BACKDIRT

ANNUAL REVIEW OF THE COTSEN INSTITUTE OF ARCHAEOLOGY AT UCLA

DECEMBER 2014

Learning from the past, preparing for the future

Message from the Director of the Institute

IT HAS BEEN ANOTHER banner year for the Cotsen Institute. As the end of the year approaches, it is nice to look back on 2014 as we prepare for the future. Our affiliated graduate programs in Archaeology and Conservation took in one of the most talented groups of young people ever. We are now beyond competitive with our peer institutions in recruiting and signing up the best students in the world. Our Ph.D. graduates are doing extremely well. Our research efforts push forward with projects on five continents. Our support from the community grows. We are all proud of these successes.

Special thanks go to Marilyn Beaudry-Corbett and Don Corbett for their generous contribution to the Archaeology Program graduate studies. Their substantial gift will endow support for women students in the graduate program in Archaeology. Moreover, Marilyn and Don created a chair in Mesoamerican Studies that will provide funds for teaching and research in this field in perpetuity. It is another transformational gift. We likewise gratefully acknowledge Sonia Gottesman and her late husband, Mike, for the gracious endowment of a fund to support graduate student travel and research, which adds to the support from Charlie Steinmetz and Jeannie Kay. We thank the late Hal Adelson for his support of the Rock Art Archive. Harris Bass, Bruce Hector, Joan Silsbee, Sara Chitjian and scores of others have helped us flourish over these years.

The theme of this year's *Backdirt* is the future. Last year, we celebrated the Cotsen Institute's fortieth birthday, and we looked back with satisfaction on our great accomplishments of the past. We have always been forward-looking, and this year we see a great future ahead. Our staff is fantastic, the faculty are prominent in their fields, our students are the best, and our supporters are simply amazing.

Charles Stanish

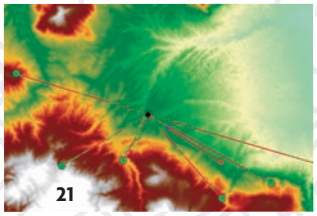
Director, Cotsen Institute of Archaeology

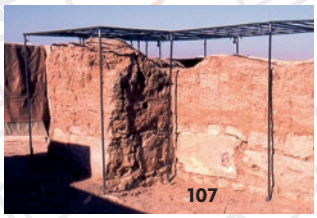
Lloyd Cotsen Chair in Archaeology

COTSEN INSTITUTE OF ARCHAEOLOGY AT UCLA

CONTENTS

BACKDIRT 2014





BACKDIRT

ANNUAL REVIEW OF THE COTSEN INSTITUTE OF ARCHAEOLOGY AT UCLA

Charles Stanish
Director of the Institute

Randi Danforth
Publications Director, CIoA Press

Brett Kaufman
Co-Editor, *Backdirt*

Abigail Levine
Co-Editor, *Backdirt*

Copyediting
Ann Lucke

Design
Doug Brotherton

To request a copy or for information on submissions, please contact the Cotsen Institute of Archaeology Press at: 310-825-7411 or email ioapubs@ucla.edu

Read *Backdirt* online at: www.ioa.ucla.edu/publications/backdirt

FRONT COVER:
Cotsen students in the Chincha Valley, Peru. From left, Jacob Bongers, Kevin Hill, Terrah Jones, Ben Nigra. Photo by Charles Stanish, submitted by Jacob Bongers.

BACK COVER:
Students displaying their work at the Zita Project, Tunisia. From left, Hannah Lents, Dylan Guerra, Amanda Dobrov, Harry O'Neil. Photo by Brett Kaufman.

ABOVE:
Photo by Gregory Areshian.

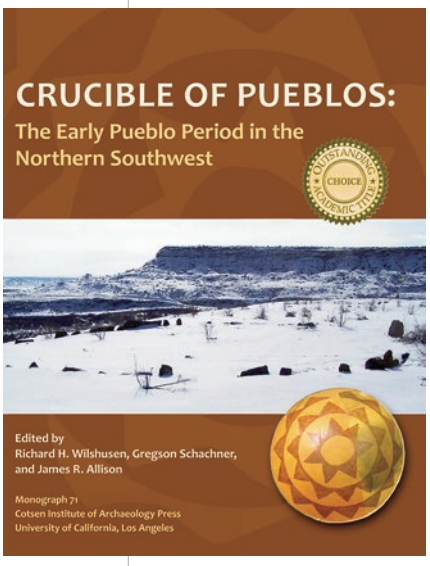
ERRATUM:
Figures 1 and 3 in Merrick Posnansky's article "Evolving Holistic Approaches to the Quaternary in East Africa" in the last volume of *Backdirt* (2013) should be credited to Kathryn Chew. The editors apologize for the oversight.

THE INSTITUTE IN THE NEWS

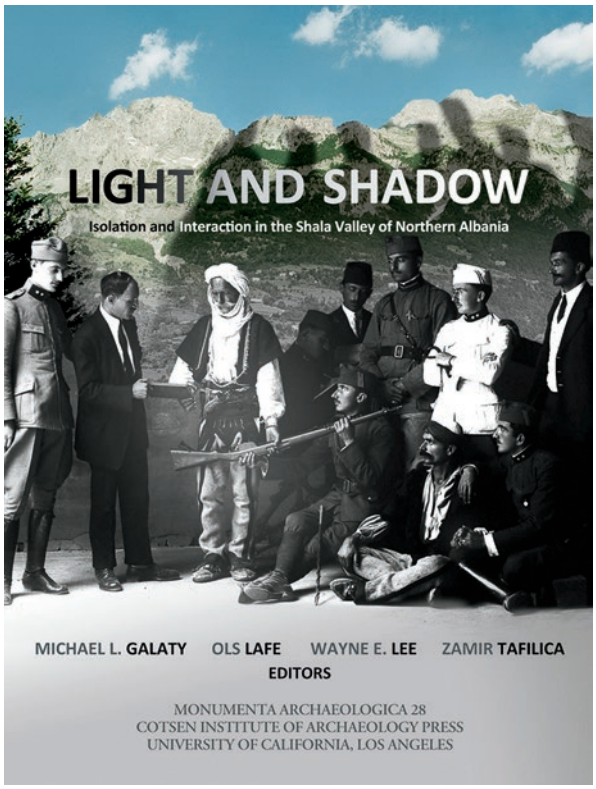
Cotsen Titles Win Big Awards

The Cotsen Institute of Archaeology Press (CIoA Press), widely recognized for high-quality academic volumes showcasing first-in-field research, continues to receive accolades from the greater archaeological community. This past year, three CIoA Press titles received prestigious awards, affirming the Institute's status as a global exchange for archaeological information and a purveyor of game-changing scholarly publications.

The first title, *Light and Shadow: Isolation and Interaction in the Shala Valley of Northern Albania*, edited by Michael L. Galaty, Ols Lafe, Wayne E. Lee, and Zamir Tafilica, was selected as the winner of the 2014 Society of American Archaeology Book Award in the scholarly category. This volume details the work of the Shala Valley Project, which employed survey archaeology, excavation, ethnographic study, and multinational archival work to uncover the many powerful and creative ways the residents of Shala shaped their world. The award was presented to the authors at the Annual Business Meeting and Awards Ceremony at the 79th Annual Meeting of the Society for American Archaeology, held in Austin, Texas.



