97	57.37	1.45	80.09	1.63	24.93	71.63	1.81
NMAI 032569	Bahamas	Jadeite and/or omphacite jade	2.79	15.08	57.42	7.73	83.02	3.37	18.17	69.16	9.31
NMAI 032224A	TCI	Jadeite and/or omphacite jade	2.48	20.87	62.15	4.21	89.71	2.76	23.26	69.29	4.69
NMAI 031913	TCI	Jadeitized siltstone	1.34	7.33	73.47	2.82	84.96	1.58	8.63	86.48[a]	3.32
NMAI 186714E	TCI	Jadeite and/or omphacite jade	2.06	15.67	50.8	3.63	72.16	2.85	21.72	70.39	5.04
NMAI 109715	PR	Jadeite and/or omphacite jade	7.97	11.72	52.34	11.9	83.93	9.49	13.96	62.36	14.18
NMAI 059188	TCI	Jadeite and/or omphacite jade	2.9	20.57	65.95	5.3	94.73	3.06	21.72	69.62	5.6
NMNH A431158H	Bahamas	Jadeite and/or omphacite jade	3.25	20.72	65.7	4.11	93.78	3.46	22.09	70.06	4.38
NMAI 032219	TCI	Jadeite and/or omphacite jade	3.14	16.56	53.73	9.87	83.31	3.77	19.88	64.49	11.85
NMNH A098728	Bahamas	Jadeite and/or omphacite jade	5.18	11.99	43.19	15.4	75.76	6.84	15.82	57	20.33
NMAI 059175C	Bahamas	Jadeite and/or omphacite jade	1.99	21.73	64.21	4.18	92.1	2.16	23.59	69.71	4.54
NMAI 031921	TCI	Jadeite and/or omphacite jade	1.91	17.81	56.1	3.17	78.99	2.42	22.54	71.03	4.01
NMAI 059203	TCI	Jadeite and/or omphacite jade	3.34	16.03	62.66	8.03	90.05	3.71	17.8	69.58	8.91
NMAI 186714B	TCI	Jadeite and/or omphacite jade	1.46	16.23	51.01	6.66	75.36	1.94	21.53	67.69	8.84
NMAI 059183	TCI	Jadeite and/or omphacite jade	2.35	18.55	58.82	3.68	83.4	2.82	22.24	70.53	4.41
NMAI 059175D	Bahamas	Jadeite and/or omphacite jade	2.52	20.29	64.54	4.17	91.52	2.76	22.17	70.52	4.56
NMAI 032229A	Bahamas	Jadeite and/or omphacite jade	2.64	9.42	32.39	12.63	57.07	4.62	16.51	56.75	22.12
NMNH A554669	Bahamas	Jadeite and/or omphacite jade	3.45	20.78	61.22	9.95	95.4	3.61	21.78	64.18	10.43
NMNH A098734	Bahamas	Jadeite and/or omphacite jade	2.06	21.74	63.06	3.01	89.87	2.29	24.19	70.17	3.35
NMNH A431158A	Bahamas	Jadeite and/or omphacite jade	3.35	19.43	64.3	5.35	92.43	3.62	21.02	69.57	5.79

TABLE A2. (*Continued*)

Color Key:	Total too low	30	45	70	90	120	140	Total too high

Sample no.	Provenance	Lithology	MgO	Al_2O_3	SiO_2	CaO	Total	Mg norm	Al norm	Si norm	Ca norm
NMAI 059181B	TCI	Jadeite and/or omphacite jade	2.54	18.41	60.84	4.55	86.34	2.95	21.32	70.47	5.26
NMAI 032229D	Bahamas	Jadeite and/or omphacite jade	1.55	14.8	48.47	4.48	69.3	2.24	21.36	69.94	6.46
NMAI 059181-01	TCI	Jadeite and/or omphacite jade	2.75	17.51	57.91	4.39	82.56	3.33	21.21	70.14	5.32
NMAI 186714H	TCI	Jadeite and/or omphacite jade	2.58	19.78	58.78	5.95	87.09	2.96	22.71	67.49	6.84
NMAI 032218B	TCI	Jadeite and/or omphacite jade	1.87	23.55	68.16	3.89	97.47	1.92	24.16	69.93	3.99
NMNH A431158D	Bahamas	Jadeite and/or omphacite jade	3.34	10.85	38.05	9.57	61.8	5.4	17.56	61.57	15.48
NMAI 090115	TCI	Jadeite and/or omphacite jade	3.51	21.4	62.32	3.73	90.95	3.85	23.53	68.52	4.1
NMAI 032568	Bahamas	Jadeite and/or omphacite jade	1.6	10.82	38.71	4.31	55.44	2.88	19.51	69.82	7.78
NMNH A431165A	Bahamas	Jadeite and/or omphacite jade	4.46	18.99	59.8	9.48	92.72	4.81	20.48	64.5	10.22
NMAI 059207	TCI	Jadeite and/or omphacite jade	2.65	18.16	59.63	4.06	84.49	3.14	21.49	70.57	4.8
NMAI 059187	Bahamas	Jadeite and/or omphacite jade	3.67	17.07	62.59	8.66	91.99	3.99	18.56	68.04	9.41
NMNH A431159	Bahamas	Jadeite and/or omphacite jade	1.5	24.36	63.16	4.89	93.91	1.6	25.94	67.25	5.21
NMAI 032564B	Bahamas	Jadeite and/or omphacite jade	2.25	17.3	58.5	12.15	90.19	2.49	19.18	64.86	13.47
NMNH A098727	Bahamas	Jadeite and/or omphacite jade	4.2	9.48	46.3	10.22	70.2	5.98	13.5	65.96	14.56
NMAI 032205	TCI	Jadeite and/or omphacite jade	1.98	26.86	75	2.42	106.27	1.87	25.28	70.57	2.28
NMAI 032563	Bahamas	Jadeite and/or omphacite jade	1.4	19.65	54.53	6.59	82.18	1.71	23.91	66.36	8.03
NMAI 031920	TCI	Jadeite and/or omphacite jade	2.5	29.73	78.54	4.65	115.42	2.17	25.76	68.04	4.03
NMAI 032227C	TCI	Jadeite and/or omphacite blue-schist jade	2.87	20.07	64.35	5.88	93.17	3.08	21.54	69.07	6.31
NMAI 031922A	TCI	Jadeite and/or omphacite jade	1.7	22.22	60.03	2.61	86.56	1.97	25.67	69.34	3.01
NMNH A098733	Bahamas	Jadeite and/or omphacite jade	1.5	16.17	62.69	5.7	86.05	1.74	18.79	72.85	6.62
NMAI 036316	DR	Jadeite and/or omphacite jade	1.33	25.51	39.85	14.95	81.64	1.63	31.25	48.81	18.32
NMNH A431158G	Bahamas	Jadeite and/or omphacite jade	1.99	32.55	51.42	3.35	89.31	2.23	36.44	57.58	3.75
NMAI 184545	DR	Jadeite and/or omphacite jade	1.3	18.41	81.33	8.21	109.25	1.19	16.85	74.45	7.51
NMAI 032567	Bahamas	Jadeite and/or omphacite jade	2.36	19.35	66.8	6.24	94.75	2.49	20.42	70.5	6.59

TABLE A2. (*Continued*)

Color Key:	Total too low	30	45	70	90	120	140	Total too high

Sample no.	Provenance	Lithology	MgO	Al_2O_3	SiO_2	CaO	Total	Mg norm	Al norm	Si norm	Ca norm
NMAI 186714C	TCI	Jadeite and/or omphacite jade	2.69	18.34	41.47	12.32	74.83	3.6	24.52	55.42	16.47
NMAI 032217	TCI	Jadeite and/or omphacite jade	1.82	19.24	60.87	4.65	86.58	2.11	22.22	70.3	5.37
NMNH A431158G-Cr rich	Bahamas	Jadeite and/or omphacite jade	2.21	25.45	60.89	4.44	92.99	2.37	27.37	65.48	4.78
NMAI 032562	Bahamas	Jadeite and/or omphacite jade	2.13	11.61	63.88	6.75	84.37	2.53	13.76	75.72	8
NMAI 032227B	TCI	Jadeite and/or omphacite jade	1.77	21.53	60.15	5.12	88.57	2	24.3	67.91	5.78
NMNH A170747	Bahamas	Jadeite and/or omphacite jade	2.22	20.85	64.86	4.98	92.91	2.38	22.45	69.81	5.36
NMAI 032229C	Bahamas	Jadeite and/or omphacite jade	3.8	16.23	63.28	9.26	92.57	4.11	17.53	68.36	10
NMNH A554667	Bahamas	Jadeite and/or omphacite jade	2.81	20.26	65.81	4.21	93.1	3.02	21.77	70.69	4.52
NMAI 186714I	TCI	Jadeite and/or omphacite jade	9.6	15.74	59.72	12.66	97.71	9.82	16.1	61.12	12.95
NMAI 032218A	TCI	Jadeite and/or omphacite jade	1.29	22.9	62.41	2.19	88.8	1.46	25.79	70.28	2.47
NMNH A098732	Bahamas	Jadeite and/or omphacite jade	3.54	15.56	59.78	9.4	88.28	4.01	17.63	67.72	10.65
NMNH A431158C	Bahamas	Jadeite and/or omphacite jade	1.33	14.69	100.32	–0.3	116.03	1.14	12.66	86.46[a]	–0.26
NMAI 220407A	Bahamas	Jadeite and/or omphacite jade	1.85	16.26	52.26	2.73	73.09	2.54	22.24	71.49	3.73
NMAI 032558	TCI	Jadeite and/or omphacite jade	2.99	16.9	58.57	5.03	83.49	3.58	20.24	70.15	6.03
NMAI 186714F	TCI	Jadeite and/or omphacite jade	2.78	18.23	58.68	4.54	84.24	3.3	21.65	69.66	5.39
NMNH A431158F	Bahamas	Greenschist	5.53	14.11	55.7	13.27	88.61	6.24	15.93	62.86	14.98
NMAI 032564A	Bahamas	Jadeite and/or omphacite jade	2.38	19.75	61.05	4.94	88.12	2.7	22.42	69.28	5.61
NMAI 060000	TCI	Jadeite and/or omphacite jade	1.35	21.83	60.12	2.54	85.85	1.58	25.43	70.03	2.96
NMAI 032566	Bahamas	Jadeite and/or omphacite jade	3.64	17.34	62.88	8.47	92.33	3.94	18.78	68.11	9.17
NMAI 059175A	Bahamas	Jadeite and/or omphacite jade	1.5	17.4	50.78	6.82	76.49	1.96	22.74	66.38	8.92
NMAI 031923	TCI	Jadeite and/or omphacite jade	4.27	19.34	50.63	12.58	86.83	4.92	22.28	58.31	14.49
NMNH A431165C	Bahamas	Jadeite and/or omphacite jade	5.74	14.84	57.38	9.56	87.52	6.56	16.96	65.56	10.92
NMAI 059205	Bahamas	Jadeite and/or omphacite jade	5.6	10.27	48.04	10.3	74.2	7.55	13.83	64.73	13.88
NMAI 032224B	TCI	Jadeite and/or omphacite jade	2.1	18.23	59.07	4.76	84.16	2.5	21.66	70.19	5.66
NMAI 059181A	TCI	Jadeite blueschist	2.46	17.51	54.42	4.09	78.48	3.13	22.31	69.34	5.21

TABLE A2. (*Continued*)

Color Key:	Total too low	30	45	70	90	120	140	Total too high

Sample no.	Provenance	Lithology	MgO	Al_2O_3	SiO_2	CaO	Total	Mg norm	Al norm	Si norm	Ca norm
NMAI 059201	Bahamas	Jadeite- blueschist	2.19	15.16	49.82	4.91	72.09	3.04	21.03	69.12	6.82
NMAI 032561	Bahamas	Limestone	1.48	1.11	1.64	79.88	84.11	1.76	1.32	1.95	94.98
NMAI 034684	West Indies	Mafic gabbro	5.19	4.3	30.21	4.83	44.53	11.66	9.65	67.84	10.84
NMAI 059184	TCI	Omphacite-rich jade	1.81	16.65	57.87	7.42	83.75	2.16	19.88	69.1	8.86
NMAI 059184-01	TCI	Omphacite-rich jade	1.79	18.54	58.83	4.21	83.37	2.14	22.24	70.56	5.05
NMAI 032200 (3 Oct 13)	TCI	Plagioclase-rich diorite	1.37	33.16	40.91	17.71	93.15	1.47	35.6	43.92	19.01
NMAI 032200 (3 Oct 13)	TCI	Plagioclase-rich diorite	1.35	26.87	39.25	17.21	84.68	1.6	31.72	46.35	20.33
NMAI 032200 (2 Oct 13)	TCI	Plagioclase-rich diorite	1.61	24.93	40.87	15.57	82.99	1.94	30.04	49.25	18.76
NMAI 059139	Bahamas	Sandstone	1.31	31.67	39.84	16.24	89.06	1.47	35.56	44.74	18.24
NMAI 031918	TCI	Silica rich tuff	1.89	13.22	65.77	8.87	89.75	2.1	14.73	73.28	9.88
NMAI 186715	TCI	Siltstone	1.34	20.75	62.46	0.39	84.94	1.58	24.43	73.53	0.46
NMAI 032559	Bahamas	Tuff	1.52	15.52	50.87	5.27	73.18	2.08	21.21	69.52	7.2
NMAI 032228	Bahamas	Meta-tuff	2.53	14.17	56.19	4.01	76.89	3.29	18.43	73.07	5.21
NMAI 045886-2	Cuba	Omphacitite	0.74	10.68	29.97	2.25	43.64	1.69	24.48	68.68	5.15
NMAI 045886-1	Cuba	Omphacitite	0.74	7.77	22.21	2.21	32.93	2.25	23.6	67.45	6.7
NMAI 059181-b	TCI	Blueschist	2.23	20.93	63.13	3.09	89.38	2.49	23.42	70.63	3.46
NMAI 198814-A	Haiti	Blueschist	2.94	17.74	60.02	4.01	84.71	3.47	20.94	70.85	4.74
NMAI 045436-2	Cuba	Blueschist	2.3	13.91	50.57	5.34	72.11	3.19	19.29	70.13	7.4
NMAI 200109-L	Haiti	Blueschist/jadeite veins	5.71	13.68	50.41	10.03	79.83	7.16	17.13	63.15	12.56
NMAI 198814-I	Haiti	Eclogite	2.65	9.96	36.56	13.21	62.38	4.24	15.97	58.6	21.18
NMAI 003787	PR	Eclogite	5.85	10.26	47.3	14.14	77.55	7.55	13.22	60.99	18.24
NMAI 045893-2	Cuba	Omphacite-jadeite jade	1.65	7.5	23.59	6.3	39.03	4.22	19.22	60.43	16.13
NMAI 032226	TCI	Jadeite and/or omphacite jade	0.74	9.31	30.61	3.38	44.04	1.69	21.14	69.49	7.67
NMAI 153347.001-10	PR	Jadeite and/or omphacite jade	1.78	16.73	52.93	2.81	74.25	2.4	22.53	71.28	3.78
NMAI 032205	TCI	Jadeite and/or omphacite jade	0.92	17.79	51.96	2.06	72.72	1.26	24.46	71.44	2.83

TABLE A2. (*Continued*)

Color Key:	Total too low	30	45	70	90	120	140	Total too high

Sample no.	Provenance	Lithology	MgO	Al_2O_3	SiO_2	CaO	Total	Mg norm	Al norm	Si norm	Ca norm
NMAI 059200	Bahamas	Jadeite and/or omphacite jade	2.96	17.46	61.72	6.31	88.45	3.35	19.74	69.78	7.14
NMAI 037935	Cuba	Jadeite and/or omphacite jade	1.14	13.6	51.12	4.15	70.01	1.62	19.43	73.03	5.92
NMAI 059204	Bahamas	Jadeite and/or omphacite jade	1.49	15.41	55.88	4.04	76.81	1.94	20.06	72.75	5.26
NMAI 032210	TCI	Jadeite and/or omphacite jade	1.07	23.48	50.1	7.58	82.24	1.3	28.55	60.92	9.22
NMAI 220407	Bahamas	Jadeite and/or omphacite jade	1.32	14.48	48.99	2.86	67.65	1.96	21.4	72.42	4.22
NMAI 059207	TCI	Jadeite and/or omphacite jade	2.79	18.86	63.84	4.26	89.75	3.11	21.01	71.13	4.75
NMAI 186714-B	TCI	Jadeite and/or omphacite jade	1.06	16.38	51.7	5.79	74.93	1.41	21.87	69	7.73
NMAI 186714-C	TCI	Jadeite and/or omphacite jade	2.48	13.59	36.59	13.33	65.99	3.76	20.6	55.45	20.19
NMAI 186714-A	TCI	Jadeite and/or omphacite jade	3.64	23.27	58.86	5.26	91.04	4	25.56	64.66	5.78
NMAI 045893-1	Cuba	Jadeite and/or omphacite jade	2.93	12.46	50.07	8.62	74.08	3.95	16.82	67.59	11.64
NMAI 186714-I	TCI	Jadeite and/or omphacite jade	2.27	22.02	67.03	6.83	98.15	2.31	22.43	68.29	6.96
NMAI 186714-G	TCI	Jadeite and/or omphacite jade	1.79	21.41	66.21	2.86	92.26	1.94	23.2	71.76	3.1
NMAI 031913	TCI	Jadeitized siltstone	1.09	5.41	73.24	3.73	83.46	1.3	6.48	87.75[a]	4.46
NMAI 041852-B	Cuba	Jadeite and/or omphacite jade	1.56	18.62	56.61	3.05	79.83	1.95	23.32	70.9	3.82
NMAI 031919	TCI	Jadeite and/or omphacite jade	3.22	15.49	58.12	6.36	83.18	3.87	18.62	69.87	7.64
NMAI 041852-A	Cuba	Jadeite and/or omphacite jade	2.32	16.18	55.56	6.32	80.38	2.89	20.13	69.12	7.86
NMAI 197100	Haiti	Jadeite and/or omphacite jade	1.33	20.39	47.53	5.69	74.95	1.77	27.21	63.42	7.59
NMAI 031920	TCI	Jadeite and/or omphacite jade	1.2	20	53.05	6.75	81.01	1.48	24.69	65.49	8.33
NMAI 031922	TCI	Jadeite and/or omphacite jade	1.99	12.59	42.44	5.72	62.75	3.18	20.07	67.64	9.12
NMAI 044957-8	Cuba	Jadeite and/or omphacite jade	1.89	20.98	56.88	2.77	82.52	2.3	25.42	68.92	3.36
NMAI 044957-9	Cuba	Jadeite and/or omphacite jade	3.34	14.06	36.5	6.63	60.53	5.52	23.22	60.3	10.96
NMAI 200109-F	Haiti	Jadeite and/or omphacite jade	3.67	15.6	54.32	8.51	82.1	4.47	19	66.16	10.37
NMAI 200109-G	Haiti	Jadeite and/or omphacite jade	2.45	20.12	64.11	3.42	90.09	2.72	22.34	71.15	3.79
NMAI 153341.002-2.24	PR	Jadeite and/or omphacite jade	1.67	19.61	61.24	2.52	85.04	1.96	23.06	72.01	2.97
NMAI 153341.002-2.25	PR	Jadeite and/or omphacite jade	0.95	15.33	45.94	2.16	64.37	1.48	23.81	71.36	3.36

TABLE A2. (*Continued*)

Color Key:	Total too low	30	45	70	90	120	140	Total too high

Sample no.	Provenance	Lithology	MgO	Al_2O_3	SiO_2	CaO	Total	Mg norm	Al norm	Si norm	Ca norm
NMAI 045747-D	Cuba	Jadeite and/or omphacite jade	1.47	17.38	52.44	3.38	74.67	1.97	23.28	70.24	4.52
NMAI 045747-C	Cuba	Jadeite and/or omphacite jade	2.27	19.79	62.48	4.57	89.1	2.54	22.21	70.12	5.13
NMAI 153341.002-2.23	PR	Jadeite and/or omphacite jade	1.88	13.39	48.47	4.43	68.17	2.76	19.64	71.11	6.5
NMAI 032560	Bahamas	Jadeite and/or omphacite jade	3.83	18.3	51.49	6.32	79.94	4.79	22.89	64.4	7.91
NMAI 153347.001-6	PR	Jadeite and/or omphacite jade	1.25	19.48	59.28	1.37	81.38	1.53	23.94	72.84	1.68
NMAI 032563	Bahamas	Jadeite and/or omphacite jade	1.55	19.98	62.33	4.57	88.43	1.76	22.6	70.48	5.17
NMAI 153347.001-2.9	PR	Jadeite and/or omphacite jade	1.49	17.72	45.9	3.87	68.97	2.16	25.69	66.55	5.61
NMAI 032566	Bahamas	Jadeite and/or omphacite jade	3.15	15.8	58.55	7.77	85.27	3.7	18.53	68.66	9.11
NMAI 059159	Bahamas	Jadeite and/or omphacite jade	1.79	12.56	45.31	12.35	72.01	2.49	17.44	62.92	17.15
NMAI 032569	Bahamas	Jadeite and/or omphacite jade	2.99	15.45	60.34	7.95	86.72	3.45	17.81	69.58	9.17
NMAI 153347.001-2.3	PR	Jadeite and/or omphacite jade	1.02	21.65	61.6	1.71	85.99	1.19	25.18	71.64	1.99
NMAI 153347.001-2.5	PR	Jadeite and/or omphacite jade	2.4	19.66	55.96	3.29	81.31	2.95	24.18	68.83	4.05
NMAI 041853	Cuba	Jadeite and/or omphacite jade	1.45	16.29	48.4	3.2	69.33	2.09	23.49	69.8	4.62
NMAI 045436-1	Cuba	Jadeite and/or omphacite jade	2.18	12.69	42.57	6.35	63.8	3.42	19.89	66.72	9.96
NMAI 059175-1	Bahamas	Jadeite and/or omphacite jade	1.18	15.32	44.78	3.63	64.91	1.82	23.6	68.98	5.6
NMAI 059176	Bahamas	Jadeite and/or omphacite jade	1.6	16.6	58.44	4.95	81.6	1.96	20.35	71.62	6.07
NMAI 059175-4	Bahamas	Jadeite and/or omphacite jade	1.53	13.73	44.61	3.58	63.44	2.41	21.64	70.31	5.64
NMAI 059175-3	Bahamas	Jadeite and/or omphacite jade	2.05	21.83	67.28	4.1	95.26	2.15	22.92	70.63	4.3
NMAI 032229-B	Bahamas	Jadeite and/or omphacite jade	0.99	3.28	14.39	11.3	29.96	3.29	10.94	48.05	37.72
NMAI 032229-C	Bahamas	Jadeite and/or omphacite jade	3.43	17.84	66.81	9.36	97.45	3.52	18.31	68.56	9.61
NMAI 042387	Cuba	Jadeite and/or omphacite jade	0.81	13.09	41.19	1.64	56.73	1.43	23.08	72.61	2.89
NMAI 032227-C	TCI	Jadeite and/or omphacite jade	2	14.39	49.63	6.96	72.97	2.74	19.72	68.01	9.54
NMAI 032224-B	TCI	Jadeite and/or omphacite jade	1.16	8.55	31.51	4.7	45.92	2.54	18.61	68.62	10.24
NMAI 059181	TCI	Jadeite and/or omphacite jade	2.4	17.59	60.65	4.63	85.27	2.82	20.62	71.13	5.43
NMAI 032227-A	TCI	Jadeite and/or omphacite jade	3.17	19.67	92.94	2.19	117.97	2.68	16.68	78.78	1.86

TABLE A2. (*Continued*)

Color Key:	Total too low	30	45	70	90	120	140	Total too high

Sample no.	Provenance	Lithology	MgO	Al_2O_3	SiO_2	CaO	Total	Mg norm	Al norm	Si norm	Ca norm
NMAI 032224-A	TCI	Jadeite and/or omphacite jade	1.15	11.4	36.18	7.84	56.57	2.04	20.15	63.95	13.86
NMAI 044958	Cuba	Jadeite and/or omphacite jade	1.47	11.99	37.29	4.49	55.23	2.65	21.71	67.51	8.13
NMAI 059187	Bahamas	Jadeite and/or omphacite jade	2.1	12.48	46.68	7.87	69.13	3.04	18.05	67.53	11.38
NMAI 059189	Bahamas	Jadeite and/or omphacite jade	1.28	18.83	57.77	3.45	81.33	1.57	23.16	71.03	4.24
NMAI 044863	Cuba	Jadeite and/or omphacite jade	1.02	13.33	39.39	2.47	56.21	1.81	23.71	70.08	4.4
NMAI 059198	Bahamas	Jadeite and/or omphacite jade	2.03	17.22	59.45	5.03	83.73	2.43	20.56	71	6.01
NMAI 032218-B	TCI	Jadeite and/or omphacite jade	1.82	17.1	55.3	3.98	78.2	2.33	21.86	70.71	5.09
NMAI 003778	PR	Jadeite and/or omphacite jade	0.84	18.54	45.96	6.35	71.69	1.18	25.86	64.11	8.86
NMAI 032218-A	TCI	Jadeite and/or omphacite jade	0.74	14.45	42.02	2.05	59.26	1.25	24.38	70.91	3.46
NMAI 044873	Cuba	Jadeite and/or omphacite jade	2.18	16.31	49.56	7	75.06	2.91	21.73	66.03	9.33
NMAI 060000	TCI	Jadeite and/or omphacite jade	0.75	18.6	53.8	3.06	76.21	0.99	24.41	70.59	4.01
NMAI 090115	TCI	Jadeite and/or omphacite jade	3.31	20.19	62.15	3.58	89.23	3.7	22.63	69.65	4.01
NMAI 090116	TCI	Jadeite and/or omphacite jade	0.74	20.3	61.79	1.89	84.71	0.88	23.96	72.94	2.23
NMAI 045435.001	Cuba	Jadeite and/or omphacite jade	1.56	14.25	61.71	4.38	81.9	1.9	17.4	75.35	5.35
NMAI 045434	Cuba	Jadeite and/or omphacite jade	2.12	17.87	57.87	3.3	81.16	2.61	22.02	71.3	4.07
NMAI 198814-D	Haiti	Jadeitite + iron oxides	0.81	10.93	33.94	1.27	46.94	1.72	23.29	72.29	2.7
NMAI 032227-B	TCI	Omphacite jade	0.92	9.19	28.13	3.65	41.9	2.21	21.95	67.15	8.7
NMAI 059184	TCI	Omphacite jade	0.85	8.02	29.82	6.68	45.36	1.87	17.67	65.74	14.72

Reflecting on the History and Use of Rectangular Obsidian "Mirrors" from Mexico: Reinterpreting Old Museum Collections and Indigenous–Colonial Intersections

Maria M. Martinez,[1,2] Michael Brandl,[3] Meredith Sharps Noyes,[4] Thomas Lam,[4] and Edward P. Vicenzi[4]*

INTRODUCTION

Over the past two decades researchers have increasingly used museum collections as primary sources for gaining a deeper understanding of socioeconomic processes of the past both independently of and in comparison to newly excavated archaeological material (Voss, 2012; Flexner, 2016a; Frieman and Janz, 2018; King, 2016; Childs and Warner, 2019). For example, recent studies of rectangular polished obsidian items, typically found within museum collections, have indicated that these objects were made by Mexican Indigenous artisans during the colonial period for European consumption. Nevertheless, much of this research was not well-grounded within the discipline of anthropology and therefore did not fully address the potential cultures or communities that manufactured these items and the Indigenous and colonial intersections under which they were produced and consumed. Additionally, many museums continue to categorize these objects as pre-Columbian mirrors and vaguely assign them to cultures of Mesoamerica.

For the current study, we initiated an obsidian "mirrors" collections-based research project at the Smithsonian Institution's National Museum of the American Indian (NMAI), which to our knowledge houses the largest collection (n = 6) of highly polished, rectangular obsidian tablets. We examined all six of the objects that are commonly classified as mirrors because of their highly reflective surfaces (Mason, 1927; Ekholm, 1973). To date no such objects have been recovered from a secure archaeological context (pre-Hispanic or colonial; Smith, 2014:13).

This research takes an ethnohistorical as well as a historical archaeology approach (see Lightfoot, 1995; Palka, 2009; Strong, 2015; Silliman, 2020) interweaving museum collections with pre-Columbian archaeological studies, Mesoamerican art and iconography, and historical sources[1] to explore the history and use of rectangular obsidian mirrors in the context of colonial entanglements in Mexico. Spain's imperial expansion into the Americas, considered one of the largest ever known in the Western Hemisphere, was as a process of geographic expansion, mercantilism, and capitalism within the modern world (Orser, 1996), one that operated on "fixed orders of racial and cultural difference" (Gosden, 2004:22). Coloniality consisted of "an invasion, a colonization effort, a social experiment, a religious crusade, and a highly economic enterprise" (Deagan, 2003:3). According to Quijano (2007:169),

1 Amerind Foundation, Inc., Post Office Box 400, 2100 North Amerind Road, Dragoon, Arizona 85609, USA.

2 Department of Anthropology, The University of Texas at Austin, 2201 Speedway Stop C3200, Austin, Texas 78712, USA.

3 Austrian Archaeological Institute, Austrian Academy of Sciences, Hollandstrasse 11-13, 1020 Vienna, Austria.

4 Museum Conservation Institute, Smithsonian Institution, 4210 Silver Hill Road, Suitland, Maryland 20746, USA.

* Correspondence: mmar@utexas.edu

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> In the beginning colonialism was a product of a systematic repression, not only of the specific beliefs, ideas, images, symbols or knowledge that were not useful to global colonial domination, while at the same time the colonizers were expropriating from the colonized their knowledge, specially in mining, agriculture, engineering, as well as their products and their work.

It is within the context of a Euro-centered colonialism—defined as a centralized government and economy controlled by the crown and monolithic Catholicism—that we explore the manufacture and use of obsidian tablets. More specifically, we investigate the socioeconomic relations between Indigenous communities in Mexico and Spanish colonizers to explore whether crafting communities operated with economic agency in these colonial situations, that is to say, if, and to what degree, Native artisans were able to exert their autonomy under the colonial rule, for example, within *encomiendas* (grant of tribute-paying subjects), imperial tribute systems, or a market economy or perhaps as independent artisans.

Additionally, we subscribe to and will add to the body of literature that disputes the colonial/Eurocentric "model of quick replacement," the notion that more sophisticated European technologies immediately replaced autochthonous ones (see Rogers 1988, 1990; Pastrana and Fournier 1998; Rodríguez-Alegría, 2005, 2008, 2014). This study illustrates how Native knowledge and technology persisted through the colonial invasion but were employed to produce objects for European elites and artists. For example, feather works and polished obsidian objects, which represent some of the most sumptuous items and required Indigenous ingenuity, technique, artistry, aesthetics, and local materials, were intended for elite European consumption and appropriation (see Feest, 1990; Meslay, 2001; Pixley, 2012).

The objects used for this study made their way into the NMAI through purchases from collectors, through early twentieth century anthropologists, and through exchanges between museums without much additional museum provenance, that is, "all associations of an artifact with individuals, collections, and institutions from the time of its discovery" (Flexner, 2016b:169). Additionally, fine-grained provenience documentation, for example, the location or coordinates of an object found during excavation or excavation notes, is nonexistent (see Barker, 2012; Flexner, 2016b). This lack of information shrouds their function, chronology, and precise cultural assignment, and in museums they are broadly identified as pre-Columbian mirrors from Mesoamerica.

According to the NMAI's museum records, the investigated items are listed as "rectangular obsidian mirrors" (see Table 1, Figure 1), and their provenience is noted as the modern-day state of Michoacán, Mexico, and the Valley of Mexico. These locations correspond to the homeland of the Purépecha[2] (CE 1350–1522 [Common Era, formerly denoted AD]) and Aztec[3] (CE 1325–1521) empires (Gorenstein and Pollard, 1983; Pollard, 2008; Berdan, 2017); therefore, we will use this museum provenience data as a starting point and place our focus on the organization of Purépecha and Aztec craft production prior to and under Spanish rule. Consequently, locating the raw material sources of the obsidian items under investigation through provenance studies is necessary to further explore and understand the development of socioeconomic relations between artisans who produced high-valued prestige items and the colonial structures of the Spanish invasion. Material sourcing allowed us to place the artisan communities within the greater cultural context of the Purépecha and/or Aztec Empires. The pre-Columbian archaeological record indicates that the Aztec and Purépecha Empires were warring polities; however, the Purépecha Empire was never subjugated by the Aztecs (Gorenstein and Pollard, 1983:1; Berdan, 2017). Because each polity had access to multiple obsidian sources within their territories, there was little obsidian exchange between the two (see Pollard and Smith, 2003; Hirth et al., 2006; Golitko and Feinman, 2015). Although we must take into account that traditional trade routes were disrupted and that European draft animals, wheeled carts, and a newly built road system were introduced after the Spanish conquest (Hassig, 1985:187–219; see also Rodríguez-Alegría et al., 2013; Pastrana Cruz et al., 2019), obsidian production remained fairly localized in its nature, and tracing the provenance of the objects under investigation allowed us to locate the specific city-state that produced these items.

MIRRORS AND RECTANGULAR, POLISHED OBSIDIAN TABLETS FROM MESOAMERICA

The manufacture of obsidian mirrors and other polished precious stone objects falls under the term "lapidary technologies" (Charlton et al., 1991; Otis Charlton, 1993). Because the items under investigation show elements of pre-Columbian crafting traditions, we provide an overview of the development and use of mirrors and polished obsidian tablets in Mesoamerica.

In Mesoamerica, the first mirrors were recorded at the Middle Preclassic Period (1200–400 BCE [Before Common Era]) site of La Venta, Mexico (Gallaga, 2018:16). Mirrors in Mesoamerica are made from a variety of ores (Carlson, 1981:120; Heizer and Gullberg, 1981:114; Blainey, 2007) and knapped and polished obsidian (Taube, 1992:31–34; Reents-Budet, 1994:322). Hematite was most commonly used in the Preclassic periods (2000 BCE–CE 250), pyrite was used most in the Classic period (CE 250–900), and obsidian was the material of choice during Postclassic times (Ekholm, 1973; Gallaga, 2001, 2009, 2018). It is suggested that mirrors and other mirroring surfaces were used for vanity in domestic contexts; however, "due to their capacity for projecting an inverse reflection of the spectator's reality, mirrors were used as divinatory or magical portals to communicate between parallel dimensions, worlds, or realities" by royal elites and shamans (Gallaga, 2018:4).

Mirrors were also worn as part of military dress in pre-Columbian Aztec society (Pastrana and Carballo, 2016). They embodied or served as religious accoutrements of Aztec and Maya

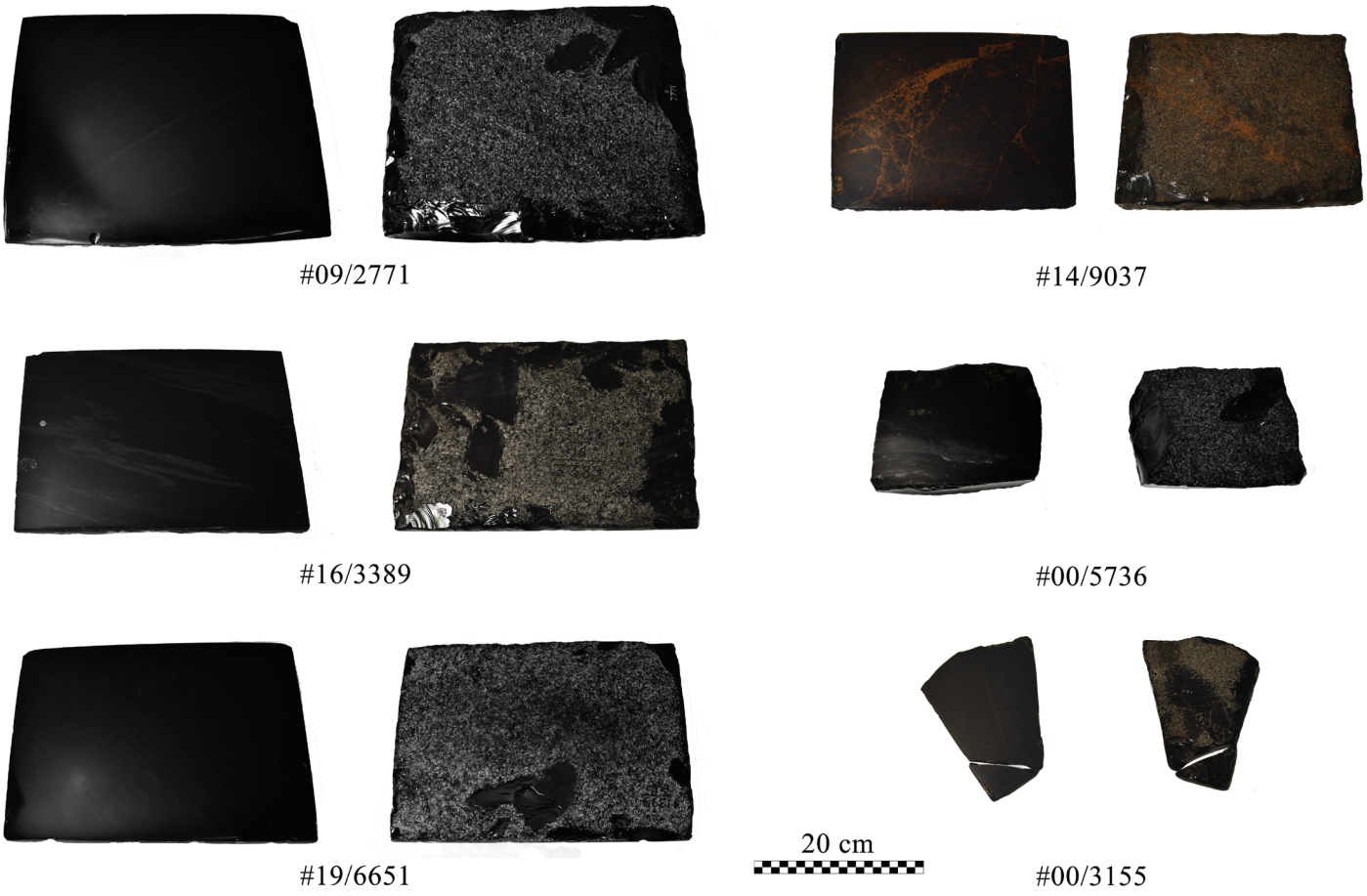

FIGURE 1. Six rectangular, polished obsidian tablets, identified by their NMAI catalog numbers.

gods. For example, iconographic representations of Tezcatlipoca (Lord of the Smoking Mirror) with his right foot replaced by a round obsidian mirror are present on various mediums, including murals, ceramic vessels, and codices, throughout central Mexico and beyond (Olivier, 2003; Smith, 2014; Umberger, 2014). According to Smith (2014:15), images of rectangular obsidian mirrors are not found in the Aztec codices. Additionally, the pre-Hispanic archaeological evidence indicates that mirrors in Purépecha society were also round rather than square (Rebnegger, 2013). In the Maya region, Classic period (CE 250–900) polychrome vessels portray courtly scenes of rulers, members of the court, and various deities using mirrors for scrying and divinatory rituals.[4] There, however, items identified as mirrors from sound archaeological context are always made of iron ore (Inomata et al., 2002; Blainey, 2007, 2018; Healy and Blainey, 2011), and to our knowledge, there is no evidence of rectangular obsidian mirrors in the Lowland Maya region during Postclassic times (CE 900–1530) either. Therefore, we can exclude the possibility that rectangular, polished obsidian tablets were made or used by the Maya, and we can exclude that they were used by pre-Columbian Purépecha or Aztec peoples.

Consequently, recent research indicates the items we consulted (rectangular, polished obsidian tablets) are not pre-Hispanic and to our knowledge were not used by the Native peoples who manufactured them. Rather, they are likely colonial period objects consumed by the Spanish (Saunders, 1997; Meslay, 2001; Evans, 2010; Pixley, 2012) and manufactured by Mesoamerican lapidarians (Calligaro et al., 2007:48). McAndrew (1965:379) has documented the presence of a rectangular, polished obsidian item serving as the main altar at San Jose de los Naturales, the atrio of San Francisco in Mexico City in CE 1564. An ethnohistoric source additionally noted that square obsidian altars were made by Native obsidian craftspeople and commissioned by Franciscan fathers Alonso Ponce and Juan de Torquemada in the state of Michoacán (see Evans, 2010:76–77; Torquemada, [1615] 1943:210). Francisco Hernández, a medical doctor in the 1570s, documented Indigenous remedies throughout New Spain (Bye and Linares, 1990). He noted the use of *Iztli* (obsidian in the Nahuatl language) for the production of *aras* (altars) used by the Spanish, which were held in high esteem because of their reflecting properties (Hernández, 1959). By the seventeenth century, polished, rectangular obsidian items were also being used as

canvases by Baroque period artists, most notably Spanish master Bartolomé Esteban Murillo (CE 1617–1682; Meslay, 2001; Calligaro et al., 2005, 2007; Pixley, 2012).

Nevertheless, some museums assign their context to tombs (The University of Pennsylvania Museum of Archaeology and Anthropology; Musée du quai Branly – Jacques Chirac), date individual specimens as early as 1500–1400 BCE (Corning Museum of Glass), and note their origin as Central America and Mexico. Frequently, museums assign obsidian mirrors with Mexican provenience to the paramount Aztec god Tezcatlipoca (Lord of the Smoking Mirror), one of the most revered deities of their pantheon (Saunders, 1997, 2001; Baquedano, 2014; Smith, 2014). However, as follows from the discussion above, we will work under the supposition that these items were novelties of the Spanish invasion of present-day Mexico, which started in 1521, and ascribe their manufacture to Purépecha and/or Aztec craftspeople. This background informed the working hypothesis for this study.

Although these previous studies revealed a certain degree of insight concerning rectangular obsidian tablets, such objects have not been assigned to a particular cultural group in Mesoamerica, and to date, no in-depth technological analysis has been published. Smith (2014) has recognized that the most appropriate approach to determine the function and cultural assignment of such obsidian objects is through technomorphological studies in tandem with material provenance analyses. Therefore, for this study we conducted macro- and microscopic manufacture trace investigations combined with portable X-ray fluorescence spectrometry (pXRF) analysis for raw material provenance.