The second title, *Crucible of Pueblos: The Early Pueblo Period in the Northern Southwest*, edited by Richard H. Wilshusen, Gregson Schachner, and James R. Allison, was awarded Outstanding Academic Title from Choice Current Reviews for Academic Libraries. First published in 2012, this volume presents the first comprehensive summary of population growth and migration, the materialization of nascent villages, cultural diversity, relations of social power, and the emergence of early great houses during the early Pueblo period in the American Southwest.



Finally, Professor Jeanne Arnold's latest book, *Life at Home in the Twenty-First Century* (co-authored with Anthony Graesch, Enzo Ragazzini, and Elinor Ochs), received the 2014 John Collier Jr. Award from the Society for Visual Anthropology for the best use of still photography in a book-length presentation of anthropological research. The prize was presented at the 2014 AAA annual meetings in Washington, D.C. Published in 2013, this volume takes an archaeological approach to the study of the middle-class American home and is the first book by researchers affiliated with UCLA's Center on the Everyday Lives of Families, supported by the Alfred P. Sloan Foundation. This award is the latest accolade for *Life at Home*, which was featured in the *New Yorker*, the *New York Times*, the *Washington Post*, *Yahoo!*, the *Wall Street Journal*, the *Boston Globe*, the *San Francisco Chronicle*, the *Los Angeles Times*, *Time Magazine*, and *People Magazine. Life at Home* was also the subject of a KCET (Los Angeles Public Television) feature story that aired in 2013 and 2014, which was nominated for an Emmy Award in the Daytime Feature category.

THE INSTITUTE IN THE NEWS

Society for Visual Anthropology John Collier Jr. Award

These awards serve to further elevate CIoA Press, which has become a premier destination for authors seeking to publish academic work. Since 1975, the Cotsen Institute of Archaeology Press (formerly the Publications Unit) has served to preserve cultural heritage through the documentation and publication of scholarly archaeological research.

Professor Monica L. Smith Elected AIA Academic Trustee

Congratulations to Monica Smith, Professor of Anthropology and member of faculty of the Interdisciplinary Program in Archaeology, who was recently elected as an Academic Trustee of the Archaeological Institute of America (AIA).

The AIA is the oldest archaeological organization in the US, founded in 1879 and the recipient of a charter by the United States Congress in 1906. The organization, which has 210,000 members, publishes scholarly journals and has a very active program of heritage awareness and public outreach, including *Archaeology Magazine* and an annual National Archaeology Day. The AIA has nine elected Academic Trustees representing a diverse set of professional interests in Old World and New World archaeology.

Esmeralda Agolli (Ph.D. Archaeology '14) has been appointed Assistant Professor of Anthropological Archaeology in the Department of Archaeology and Culture Heritage, Faculty of History and Philology at the University of Tirana, Albania.

Professor Giorgio Buccellati Appointed to German Archaeological Institute

Giorgio Buccellati, Professor Emeritus of History and Near Eastern Languages and Cultures, was elected Corresponding Member of the German Archaeological Institute (Deutsches Archäologisches Institut; DAI) in December 2013. The DAI is a German federal agency that sponsors research in archaeology and related fields, including domestic and international excavations, expeditions, and other research projects. This highly prestigious appointment recognizes Professor Buccellati's research on the Akkadian Empire, notably his work at the site of Urkesh (Tell Mozan), where the DAI has also conducted fieldwork (see page 104).

Professor Buccellati was the founding director of the Cotsen Institute of Archaeology, which he established in 1973. His research interests focus on political institutions and the growth of the state in ancient Syro-Mesopotamia and particularly on the religious experience in ancient Mesopotamia and its structural contrast with biblical religion. He is currently Director of the Cotsen Institute's Mesopotamian Laboratory. He is also the Director of IIMAS, the International Institute for Mesopotamian Area Studies.

Discoveries on the South Coast of Peru Draw International Attention

A research team led by Professor Charles Stanish stunned the archaeological community with their discovery of a 2,300-year-old architectural and astronomical complex in the Chincha Valley, Peru. As reported in the May 20, 2014, issue of *Proceedings of the National Academy of Sciences*, the team's findings demonstrate how the Paracas societies of the region built an artificial landscape in an open desert to mediate periodic social events. These exciting new data provide crucial insight into the ways in which people in nonstate societies organized their social, political, and economic lives.

The team, which included Archaeology IDP graduate students Benjamin Nigra and Laura Griffin, who co-authored the *PNAS* article, conducted an intensive survey over a 30 km^2 area of the valley. Using GPS technology, the researchers plotted settlements, mounds, and other significant archaeological features, including geoglyphs, stone circles, platforms, and cairns. Hand-drafted and digitally generated models of the survey data aided the identification of feature clusters and sets of associated geoglyphs. Orientations for the geoglyphs were independently confirmed by multiple GPS ground measurements and confirmed with hand compasses.

Geoglyphs that crisscross the valley floor serve to mark ceremonial mounds and residential sites and, in most cases, help guide the viewer across the desert.

Analyzing the data, the team discovered that the geoglyphs that crisscross the valley floor serve to mark ceremonial mounds and residential sites and, in most cases, help guide the viewer across the desert. As quoted in *Science Magazine*, Professor Stanish explained that lines, created by sweeping dark desert soil to expose the bright limestone underneath, "would be unmistakable" to people traveling from the surrounding hills. Notably, three of the large mounds were associated with distinct pairs of geoglyphs that mark the winter solstice in June, suggesting that they had a ceremonial function.

Excavations in three of the mounds in the survey area confirm that these geoglyphs date to the Paracas period, predating the better-known Nasca lines to the south. To securely date these settlements, Professor Stanish and his team selected samples of noncarbonized annual plant remains, mainly maize and reed leaves or stalks, from stratified, sealed contexts for radiocarbon dating. Future research in the Chincha Valley will include excavations at the mound sites in order to determine the exact nature of the activities that took place at Paracas-period settlements.

THE INSTITUTE IN THE NEWS

Former Institute of Archaeology Director Elected to the American Academy of Arts and Sciences

Timothy Earle, Professor Emeritus of Anthropology at Northwestern University and former Director of the Cotsen Institute of Archaeology, was elected to the American Academy of Arts and Sciences in April 2014. This honor was bestowed in recognition of his groundbreaking work on the rise of early chiefdoms and states.

An economic anthropologist, Professor Earle specializes in the archaeological studies of social inequality, leadership, and political economy in early chiefdoms and states. He has researched these topics across the globe, conducting archaeological fieldwork in Peru, Argentina, Polynesia, Denmark, and Hungary. He is the recipient of many grants from the National Science Foundation and the Wenner-Gren Foundation and has served on the review boards of the National Science Foundation, the journal *Annual Reviews in Anthropology*, and Cambridge University Press.

Prior to joining the faculty at Northwestern, he was Professor of Anthropology at UCLA from 1973 to 1995, serving as Director of the Cotsen Institute of Archaeology from 1987 to 1992. During his tenure at Northwestern, he served as Chair of the Department of Anthropology and President of the Archaeology Division of the American Anthropological Association.

Professor Earle was one of 204 members recognized this year by America's most prestigious learned societies. The academy membership of 4,600 Fellows and 600 Foreign Honorary Members includes more than 250 Nobel laureates and 60 Pulitzer Prize winners.

Graduate Students Receive National Science Foundation Awards

The Cotsen community congratulates Hannah Lau and Adrienne Bryan, who successfully competed for prestigious awards from the National Science Foundation during the 2013–2014 academic year. Hannah Lau, a doctoral candidate in the interdisciplinary program in Archaeology, was awarded a Doctoral Dissertation Improvement Grant (DDIG), which will fund her dissertation research at the Late Neolithic Halaf (ca. 6100–5200 BCE) site of Domuztepe in Turkey. Her proposal, titled "Mobility, Cooperation, and Emergent Political Complexity," aims to assess cooperation and interaction among settled and mobile farmers and herders during this time of major transition. To do this, she will utilize data from animal bones, combining information from both zooarchaeological analysis and analyses of isotopes from teeth specimens of domestic animals to examine economic

Hannah Lau received a Dissertation Improvement Grant from the National Science Foundation.

coordination among people in both daily subsistence activities and in the feasting events at Domuztepe. Through these analyses, this study will reveal ancient people's management choices regarding their livestock—an integral aspect of their political economy—and contributes to broader discussions of emergent political complexity and resource management. This DDIG is Hannah's second award from the National Science Foundation.

Adrienne Bryan, a second-year student in the Anthropology Department, received a National Science Foundation Graduate Research Fellowship. The highly competitive GRF provides three years of support for graduate study leading to a research-based master's or doctoral degree. As a NSF fellow, Adrienne will conduct research in the Cuzco region of Peru—once the heartland of the Inca Empire—focusing on the development of architectural styles during the period between the Wari and Inca occupation of the Cuzco region, or the Late Intermediate Period (1000–1400 CE).

Adrienne Bryan received a National Science Foundation Graduate Research Fellowship.

Faculty Honors, Distinctions, and Awards

Professor Lothar Von Falkenhausen was appointed Honorary Professor at Zheijiang University. On the occasion of his appointment, he presented a lecture titled, "The Present Situation of Chinese Archaeology: An International Perspective" in the Qizhen Global Lecture Series.

On October 6, the Cotsen community celebrated Professor Willeke Wendrich's installation as the Joan Silsbee Chair of African Cultural Archaeology in the Department of Near Eastern Languages and Cultures.

Professor Ioanna Kakoulli received an award from the A. G. Leventis Foundation to support travel to Cyprus for the analysis of thirteenth-century Byzantine paintings at Sotera Ammohostou.

Associate Professor Kara Cooney received a grant from the American Research Center in Egypt's Antiquities Endowment Fund to study and document coffins in Cairo.

Professor John Papadopoulos was appointed as Getty Consortium Professor for 2014–2015. He will be teaching a course inspired by the recently published volume, *The Construction of Value in the Ancient World*, which he co-edited with Gary Urton of Harvard University.

As reported in Proceedings of the *Royal Society B: Biology*, Tom Wake was part of a team that discovered that Caribbean fighting conch used to be harvested with more meat, but owing to human intervention, evolved to mature to a smaller size. Such "unnatural selection" is indicative of the impact humans can have on the environment, even in nonindustrial contexts.

Wake was also featured on the social news website BuzzFeed, comparing real archaeology to the archaeology portrayed in the *Indiana Jones* films: http://www.buzzfeed.com/dimitri/surprising-ways-indiana-jones-is-actually-realistic.

— Abigail Levine, Cotsen Institute of Archaeology, UCLA

FEATURE

Landscapes of Defense: Kastro Kallithea and Its Role in Fourth-Century-BCE Achaia Phthiotis

C. Myles Chykerda[1], Margriet Haagsma[2], and Sophia Karapanou[3]

THE FORTIFIED CITY near modern Kallithea, located in Achaia Phthiotis, dates to the late fourth century BCE (Figure 1). It presents a unique opportunity to investigate contemporary Greek defensive tactics beyond the powerful centers of Athens, Syracuse, and other large poleis whose extant defensive architecture dominate the archaeological landscape. Their elaborate walls, towers, and associated country forts and guard posts present examples that are exceptions rather than something representative of the general state of affairs in the early Hellenistic period. Kallithea's geographical setting combined with its own defensive system allowed the city to dominate its surrounding landscape, demonstrating that substantial investment in military architecture occurred even at relatively minor Greek cities. However, Kallithea was not an isolated settlement; numerous nearby cities were of equal or greater stature, both in size and political power. For this reason, a number of questions remain: How did the city associate with its neighbors? What was the political status of Kallithea in relation to surrounding cities? We propose that an examination of the individual site, taking into account both archaeological and epigraphic evidence, demonstrates that as a true polis, Kallithea must have had socio-political and military interactions with nearby sites. Specifically, it must have been closely associated with the communities of New Halos and Pharsalos owing to relatively proximity coupled with the region's high population density. To demonstrate this connection, a series of towers and forts along the Othrys Mountain range are examined using Geographical Information System (GIS) methodology. The viewsheds and lines of sight originating from each city suggest that Kallithea and New Halos were important cities that anchored two ends of a monitoring system designed to secure the southern border of Achaia Phthiotis against southern intrusions.

1. Cotsen Institute of Archaeology, UCLA.
2. Department of History and Classics, University of Alberta, Canada.
3. Fifteenth Ephorate of Prehistoric and Classical Antiquities, Larissa, Greece.

GREEK WARFARE IN THE FOURTH CENTURY BCE

The fourth century BCE was a period of change and innovation regarding Greek siege strategies. Previously, the taking of a city had been dependent upon the use of manual weapons and sheer manpower to surround, blockade, and wait out the stored resources of the defenders. If an army was not willing to wait for a settlement's eventual capitulation, numerous tactics could be employed in an attempt to overcome the walls and towers (Fields 2006:50–52; Lawrence 1979:39–41; Nossov 2009:35–46; Ober