MATERIALS AND METHODS

Objects and Museum Provenance

The collections currently under the stewardship of the NMAI were transferred from the Museum of the American Indian, Heye Foundation to the Smithsonian Institution in 1989 under the federal legislation known as the National Museum of the American Indian Act. George Gustave Heye began collecting Native American and Indigenous items from throughout the Americas in 1897. By 1916, his collection contained more than 58,000 items, and he established the Museum of the American Indian, Heye Foundation in New York. Although George Gustave Heye consulted with many professional anthropologists, most notably Franz Boas, much of the collection was amassed through purchases from untrained collectors and amateur anthropologists (see Jacknis, 2008). Therefore, contextual data can be inaccurate, meager, and sometimes nonexistent. His collecting practices are part of what has been termed the "collection frenzy" (Bench, 2014:57) during the founding of most large natural history museums, also referred to as the Museum Period, 1860–1900 (Fenton, 1960:330). Many believed that the effects of colonization would soon cause the demise of all Native and Indigenous peoples and their traditional lifeways, prompting museums and anthropologists to begin their frenetic collection programs (e.g., Bell, 2017). Therefore, we must acknowledge and never forget that many of the items and much of the documentation acquired by museums were collected under social, political, and economic duress and sometimes through illicit activities.

The six items we selected for this project are identified as obsidian mirrors from the Valley of Mexico and Michoacán, Mexico. Our initial examination confirms the material is obsidian. All six items are identified as archaeological in the NMAI catalog, but no records exist indicating their contexts except for item 09/2771, which was assigned to a specific culture and chronological context by NMAI curators in the course of an exhibition (*Great Masters of Mexican Folk Art from the Collection of Formento Cultural Banamex, A.C.*, 2002–2003, National Museum of the American Indian George Gustave Heye Center, New York; see Table 1). Two of the items (NMAI 00/3155 and 00/5736) were on loan and exhibited at The University of Pennsylvania Museum of Archaeology and Anthropology from 1909 to 1917. Two, NMAI 14/9037 and 19/6651, were on exhibit at the Museum of the American Indian but were taken off exhibit in 1941 for fear of air strikes when America entered World War II. Additionally, NMAI 09/2771, 00/3155, 16/3389, and 19/6651 have associated accession records, but not much information beyond that exists for these items. As is apparent from Table 1, most of these objects came to the NMAI through collectors or exchange with other museums, which does not provide more detailed information concerning their Indigenous history (see Turner, 2015, 2020). Since the results of studying the practices and collection history of the collectors and the one ethnographer (Carl Lumholtz) did not promise to provide crucial information for answering our primary questions concerning the artisans and their roles after the Spanish conquest, we decided not to follow this line of investigation beyond the available museum records.

Methods

Technomorphological Analyses

The obsidian tablets were investigated through a multiscalar optical approach for the identification and documentation of manufacturing traces. We used macroscopic examination, as well as stereo- and digital microscopy. Macroscopic investigation confirmed the general "internal stratigraphy" of manufacture, allowing for a reconstruction of the *chaîne opératoire* from basic shaping to the final design of the polished objects. For stereomicroscopy, we used a Zeiss reflected light microscope, and digital microscopic documentation was performed with a AF4515ZT-Wired Dino-Lite Edge. The latter produced photomicrographs of characteristic manufacturing traces under various magnifications, providing in-depth information about specific tools used in each production step.

TABLE 1. Description and museum provenance for objects cataloged in the Smithsonian Institution's National Museum of the American Indian (NMAI).

NMAI catalog no.	Object description	Museum provenance
09/2771	Large rectangular obsidian mirror; 40.9 × 32.3 × 2.93 cm; 8.4 kg	Mexico; Michoacán State; Pátzcuaro Municipality, Purépecha, CE 1000–1521; Henry Hurlburt Rice Collection, purchased in 1919
16/3389	Large rectangular obsidian mirror; 34.5 × 24.8 × 2.68 cm; 4.4 kg	Valley of Mexico, Leo Stein Collections, purchased in 1928 from Basel, Switzerland
19/6651	Rectangular obsidian mirror; 28.7 × 36.2 × 2.83 cm; 5.6 kg	Valley of Mexico; exchange with Cranmore Ethnographical Museum in 1937
00/5736	Obsidian mirror; 20.8 × 15.53 × 3.5 cm; 2 kg	Mexico; Michoacán State, Pátzcuaro; collected by Carl Lumholtz in 1905
00/3155	Obsidian mirror fragment; 19 × 15 × 2 cm; 1 kg	Valley of Mexico; Henry Booth Collection, purchased in 1905
14/9037	Square mahogany obsidian mirror; 26.5 × 19.9 × 2.96; 3 kg	Valley of Mexico; purchased in 1926

Raw Material Provenance Analyses

Given the high sensitivity of archaeological museum collections, nondestructive and at the same time reliable techniques are required for their scientific investigation. One promising method meeting these requirements is pXRF. Since the detection limits of newer generations of pXRF detectors have been significantly improved over the past decade, analytical results have become more comparable to laboratory-based XRF, specifically with regard to X-ray lines with energies from ~6 to 19 keV (Craig et al., 2007; Shugar and Mass, 2013). Especially for obsidian, the suitability of pXRF for tracing archaeological artifacts back to their sources has convincingly been demonstrated, making this technique the method of choice for museum-based research endeavors. Additionally, such research holds the potential to expand the general database of archaeological provenance studies by making otherwise inaccessible datasets available for research (e.g., Forster and Grave, 2011; Millhauser et al., 2011; Frahm, 2014).

For Mesoamerican obsidian provenance studies, pXRF has also been successfully applied, and the most important sources have been characterized (e.g., Millhauser et al., 2011; Moholy-Nagy et al., 2013; Ebert et al., 2015). Archaeological and provenance studies demonstrate that obsidian was omnipresent in pre-Hispanic Mesoamerica and was traded and used by both small- and large-scale societies for a variety of purposes for more than 10,000 years (Gaxiola and Clark, 1989; Saunders, 2001; Cobean, 2002; Hirth and Andrews, 2002; Hirth, 2006; Pastrana Cruz et al., 2019). Various studies involving geochemical and visual analyses have identified the sources of obsidian artifacts throughout central Mexico and the Guatemalan and Honduran highlands and have provided indications of the crafting communities using those sources (e.g., Darras, 1994, 2008, 2009; Glascock et al., 1998; Braswell et al., 2000; Cobean, 2002; Glascock, 2002; Healan 2002, 2009).

The six rectangular obsidian tablets from the NMAI were analyzed using a Bruker ELIO pXRF in atmosphere with a polychromatic Rh X-ray source and a 50 mm^2 silicon drift detector. Multiple point spectra were acquired for each specimen at operating conditions of 50 kV and 75 μA and with a 240 s real-time acquisition. K_α X-ray line intensities for Mn, Fe, Rb, Sr, Y, Zr, and Nb were measured and processed using Bruker Esprit (version 2.1) software after an energy shift correction was applied. Peak intensities were background corrected and deconvolved to account for overlapping peaks to obtain a net count inventory for each of the seven elements. Net count ratios for five element pairs (Rb/Zr, Sr/Zr, Y/Zr, Nb/Zr, and Fe/Mn) were compared to reference obsidians from four archaeologically

relevant obsidian deposits in central Mexico. To provide a regional sourcing comparison, seven polished reference standards from these four obsidian flows were also measured using the ELIO pXRF under conditions identical to those used to collect spectra from the obsidian tablets. Three samples were supplied by Michael Glascock of the University of Missouri Research Reactor (MURR; Cobean, 2002), one specimen was supplied by Dan Healan (DH Ucareo; Healan, 1997), and three samples were provided on loan from the National Museum of Natural History's (NMNH) National Rock and Ore Collection (Robert Smith obsidian collection). These samples encompass archeological obsidian sources from the Pachuca (Sierra de Las Navajas), Otumba, Ucareo, and Zinapécuaro areas (see Figure 5 for a map). One final obsidian reference specimen, NMNH 72854/VG-568, from Obsidian Cliff in Yellowstone National Park, was measured during each analytical session to determine the accuracy and precision of the instrument throughout the period of the project. The Yellowstone obsidian used here is part of the Smithsonian Microbeam Standards collection, and as such its major and minor elemental composition has been well characterized by wet chemical methods and electron microprobe analysis (Jarosewich et al., 1990). Source plots of element ratios were made by computing 95% reliability ellipses for the reference samples (where 95% of the values from the source references plot within the ellipse) with JMP statistical software from SAS, using a method similar to that of Stroth et al. (2019). Source assignments were determined by comparing the net count ratios from the tablets to the source plots. To further determine the validity of the biplot method using XRF net counts, the elemental ratios determined from the net counts for the obsidian standards were compared to elemental ratios from previous analyses in the literature, encompassing data collected by instrumental neutron activation analysis (Cobean, 2002; Glascock, 2011), XRF (Healan, 1997; Glascock, 2011; Millhauser et al., 2015), and laser ablation–inductively coupled plasma–mass spectrometry (Carballo et al., 2007). The net count ratios reported here are in good agreement with elemental ratios published previously.

Results

Technomorphological Analyses

Generally, all sides of the objects were investigated, and the working traces were documented. The anatomical terms for obsidian tablets are provided in Figure 2 (after Wright, 1992). Object NMAI 00/5736 is a fragment, and only the original upper and lower sides are preserved; therefore, we did not include the edges in the analyses. Similarly, for object 00/3155 only the original edges were analyzed. During the first step of production of all objects in this study, rough shaping was applied to produce a rectangular tablet. All sides were worked mainly by direct soft percussion flaking with additional pressure flaking for the edges when needed. Large thinning flakes were removed from the lower and most likely upper sides to create extensive multifaceted surfaces. The upper sides were polished to such a high degree that all previous traces of manufacture were completely erased. The second reduction strategy consisted of systematic pecking of protruding ridges resulting from the flake scars (Figure 3a). It can be observed predominately on the flat lower sides of all specimens and partly on some edges. All except two pieces show medium to coarse pecking marks and embedded Hertzian cones; however, objects 14/9037 (mahogany) and 00/3155 (fragment) display finer pecking scars (perhaps from different tools and/or techniques). For most specimens, the individual pecking marks measure approximately 2 mm in diameter (Figure 3b,c), whereas for 14/9037 the diameter is only slightly greater than 0.5 mm. Healan (2009:104) describes various tools producing such impact marks for working platforms of prismatic obsidian cores at Tula and Xochicalco and the Villafuerte workshop at the Ucareo source. He lists small, pointed chert pebbles, flakes, or bifaces as well as soft hammerstones as most likely tools.The third stage of production involved grinding, predominately on the edges. We conducted experiments to gain comparable manufacturing traces from known lapidary tools. These tools consisted of a quartzite grinding stone, a gneiss grinding plate, a coarse metal file, and a sandstone grinding wheel. The latter was a commonly used tool in postmedieval European lapidary, especially for hard rocks, such as gemstones. The traces observed on the edges of the obsidian plates (e.g., Figure 3d,e) correspond best to

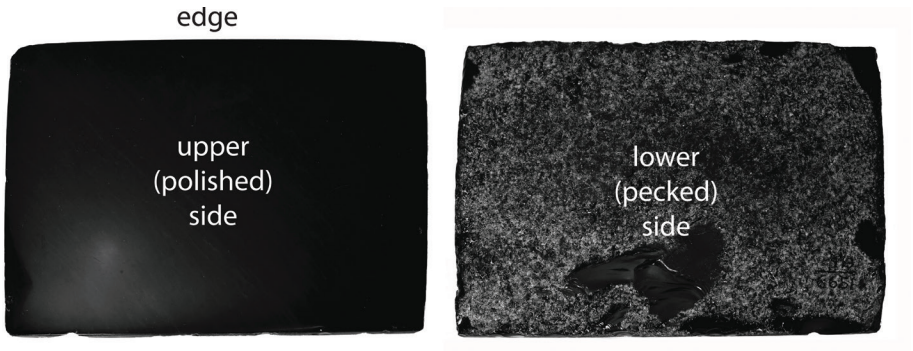

FIGURE 2. Obsidian tablet morphology, NMAI 19/6651.

the experimental traces produced by the grinding wheel (Figure 3f). Polishing traces on the upper sides are microscopically visible on all objects except for one. Object 16/3389 was polished to a degree that all traces were removed (Figure 3i). Objects NMAI 00/3155, 00/5736, and 09/2771 show remaining polishing traces, item 14/9037 (mahogany tablet) has extensive fine striations (Figure 3h), and object 19/6651 has abundant fine bundles of striae covering the entire surface (Figure 3g). It appears that the six tablets fall into two separate groups based on different tool traces. Objects 16/3389 and 19/6651 are strikingly similar in all aspects of manufacture except for the final polishing; perhaps more time was invested in the production of the former. Objects 00/5736 and 09/2771 fit into the same extending group, whereas items 14/9037 and 00/3155 differ because of their finer pecking patterns on the lower sides. Therefore, it is possible that these objects come from two different workshops or schools of practice using different tools and techniques or from two different artisans. Another possibility is that these items were manufactured over a period of more than 100 years, and the technology used to manufacture them may have changed over time.

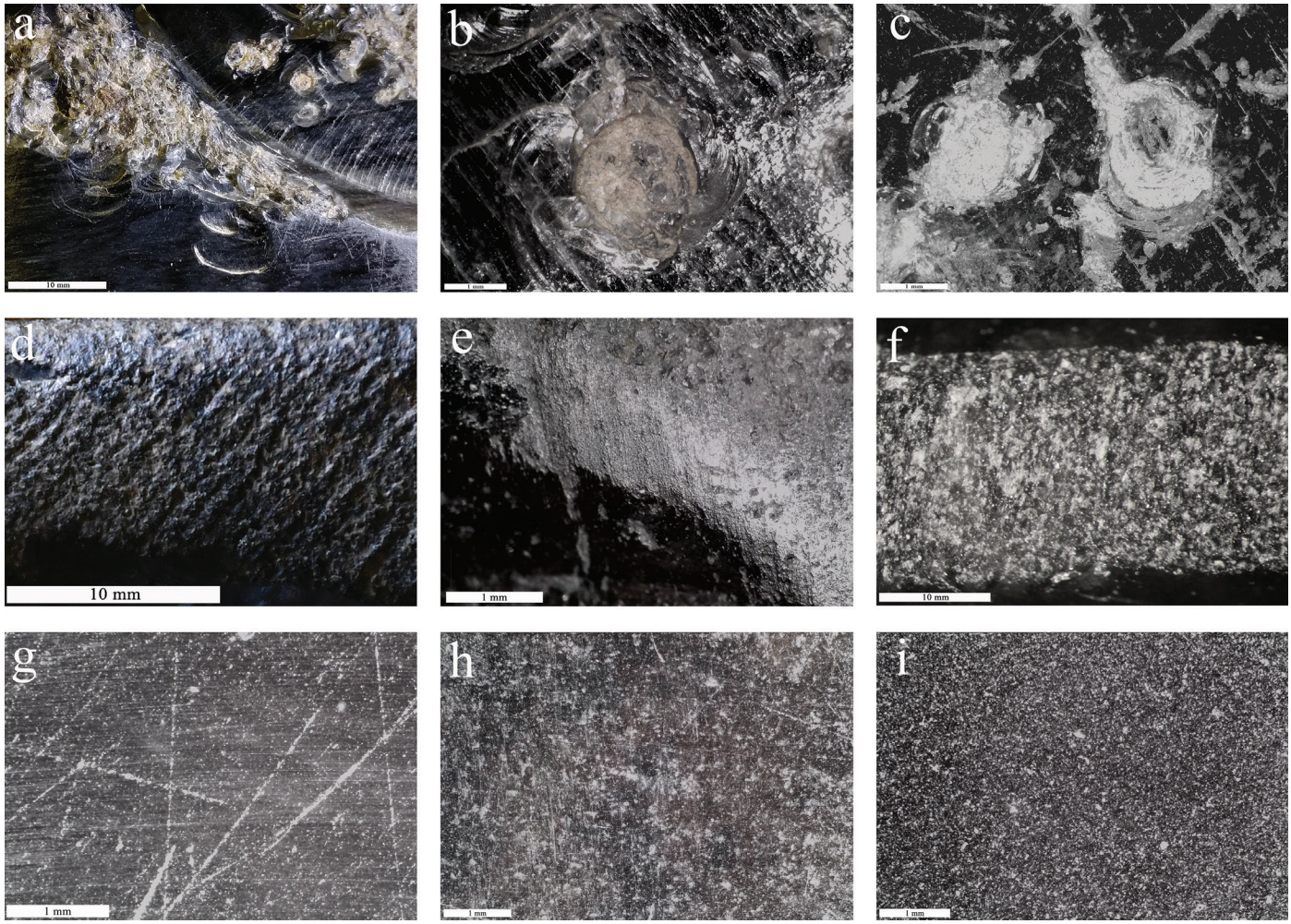

FIGURE 3. Manufacturing traces on the investigated obsidian tablets and one experimental specimen, illustrating individual production stages (pecking, grinding, polishing). (a) Leveling of a remaining ridge from knapping by pecking on the back of item NMAI 16/3389; scale bar = 10 mm. (b) Close-up of an individual pecking mark on the back of item NMAI 16/3389; scale bar = 1 mm. (c) Individual pecking marks on the back of item NMAI 00/3155; scale bar = 1 mm. (d) Detail of the edge of object NMAI 00/3155, with raking light revealing uniform grinding traces; scale bar = 10 mm. (e) Microscopic image of uniform edge grinding traces on object NMAI 14/9037 (mahogany tablet) ; scale bar = 1 mm. (f) Experimental grinding of obsidian with a sandstone lapidary wheel; scale bar = 10 mm. (g) Bundles of striations from polishing on the upper side of object NMAI 19/6651; scale bar = 1 mm. (h) Polishing traces on the upper side of object NMAI 14/9037 (mahogany tablet) ; scale bar = 1 mm. (i) Extremely finely polished upper surface of object NMAI 16/3389; scale bar = 1 mm. Microscopically, no polishing traces are visible.

Raw Material Provenance Analyses

Net count ratio data acquired from XRF point spectra for all objects and obsidian reference samples are shown in Table 2. In cases where multiple reference samples from the same obsidian source were measured, the ratios are consistent with each other. Ratios from reference samples were plotted against each other, and 95% reliability ellipses were calculated, shown in the example biplot for Fe/Mn and Rb/Zr in Figure 4. Data points determined from the tablets were plotted and compared to the compositional space occupied by these reference specimen ellipses. Five of the tablets (items 0/92771, 19/6651, 16/3389, 00/5736, and 00/3155) fall within the area defined by the Ucareo source, whereas object 14/9037 falls outside all of the source regions as determined by the geochemical biplots.

Of the five tablets consistent with an Ucareo source assignment, two of the tablets (00/5736 and 00/3155) exhibit some values that lie within the overlap between the Ucareo and Zinapécuaro sources. The Ucareo and Zinapécuaro obsidian sources are spatially close, separated by only ~20 km, but the flows likely originate from two different magmatic events and can be readily distinguished chemically (Healan, 1997, 2009; Pollard, 1993; Pollard et al., 2001; Glascock, 2011). Nelson and Healan (1995) have documented chemical variation across the Ucareo obsidian source, with higher Rb and lower Fe and Zr in the southern part of the erupted lobe relative to other areas in the flow. Although closer to the overlap in the biplots, the mean ratio values for objects 00/5736 and 00/3155 shown in Table 2 are consistent with an Ucareo source. The subtle chemical differences exhibited by the two tablets (00/5736 and 00/3155) relative to the three that fall well within the Ucareo source suggest that the raw material likely came from a different part of the obsidian flow within the Ucareo source, rather than originating from the Zinapécuaro area (Figure 5).

The sixth tablet (14/9037) is made of brecciated mahogany obsidian, with a reddish-brown matrix surrounding black and patchy reddish-brown clasts, and is visually distinct from the other five tablets that source to the Ucareo area. Mahogany (red or meca) obsidian has been detected in a variety of obsidian sources in central and western Mexico (Pollard, 1977; Glascock et al., 1994; Pollard and Vogel, 1994) but was found in greater quantities and quarried at the Otumba source (Clark, 1979; Otis Charlton, 1993). Cerro Zináparo also provided red obsidian within the Purépecha Empire (Figure 5; Pollard, 1977; Rebnegger, 2010:83, 2013:102–115; Walton, 2017). Methods for sourcing mahogany obsidian are identical to those used to geochemically fingerprint a source locality for conventional black obsidian because the color mechanism arises from differences in the iron oxidation state and nanoscale structure (Glascock et al., 1994; Kasztovszky et al., 2018). The mahogany tablet in the NMAI collections is similar in appearance to a square-shaped painting on mahogany obsidian at the University of Missouri Museum of Art and Archaeology, which is thought to originate from the Ucareo source (Pixley, 2012). However, item 14/9037 is not consistent with any of the obsidian sources analyzed in this study, and therefore, its source locality remains unknown.

DISCUSSION: RECTANGULAR, POLISHED OBSIDIAN TABLETS AND INDIGENOUS–COLONIAL INTERSECTIONS

The results of our technomorphological investigations provide clear evidence that the manufacturing process of the obsidian tablets involved expert obsidian knapping skills and the use of colonial lapidary tools, notably the grinding wheel, as attested by

TABLE 2. Mean net count ratios ± 1σ for *n* points across each specimen. The abbreviation BDL (below detection limit) indicates the numerator value was not detected by portable X-ray fluorescence spectrometry.

Sample	*n*	Source	Rb/Zr	Sr/Zr	Y/Zr	Nb/Zr	Fe/Mn
MURR SH1101	4	Pachuca	0.178 ± 0.009	BDL	0.102 ± 0.002	0.104 ± 0.006	18.8 ± 0.2
NMNH 91655	4	Pachuca	0.177 ± 0.001	BDL	0.0957 ± 0.0003	0.108 ± 0.003	18.4 ± 0.1
NMNH 117450-34	4	Pachuca	0.176 ± 0.004	BDL	0.099 ± 0.002	0.112 ± 0.005	18.3 ± 0.1
MURR OM0303	4	Otumba	0.85 ± 0.06	0.91 ± 0.05	0.11 ± 0.05	BDL	30.2 ± 1.1
NMNH 117450-51	10	Zinapécuaro	1.4 ± 0.2	0.05 ± 0.03	0.18 ± 0.03	0.28 ± 0.04	49.8 ± 1.5
MURR UM0607	4	Ucareo	1.14 ± 0.07	0.08 ± 0.02	0.09 ± 0.03	0.27 ± 0.04	55.4 ± 4.2
DH Ucareo	10	Ucareo	1.13 ± 0.06	0.09 ± 0.01	0.14 ± 0.02	0.23 ± 0.02	54.7 ± 2.3
NMAI 09/2771	14		1.13 ± 0.04	0.09 ± 0.01	0.14 ± 0.01	0.24 ± 0.02	55.4 ± 1.8
NMAI 19/6651	12		1.09 ± 0.08	0.10 ± 0.02	0.13 ± 0.02	0.23 ± 0.02	54.6 ± 2.8
NMAI 16/3389	12		1.15 ± 0.05	0.10 ± 0.01	0.14 ± 0.01	0.24 ± 0.02	54.5 ± 2.4
NMAI 00/5736	10		1.24 ± 0.03	0.08 ± 0.01	0.13 ± 0.01	0.25 ± 0.01	52.3 ± 1.6
NMAI 00/3155	10		1.22 ± 0.05	0.10 ± 0.01	0.15 ± 0.01	0.24 ± 0.01	53.2 ± 2.3
NMAI 14/9037	15		1.63 ± 0.03	0.04 ± 0.01	0.22 ± 0.02	0.33 ± 0.02	41.9 ± 1.5

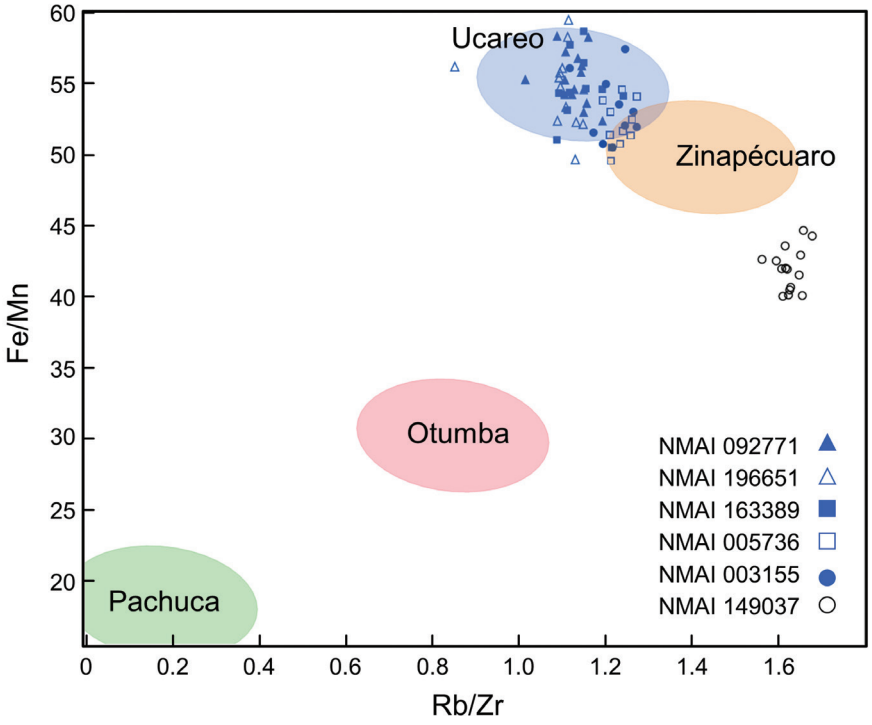

FIGURE 4. Biplot for the XRF net count ratios Fe/Mn and Rb/Zr. The areas within the ellipses represent 95% reliability for each source area. Data points from the obsidian tablets are plotted on the graph, with blue symbols being consistent with the Ucareo source area. Two tablets, NMAI 00/5736 and 00/3155, have values that overlap with the Zinapécuaro source area, whereas one tablet, NMAI 14/9037, does not align with any of the source references studied.

characteristic traces (Figure 3d–f). Therefore, we see Indigenous expertise applying both traditional and colonial tools in the production of such novel products. Thus, we have established direct correlation of manufacturing traces, notably pecking to level all surfaces, between the colonial obsidian tablets and Late Postclassic lapidary objects from the site of Erongarícuaro (see Rebnegger, 2013:102, figs. 5.22, 5.23). Pecking and grinding of faceted surfaces are also attested for polyhedral Ucareo obsidian cores, for example, at the site of Villafuerte, which display patterns strikingly similar to those observed on our study objects (see Healan, 2009). Additionally, museum records lack evidence that rectangular, polished obsidian items have ever been found in secure archaeological contexts, and historical sources and contemporary research indicate that they were used as altars, or *aras*, and canvases for Baroque paintings during the sixteenth and seventeenth centuries. These results unambiguously support the initial supposition that polished, rectangular obsidian tablets at the NMAI are not pre-Columbian and are, instead, more likely objects produced for and consumed by the Spanish for various purposes.

Only very limited studies on the provenance of such objects exist. Particle-induced X-ray emission and XRF analyses have proposed Ucareo, Michoacán State, Mexico, as the main source of the obsidian raw material used to make these colonial specimens (Calligaro et al., 2005, 2007; Pixley, 2012:18). Initially believed to be part of one large undistinguishable source region called Zinapécuaro, more recent research employing XRF analysis was able to distinguish between the three separate sources of Ucareo, Zinapécuaro, and Cruz Negra (Pollard, 1993; Healan, 1997, 2009; Pollard et al., 2001; Glascock, 2011). Although previous studies were not able to achieve a clear source assignment for two obsidian tablets used as canvases by Bartolomé Esteban Murillo (Musée du Louvre) and four blank tablets (Musée de l'Homme) on the basis of particle-induced X-ray emission analyses (Calligaro et al., 2007:47), our provenance studies using pXRF were more successful and agree with another sourcing study of a painted obsidian canvas at the Museum of Art and Archaeology at the University of Missouri (Pixley, 2012).

The raw material provenance analyses conducted for this study demonstrate that five of the six investigated objects originated from the Ucareo source area, and the mahogany (meca or red) obsidian tablet could also belong to this larger geological region, although currently, it is not possible to identify its original source location (see Table 2, Figure 4). Other obsidian sources within the Purépecha realm were also intensively used, for instance the Zináparo-Varal-Prieto source area; therefore, it is of utmost importance to include these geological sources to identify the source of this object. Pollard (1977) and Walton (2017) note that red obsidian was procured from Cerro Zináparo during the Late Postclassic period and distributed to Tzintzuntzan for the production of luxury items (also see Rebnegger, 2010:83, 2013:102–115). The presence of outside sources in smaller quantities, for example, Sierra de La Navajas (Pachuca), Sierra de Pénjamo (present-day Mexican state of Guanajuato), and the highland sources from Jalisco, was also documented by Rebnegger (2010:83, 2013:115). Notably, at Ucareo the occurrence of tabular obsidian was reported by Calligaro et al. (2007), making this source ideally suited for the production of such items. However, the objects from the NMAI were worked to the point that our technomorphological study could not determine whether large nodules or plates were used in their production.

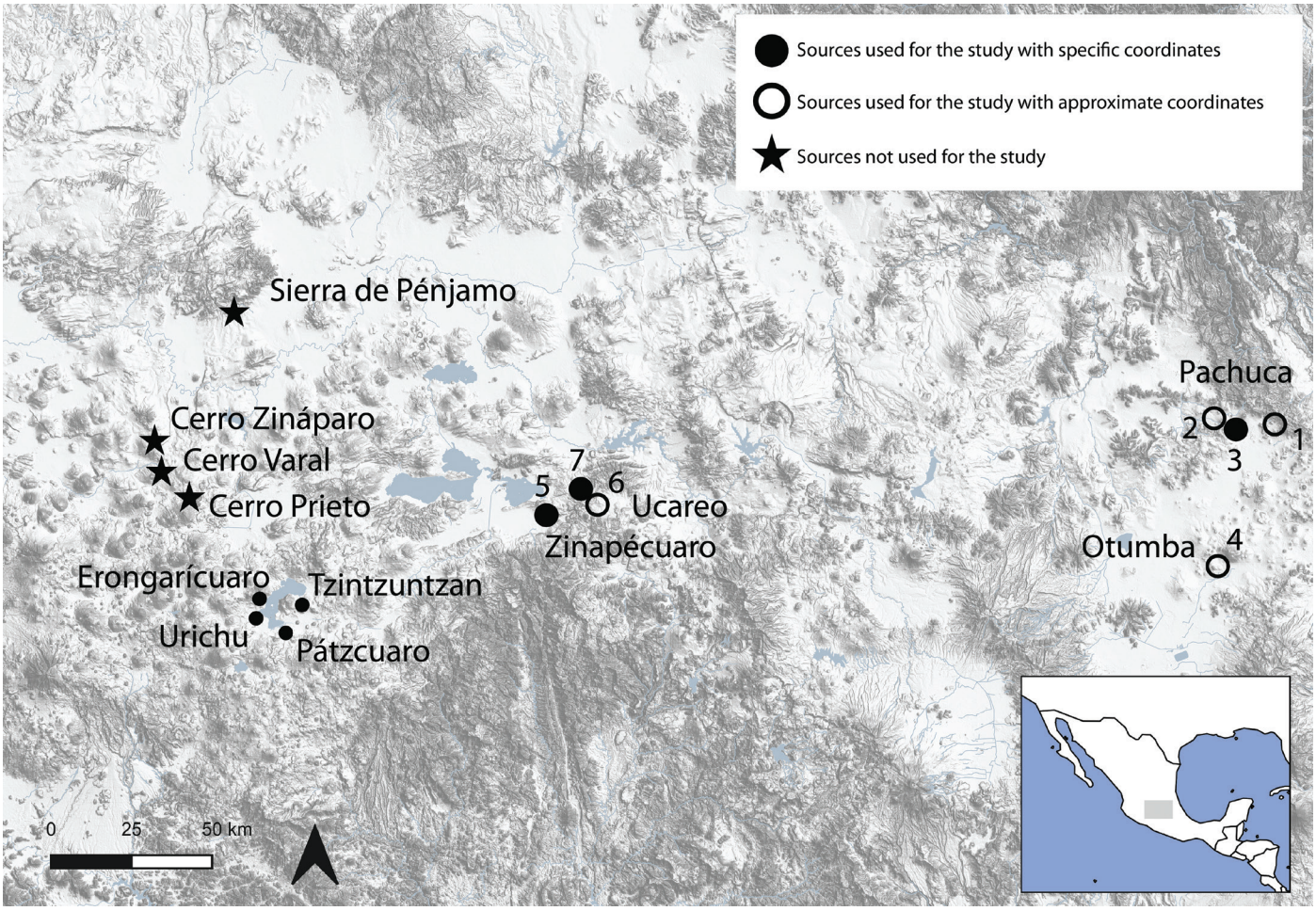

FIGURE 5. Map of central Mexico with Purépecha archaeological sites around Lake Pátzcuaro and obsidian sources in the Purépecha and Aztec Empires. Locations of obsidian reference specimens with specific latitude and longitude coordinates are marked by solid circles, whereas open circles represent approximate locations based on previously published descriptions. Samples 1–3 represent the Sierra de Pachuca source area, sample 4 represents Otumba, sample 5 represents Zinapécuaro, and samples 6 and 7 represent the Ucareo source. Sources indicated by a star were not available for the current study.

As noted earlier, obsidian production shortly before and especially after colonization was fairly localized in its nature. Consequently, having identified the geological source of these objects, we focused our subsequent research agenda on various crafting communities under colonial rule in western central Mexico that heavily relied on Ucareo obsidian for lapidary products: the pre- and postconquest Purépecha Empire.

The Purépecha Empire

From CE 1350 to 1522, the Purépecha Empire ruled a vast territory that included the present-day state of Michoacán and parts of Jalisco and Guanajuato as well as a large number of obsidian sources (Figure 5). The Purépecha people considered obsidian sacred, embodying royal and divine powers, which is apparent from the pre-Hispanic archaeological record (Darras, 1998, 2010) and the historical narrative *Relación de Michoacán* (RM).[5] Using archaeological data, Pollard (2017), Rebnegger (2010, 2013), and Walton (2017) document pre-Hispanic obsidian lapidary in the Purépecha Empire. According to their studies, the production and consumption of obsidian lapidary products, for example, ear flares and labrets, took place at the Lake Pátzcuaro Basin within elite residential areas of primary and secondary administrative centers (Figure 5). These included the king's main residence of Tzintzuntzan and secondary centers with high-ranking elites such as the site of Erongarícuaro (Rebnegger, 2010:80; Pollard, 2017:15; Walton, 2017:101–102). The archaeological data and the RM indicate that items such as ear flares and labrets signify the rank of royalty

and only the king and certain office holders were entitled to wear them (Walton, 2017:101). Rebnegger (2013) notes that during the Tariacuri phase (Late Postclassic, CE 1350–1525) lapidary work at Erongarícuaro also included mirror production. Likewise, Pollard (1977) mentions the presence of obsidian disks at lapidary workshops, and Walton (2017) also documents production of polished disks or cylinders on the Great Platform in Tzintzuntzan during the Late Postclassic (Figure 5). Olivier (2003) cites two historical references that suggest the use of circular mirrors in the Purépecha Empire.

According to the RM ([1541] 1956:171–172), the king may have had skilled craft specialists who lived within the royal family residences at Tzintzuntzan. Archaeological data combined with accounts in the RM led Walton (2017) to assert that lapidarian specialists were lower-level elite males attached to the royal residence. Maldonado (2008:293) documents a similar pattern for precious metal items and also suggests a form of attached specialization during precolonial times. For further discussions on the organization of craft production see Costin (1991, 2005).

Obsidian provenance studies at Tzintzuntzan and Erongarícuaro demonstrate that these centers almost exclusively used obsidian from Ucareo for both utilitarian and lapidary items, indicating that this source was most likely state controlled by the capital during pre-Columbian times (see Pollard et al., 2001; Rebnegger, 2010), but a tributary system of local workers has also been considered (Healan, 1997). It is also likely that Ucareo obsidian remained the main source at primary centers in the Pátzcuaro Basin core during colonial times, even with the disruptions and changes in all trade routes throughout New Spain that occurred shortly after conquest.

Purépecha Artisans and Obsidian Use Under Colonial Rule: Sixteenth and Seventeenth Centuries

Although some metal tools were introduced by the Spanish, obsidian tools remained markedly essential and continued to be made and used by the Indigenous population for their own consumption and for the production of items that supported enslaved Africans and their descendants and local Native slave laborers working in the Spanish mining, cattle, and agricultural industrial complexes (Warren, 1985:172–210; Serrano, 2017:72–73). These items include bulk goods such as chilies, corn, beans, blankets, footgear, mantas, and pottery. For example, the processing of hides from the Spanish cattle industry in central Mexico, including Michoacán (see Endfield, 1997), precipitated the modification of scraper obsidian technology (see Pastrana Cruz et al., 2019:21–23). It is ironic to consider that obsidian played such an important and critical role in the economy that fueled the European Renaissance.

Nonutilitarian polished obsidian items along with other luxury objects were also of great importance to the Spanish. Warren (1985:21) notes that Purépecha art was highly regarded by the Europeans and gifted to the Spanish king by the *Cazonci* (Purépecha king or ruler; see Garcia, 2012:8, 18). Bartolomé de las Casas observed, "The artisans who exceed all others of New Spain in this art are those of the province of Michoacán" (Casas and Pérez de Tudela y Bueso, 1958:208). Therefore, it was of great interest for the invaders to preserve, continue, and/or control the arts and obsidian economy for their own consumption.

It is likely that the highest Purépecha elites, who remained in power after the invasion, maintained control over specialized artisans for producing traditional regalia, for example obsidian and turquoise earspools and labrets. This is attested by an *oficial* of Pátzcuaro, also listed among the nobles of this town, named Pablo Coyote, who indicated in CE1565 that he had been a lapidist of the lord of Ihuatzio in the past (Kuthy-Saenger, 1996:313, Appendix 1). When such items of status and authority were replaced by Spanish status symbols is an important question that remains. For example, the RM, created between CE 1539 and 1541, illustrates the *Cazonci* and other noble elites wearing traditional regalia and status symbols, including labrets. However, the RM was created to show Purépecha society prior to the Spanish invasion, so these images may not represent elite accoutrements during the time of its creation.

According to Kuthy-Saenger (1996:104), by the late sixteenth century the general Native population had already adopted Spanish-style clothing. It is not clear whether this shift in clothing style included the abandonment of all Indigenous elite lapidary status symbols, particularly because these items were considered to embody legitimate authority and noble status (Haskell, 2008:235). However, the highest Purépecha elites and other nobles, most likely a very small number by this time (Gorenstein and Pollard, 1983:54), may have abandoned their traditional regalia faster than the general population, particularly because of their proximity to the Spanish elites and their desire to assimilate to the new elite culture. As Kuthy-Saenger (1996:100) states, "It was the highest-ranking Tarascan elite who adjusted to and associated with the Spanish elite, and, therefore, rapidly adopted the new colonial symbols of status that identified the Spanish conquerors." Therefore, it is reasonable to conclude that shortly after the assassination of the last Purépecha king, Tzintzicha Tangaxoan, in CE 1530 the remaining Purépecha elites ceased using their traditional regalia, including clothing and obsidian lapidary items. This shift forced the lapidists formerly attached to elite households and responsible for the production of these status symbols to adapt to a new reality under Spanish rule soon after CE 1530.

After the execution of the *Cazonci*, Bishop Vasco de Quiroga (CE 1470–1565) was sent by Charles I to Michoacán to end a period of violence and abuse against the Native populations and to restore order from the chaos that had ensued under the tyrannical rule of Nuño de Guzmán (Warren, 1985:138–156; Zarandona, 2006). Vasco de Quiroga served as the first bishop of Michoacán from CE 1536 to 1565 and moved the capital from Tzintzuntzan to Pátzcuaro in 1540. A fundamental legacy of Vasco de Quiroga was the establishment of a "utopian" construction according to Thomas More's ideas in the form of hospital towns and several colleges (Warren, 1999, 2005:83; Gómez, 2001). Indigenous peoples were relocated and consolidated at centralized town locations through the process known as *reducción* (see Deagan, 2003:5).

Within these newly created and repopulated villages, Vasco de Quiroga also called for the revitalization and preservation of traditional crafts (Pérez de Ribas, 1896:103–104; Jarnés, 1942:275–279; Lacas, 1957:82–84).

Specific villages were assigned particular trades, arts, or crafts reflecting the specialty of the locale. Historical accounts list a wide array of crafts, among them woodworking, feather working, and lapidary, in these villages of economic specialization (Lacas, 1957; Dinerman, 1972; Pollard, 2017:15). Along with the introduction of some European tools for making craft production more efficient, Vasco de Quiroga also introduced European arts and played a significant role in the regional craft industry around Lake Pátzcuaro sometime after 1539 (Lacas, 1957:82). These specialized crafting villages and/or wards within the larger centers may have served as the foundations for a system comparable to craft guilds developed by the Spanish (see Pastrana Cruz et al., 2019:21–24, for craft production in colonial Aztec society). Kuthy-Saenger (1996:159–160, 195, 219, 315) documents sixteenth century lapidarians and a number of other craft specialists as *oficiales de oficio* or *anataquareni* from crafting wards in Pátzcuaro.

These developments resulted in the creation of hybrid products combining old and new technologies. Items produced with Indigenous ingenuity, skill, artistry, and materials that were held sacred were transformed into objects with entirely different values and motives of use, for instance, obsidian tablets serving as altars in Catholic churches and obsidian canvases with depictions of Christian iconography from Baroque times. Historical evidence of lower-status elites active as craftspeople (Zurita, [1560–1585] 1840; Kuthy-Saenger, 1996) points toward the most likely producers of high-value objects, such as rectangular, polished obsidian tablets during colonial times: lower elite Purépecha lapidarians most likely under a craft guild system who still held a position of higher status and had knowledge of traditional craftmanship accompanied by colonial technology, for example, the grinding wheel, in the area of Lake Pátzcuaro. The Native artisans could have developed their own niche within this guild system under Spanish control that afforded entrepreneurship to meet the market demands, as Pastrana Cruz et al. (2019) suggest for Aztec artisans.

CONCLUSION

The outcomes of this study highlight the importance of integrated collections-based research utilizing nondestructive analytical techniques and the full breadth of historical sciences to answer complex socioeconomic questions. Additionally, this study developed an anthropological and techno-morphological analytical protocol for collections-based research involving rectangular, polished obsidian tablets from Mesoamerica on a larger scale that can be used by researchers working within and outside museum settings. Through the investigation of manufacturing traces (*chaîne opératoire*), the (ethno)historical records, and precolonial and colonial period iconography and art, we have presented multifaceted evidence that when taken together, the obsidian tablets at the NMAI are most assuredly colonial objects. They were created by Indigenous artisans and primarily used as early as the middle sixteenth to seventeenth centuries by Spanish colonists in Mexico and Europe, and their significance lives on in the twenty-first century within museums settings worldwide.