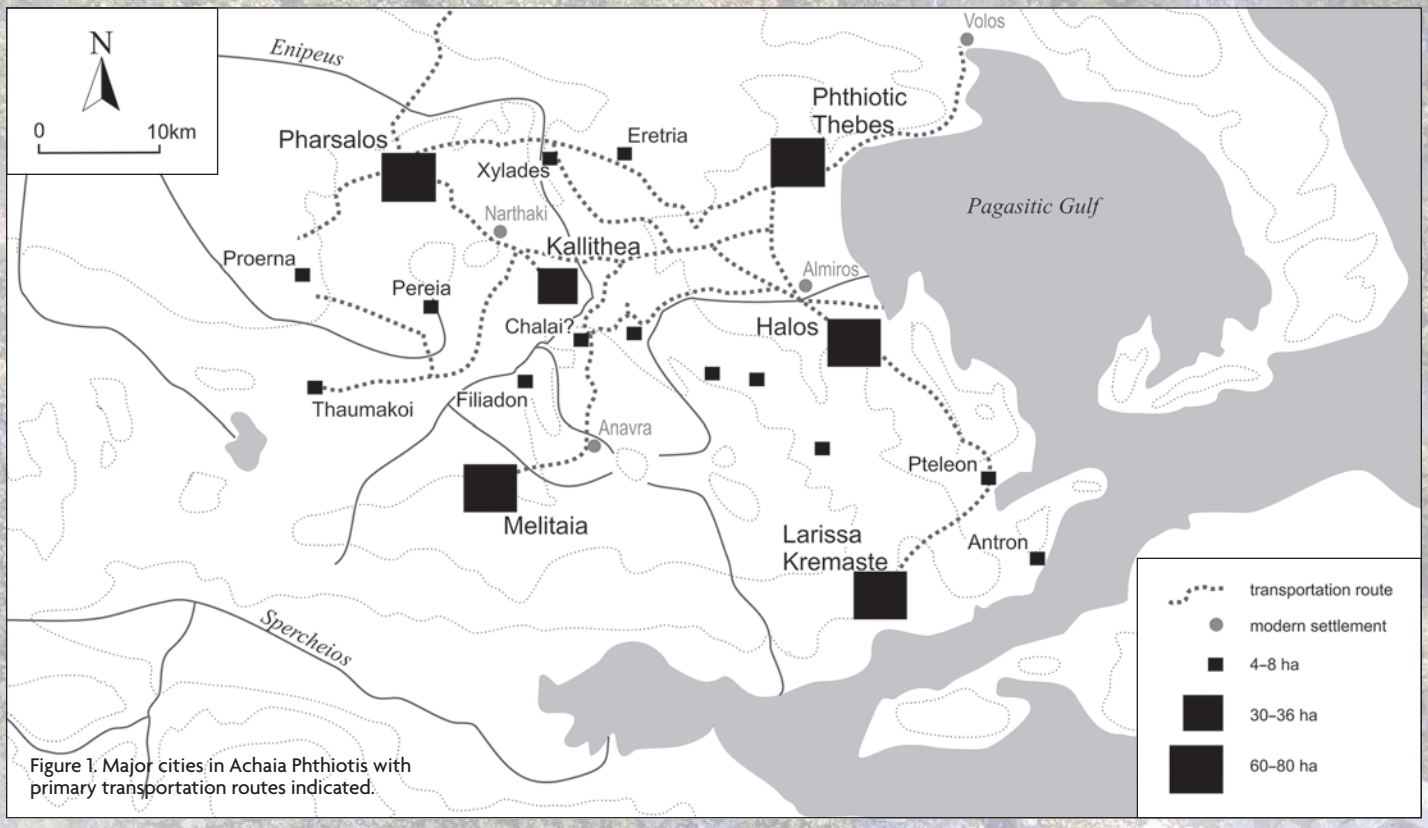


Figure 1. Major cities in Achaia Phthiotis with primary transportation routes indicated.

1985:44–45). Such methods include scaling a wall with ladders and slinging lead bullets; later strategies involved constructing ramps, as well as digging tunnels designed to undercut the walls of a settlement. Thucydides's account of the siege of Plataea in 429 BCE demonstrates that such tactics did not guarantee success (Thuc. 2.75–78). The Spartans and their allies besieged Plataea for 70 days, during which they attempted to build a ramp to overcome the city walls. In response, the Plataeans not only built up their own wall height opposite the approaching ramp but also undercut the attackers' efforts from beneath, mining out the ramp's mass through a hole dug in the lower city wall.

The late fifth century BCE ushered in a new era of Greek warfare. In 409 BCE, Hannibal the Magonid besieged Selinus with a force that included six mobile towers of exceptional size from which the attackers, positioned high above the city's parapet, had a crucial advantage (Lawrence 1979:42–43; Diod.13.54–55). At the battle of Motya in 397 BCE, the use of siege towers was enhanced by an innovation of Dionysius of Syracuse that would forever change the nature of Greek warfare: catapults (Diod.14.48–52). The earliest catapults could only throw bolts and perhaps small stones but nevertheless had a profound impact on Greek poliorcetics. Within 30 years, torsion engines, powered by springs made of sinew or horsehair, became the standard siege weapon, capable of hurling massive stone shots up to 350 m (Marsden 1969:56–60). As both nontorsion and torsion engines continued to be improved, architects were forced to change the way defensive structures were built in order to meet the increasing offensive capabilities of well-equipped Greek armies. Defensive innovations not only resulted in new ways to build walls and towers but also in new concepts of territorial protection. During the fourth century BCE, unwalled cities were rare (Lawrence 1979:121), as were cities not part of some form of regional system designed to guard the territory/*chora*[4] of a city-state (Frederiksen 2011:8; Lawrence 1979:159; Ober 1985:130–180; Winter 1971:42–43).

Ongoing development of siege tactics also necessitated communication methods capable of sending discreet messages between the nodes of defensive networks. Greek literature suggests that simply lighting a large beacon or bonfire was once a suitable method for communicating a predetermined message. In the opening of the *Agamemnon*, Aeschylus presents the image of the fall of Troy being relayed to Clytemnestra through beacons (Aesch. *Ag.* 8–9). Whether a signal could be transmitted over such distances is

4. χώρα: generally, a space, place, or spot. When referencing land, this term specifically denotes the country in opposition to the town.

debatable; Diels argues that two necessary steps in the path would require breaks of 150 and 180 km (Diels 1914:71–90). Nevertheless, Polybius notes that early forms of fire signaling relied upon prearranged meanings (Polybius 10.43), suggesting that large bonfires visible for long distances certainly could have been used. Prearranged messages are still noted in fourth-century histories, such as when Alexander of Pherae directed a garrison monitoring an Athenian fleet to light an additional beacon on the tower facing Magnesia, from where the signal would be relayed to Pagasae (Polyaenus 6.2.1).

In Polyaenus's account, the second beacon indicates that the observers would have to differentiate between two discrete sources of light from a single tower. Other ancient sources also suggest that large, single beacons did not fulfill communication requirements of fourth-century Greek warfare. Polybius, recounting the fourth-century writings of Aeneas Tacticus[5], details how two large jars of identical capacity could be utilized to transmit one of several prearranged messages. Both vessels are filled with water into which a rod set in a cork float is placed. On the side of this rod are lines signifying various messages. The sender raises a torch, which is answered by the receiver also raising a torch, indicating they are at attention. When the sender drops his torch, plugs are pulled from each jar, water flows out, and the rods descend in tandem. When the desired message meets the rim of the vessel, the sender again raises his torch, indicating to the receiver that they should stop their jar and note the message indicated on the rod. Despite such innovations, this system can only convey a limited amount of information as one is limited to predetermined messages (such as "enemies approaching," "fort breached," or "send reinforcements"), further constrained by the maximum number of notches set into the rod (Ober 1985:198; Polybius 10.45). This problem is tackled by Polybius, who developed his own system.