Our provenance investigations revealed that these tablets, with the exception of the mahogany (meca or red) obsidian specimen, originate from the Ucareo source, although Calligaro et al. (2007) note that one rectangular obsidian tablet at the Musée de l'Homme (MH.78.1.498) originated from the Sierra de Pachuca source. The fact that similar objects (n = 6) housed in museums in Paris, France (Calligaro et al., 2007), and the University of Missouri (n = 1; Pixley, 2012) also originate from the Ucareo source area allows us to identify one of the main production hubs of such objects within the former Purépecha Empire.

Pre-Hispanic archaeological evidence of obsidian at the Purépecha capital, Tzintzuntzan, and the secondary center of Erongarícuaro illustrates a strong obsidian lapidary tradition with artisans attached to royal and elite households. Additionally, this tradition almost exclusively relied upon Ucareo raw material and had limited use of other sources from within and outside the Purépecha territory. Some of the manufacturing techniques at Erongarícuaro and at the Ucareo workshops, for example, Villafuerte, directly correspond to manufacturing techniques attested for all items in this study and previously published rectangular, polished obsidian tablets, notably the pecking on the unpolished surfaces. Tzintzuntzan and the secondary center of Erongarícuaro are also known locations where mirrors and polished disks were manufactured during the Tariacuri phase (Late Postclassic, CE 1350–1525; see Figure 5). Therefore, these are the centers where such crafting knowledge and techniques were already in place and well established when the Purépecha Empire was invaded.

After the conquest, lapidarians remained attached to elite households as long as their skills used in the production of high-status symbols were required by the Native elites. This changed not long after the execution of the last *Cazonci* in 1530. On Vasco de Quiroga's arrival he must have recognized the strong crafting traditions already in practice at the pre-Hispanic primary and secondary centers, and with his plan focusing on specialized skills using locally available raw materials, he had the prime opportunity to reorganize and revitalize specialized crafting communities in the mid-sixteenth century around Lake Pátzcuaro. Thereafter, these artists were organized within a system best comparable to European craft guilds (Kuthy-Saenger, 1996; Pastrana Cruz et al., 2019). This strong historical evidence makes the area around Pátzcuaro and Tzintzuntzan or one of the associated secondary centers the most likely candidate for being the production site of the obsidian tablets under investigation.

Nevertheless, owing to incomplete Spanish documentation and the Purépecha upper nobility's attempt to erase lower elites from this discourse, we cannot with certainty determine the precise village or town where these items were produced (see Pollard, 2005). Notably, we are able to specify that lower Purépecha

elites during the sixteenth and seventeenth centuries (and perhaps beyond) from the Lake Pátzcuaro area were the producers of these objects. Working as craft specialists, although of elite status, within these specialized craft villages must have provided these artisans with a certain amount of autonomy; however, it is unlikely that they were completely independent entrepreneurs.

European colonists appropriated these novel products, consequently misappropriating Native knowledge, artistic skill, and sacred materials, and assimilated them as Christian paraphernalia and as canvases for artistic executions of Baroque period Christian art (see Saunders, 1997, 2001). Other studies have shown that Indigenous materials and technology were not so quickly replaced by European products (see Rodríguez-Alegría, 2005, 2008, 2014); likewise, this study of rectangular, polished obsidian tablets supports the principle that Native craft and technology were highly desired by the Spanish colonizers.

This contribution is an example of research from the museum to the field, so to speak. Archaeologists working in the Lake Pátzcuaro Basin have encountered pre-Columbian lapidary workshops; however, to our knowledge, colonial period workshops—which also must have existed—have not been recognized or published yet. However, because these items lack provenience (Barker, 2012; Joyce, 2012), we cannot determine whether they were excavated or whether these items were acquired directly from the artisans themselves and can be classified as archaeological/ethnographic (see the section "Defining Anthropological Museum Collections" and Table 2 in this volume's Introduction). Although this insight does not change our interpretations, it does change how the museum categorizes, views, and values these items. According to Joyce (2012), we could not trace the provenience of these objects, but we were able to recover and add multiple layers to their provenance that were previously inaccessible. Therefore, this study could serve as an incentive for exploring manufacturing debris from lapidary workshops at colonial period archaeological sites on the basis of the finished products of highly polished obsidian tablets.

Such a study could also elucidate broader patterns of obsidian procurement, use, and distribution, for instance, which obsidian sources were used, what items were manufactured, and by whom and for whom. Finally, the investigation of colonial period lapidary workshops could be used to critically assess the historical sources, for exmaple, the role of Quiroga's utopian system in the revitalization and reorganization of craft production in the Purépecha Empire core. Future studies may be able to determine the use of such obsidian tablets housed in museums worldwide by defining a typology based on their morphological characteristics and to unambiguously determine their function as canvases or altars. Additionally, it would be a beneficial undertaking to include data from all obsidian sources within the Purépecha realm for a large-scale obsidian tablet sourcing study.

Obsidian art continues to be an important economic foundation for Indigenous communities living near obsidian sources in Mexico. As a second component of this project, we would like to consult and build a collaborative partnership with the descendant Purépecha artisan communities in Michoacán (see Colwell-Chanthaphonh et al., 2010; Silliman and Ferguson, 2011; Atalay, 2012, 2020; Gonzalez, 2016; Burgio-Ericson and Seowtewa, this volume; Norman et al., this volume). Many Native communities are unaware of the vast amounts of their community belongings that are currently housed in museums and private collections worldwide, particularly when they remain completely anonymous in museum records (also see Berger et al., this volume). The incorporation of Indigenous oral tradition is critical for archaeological practice (Lightfoot, 1995; Echo-Hawk, 2000). With our current undertaking in collections-based research, we are contributing to the restoration of ancestral intellectual knowledge and labor to the Purépecha peoples that were erased through the process of coloniality, including museum practices of the the nineteenth and twentieth centuries.

NOTES

1. We used primary and secondary historical sources. It is necessary to consider all the problems inherent in relying on ethnohistorical sources, both primary and secondary. Colonial and other institutional documents must be critically interrogated for prejudices and misapprehensions about Indigenous beliefs and practices and must be placed within the context of colonialism, capitalist expansion, evangelization, and Indigenous and nationalist social movements (Strong, 2015:7–10). For example, the *Relación de Michoacán* represents a mythical narrative and is based on a reiteration of history "that was brutally interrupted by the Spanish" (Darras, 2014:49). Additionally, these sources are incomplete, idealized, and urban oriented (Otis Charlton, 1993:231). We have also encountered researchers omitting words in their Spanish to English translations, a separate issue that needs to be addressed.
2. The Purépecha Empire is also called the Tarascan Empire, the name given to them by the Spanish (see Warren, 1985:6–10), and is also known as the Kingdom of Tzintzuntzan (Iréchecua Tzintzuntzani). Tarascans spoke Purépecha and formed a state that later became a multilingual empire, where Purépecha was the dominant language. Today, the name "Purépecha" is the name with which contemporary people from Michoacán identify. From this point forward we will address this empire and its people as the Purépecha for pre- and postconquest times.
3. Although there were multiple and culturally diverse city-states in the Valley of Mexico during the Late Postclassic, we use the term "Aztec" when considering the Indigenous people who resided in and governed this region and spoke Nahuatl for pre- and postconquest times. Although we would like to address these peoples by their Indigenous name, these names tend to be exclusionary and circumscribed to very specific geographical locations. Smith (2012) refers to the people of the Valley of Mexico and nearby highland valleys as Aztec during preconquest times and as Nahuas postconquest.
4. See the Maya Vase Database (Kerr, 2006) at http://research.mayavase.com/kerrmaya.html, for example, Kerr numbers 625, 764, 787, 1453, 1790, 3203, and 4096.
5. The RM (Relación de Michoacán [1541] 1956) is the oldest illustrated manuscript chronicling pre- and post-Spanish contact Purépecha and was composed between 1539 and 1541 under the auspices of the Franciscan Jerónimo de Alcalá in collaboration with Indigenous scribes, authors, and witnesses (Nesvig, 2018:22). The precontact archaeological record is now often used to refine and deconstruct the narrative disseminated by the RM by providing a deeper insight into the social, political, and economic complexities of the Purépecha Empire (see Darras, 1998, 2014; Maldonado, 2008; Pollard, 2017).

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REFERENCES

Atalay, Sonya. 2012. *Community-Based Archaeology: Research with, by, and for Indigenous and Local Communities*. Berkeley: University of California Press.

Atalay, Sonya. 2020. Indigenous Science for a World in Crisis. *Public Archaeology*, 19:1–16. https://doi.org/10.1080/14655187.2020.1781492

Baquedano, Elizabeth, ed. 2014. *Tezcatlipoca: Trickster and Supreme Deity*. Boulder: University Press of Colorado. https://doi.org/10.5876/9781607322887

Barker, Alex. 2012. Provenience, Provenance, and Context(s). In *The Future of Our Pasts: Ethical Implications of Collecting Antiquities in the Twenty-First Century*, ed. Michael A. Adler and Susan B. Bruning, pp. 19–30. Santa Fe, N.M.: School for Advanced Research Press.

Bell, Joshua A. 2017. A Bundle of Relations Collections, Colleting, and Communities. *Annual Review of Anthropology*, 46:241–259. https://doi.org/10.1146/annurev-anthro-102313-030259

Bench, Raney. 2014. *Interpreting Native American History and Culture at Museums and Historic Sites*. Lanham, Md.: Rowman and Littlefield.

Berdan, Frances. 2017. Late Postclassic Mesoamerica Trade Networks and Imperial Expansion. *Journal of Globalization Studies*, 8:14–29.

Braswell, Geoffrey E., John E. Clark, Kazuo Aoyama, Heather I. McKillop, and Michael D. Glascock. 2000. Determining the Geological Provenance of Obsidian Artifacts from the Maya Region: A Test of the Efficacy of Visual Sourcing. *Latin American Antiquity*, 11:269–282. https://doi.org/10.2307/972178

Blainey, Marc G. 2007. Surfaces and Beyond: The Political, Ideological, and Economic Significance of Ancient Maya Iron-Ore Mirrors. Master's thesis, Trent University, Peterborough, ON, Canada.

Blainey, Marc G. 2018. Techniques of Luminosity. In *Manufactured Light: Mirrors in the Mesoamerican Realm*, ed. Emiliano Gallaga M. and Marc G. Blainey, pp. 179–206. Boulder: University Press of Colorado.

Bye, Robert, Jr., and Edelmira Linares. 1990. Mexican Market Plants of the 16th Century. I. Plants Recorded in Historia Natural De Nueva España. *Journal Ethnobiology*, 10:151–168.

Calligaro, Thomas, Pierre-Jacques Chiappero, François Gendron, Erik Gonthier, Olivier Meslay, Gérard Poupeau, and Dolores Tenorio. 2007. PIXE Analysis of the Obsidian Support of Two Paintings from the Louvre by Murillo. *Revista Mexicana De Física*, 53:43–48.

Calligaro, Thomas, Jean-Claude Dran, S. Dubernet, Gérard Poupeau, François Gendron, Erik Gonthier, Olivier Meslay, and Dolores Tenorio. 2005. PIXE Reveal that Two Murillo's Masterpieces Were Painted on Mexican Obsidian Slabs. *Nuclear Instruments and Methods in Physics Research, Section B*, 240:576–582. https://doi.org/10.1016/j.nimb.2005.06.155

Carballo, David M., Jennifer Carballo, and Hector Neff. 2007. Formative and Classic Period Obsidian Procurement in Central Mexico: A Compositional Study Using Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry. *Latin American Antiquity*, 18:27–43. https://doi.org/10.2307/25063084

Carlson, John B. 1981. Olmec Concave Iron-Ore Mirrors: The Aesthetics of a Lithic Technology and the Lord of the Mirror. In *The Olmec and Their Neighbors*, ed. Elizabeth P. Benson, pp. 117–147. Washington, D.C.: Dumbarton Oaks Research Library and Collections.

Casas, Bartolomé de las, and Juan Pérez de Tudela y Bueso. 1958. *Obras escogidas de Fray Bartolome de las Casas / texto fijado por Juan Perez de Tudela y Emilo Lopez Oto; estudio critico preliminar y edicion por Juan Perez de Tudela Bueso*. Madrid: Ediciones Atlas.

Charlton, Thomas H., Deborah L. Nichols, and Cynthia Otis Charlton. 1991. Aztec Craft Production and Specialization: Archaeological Evidence from the City-State of Otumba, Mexico. *World Archaeology*, 23:98–114. https://doi.org/10.1080/00438243.1991.9980161

Childs, S. Terry, and Mark S. Warner, eds. 2019. *Using and Curating Archaeological Collections*. Washington, D.C.: Society for American Archaeology.

Clark, John. E. 1979. A Specialized Obsidian Quarry at Otumba, Mexico: Implications for the Study of Mesoamerican Obsidian Technology and Trade. *Lithic Technology*, 8:46–49. https://doi.org/10.1080/01977261.1979.11754452

Cobean, Robert H. 2002. *A World of Obsidian: The Mining and Trade of a Volcanic Glass in Ancient Mexico*. Serie Arqueología de México. Mexico City: Instituto Nacional de Antropología e Historia.

Colwell-Chanthaphonh, Chip, T. J. Ferguson, Dorothy Lippert, Randall H. McGuire, George P. Nicholas, Joe E. Watkins, and Larry J. Zimmerman. 2010. The Premise and Promise of Indigenous Archaeology. *American Antiquity*, 75:228–238. https://doi.org/10.7183/0002-7316.75.2.228

Costin, Cathy L. 1991. Craft Specialization: Issues in Defining, Documenting, and Explaining the Organization of Production. *Archaeological Method and Theory*, 3:1–56.

Costin, Cathy L. 2005. Craft Production. In *Handbook of Archaeological Methods*, ed. Herbert D. G. Maschner and Christopher Chippindale, pp. 1034–1107. Walnut Creek, Calif.: AltaMira Press.

Craig, Nathan, Robert J. Speakman, Rachel S. Popelka-Filcoff, Michael D. Glascock, David J. Robertson, Michael J. Shackley, and Marc Aldenderfer. 2007. Comparison of XRF and PXRF for Analysis of Archaeological Obsidian from Southern Perú. *Journal of Archaeological Science*, 34:2012–2024. https://doi.org/10.1016/j.jas.2007.01.015

Darras, Véronique. 1994. Las actividades de talla en los talleres de obsidiana del Conjunto Zinápara-Prieto, Michoacán. In *Arqueología del occidente de México: nuevas aportaciones*, ed. Eduardo Williams and Robert Novella, pp. 139–158. Zamora, Mexico: El Colegio de Michoacán.

Darras, Véronique. 1998. La obsidiana en la relación de Michoacán y en la realidad arqueológica: del símbolo al uso o del uso de un símbolo. In *Génesis, cultura, y espacios en Michoacán*, ed. Véronique Darras, pp. 61–88. Mexico City: Centro de Estudios Mexicanos y Centroamericanos. https://doi.org/10.4000/books.cemca.3397

Darras, Véronique. 2008. Estrategias para la producción de navajas en la región de Zacapu y la vertiente del lerma (Michoacan, México) entre el Epiclásico y el Posclásico Tardío. *Ancient Mesoamerica*, 19:243–264. https://doi.org/10.1017/S0956536108000370

Darras, Véronique. 2009. Peasant Artisans: Household Prismatic Blade Production in the Zacapa Region, Michoacan (Milpillas Phase 1200–1450 AD). *Archaeological Papers of the American Anthropological Association*, 19:92–114. https://doi.org/10.1111/j.1551-8248.2009.01015.x

Darras, Véronique. 2010. *Paysans artisans de l'ouest mésoaméricain: Approche technoéconomique et sociale: des Tarasques eux Chupicuaro*. 2 vols. Paris: Habilitation à diriger des recherches, Université de Paris 1 Panthéon-Sorbonne.

Darras, Véronique. 2014. Ethnohistorical Evidence for Obsidian's Ritual and Symbolic Uses among the Postclassic Tarascans. In *Obsidian Reflections: Symbolic Dimensions of Obsidian in Mesoamerica*, ed. Marc N. Levine and David M. Carballo, pp. 45–74. Boulder: University Press of Colorado. https://doi.org/10.5876/9781607323013.c002

Deagan, Kathleen. 2003. Colonial Origins and Colonial Transformations in Spanish America. *Historical Archaeology*, 37:3–13. https://doi.org/10.1007/BF03376619

Dinerman, Ina R. 1972. Community Specialization in Michoacán: A Regional Analysis of Craft Production. Ph.D. diss., Brandeis University, Waltham, Mass.

Ebert, Claire E., M. Dennison, Kenneth G. Hirth, Sarah B. McClure, and Douglas J. Kennett. 2015. Formative Period Obsidian Exchange along the Pacific Coast of Mesoamerica. *Archaeometry*, 57:54–73. https://doi.org/10.1111/arcm.12095

Echo-Hawk, Roger. C. 2000. Ancient History in the New World: Integrating Oral Traditions and the Archaeological Record in Deep Time. *American Antiquity*, 65:267–290. https://doi.org/10.2307/2694059

Ekholm, Gordon. 1973. The Archaeological Significance of Mirrors in the New World. *In* Atti del XL Congresso Internazionale degli Americanisti, Roma–Genova, 1972 [Proceedings of the 40th International Congress of Americanists, Rome–Genoa], Vol. 1:133–135. Genoa, Italy: Casa Editrice Tilgher.

Endfield, Georgina H. 1997. Social and Environmental Change in Colonial Michoacán, West Central Mexico. Ph.D. diss., University of Sheffield, Sheffield, U.K.

Evans, Susan T. 2010. Aztec: Art from the Great Empire. In *Ancient Mexican Art at Dumbarton Oaks: Central Highlands, Southwestern Highlands, Gulf Lowlands*, ed. Susan T. Evans, pp. 57–86. Pre-Columbian Art at Dumbarton Oaks, No. 3. Washington, D.C.: Dumbarton Oaks Research Library and Collection.

Feest, Christian F. 1990. *Vienna's Mexican Treasures: Aztec, Mixtec, and Tarascan Works from 16th Century Austrian Collections*. Archiv für Völkerkunde, No. 44. Vienna: W. Braumüller.

Fenton, William N. 1960. The Museum and Anthropological Research: The Role of the Research Museum in Science. *Curator*, 3:327–355. https://doi.org/10.1111/j.2151-6952.1960.tb01697.x

Flexner, James L. 2016a. Introduction: Dark and Bright Futures for Museum Archaeology. *Museum Worlds: Advances in Research*, 4:1–3. https://doi.org/10.3167/armw.2016.040101

Flexner, James L. 2016b. Archaeology and Ethnographic Collections: Disentangling Provenance, Provenience, and Context in Vanuatu Assemblages. *Museum Worlds: Advances in Research*, 4:167–180. https://doi.org/10.3167/armw.2016.040113

Forster, Nicola, and Peter Grave. 2011. Non-destructive PXRF Analysis of Museum-Curated Obsidian from the Near East. *Journal of Archaeological Science*, 39:728–736. https://doi.org/10.1016/j.jas.2011.11.004

Frahm, Ellery. 2014. Characterizing Obsidian Sources with Portable XRF: Accuracy, Reproducibility, and Field Relationships in a Case Study from Armenia. *Journal of Archaeological Science*, 49:105–125. https://doi.org/10.1016/j.jas.2014.05.003

Frieman, Catherine J., and Lisa Janz. 2018. A Very Remote Storage Box Indeed: The Importance of Doing Archaeology with Old Museum Collections. *Journal of Field Archaeology*, 43:1–12. https://doi.org/10.1080/00934690.2018.1458527

Gallaga, Emiliano. 2001. Descripción y análisis de los espejos de pirita del sitio de Snaketown, AZ, EU y su relación con Mesoamérica. Paper presented at the XXVI Mesa Redonda de Antropología, Zacatecas, Zacatecas, México, 29 July–3 August.

Gallaga, Emiliano. 2009. La manufactura de los espejos de pirita: Una experimentación. Paper presented at the 33rd Congreso Internacional de Americanistas, Mexico City, July.

Gallaga, Emiliano. 2018. Introduction. In *Manufactured Light: Mirrors in the Mesoamerican Realm*, ed. Emiliano M. Gallaga and Marc G. Blainey, pp. 3–24. Boulder: University Press of Colorado. https://doi.org/10.5876/9781607324089.c001

Garcia, Dominique E. 2012. *Materials of the Sacred: 16th to 18th Century Religious Materiality in Michoacán*. M.A. thesis, University of California, Riverside.

Gaxiola, Margarita, and John E. Clark, eds. 1989. *La obsidiana en Mesoamérica*. Mexico City: Instituto Nacional de Antropología e Historia.

Glascock, Michael D. 2002. Obsidian Provenance Research in the Americas. *Accounts of Chemical Research*, 35:611–617. https://doi.org/10.1021/ar010041f

Glascock, Michael D. 2011. Comparison and Contrast Between XRF and NAA: Used for Characterization of Obsidian Sources in Central Mexico. In *X-Ray Fluorescence Spectrometry (XRF) in Geoarchaeology*, ed. Steven M. Shackley, pp. 161–192. New York: Springer. https://doi.org/10.1007/978-1-4419-6886-9_8

Glascock, Michael D., Geoffrey E. Braswell, and Robert H. Cobean. 1998. A Systematic Approach to Obsidian Source Characterization. In *Archaeological Obsidian Studies: Method and Theory*, ed. Steven M. Shackley, pp. 15–66. Advances in Archaeological and Museum Science, No. 3. New York: Plenum Press. https://doi.org/10.1007/978-1-4757-9276-8_2

Glascock, Michael D., Hector Neff, Joaquin Garcia-Barcena, and Adriana Pastrana. 1994. La obsidiana "meca" del centro de Mexico, analisis quimico y petrografico. Trace, 25:66–73.

Gómez, Fernando. 2001. *Good Places and Non-places in Colonial Mexico: The Figure of Vasco de Quiroga (1470–1565)*. Lanham, Md.: University Press of America.

Gonzalez, Sara L. 2016. Indigenous Values and Methods in Archaeological Practice: Low-Impact Archaeology through the Kashaya Pomo Interpretive Trail Project. *American Antiquity*, 81:533–549. https://doi.org/10.1017/S000273160000398X

Gosden, Chris. 2004. *Archaeology and Colonialism: Culture Contact from 5000 BC to the Present*. Cambridge, U.K.: Cambridge University Press.

Golitko, Mark, and Gary M. Feinman. 2015. Procurement and Distribution of Pre-Hispanic Mesoamerican Obsidian 900 BC–AD 520: A Social Network Analysis. *Journal of Archaeological Method and Theory*, 22:206–247. https://doi.org/10.1007/s10816-014-9211-1

Gorenstein, Shirley, and Helen Pollard. 1983. *The Tarascan Civilization: A Late Prehispanic Cultural System*. Nashville, Tenn.: Vanderbilt University.

Haskell, David Louis. 2008. Tarascan Kingship: The Production of Hierarchy in the Prehispanic Patzcuaro Basin, Mexico. Ph.D. diss., University of Florida, Gainesville.

Hassig, Ross. 1985. *Trade, Tribute, and Transportation: The Sixteenth-Century Political Economy of the Valley of Mexico*. Norman: University of Oklahoma Press.

Healan, Dan M. 1997. Pre-Hispanic Quarrying in the Ucareo-Zinapecuaro Obsidian Source Area. *Ancient Mesoamerica* 8:77–100. https://doi.org/10.1017/S0956536100001590

Healan, Dan M. 2002. Producer Versus Consumer: Prismatic Core-Blade Technology at Epiclassic/Early Postclassic Tula and Ucareo. In *Pathways to Prismatic Blades: A Study in Mesoamerican Obsidian Core-Blade Technology,* ed. Kenneth G. Hirth and Bradford Andrews, pp. 27–36. Cotsen Institute of Archaeology Monograph, No. 45. Los Angeles: Cotsen Institute of Archaeology, University of California, Los Angeles. https://doi.org/10.2307/j.ctvhhhfbz.5

Healan, Dan M. 2009. Ground Platform Preparation and the "Banalization" of the Prismatic Blade in Western Mesoamerica. *Ancient Mesoamerica*, 20:103–111. https://doi.org/10.1017/S0956536109000108

Healy, Paul F., and Marc G. Blainey. 2011. Ancient Maya Mosaic Mirrors: Function, Symbolism and Meaning. *Ancient Mesoamerica*, 22:229–244. https://doi.org/10.1017/S0956536111000241

Heizer, Robert F., and Jonas E. Gullberg. 1981. Concave Mirrors from the Site of La Venta, Tabasco: Their Occurrence, Mineralogy, Optical Description, and Function. In *The Olmec and Their Neighbors*, ed. Elizabeth P. Benson, pp. 109–116. Washington, D.C.: Dumbarton Oaks Research Library and Collections.

Hernández, Francisco. 1959. *Historia natural de Nueva España*. Volume 2. Mexico City: Universidad Nacional Autonóma de Mexíco.

Hirth, Kenneth G. 2006. *Obsidian Craft Production in Ancient Central Mexico: Archaeological Research at Xochicalco*. Salt Lake City: University of Utah Press.

Hirth, Kenneth G., and Bradford W. Andrews, eds. 2002. *Pathways to Prismatic Blades: A Study in Mesoamerican Obsidian Core-Blade Technology*. Los Angeles: Cotsen Institute of Archaeology, University of California, Los Angeles. https://doi.org/10.2307/j.ctvhhhfbz

Hirth, Kenneth G., Gregory Bondar, Michael D. Glascock, A. J. Vonarx, and Tierry Daubenspeck. 2006. Supply-Side Economics: An Analysis of Obsidian Procurement and the Organization of Workshop Provisioning. In *Obsidian Craft Production in Ancient Central Mexico*, ed. Kenneth G. Hirth, pp. 115–136. Salt Lake City: University of Utah Press.

Inomata, Takeshi, Daniela Triadan, Erick Ponciano, Estela Pinto, Richard E. Terry, and Markus Eberl. 2002. Domestic and Political Lives of Classic Maya Elites: The Excavation of Rapidly Abandoned Structures. *Latin American Antiquity*, 13:305–330. https://doi.org/10.2307/972113

Jacknis, Ira. 2008. A New Thing? The National Museum of the American Indian in Historical and Institutional Perspective. In *The National Museum of the American Indian: Critical Conversations*, ed. Amy Lonetree and Amanda J. Cobb, pp. 3–42. Lincoln: University of Nebraska Press.

Jarnés, Benjamím. 1942. *Don Vasco de Quiroga, obispo de Utopía, por Benjamín Jarnés*. Mexico: Ediciones Atlántida.

Jarosewich, Eugene, J. A. Nelen, and Julie A. Norberg. 1990. Reference Samples for Electron Microprobe Analysis. *Geostandards and Geoanalytical Research*, 4:43–47. https://doi.org/10.1111/j.1751-908X.1980.tb00273.x

Joyce, Rosemary A. 2012. From Place to Place: Provenience, Provenance, and Archaeology. In *Provenance: An Alternate History of Art*, ed. Gail Feigenbaum and Inge Reist, pp. 50–62. Los Angeles: Getty Research Institute Publications Program.

Kasztovszky, Zsolt, Károly Lázár, Vikória kovács Kis, Adél Len, János Füzi, András Markó, and Katlin T. Biró. 2018. A Novel Approach in the Mineralogy of Carpathian Mahogany Obsidian Using Complementary Methods. *Quaternary International*, 467, part B:332–341. https://doi.org/10.1016/j.quaint.2017.12.028

Kerr, Justin. 2006. Maya Vase Database. Foundation for the Advancement of Mesoamerican Studies. http://research.mayavase.com/kerrmaya.html (accessed 5 August 2017).

King, Julia A. 2016. Comparative Colonialism and Collections-Based Archaeological Research. *Museum Worlds: Advances in Research*, 4:4–17. https://doi.org/10.3167/armw.2016.040102

Kuthy-Saenger, Maria de Lourdes. 1996. Strategies of Survival, Accommodation and Innovation: The Tarascan Indigenous Elite in Sixteenth Century Michoacán. Ph.D. diss., Michigan State University, East Lansing.

Lacas, M. M. 1957. A Social Welfare Organizer in Sixteenth-Century New Spain: Don Vasco de Quiroga, First Bishop of Michoacán. *Americas*, 14:57–86. https://doi.org/10.2307/979120

Lightfoot, Kent G. 1995. Culture Contact Studies: Redefining the Relationship between Prehistoric and Historical Archaeology. *American Antiquity*, 60:199–217. https://doi.org/10.2307/282137

Maldonado, Blanca E. 2008. A Tentative Model of the Organization of Copper Production in the Tarascan State. *Ancient Mesoamerica*, 19:283–297. https://doi.org/10.1017/S0956536108000400

Mason, J. Alden. 1927. Mirrors of Ancient America. *University of Pennsylvania Museum Journal*, 18:201–209.

McAndrew, John. 1965. The Open-Air Churches of Sixteenth-Century Mexico. Cambridge, Mass.: Harvard University Press. https://doi.org/10.4159/harvard.9780674186354

Meslay, Oliver. 2001. Murillo and 'Smoking Mirrors.' *Burlington Magazine*, 143:73–79.

Millhauser, John K., Lane F. Fargher, Verenice Y. Heredia Espinoza, and Richard E. Blanton. 2015. The Geopolitics of Obsidian Supply in Postclassic Tlaxcallan: A Portable X-ray Fluorescence Study. *Journal of Archaeological Science*, 58:133–146. https://doi.org/10.1016/j.jas.2015.02.037

Millhauser, John K., Enrique Rodríguez-Alegría, and Michael D. Glascock. 2011. Testing the Accuracy of Portable X-ray Fluorescence to Study Aztec and Colonial Obsidian Supply at Xaltocan, Mexico. *Journal of Archaeological Science*, 38:3141–3152. https://doi.org/10.1016/j.jas.2011.07.018

Moholy-Nagy, Hattula, James H. Meierhoff, Mark Golitko, and Caleb Kestle. 2013. An Analysis of pXRF Obsidian Source Attributions from Tikal, Guatemala. *Latin American Antiquity*, 24:72–97. https://doi.org/10.7183/1045-6635.24.1.72

Nelson, S. A., and Dan M. Healan. 1995. Obsidians from the Ucareo and Zinapecuaro Areas, Michoacan, Mexico. Paper presented at the Geological Society of America Annual Meeting, New Orleans, La.

Nesvig, Austin Martin. 2018. *Promiscuous Power: An Unorthodox History of New Spain*. Austin: University of Texas Press. https://doi.org/10.7560/315828

Olivier, Guilhem. 2003. *Mockeries and Metamorphoses of an Aztec God: Tezcatlipoca, "Lord of the Smoking Mirror."* Trans. Michel Besson. Boulder: University Press of Colorado.

Orser, Charles E., Jr. 1996. *A Historical Archaeology of the Modern World*. Philadelphia: Plenum Press. https://doi.org/10.1007/978-1-4757-8988-1

Otis Charlton, Cynthia L. 1993. Lapidary Production in Aztec Otumba, Mexico. *Ancient Mesoamerica*, 4:231–243. https://doi.org/10.1017/S0956536100000924

Palka, Joel W. 2009. Historical Archaeology of Indigenous Culture Change in Mesoamerica. *Journal of Archaeological Research*, 17:297–346. https://doi.org/10.1007/s10814-009-9031-0

Pastrana, Alejandro, and David M. Carballo. 2016. Aztec Obsidian Industries. In *The Oxford Handbook of the Aztec*, ed. Deborah L. Nichols and Enrique Rodríguez-Alegría, pp. 329–342. Oxford, U.K.: Oxford University Press.

Pastrana, Alejandro and Patricia Fournier. 1998. Explotación de obsidiana en el yacimiento de Sierra De las Navajas [Colonial exploitation of obsidian in the outcrop at Sierra de las Navajas]. In *Primer Congreso Nacional de Arqueología Histórica: Memoria* [*First National Congress of Historical Archaeology: Proceedings*], ed. Enrique Fernández Dávila and Susana Gómez Serafín, pp. 486–496. México, D.F.: Instituto Nacional de Antropología e Historia.

Pastrana Cruz, Alejandro, Patricia Fournier Garcia, William J. Parry, and Cynthia L. Otis Charlton. 2019. Obsidian Production and Use in Central Mexico after the Spanish Invasion. In *Technology and Tradition in Mesoamerica after the Spanish Invasion: Archaeological Perspectives*, ed. Alexander T. Rani, pp. 15–34. Albuquerque: University of New Mexico Press.

Pérez de Ribas, Andrés. 1896. *Corónica y historia religiosa de la provincial de la Compañía de Jesús de México en Nueva España, escrita por el padre Andrés Pérez de Rivas*. Mexico: Imprenta del Sagrado Corazon de Jesús.

Pixley, L. Mary. 2012. Preserved for Eternity on Obsidian: A Baroque Painting Showing the Miracle of Milk at St. Catherine of Alexandria's Martyrdom. *Muse*, 46:1–39.

Pollard, Helen P. 1977. An Analysis of Urban-Zoning and Planning at Prehispanic Tzintzuntzan. *Proceedings of the American Philosophical Society*, 121:46–69.

Pollard, Helen P. 1993. *Taríacuri's Legacy: The Prehispanic Tarascan*. Norman: University of Oklahoma Press.

Pollard, Helen P. 2005. From Imperial Core to Colonial Periphery: The Lake Pátzcuaro Basin 1400–1800. In *The Postclassic to Spanish-Era Transition in Mesoamerica: Archaeological Perspectives*, ed. Susan Kepecs and Rani T. Alexander, pp. 65–76. Albuquerque: University of New Mexico Press.

Pollard, Helen P. 2008. A Model of the Emergence of the Tarascan State. *Ancient Mesoamerica*, 19:217–230. https://doi.org/10.1017/S0956536108000369

Pollard, Helen P. 2017. Markets, Tribute, and Class in Tarascan Commodity Consumption: The Lake Pátzcuaro. *Americae: European Journal of Americanist Archaeology*, 2:2497–1510.

Pollard, Helen P., Amy Hirshman, Hector Neff, and Michael D. Glascock. 2001. Las élites, el intercambio de bienes y el surgimeniento del área nuclear Tarasca: Análisis de la cerámica de la cuenca de Pátzcuaro. In *Estudios cerámicos en el Occidente y norte de Mexico*, ed. Eduardo Williams and Phil C. Weigand, pp. 289–309. Zamora, Mexico: El Colegio de Michoacán.

Pollard, Helen P., and Michael E. Smith. 2003. The Aztec/Tarascan Border. In *The Postclassic Mesoamerican World*, ed. Michael E. Smith and Frances F. Berdan, pp. 87–90. Salt Lake City: University of Utah Press.

Pollard, Helen P., and Thomas A. Vogel. 1994. Implicaciones Políticas y Económicas Del Intercambio de Obsidiana Dentro Del Estado Tarasco. In *Arqueología del occidente de México: nuevas aportaciones*, ed. Eduardo Williams and Robert Novella, pp. 159–182. Zamora, Mexico: El Colegio de Michoacán.

Quijano, Aníbal. 2007. Coloniality and Modernity/Rationality. *Cultural Studies*, 21:168–178. https://doi.org/10.1080/09502380601164353

Rebnegger, Karin J. 2010. Obsidian Production and Changing Consumption in the Lake Patzcuaro Basin, Michoacán, Mexico. *Ancient Mesoamerica*, 21:79–89. https://doi.org/10.1017/S0956536110000167

Rebnegger, Karin J. 2013. Obsidian Consumption and Production in the Tarascan State. Ph.D. diss., Michigan State University, East Lansing.

Reents-Budet, Dorie. 1994. *Painting the Maya Universe: Royal Ceramics of the Classic Period*. Durham, N.C.: Duke University Press.

Relación de Michoacán [1541] 1956. *Relación de las ceremonias y ritos y población y gobierno de Michoacán*. Reproducción facsimilar del Ms. C IV 5 de El Escorial. Transcripción, prologo, introducción y notas por José Tudela y estudio preliminar por Paul Kirchhoff. [Facsimile reproduction of Manuscript C IV 5 de El Escorial, Madrid. Transcription, prologue, introduction, and notes by Jose Tudela.] Madrid: Aguilar Publicistas.

Rogers, J. Daniel. 1988. The Social and Material Implications of Culture Contact on the Northern Plains. In *Ethnohistory and Archaeology: Approaches to Postcontact Change in the Americas*. ed. J. Daniel Rogers and Samuel Wilson, pp. 73–87. New York: Plenum Press.

Rogers, J. Daniel. 1990. *Objects of Change: The Archaeology and History of Arikara Contact with Europeans*. Washington, D.C.: Smithsonian Institution Press.

Rodríguez-Alegría, Enrique. 2005. Eating Like an Indian: Negotiating Social Relations in the Spanish Colonies. *Current Anthropology*, *46*:551–573. https://doi.org/10.1086/431526

Rodríguez-Alegría, Enrique. 2008. Narratives of Conquest, Colonialism, and Cutting-Edge Technology. *American Anthropologist*, 110:33–43. https://doi.org/10.1111/j.1548-1433.2008.00006.x

Rodríguez-Alegría, Enrique. 2014. A Paradox in Colonialism and Technological Change. *Revista de Arqueología Americana*, 32:7–26.

Rodríguez-Alegría, Enrique, John K. Millhauser, and Wesley D. Stoner. 2013. Trade, Tribute, and Neutron Activation: The Colonial Political Economy of Xaltocan, Mexico. *Journal of Anthropological Archaeology*, 32:397–414. https://doi.org/10.1016/j.jaa.2013.07.001

Saunders, Nicholas J. 1997. Obsidian Mirrors and Tezcatlipoca in Conquest and Post-Conquest México. Foundation for the Advancement of Mesoamerican Studies. http://www.famsi.org/reports/98056/98056Saunders01.pdf (accessed July 15 2017).

Saunders, Nicholas J. 2001. A Dark Light: Reflections on Obsidian in Mesoamerican. *World Archeology*, 33:220–236. https://doi.org/10.1080/00438240120079262

Serrano, Fernando. 2017. Indigenous Mine Workers in the Guanajuato-Michoacán Region: Labor, Migration, and Ethnic Identity in Colonial Mexico, 1550–1800. Ph.D. diss., University of California, Los Angeles.

Shugar, Aaron N., and Jennifer L. Mass, eds. 2013. *Handheld XRF for Art and Archaeology*. Studies in Archaeological Sciences, No. 3. Leuven, Belgium: Leuven University Press. https://doi.org/10.11116/9789461660695

Silliman, Stephen W. 2020. Colonialism in Historical Archaeology: A Review of Issues and Perspectives. In *The Routledge Handbook of Global Historical Archaeology*, ed. Charles E. Orser Jr., Andres Zarankin, Pedro Funari, Susan Lawrence, and James Symonds, pp. 41–60. London: Routledge Taylor & Francis Group.

Silliman, Stephen W., and T. J. Ferguson. 2011. Consultation and collaboration with Descendant Communities. In *Voices in American Archaeology: 75th Anniversary Volume of the Society for American Archaeology*, ed. Wendy Ashmore, Barbara Mills, and Dorothy Lippert, pp. 48–72. Washington, D.C.: Society for American Archaeology.

Smith, Michael E. 2012. *The Aztecs*. 3rd ed. Oxford, U.K.: Wiley-Blackwell. https://doi.org/10.1093/oxfordhb/9780199232444.013.0036

Smith, Michael E. 2014. The Archaeology of Tezcatlipoca. In *Tezcatlipoca: Trickster and Supreme Deity*, ed. Elizabeth Baquedano, pp. 7–40. Boulder: University Press of Colorado. https://doi.org/10.5876/9781607322887.c001

Strong, Pauline T. 2015. Ethnohistory. In *International Encyclopedia of the Social and Behavioral Sciences*, 2nd ed., vol. 8, ed. James D. Wright, pp. 192–197. New York: Elsevier. https://doi.org/10.1016/B978-0-08-097086-8.12191-9

Stroth, Luke, Raquel Otto, James T. Daniels, and Geoffery E. Braswell. 2019. Statistical Artifacts: Critical Approaches to the Analysis of Obsidian Artifacts by Portable X-ray Fluorescence. *Journal of Archaeological Science: Reports*, 24:738–747. https://doi.org/10.1016/j.jasrep.2019.02.023

Taube, Karl. 1992. *The Major Gods of Ancient Yucatan*. Washington, D.C.: Dumbarton Oaks Research Library and Collection.

Torquemada, Juan de. [1615] 1943. *Monarquía indiana*. 3rd ed. Mexico City: Salvador Chávez Hayhoe.

Turner, Hannah. 2015. Decolonizing Ethnographic Documentation: A Critical History of the Early Museum Catalogs at the Smithsonian's National Museum of Natural History. *Cataloging and Classification Quarterly*, 53:658–676. https://doi.org/10.1080/01639374.2015.1010112

Turner, Hannah. 2020. *Cataloguing Culture: Legacies of Colonialism in Museum Documentation*. Vancouver, B.C., Canada: UBC Press.

Umberger, Emily G. 2014. Tezcatlipoca and Huitzilopochtli: Political Dimensions of Aztec Deities. In *Tezcatlipoca: Trickster and Supreme Deity*, ed. Elizabeth Baquedano, pp. 83–112. Boulder: University Press of Colorado. https://doi.org/10.5876/9781607322887.c004

Voss, Barbara L. 2012. Curation as Research. A Case Study in Orphaned and Underreported Archaeological Collections. *Archaeological Dialogues*, 19:145–169. https://doi.org/10.1017/S1380203812000219

Walton, David P. 2017. Lithic Production and Consumption Patterns from the Great Platform at Late Postclassic (A.D. 1350–1525) Tzintzuntzan, Mexico. *Journal of Field Archeology*, 42:97–114. https://doi.org/10.1080/00934690.2017.1286720

Warren, J. Benedict. 1985. *The Conquest of Michoacán: The Spanish Domination of the Tarascan Kingdom in Western Mexico, 1521–1530*. Norman: University of Oklahoma Press.

Warren, J. Benedict. 1999. *Ordenanzas de Santa Fe de Vasco de Quiroga*. Morelia, Mexico: Fimax Publicistas.

Warren, J. Benedict. 2005. *Estudios Sobre El Michoacán Colonial: Los Inicios*. Morelia, Mexico: Instituto de Investigaciones Históricas, Universidad Michoacana de San Nicolás de Hidalgo.