Polybius (10.45) details his own improvements made to a method developed by Cleoxenus and Democlitus, which aimed to allow the sender to transmit any desired message. In this system, each party has a set of five tablets with five letters on each. The sender raises two torches and waits until the receiver also raises two torches, indicating both parties are at attention. These are lowered, and then torches are raised on the left to indicate which tablet is to be consulted and torches on the right indicate which letter on the tablet is to be written down. It therefore becomes imperative that the observer is able to distinguish not only between torches positioned at the left and right of an observation point, but a total of five torches at each side. Polybius (10.46) suggests the aid of an optical instrument with two tubes[6]. Although Polybius was writing in the mid-second century, his attention to signaling and references to Aeneas indicate that the problem of communicating complex messages was a matter of investigation in the fourth century and that fire signaling utilized handheld torches placed very close to each other. Distances between signaling stations thus becomes a primary consideration. Forbes (1958:176) suggests that torches 10 m apart can be resolved by the naked eye of an observer 10 km distant, while Merriam (1890:14) suggest 16 km is the convenient limit of distinguishing between torches at each end of a 6 m fence.

New methods of signaling were not the only innovations to be developed in this period. The necessity of large-scale defenses at both the city and regional level is seen via extant ruins throughout Greece and the colonial territories. Athens developed a complex network of towers, forts, and walls to guard the territory of Attica (Munn 1993; Ober 1985), while Syracuse was heavily fortified by the addition of the Euryalos fort (Winter 1963). Examples are also found in connection with less-prominent areas, such as the collections of towers that dot the islands of Lesbos (Spencer 1995) or Leukas (Morris 2001), and are found inland throughout the region of Boiotia (Fossey 1986, 1988, 1990, 1992). Despite the seeming ubiquity of such systems, few have been well studied in relation to their associations with nearby poleis (Winter 1971:45). Of note is how isolated towers, numbering in the hundreds throughout mainland Greece, have been scarcely noted in archaeological reports concerning Thessaly (Lawrence 1979:187). This is surprising given fourth-century Thessaly was by no means beyond the sphere of Aegean conflict. In the 370s BCE, Jason of Pherae almost succeeded in uniting the entire Thessalian region under a single banner (Sprawski 1999; Westlake 1935). Later, the region became a strategic theater for conflicts between Demetrius Poliorcetes and Cassander, sons of rivals who vied for power after the death of Alexander

5. Aeneas's sole surviving work, *How to Survive under Siege*, makes several mentions of signaling but reports in 7.4 that such matters are treated at length in another book, *Preparations* (now lost), which must be the work to which Polybius refers.

6. διόπτραν ἔχειν δύ' αὐλίσκους ἔχουσαν (Polybius 10.45.1).

the Great. Achaia Phthiotis, at the southern edge of Thessaly proper, was of particular strategic value for anyone wishing to move from Macedonia and northern Greece into southern Greece. As such, it seems logical that developments in defensive architecture and regional planning would be implemented throughout Thessaly in the closing years of the fourth century, particularly in Achaia Phthiotis.

ACHAIA PHTIOTIS AND KASTRO KALLITHEA

Since 2004 the Kastro Kallithea Archaeological Project, a joint effort of the Fifteenth Ephorate of Prehistoric and Classical Antiquities in Larissa, Greece and the University of Alberta, Edmonton, Canada, has investigated an ancient Greek city located near the modern village of Kallithea, carried out under the aegis of the Canadian Institute in Greece and the Hellenic Ministry of Culture. The project began with an intensive urban survey, which included documenting various extant architectural features (Tziafalias et al. 2006a, 2006b, 2009). In this paper we present an overview of the defensive network before moving on to questions regarding the militarization of the surrounding landscape.

METHODS

The recording and analyses of the fortification systems discussed below involve two sets of methodologies. Components of Kallithea's defenses were recorded in detail through a combination of traditional architectural drawing and Total Station survey methodology during the 2004, 2005, and 2006 seasons. These highly detailed data were collected in both ESRI's ArcGIS and Golden Software's Surfer, the full results of which are available in Tziafalias et al. 2006a.

In moving to questions regarding the broader landscape of Achaia Phthiotis, we utilized digital topographic data and GIS to produce an analytic framework for the entire region. While we had already produced detailed maps at a site level, we were interested in the potential to test hypotheses on a larger scale, including what was visible from our site and surrounding locales via GIS (ex. Llobera 2006, 2007). Owing to time constraints arising from our primary task of completing the urban survey of Kallithea (2004–2006) and excavation of Building 10 (2007–2013), we utilized digital topographic data and GIS to address these questions remotely. The use of programs, such as ESRI's ArcGIS 10.1, to analyze viewsheds[7] and lines of sight[8] was of particular interest in determining whether or not the Othrys system was visually connected with Kallithea, Halos, or both.

> Isolated towers, numbering in the hundreds throughout mainland Greece, have been scarcely noted in archaeological reports.

Base data included a digital elevation map (DEM) produced by the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) program[9], which was converted into a Triangular Irregular Network (TIN) for work within the GIS environment (de Boer et al. 2008:77–78). ASTER's version 2.0 DEMs were released in 2011 and are reported as having excellent vertical and horizontal accuracies well within tolerances for archaeological investigations[10].

THE FORTIFICATIONS

One of Kallithea's most impressive features is the substantial amount of preserved curtain wall, towers, gates, and posterns (Figure 2). Although much stone has either fallen down the slopes of the hill[11] or become buried in sediment, the visible structures speak to the enormous effort and cost that must have been required for their construction. This section will briefly review the characteristics of each component before entering into a general discussion considering the elements as a whole.

THE ACROPOLIS FORTIFICATIONS

The western hill is crowned by an oval circuit wall 2.06–2.90 m in width, which encircles an area of ca.

---

7. A viewshed identifies what can be seen from one or more observation locations. In a GIS, this analysis gives each cell in an output raster image a value that indicates how many observer points can be seen.

8. A line of sight is a graphic line between an observation point and target which indicates an unobstructed view or, in the case of an obstruction, where along the line the view is blocked. 9. http://asterweb.jpl.nasa.gov/documents.asp.

10. http://www.jspacesystems.or.jp/ersdac/GDEM/ver2Validation/Summary_GDEM2_validation_report_final.pdf.

11. Visible fallen blocks and internal fill are most evident around towers. However, despite the thick vegetation of the hill, one can still see significant amounts of stone from the curtains on the slopes. When our project began in 2004, such remains were much clearer as a result of a fire clearing the entire site only several years prior. In 2013, many sections of the wall were almost entirely hidden in the dense maquis.

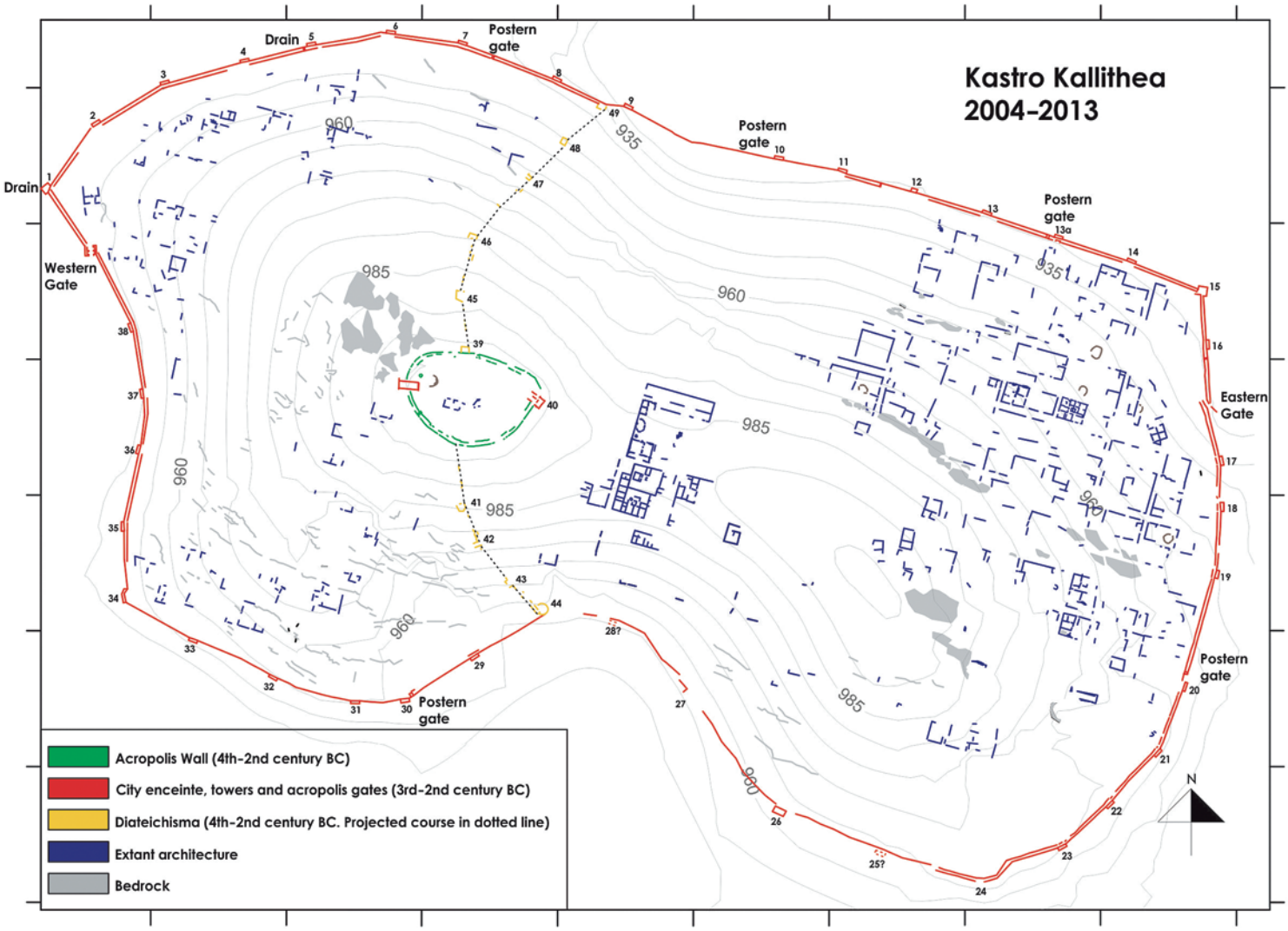


Figure 2. City plan of Kastro Kallithea with segments of the fortification system color-coded.

0.5 ha with two points of access: the western and eastern acropolis gates. The wall's style of construction aligns with Scranton's classification of irregular trapezoidal, examples of which he dates generally to the fifth century BCE (Scranton 1941:71–73, 167–168). Stones are flattened limestone blocks laid in irregular courses along the exterior and interior faces. The interior is a rubble fill with irregular arrangement of blocks in stretcher and header /*emplekton* construction (Lawrence 1979:214–215; cf. Tomlinson 1961)[12]. It is difficult to estimate the height of the preserved wall because of the rubble that has collected along both its interior and exterior faces (Figure 3). Despite the relatively small size of individual stones (much smaller than construction blocks seen elsewhere on the site), they should not be viewed as rubble construction as they are well worked and finished in order to ensure tight fits with adjacent blocks.

This summit is a typical acropolis (Lawrence 1979:130–136), which almost entirely lacks visible remains of houses or barracks reflecting early periods of habitation and protection. What does remain are likely religious buildings and areas of cut bedrock with particular cult significance (Tziafalias et al. 2006a:114–115). The summit is also similar to many acropolis precincts in that it does not rise completely isolated from the center of the urban area (Lawrence 1979:131–132). Instead, it is a highly defendable area linked to the enceinte via cross walls that divided the entire city into eastern and western segments.

The two gates of the acropolis are unusual by being identical in construction style to the main city wall but different from the style seen along the remainder of the acropolis wall. While the west gate is a large chamber gate, the east appears to consist of a passage that proceeded either under or beside a tower to its immediate north. Blocks are larger, more regular in shape, and feature corner drafting. Here we see a quintessential embodiment of the philosophy that walls must be as pleasing to the eye as they are

12. The lateral stones are so infrequent (or hidden in rubble) that those present may in fact be evidence for small posterns. Future investigatory excavation is needed to test this hypothesis.

Figure 3. The acropolis wall facing (left) and interior structure (right).

strong[13]. These gates, through which an individual would have had to proceed *en route* from the main western gate to the central agora[14], must have been reconstructed at the same time as the other works of the Hellenistic period.

THE DIATEICHISMA

Cross-walls, or *diateichismata*, are found in many Greek cities and were constructed for numerous reasons, including reducing the size of a fortress or encircling an internal population that had unsettled relations with another group (Lawrence 1979:148–149). However, in Hellenistic times, the term is often applied to walls built through the interior of a city, marking off a section of the settlement that was no longer defended. This was a process often associated with a reduction in the overall length of an enceinte so that it could be patrolled by a small garrison (Lawrence 1979:149). Kallithea is no exception to this general tactical rule. While the enceinte encompassed the whole of the hill in *Geländemauer*[15] fashion, the *diateichismata*, radiating north and south from the acropolis wall toward the enceinte, provided a secondary line designed to guard the eastern part of the city against incursion from the west (as seen in the west-facing orientation of the *diateichisma* towers).

The *diateichismata* of Kallithea both follow steep terrain, descending 60 m from the acropolis to the enceinte. The remaining heaps of irregular stone and rubble from the original structure, particularly at the locations of its ten towers, make the courses extremely visible despite overall poor preservation. The interface of the *diateichismata* with both the acropolis wall and enceinte was relatively clear in 2004 and 2005, which allows us a few comments on its period of construction (Figure 4). It is evident that the stones of the *diateichisma* were not integrated into the walls of the acropolis, particularly so where a tower of the north *diateichisma* abuts the acropolis wall. The interface with the enceinte demonstrates an opposite situation. Collapse of wall stones in the area of Tower 49 allowed us to observe that here the structure of the *diateichisma* was bonded into that of the enceinte. The construction of this interface enables us to suggest that the *diateichismata* were built as part of the same program that planned the enceinte, to which we now turn.

THE ENCEINTE

The main enceinte is 2.4 km in length and encircles the upper third of the hill (Figure 5). The curtain consists of a double scale wall filled with limestone rubble and earth. Both inner and outer faces are built with stones that are pseudo-isodomic trapezoidal blocks with quarry face. The average course height is 0.7 m, with lengths that typically reach 1.5 m. Individual stones have smoothed joints, providing a better grip and a closely locking construction, adding to the overall strength of the wall. Internal headers occur on average every 3 m, sometimes with an extra stone placed between the headers protruding inward from each face, thereby creating an internal structure that functioned to stabilize the rubble fill.