Wright, Katherine. 1992. A Classification System for Ground Stone Tools from the Prehistoric Levant. *Paléorient*, 18:53–81. https://doi.org/10.3406/paleo.1992.4573

Zarandona, Miguel Juan. 2006. The Biography of Vasco de Quiroga (1470–1565), Bishop of Utopia, by Benjamín Jarnés (1888–1949). *Space of Utopia*, 3:69–83.

Zurita, Alonzo de. [1560–1585] 1840. *Rapport sur les différentes classes de chefs da la nouvelle-Espangne, sur les lois, les moeurs des habitants, sur les impôts établis avant et dupuis la conquête, etc., etc*. Paris: Arthus Bertrand.

Recontextualizing Pre-Columbian Gold and Resin Artifacts from Panama in the Smithsonian Collections

Ainslie Harrison,[1] Harriet F. Beaubien,[2] Kim Cullen Cobb,[2] and Jennifer Giaccai[3]*

INTRODUCTION

Cultures across the isthmian region of Central America, where current day Panama is located, developed a distinctive goldworking tradition that began in the early centuries of the common era and continued through the time of contact with Europeans. Although numerous examples can be found in museum collections, Panamanian objects have been the focus of relatively few technical studies (see Root, 1950; Howe, 1986; Fleming, 1992; Scott, 1995). The reason is likely the added difficulties inherent in studying archaeological materials in museum collections, many of which lack contextual information, a trend noted throughout this volume. This essay addresses a collections-based study that began in 2008 by conservators at the Smithsonian Institution to recontextualize the Panamanian gold objects in the Smithsonian collections through compositional analysis and archival research.

This study grew out of a large-scale technical investigation of Panamanian goldwork initiated in 2007 at the Smithsonian Institution's Museum Conservation Institute (MCI) as a collaboration with the Smithsonian Tropical Research Institute. Involving conservators, conservation scientists, and archaeologists, this phase focused on several Panamanian collections, including those excavated by and curated at the Smithsonian Tropical Research Institute (Beaubien, 2008, 2009).

In 2008, the study was expanded to include Panamanian goldwork in the Smithsonian Institution's museum collections, which offered an excellent opportunity to build a larger data set that could be statistically significant enough to reveal compositional patterns related to technology and geographic origin (Harrison, 2010). Part of this research also involved taking a closer look at a selection of composite resin and gold objects in the National Museum of the American Indian (NMAI) collection to try to identify the plant source for those resins.

A total of 309 cataloged objects were included in this phase of the project, representing 78 objects from the National Museum of Natural History (NMNH) and 231 objects from the NMAI. These gold alloy objects, selected on the basis of their Panamanian attribution, included beads, pendants, bands, plaques, sheathing, bells, rings, and tools. These objects also represent combinations of materials such as gold sheathing on

[1] Virginia Museum of Fine Arts, 200 North Arthur Ashe Boulevard, Richmond, Virginia 23220, USA.

[2] Museum Conservation Institute, Smithsonian Institution, 4210 Silver Hill Road, Suitland, Maryland 20746, USA.

[3] Freer Gallery of Art and Arthur M. Sackler Gallery, Smithsonian Institution, 1050 Independence Avenue SW, Washington, D.C. 20560, USA.

* Correspondence: ainslie.harrison@vmfa.museum

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stone, bone, and resin. In some cases, a single catalog number represented multiple components, including necklaces strung with different types of beads and bells, multiple ornaments of the same type cataloged together, and multiple pieces of gold sheathing on a single figurine.

A project database was built to combine information on each object from museum catalog records, technical examination, condition assessment, compositional analysis, and archival research. This database allowed for the association of a wide range of physical and material characteristics while also providing the opportunity to cross-check information from museum and archival records. The project database was also used to help update the NMAI museum database with compositional and archival data, and a copy was also archived along with the research reports at each museum and the Smithsonian's MCI.

ARCHIVAL RESEARCH: INSIGHTS INTO PROVENIENCE

In an effort to ensure that accurate provenience information was associated with as many artifacts as possible, archival background research into the Smithsonian collections was carried out to augment the often-sparse provenience information found in the museum catalog records. Research was conducted in the collection archives at NMAI and NMNH, as well as holdings at the Penn Museum and the American Philosophical Society. A search of the National Anthropological Archives for pertinent records in 2009 unfortunately did not provide additional contextual information; however, the collection has since expanded to include records from Matthew Stirling, a collector of Pre-Columbian gold objects in Panama and donor to the NMNH, a promising resource.

Information on the NMNH objects was gathered primarily from the museum's card catalog, as well as hard copy files and microfilm accession records in the anthropology collections management office at the Museum Support Center. The provenance and provenience information most frequently included in these records were collector and/or donor, country of origin, and province. Some of the records also included a collection date and general location, but rarely was the specific site of excavation noted on the catalog card or in accession documents. The scarceness of specific excavation information may, in part, be ascribed to the method by which many of the objects were obtained by the museum, namely, through regional collecting expeditions; professional tomb looters, or *huaqueros*; and purchases from private citizens.

Although a number of different individuals collected and purchased objects for the NMNH (previously referred to as the U.S. National Museum until 1957), it is clear from the accession documents that the majority of these were purchased from *huaqueros* in Panama. One of the most prolific of these grave robbers was Señor Juan Gratacós, who operated primarily in Veraguas and sold at least 28 documented objects to the museum through intermediaries such as J. Alden Mason and Karl P. Curtis. A translation of a letter from Gratacós to Mason dated 14 February 1941 (J. Alden Mason Correspondence) states,

> I send you a box of 29 objects of plated charcoal (carbon banados) including many fragments; all the broken ones including the eagles are to be melted up so that they may serve as study material for the technique & materials, if that interests you. I have melted up many that give me 4 to 8 carats of gold.

With regard to the other collectors, only James A. McNiel and Matthew W. Stirling contributed significant numbers of objects to the NMNH. The earliest collection of Panamanian objects at the U.S. National Museum was gathered by McNiel, who was present in Panama during the 1859 "gold rush" in Chiriquí when the discovery of gold in graves caused a flurry of grave robbing (Wood and Shelton, 1996). William Henry Holmes, who studied the McNiel collection at the U.S. National Museum, described their lack of excavation records in an article on the subject, saying

> Mr. McNiel acknowledges that with all his experience in the work of excavation no single piece has been taken from the ground with his own hands, and he cannot say that he ever witnessed the exhumation by others, although he has been present when they were brought up from the pits. Generally, the workmen secrete them and afterwards offer them for sale. He has, however, no shadow of a doubt that all the pieces procured by him came from the graves as reported by his collectors. (Holmes, 1887:13)

Although McNiel may have trusted that the pieces he acquired were found in the locations described by his workmen, that information unfortunately did not make it into the museum records.

Stirling, working half a century after McNiel, excavated several sites throughout Panama with Gordon Willey; however, the only material subsequently published in full originated from the Parita sites in central Panama (Willey and McGimsey, 1954; Willey and Stoddard, 1954; Ladd, 1964). Most of the Panamanian gold in the NMNH collection is documented as originating from Veraguas, which they visited after excavating at Barriles in Chiriquí in 1949 (Wood and Shelton, 1996). They worked first at the site of La Pita in Veraguas and later at three other funerary sites in the region. Juan Gratacós assisted with the excavation at La Pita (Wood and Shelton, 1996) and may therefore have been the source of the objects that Stirling purchased in Veraguas.

The archival research conducted in the NMAI archives was somewhat more successful, in part because of the trail of correspondence and customs documents from the mid-twentieth century amateur archaeologists who sold their finds to the Museum of the American Indian, Heye Foundation (MAI) in New York City (the predecessor of the NMAI). The earliest Panamanian gold and tumbaga objects in the collection were gathered during trips headed by employees of George Gustave Heye charged with gathering ethnographic and archaeological materials from Central and South America. George Dissette, Frank Utley, and

Marshall Saville were the first such collectors for Heye in Panama at the beginning of the twentieth century, shipping back to the museum a total of 55 gold and tumbaga objects along with a range of other materials. The provenience specificity in the museum records varies between these collectors, with catalog cards from Utley's finds containing more specific locale information. Unfortunately, there is no extant documentation in the NMAI archives detailing the provenience of these early collections. Later, in 1924, Heye commissioned Hyatt Verrill to go to Panama specifically to collect ethnographic and archaeological objects. Verrill began excavation in 1925 at El Caño in Coclé, sending the excavated material back to the museum, including one object in our study, a greenstone nose ring with gold sheathing.

The majority of the Panamanian gold objects housed at the NMAI acquired through donation or purchase from private individuals were obtained from three main collectors, Philip Dade and the husband-and-wife team Eva and Neville Harte. These amateur archaeologists and American expatriates operated primarily in the 1950s and 1960s, digging at archaeological sites such as Venado Beach and selling finds to individuals and museums to fund their recreational expeditions (McMullen, 2013).

Early correspondence between the Hartes and Frederick Dockstader, then director of the MAI, mentions a few items sold to the museum; however, they were not inclined to sell the gold collection they had amassed until much later. For personal and financial reasons, the majority of objects in the Harte collection were sold to the museum in one batch in 1967, and an invoice with a list of the objects is present in the archives. Unfortunately, no documentation regarding the provenience of these materials was found in the NMAI archives at the time of this research. The gold listed on the invoice is labeled only "Gold Huacas- Panama."

During the 1950s and 1960s, Philip Dade sold a large collection of Panamanian ceramics, metals, and other artifacts to the MAI. The close relationship that developed between Dade and Dockstader is evidenced in the collection of their correspondence in the NMAI archives spanning the years 1957 to 1974. In the letters, Dade often refers to the location of his excavations and provides descriptions of objects sold to Dockstader.

A gold ring in the NMAI collection (NMAI 23/7887), acquired from Dade, is a good example (Figure 1A). The original museum catalog card reads only "Cast Gold ring, Twisted wire with rings on band, 10 grams, Panama" (NMAI catalog record, 23/7887). This type of brief description and very general location information was found to be fairly typical for the museum objects.

In one of the letters, dated 7 November 1966, Dade discusses the many gold pieces he found in Grave 1-2, Mound 6, at Parita, a site on the Azuero Peninsula in Gran Coclé, which has since been independently identified as the site of El Hatillo/Finca Calderón (He-4; Ladd, 1964). He goes on to describe each object, giving its weight, including an exact description of the gold ring (Dade to Frederick J. Dockstader, 7 November 1966, Museum of the American Indian/Heye Foundation Records, 1890–1989 [hereafter MAI Records]). On the basis of similar findings, site and province attributions were assigned or confirmed for many of the objects in the NMAI collection, and the relevant documents pertaining to provenience were digitized and included in the object record in the project database.

FIGURE 1. (A) Gold ring, National Museum of the American Indian, Smithsonian Institution (23/7887). (Photo by NMAI Photo Services.) (B) Tubular gold bead, National Museum of the American Indian, Smithsonian Institution (23/0154). (Photo by NMAI Photo Services.) (C) Detail of soldered repair on 23/0154. (Photo by Ainslie Harrison.) (D) Gold necklace, National Museum of the American Indian (23/7891). (Photo by Ainslie Harrison.)

ARCHIVAL RESEARCH: INSIGHTS INTO REPAIRS

In the course of researching provenience information for the NMAI collection, we found that the archival records also illuminated the ways in which these objects were altered, documenting early treatments prior to collection (Harrison and Kaplan, 2011). For example, Penn Museum archaeologist Alden Mason, referring to a collection of recently excavated Panamanian objects for sale, mentions in his correspondence with Chauncey J. Hamlin, president of the Buffalo Museum of Science, the common practice of repairing broken archaeological objects: "The ones that are broken can easily be mended by a little soldering in the interior; we have been too busy to mend ours yet" (Mason to Hamlin, 9 April 1941, J. Alden Mason Correspondence).

This sort of repair is almost never documented in the museum records and could therefore be misleading to researchers today. In fact, we've identified silver-rich solder on several NMAI objects (NMAI 23/3891, 23/0154, 24/0651.004, and 24/0651.006) and now believe these to be modern rather than ancient repairs (Figure 1B,C).

Amateur archaeologist Philip Dade also mentions his methods for cleaning gold objects in correspondence with the director of the MAI, including polishing with Brasso (Dade to Dockstader, 1963 [date unspecified; dated only as "Monday" in reply to 25 July 1963 letter from Dockstader], MAI Records), a highly abrasive product containing ammonia, and coating with a clear lacquer spray "used by artists to cover oil paintings" (Dade to Dockstader, 12 March 1969, MAI Records). Not only is ammonia corrosive to copper, but the use of strong abrasives on soft gold surfaces can leave scratches and remove thin depletion gilded layers, interfering with compositional analysis and our ability to reach conclusions about the finishing techniques used by the ancient Panamanian goldsmiths (Perea et al., 2011). Coatings can also interfere with analysis, as we found in our study of the resin figurines.

Some of the correspondence found in the archives also mentions the practice of merging multiple objects into one and adding modern components, such as inlays and gold spangles where the original components were missing. In other cases, beads were restrung in elaborate patterns and passed off as the original design. Although some of these alterations are documented, it must be assumed that there are many more examples that are not. For example, NMAI object 23/7891 is described in the museum record as a necklace (Figure 1D). Given the certain degradation of the original stringing material, the beads would have been loosely collected in the field and most likely would not have originally been strung together in such a way. In this case, the museum record states, "Animal teeth inserts may not be original, although they came with the necklace – FJD [Frederick J. Dockstader]." This is oddly ambiguous language considering Dade wrote to Dockstader in 1966 with information specific to this necklace:

> Now, one other thing about the twin-alligator beads. They have hollow bottoms for some sort of insert. Unfortunately it was a crematory burial so the insert was simply not there. . . . Now I had an antique ivory tusk from Alaska - ancient, and had some inserts made for those alligators. I am giving them to you. Use them if you wish, shorten them or change their shape if you wish (Dade to Dockstader, 22 November 1966, MAI Records).

Dockstader's response was equally informative, stating that

> I am indeed pleased to have these, and trust that you are as happy as we are that they have found a good home. Our prep man has already put the little white bottoms back in the beasties, and they indeed look magnificent. I shall put them on display shortly (Dockstader to Dade, 5 January 1967, MAI Records).

Although we can only guess why this information did not make its way into the object's catalog records, this serves as a useful reminder that extra caution is needed when interpreting archaeological objects in museum collections.

METAL ANALYSIS

Once archival research was completed, examination and analysis were carried out on each museum object in our study. Visual examination and optical microscopy were used to help record condition information and notes on fabrication techniques, including evidence of tool marks, casting traces, joinery, surface enrichment, coloration, and corrosion. The primary production technique (e.g., hammered or cast) was also identified for each object at this time.

X-ray fluorescence (XRF) analysis was chosen as the primary method of compositional analysis of the metal alloy components during the initial phase of research in 2007 because of its ability to yield semiquantitative results for elements present without the need for sampling. To produce more accurate quantitative data, a gold calibration was custom designed for this project on MCI's ElvaX portable benchtop spectrometer by R. Jeff Speakman, then head of Technical Studies at MCI. We continued to use the same instrumentation for the analysis of the Smithsonian museum objects, facilitating comparability of results throughout the research project and, because it was a preservation-minded nondestructive method, making the approval process for analysis requests of museum collections much faster.

In the case of XRF, the trade-off for the ability to measure alloy constituents nondestructively is the limitation on analysis depth. Because of the significant attenuation of the X-ray beam in the gold alloy matrix, compositional results are considered to be only approximations of the bulk alloy. As objects with little to no enrichment or corrosion are most likely to give results closest to the bulk composition, we made sure to record any evidence of these surface changes in the database during examination. This detailed documentation was essential in data interpretation, as it allowed us to refine the data set by removing analyses from 29 objects that exhibited surface alterations that could skew the compositional results. The data set was further refined to include only objects with reliable provenience to the province level, limiting the final count of objects to 189, which represents 240 unique analyses (Figure 2A–C), accounting for multiple objects cataloged together and objects made of multiple components (e.g., objects with multiple beads, spangles, etc.).

As expected, the compositional data indicate that all the museum objects contained gold and silver, with a majority also containing copper (Harrison and Beaubien, 2010). Many had trace amounts of iron, which is often found as a trace impurity in gold ores but was also due in part to the presence of residual soil on some of their surfaces. No other elements were detected. For interpretation, the iron data were removed from the compositional calculations, and the silver, gold, and copper measurements were normalized to 100%. Typically, gold content is the highest, with significant variation in copper content (with most up to 50%), and lower silver content.

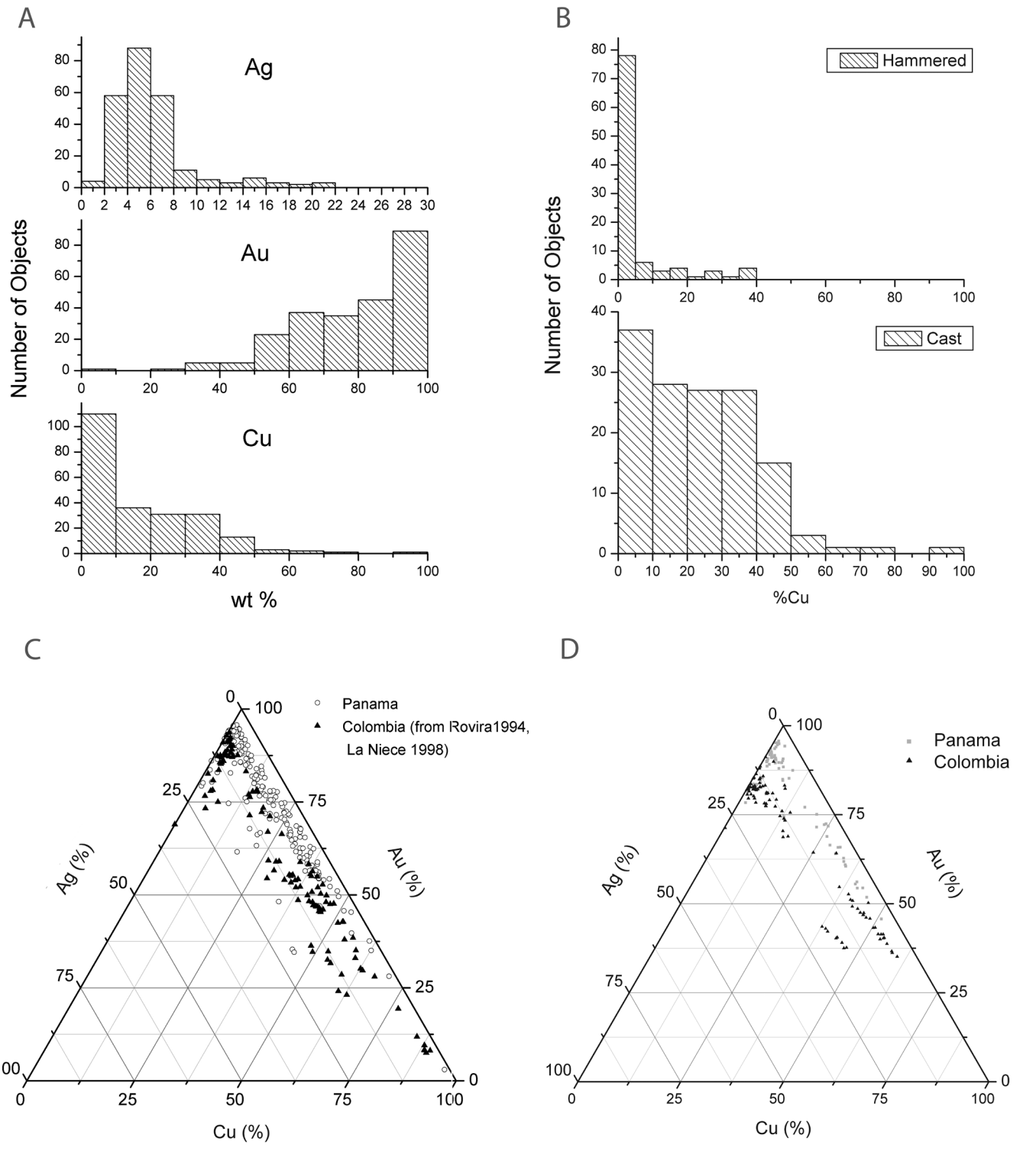

FIGURE 2. (A) Frequency plot of all Panamanian gold objects in the Smithsonian Institution (SI) collections plotted for silver, gold, and copper composition. (B) Frequency plot of copper content in the cast and hammered Panamanian objects (141 and 100 total analyses are represented, respectively). (C) Ternary diagram of gold, silver, and copper, comparing the composition of Panamanian objects in the SI collections and published data from Colombian gold alloy objects. (D) Ternary diagram comparing the composition of Panamanian and Colombian gold alloy beads in the SI collections (81 and 101, respectively).

A key consideration in examining compositional variation is whether the metal mixture reflects the use of unmodified natural ores or creation of deliberate alloys. The silver content for a majority of Smithsonian objects was found to be between 4% and 6%, with the occasional outlier ranging up to 22% (Figure 2A). The low concentration of silver in these objects correlates with the ranges found in other studies of Panamanian objects as well as gold ore sources. This result indicates that silver was not intentionally alloyed with the gold and copper but is present solely as an impurity in the gold ore used in the mixture. The copper content, by contrast, ranged significantly from 0% to near 100%, with the majority of ores containing less than 50% copper. Copper is generally present as an impurity in gold in much smaller quantities than silver, and although the natural range of copper in Panamanian gold ore is not definitively known, a general range given by Scott (1983) for copper as an impurity in gold placer deposits is ~0.1%–5%. On the basis of this range, we can argue that quantities much greater than 5% reflect an intentional alloy, whereas copper content below that could indicate either an intentional or a natural alloy. In our data set, the majority of objects containing less than 5% copper were made by hammering, whereas the majority of objects containing more than 5% copper were made by casting, indicating a correlation in the compositional data between alloy choice and fabrication method (Figure 2B). This suggests that the ancient Panamanian goldsmiths recognized that the addition of copper to gold, which lowers the melting point of the mixture and increases the hardness of the finished product, was advantageous for casting, whereas the use of a gold mixture with low copper content was more malleable and thus advantageous for hammering (Cullen Cobb et al., 2015).

When we compared data from the Panamanian material with published data from a variety of gold alloy objects produced by the Calima, Muisca, Quimbaya, Sinú, and Tairona pre-Columbian cultures in Colombia, a clear compositional trend emerged (Figure 2C; Rovira, 1994; La Niece, 1998). Although the Colombian material was found to have a range of gold content similar to the Smithsonian's Panamanian objects, those from Colombia had a higher silver content, averaging 9.5%.

To test these findings using Smithsonian objects, additional analysis was carried out on gold alloy beads from a number of regions in Central and South America. Plotting the gold, silver, and copper content of Colombian and Panamanian beads from the NMAI collection on a ternary diagram revealed a pattern similar to that previously noted for other gold alloy objects (Figure 2D). The silver content for Panamanian beads averaged 7%, whereas the silver content of Colombian beads averaged 12.7%. The compositional distinction between Panamanian objects and those produced farther south of the isthmus, a trend noted also by Scott (1995), provides evidence that the majority of the Panamanian objects were made using local raw materials in Panama.

Researchers have convincingly argued that goldworking arrived as a well-developed craft in Panama in the early centuries of the common era, either from Colombian or Ecuadorian goldsmiths who traveled to Panama or trained others visiting from Panama (Cooke et al., 2003). Helms (1979), on the other hand, considered the appearance of skillfully crafted goldwork in the Panamanian archaeological record as evidence that the artifacts themselves were imported through long-distance trade from Colombia. Certainly, the results from this study can conclusively rebut the latter, but care should be taken not to use silver content alone as a diagnostic for geographic origin for individual gold objects lacking provenience. There still remains some overlap in silver content between the Panamanian and Colombian objects that may be related to inherent variability within the gold sources in Panama (Cooke et al., 2003; Beaubien et al., 2021).

Although these results demonstrate the value of collections-based archaeometric projects, even in cases where specific site locations are not known, the lack of chronological specificity in our data set unfortunately makes it difficult at present to relate patterns in composition to the development of goldworking technology in the region. Further study of the museum objects to relate them stylistically and culturally to scientifically excavated and more securely dated materials could provide an additional dimension for interpretation. It is therefore hoped that researchers will utilize the compositional analysis and technical examination carried out here and build upon this research with additional lines of inquiry.

RESIN ANALYSIS

The NMAI collection includes 15 figurines from Panama made of shaped plant resin, many of which have gold sheathing burnished over their arms and legs that was included in the metal analysis component of this study. With little information in the museum records identifying the resin(s) used, three composite resin and gold figurines were selected for resin analysis, including two monkey figurines (NMAI 23/2351, 23/2352) and one sloth figurine (NMAI 23/2340; Figure 3A–C), all collected by Philip Dade. These objects, belonging to the Gran Coclé tradition, had small resin fragments in their storage containers readily available for sampling. In addition to the three NMAI objects, a recently excavated anthropomorphic resin figurine from El Caño was also sampled (NA6685). This figurine also belongs to the Gran Coclé tradition and dates to the Conte period (AD 700–1000).

To build a body of comparative data, 17 reference samples of resins from trees indigenous to the Americas representing at least 10 different plant species were collected from the New York Botanical Garden (NYBG) and Kew Gardens (Table 1). The NYBG holds Jean Langenheim's resin collection, which was particularly useful as her research focus was on American resin-producing species. The reference samples and museum specimens were analyzed using Fourier transform infrared spectroscopy (FTIR)[1] and gas chromatography–mass spectrometry (GC-MS)[2] following the methods described by Stacey et al. (2006; see also Giaccai, 2014).

FIGURE 3. (A)–(C) Resin and gold figurines, AD 450–900, Gran Coclé, Panama, Herrera Province, in the National Museum of the American Indian collections: (A) sloth 23/2340, (B) monkey 23/2351, and (C) monkey 23/2352. (Photos by NMAI Photo Services.) (D) Resin figurine, AD 780–900, Gran Coclé, El Caño, Panama (NA6685). (Photo courtesy of Fundación El Caño.)

TABLE 1. Resin reference samples analyzed with Fourier transform infrared spectroscopy and gas chromatography–mass spectrometry for comparison with the object samples. A dash (—) indicates not applicable.

Group	Family	Genus	Species	Distribution	Sample
Angiosperms	Burseraceae	*Bursera*	*excelsa*	Central America (north of Nicaragua)	NYBG 79651
		Protium	*heptaphyllum*	South America	NYBG 79661
	Burseraceae?	*Bursera?*	"Copal Blanca"	Central America	NYBG 79644
			"Copal de China"	Central America	NYBG 79672
	Fabaceae	*Hymenaea*	*courbaril*	Central and South America (including Panama)	Kew catalog nos. 57852, 57895
		Pseudosamanea	*guachapele*	Central and South America (including Panama)	El Caño sample
		Enterolobium	*cyclocarpum*	Central and South America (including Panama)	El Caño sample; NYBG 1027331
		Myroxylon	*balsamum*	Central and South America (including Panama)	Kew catalog no. 58208
		Prosopis	*juliflora*	Central and South America (including Panama)	Kew catalog no. 59161
Gymnosperms	Pinaceae	*Pinus*	*ayacahuite*	Central America (north of Nicaragua)	NYBG 79762
			cembroides (var. *monophylla*)	Mexico (and Southwest)	NYBG 79732
			oocarpa	Central America (north of Costa Rica)	NYBG 79765
			leiophylla	Mexico (and Southwest)	NYBG 79763
Fossil resins	—	—	"Chiapas Amber"	Central America	NYBG 202193

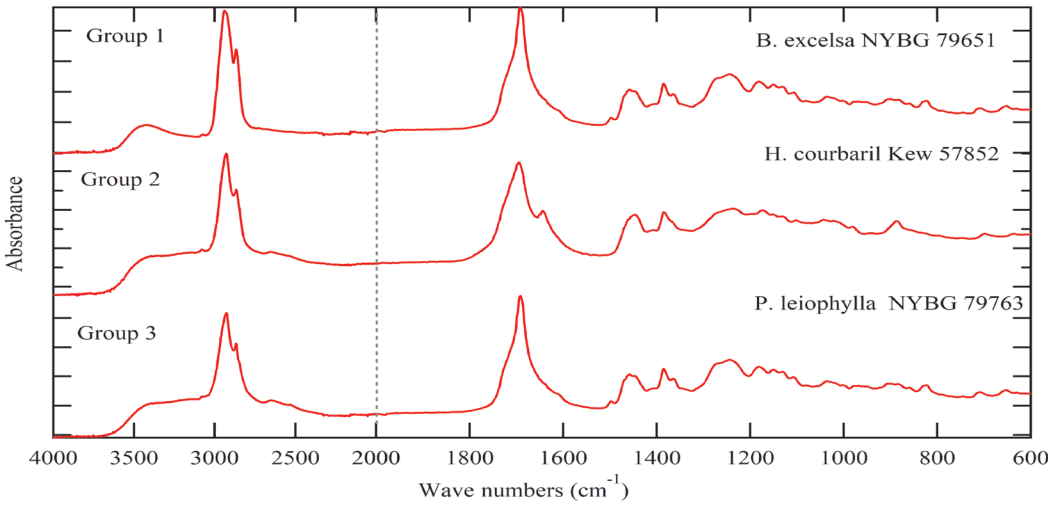

FIGURE 4. Representative FTIR spectra of reference resin samples from *Bursera excelsa*, *Hymenaea courbaril*, and *Pinus leiophylla*, which make up three distinctive groups.

The FTIR spectra of the reference resins were sorted into three groups (Figure 4). Group 1 showed a carbonyl peak at ~1,706 cm^{-1}, indicative of triterpenoids. Group 2 contained a C–H stretch above 3,000 cm^{-1} (~3,075 cm^{-1}) as well as a carbonyl peak at 1,700 cm^{-1} and a distinct vinyl absorption peak at 1,640 cm^{-1}. Group 3 has a lower carbonyl peak (below 1,700 cm^{-1}, indicative of diterpenoids), as well as vinyl C–H stretch at 3,081 cm^{-1}.>

The object samples mostly matched the group 2 reference resins, comprising samples of *Hymenaea courbaril*. The sample from NA6685, the recently excavated figurine, was highly degraded and showed trends matching both group 2 and group 1. One sample from one of the monkey figurines (NMAI 23/2351), however, produced a matching spectrum for an acrylic adhesive, likely from a past restoration such as an applied coating.

The GC-MS analysis of the samples allowed for more detailed analysis. It also clustered the reference samples into three general groups, including two chemically distinct groups containing diterpenoid compounds, one from the different species of *Pinus* and the second comprising the *Hymenaea courbaril* samples. The *Bursera* species showed triterpenoid compounds, as previously found by Stacey et al. (2006).

All four figurines showed similar chemical compositions, which matched that of the *Hymenaea courbaril* samples (Figure 5). It should be noted that recent analysis of several additional objects from El Caño, carried out elsewhere using pyrolysis-GC-MS, thermally assisted hydrolysis, and methylation-GC-MS, also identified *Hymenaea courbaril* as the resin used for a zoomorphic figurine (Kaal et al., 2018). The mass spectra from our analysis of the anthropomorphic and sloth figurines (NA6685 and NMAI 23/2340, respectively) showed more chemical oxidation than the samples from the two monkey figurines, possibly related to burial conditions. The degraded appearance of the excavated

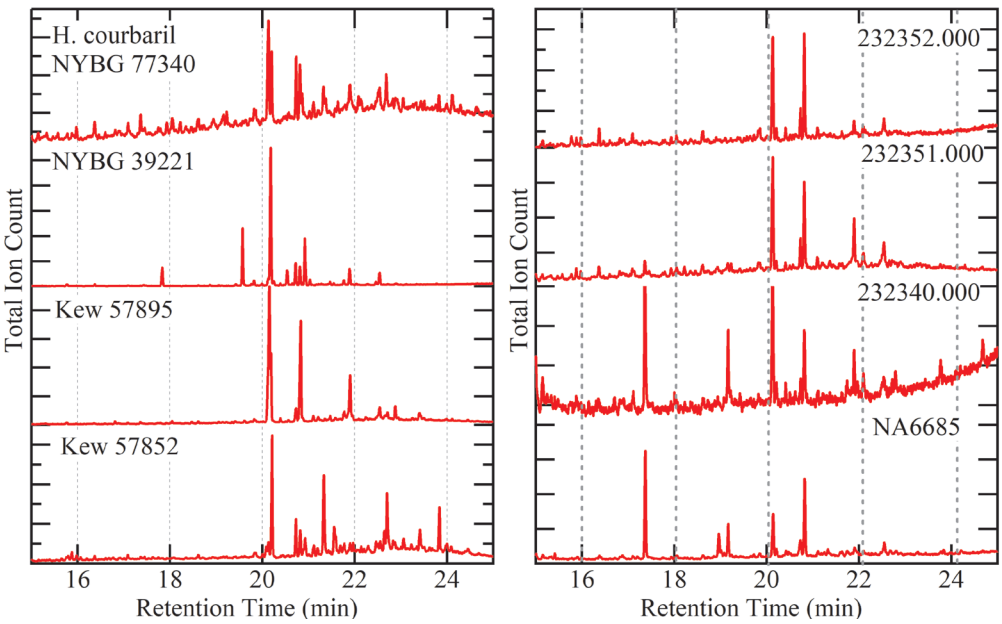

FIGURE 5. The GC-MS chromatograms of the four *Hymenaea courbaril* reference samples (left) and the samples from the four resin objects (right).

figurine compared to the relatively well preserved figurines in the NMAI collection raises questions not only about burial conditions but also about what treatment the museum objects may have undergone in the past.

Hymenaea courbaril is distributed across Central and South America and the Caribbean region. It is referred to by several common names: jatobá, courbaril, West Indian locust, Brazilian copal, Amami-gum, and stinkingtoe or stinktoe. Interestingly, Jean Langenheim identified *Hymenaea courbaril* as the plant source for various archaeological resin objects excavated from burial sites across Costa Rica, including from the Diquís region, which borders on the western Chiriquí region of Panama (Langenheim, 2003). Why and how *Hymenaea courbaril* was used across the region to make these zoomorphic and anthropomorphic figurines is a topic ripe for further investigation.

CONCLUSION

This research adds to the growing number of studies that demonstrate how archaeological objects from museum collections may be fruitfully studied despite their often limited provenience information and the preference in the museum field for use of only nondestructive analytical techniques. The sheer quantity of archaeological material in museum collections offers an excellent opportunity for compositional analysis in which even qualitative comparisons within a data set can reveal patterns related to material sourcing and technological preferences. In the case of the Panamanian gold in the Smithsonian collections, compositional analysis confirmed a pattern in silver content related to geographic origin. The difference in average silver composition between gold artifacts from Colombia and Panama indicates that the majority of archaeological goldwork from ancient Panama was made by local craftspeople using Panamanian sources of gold. The research confirmed results also found by others that objects fabricated by casting or hammering correlated with higher or lower copper content in the alloys selected, respectively, choices linked by experience to the improved working qualities that could be achieved. And analysis of resin figurines in the NMAI collection resulted in the identification of the resins' botanical source as *Hymenaea courbaril*, augmenting the museum's records on the materials making upa these artifacts.

Like several other studies presented in this volume, we found archival research was useful for augmenting the provenience information in the museum catalog records. A review of correspondence between archaeologists, collectors, and museum directors highlighted the types of alterations that were regularly made to the archaeological pieces entering museum collections that were otherwise not recorded, including soldering, polishing, coating, and the addition of nonoriginal materials to create pastiches. Although relevant archival holdings may not always be available for every collection, our findings suggest that close examination of each object and a healthy skepticism of museum records may be useful in the interpretation of objects that have undergone past treatments or restoration.

ACKNOWLEDGMENTS

We thank Dr. R. Jeff Speakman for development of the gold quantification analytical method on the XRF instrument and advice on XRF methodology. We also thank Dr. Julia Mayo for allowing us to analyze the resin figurine from El Caño and Dr. Carlos Mayo for sharing the reference resins he collected in Panama. We are also very grateful to Emily Kaplan for providing the reference resin samples from Kew Gardens.

NOTES

1. The FTIR analysis was carried out on a Thermo Nicolet 6700 FTIR spectrometer at a resolution of 4 cm^{-1}. Samples were analyzed using either attenuated total reflectance, in which case spectra were corrected to standard transmission spectra, or a Centaurus microscope in transmission mode.
2. The GC-MS analysis was performed on an Agilent 6890N gas chromatograph with a 5975 quadrupole mass spectrometer and an Agilent J&W HP-5MS, 30 m × 0.25 mm × 0.50 µm column. Samples were weighed out and extracted with 50:50 chloroform methanol solution at 1 µL/2 µg. The sample solutions were heated at 55°C for 4 hours and then cooled to room temperature. Aliquots of 50–250 µL were taken and evaporated under a stream of N_2 to dryness; 50 µL of N,O-Bis(trimethylsilyl)trifluoroacetamide (BSTFA) with 1% Trimethylchlorosilane (TMCS) was added to the resin extract and analyzed with the GC-MS. Multiple GC-MS runs of each sample were made and compared for sample integrity. For all GC-MS analyses, the chromatogram peaks were identified using both retention time and the mass spectrum. A library of the compounds found in the reference materials and in the object samples was created to aid in identification of the resins.

REFERENCES

Beaubien, Harriet F. 2008. MCI 6100.1: Pre-Columbian Goldworking in Panama – Report #1: Technical Study and Conservation Overview. Suitland, Md.: Museum Conservation Institute, Smithsonian Institution.

Beaubien, Harriet F. 2009. MCI 6100.1: Pre-Columbian Goldworking in Panama – Report #2: Results of the Technical Investigation. Suitland, Md.: Museum Conservation Institute, Smithsonian Institution.

Beaubien, Harriet F., Kim Cullen Cobb, and Ainslie Harrison. 2021. Technological Insights into Goldworking in Pre-Columbian Panama. In *Pre-Columbian Art from Central America and Colombia at Dumbarton Oaks, Volume 1*, ed. Colin McEwan and John Hoopes, pp. 381–391. Washington, D.C.: Dumbarton Oaks.

Cooke, Richard, Ilean Isaza, John Griggs, Benoit Desjardians, and Luis Alberto Sanchez. 2003. Who Crafted, Exchanged, and Displayed Gold in Pre-Columbian Panama? In *Gold and Power in Ancient Costa Rica, Panama and Colombia: A Symposium at Dumbarton Oaks, 9 and 10 October 1999,* ed. Jefferey Quilter and John Hoopes, pp. 91–158. Washington, D.C.: Dumbarton Oaks Research Library and Collection.

Cullen Cobb, Kim, Ainslie Harrison, and Harriet F. Beaubien. 2015. El Caño Goldsmiths. In *Guerreros de oro: Los señores de Coclé*, ed. Julia Mayo and Jose A. Carles, pp. 184–217. Panama City: Editora del Caribe.

Fleming, Stuart. 1992. Appendix B, Sitio Conte Goldwork: Alloying and the Treatment of Surfaces. In *River of Gold: Precolumbian Treasures from the Sitio Conte*, ed. Pamela Hearne and Robert J. Sharer, pp. 54–59. Philadelphia: University Museum, University of Pennsylvania.

Giaccai, Jennifer. 2014. MCI 6419: Analysis of Pre-Columbian Resins from Panama, NMAI. Suitland, Md.: Museum Conservation Institute, Smithsonian Institution.

Harrison, Ainslie. 2010. MCI 6100.2: Technology of Pre-Columbian Gold in Panama: A Study of Fabrication and Compositional Analysis. Research Report, Part I: NMAI and NMNH. Suitland, Md.: Museum Conservation Institute, Smithsonian Institution.

Harrison, Ainslie, and Harriet Beaubien. 2010. Bringing Context to the Smithsonian Collection of Pre-Columbian Gold from Panama through Technical Examination and Analysis. In *Metal 2010: Preprints of the ICOM-CC Interim Meeting of the Metal Working Group, October 11–15, 2010, Charleston, South Carolina*, ed. Paul Mardikian, Claudia Chemello, Christopher Watters, and Peter Hull, pp. 198–203. Charleston, S.C.: Clemson University.

Harrison, Ainslie, and Emily Kaplan. 2011. Pre-Columbian Gold from Panama: Historic Collecting Practices and Conservation. In *ICOM CC Lisbon 2011, Abstracts : 16th triennial conference, Lisbon, 19–23 September 2011. Preprints CD,* ed. J. Bridgland, Almada: Critério.

Helms, Mary W. 1979. *Ancient Panama: Chiefs in Search of Power*. Austin: University of Texas Press.

Holmes, William H. 1887. *The Use of Gold and Other Metals among Ancient Inhabitants of Chiriquí, Isthmus of Darien*. Bureau of American Ethnology Bulletin, No. 3. Washington, D.C.: Smithsonian Institution.

Howe, Ellen G. 1986. Estudio radiográfico de colgantes de oro fundidos al vacío de Sitio Conte. In *Metalurgia de América Precolombina,* ed. C. Plazas, pp. 169–200. Bogotá: Banco de la República.

Kaal, Joeri, Cesar Oliveira, Maria Martin-Seijo, Julia Mayo, and Carlos Mayo. 2018. Objetos de resina en los ajuares de El Caño (Panamá): diseño de un protocolo de análisis y primeros resultados. In *Memoria del 56. Congreso Internacional de Americanistas.* Volume 3: *Arte y patrimonio cultural*, ed. Manuel Alcántera, Mercedes García Montero, and Francisco Sánchez López, pp. 576–587. Salamanca, Spain: Ediciones Universidad de Salamanca.

Ladd, John. 1964. *Archaeological Investigations in the Parita and Santa Maria Zones of Panama*. Washington, D.C.: U.S. Government Printing Office.

Langenheim, Jean. 2003. *Plant Resins: Chemistry, Evolution, Ecology, and Ethnobotany*. Portland, Ore.: Timber.

La Niece, Susan. 1998. Metallurgical Case Studies from the British Museum's Collections of Pre-Hispanic Gold. *Boletín Museo del Oro*, 44:139–157.

Mason, J. Alden. Correspondence. Admin Records, Curatorial American Section, Collectors & Collections. University of Pennsylvania Museum Archives, Philadelphia.

McMullen, Ann. 2013. Adventurers, Dilletantes, and Looters. In *Revealing Ancient Central America*, ed. Rosemary Joyce, pp. 74–75. Washington D.C.: Smithsonian Institution.