The preserved height of the wall varies greatly. Along the eastern side of the city there is a small section that reaches 2.5 m in height, while several sections in the south-central area are almost entirely buried and obscured by vegetation. Substantial

13. *Laws* 778d–779b.

14. Likewise, the eastern acropolis gate is a prominent part of the visual landscape of the civic center.

15. This term refers to the manner in which architects of the fifth and fourth centuries built city walls to encompass a large area of land so as to prevent the enemy from gaining any surrounding high ground.

Figure 4. Postern V in the foreground with the remains of the *diateichisma* visible in the background. Note the poor level of preservation and heavy overgrowth.

Figure 5. The hill of Kastro Kallithea. The upper arrow points to the line of the enceinte, while the lower line indicates a modern road along the base of the hill.

amounts of rubble can be seen along the exterior base of the wall, while many more stones are hidden amid the dense maquis of the slope. We are unable to say for certain whether the walls were built entirely out of stone or if they featured a mud brick superstructure atop a stone socle. Despite the entire hill being a potential source of limestone, no evidence for local quarrying has been found. Regarding the possibility of a mud brick construction, we observe no preserved level stretch of stone atop which a mud brick superstructure could sit. To date, we have not removed any rubble in an attempt to determine the construction of the lower foundations of the curtain or associated towers and to ascertain whether the remains of mud brick are present in associated stratigraphic layers[16].

A total of 38 towers[17] supplemented the main curtain, located at irregular intervals with spacing ranging from 39 m to 157 m (Figure 2). The closest-set towers occur along the western side where the site is most vulnerable given the relatively low slope compared

16. The presence of a wash layer along the exterior of the walls at the nearby Goritsa hill led the site's investigators to propose a mud brick enceinte (Bakhuizen 1992:152); cf. Reinders 1998:71–72, where an all-stone wall is suggested.

17. Stählin (1938:1401–1402) counts 38 towers during his initial visits to the site. We have maintained his numbering system but added an undocumented tower 13a to the list. Conversely we could find no trace of towers 25 and 28 along the south wall of the city, which may indicate damage by human intervention or seismic activity since Stählin's visit. We also added tower numbers 39 through 49 for the diateichisma towers and the east acropolis gate tower.

to elsewhere along the hill. Towers have an average width of 6.7 m and protrude 2.3 m from the wall, giving them an overall average depth of 4.8 m (Figure 6). Towers 1 and 15 are of a different construction: both are large square towers that significantly protrude from the wall, creating large platforms which may have served as convenient points for observing the surrounding plains and signaling nearby outposts. We cannot make any definitive statements concerning the superstructure of the towers as they are preserved to relatively low levels and have no traces of sills, thresholds, staircases, or other architectural features[18]. Towers from sites dating to the second half of the fourth century often housed catapults (Ober 1983, 1987, 1992). Kallithea's towers were likely no different, although they are smaller than towers found at many contemporary cities. Nevertheless, the interior space of these towers is sufficient for modest defensive catapults (Chykerda 2010:98–99).

Two main gates, each constructed with a plan distinct from the other's layout, allowed passage at the east and west sides of the city. The east gate, which faces a steep approach, is structurally the simpler of the two, built in a basic overlap style (Lawrence 1979:175)[19], classified by Winter (1971:208) as Type II. Although we have not identified any pivot stones or other mechanical features, we can assume that the gate was located approximately halfway through the passage, a conclusion supported by a line of revetment in the wall face. The west gate, located at a far easier approach, is a more complex construction combining elements of both Type I and Type II gates. Such a novel combination is not surprising given the location's vulnerability (Winter 1971:206). While the form is still that of an overlap gate, a chamber-house has been set within the gap, oriented 90 degrees to the course of the wall. There are three protruding arms, possibly indicative of multiple gates. Five postern gates are also located around the site's perimeter. They are relatively simple: all are small openings, approximately 1.25 m in width, with no clear evidence of how they were bared. Only one, Postern III, near Tower 13a, has an intact lintel stone, although sediment has filled the opening[20]. While all posterns are situated in close proximity to a tower, the Tower 30 / Postern V combination, cleared and drawn in summer 2011, is the most integrated pair and also the best-preserved example free of thick vegetation (Figure 7).

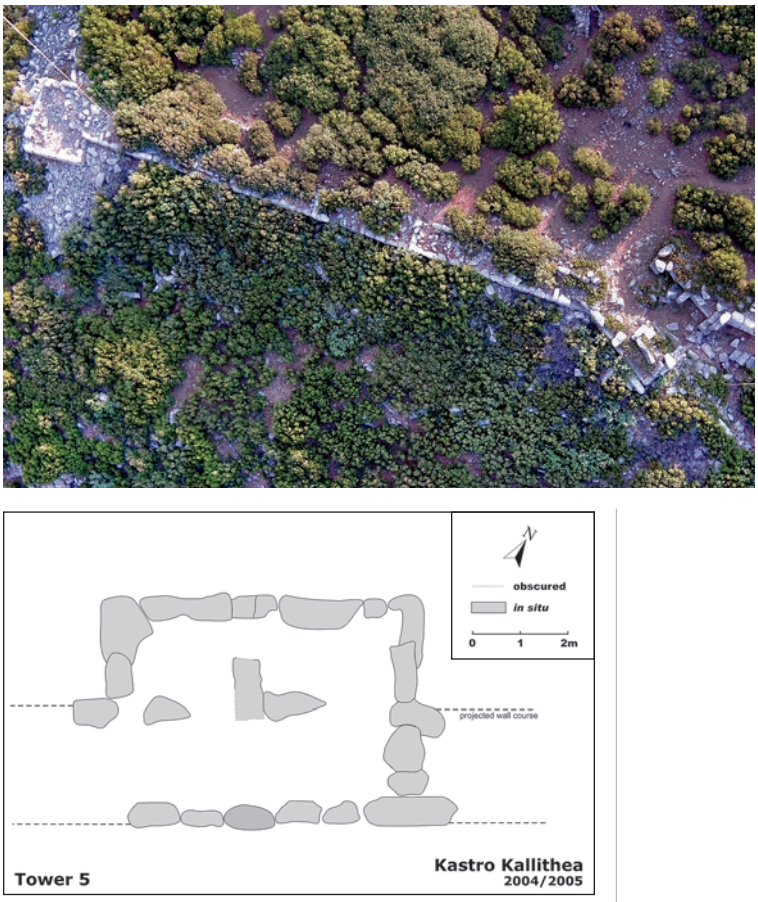


Figure 6. Typical towers of Kallithea. Aerial photo of Tower 1 above, Tower 5 plan below.