Museum of the American Indian/Heye Foundation Records, 1890–1989. Subseries 1C: Frederick Dockstader, 1950–1976. Philip Dade, 1957–1963 and 1964–1974. Box 17, Folders 6, 7. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

Perea, Alicia, Patricia Fernandez-Esquivel, Salvador Rovira-Lloren, Jose Luis Ruvalcaba-Sil, A. Verde, O. Garcia-Vuelta, and F. Cuesta-Gomez. 2011. Combining SEM-EDS, PIXE and XRF Techniques for Complex Analytical Problems: Depth Profile Characterization of Prehispanic Gold. *Microscopy and Microanalysis*, 17(suppl. 2):1776–1777. https://doi.org/10.1017/S1431927611009755

Root, William C. 1950. A Report on Some Metal Objects from Veraguas. In *Archaeology of Southern Veraguas, Panama. Memoirs of the Peabody Museum of Archaeology and Ethnology*, 9(3):93–96.

Rovira, Salvador. 1994. Pre-Hispanic Goldwork from the Museo de América, Madrid: A New Set of Analyses. In *Archaeometry of Pre-Columbian Sites and Artifacts: Proceedings of a Symposium Organized by the UCLA Institute of Archaeology and the Getty Conservation Institute, Los Angeles, California, March 23–27, 1992*, ed. David A. Scott and Pieter Meyers, pp. 323–350. Los Angeles: Getty Conservation Institute.

Scott, David A. 1983. The Deterioration of Gold Alloys and Some Aspects of Their Conservation. *Studies in Conservation*, 28:194–203. https://doi.org/10.1179/sic.1983.28.4.194

Scott, David A. 1995. Goldwork of Pre-Columbian Costa Rica and Panama: A Technical Study. In *Material Issues in Art and Archaeology IV, Materials Research Society Symposium Proceedings (Meeting Held 16–21 May 1994 in Cancún, Mexico),* ed. Pamela Vandiver, James Druzik, J. L. Galvan Madrid, Ian Freestone, and G. Wheeler, pp. 499–526. Pittsburgh, Pa.: Materials Research Society.

Stacey, Rebecca J., Caroline R. Cartwright, and Colin McEwan. 2006. Chemical Characterization of Ancient Mesoamerican 'Copal' Resins: Preliminary Results. *Archaeometry*, 48(2):323–340. https://doi.org/10.1111/j.1475-4754.2006.00259.x

Willey, Gordon R., and Charles R. McGimsey. 1954. *The Monagrillo Culture of Panama. Papers of the Peabody Museum of Archaeology and Ethnology*, 49(2).

Willey, Gordon R., and Theodore L. Stoddard. 1954. Cultural Stratigraphy in Panama: A Preliminary Report on the Giron Site. *American Antiquity*, 19:332–342. https://doi.org/10.2307/277601

Wood, Deborah, and Catherine N. Shelton. 1996. New Data from Old Collections: The 1949 Stirling Collection from Panama in the National Museum of Natural History. *Museum Anthropology*, 20:3–20. https://doi.org/10.1525/mua.1996.20.1.

Taking Ancient Maya Vases Off Their Pedestals: A Case Study in Optical Microscopy and Ultraviolet Light Examination

Cara Grace Tremain

INTRODUCTION

The Smithsonian Institution's National Museum of the American Indian (NMAI) has a large number of ancient Maya ceramics in their extensive pre-Columbian collection. The majority are in storage at the Cultural Resources Center (CRC) in Suitland, and a few are on display in the *Infinity of Nations* exhibition at the NMAI's George Gustav Heye Center in New York (NMAI-NY). Although many of the ceramics are not publicly visible, which might invite the often-repeated criticism that museums should display their entire collections (Groskopf, 2016), the location of Maya ceramics at the CRC in close proximity to the Conservation Department enables researchers to study them in detail using specialized equipment. This facilitates the ability to learn more information about them that, in turn, can be presented to the public. This essay reviews my nondestructive analyses of the ceramics to investigate evidence of restorations, fakes, and forgeries. It also discusses archival investigations into their provenance and research of comparative objects in other collections. The results demonstrate the utility of both a hands-on and hands-off approach to collections research.

ANCIENT MAYA CERAMICS AT THE NMAI

The ancient Maya objects at the CRC form part of a much larger collection of pre-Columbian objects at the NMAI (Joyce, 2013), the majority of which were collected under George Gustav Heye's directorship of the Museum of the American Indian, Heye Foundation (MAI) in New York. Heye began collecting artifacts from the Americas in the late 1890s and is considered a "pioneer" of the trend of collecting from Central and South American regions, including the Caribbean (Jacknis, 2006:515). After Heye's death in 1957, the MAI continued to acquire objects under the directorship of various individuals—including the infamous Frederick J. Dockstader—who was investigated by the attorney general of New York for giving away and selling parts of the museum's collection.[1] Other artifacts from pre-Columbian America at the Smithsonian (such as those excavated by archaeologist Matthew Stirling at Olmec sites in the 1930s and 1940s; Stirling, 1939, 1943) are housed in the National Museum of Natural History's Anthropology

Department of Sociology and Anthropology, Langara College, 100 West 49th Avenue, Vancouver, British Columbia V5Y 2Z6, Canada.
* Correspondence: ctremain@langara.ca
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Department collections at the Museum Support Center across the road from the CRC in Suitland (see Sears et al., this volume, for an example of research with objects from Tres Zapotes, Mexico, at the National Museum of Natural History).

As a Smithsonian Predoctoral Fellow of the NMAI in 2015, I was based at the CRC for three months to study ancient Maya ceramics as part of my doctoral research (Tremain, 2017b). Although the NMAI has a large number of Maya ceramics, I concentrated on painted ceramics with representations of human individuals (Tremain, 2016). In total, 18 vessels (including vases, bowls, and jars) and 10 plates and dishes were studied using both an optical microscope (a Wild Heerbrugg MZ3) and ultraviolet (UV) light (specifically, a UVA long-wave 315–400 nm wave lamp). One of the vessels (NMAI 24/4275), was identified as an Ulúa Polychrome from the Ulúa River of Honduras by Rosemary Joyce (1993), and another (NMAI 24/3691) also appears to be from the Ulúa River or nearby on the basis of its similarity to styles from Honduras (see Table 1).

As containers for food and drink (McNeil, 2010; Loughmiller-Newman, 2012; Loughmiller-Cardinal, 2018) and currency in tribute and gift-giving events, ceramics were important components of ancient Maya society. Elaborately painted polychrome ceramics, many decorated by way of a slip painting technique known as *terra sigillata* (Reents-Budet and Hole, 2010:31), are characteristic of the Late Classic period (approximately AD 600–900). The Late Classic was a time of competing polities in the Maya region, and Reents-Budet (1998) has suggested that polychrome ceramics emerged as important cultural objects at this time because their production, decoration, and use were tied directly to political networks, relationships, and alliances. Such ceramics were manufactured mainly in the southern Maya lowlands (southern Mexico, northern Guatemala, Belize, and northwestern Honduras) and highlands of Guatemala. Thus, as explained below, although the Maya ceramics in the NMAI collection are largely unprovenienced (lacking archaeological context), they likely originated from one or more of these regions.

The representations painted and carved onto the surfaces of Maya ceramics include scenes of the royal court, ceremonial activities and events, and mythological stories. Such iconographic evidence provides great insight into the life of the ancient Maya that otherwise is not preserved in the archaeological record (because of the humidity of the environment and acidity of the soils). Maya ceramics have long attracted the attention of scholars for the extensive information that their study can add to the understanding of the ancient Maya (Miller, 1989; Reents-Budet, 1994), and many objects (in both public and private collections) have been photographed by Justin Kerr and made publicly available on his Maya Vase Database[2] and in his six published volumes (Kerr, 1989, 1990, 1992, 1994, 1997, 2000). Of the ceramics I studied in the NMAI collection, three have been photographed and published by Kerr (see Table 1).

Having long been admired for their aesthetic appeal, Maya ceramics often form part of the collections of museums, galleries, and independent private collectors around the world. Thus, it is

TABLE 1. Maya ceramics studied by the author at the Cultural Resources Center, organized chronologically by date of entering collection. The K numbers refer to photographs taken by Justin Kerr. A dash (—) indicates data not available or not applicable. A question mark (?) indicates information not known.

Ceramic(s)	Provenance	Entered collection	Acquisition method	K no.
09/6529, 09/6546 (*n*=2)	Thomas Gann	1918	Purchase	—
23/5883, 23/5882, 23/5880 (*n*=3)	Gisele Charat	1965	Exchange	—
23/9575 (*n*=1)	Robert Huber	1967	Purchase	—
24/2725 (*n*=1)	Rassiga Gallery	1969	Exchange	
23/3800 (*n*=1)	Robert Stopler	1969	Exchange	K7613
24/4005, 23/588, 24/4015 (*n*=3)	Cedric Marks	1970	Donated	—
24/3928, 24/392 (*n*=2)	Robert Huber	1970	Exchange	—
24/3691 (*n*=1)	Joseph Sachs	1970	Purchase	—
24/4273, 24/4274, 24/4275, 24/4278 (*n*=4)	Joseph Sachs	1971	Purchase	—
24/4313, 24/4314, 24/4089 (*n*=3)	Robert Huber	1971	Exchange	K6020 (24/4313), K1403 (24/4089)
24/6499 (*n*=1)	Jonathan Holstein	1972	Exchange	—
24/7491 (*n*=1)	James Economos (Rassiga Gallery)	1972	Exchange	—
24/8750 (*n*=1)	Lee Moore	1973	Purchase	—
25/0212, 25/0221 (*n*=2)	Cedric Marks	1975	Donated	—
24/8994 (*n*=1)	John McGhee	?	Exchange	—
24/3366 (*n*=1)	?	?	?	—

no surprise that the MAI acquired as many as they did. Recently, I demonstrated that of the Maya antiquities sold over a 50-year period at Sotheby's auction house, ceramics (particularly painted varieties) have been the most popular material class (Tremain, 2017a). The drive to collect objects such as these has resulted in widescale looting across the entire Maya region and larger Mesoamerican cultural region of Central America (for other examples of looted objects from Mesoamerica, see Berger et al., Dominici, Martinez et al., and Sears et al., all of this volume). The 1960s and 1970s in particular were a time when looting of the Maya region was rampant; Clemency Coggins (1969) published the influential article "Illicit Traffic of Pre-Columbian Antiquities" at that time to call attention to the problem. The decline in the market for chicle (the ingredient traditionally used to manufacture chewing gum) around that time led to *chicleros* (gatherers of chicle) supplementing their income by reporting archaeological sites to looters and local antiquities traffickers (Yates, 2015a:25). Ongoing deforestation in the Maya region has led to *chicleros* continuing to rely on looting practices (as documented by Paredes Maury, 1999). Despite national and international laws and agreements, such as the 1970 United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property (Gerstenblith, 2013), looting of artifacts from the Maya region and elsewhere in Mesoamerica continues unabated because of market demand (Tremain and Yates, 2019).

Ancient Maya ceramics are targeted artifacts by looters because of the high prices that they fetch on the art market. Maya polychrome ceramics are the first objects listed in the International Council of Museums' (ICOM) *Red List of Latin American Cultural Objects at Risk* (ICOM 2003) and the *Red List of Endangered Cultural Objects of Central America and Mexico* (ICOM 2009). These red lists are part of ICOM's "Fighting Illicit Traffic" program and classify the categories of objects in certain regions and countries that are vulnerable to looting and illegal exportation.[3] Such looted material is problematic not only because it violates many national and international laws and ethics but also because it has been removed from its original context and therefore lacks provenience. Many museums adhere to guidelines set out by ICOM and the Association of Art Museum Directors, which recommends that acquisition of unprovenienced artifacts be avoided unless it can be demonstrated they were exported from their country of origin prior to the 1970 UNESCO convention. In the United States, the UNESCO convention was legally implemented in 1983 with the passing of the Convention on Cultural Property Implementation Act. As will be demonstrated below, almost half of the Maya ceramics in the NMAI collection were collected in or before 1970, and the remainder (when dates are known) were collected prior to 1983.

PROVENANCE OF THE NMAI'S MAYA CERAMICS

Considering that more than 80% of Maya antiquities sold at Sotheby's over a recent 50-year period lack clear provenance information (Tremain, 2017a), it is notable that almost all of the Maya ceramics in the NMAI collection have some form of provenance information (note that provenance is used to refer to the history of ownership of an object; see Milosch and Pearce, 2019, for a recent publication on the utility of provenance studies). As Table 1 shows, of the 28 ceramics I studied, only one lacks provenance information, and a second lacks a secure date of entry into the NMAI collection (because of a lack of archival information for both vessels). Of the four Maya ceramics on display at the NMAI-NY (Table 2), three were acquired from the same individuals as those in the CRC collection.[4] Regardless of the incomplete provenance records for some of the ceramics, it is clear that a number of different individuals (n = 12) donated, exchanged, or sold Maya vessels to the MAI almost exclusively during the time of Dockstader's tenure as director (from 1960 to 1975).

The earliest ceramics to enter the collection were purchased from Thomas Gann—a British physician and amateur archaeologist (Wallace, 2011)—who reportedly collected the ceramics during his travels in the Maya region. The Holmul-style vase (NMAI 09/6546) was published in Gann's memoirs about his explorations (1918: pls. 26–28, [1925] 1997:72), but the information he gave about its provenience is contradictory. In 1918 he reported that the vase was discovered in a *chultun* (an underground chamber) at Yalloch in Guatemala that served as a "burial place" (Gann, 1918:138), but in 1925 he reported that it

TABLE 2. Maya ceramics in the National Museum of the American Indian collection on display at the George Gustav Heye Center in New York, organized chronologically by date of entering collection.

Ceramic(s)	Provenance	Entered collection	Acquisition method
11/7631 (n=1)	Marshall Saville	1923	Purchase
24/4090 (n=1)	Robert Huber	1971	Exchange
24/6503 (n=1)	Jonathon Holstein	1972	Exchange
24/8346 (n=1)	James Economos (Rassiga Gallery)	1973	Exchange

was found in a "cave near Benque Viejo" in Belize (Gann, [1925] 1997:72). Both locations are close to the Belize-Guatemala border, and it is likely that Gann was unaware of the exact location at which it was discovered because he himself did not excavate the vase; he reportedly purchased it from the mayor of Yalloch, who had found it a few years prior (Miller, 1989:131). One of the reasons that Gann would have been interested in acquiring Maya artifacts during his travels, rather than relying on what he found during his excavations, is that he was a collector for museums (Miller, 1989:131). In addition to the MAI, Gann also provided Maya ceramics for museums in Britain such as the Bristol Museum (Miller, 1989), the National Museums Liverpool World Museum,[5] and the British Museum,[6] which is likely why the Holmul-style vase was incorrectly labeled as belonging to the Bristol Museum in 1925 (Gordon, 1925: pls. 17–18).

Gann was a lecturer in Central American antiquities and the director of excavations in British Honduras at the University of Liverpool. He also presented his research at institutions such as the Society of Antiquaries of London, which explains his connections to museums in Britain. He later became involved in archaeological explorations for the MAI and the Carnegie Institution of Washington (Wallace, 2011:28), which explains his later connection to North American museums. A few years after the purchase of the ceramics from Gann, the MAI purchased a ceramic from Marshall Saville, who worked under the patronage of George Heye in South America in 1907. In 1918 Saville joined the staff at the MAI (Jacknis, 2006:518).

The rest of the painted Maya ceramics in the NMAI collection that are considered here entered the MAI's collection in the 1960s and 1970s, which (as mentioned previously) was during the tenure of director Frederick J. Dockstader. Continuing the zeal that Heye had for building a significant collection representative of the Americas, Dockstader added to the MAI collection through purchases and exchanges. Thus, it is no surprise that the majority of the collection considered here was acquired during Dockstader's tenure, and it is therefore likely that the two ceramics in Table 1 lacking full provenance entered the collection as a result of his efforts to expand the number of Maya ceramics at the MAI. In the archived correspondence between Dockstader and dealer Robert Stolper we see evidence of the director's active efforts in this regard by way of his encouragement for dealers to bring him noteworthy specimens: "I've just gotten back from a short chattour and found the purty [*sic*] pottery awaiting me . . . seriously, it is indeed a corker . . . almost as good as you claimed. Not up to our usual standard, but you *are* trying."[7] In later correspondence, as if to continue to encourage Stolper to acquire pieces of a certain quality and appearance, Dockstader refers to the same vase as a "Chamásterpiece."[8] The archived correspondence between Dockstader and the antiquities dealers with whom he dealt provides a revealing insight into the close relationship between a museum director and antiquities dealers, the way in which the MAI was expanding its collection during the 1960s and 1970s, and the market trends of the time (see Berger et al., this volume, for more examples of correspondence between Dockstader and Stolper).

Of the individuals who are associated with the provenance of the Maya ceramics, it is clear that some had stronger relationships with the MAI than others during Dockstader's tenure. Robert Huber, for example, sold and exchanged eight ceramics with the museum over a five-year period. As an active and well-known antiquities dealer with "friendly relations with a variety of auctions" (Heritage Auction Galleries, 2010), it is not surprising that he is associated with more than one-quarter of the Maya ceramics in the collection. Letters indicate that Huber would often inform Dockstader about objects on the market that he was aware of and had in his possession to sell. In these letters Huber describes their dimensions and appearance or provides photographs of them and explains where they were found (although he admits that at times his "contact may or may not be giving me the true location").[9] It is unclear whether Huber himself continues to publicly deal in antiquities, but his wife Marianne heads an appraisal company in this field,[10] which is surprising considering the pair were found guilty of being involved in the sale of illicitly looted Maya stela fragments from the site of Piedras Negras to the Brooklyn Museum in 1964 (O'Neil, 2012:200). Interestingly, as with Thomas Gann, Huber has also provided Maya ceramics to the British Museum.[11]

CERAMIC RESTORATIONS, FAKES, AND FORGERIES

When the MAI collection was transferred to the Smithsonian in 1989, the (often limited) provenance information was also transferred, but any documented information about modern restorations was not. Time, environmental conditions, and even the process of rediscovery all impact the condition of ancient Maya ceramics; treatment to prevent deterioration is often necessary to stabilize and preserve them. In other instances, restorations are carried out to achieve a resemblance to the original condition and improve the aesthetic condition and resulting comprehension of the ceramic.[12] Some of the most common forms of restoration of ancient Maya ceramics include adhering broken sherds together, infilling areas of loss (with material such as plaster), and in-painting areas of pigment loss (with modern paint).[13]

Because of the monetary value of ancient Maya ceramics, restorations to aesthetically improve (or recreate parts of) them are commonplace, and the prevalent attitude is that such restorations should be invisible to disguise the true extent of intervention—otherwise, the restoration may affect the sale price (since it affects their "authenticity").[14] Therefore, without accompanying documentation, restorations are often difficult, if not impossible, to visually detect.[15] When restorations are extensive, they can easily become misleading; Taylor (1982) provides examples of misleading restorations of ancient Maya ceramics, including instances in which completely eroded imagery has been repainted.[16] Scholars such as Boone (1982) and Kelker and Bruhns (2010) call attention to the dangers of excessive restorations and explain that they are a recognized problem for pre-Columbian art. Unfortunately, it is not only misleading restorations that

negatively impact ancient Maya ceramics. Fakes and forgeries abound in the art world and are especially common when demand outweighs supply, which is the case with ancient Maya ceramics. Although the two terms are often used interchangeably, in this essay a fake is defined as a genuine ancient artifact that has been deliberately altered for the purpose of enhancing its value,[17] whereas a forgery is defined as a copy of an ancient artifact (or a reproduction in the style of one) that fraudulently pretends to be an original, again, for the purposes of monetary gain (following Savage, 1976:1; Bellingham, 2008:184).

Fakes and forgeries are related by their intention to confuse, deceive, and/or exploit, and they are a long-standing concern of scholars of pre-Columbian art because of their negative impact on the understanding of ancient artworks (Batres, 1910; Ekholm, 1964; Boone, 1982). The archived correspondence between Dockstader and Huber reveals that Dockstader was aware of the problem, and in a letter to Huber he wrote that he was "terribly suspicious" of a pair of Huastec shells and instructed Huber to have them "very, very carefully checked for authenticity."[18] In a later letter to Huber, concerning what seem to be the same objects, Dockstader informed him "with the greatest sorrow . . . that most of the shell pieces are fake."[19] Although acknowledging their archaeological context was likely genuine, Dockstader explained that "exhaustive tests" of the objects indicated that their incised designs were "added at a later time." Such testing is often necessary because individuals who manufacture fakes and forgeries use a variety of often sophisticated techniques to create the illusion of authenticity.

Some of the techniques used to manufacture fake and forged Maya ceramics include burying them in the ground for a period of time so they appear as ancient buried ceramics would; adding root marks, abrasions, and a dark "stained" appearance to make them seem ancient; and even using ancient molds and tools in their manufacture.[20] The aforementioned techniques are a means of creating visual deceit, but techniques to create deceitful testing results are also numerous. For example, crushed pieces of excavated ceramics in the paste of a modern ceramic can render an ancient date if it is tested with archaeometric methods such as thermoluminescence dating (Artioli, 2010). Furthermore, the exclusive use of pigments known to the ancient Maya to create painted decorations (as opposed to modern pigments such as zinc white, which came into use only in the eighteenth century; Cole, 1955:175) can enable modern decoration to remain undetected if tested.

Although archaeometric methods might be thought of as superior to, and less biased than, visual analysis and other nonchemical methods, they are not necessarily so. Some archaeometric methods may not be suitable for certain objects, may be carried out on the wrong section of an object, or may even be conducted using an incorrect strategy. Visual analysis is a necessary precursor to archaeometric methods because it helps to plan selection and strategy. In some cases it can even eliminate the need for archaeometric methods altogether. My study of the Maya ceramics in the NMAI collection is thus an essential first step in identify and assessing restorations, fakes, and forgeries.

RESULTS OF THE NMAI STUDY

Prior to my arrival at the CRC, conservator Emily Kaplan and curator Antonio Curet identified ceramic NMAI 23/9575 as a forgery manufactured from plaster (Figure 1). The ceramic was purchased from Robert Huber in 1967, which is unsurprising considering his experience providing inauthentic objects to the MAI as previously discussed. Unfortunately, the vessel was previously published as an authentic ceramic in *A Study in Maya Art and History: The Mat Symbol* by the Heye Foundation (Robicsek, 1975). Looking at its manufacture, it is not surprising that it was once thought to be genuine because its dimensions and appearance are in line with ancient Maya ceramics. Its iconography is similar to vase 2004.24.24939A in the Peabody Museum of

FIGURE 1. Four views of ceramic NMAI 23/9575 in the NMAI collection. (Photograph by author.)

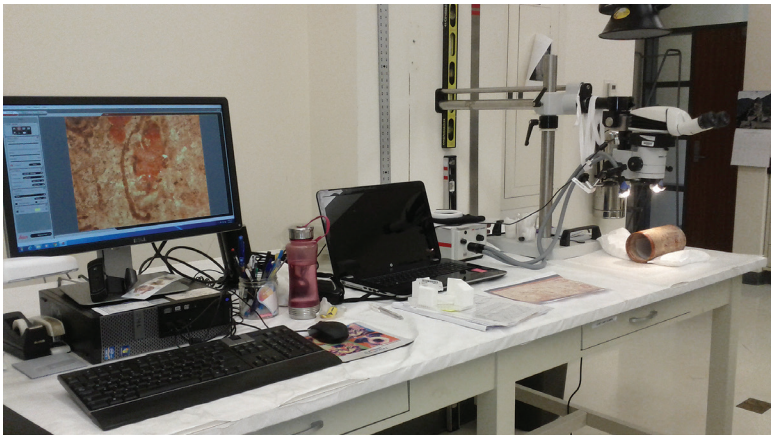


FIGURE 2. My work station at the Cultural Resources Center. Ceramic NMAI 24/4313 is under the microscope at right, and the image captured by the microscopic camera is visible on the monitor screen. Photograph by author.

Archaeology and Ethnology at Harvard University[21] and somewhat similar to another vase published by Robicsek (1972: fig. 262d). Its manufacturing techniques included breaking the object and gluing its pieces back together and painting over the cracks (thus making it appear similar to restored authentic ceramics). However, it is surprising that its light weight (at odds with authentic ceramics manufactured from clay) did not act as a clue to its fraudulent status. This alone is as an example of why it is necessary to perform hands-on research with artifacts in museums and not rely on photographs or viewing objects from behind display cases.

While at the CRC, I was able to work closely with Emily Kaplan and staff in the Conservation Department and was given access to microscopes, a microscopic camera, and a UV light (Figure 2). UV light can be used to identify materials or breakage patterns not readily visible in natural light because modern substances fluoresce differently under UV light compared to ancient, original materials. Using the aforementioned equipment, I was able to identify and record numerous instances of in-painting on the ceramics (Figure 3a), application of paint and other materials to falsely age the ceramic surfaces (Figure 3b), and areas of repair (Figure 3c). Among the ceramics studied, two in particular were interesting examples of how restorations can help to recover parts of the life histories of Maya ceramics.[22]

The first, ceramic NMAI 24/4275, is reportedly from the site of Copán in Honduras (Figure 4) and was purchased in 1971 from Joseph Sachs with funds donated by Alice Bache (a New York City art collector and widow of investment banker Harold Bache). In a letter in the NMAI archives pertaining to the ceramic, Sachs writes to Dockstader from Merida describing himself as a "student of the Mayans and a minor collector" and reflects on his earlier visit to the MAI where he had met with Dockstader and informed him about a group of ceramics for sale.[23] He asks Dockstader to purchase the ceramics or help him find a buyer for them to recover the financial losses he experienced securing them for sale. In letters to Dockstader that follow, Sachs asks him to help purchase more ceramics from Honduras. In a letter from Dockstader to Alice Bache, Dockstader claims that the "Mayan Polychrome Cache" he showed her was discovered in a tomb as a "single burial offering."[24] He requests funds to purchase the cache because "usually such lots are distributed among several persons for distribution, permanently destroying any hope for study as a group."

Joyce (1993) identifies the aforementioned ceramic as a Tenampua cylinder from the Ulúa River with strong parallels to Lowland Maya polychrome ceramics, which makes its reported Honduran origin probable. My assessment revealed numerous instances of scattered in-painting on the exterior of the vase, and inspection under UV light did not indicate any other restorations. Much of the in-painting appears to follow the outlines of fainter pigment and thus appears to be largely accentuating what is likely the ceramic's original imagery (Figure 4a). In some instances the in-painting does not seem necessary and appears to have been applied to blend the modern pigments with the fainter, and likely ancient, pigments. The exterior of the ceramic also has a number of black accretions, which might be manganese dioxide. Such accretions result mostly from a combination of bacterial and weathering activity. Scholars have used them as a measure of authenticity for objects originating elsewhere in Mesoamerica (Pickering and Cuevas, 2003; O'Grady, 2005), although it can be difficult to determine the authenticity of such accretions.

Microscopic assessment of the accretions indicated that whoever carried out the in-painting on the exterior of the ceramic was very careful to paint around them and not cover them with paint (Figure 4b). This suggests that they might be authentic and the individual restoring the vase was aware of the value of the accretions as a marker of authenticity. If the accretions were falsely manufactured, it is expected that they would have been applied on top of the painted surface after in-painting was carried out (i.e., as the last step in restoration). Close assessment of the ceramic in this way provides insight into not only the nature and level of restoration but also the mindset of the individual restoring it and the decisions they made. Considering the actions and mindset of the person restoring the ceramic allows us to better understand its life history and the changes it has been subjected to through time.

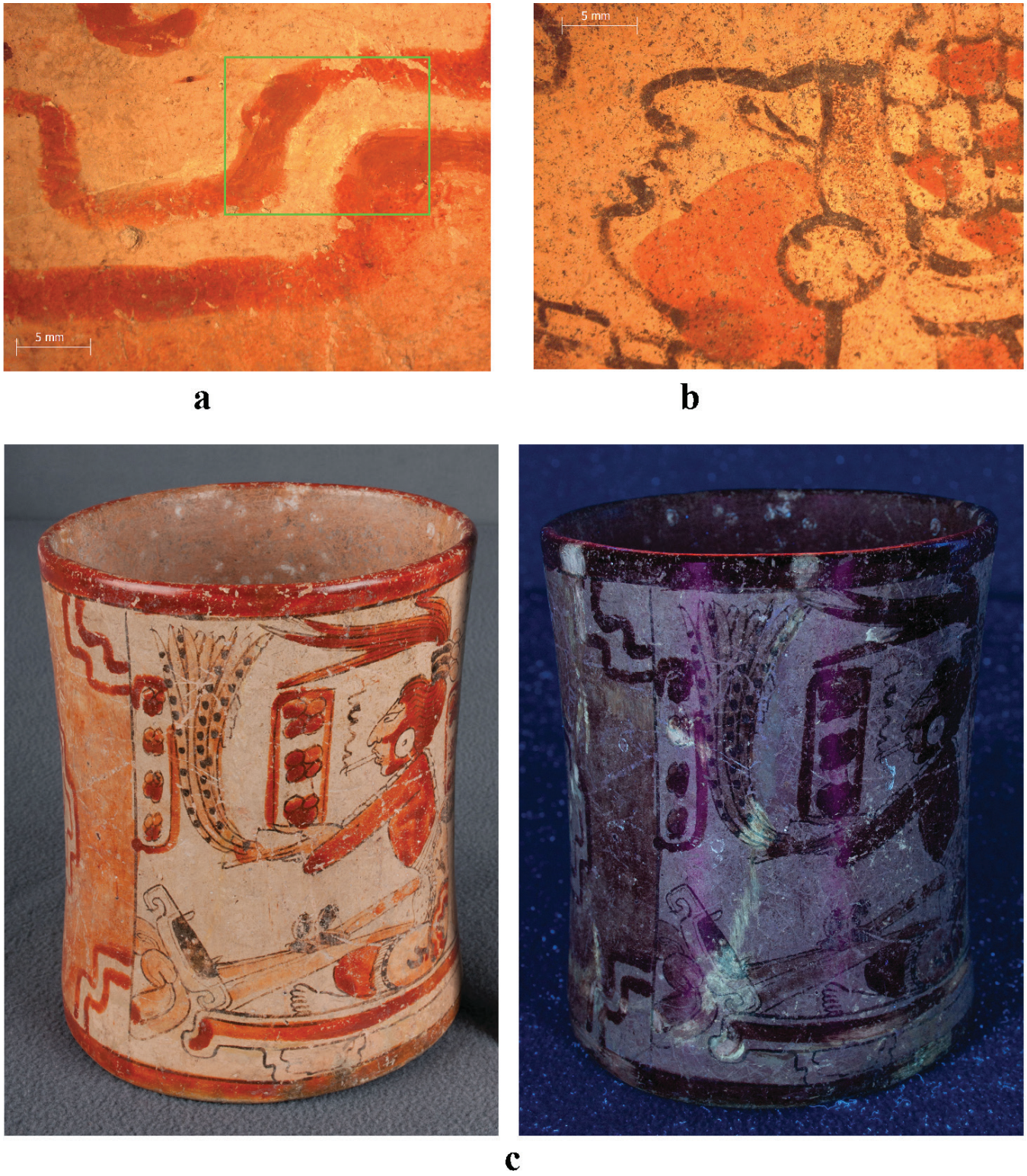


FIGURE 3. (a) In-painting (highlighted within the square box) on ceramic NMAI 24/8750. (b) Application of dark paint on ceramic NMAI 244/314 to suggest an aged surface. Photographs by author. (c) Ceramic NMAI 24/8750 under natural (left) and UV light (right), with the latter clearly showing areas of repair. Photographs by Emily Kaplan.

FIGURE 4. (a) Highlighted within the square box of ceramic NMAI 24/4275 (left) is a section of painted decoration that when magnified (right), shows modern in-painting atop what appears to be older, fainter paint. (b) Highlighted within the square box of ceramic NMAI 24/4275 (left) is a section of in-painting adjacent to a dark accretion that when magnified, (right) shows careful avoidance of the accretion. Photographs by author.

The second ceramic, NMAI 24/2725 (Figure 5a), was acquired by the MAI via an exchange with the Rassiga Gallery in 1969 and, as is common for vases from private collections, lacks any other provenance information. Everett Rassiga operated his gallery in New York and worked with the infamous dealer Leonardo Patterson (von Hammerstein, 2016), who has been arrested and convicted multiple times (most recently in 2015) for illegal activities related to dealing in both authentic and fake antiquities (Honan, 1995; Mashberg, 2015). Rassiga himself is also known to have been involved in illegal activities, such as arranging for a stucco facade from the site of Placeres in Campeche, Mexico, to be looted and shipped to the United States (reported by Donna Yates on the Trafficking Culture website).[25] The vase is very likely to be a fake or forged ceramic, and I previously published information about the study of it in *Anthropology of Forgery: A Multidisciplinary Approach to the Study of Archaeological Fakes* (Tremain, 2019).

On first appearance, the painted decoration on the vase is very dense compared to ancient Maya slip paint, and the decoration is at odds with Classic Maya iconography. The vase is also very light in comparison to other ancient Maya ceramics, which may indicate that the body of the vase is not ancient but a modern fabrication. Using optical microscopy, it is clear that paint has been applied (haphazardly) to the exterior of the vase to give an aged appearance (Figure 5b). Such an appearance can also be achieved by intentionally abrading the surface or breaking and refixing a ceramic. In the case of this ceramic, numerous visible cracks on the interior have been filled with plaster and extensively smoothed on the exterior. If any original slip paint was present on the exterior of the ceramic prior to restoration, it would have been removed through this excessive sanding/smoothing process. Thus, it is highly likely that the painted decoration currently present on the exterior of the ceramic has been applied by a modern hand.

Further evidence that the ceramic's painted decoration is inauthentic is the presence of paint atop damaged surfaces. A small section of paint in a damaged region was removed easily with ethanol by Emily Kaplan, indicating that it was applied *after* the damage had occurred (Figure 5b). Ancient Maya slip paint was fired onto Maya ceramics and does not remove easily like this, which is further evidence to suggest that the painted decoration is inauthentic. Finally, when the ceramic was assessed under UV light (Figure 5c) the surface glowed luminous orange, which indicates that the entire exterior had been overpainted—likely using a modern pigment mixed with shellac (a natural resin that is secreted from lac insects; McGowan-Jackson, 1992), which is why it was so easily removed with ethanol.

NMAI CERAMIC PARALLELS

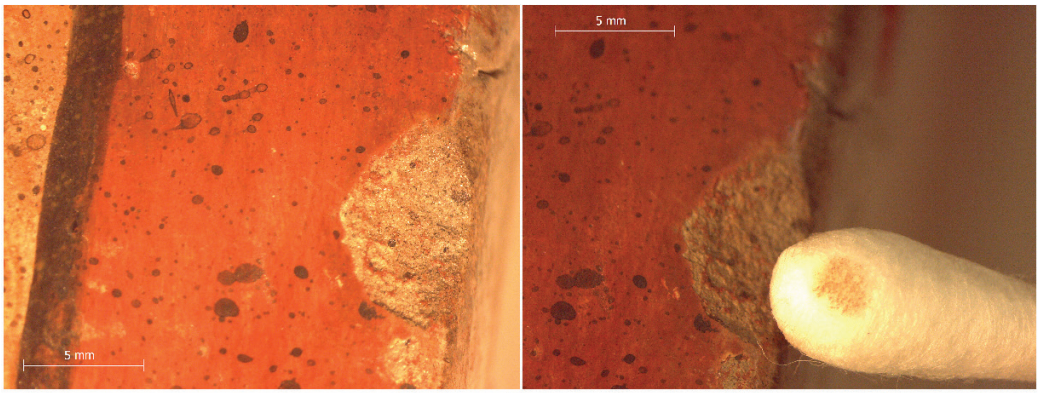
Similar to ceramic NMAI 23/9575, which was likely decorated using iconographic details of other Maya ceramics as a guideline, the painted decoration of NMAI 24/2725 was likely based on the iconography of other ceramics. Ceramic 81.109 in the Seattle Art Museum (SAM) is incredibly similar in its decorative imagery, and it is possible that the individual responsible for the decorative imagery on NMAI 24/2725 used the SAM vase for inspiration (or vice versa) (Figure 6a). The SAM vase was purchased by John H. Hauberg from Andre Emmerich (likely in the late 1960s or early 1970s) and gifted to the museum in 1981.[26] Hauberg was a Seattle-based businessman in the forestry industry, as well as a collector of Native American and pre-Columbian art, who gifted much of his collection to the SAM.[27] Hauberg also served both as president and chairman of the museum board and as a member of its acquisitions committee (Hackett, 2002).

Emmerich owned one of New York's most influential art galleries, which specialized in classical antiquities and pre-Columbian art in its early years.[28] He was known for his expertise in pre-Columbian art, from the various exhibitions he mounted in his gallery and through the books that he authored (including a catalog of the Wray collection [Andre Emmerich Gallery and Perls Gallery, 1984], which also contained Maya ceramics [Tremain, 2017a:209–210]). Emmerich reportedly stopped exhibiting such art "because of increasing export restrictions" (Glueck, 2007).

Considering that both Emmerich and Rassiga owned galleries in New York City, where they dealt in pre-Columbian antiquities and frequently purchased from and sold and consigned objects to one another (as evidenced in the Smithsonian archives), it is clear that the dealers were aware of the Maya vases in one another's collections. They may even have shared ownership of certain objects, as was the case with Rassiga and Stolper (revealed in a letter from Stolper to Dockstader on 12 July 1966).[29] The similarity between NMAI 24/2725 and the SAM vase can, perhaps, then be explained by the relationship between the individuals from whom they were acquired.

The practice of copying iconographic elements from Maya vases is likely to be fairly widespread, especially in the creation of fakes and forgeries. For example, I identified a vase associated with La Fundación Cultural Armella Spitalier (FCAS) that is very similar to a provenienced vase excavated in 1965 from burial 196 at the site of Tikal in Guatemala (Figure 6b). Based in Mexico City, FCAS is a foundation created in 2004 to house and publicize the collection of pre-Hispanic artifacts belonging to the Armella Spitalier family.[30] Today, the foundation specializes in the publication of both academic and children's material related to Mesoamerica and includes objects from their collection in these publications.[31] According to a 2013 interview with Carlos Armella Sánchez, president and CEO of FCAS, the foundation acquired and restored some 9,000 looted pre-Hispanic artifacts (which have been registered with the Mexican National Institute of Anthropology and History) to prevent them from being sold on the art market (Talavera, 2013). In that interview and elsewhere (e.g., Armella Sánchez et al., n.d.), Armella Sánchez maintains that the FCAS are "holders," not collectors, of the artifacts and that they distribute knowledge about them through various avenues.[32] Unfortunately, the provenance of the vase in Figure 6b is unknown.[33] It is entirely possible that the FCAS vase is an authentic vase looted from an archaeological site, but since

a



b

c

FIGURE 5. (a) Ceramic NMAI 24/2725. (b) Paint spatters on the surface of the ceramic and atop an abrasion (left) that remove effortlessly with ethanol (right). Photographs by author. (c) The ceramic under natural (left) and UV light (right). Photographs by Emily Kaplan.

FIGURE 6. Examples of visually similar vases. (a) Left, Seattle Art Museum Ancient American Art Collection, 81.109, ceramic with colored slip, Maya ca. 600–900, 19.9cm, gift of John H. Hauberg, photo by Susan Cole; right, NMAI Ceramic 24/2725, photograph by author. (b) Left, vase from Tikal burial 196, Justin Kerr, K8006, Justin Kerr Maya Vase Archive, Dumbarton Oaks, Trustees for Harvard University, Washington, D.C.; right, vase from La Colección Fundación Armella Spitalier (FCAS). (c) Left, vase G83.1.0108 at the Gardiner Museum of Ceramic Art ceramic, Justin Kerr, K6062, Justin Kerr Maya Vase Archive, Dumbarton Oaks, Trustees for Harvard University, Washington, D.C.; right, NMAI ceramic 24/4090.

the Tikal vase has been known publicly since at least 1975 (Coggins, 1975: fig. 142), it is also possible that the FCAS vase is a fraudulent copy made at a later date.

Interestingly, there is another vase in the NMAI collection that is visually similar to a vase in another institution and furthers the evidence for parallels of Maya ceramics in different collections. Vase NMAI 24/4090, which was acquired via an exchange with Robert Huber in 1971, is nearly identical to vase G83.1.0108 in the Gardiner Museum of Ceramic Art in Toronto (Figure 6c). The Gardiner vase was acquired by George and Helen Gardiner in 1981, after they purchased it for $26,000 from a Sotheby's auction; I was able to determine its provenance on the basis of my study of Sotheby's sales catalogs (the Gardiner vase is identical to a photograph of lot 181 in the 9 May 1981 "Fine Pre-Columbian Art" sale). George Gardiner was a Toronto-based stockbroker and began collecting ceramics in 1976 as a means of decorating his home. With his wife, Helen, George founded the Gardiner Museum in 1984 to display their collection of ceramics, including those from the ancient Americas.[34] Both the NMAI and Gardiner vases were on public display during my study period at the CRC (the former at the NMAI-NY and the latter in the Ancient Americas Collection at the Gardiner museum); taking both off display and allowing them to be studied in detail will likely uncover more information about their life histories and possibly even reveal what the relationship is between two such visually similar ceramics.

CONCLUSION

It is clear that careful and detailed analysis of ancient Maya ceramics within museum collections like the NMAI is an important means of learning more about the plethora of Maya ceramics that have been illegally looted and subsequently acquired new lives as commodities on the international art market. Although many art historians and archaeologists rely on learning about these kinds of ceramics from published images and databases such as Justin Kerr's, we cannot study them from photographs alone. Nor can we rely on learning about them while they are on display in (however seemingly transparent) glass cases—especially when we know fakes and forgeries lurk in many, if not the majority, of museum collections. Tactile, hands-on analysis is necessary (even though it can be time-consuming), especially since it is nondestructive, relatively inexpensive, and—above all—effective. Museums and researchers need to remove these ceramics from their pedestals and take a long, hard, look at them. It is likely that the results will be surprising.

ACKNOWLEDGMENTS

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NOTES

1. Smithsonian Institution Archives, Dockstader Charged with having Sold Museum Artifacts, 1975, https://siarchives.si.edu/collections/siris_sic_2206 (accessed 26 November 2021).
2. Justin Kerr, Maya Vase Database, http://research.mayavase.com/kerrmaya.html (accessed 26 November 2021).
3. International Council of Museums, Red Lists Database, https://icom.museum/en/resources/red-lists/ (accessed 26 November 2021).
4. Many of the ceramics in the NMAI collection and their corresponding archival information can be viewed using the museum's online catalog at https://collections.si.edu/search/index.htm (accessed 26 November 2021).
5. Although information about Thomas Gann is not presently on the museum's website, it is possible to see information about Gann in the World Cultures Americas Gallery using the virtual gallery tour at https://www.liverpoolmuseums.org.uk/world-cultures-virtual-gallery-tour (accessed 26 November 2021).
6. For example, ceramic Am1924,0510.11, which can which can be viewed on the museum's collection database (https://www.britishmuseum.org/research/collection_online/search.aspx, accessed 26 November 2021).
7. Frederick Dockstader to Robert Stolper, 4 April 1964, Attorney General: Correspondence between MAI and Dealers Everett Rassiga and Robert Stolper, 1964–1974, Museum of the American Indian/Heye Foundation Records, Box 147, Folder 7, National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md. (hereafter NMAI Archive Center).
8. Dockstader to Stolper, 3 May 1964, Attorney General: Correspondence between MAI and Dealers Everett Rassiga and Robert Stolper, 1964–1974, Museum of the American Indian/Heye Foundation Records, Box 147, Folder 7, NMAI Archive Center
9. Huber to Dockstader, 18 August 1966, Frederick Dockstader Correspondence, Robert Huber 1964–1974, Museum of the American Indian/Heye Foundation Records, Box 27, Folder 3, NMAI.AC.001, NMAI Archive Center.
10. Robert Huber's company until recently operated under the name Huber Primitive Art, but its website is now defunct. Marianne Huber is head of New World Art Services.
11. For example, ceramic Am1974,08.1.b, which can be viewed on the museum's collection database (https://www.britishmuseum.org/research/collection_online/search.aspx, accessed 26 November 2021).
12. Although conservators in museums and other institutions often treat and restore objects, dealers sometimes restore objects or outsource the work to private restorers. Just (2012:196, note 28) explains that Barbara Kerr (wife of photographer Justin Kerr) and Lee Moore (a Miami-based dealer who provided ceramic NMAI 24/8750 to the MAI) both restored Maya vases in the 1970s.
13. See Grant (2006) for an overview of these types of restorations.
14. For an example, see Lauffenburger (2012: fig. 15).
15. Several of the letters in the Dockstader and Huber Correspondence file at the NMAI Archive Center reveal that when Huber was informing Dockstader of objects for sale, he noted the ones that had been restored. This indicates that restorations often took place in the source country of the artifact prior to its sale in an overseas country.
16. See Nunberg (2012) for an overview of the process of removing excessive restorations to ancient Maya ceramics.

17. See Tremain (2017b: fig. 4.8) for an example of an ancient Maya ceramic with completely overpainted decoration.
18. Dockstader to Huber, 14 February 1967, Frederick Dockstader Correspondence, Robert Huber 1964–1974, Museum of the American Indian/Heye Foundation Records, Box 27, Folder 3, NMAI.AC.001, NMAI Archive Center.
19. Dockstader to Huber, 22 November 1967, Frederick Dockstader Correspondence, Robert Huber 1964–1974, Museum of the American Indian/Heye Foundation Records, Box 27, Folder 3, NMAI.AC.001, NMAI Archive Center.
20 Both Lehmann (1962:116) and Stanish (2009:60) report the use of ancient molds to make modern replicas.
21. The vase is viewable in the museum's online collection (https://collections.peabody.harvard.edu/collections, accessed 26 November 2021).
22. The idea of archaeological objects having "lives" is one that both Appadurai (1986) and Just (2012) touch upon.
23. Sachs to Dockstader, 15 December 1970, Frederick Dockstader Correspondence, Ry-Saf, 1955–1975, Museum of the American Indian/Heye Foundation Records, Box 47, Folder 5, NMAI Archive Center.
24. Dockstader to Bache, 15 January 1971, Frederick Dockstader Correspondence, Bab-Bal, 1956–1975, Museum of the American Indian/Heye Foundation Records, Box 10, Folder 6, NMAI Archive Center.
25. Donna Yates, Placeres Stucco Temple Façade, Trafficking Culture, 13 February 2015, https://traffickingculture.org/encyclopedia/case-studies/placeres-stucco-temple-facade/ (accessed 26 November 2021).
26. See Hauberg (2003:274).
27. See information at the bottom of the following blog page: https://samblog.seattleartmuseum.org/2016/09/keet-shagoon-killer-whale/, accessed 26 November 2021.
28. Smithsonian Institution, Andre Emmerich: A Documentary Portrait, https://www.si.edu/spotlight/andre-emmerich (accessed 26 November 2021).
29. Stolper to Dockstader, 12 July 1966, Attorney General: Correspondence between MAI and Dealers Everett Rassiga and Robert Stolper, 1964–1974, Museum of the American Indian/Heye Foundation Records, Box 147, Folder 7, NMAI Archive Center.
30. http://www.elem.mx/institucion/datos/1880, accessed 26 November 2021.
31. Fundación Cultural Armella Spitalier, https://www.fcas.mx/ (accessed 26 November 2021).
32. Mexican law stipulates that all national property, including archaeological sites and materials, is property of the Mexican nation and that private collections must be registered (Castillo Mangas, 2007:35; García-Bárcena, 2007:14). Armella Sánchez states that his foundation legally protects their registered objects in a large storage facility in Mexico City (see Armella Sánchez et al., n.d.)
33. Because the Mexican National Institute of Anthropology and History registry was closed due to COVID-19 at the time of writing, no further information about the vase other than its registry number of 1666 P.J. could be located.
34. Gardiner Museum, Museum History, https://www.gardinermuseum.on.ca/the-museum/about-the-museum/museum-history/ (accessed 26 November 2021).

REFERENCES

André Emmerich Gallery and Perls Galleries. 1984. *Masterpieces of Pre-Columbian Art from the Collection of Mr. and Mrs. Peter G. Wray*. New York: Andre Emmerich Gallery and Perls Galleries.

Appadurai, Arjun. 1986. *The Social Life of Things: Commodities in Cultural Perspective*. Cambridge, U.K.: Cambridge University Press. https://doi.org/10.1017/CBO9780511819582

Armella Sánchez, Carlos, Victor Daniel Camacho Maldonado, Natalia Ramos Garay, and Mariana Castro Armella. n.d. La 'no colección' y el mercado negro prehispánico. *Amura Yachts and Lifestyle Brasil*, pp. 104–116. https://amuraworld.com/digital_issues/amura_brasil/HTML/files/assets/basic-html/index.html#1 (accessed 15 December 2020).

Artioli, Gilberto. 2010. *Scientific Methods and Cultural Heritage: An Introduction to the Application of Materials Science to Archaeometry and Conservation Science*. Oxford, U.K.: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199548262.003.0001

Batres, Leopoldo. 1910. *Antigüedades Mejicanas Falsificadas: Falsificacion y Falsificadores*. Mexico City: Fidencio S. Soria.

Bellingham, David. 2008. Ethics and the Art Market. In *The Art Business*, ed. Iain Robertson and Derrick Chong, pp. 176–196. London: Routledge. https://doi.org/10.4324/9780203885611.ch10

Boone, Elizabeth Hill. 1982. *Falsifications and Misreconstructions of Pre-Columbian Art: A Conference at Dumbarton Oaks, October 14th and 15th, 1978*. Washington D.C.: Dumbarton Oaks, Trustees for Harvard University.

British Museum. 2021. Explore the Collection. https://www.britishmuseum.org/research/collection_online/search.aspx (accessed 26 November 2021).

Castillo Mangas, Maria Teresa. 2007. Archaeological Curatorship and Material Analysis at INAH. *SAA Archaeological Record*, 7(5):35–39.

Coggins, Clemency. 1969. Illicit Traffic of Pre-Columbian Antiquities. *Art Journal*, 29:94–114. https://doi.org/10.1080/00043249.1969.10794675

Coggins, Clemency. 1975. Painting and Drawing Styles at Tikal: An Historical and Iconographic Reconstruction. Ph.D. diss., Harvard University, Cambridge, Mass.

Cole, Sonia. 1955. *Counterfeit*. London: John Murray.

Ekholm, Gordon F. 1964. The Problem of Fakes in Pre-Columbian Art. *Curator: The Museum Journal*, 7:19–32. https://doi.org/10.1111/j.2151-6952.1964.tb01723.x

Enciclopedia de la literatura en México. 2021. Fundación Cultural Armella Spitalier. http://www.elem.mx/institucion/datos/1880, accessed 26 November 2021.

Fundación Cultural Armella Spitalier. 2021. https://www.fcas.mx/ (accessed 26 November 2021).

Gann, Thomas William Francis. 1918. *The Maya Indians of Southern Yucatan and Northern British Honduras*. Bureau of American Ethnology Bulletin, No. 64. Washington, D.C.: Smithsonian Institution.

Gann, Thomas. [1925] 1997. *Mystery Cities of the Maya*. Archaeology and Adventure in Central America, Mystic Travellers Series. Reprint, Kempton, Ill.: Adventures Unlimited Press.

García-Bárcena, Joaquín. 2007. Law and the Practice of Archaeology in Mexico. *SAA Archaeological Record*, 7:14–15.

Gardiner Museum. 2021 Museum History. https://www.gardinermuseum.on.ca/the-museum/about-the-museum/museum-history/ (accessed 26 November 2021).

Gerstenblith, Patty. 2013. The Meaning of 1970 for the Acquisition of Archaeological Objects. *Journal of Field Archaeology*, 38:364–373. https://doi.org/10.1179/0093469013Z.00000000062

Glueck, Grace. 2007. André Emmerich, Eminent Art Dealer, Dies at 82. *New York Times*, 26 September.

Gordon, George Byron. 1925. *Examples of Maya Pottery in the Museum and Other Collections*. Volume 1. Philadelphia: The University of Pennsylvania Museum.

Grant, Lynn A. 2006. *The Maya Vase Conservation Project*. Philadephia: University of Pennsylvania Press.

Groskopf, Christopher. 2016. Museums Are Keeping a Ton of the World's Most Famous Art Locked Away in Storage. *Quartz*, 20 January. https://qz.com/583354/why-is-so-much-of-the-worlds-great-art-in-storage/ (accessed 29 May 2019).

Hackett, Regina. 2002. John Hauberg, Key Backer of Seattle Arts, Dies at 85. *Seattle Pi*, 5 April.

Hauberg, John. 2003. *Recollections of a Civic Errand Boy: The Autobiography of John Henry Hauberg, Junior*. Seattle: Pacific Denkmann.

Heritage Auction Galleries. 2010. *Pre-Columbian Art Auction December 5, 2010*. New York: Heritage Auction Galleries.

Honan, William H. 1995. Art for Whose Sake?: Trading in Antiquities; Rare Pre-Columbian Relics, at Any Cost. *New York Times*, 31 July.

International Council of Museums. 2003. Red List of Latin-American Cultural Objects at Risk. Paris, France: ICOM.

International Council of Museums. 2009. Red List of Endangered Cultural Objects of Central America and Mexico. Paris, France: ICOM.

International Council of Museums. 2021. Red Lists Database, https://icom.museum/en/resources/red-lists/ (accessed 26 November 2021).

Jacknis, Ira. 2006. A New Thing? The NMAI in Historical and Institutional Perspective. *American Indian Quarterly*, 30:511–542. https://doi.org/10.1353/aiq.2006.0026

Joyce, Rosemary. 1993. The Construction of the Mesoamerican Frontier and the Mayoid Images of Honduran Polychromes. In *Reinterpreting Prehistory of Central America*, ed. Mark M. Graham, pp. 51–100. Niwot: University Press of Colorado.

Joyce, Rosemary A., ed. 2013. *Revealing Ancestral Central America*. Washington, D.C.: Smithsonian Latino Center and National Museum of the American Indian.

Just, Bryan R. 2012. *Dancing into Dreams: Maya Vase Painting of the Ik' Kingdom*. Princeton, N.J.: Princeton University Art Museum.

Kelker, Nancy L., and Karen O. Bruhns. 2010. *Faking Ancient Mesoamerica*. Walnut Creek, Calif.: Left Coast Press.

Kerr, Justin. 1989. *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*. Volume 1. New York: Kerr Associates.

Kerr, Justin. 1990. *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*. Volume 2. New York: Kerr Associates.

Kerr, Justin. 1992. *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*. Volume 3. New York: Kerr Associates.

Kerr, Justin. 1994. *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*. Volume 4. New York: Kerr Associates.

Kerr, Justin. 1997. *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*. Volume 5. New York: Kerr Associates.

Kerr, Justin. 2000. *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*. Volume 6. New York: Kerr Associates.

Kerr, Justin. 2021. Maya Vase Database. http://research.mayavase.com/kerrmaya.html (accessed 26 November 2021).

Lauffenburger, Julie. 2012. Approaches to Authentication. In *Exploring Art of the Ancient Americas: The John Bourne Collection*, ed. Dorie Reents-Budet, pp. 184–203. Baltimore: Walters Art Museum.

Lehmann, Henry. 1962. *Pre-Columbian Ceramics*. London: Elek Books.

Loughmiller-Cardinal, Jennifer A. 2018. Distinguishing the Uses, Functions, and Purposes of Classic Maya "Chocolate" Containers: Not All Cups Are for Drinking. *Ancient Mesoamerica*, 30:13–30. https://doi.org/10.1017/S0956536117000359

Loughmiller-Newman, Jennifer. 2012. The Analytic Reconciliation of Classic Mayan Elite Pottery: Squaring Pottery Function with Form, Adornment, and Residual Contents. Ph.D. diss., State University of New York at Albany, Albany.

Mashberg, Tom. 2015. Antiquities Dealer Leonardo Patterson Faces New Criminal Charges. *New York Times*, 8 December.

McGowan-Jackson, Holly. 1992. Shellac in Conservation. *AICCM Bulletin*, 18(1–2):29–39. https://doi.org/10.1179/bac.1992.18.1-2.002

McNeil, Cameron L. 2010. Death and Chocolate: The Significance of Cacao Offerings in Ancient Maya Tombs and Caches at Copan, Honduras. In *Pre-Columbian Foodways: Interdisciplinary Approaches to Food, Culture, and Markets in Ancient Mesoamerica*, ed. John Edward Staller, pp. 293–314. New York: Springer. https://doi.org/10.1007/978-1-4419-0471-3_12

Miller, Mary Ellen. 1989. The History of the Study of Maya Vase Painting. In *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*, ed. Justin Kerr, Volume 1, pp. 128–145. New York: Kerr Associates.

Milosch, Jane, and Nick Pearce, eds. 2019. *Collecting and Provenance: A Multidisciplinary Approach*. Lanham, Md.: Rowman and Littlefield.

Museum of the American Indian/Heye Foundation Records. National Museum of the American Indian Archive Center, Smithsonian Institution, Suitland, Md.

National Museums Liverpool. 2021. Virtual Gallery Tour. https://www.liverpoolmuseums.org.uk/world-cultures-virtual-gallery-tour (accessed 26 November 2021)

Nunberg, Sarah. 2012. New Insights from Conservation and Materials Analysis of Maya Vases at Princeton. In *Dancing into Dreams: Maya Vase Painting of the Ik' Kingdom*, ed. Brian R. Just, pp. 220–236. Princeton, N.J.: Princeton University Art Museum.

O'Grady, Caitlin R. 2005. Morphological and Chemical Analyses of Manganese Dioxide Accretions on Mexican Ceramics. *MRS Proceedings*, 852:183–192. https://doi.org/10.1557/PROC-852-OO8.7

O'Neil, Megan Eileen. 2012. *Engaging Ancient Maya Sculpture at Piedras Negras, Guatemala*. Norman: University of Oklahoma Press.

Paredes Maury, Sofia. 1999. Surviving in the Rainforest: The Realities of Looting in the Rural Villages of El Petén, Guatemala. Foundation for the Advancement of Mesoamerican Studies. http://www.famsi.org/reports/95096/95096ParedesMaury01.pdf (accessed 27 January 2019).

Peabody Museum of Archaeology and Ethnology. 2021. Peabody Museum Collections Online. https://pmem.unix.fas.harvard.edu:8443/peabody/ (accessed 26 November 2021).

Pickering, Robert B., and Ephraim Cuevas. 2003. The Ancient Ceramics of West Mexico: Corpse-Eating Insects and Mineral Stains Help a Forensic Anthropologist and a Chemist Determine the Authenticity of 2,000-Year-Old Figurines. *American Scientist*, 91:242–249. https://doi.org/10.1511/2003.3.242

Reents-Budet, Dorie. 1994. *Painting the Maya Universe: Royal Ceramics of the Classic Period*. Durham, N.C.: Duke University Press.

Reents-Budet, Dorie. 1998. Elite Maya Pottery and Artisans as Social Indicators. *Archeological Papers of the American Anthropological Association*, 8:71–89. https://doi.org/10.1525/ap3a.1998.8.1.71

Reents-Budet, Dorie, and Heather Hole. 2010. The America's First Art. In *A New World Imagined: Art of the Americas*, ed. Elliot Bostwick Davis, Dennis Carr, Nonie Gadsden, Cody Hartley, Erica E. Hirshler, Heather Hole, Kelly H. L'Ecuyer, Karen E. Quinn, Dorie Reents-Budet, F. Gerald, and W. R. Ward, pp. 29–49. Boston: Museum of Fine Arts, Boston.

Robicsek, Francis. 1972. *Copan: Home of the Maya Gods*. New York: Museum of the American Indian, Heye Foundation.

Robicsek, Francis. 1975. *A Study in Maya Art and History: The Mat Symbol*. New York: Museum of the American Indian, Heye Foundation.

Savage, George. 1976. *Forgeries, Fakes and Reproductions: A Handbook for Collectors*. London: White Lion Publishers.

Smithsonian Institution. 2021. Andre Emmerich: A Documentary Portrait. https://www.si.edu/spotlight/andre-emmerich (accessed 26 November 2021).

Smithsonian Institution. 2021. Collections Search Center. https://collections.si.edu/search/index.htm (accessed 26 November 2021).

Smithsonian Institution Archives. 1975. Dockstader Charged with having Sold Museum Artifacts. https://siarchives.si.edu/collections/siris_sic_2206 (accessed 26 November 2021).

Stanish, Charles. 2009. Forging Ahead. *Archaeology*, 62:18–66.

Stirling, M. W. 1943. *Stone Monuments of Southern Mexico*. Bureau of American Ethnology Bulletin, No. 138. Washington, D.C.: Smithsonian Institution.

Stirling, Matthew W. 1939. Discovering the New World's Oldest Datest Work of Man. *National Geographic Magazine*, 76:183–218.

Talavera, Juan Carlos. 2013. Fundación Cultural Armella Spitalier, centinela de arte prehispánico. *La Cronica*, 12 August.

Taylor, Dicey. 1982. Problems in the Study of Narrative Scenes on Classic Maya Vases. In *Falsifications and Misreconstructions of Pre-Columbian Art*, ed. Elizabeth H. Boone, pp. 107–124. Washington, D.C.: Dumbarton Oaks.

Tremain, Cara G. 2016. NMAI Cultural Resource Centre Maya Ceramic Report. Washington, D.C.: National Museum of the American Indian.

Tremain, Cara G. 2017a. Fifty Years of Collecting: The Sale of Ancient Maya Antiquities at Sotheby's. *International Journal of Cultural Property*, 24:187–219. https://doi.org/10.1017/S0940739117000054

Tremain, Cara G. 2017b. A Study of Dress and Identity in the Late Classic Maya Court. Ph.D. diss., University of Calgary, Calgary, AB, Canada.

Tremain, Cara G. 2019. Non-invasive Techniques to Authenticate the Painted Surfaces of Ancient Maya Ceramics. In *Anthropology of Forgery: A Multidisciplinary Approach to the Study of Archaeological Fakes*, ed. Monica Baggio, Elisa Bernard, Monica Salvadori, and Luca Zamparo, pp. 173–180. Antenor Quaderni, No. 46. Padua, Italy: Padova University Press.

Tremain, Cara G., and Donna Yates, eds. 2019. *The Market for Mesoamerica: Reflections on the Sale of Pre-Columbian Antiquities*, *Maya Studies*. Gainesville: University Press of Florida. https://doi.org/10.2307/j.ctvx0738n

von Hammerstein, Konstantin. 2016. The Murky World of the Ancient Artifact Market. *Speigel Online*, 14 April. https://www.spiegel.de/international/business/the-dubious-market-for-ancient-artifacts-a-1086597.html (accessed 20 March 2019).

Wallace, Colin. 2011. Reconnecting Thomas Gann with British Interest in the Archaeoogy of Mesoamerica: An Aspect of the Development of Archaeology as a University Subject. *Bulletin of the History of Archaeology*, 21:23–36. https://doi.org/10.5334/bha.2113

Werner-Jatzke, Chelsea. 2016. Object of the Week: Keet Shagoon (Killer Whale). SAMBlog, 9 September. https://samblog.seattleartmuseum.org/2016/09/keet-shagoon-killer-whale/, accessed 26 November 2021.

Yates, Donna. 2015a. Displacement, Deforestation, and Drugs: Antiquities Trafficking and the Narcotics Support Economies of Guatemala. In *Cultural Property Crime: An Overview and Analysis on Contemporary Perspectives and Trends*, ed. Joris Kila and Marc Balcells, pp. 23–36. Leiden: Brill.

Yates, Donna. 2015b. Placeres Stucco Temple Façade. Trafficking Culture, 13 February. https://traffickingculture.org/encyclopedia/case-studies/placeres-stucco-temple-facade/ (accessed 26 November 2016).

The New Adventures of Old Ceramic Figurines from Tres Zapotes, Mexico

Erin L. Sears,[1] Christopher A. Pool,[2] and Ronald L. Bishop[1]*

INTRODUCTION

Over time, museum collections can take on new meaning beyond the reasons for the original acquisition or collector's choice of the "best" representation of ancient or ethnographic expressions of culture. Additionally, the objects that are curated in many museums' shelving units attain new meaning through collaborative publications, public educational programming, and exhibition efforts. Fortunately, this cumulative base of knowledge has the potential to allow for alternative viewpoints and future comparative access. The idea that every object in our national or international collective possession could achieve a narrative biography is a type of intellectual methodology (or in Tremain's perspective, an object's "life history"; Tremain, this volume). It is one in which a museum object can be scaled down and discussed as a unique item to be prized for its absolute cultural essence or, at other moments, folded within a collective group, thus providing avenues for creating multiple stories in an eternal cycle (Joyce, 2015:23). In general, humans create cultural material to assist or ease their lifeways, and certain produced materials continue beyond the original intentions of those who created the object (Appadurai, 1986; Kopytoff, 1986). Unfortunately, scholars cannot query past peoples about the range of the daily use or importance of an object. Archaeologists can contribute new interpretations by deconstructing the ancient manufacturing choices that are observed in a finished object or sets of objects (known as *chaîne opératoire*, or behavioral chains; see Schiffer, 1995; Roux, 2017). Such analyses may be part of an attempt to ascertain the dispersal of an object from the point of manufacture to another site using scientific techniques to determine what is local versus long-distance exchange or to discern patterns of custom (ritual, mortuary, daily life) in contrast to objects that were disposed of as trash by ancient persons long ago.

The pre-Columbian collections of the National Museum of Natural History (NMNH), Smithsonian Institution, located at the Museum Support Center, provide an opportunity for such rediscovery and reevaluation. The multilevel storage systems at the Museum Support Center house thousands of examples of prehistoric material culture that can benefit new explorations for archaeological meaning within different research and collection management frameworks (see NMNH, 2021, for current collections programs).

[1] Department of Anthropology, National Museum of Natural History, Smithsonian Institution, P.O. Box 37012, MRC 010, Room 153, Washington, D.C. 20013-7012, USA.

[2] Department of Anthropology, University of Kentucky, 211 Lafferty Hall, Lexington, Kentucky 40506, USA.

* Correspondence: erinl.sears@outlook.com

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An example of the benefits of examining "old" pre-Columbian holdings is found in the rediscovery and publication of a wooden lintel piece taken from a Maya site in Guatemala. The glyph-decorated fragment was donated to the museum in 1907 during what was the beginning of a great institutional acquisition period (Doyle and Houston, 2014). Doyle and Houston contextualize the object through current understandings of glyph meanings and imagery comparisons. They conclude that the small wood fragment must have been removed from the doorway of Temple I or II from the site of Tikal. Another aspect of their research focused on the biography of the donor, Dr. Leonard A. Wailes, a Confederate officer in his youth and medical officer for the Louisiana State Board of Heath (Doyle and Houston, 2014:139). Through modern academic inspection, the broken lintel is brought into a sharper locational context than had been previously known, and the piece is placed within other examples of rare lintel woodcarving that currently exist in the Classic Maya hieroglyphic corpus. Additionally, through the historic narrative, Wailes's acquisition of such a unique specimen is contextualized within his lifetime collecting habits.

In a similar effort to correct misunderstandings about the provenance of a significant object in the NMNH collections, one of the coauthors of this essay collaborated with colleagues at the Smithsonian, the Instituto Nacional de Antropología e Historia, universities in the United States and Mexico, and descendants of the original owner of the "Tuxtla Statuette". A jadeite figure of a person in an avian mask and costume about 15 cm in height, the statuette was acquired by the Smithsonian between 1904 and 1907 in the early years of the same acquisitive period as the Wailes lintel. Alfred Bishop Mason, president of the Veracruz and Pacific Railroad, brought the statuette to the attention of the Smithsonian, stating in a 1902 letter that it had been dug up "in the district of San Andrés Tuxtla," which was then the head town of the "Cantón de los Tuxtlas," a district that included the Hacienda Hueyapan de Mimendi, where the Olmec "Cabeza Colosal de Hueyapan" had been found a half century earlier on the site we now know as Tres Zapotes (Justeson et al., 2020:749). Sylvanus Morley, an undergraduate at Harvard who would become one of the great figures in Maya archaeology, and William Henry Holmes, who was then chief of the Bureau of American Ethnology at the Smithsonian, both misinterpreted Mason's phrase to indicate that it was found near the town of San Andrés Tuxtla, dubbing it the "Tuxtla Statuette," and thereby creating confusion that has continued to the present (Holmes, 1907; Morley, 1915). This locational conundrum persisted despite a letter from the original owner, Felix Cházaro, forwarded to Holmes, that clearly stated it was found on the hacienda, "very close" to the monument called "La Cabeza Colosal de Hueyapam [*sic*]" (Justeson et al., 2020:749). John Justeson and Jane MacLaren Walsh's discovery of this letter in the Smithsonian archives initiated the expanded archival research and interviews with family members and former residents of the hacienda that confirmed the original findspot of the figurine within or very near the site that is the subject of this essay.

Beyond an individual object, larger pre-Columbian collections in NMNH are similarly worthy of renewed interest. Fifteen hundred archaeological and ethnographic specimens were collected by Louis H. Ayme as part of a Smithsonian-sponsored expedition in 1885 and were sent to the museum from the town of Santa Maria Coatlan, Oaxaca, Mexico. Cynthia Pinkston reviewed the collection as part of her study of ancient Zapotec ritual traditions performed within caves. Following the review of the collections, she subsequently visited the site of two active cave shrines at the edge of the town to glean information regarding recent ritual cave traditions; her field studies provided an amplified context for the objects in the Ayme collection (Pinkston, 2002).

Although the previous discussion highlights three recent examples of pre-Columbian items from the NMNH, many of the contributions in the present volume provide examples of the benefits of combining collections from both the anthropological collections of the NMNH and the National Museum of the American Indian and incorporation of international museum-based holdings. Collections of museum objects can provide a basis for various explanations and interpretations. Their use, however, involves a range of caveats, ethical decisions, and consideration of an object's historicity that need to be addressed when dealing with cultural materials that have a less-than-perfect pedigree (see Tremain, this volume, for consideration of what is "fake" in a collection).

A common thread in both the museum world and archaeological discipline is the issue of ethical responsibility and how that has caused some scholars to exclude museum collections from their discourse. The modern dilemma to use museum collections in current academic methodology stems in part from the lack of standards for accessory contextual information acquired during the early nineteenth to twentieth century and into present acquisition practices. The origins of museum exhibition began with wealthy sixteenth century European families creating cabinets of curiosities, or *Wunderkammern*, aggregating perfect specimens of natural and cultural objects for display to indicate their knowledge of the world (Alexander, 1996:8). In the United States, the transition to targeted large-scale research by institutional museums (the Smithsonian Institution was inaugurated in 1846) created an arms race of acquisition of natural and cultural material in order to understand and educate the new nation (Alexander, 1996:50). By the mid- to late twentieth century, the cycle of the donation of large collections from wealthy donors for tax purposes or exclusively for the benefit of the public created unique multiple levels of "accurate" information that reside within each museum collection (Collier and Tschopik, 1954).

American archaeologists have also examined their inadvertent impact upon the illicit antiquities trade as a by-product of bringing attention to nonprovenienced Mesoamerican archaeological collections. A focus of discussion concerns how museums, as an industry, were the end cycle of the looting activity as donors sought large tax exemptions for their pre-Columbian donations (see Coggins, 1969, 1995; Wiseman, 1984; Brodie et

al., 2006; Elia, 2007; Malaro and DeAngelis, 2012). The result of these considerations, rightly or wrongly, has become codified within the Society of American Archaeology's (2019) policy as Principle No. 3 of their Principles of Archaeological Ethics:

> Archaeologists should therefore carefully weigh the benefits to scholarship of a project against the costs of potentially enhancing the commercial value of archaeological objects. Whenever possible they should discourage, and should themselves avoid, activities that enhance the commercial value of archaeological objects, especially objects that are not curated in public institutions, or readily available for scientific study, public interpretation, and display.

While this regulation promotes the idea that what is in the public domain is fair game for study, publication regulations of various academic venues restrict the discussion of nonprovenienced cultural material, with its incorporation into new scholarship approved on a case-by-case basis by each editor (e.g., Society for American Archaeology, 2019: editorial policy 1.1.8; 2021:editorial policy 1.1.9 [see Berger et al., this volume, for expanded positioning of this perspective]). In this study, the various levels of contextual information (or lack thereof) and access to where Tres Zapotes ceramic figurine material was recovered played an important role in understanding the analytical data sets that were generated.

THE "OLD" COLLECTION OF TRES ZAPOTES FIGURINES

Our research into the manufacture and circulation of Tres Zapotes figurines is also affected by the caveats and historicity pertaining to museum-based research collections. The long-term exploration of Formative florescence (BC 2000–350 AD) within the Veracruz region in Mexico has been supported through early twentieth century explorations and continued collection management protocols of the NMNH Department of Anthropology. The original archaeological expedition to the Olmec site of Tres Zapotes was jointly supported by the National Geographic Society and led by the director of the Smithsonian's Bureau of American Ethnology, Matthew Stirling (Drucker, 1943; Stirling, 1943; Weiant, 1943; Matthew W. Stirling and Marion Stirling Pugh Papers [hereafter Stirling and Stirling Pugh Papers]; Figure 1). The site is currently under investigation by Christopher Pool and team members from the University of Kentucky to determine the organization of the site center and to place it in regional context (Pool, 2003, 2007; Pool et al., 2014, 2017). The goal of our study of miniature ceramic figurines from Tres Zapotes, both recently excavated and older collections, is to contribute to understanding distributional relationships between the site center, the periphery, and beyond. The incorporation of technical studies, archival research, and comparative methods serves to demonstrate the benefits of museum collections for new interpretations. Caution, however, is required when using the older Tres Zapotes curated objects and data at the Museum Support Center. The quality of the accession information and field notes, as well as the published documents, at times creates a confusing detective mystery to be solved in order to understand the excavation record created by different project members. It is not surprising to read the temporal and spatial internecine squabbles among the original contributors to a project (see debates concerning ceramic and figurine analysis in Drucker, 1952b; Weiant, 1952). Luckily, the 1938–1940 collections from Tres Zapotes has documentation from many sources—the original Bureau of American Ethnology reports (Stirling, 1943; Drucker, 1943; Weiant, 1943), the accession records housed in the NMNH Department of Anthropology, the papers from Philip Drucker (Philip Drucker Papers), Charles Weiant's contributions (Charles Weiant Papers), the photographic record of the daily life of the Tres Zapotes camp by Alexander Wetmore (Alexander Wetmore Papers), and the recently donated material from the estate of Matthew Stirling's widow, Marion Stirling Pugh, and her grandchildren (Stirling and Stirling Pugh Papers) now held in the NMNH National Anthropological Archives.

An academic appraisal published in the latter half of the twentieth century evaluated the excavation techniques and field recording activities that occurred at Tres Zapotes and other Olmec sites within the Veracruz region as part of the National Geographic–Smithsonian Institution consortium. They were considered 'good for the time period' while acknowledging that there were multiple agendas among the participants (Lyon, 1997), such as relegating solely to Drucker the archaeological necessity of conducting stratigraphic excavations because the director of the project could not be bothered with such details (Wicke, 1965:28). The 1943 publication of both Weiant's revised dissertation research using the 1939 collection and Drucker's report of his 1940 Tres Zapotes stratigraphic excavations in the *Bureau of American Ethnology Bulletin* series employed two different approaches to ceramic chronology and figurine classification, with Weiant applying broad knowledge of extant typologies from across Mesoamerica and Drucker being more attuned to stratigraphic context and technical attributes (Drucker, 1943; Weiant, 1943; see also Pool, 2017). The simultaneous publication of their divergent typologies led to confusion and a heated exchange in *American Antiquity* defending their work in response to Wauchope's consternation as he attempted to clarify the chronology of the Olmec region (Drucker, 1952b; Wauchope, 1950, Weiant 1952). With respect to figurines, Drucker (1943) employed a classification devised by Stirling that separated the figurines into "two broad technological divisions: I Punctate forms . . . and II, Modeled and Incised forms," subdividing them on the basis of details of execution, head forms, etc., an approach he further refined in his study of ceramics from the Olmec site of La Venta (Drucker, 1952a:78–86). He also analyzed the stratigraphic distribution of these technological types at Tres Zapotes, documenting their depths and feature associations within excavation units (Drucker, 1943:129–134, pls. 28–36). In contrast, Weiant's (1943) classification of figurines was from only his first season of fieldwork at Tres Zapotes, which focused on clearing monuments and conducting nonstratigraphic excavations within

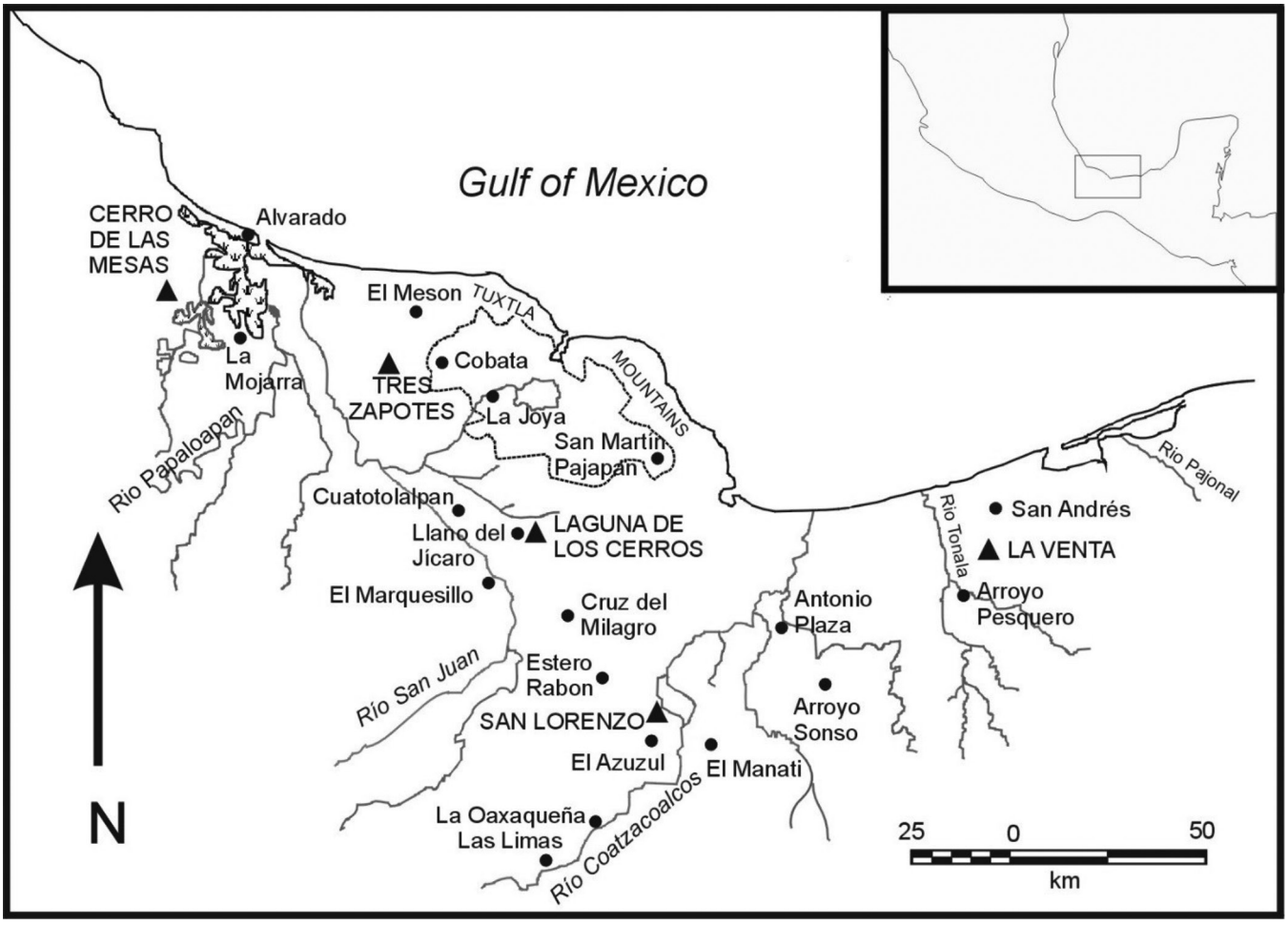

FIGURE 1. Map of the Veracruz region indicating the major Formative Olmec sites. (Drawing courtesy of Christopher A. Pool.)

mounds, and employed a typological approach relating the figurines to established sequences in central Mexico and the Maya region primarily. Weiant demonstrated the variation (style) of the collection by publishing 61plates of figurine heads and body categories (versus Drucker's 38 plates of figurine examples). Weiant's organization of imagery demonstrates a uniformity of design aggregating specific ceramic figurine heads and bodies, whereas Drucker's illustrations demonstrate the range of figurine parts that were recovered from specific trench cuts.

The attempt to glean more information about the old Tres Zapotes ceramic figurine collections benefitted from the use of the National Anthropological Archives (NAA) material and the NMNH accession records, which are located in the Collections Division of the Department of Anthropology. Drucker's field notebook from the 1940 season (Philip Drucker Papers, Box 21, Volume 5) might be characterized as having the warmth of an accountant's ledger. The first pages describe what was excavated during the season and packed in 99 boxes that were brought back for study. Purchases of nonprovenienced figurines from local landowners and objects from the site of San Marcos were also recorded. He recorded specific trench discards and the forms (hemispherical bowls, ollas, and flared walled bowls), included rough sketches, and noted the specific paste colors and textures. Seemingly shoved in the back of the notebook are loose-leaf, legal pad papers that describe the specific box contents and the stratification sections from the Ranchito group excavations that were conducted during that season. The word "figurine" is mentioned in the remarks category in the first pages; additional descriptors of "fine," "special," and "ordinary" are applied to figurines in Ranchito boxes 11–15 and 22.

Drucker's 1941 field notebook is concerned with the regional survey that he conducted. He detailed trench pits and survey information from the sites of El Mesón, Salta Barranca, Cerro de la Piedra, Grande and Tres Piedra, and Cerro del Gallo de Lerdo. At Cerro de la Piedra, the test unit revealed two intact "San Marcos"–style figurines, and he commented that the actual objects are better "in person" than his quick sketches. Within Drucker's 1941 notes (Philip Drucker Papers, box 21, volume

6) are found aspects of correlation of the figurines with ceramic types and pastes, which he calls "TZ," in comparison to what is found in the surrounding regional sites.

The Weiant documents (Charles Weiant Papers) were not as helpful as Drucker's for obtaining insights into his field discoveries or for understanding his excavations. In contrast, Matthew Stirling's field pocketbook does address the trench findings and burial arrangements from the Ranchito group (Stirling and Stirling Pugh Papers, box 4, folder 3). He notes each ceramic vessel and figurine fragment that is connected to the interred individuals. Stirling and his colleague Marion Stirling Pugh typed field experiences, and their collected papers are too numerous to describe and lie beyond the scope of this essay. Their informally recorded, nonpublished work can be mined for information and will surely assist future archaeological interpretations (see Duvall, 2019).

A COMBINED APPROACH

As stated above, archaeological collections of ceramic materials can provide rich information beyond what might have been envisioned by original research designs. With analytical techniques, these cultural remains residing in museum collection drawers can be linked with recently excavated artifacts, thereby providing an enhanced understanding of the past. A good example of such linkage is provided by figurines and ceramics obtained from recent reconnaissance and excavation at Tres Zapotes in combination with the 1940s collection of the same site housed in the anthropology collections of the NMNH.

Our study of Tres Zapotes pottery and figurines involves the use of instrumental neutron activation analysis (INAA) to obtain elemental concentration data from samples of the ceramic pastes; INAA is the preferred means to obtain such data as it can simultaneously determine many elements with different concentrations, some of which may be present at less than 1 part per million. In routine usage INAA is capable of very good analytical precision with the use of certified analytical standards. High analytical sensitivity and precision, combined with a reasonable speed of sample throughput, have made INAA the technique of choice for the characterization of archaeological ceramics since the 1970s (e.g., Speakman and Glascock, 2007; Glascock, 2019). The technique involves bombarding a sample with neutrons, usually produced in a nuclear reactor, causing some atoms in the sample to form radioactive isotopes. Gamma rays emitted by these isotopes can be detected, sorted by energy, and counted. Through comparison to a standard reference material, treated in the same manner as the ceramic material, elemental abundance in the sample can be quantified.

One of the highly attractive features of using neutron activation for archaeological purposes is the relatively small quantity of sample that needs to be extracted from the ceramic material, subject to the requirement that the sample taken is representative of the object. This is an important consideration when working with whole museum vessels (Bishop et al., 1986; Reents and Bishop, 1987; Canouts and Bishop, 2003), especially figurines, which are often hollow or fragile (Sears, 2016). For the latter, 100–200 mg of the ceramic body are removed from an inconspicuous part of the figurine using a 3/32" or 1/16" diameter tungsten carbide dill bit. Long established through experimentation, the quantity of the fine- to medium-textured sample removed permits reproducible results and provides sufficient residual powder for an additional analysis, should it be necessary.

Ceramic artifacts, including figurines, were selected for neutron activation to assess the diversity of paste matrices in the region of the site core. Sampling was conducted in two stages, the first of which consisted of selecting 72 pottery sherds and 34 figurine fragments excavated from the site center of Tres Zapotes in 2007. Another 70 ceramic sherds, provided to the late Robert Rands by Philip Drucker in the 1960s, were included. These samples were supplemented with 160 more from the 1939–1940 excavations at Tres Zapotes and the nearby site of San Marcos from the NMNH Department of Anthropology collections.

The original fieldnotes from the 1939–1940 excavation did not explain where each figurine was recovered in the units (trenches). The accession records, however, assisted in determining which "old" figurines selected for INAA would complement the "new" excavation areas (Table 1). As this was a preliminary sampling, both Weiant's and Drucker's figurine examples were used. Weiant's figurine examples (INAA samples TZF066–95) come from one accession cabinet (NMNH 385657), and the collection's accession information on microfiche notes at the very edge of the page "Tr. 13," which potentially means that they originated from Trench 13, which was placed on the first terrace of the Ranchito group. The recent excavations in the Ranchito group were carried out on the second terrace (Proyecto Arqueologíco Tres Zapotes Operations 3A, 3B; INAA samples TZF019–22, TZF028–33). Drucker's trench units 1, 4, 10, and 13 were also sampled to give a wider range of examples from the Ranchito group (see Table 1).

The mound area of Group 2 provided another focus of figurines and ceramics where the old collections could be meaningfully combined with materials obtained more recently. The Proyecto Arqueológico de Tres Zapotes units were placed northwest, south, and southeast of the largest mound (Pool, 2003:10, fig. 2.2), and Drucker's Trench 22 was placed on the farthest western mound of Group 2 (Drucker, 1943:21; INAA samples TZF099–113). Two figurine heads from the Burnt Mounds group near Group 2 were included (INAA samples TZF037, TZF039). Other zones not studied in the 2003 season benefited from sampling the old collection excavations from the "New Lands" (the area between the Ranchito Group and Group 3) and the northeastern Group 3 mounds (INAA samples TZF057–65).

A preliminary report on the compositional variation among Tres Zapotes figurines was made by Sears in 2009. These initial observations were incorporated into a more extensive paper by Pool et al. (2017) that used the Tres Zapotes pottery and figurines excavated by the current Proyecto Arqueológico de Tres Zapotes as an expression of the Olmec manifestation during the

TABLE 1. Instrumental neutron activation analysis (INAA) sample numbers, National Museum of Natural History (NMNH) accession numbers, and locations for figurines from the 1939–1940 excavations at Tres Zapotes, San Marcos, and Cerro de las Mesas selected for analysis.

INAA sample no.	NMNH accession no.	Tres Zapotes location[a]	INAA group
TZF036	385965	Trench 1	TZL1
TZF037	385941	Trench 24	TZL2
TZF038	385958	Trench 19	TZL2
TZF039	385941	Trench 24	TZL2
TZF040	385965	Trench 1	TZL2
TZF041	385965	Trench 1	TZL2
TZF042	385965	Trench 1	TZLV
TZF043	385952	Trench 13	TZL3
TZF044	385952	Trench 13	TZLV
TZF045	385857	Trench 10	TZFO
TZF046	385857	Trench 10	TZLV
TZF047	385857	Trench 10	TZLV
TZF048	385857	Trench 10	TZLV
TZF049	385962	Trench 13	TZL3
TZF050	385970	Trench 1	TZL3
TZF051	385970	Trench 1	TZL2
TZF052	386009	Weiant / Purchased	TZLV
TZF053	386009	Purchased	TZLV
TZF054	386009	Purchased	TZLV
TZF055	386009	Purchased	TZLV
TZF056	385972	Trench 19	TZL2
TZF057	385968	Trench 19	TZL3
TZF058	385968	Trench 19	TZL3
TZF059	385972	Trench 19	TZLV
TZF060	385972	Trench 19	TZL2
TZF061	385972	Trench 19	TZL3
TZF062	385863	Trench 16	TZLV
TZF063	385863	Trench 16	TZLV
TZF064	385863	Trench 16	TZLV
TZF065	385863	Trench 16	TZL1
TZF066	391636	Cerro de las Mesas	No group
TZF067	385657	Weiant / A10	TZL3
TZF068	385657	Weiant / A20	TZL3
TZF069	385657	Weiant / A10	TZL3
TZF070	395657	Weiant / A10	TZL1
TZF071	385657	Weiant / A10	TZLV
TZF072	385657	Weiant / A20	TZL3
TZF073	385657	Weiant / A20	TZL2
TZF074	385657	Weiant / A20	TZL3
TZF075	385657	Weiant / A20	TZL3
TZF076	385657	Weiant / A20	TZL3
TZF077	385657	Weiant / D0	TZL1
TZF078	385657	Weiant / D0	TZL1
TZF079	385657	Weiant / D0	TZL2
TZF080	385657	Weiant / F30	TZLV
TZF081	385657	Weiant / D0	TZL1
TZF082	385657	Weiant / F10	TZL1
TZF083	385657	Weiant / F30	TZLV
TZF084	385657	Weiant / E0	TZLV
TZF085	385657	Weiant / F10	TZL2
TZF086	385657	Weiant / F20	TZL1
TZF087	385657	Weiant / E0	TZL1
TZF088	385657	Weiant / F10	TZL1
TZF089	385657	Weiant / F20	TZL1
TZF090	385657	Weiant / F30	TZL1
TZF091	385657	Weiant / D0	TZLV
TZF092	385657	Weiant / D0	TZL2
TZF093	385657	Weiant / D0	TZL2
TZF094	385657	Weiant / D0	TZL2
TZF095	385657	Weiant / D0	TZL2
TZF096	385963	Trench 1	TZL1
TZF097	385666	Trench 10	TZLV
TZF098	385959	Trench 30	TZLV
TZF099	385901	Trench 22	TZL3
TZF100	385901	Trench 22	TZL3
TZF101	385901	Trench 22	No group
TZF102	385901	Trench 22	TZL1
TZF103	385901	Trench 22	TZL2
TZF104	385901	Trench 22	TZL1
TZF105	385901	Trench 22	TZL1
TZF106	385901	Trench 22	TZL1
TZF107	385901	Trench 22	TZL1
TZF108	385901	Trench 22	TZL1
TZF109	385901	Trench 22	TZL3
TZF110	385901	Trench 22	TZL1
TZF111	385901	Trench 22	TZL3
TZF112	385901	Trench 22	TZFO
TZF113	385901	Trench 22	TZL3
TZF114	385831	Trench 4	TZLV
TZF115	385686	Tres Zapotes	TZFO
TZF116	385662	Tres Zapotes	TZLV
TZF117	385658	Tres Zapotes	TZFO
TZF118	385658	Tres Zapotes	TZFO
TZF119	385708	Tres Zapotes	TZLV
TZF120	386013	San Marcos	TZLV

[a] When location data is not relevant, who controlled the object acquisition is sometimes included.

Arroyo Phase (circa 1500–400 BC). Data for pottery and figurines were graphed using three of the four principal components that were extracted. Shown in a tricomponent plot, variation among figurines could be seen relative to that observed for the other ceramics, leading to the suggestion that some were "locally" manufactured and others were "imported" (Pool et al., 2017: figs. 4.20, 4.21, 4.22). Six groups were considered to be the best portioning of the ceramic and figurine compositional data, with some groups appearing to be more cohesive than others. Group membership for the figurines in the statistically defined groups, however, could not be convincingly established as they occurred in areas of the plot that were insufficiently populated. The figurine data indicated a connection to a local paste recipe with a specific figurine type known as Trapiche, and preliminary interpretations were made concerning the directionality of specimens outside the Tres Zapotes core toward either the La Venta area or Lower Coatzacoalcos zone (Pool et al., 2017:115, fig. 4.21). Other studies of Formative figurines in the Olmec region noted the Trapiche form was also present at the site of La Joya near the Tuxla mountains in the northwest of the zone (Arnold and Follensbee, 2015). Clearly, more samples were needed as ceramics that appeared to be similar were found to be compositionally differentiable.

DATA ANALYSIS

Analyses of Tres Zapotes ceramics and ceramic figurines from the NMNH Department of Anthropology collections were added to the database. The present discussion focuses on 122 ceramics and 123 figurines from the Tres Zapotes site core, of which 85 of the figurines are from the NMNH collections. Data were transformed to log values to reduce the magnitude between concentrations that were measured as percentages and as parts per million. Not all determined elemental concentrations were used; some were ignored as being highly mobile in the depositional environment, having excessive analytical errors, or possibly being impacted by contamination from the tungsten carbide drill bit. Following such data screening, the values of K, Sc, Cr, Fe, Rb, Sb, Cs, Ba, La, Ce, Sm, Eu, Lu, Hf, and Th were retained for data analysis. Initial inspection for patterns that might be due to different manufacturing locations was carried out by an average linkage cluster analysis of Euclidean distances. Clusters of samples were noted on a dendrogram and labeled. Those clusters that were found to be sufficiently populated were subjected to statistical refinement based on the group's pattern of interelemental correlation and a sample's distance from the group's multivariate centroid. Initially included samples that were determined to lie outside of a 95% confidence interval were rejected, and the group characteristics were recalculated (Bieber et al., 1976; Bishop and Neff, 1988). The refined cluster of samples was elevated to group status; distinct clusters of samples that were too few in number to be statistically refined remained clusters.

Within the current data set, a compositional expression for figurines made locally at Tres Zapotes is found in the statistically refined reference groups TZ1, TZ2, and TZ3 (Figures 2–7, Tables 1–3). These three groups are chemically separated at a 90% confidence interval, with two samples showing group overlap with TZ1 and TZ2. Differences between the latter two groups are found primarily in the concentrations of the alkali elements, especially potassium and rubidium. Weathering of the surface has exposed medium-coarse grains that now stand out in relief. Group TZ3 differs considerably from TZ1 and TZ2, most notably in the lower concentration of the transition elements iron, scandium, chromium, and hafnium. The figurines in this group tend to be finer in texture, presumably with fewer iron-containing nonplastics. The similarity among all three groups in terms of rare earth and thorium concentrations helps us to attribute TZ3 to local Tres Zapotes composition, albeit with the noted differences in the manufacturing recipe.

With the combined sampling of recently excavated Tres Zapotes figurines and data from the museum-based collection, we were able to define a robust, statistically refined group of ceramics that were imported from a location outside of Tres Zapotes. With the dendrogram-observed cluster as a trial core group, the full database of Gulf Coast ceramic analyses was searched for possible matches as defined by a 90% confidence interval for the core group. Ten samples from La Venta and six from a site near La Venta, San Andres, were found to be similar in composition; these were added to the original cluster. No additional matches were found to these samples in the database. We do not believe that this group represents ceramic manufacture at La Venta per se as only 10 of 178 La Venta ceramics were admitted to what we are calling TZLV. More likely, it reflects resources from the La Venta region floodplain.

One loosely constituted but separable group is designated TZFO, which contains several Fine Orange Ware ceramics. This unit is substantially different in composition from any of the statistically refined Tres Zapotes groups. The source of manufacture is unknown, but connections to the pottery of the lower Papaloapan basin may be indicated. Treating TZFO as a core group and searching the database using Mahalanobis distances yielded no matching samples. Searching the database with the considerably less demanding Euclidean distances based on the absolute magnitude of elemental determinations indicated compositional similarities to Classic period Patarata 52 pottery (Harbottle and Bishop, 1989; Stark et al., 2007). Thus, a manufacturing location somewhere in the floodplain of the Papaloapan River is plausible.

The composition-based relationship among the five groups is graphically depicted in Figure 2 using discriminant analysis based on the inferred local Tres Zapotes groups TZL1, TZL2, and TZL3. Ellipses show the 90% confidence intervals for the groups.

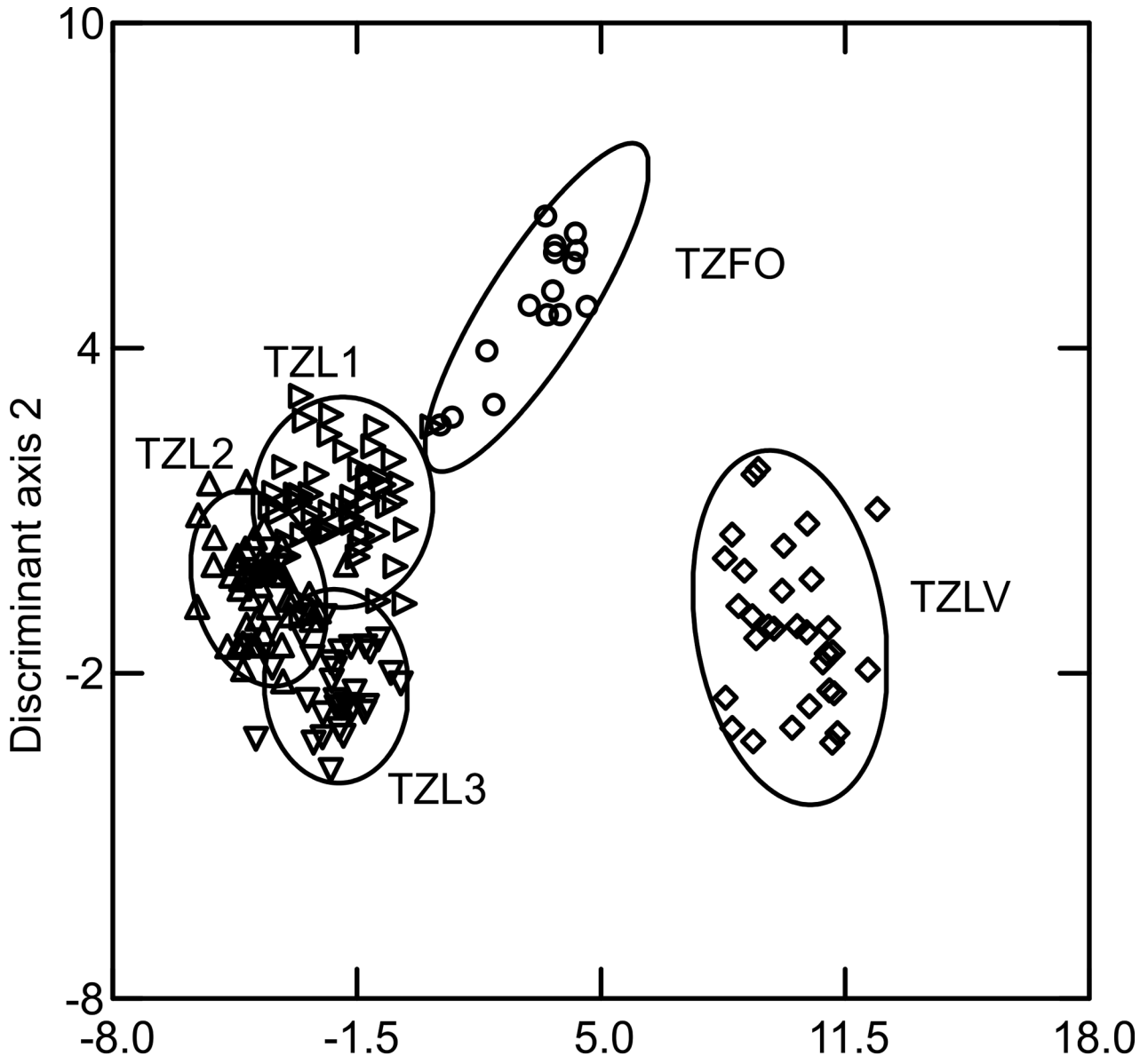

FIGURE 2. Bivariate plot showing discriminant axes 1 and 2 on the basis of discriminant analysis of the five compositional groups. Ellipses represent 90% confidence intervals.

FIGURE 3. Tres Zapotes figurines from the NMNH collections that fall within the TZL1 group. (Photos by Erin L. Sears.)

TZF037 TZF038 TZF039 TZF040 TZF041

TZF051 TZF056 TZF060 TZF073 TZF085

TZF092 TZF093 TZF094 TZF095 TZF103

FIGURE 4. Figurines from the NMNH collections that belong in the TZL2 group. (Photos by Erin L. Sears.)

FIGURE 5. The ceramic figurines from the NMNH collections that are in the TZL3 group. (Photos by Erin L. Sears.)

TZF042 TZF044 TZF046 TZF047 TZF048

TZF052 TZF053 TZF054 TZF055 TZF059

TZF062 TZF063 TZF064 TZF071 TZF080

TZF083 TZF084 TZF091 TZF097 TZF098

FIGURE 6. The majority of the TZLV group of figurines from the NMNH collections. (Photos by Erin L. Sears.)

FIGURE 7. The remaining figurines from the TZLV group (top) and the small group of Fine Orange paste figurines (TZFO; bottom) from the NMNH collections. (Photos by Erin L. Sears.)

TABLE 2. Mean elemental concentrations and coefficient of variation (CV) for each reference group (TZL1–TZL3, TZFO, and TZLV). Concentrations are given as parts per million except when indicated as a percentage (%).

Element	TZL1 (*n*=50)	CV	TZL2 (*n*=49)	CV	TZL3 (*n*=32)	CV	TZFO (*n*=15)	CV	TZLV (*n*=31)	CV
K (%)	1.00	22	0.63	25	0.64	21	1.76	11	1.80	18
Sc	23.1	10	24.4	11	16.9	10	23.6	6	12.1	13
Cr	471	24	539	22	200	34	192	10	140	21
Fe	5.61	15	6.14	15	3.89	16	5.33	16	2.53	23
Rb	67	21	41	27	47	18	120	12	104	13
Sb	0.57	24	0.53	23	0.64	27	1.03	21	0.95	17
Cs	3.11	18	2.25	22	2.45	13	5.75	14	5.91	17
Ba	965	22	758	38	939	30	1,060	27	1,264	24
La	32.8	12	27.7	17	26.6	16	42.4	10	36.0	11
Ce	58.1	12	49.0	19	49.9	16	76.7	10	61.6	21
Sm	6.58	17	5.12	16	5.05	20	7.86	10	5.49	12
Eu	1.52	13	1.24	17	1.18	17	1.70	10	1.13	13
Yb	2.51	17	2.11	13	2.52	13	3.58	10	2.53	11
Lu	0.39	20	0.33	13	0.41	13	0.55	9	0.37	16
Hf	5.76	18	6.78	17	8.39	15	7.46	10	4.16	13
Th	7.81	9	7.51	11	7.09	9	11.77	8	13.28	7
Not Used in Group Formation or Refinement										
Na (%)	0.60	24	0.45	27	0.33	26	0.63	16	0.99	14
Ca (%)	2.9	56	2.0	44	0.8	48	0.9	11	0.3	13
Co	38.6	22	40.2	27	19.3	37	26.3	61	11.3	40
Zn	113	19	93	26	76	28	146	18	97	39
As	2.9	36	2.8	32	3.1	38	5.3	31	7.7	47
Tb	0.83	22	0.65	25	0.68	19	0.99	13	0.76	15
Ta	0.96	22	1.06	36	1.05	35	1.43	57	0.96	20

DISCUSSION

The incorporation of the ceramic figurine material from the earlier National Geographic–NMNH excavations added more data points that adjusted how the five compositional groups were interpreted following the more recent investigation. Previously, compositional modeling created a main cloud of figurines that appeared to be local. Following the addition, three statistically defined groups appeared: TZ1, TZ2, and TZ3. Additionally, a Late Classic group, TZFO (Fine Orange group), resulted from the initial sampling of the San Marcos figurines in the collection. The differentiation among the three new local groups is a reflection of both resource variation and paste production recipe (multiple paste acquisition areas) resulting in texture differences (TZ1 is the coarsest, with actual large grains on the surface of the figurines, and TZ3 is a finer paste with smaller inclusions). Earlier interpretations had noted a trend in the presence of Trapiche figurines in the local compositional group (Pool et al., 2017:115, fig. 4.21). The occurrence of these Trapiche figurines is within the TZ1 and TZ2 groups (seven examples are placed within each group). The style trend that separates TZ1 is the abundance of round head-shaped figurines described as Uaxactun style. The group, thought to be directed "towards La Venta area" in our original understanding (Pool et al., 2017:116, fig. 4.22), is actually a local group—TZ2s.

What was previously known as an outlier, figurine TZF026 (Pool et al., 2017), is actually a member of a newly designated local group, TZ3. This group contains small and large Olmec-style baby face figurine fragments as well as a trend in beatific, pointed-chin, or prognathic Tres Zapotes head designations. They have a lighter orange surface color as a result of the amount of iron in the fired clay.

For now, the use of technical studies to assist in understanding ceramic interaction patterns in relation to figurines within the Olmec world has created interpretations similar to what occurred with the Tres Zapotes obsidian studies (Pool et al., 2014). Regional interaction took place among these three Olmec capitals, as noted by the movement of certain ancient cultural

TABLE 3. Canonical discriminant functions (CDF) for the indicated elements, standardized by within variances.

Element or statistic	CDF 1	CDF 2	CDF 3	CDF 4
K	0.177	0.366	0.392	0.018
Sc	–0.711	0.521	0.008	0.365
Cr	0.053	0.029	0.659	0.042
Fe	–0.187	0.238	–0.110	0.219
Rb	0.137	0.459	–0.248	–0.134
Sb	0.160	0.041	–0.176	0.094
Cs	–0.143	–0.048	–0.303	–0.155
Ba	0.257	0.114	–0.016	–0.109
La	–0.173	–0.107	–0.033	0.287
Ce	0.137	0.154	–0.191	0.029
Sm	0.096	0.149	0.286	–0.282
Eu	0.081	0.041	–0.027	–0.779
Yb	0.211	0.163	–0.121	0.091
Lu	–0.115	0.063	–0.284	–0.024
Hf	–0.432	0.067	–0.336	0.536
Th	0.890	–0.140	0.419	0.545
Eigenvalue	25.71	3.58	2.44	0.93
Cumulative proportion of total dispersion	79	90	97	100

materials, but extreme long-distance interaction remains to be found. Without the use of the NMNH collections and the continued work at the National Anthropological Archives, our ability to ask questions—concerning the figurines of Tres Zapotes and of their intersite and regional interactions—would be limited.

CONCLUSION

At the 1996 sesquicentennial celebration of the Smithsonian Institution, curators explored varied issues of the representation of cultures and objects using the national collections as points of conversation. Discussion included the effects of colonialism and the positive response of an institution that recognizes its own historic impact across museological and anthropological disciplines (Henderson and Kaeppler, 1997). Amy Henderson and Adrienne Kaeppler, editors of the volume of essays related to the celebration, noted that "the transformation of the museum from reliquary to forum has forced curators to reassess their role as 'cultural custodians'" (Henderson and Kaeppler, 1997:2). These challenges were posed as dilemmas, such as the responsibility of creating varied representations through modern cultural material to imbue recent events, the appropriateness of displaying nonauthenticated objects, and exhibits representing cultural stereotypes that do not represent current Native traditions.

Although repatriation efforts and restricting collection acquisition protocols are changing the growth of museum collections in order to break the cycle of looting of archaeological sites in Mesoamerica, access for research purposes provides an avenue for growth that can create an alternative knowledge base for understanding ancient cultural heritage. The use of the old Tres Zapotes collection added much more than just data points on a plot for researchers to consider. Not all of the archival papers, however, were available when the sampling process started in 2010. As we tried to ascertain additional excavation information, in the end, the accession records in NMNH Anthropology's collection department were more helpful than the recent archival information for understanding general excavation context to connect the old collection with more recent archaeological investigations.

Jenkins (2016:10) offers a more positive statement concerning future efforts and directives of collection management, noting that "museum collections are more than merely a sum of their exhibits: they have played an important role in the expansion of our understanding of history, the specificity, and interaction of different cultures." The collections-based research of ancient material should be considered a multiaccess point for student development, a nexus for new biographies/life histories that bridge a long-distant past, and the potential wellspring to redirect aspects of questioning as information from recent excavations continuously causes researchers to reformulate interpretations. From this study, the incorporation of museum-based collections with more recent regional excavations has been invaluable in creating an amplified data set, and the efforts to combine disparate current and past archaeological field information created their own secondary "excavation" of paperwork to help us understand the ceramic material culture that was recovered from different projects at the ancient Olmec site of Tres Zapotes.

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REFERENCES

Alexander, Edward P. 1996. *Museums in Motion: An Introduction to the History and Functions of Museums*. Walnut Creek, Calif.: AltaMira Press.

Appadurai, Arjun. 1986. *The Social Life of Things: Commodities in Cultural Perspective*. Cambridge, U.K.: Cambridge University Press. https://doi.org/10.1017/CBO9780511819582

Arnold, Phillip J., and Billie J. A. Follensbee. 2015. Early Formative Anthropomorphic Figurines from La Joya, Southern Veracruz, Mexico. *Ancient Mesoamerica*, 26:13–28. https://doi.org/10.1017/S0956536115000012

Bieber, Alan M., Jr., Dorthea W. Brooks, Garman Harbottle, and Edward V. Sayre. 1976. Application of Multivariate Techniques to Analytical Data on Aegean Ceramics. *Archaeometry*, 18:59–74. https://doi.org/10.1111/j.1475-4754.1976.tb00145.x

Bishop, Ronald L., Garman Harbottle, Dorie J. Reents, Edward V. Sayre, and Lambertus van Zelst. 1986. Compositional Attribution on Non-provenienced Maya Polychrome Vessels. In *Applications of Science in Examination of Works of Art*, ed. Pamela A. England and Lambertus van Zelst, pp. 117–124. Boston: The Research Laboratory, Museum of Fine Arts, Boston.

Bishop, Ronald L., and Hector Neff. 1988. Compositional Data Analysis in Archaeology. In *Archaeological Chemistry IV*, ed. Ralph O. Allen, pp. 57–86. Advances in Chemistry Series 220. Washington, D.C.: American Chemical Society. https://doi.org/10.1021/ba-1988-0220.ch004

Brodie, Neil, Morag M. Kersel, Christina Luke, and Kathryn Walker Tubb, eds. 2006. *Archaeology, Cultural Heritage, and the Antiquities Trade*. Gainesville: University of Florida Press. https://doi.org/10.5744/florida/9780813029726.001.0001

Canouts, Valetta, and Ronald L. Bishop. 2003. Modern Measures of Traditional Hopi Pottery: Physical and Behavioral Sources of Variation in Hopi Pottery Production and Exchange, A.D. 1300–2000. In *Patterns and Processes: A Festschrift in honor of Dr. Edward V. Sayre*, ed. Lambertus van Zelst, pp. 135–156. Washington, D.C.: Smithsonian Center for Materials Research and Education.

Coggins, Clemency Chase. 1969. Illicit Traffic in Pre-Columbian Antiquities. *Art Journal*, 29:94–98. https://doi.org/10.1080/00043249.1969.10794675

Coggins, Clemency Chase. 1995. A Licit International Traffic in Ancient Art: Let There Be Light, *International Journal of Cultural Property*, 1:61–80. https://doi.org/10.1017/S0940739195000051

Collier, Donald, and Harry Tschopik Jr. 1954. The Role of Museums in American Anthropology. *American Anthropologist*, 56:769–779. https://doi.org/10.1525/aa.1954.56.5.02a00040

Doyle, James, and Steven Houston. 2014. Confederate Curio: A Wooden Carving from Tikal, Guatemala. *Mexicon*, 36:139–145.

Drucker, Philip. 1943. *Ceramic Sequences at Tres Zapotes, Veracruz, Mexico*. Bureau of American Ethnology Bulletin, No. 140. Washington, D.C.: Smithsonian Institution.

Drucker, Philip 1952a. *La Venta, Tabasco: A Study of Olmec Ceramics and Art*. Bureau of American Ethnology Bulletin, No. 153. Washington, D.C.: Smithsonian Institution.

Drucker, Philip. 1952b. Middle Tres Zapotes and the Preclassic Ceramic Sequence. *American Antiquity*, 17:258–260. https://doi.org/10.2307/276367

Drucker, Philip. Papers. Manuscript 4516, Boxes 19, 21, 23, 24, 25. National Anthropological Archives, Smithsonian Institution, Suitland, Md.

Duvall, Katie. 2019. Guide to the Matthew Williams Stirling and Marion Stirling Pugh Papers, 1876–2004 (Bulk 1921–1975). National Anthropological Archives, Smithsonian Institution, Suitland, Md.

Elia, Ricardo J. 2007. Comment on "Irreconcilable Differences?": Scholars for Sale. *Papers from the Institute of Archaeology*, 18:16–18. https://doi.org/10.5334/pia.297

Glascock, Michael D. 2019. Compositional Analysis of Archaeological Ceramics. In *Ceramics of the Indigenous Cultures of South America: Studies of Production and Exchange through Compositional Analysis*, ed. Michael D. Glascock, Hector Neff, and Kevin J. Vaughn, pp. 1–13. Albuquerque: University of New Mexico Press.

Harbottle, Garman, and Ronald L. Bishop. 1989. Chemical Variation within Pottery from Patarata 52, Veracruz, Mexico. In *Patarata Pottery: Classic Period Ceramics of the South-Central Gulf Coast, Veracruz, Mexico* by Barbara L. Stark, pp. 129–139. Tucson: University of Arizona Press.

Henderson, Amy, and Adrienne L. Kaeppler, eds. 1997. *Exhibiting Dilemmas: Issues of Representation at the Smithsonian*. Washington, D.C.: Smithsonian Institution Press.

Holmes, William Henry. 1907. On a Nephrite Statuette from San Andrés Tuxtla, Vera Cruz, Mexico. *American Anthropologist*, 9:691–701. https://doi.org/10.1525/aa.1907.9.4.02a00030

Jenkins, Tiffany. 2016. *Keeping Their Marbles: How the Treasures of the Past Ended Up in Museums . . . and Why They Should Stay There*. Oxford, U.K.: Oxford University Press.

Joyce, Rosemary A. 2015. Things in Motion: Itineraries of Ulua Marble Vases. In *Things in Motion: Object Itineraries in Anthropological Practice*, ed. Rosemary A. Joyce and Susan D. Gillespie, pp. 21–38. Santa Fe: School for Advanced Research Press.

Justeson, John, Christopher A. Pool, Ponciano Ortiz Ceballos, María del Carmen Rodríguez Martínez, and Jane MacLaren Walsh. 2020. The Environs of Tres Zapotes as the Find-Spot of the Tuxtla Statuette. *Latin American Antiquity*, 31:747–764. https://doi.org/10.1017/laq.2020.61

Kopytoff, Igor. 1986. The Cultural Biography of Things: Commoditization as a Process. In *The Social Life of Things: Commodities in Cultural Perspective*, ed. Arjun Appaderai, pp. 64–91. Cambridge, U.K.: Cambridge University Press. https://doi.org/10.1017/CBO9780511819582.004

Lyon, Rosemary D. 1997. (Re)Discovering the Olmec: The National Geographic-Smithsonian Institution Archaeological Expeditions to Veracruz/Tabasco 1939–1940. M.A. thesis, American University, Washington, D.C.

Malaro, Marie C., and Ildiko P. DeAngelis. 2012. *A Legal Primer on Managing Museum Collections*. Washington, D.C.: Smithsonian Institution Press.

Mason, Alfred Bishop. 1902. Letter to Smithsonian Institution. [AU: UPDATE NEEDED WITH ARCHIVE INFO.]

Morley, Sylvanus G. 1915. *An Introduction to the Study of Maya Hieroglyphs*. Bureau of American Ethnography Bulletin, No. 57, Washington, D.C.: Smithsonian Institution.

National Museum of Natural History (NMNH). 2021. Department of Anthropology. https://naturalhistory.si.edu/research/anthropology (accessed 17 October 2021).

Pinkston, Cynthia N. 2002. Tracing Louis H. Ayme's Exploration in Oaxaca, 1884–1885. Report submitted to the Foundation for the Advancement of Mesoamerican Studies Inc. http://www.famsi.org/reports/98040/ (accessed 16 April 2016).

Pool, Christopher A. 2003. *Settlement Archaeology and Political Economy at Tres Zapotes, Veracruz, Mexico*. Cotsen Institute of Archaeology Monograph, No. 50. Los Angeles: Cotsen Institute of Archaeology, University of California, Los Angeles.

Pool, Christopher A. 2007. *Olmec Archaeology and Early Mesoamerica*. Cambridge, U.K.: Cambridge University Press. https://doi.org/10.1017/CBO9781139167147

Pool, Christopher A. 2017. Mesoamerica–Olmec Figurines. In *The Oxford Handbook of Prehistoric Figurines*, ed. Timothy Insoll, pp. 245–272. Oxford, U.K.: Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199675616.013.012

Pool, Christopher A., Charles L. Knight, and Michael. D. Glascock. 2014. Formative Obsidian Procurement at Tres Zapotes, Veracruz, Mexico: Implications for Olmec and Epi-Olmec Political Economy. *Ancient Mesoamerica*, 25:271–293. https://doi.org/10.1017/S0956536114000169

Pool, Christopher A., Ponciano Ortiz Ceballos, María del Carmen Rodríguez, Erin L. Sears, Ronald L. Bishop, and M. James Blackman. 2017. An Early Olmec Manifestation in Western Olman: The Arroyo Phase at Tres Zapotes. In *The Early Olmec and Mesoamerica: The Material Record*, ed. Jeffery P. Bomster and David Cheetham, pp. 89–118. Cambridge, U.K.: Cambridge University Press. https://doi.org/10.1017/9781316228098.005

Reents, Dorie J., and Ronald L. Bishop. 1987. The Late Classic Maya "Codex Style" Pottery. In *Memorias Primer Coloquio Internacional de Mayistas*, pp. 775–789. Mexico City: Universidad Nacional Autónoma de México.

Roux, Valentine. 2017. Ceramic Manufacture: The Chaîne-Operatoire Approach. In *The Oxford Handbook of Archaeological Ceramic Analysis*, ed. Alice M. Hunt, pp. 101–113. Oxford, U.K.: Oxford University Press.

Schiffer, Michael B., ed. 1995. *Behavioral Archaeology: First Principles*. Salt Lake City: University of Utah Press.

Sears, Erin L. 2009. Preliminary Analysis of Figurines from Tres Zapotes, Veracruz, Mexico. Paper presented at the 74th Annual Meeting of the Society for American Archaeology, Atlanta, Ga., 22–25 April.

Sears, Erin L. 2016. A Reflection of Maya Representation, Distribution, and Interaction: Ceramic Figurines from the Late Classic Site of Cancuén, Petén Department, Guatemala. Ph.D. diss., University of Kentucky, Lexington.

Society for American Archaeology. 2019. SAA Principles of Archaeological Ethics. https://www.saa.org/career-practice/ethics-in-professional-archaeology (accessed 15 January 2019).

Society for American Archaeology. 2021. Editorial Policy, Information for Authors, and Style Guide for *American Antiquity*, *Latin American Antiquity*, and *Advances in Archaeological Practice*. https://documents.saa.org/container/docs/default-source/doc-publications/style-guide/saa-style-guide_english_updated_2021_final08023c15928949dabd02faafb269fb1c.pdf?sfvrsn=c1f41c1b_2 (accessed 26 November 2021).

Stark, Barbara L., R. Jeff Speakman, and Michael D. Glascock. 2007. Inter-regional and Intra-regional Scale Compositional Variability in Pottery from South-Central Veracruz, Mexico. *Latin American Antiquity*, 18:59–84. https://doi.org/10.2307/25063086

Stirling, Matthew W. 1943. Stone Monuments of Southern Mexico. *Bureau of American Ethnology Bulletin,* 138. Washington, D.C.: Smithsonian Institution.

Stirling, Matthew W., and Marion Stirling Pugh. Papers. Manuscript 2016-24. National Anthropological Archives, Smithsonian Institution, Suitland, Md.

Speakman, Jeff, and Michael D. Glascock. 2007. Special Issue: Acknowledging Fifty Years of Neutron Activation Analysis in Archaeology. *Archaeomentry*, 49:179–183. https://doi.org/10.1111/j.1475-4754.2007.00294.x

Wauchope, Robert. 1950. *A Tentative Sequence of Pre-Classic Ceramics in Middle America*. Middle American Research Records, Volume 1, No. 14. New Orleans, La.: Tulane University.

Weiant, Charles W. 1943. *An Introduction to the Ceramics of Tres Zapotes, Veracruz, Mexico*. Bureau of American Ethnology Bulletin, No. 139. Washington, D.C.: Smithsonian Institution.

Weiant, Charles W. 1952. Reply to "Middle Tres Zapotes and the Pre-Classic Ceramic Sequence." *American Antiquity*, 18:57–59. https://doi.org/10.2307/276242

Weiant, Charles W. Papers. Manuscript 1998-66. National Anthropological Archives, Smithsonian Institution, Suitland, Md.

Wetmore, Alexander. Papers. Manuscript 1998-09. National Anthropological Archives, National Smithsonian Institution, Suitland, Md.

Wicke, Charles R. 1965. Olmec: An Early Art Style of Pre-Columbian Mexico. Ph.D. diss., University of Arizona, Tucson.

Wiseman, James. 1984. Scholarship and Provenience in the Study of Artifacts. *Journal of Field Archaeology*, 11:67–77. https://doi.org/10.1179/jfa.1984.11.1.67

Breaking Out of the "Cabinet of Curiosities": Ethics, Interdepartmental Studies, and New Perspectives on Museum Objects

Erin L. Sears,[1] Lauren Sieg,[2] and Maria M. Martinez[3,4]*

This volume was created in the spirit of highlighting the scholarly value and ethical considerations of using museum or repository collections for research purposes (Sullivan and Childs, 2003). The range of collection-based studies in this volume demonstrates the value of analytic techniques, provenance investigation, multidisciplinary approaches, and, especially, collaboration. The contributors to this volume have demonstrated that analyses of collections can illustrate the ways in which objects inform new interpretations concerning field data (e.g., Joyce, this volume; Sears et al., this volume), provide information to source communities (e.g., Bishop et al., this volume; Burgio-Ericson and Seowtewa, this volume), improve methodologies and ethics (Norman et al., this volume), shed new light on museum practices (Harrison et al., this volume; Tremain, this volume), and provide new data sets and interpretations. In part, we hope this volume opens avenues for reflection, analysis, and support for new scholars who want to pursue collections research and situate their work within the larger U.S. debate about who should create information concerning the Indigenous peoples of the Americas (e.g., Lonetree, 2012; Shannon, 2014; Sleeper-Smith, 2009; Windchief and San Pedro, 2019).

TRENDS IN SMITHSONIAN COLLECTIONS RESEARCH

A fitting close to the volume is a retrospective look at the use of Smithsonian collections in research. Published accounts are lacking for how many academic investigations into collections, public inquiries about them, and exhibitions including them have occurred over time; it is hoped that this type of analysis will become part of future museum studies methodologies. Good metrics about who is studying a museum's collection, obtained from administrative records, can assist with museum management practices. Analyzing the many uses of collections, the frequency of their use, and the backgrounds of those who study them can provide important information about how well a museum is achieving its mission and serving its constituency. The data can be compared and contextualized within larger disciplines such as anthropology, art history, and museology to determine the extent to which museum research is informed by those fields or deviates from them. Metrics can demonstrate if one group of researchers is disproportionately represented, if a particular collection is overutilized, and when follow-up is needed to

[1] Department of Anthropology, National Museum of Natural History, Smithsonian Institution, Post Office Box 37012, MRC 010, Room 153, Washington, D.C. 20013-7012, USA.

[2] National Museum of the American Indian, Smithsonian Institution, 4220 Silver Hill Road, Suitland, Maryland 20746-2863, USA.

[3] Amerind Foundation, Inc., Post Office Box 400, 2100 North Amerind Road, Dragoon, Arizona 85609, USA.

[4] Department of Anthropology, The University of Texas at Austin, 2201 Speedway Stop C3200, Austin, Texas 78712, USA.

* Correspondence: erinl.sears@outlook.com

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ensure that the results of the research are reflected in museum records and curatorial practices. On a practical level, metrics provide the information needed for better management, ranging from improved identifications in catalog records to better allocations of staff and financial resources.

The scope and extent of research conducted on anthropological collections at the Smithsonian can be difficult to track because there are different departmental efforts to systematically record and centralize information on who was conducting research on the collections up until the late twentieth century. At the National Museum of Natural History (NMNH), data on who has conduced collections-based research are decentralized and variable; without a dedicated researcher among the overcommitted staff of the NMNH Anthropology Department, a full analysis of the research at NMNH could not be completed for this volume. The collection at the National Museum of the American Indian (NMAI) in Washington, D.C., is smaller, has a shorter history, and was less well-known because it originated with George Heye's private collection before becoming part of the Smithsonian's Museum of the American Indian, Heye Foundation (MAI) in New York (and therefore was less frequently researched) than the NMNH collections. Additionally, the staff at the NMAI and its predecessor institution is substantially smaller than that of NMNH. As a result, it is possible to gain a general sense of collections usage though references to researchers and projects in annual reports, curatorial meeting minutes, and internal correspondence, and publications can be compiled to examine collections-based research. The record-keeping of the MAI and the recent history of the NMAI provide an opportunity to understand the *longue durée* of collections research. Although the data on the type of research conducted over a century are discontinuous, of uneven quality, and nonstandardized, they nonetheless provide enough information that allows long-term trends to emerge. Of particular importance for this volume are the trends in three areas: democratizing access, expanded research scope, and increased collaboration. Comparative data concerning the history of research at NMNH within the same time period will need to be compiled for future analysis.

The collections research at the MAI and NMAI can be understood within the context of the museums' founding mission and charter. The MAI was established to promote scholarship of the Indigenous peoples of the Western Hemisphere, with the "sole aim . . . to gather and to preserve for students everything useful in illustrating and elucidating the anthropology of the aborigines of the Western Hemisphere, and to disseminate by means of its publications the knowledge thereby gained" (Museum of the American Indian, Heye Foundation, 1929:3, 18). This mission is reminiscent of that articulated for the Smithsonian Institution, "the increase and diffusion of knowledge," when

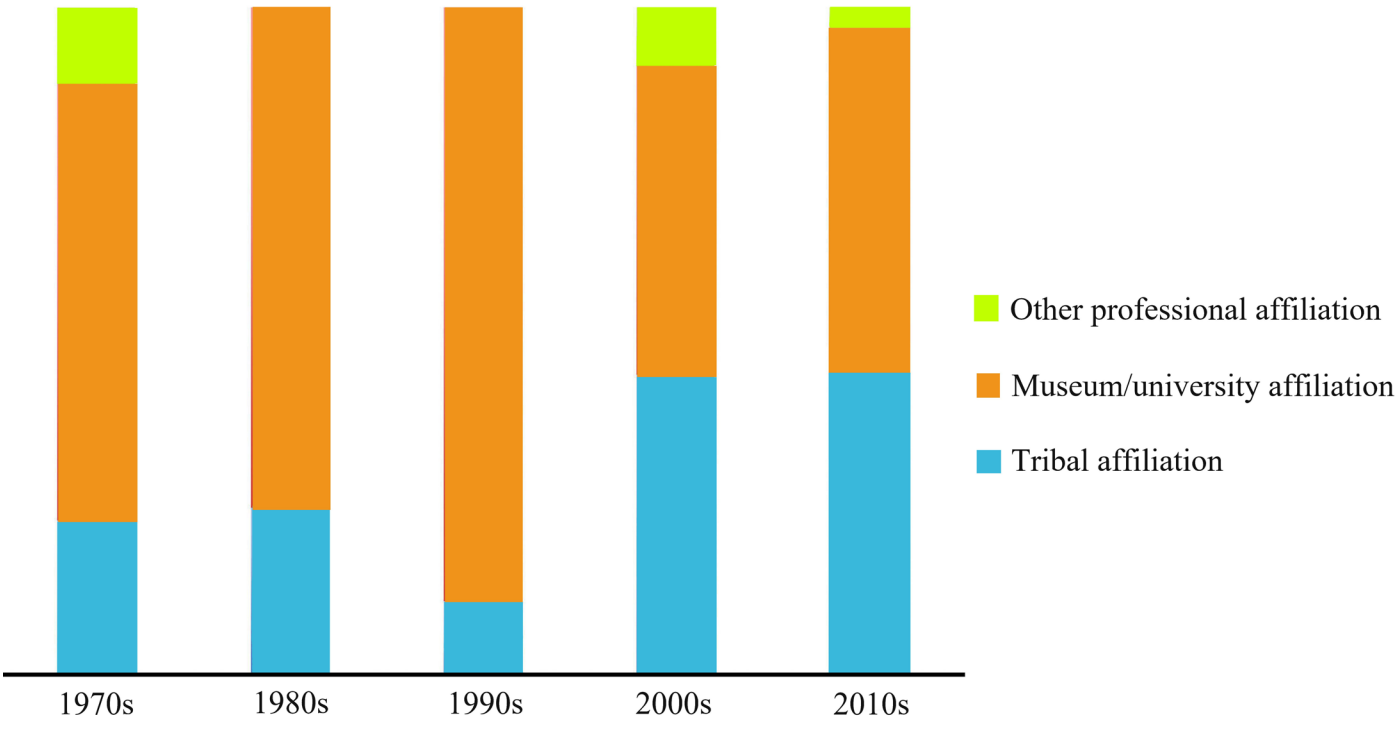

FIGURE 1. Relative numbers of researchers using the NMAI collections broken down by affiliation. Because of the limited availability of data prior to 1970, only the past five decades of research are shown.

it was founded in 1846. The MAI supported its mission through the work of the anthropologists and archaeologists on its staff, which was published in the museum's *Indian Notes* series.

When the NMAI was created in 1989, it set out a new mission, to "advance[e] knowledge and understanding of the Native cultures of the Western Hemisphere" through partnerships with Indigenous peoples and inclusion of their voices. Rather than being an institution for anthropological study, the primary goal of the museum was "to support the continuance of culture, traditional values, and transitions in contemporary Native life." The mission was updated in 2020 and now states "In partnership with Native peoples and their allies, the National Museum of the American Indian fosters a richer shared human experience through a more informed understanding of Native peoples."

Over the past 50 years, there has been an increase in use of collections by a broader range of researchers. Prior to the creation of the NMAI, research was conducted primarily—if not solely—by the curators on staff, although after 1950 more research began to be conducted by outside scholars, including university professors, federal archaeologists, staff from other museums, and private individuals (Figure 1). Since 2010, there has been proportionally more research by staff from other museums, whereas more of the research by NMAI staff has been through the work of the conservators rather than curators. The affiliation of researchers began to change in the early 1970s; during this decade tribal members began to visit the collections for research purposes, often in collaboration with a university professor. With the creation of the NMAI, tribal visits began to increase, although initially, they were focused on identifying items for repatriation or special care rather than research. Once the collection was relocated the Washington, D.C., area, tribal research became a consistent part of the NMAI collections scholarship. Since 2000, tribal research has accounted for approximately half of the research visits, in accordance with the museum's focus on facilitating tribal access to collections and increasing scholarship based on Indigenous voices and perspectives. Many of the tribal research visits were supported through programmatic efforts such as the Artist Leadership Program and Recovering Voices. Most of these research visits, however, did not include archaeological items. Last, in recent decades, the gender divide in research has shrunk. Women and men now engage in collections-based studies at approximately the same levels. There is a slight difference in areas of research, with women being less represented in archaeological collections research and men being less represented in ethnographic collections research.

Overall, the types of collections that are researched have become more diverse (Figure 2). Before 2000, the majority of research efforts focused on archaeological collections, which

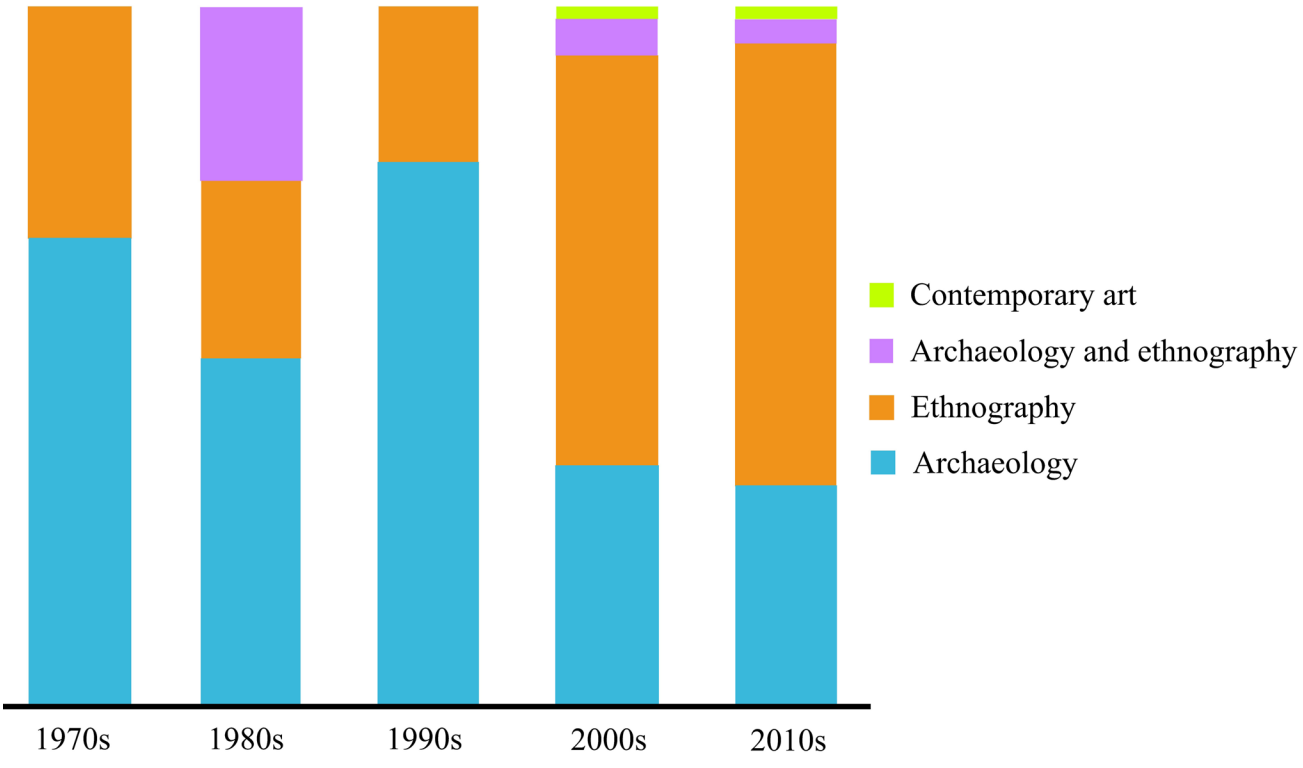

FIGURE 2. Relative amounts of collection types used in research.

comprise over half of the museum's collections. Since 2000, the use of ethnographic and contemporary art collections has been increasing—which clearly aligns with the mission of the NMAI—with a concomitant decrease in research on archaeological collections.

The collections of the NMAI include material from North, Middle, and South America. North American collections research is most common; approximately 75% of recent collections-based research involved items from North America. This reflects the provenience for the collections, with 73% originating from the United States and Canada. Although it is difficult for Indigenous community members to travel to the Smithsonian to work with their ancient belongings, the barriers are even higher for Indigenous people living in Latin America. Therefore, this study notes that most of the Native researchers are tribal members from the United States and Canada. Since 2000, university-affiliated researchers have conducted most of the research on Middle American items, whereas museum-based researchers account for more of the South American research. Overall, museum-based researchers do more comparative work, examining materials from multiple regions. In general, the diversity in the collections that are researched by region has been increasing (Figure 3).

In the early years of the MAI, collections-based research projects were independent endeavors. That has changed in the past 50 years, as the number of collaborative and interdisciplinary projects has increased. Research has become increasingly collaborative as source communities are included in the work and multidisciplinary approaches are utilized, a trend that is reflected in this volume. Data from the current NMAI research suggests that there may be an ever-increasing shift toward joint research for archaeological projects (Figure 4).

From the above discussion, it is apparent that research has changed over time. These changes reflect broader shifts within the discipline of anthropology as well as changes that are specific to the NMAI's history. The trends are reflected by the contributors to this volume; they include researchers from a range of backgrounds, and most of the lead authors are female. The essays cover North, Middle, and South American collections from a variety of time periods. Many of the research projects were performed by an interdisciplinary research team, and some projects involved collaboration with members of Indigenous communities.

EXPLORING ETHICAL DIMENSIONS OF COLLECTIONS RESEARCH

The collected essays present how scholarship can be created in various forms that do not always fit within the comfortable academic canon but have a place for advancing knowledge. Some of the contributions highlight the ethical considerations of collections-based research (Berger et al., this volume; Norman et al., this volume). For example, research on provenance may lead to the

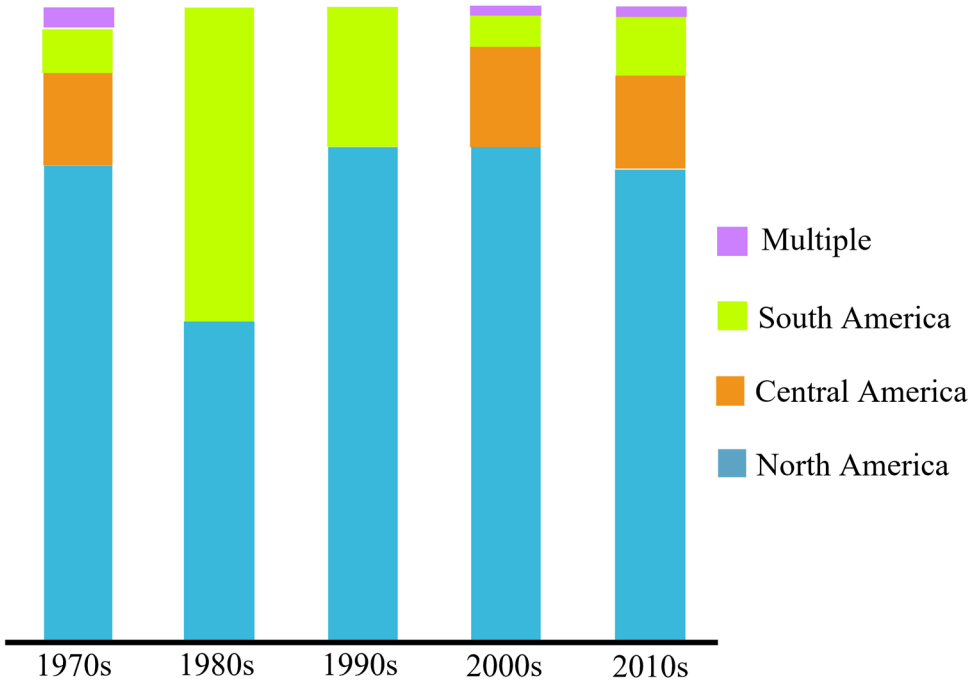

FIGURE 3. Proportion of source areas for collections researched. The spike in South American research in the 1980s is a reflection of the work of MAI curator Anna Roosevelt.

discovery that items in a legacy collection may have entered an institution either illegally or unethically, in terms of what is currently known as best practices. Some academic outlets do not want to create a space for the incorporation of collections with incomplete information in order to stop the cycle of looting and to avoid inadvertently imparting a value to the objects should they be deaccessioned in the future and returned to the public art market (e.g., Society for American Archaeology, 2018: editorial policy 1.1.8; Society for American Archaeology, 2021:editorial policy 1.1.9). Several questions will always be considered for administrative discussions: How should a museum resolve issues surrounding looted or unethically acquired collections? Do the laws, policies, or norms at the time affect the decisions on the use or retention of such collections? Should the issues be resolved through a return to a nation-state, the source community, or heirs? Should there be additional methods of redress or forms of restitution?

Another ethical consideration is whose voice should determine the collections management policies of the institutions where research is conducted (e.g., Burgio-Ericson and Seowtewa, this volume). Some academic viewpoints believe that museums should be a space for exhibit, research, and object veneration for public use regardless of the present-day expressions of source communities or sovereign rights of repatriation (see Cuno, 2008, 2014 [for an overview]; Jenkins, 2016 [concerning the continuous modern conflict of the Elgin marbles residing in the British Museum]; McGreevy, 2021 [for a recent NMAI decision to return the Peruvian Echenique gold disc]). The NMAI and NMNH, in contrast, seek source community input on collections stewardship and create alternative access for everyone through digital collection practices (National Museum of the American Indian, 2020a, 2020b; National Museum of Natural History, 2020; Wu, 2020). Should researchers wish to perform destructive or invasive tests on objects, they must submit a detailed research proposal for approval by the museums. If a contemporary Indigenous group does not wish to support research, what are the implications of holding a collection if it is not accessible for study, given the Smithsonian's mission of the promotion and diffusion of knowledge?

Finally, most of essays in this volume either directly or indirectly highlight the issues of whether it is appropriate for items to be under the stewardship of a museum or repository where they can be researched, given the colonial legacy involved in the creation of the collections. Although the obvious answer would be that only those collections generated through contemporary, ethically conducted archaeological fieldwork should be

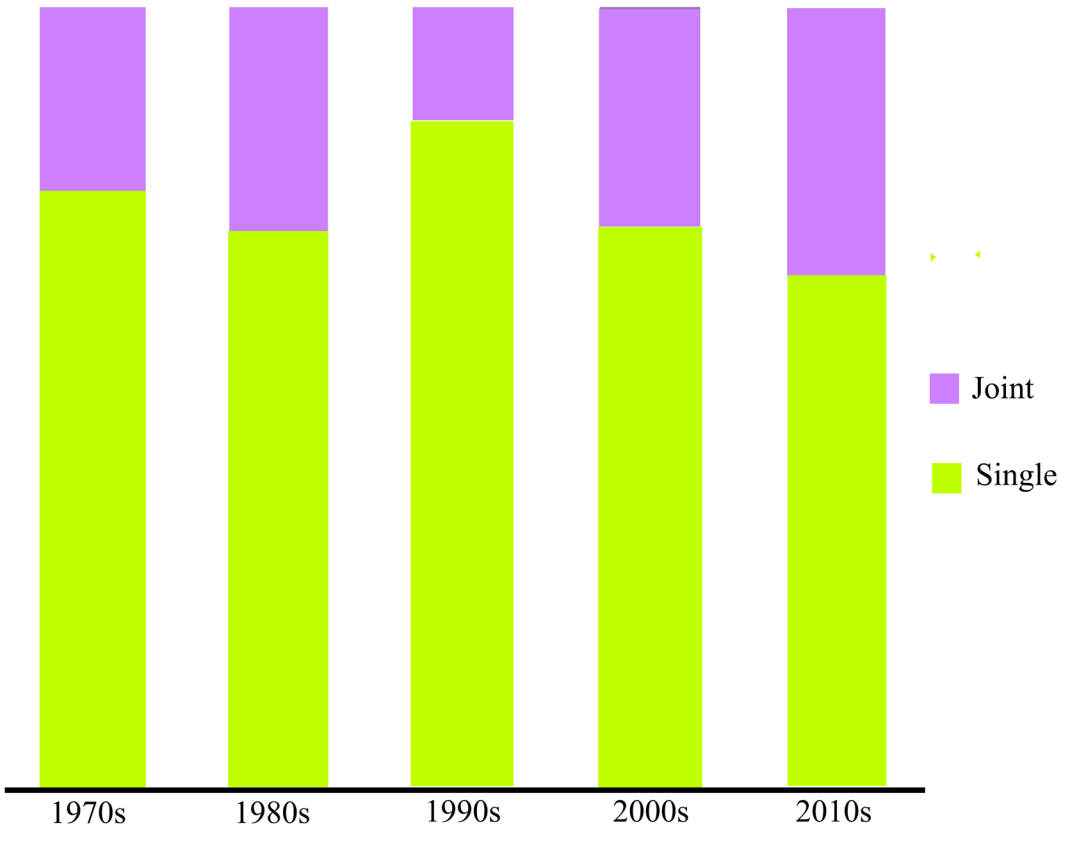

FIGURE 4. Proportion of research by single researchers and joint research teams.

researched, the reality is that colonialism inherently permeates all parts of any fieldwork and that all fieldwork involves some level of destruction of archaeological features and sites. As ethical standards continue to evolve, the domain of acceptable and unacceptable research will shift in response.

INTERDISCIPLINARY COLLABORATION AND ANALYTICAL METHODS

The volume contributors discussed, to varying degrees, the absence of information within each data set, at times using different methodological techniques to reveal how to rewrite or overcome the lack of contextual information. What was not discussed in this work is the misperception that analytical techniques are magic machines that instantaneously address research questions. If the scholar/archaeologist/museum staff member does not have a working knowledge of the drawbacks to a technique, then the time and effort of access are wasted (Bishop et al., 1982; Neff et al., 1996; Speakman et al., 2011; Bishop, 2014). An example of this point of view is choosing to use scientific equipment on museum objects just because it is a nondestructive tool. The creation of new data may be spurious or, worse, just another set of information that cannot be incorporated into overarching cultural discussions (i.e., creating more descriptive material information of elemental concentrations concerning each object that is not replicable, comparable to other sampled objects from fieldwork, or useful to future studies). The careful balance of having enough data points to make a statistical pattern versus the need to create accurate information from the chosen analytical technique is a constant point to consider throughout the process of creating new information for research purposes.

Research design should also consider the scale of analytical techniques to initiate research, such as low-tech visual examination (see Tremain, this volume), and build toward high-tech instrumentation to produce interpretive results (Bishop et al., this volume; Harrison et al., this volume; Sears et al., this volume). Many of the essays in this volume are the result of creating methodologically reasoned proposals that were approved by either or both the NMAI and NMNH sampling committees. This approval is especially important when researchers are engaged in destructive testing of a museum object. Just as archaeological sites are a finite resource for excavations, taking a sample has impacts on source communities' ability to further understand their material, future investigations, and the potential for display of the object. Also, the remaining samples left over from the analysis must be returned to the museum collection for continued stewardship to further exploration when better techniques arise and for community members and future scholars to access. At times, the advancement of academic projects coupled with a lack of follow-up from overcommitted museum staff may leave these unused samples in a forgotten drawer, divorced from their source material and without institutional memory of how to reconnect the samples to their origin.

ANTHROPOLOGICAL COLLECTIONS AT THE SMITHSONIAN: FUTURE CHAPTERS

The contributions to this volume are an exploration of bringing to the forefront objects that are not always exhibited and are worthy of greater contextualization than the basic details currently available within catalog records of the NMAI and NMNH. It is hoped that these essays create a collective biography for the objects residing in the NMNH and NMAI collections facilities. These precontact and historical Indigenous belongings will continue to have many "lives" both in an academic sense and within native ontologies beyond the scope of this volume. One can imagine that although these material objects are nestled within their storage facilities, they continue to take journeys as they are visited by members of their descendant communities, considered for new exhibition purposes, taken off the shelf for academic exploration, digitized so that their imagery can be used for virtual research, and reanimated as their designs are used in contemporary artistic expressions. While scholars may not be able to fully understand the nature of Indigenous systems or the intent of ancient societies that made material remains, the use of these objects through visual analysis, analytical techniques, and present-day Native involvement can potentially create deeper comparative connections and sustain community knowledge within an interdisciplinary environment.

REFERENCES

Bishop, Ronald L. 2014. Instrumental Approaches to Understanding Mesoamerican Economy: Elusive Promises. *Ancient Mesoamerica*, 25:251–269. https://doi.org/10.1017/S0956536114000157

Bishop, Ronald L., Robert L. Rands, and George R. Holley. 1982. Ceramic Compositional Analysis in Archaeological Perspective. *Advances in Archaeological Method and Theory*, 5:275–330. https://doi.org/10.1016/B978-0-12-003105-4.50012-1

Cuno, James. 2008. *Who Owns Antiquity?: Museums and the Battle over Our Ancient Heritage*. Princeton, N.J.: Princeton University Press.

Cuno, James. 2014. Culture War: The Case Against Repatriating Museum Artifacts. *Foreign Affairs*, 93:119–129.

Jenkins, Tiffany. 2016. *Keeping Their Marbles: How the Treasures of the Past Ended up in Museums . . . and Why They Should Stay There*. Oxford, U.K.: Oxford University Press.

Lonetree, Amy. 2012. *Decolonizing Museums: Representing Native America in National and Tribal Museums*. Chapel Hill: University of North Carolina Press.

McGreevey, Nora. 2021. A Golden Symbol of National Identity Returns to Peru: The Smithsonian's National Museum of the American Indian Has Sent an Ancient, Pre-Inca Breastplate Back Home. *Smithsonian Magazine*, 24 June. https://www.smithsonianmag.com/smithsonian-institution/golden-symbol-national-identity-returns-peru-180978052/ (accessed 29 June 2021).

Museum of the American Indian, Heye Foundation. 1929. *Aims and Objects of the Museum of the American Indian, Heye Foundation*. 4th printing, rev. New York: Museum of the American Indian, Heye Foundation.

National Museum of the American Indian. 2020a. *Americans*. Online exhibition, 8 January 2018–2022. https://americanindian.si.edu/americans/ (accessed 18 April 2020).

National Museum of the American Indian. 2020b. Collections Management Policy. Washington, D.C.: Collections Management Department, National Museum of the American Indian, Smithsonian Institution.

National Museum of Natural History. 2020. Sampling and Analysis. https://naturalhistory.si.edu/research/anthropology/collections-and-archives-access/sampling-and-analysis (accessed 28 April 2020).

Neff, Hector, Michael D. Glascock, Ronald L. Bishop, and M. James Blackman. 1996. An Assessment of the Acid-Extraction Approach to Compositional Characterization of Archaeological Ceramics. *Latin American Antiquity*, 61:389–404. https://doi.org/10.2307/282433

Shannon, Jen. 2014. *Our Lives: Collaboration, Native Voice, and the Making of the National Museum of the American Indian*. Santa Fe: School of American Research Press.

Sleeper-Smith, Susan, ed. 2009. *Contesting Knowledge: Museums and Indigenous Perspectives*. Lincoln: University of Nebraska Press.

Society for American Archaeology. 2018. Editorial Policy, Information for Authors, and Style Guide for *American Antiquity*, *Latin American Antiquity*, and *Advances in Archaeological Practice*. https://documents.saa.org/container/docs/default-source/doc-publications/style-guide/saa-style-guide_updated-july-2018c5062f7e55154959ab57564384bda7de.pdf?sfvrsn=8247640e_6 (accessed 18 June 2019 [this version no longer available online]).

Society for American Archaeology. 2021. Editorial Policy, Information for Authors, and Style Guide for *American Antiquity*, *Latin American Antiquity*, and *Advances in Archaeological Practice*. https://documents.saa.org/container/docs/default-source/doc-publications/style-guide/saa-style-guide_english_updated_2021_final08023c15928949dabd02faafb269fb1c.pdf?sfvrsn=c1f41c1b_2 (accessed 26 November 2021).

Speakman, Robert J., Nicole C. Little, Darrell Creel, Myles R. Miller, and Javier G. Iñañez. 2011. Sourcing Ceramics with Portable XRF Spectrometers? A Comparison with INAA Using Mimbres Pottery from the American Southwest. *Journal of Archaeological Science*, 38:3483–3496. https://doi.org/10.1016/j.jas.2011.08.011

Sullivan, Lynne P., and S. Terry Childs. 2003. *Curating Archaeological Collections: From the Field to the Repository.* Archaeologist's Toolkit, No. 6. Walnut Creek, Calif.: AltaMira Press.

Windchief, Sweeney, and Timothy San Pedro, eds. 2019. *Applying Indigenous Research Methods: Storying with Peoples and Communities*. New York: Routledge. https://doi.org/10.4324/9781315169811

Wu, Katherine J. 2020. Smithsonian Releases 2.8 Million Images into the Public Domain. *Smithsonian Magazine*, 25 February. https://www.smithsonianmag.com/smithsonian-institution/smithsonian-releases-28-million-images-public-domain-180974263/ (accessed 4 April 2020).

About the Contributors

Christopher E. Barrett is currently a Ph.D. candidate at the University of Kansas studying the ancient DNA of the western Aleutian Islands. This project is in collaboration with the Aleut Cooperation, Aleutian and Pribilof Island Association, and Native Village of Atka, which provided consent to work with ancestral remains curated at the Smithsonian's National Museum of Natural History. He received his bachelors of arts in biocultural anthropology from Western Washington University as well as a masters of arts in biological anthropology, researching metabolic hormone variation in Kansas Mennonite communities.

Harriet "Rae" F. Beaubien is an objects conservator in Santa Fe, New Mexico, and a research associate of the Smithsonian Institution's Museum Conservation Institute, where she served for 26 years as senior objects conservator, including six as head of conservation. Throughout her career, the technical study and conservation of archaeological materials have been a primary focus of her lab-based projects and on-site fieldwork, much of it centering on ancient Central America. Currently, in addition to working with regional museum collections, she teaches introductory conservation courses at the University of New Mexico through its museum studies program.

Martin E. Berger is an assistant professor in the Faculty of Archaeology at Leiden University, Netherlands. Previously, he was curator for the Latin American collections of the National Museum of World Cultures, The Netherlands, and for the Paul and Dora Janssen-Arts collection of pre-Columbian art at the Museum aan de Stroom in Antwerp, Belgium. He holds a doctorate from Leiden University and held fellowships at the Dumbarton Oaks Research Library and Collection/Harvard University (2014) and the Institute for the Preservation of Cultural Heritage, Yale University (2017). His research interests include the archaeology and anthropology of Oaxaca and central Mexico, the representation of pre-Columbian cultures in popular culture and museums, museum ethics, and migration and globalization studies.

Ronald L. Bishop has worked in research institutions and museums in the United States and Latin America for most of his career. He is a retired research associate and former curator for Mexican and Central American archaeology in the Department of Anthropology, Smithsonian Institution. His early interest in physical and natural science led to an invitation by the Brookhaven National Laboratory to apply neutron activation analysis to the study of archaeological materials. He graduated with a Ph.D. in anthropology from Southern Illinois University at Carbondale, acquiring further expertise in clay mineralogy, sedimentary petrology, geochemistry, and geostatistics.

Michael Brandl is researcher and coordinator of the Archaeological Sciences unit of the Austrian Archaeological Institute at the Austrian Academy of Sciences and lecturer at the University of Vienna, Austria. He received his Ph.D. from the Institute of Prehistoric and Historical Archaeology of the University of Vienna. He developed the multilayered chert sourcing approach for lithic provenance studies combining petrographic analyses and geochemistry. His main research interests are provenance studies of chipped stone tools from Paleolithic to historic times and socioeconomic dynamics in the framework of lithic raw material procurement and distribution.

Klinton Burgio-Ericson is an artist, art historian, and educator. Currently an adjunct faculty member at the University of New Mexico and residential fellow at the School for Advanced Research, Santa Fe, New Mexico (2022), he recently completed his Ph.D. in art history from the University of North Carolina at Chapel Hill. His research employs an interdisciplinary approach to the material record, exploring the diverse agencies of historical actors in the colonial Americas and the lasting relevance of these interactions to anthropology, museums, and Native communities today. He is a research collaborator with the National Museum of Natural History's Department of Anthropology, developing collaborative, community-based projects and research in ethnohistory.

Veletta Canouts received her Ph.D. in anthropology from Southern Illinois University at Carbondale. For most of her career, she worked in the areas of conservation archaeology and historic preservation at the Arizona State Museum, the South Carolina Institute for Archaeology and Anthropology, and the U.S. Park Service, Washington, D.C. Her work with the Hopi students eventually led to her involvement in helping to establish Native American museums in Arizona, the Gila River Indian Community, and the Tohono O'odham Nation. She has her own consultancy and is presently working to promote historical and cultural tourism in southern Arizona.

Kim Cullen Cobb is an objects conservator in private practice and a research associate with the Smithsonian's Museum Conservation Institute. She works on exhibition-related projects, research, and conservation-training-related projects within the Smithsonian and at institutions and historic foundations in the United States, Central America, Europe, the Middle East, and Asia. In addition, she is a goldsmith with an enduring interest is the study and conservation of ancient and historic craft technology.

Gareth R. Davies is a professor of petrology and was head of the geology and geochemistry group at the Vrije Universiteit Amsterdam from 2011 until 2020, where he managed a world-renowned isotope geochemistry facility. He is the current recipient of a European Research Council Synergy grant. An author of more than 160 peer-reviewed articles, he has been the scientist in charge at the Vrije Universiteit Amsterdam of three European Union–funded training networks and two research infrastructures and the promotor or copromotor of 24 successful Ph.D. students.

Suzanne P. De Atley received her M.A. in archeology and her Ph.D. in anthropology from the University of California, Los Angeles, where she was a research assistant at the Radiocarbon Laboratory. She held fellowships at the Smithsonian and was an assistant professor at the Massachusetts Institute of Technology, employing materials analysis and ethnoarchaeological inquiry to investigate the development of craft specialization and the interplay between technological and economic development. Her interest in the survival of traditional technologies in contemporary society led her to a subsequent career in publishing at Interweave Press in Colorado and, ultimately, to becoming a founding partner in ClothRoads.

Davide Domenici, anthropologist, is an associate professor at the Department of History and Cultures of the University of Bologna (Italy), where he teaches Native American art and culture, Indigenous civilizations of the Americas, and historical anthropology. He directed the Río La Venta Archaeological Project, Chiapas, Mexico (1998–2010), and the Cahokia Project, Illinois, USA (2011–2017). Since 2007, in collaboration with MOLAB (Mobile Laboratory), he has been working on the identification—by means of nondestructive techniques—of painting materials used on pre-Hispanic and early colonial Mesoamerican pictorial manuscripts. He is currently working on the cultural biographies of Mesoamerican artifacts in Europe.

Jennifer Giaccai is a conservation scientist at the Freer Gallery of Art and Arthur M. Sackler Gallery at the Smithsonian Institution. She has previously worked as a conservation scientist at the Smithsonian's Museum Conservation Institute and the Walters Art Museum. She has degrees in chemistry and materials science from Macalester College and Johns Hopkins University. Areas of interest are colorants and organic materials used in cultural heritage.

Ainslie Harrison is objects conservator and head of Sculpture and Decorative Arts Conservation at the Virginia Museum of Fine Arts and previously worked at the National Museum of American History as a project conservator. She received her M.A. in art conservation from Queen's University in 2008 and went on to hold fellowships at the Metropolitan Museum of Art, the Penn Museum, the National Museum of the American Indian, and the Smithsonian's Museum Conservation Institute. She has also worked as an archaeological conservator at sites in Turkey and Panama.

Anne M. Jensen is a Research Affiliate at the University of Alaska Museum of the North, and Affiliate Research Assistant Professor in the University of Alaska Fairbanks, Department of Anthropology. She is also the archaeologist at the North Slope Borough Iñupiat History Language and Culture Department, after years as senior scientist/cultural resource manager at Ukpeaġvik Iñupiat Corporation's science subsidiary. She is the principal investigator for excavation projects at Pingusugruk, Ukkuqsi, Ipiutaq, Nuvuk, and Walakpa, all of which are significant eroding coastal sites. The Nuvuk Project revealed a rapidly eroding Thule cemetery and a newly discovered frozen Ipiutak habitation site at Point Barrow, at the request of and with the participation of the descendant community. Much of the

work on this project was done by local students and volunteers, as well as students from elsewhere. Her current research focuses on the effects of climate change on Arctic archaeological resources, human adaptation in changing Arctic and subarctic environments, and traditional knowledge of Iñupiat people.

Rosemary A. Joyce, distinguished professor of anthropology at the University of California, Berkeley, received a Ph.D. from the University of Illinois at Urbana-Champaign in 1985. A curator and faculty member at Harvard University from 1985 to 1994, she moved to Berkeley in 1994 and served as director of the Hearst Museum of Anthropology until 1999. She began participating in archaeological fieldwork in Honduras as an undergraduate and has codirected projects on early village life, the Classic period, and the colonial and Republican periods. While collaborating on research in the western Maya area with Mexican colleagues, she continues research on Honduran collections in museums.

Alice C. S. Knaf is a postdoctoral associate at Yale's Institute for the Preservation of Cultural Heritage (IPCH). Her research interest lies in studying the composition of materials encountered in cultural heritage and in answering questions about their provenance, manufacturing technology, and authenticity. She is further interested in technique optimization of portable in situ laser ablation sampling systems and in development of essentially noninvasive analytical methods. She conducted her Ph.D. research at the Vrije Universiteit (VU) Amsterdam, focusing on the geochemical characterization and discrimination of circum-Caribbean jadeite–omphacite jade source rocks to assess the provenance of Indigenous jade celts and paraphernalia. She earned her M.S. in geochemistry and geology from the Eidgenössische Technische Hochschule Zürich (ETHZ) and her B.S. in geosciences from the Ludwig-Maximilians-Universität München (LMU) and the Technische Universität München (TU).

Thomas Lam is a physical scientist at the Smithsonian Institution's Museum Conservation Institute (MCI), where he applies his knowledge of material science and characterization skills to contribute to the MCI technical studies team. Prior to joining MCI, he was a senior research specialist at Electron Microscopy Core Facility at the University of Missouri and completed a postdoc at the National Institute of Standards and Technology. He has a Ph.D. in ceramics from Alfred University, along with an M.S. and B.S. in ceramic engineering from Alfred University.

Serge Lemaitre has a Ph.D. in archaeology. He is a specialist of rock art and worked in Canada, Easter Island, and Syria. Curator of the American collection at the Royal Museums of Art and History, Brussels, Belgium, he realized and participated in several international exhibitions. As the head of the department he also managed different research studies on the objects and, over the past four years, has worked specifically on human remains and the pre-Columbian mummies.

Maria M. Martinez is associate curator of collections and exhibits at the Amerind Foundation, Inc. She served as a program specialist for research and collections access at the Smithsonian Institution, National Museum of the American Indian, for five years. She received her Ph.D. in anthropology from the University of Texas at Austin in 2013. She continues her research in Maya archaeology as a research fellow at the University of Texas at Austin and with lithic provenance studies at the Austrian Archaeological Institute, Austrian Academy of Sciences. Her research interests are collections-based community-centered research, Indigenous stewardship of museum collections, Mesoamerican archaeology, lithic raw material provenance studies (chert and obsidian), economic archaeology (mechanisms of exchange, distribution, and consumption), household archaeology, craft production, and contemporary and ancient Maya ritual practices.

Christophe Moreau has a Ph.D. in physics. He is a senior physicist and an expert in the field of the radiocarbon dating technique and the associated physics at the Commissariat à l'énergie atomique. As the head of the accelerator mass spectrometer team of the Laboratoire de Mesure du Carbone 14 (LMC14) national laboratory at Université Paris-Saclay, Gif-sur-Yvette, France, he is responsible for the quality of the measurements and the research and development around Artemis. He collaborates on different research topics that involve radiocarbon dating.

Lauren E. Y. Norman is a visiting assistant professor in archaeological and biological anthropology in the Department of Anthropology at the University of Kansas. Her postdoctoral work there was funded through a National Science Foundation collaborative proposal. She has a Ph.D. in anthropology from the University of Toronto. Her research focuses on the use of traditional and molecular faunal methods to investigate how small-scale societies in the past modified their relationships to the environment at times of social or environmental change. She is currently addressing questions related to Arctic Holocene human-animal interactions.

Meredith Sharps Noyes is a research scientist at Rochester Institute of Technology's Image Permanence Institute and was a postdoctoral fellow at the Smithsonian Institution's Museum Conservation Institute working in the microanalysis laboratory during this project. She received her Ph.D. in chemistry with a focus on inorganic nanomaterials in 2019 from the University of Oregon, where she was supported by a National Science Foundation Graduate Research Fellowship. During her graduate work, she held an internship at the Museum Conservation Institute characterizing surface coatings forming on the Smithsonian Castle. She obtained an M.S. in chemistry from the University of Oregon and a B.S. from Emory University, where she double majored in chemistry and music.

Dennis H. O'Rourke is Foundation Distinguished Professor of Anthropology at the University of Kansas, director of the Laboratories of Molecular Anthropology, University of Kansas, and professor emeritus at the University of Utah. His research focuses on the use of molecular methods, especially ancient DNA, to address

questions of dispersal and settlement in the Western Hemisphere. He is the editor of *Companion to Anthropological Genetics* and associate editor for genetics of the *International Encyclopedia of Biological Anthropology*, both by Wiley-Blackwell. He is a past president of the American Association of Physical Anthropologists and past program officer of Biological Anthropology at the National Science Foundation.

Joanna Ostapkowicz is a research associate in Caribbean archaeology at the School of Archaeology, University of Oxford. For the past two decades, her research has focused on detailed material and chronological analyses of pre-Hispanic and early contact period Caribbean artifacts in international museum collections. Recent research projects include Pre-Hispanic Caribbean Sculptural Arts in Wood (2007–2010); Black Pitch, Carved Histories: Prehistoric wood sculpture from Trinidad's Pitch Lake (2014–2017); Stone Interchanges within the Bahama Archipelago (SIBA, 2017–2021: http://siba.web.ox.ac.uk/); and Jaguars, Raptors, and the Patterns of War: 14th–18th century South American Indigenous Sculptural Arts (jagWARS, 2019–2023: https://jagwars.web.ox.ac.uk).

Christopher A. Pool is a research professor in the Department of Anthropology, University of Kentucky. His books include *Pottery Economics in Mesoamerica* (edited with George J. Bey III, University of Arizona Press, 2007), *Olmec Archaeology and Early Mesoamerica* (Cambridge University Press, 2007), *Classic Period Currents in Southern and Central Veracruz* (edited with Philip J. Arnold III, Dumbarton Oaks, 2008), and *The Oxford Handbook of the Olmecs* (edited with Carl J. Wendt, Oxford University Press, forthcoming). The current investigations have led him to propose that the Tres Zapotes polity survived the collapse of eastern Olmec centers by instituting collaborative governmental structures.

Jennifer Raff is an associate professor of biological anthropology and affiliate faculty in the Indigenous studies program at the University of Kansas. She has a dual Ph.D. in molecular, cellular, and developmental biology and biological anthropology from Indiana University and has completed postdoctoral work at the University of Utah, Northwestern University Feinberg School of Medicine, and the University of Texas. Her research focuses on understanding human histories in North America through the analysis of genomes from ancient and contemporary human populations. She is a former president of the American Association of Anthropological Genetics and the author of *Origin: A Genetic History of the Americas* (Twelve Books, 2022).

Erin L. Sears is a research associate at the Department of Anthropology, National Museum of Natural History. She completed her Ph.D. from the University of Kentucky in 2016. She is a team member on many archaeological projects ranging from Veracruz to the Transversal region in Guatemala. She has contributed overviews focused on Late Classic Maya ceramic figurines to *The Oxford Handbook of Prehistoric Figurines* (Oxford Press, 2017) and to the future volume of *The Oxford Handbook of Maya Archaeology* (Oxford Press, forthcoming, with Christina T. Halperin). Her work with ancient Pre-Columbian ceramic figurines has greatly benefitted from accessing international and national museum collections to create larger data sets in comparison with newly excavated materials.

Octavius Seowtewa is a member of the Corn Clan and a child of the Crane Clan. He is leader of Zuni Pueblo's Galaxy Fraternity and a member of the Eagle Plume Down Medicine Society and Flat Wall Kiva Group. He supervises the Zuni Cultural Resources Advisory Team and has participated in widespread efforts to protect and interpret Zuni cultural resources in situ and among museum collections. His work has included efforts to repatriate *Ahayu:da* figures from collections both within the United States and internationally. He is also a noted artist and master of the needlepoint jewelry technique.

Lauren Sieg is a repatriation research specialist at the National Museum of the American Indian. Her graduate and professional work have concentrated on the study of Native American collections using both quantitative and qualitative methods. She has examined collections at museums ranging from state historical societies to the Smithsonian Institution.

Cara Grace Tremain is an instructor in the Department of Sociology and Anthropology at Langara College [snəẃeyəɬ leləḿ] in Vancouver. She received her Ph.D. from the University of Calgary, her M.A. from Trent University, and her B.A. from the Institute of Archaeology, University College London. Her research has focused on Mesoamerican antiquities within museum collections and on the auction market, and she is co-editor of The Market for Mesoamerica: Reflections on the Sale of Pre-Columbian Antiquities (University Press of Florida, 2019). Currently, her research examines Canadian museums and the theft of cultural heritage.

Sarah Unkel is a graduate student in the Department of Anthropology at the University of Kansas and received a bachelor's degree in biology from the University of Central Missouri. She works in the Ancient DNA Research Facility at the University of Kansas and specializes in the peopling of the Arctic. Her current project is in collaboration with the Native Village of Utqiaġvik and aims to examine the ancestral lineages of contemporary Inuit and Iñupiat people by sampling remains of individuals excavated from archaeological sites curated at the Smithsonian National Museum of Natural History. Her interests include population genetics, peopling of the Americas, and research ethics.

Edward P. Vicenzi is a research scientist at the Smithsonian Institution's Museum Conservation Institute. He utilizes microbeam techniques to study museum specimens and related materials to understand their history and origin. Before taking up his position at the Museum Conservation Institute he served as the director of the Analytical Laboratories in the National Museum of Natural History's Department of Mineral Sciences and the comanager of the Imaging and Analysis Center at Princeton University. He was named a fellow of the Microanalysis Society in 2019. He obtained a Ph.D. from Rensselaer Polytechnic Institute, an M.S. from the University of Oregon, and a B.Sc. from McGill University.

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