THE SYSTEM IN TOTAL

By examining the defensive system as a whole, we are able to come to several preliminary conclusions about the stages of construction and the overall strategic nature of Kallithea's defenses. There were at least two phases of construction in the Classical and Hellenistic periods, represented respectively by the acropolis wall and the later addition of the enceinte and *diateichismata*, with a possible third stage of later renovations (Figure 2). The Classical acropolis fortifications provided a refuge for the surrounding area in times of strife. The Hellenistic expansion, which we have dated to the late fourth century BCE, saw a significant augmentation of the fortified area and the construction of civic and domestic zones in the central and southeast-

18. The eastern acropolis tower gate appears to have one of its two lintel stones in place, but the lintel covering the external access to the tower has fallen and is broken. The overall design of this gate is rather different from the various elements of the city enceinte. It is also almost entirely buried in rubble, and while an overall plan has been drafted, the overall construction style is difficult to ascertain.

19. Also referred to as "tangential" by Frederiksen (2011:55).

20. Stählin (1906, 1914) did not report either Postern III or the neighboring Tower 13a. He did, however, note that several of the posterns were intact. All except Postern III have since lost their lintel stones due to earthquakes or human intervention.

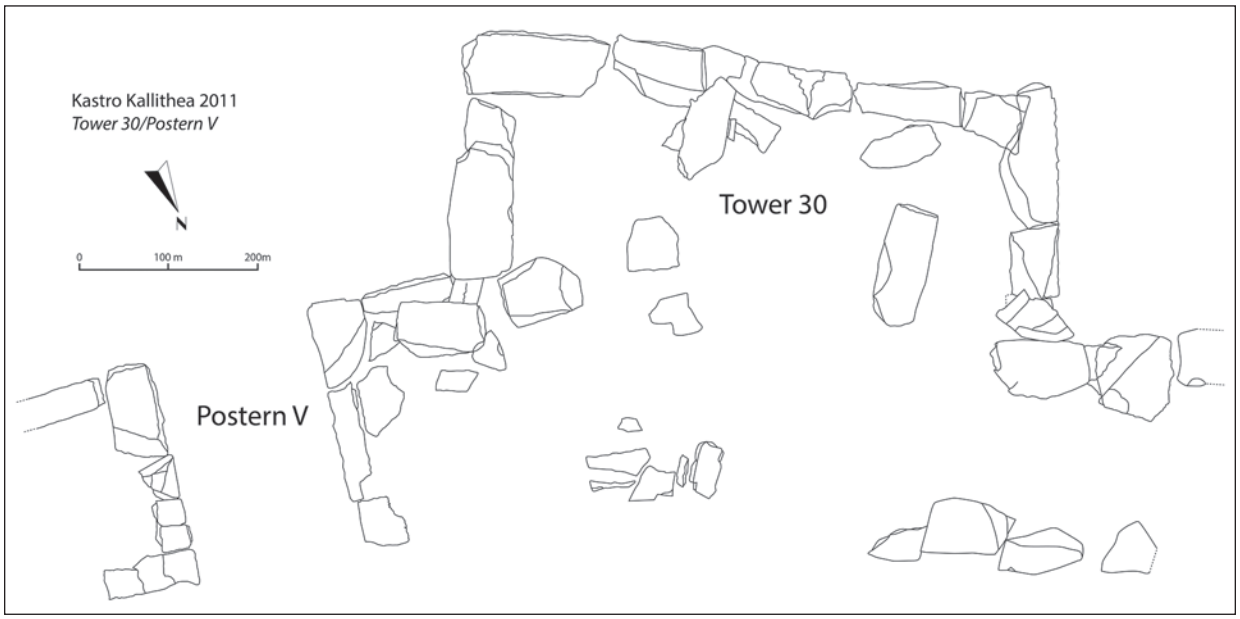


Figure 7. Plan drawing of the Postern V / Tower 30 complex.

ern sections of the city (Tziafalias et al. 2006a:115–130). Defensive elements added at this stage were designed to withstand siege techniques of the period but also took advantage of the incredibly strong position Kallithea was afforded due to its topographical setting. With the enceinte set directly on bedrock high upon the hill, defending forces would not have to worry about many of the siege tactics employed in the fourth century. Even catapults may not have posed a significant threat, as there are few areas at the base of the hill where an offensive force could set up engines close enough to damage walls several hundred meters above them.

However, incursions against the relatively weak western half were a primary concern. The design and construction of the western gate were more sophisticated and therefore much stronger than the eastern, while the *diateichismata* provided a fall-back position in case of an enemy breach, the western-facing towers of which indicate that the wall was designed to protect the civic and domestic areas lying farther to the east. While the western part of the site is not as densely built up as the eastern half, what foundations are visible may be remains of barracks and support structures used to attend to rural populations taking refuge within the city. Once again, we note that from all available evidence, the enceinte and *diateichisma* appear to be of a single phase of construction and are not suggestive of different periods as is often indicated by two or more lines of wall (Lawrence 1979:145).

We are therefore presented with the image of an urban center that was greatly expanded at the end of the fourth century at what must have been a costly enterprise. This wholesale expansion, which not only aimed to fortify an expanded area, but also included the renovation of the acropolis gates and the implementation of civic projects (i.e., the layout of streets and the construction of several buildings at the agora), leads to several questions. Could Kallithea afford such expansion on its own, or did it need to turn elsewhere for funds, material, and manpower, such as was the case at nearby Melitaia[21]? If dependent on a benefactor, can we consider it to be a true polis or, rather, a military outpost? In order to gain a broader understanding of Kallithea's role in regional politics we must consider not just the city but also its territorial context.

A POLIS AND ITS *CHORA*

The impressive form of Kallithea's defenses leads to questions concerning the nature of urban centers in Hellenistic antiquity and their connection with the surrounding landscape. Many heavily fortified settlements dating to the late fourth century are found in Achaia Phthiotis, but not all of these were necessarily full poleis or inhabited for lengthy periods. The founding of Demetrias in 294 BCE by Demetrius Poliorcetes led to the depopulation of established cities, such as Pagasae, through a forced *synoikismos*[22]. However, at the same time that the population of Demetrias's surroundings was consolidated, the large hill of Goritsa, near modern Volos, was fortified with substantial defenses (Bakhuizen 1992). Despite its size, the

21. See Stamatopoulou 2012:85. An inscription found incorporated into one of the city towers mentions that their construction was funded with a sum of ten talents by Amynandros kin of the Athamanians.

22. συνοικισμός: the founding of a new city through the migration of populations from numerous existing settlements resulting in the depopulation of the pre-existing centers.

presence of public spaces, and visible housing blocks, the settlement's standing is not entirely clear. Winter argues that many Hellenistic settlements, which were primarily strategic in nature, were as large as or larger than classical cities owing to their role as centers of influence for a whole district, Demetrias being a prime example (Winter 1971:45). Goritsa[23], despite its physical size and the discovery of numerous housing blocks and potentially public spaces by Bakhuizen's team (1992:315), is contrastingly described by Winter as only an outlying fort that was responsible for guarding the northern territory of its parent polis, Demetrias (Winter 1971:45). Winter's interpretation may be called into question given later discoveries which showed that Goritsa possibly housed a considerable population, short-lived as it may have been. Indeed, Bakhuizen notes that their survey led them to interpret the site as a center of habitation similar in nature to Olynthos or Kassope, as opposed to a purely military site (Bakhuizen 1992:315). The problem is perhaps a matter of semantics; what constitutes a fort and what separates a fort from a settlement? In order to evaluate Kallithea's standing, it is necessary to consider how fortified sites, both small and large, were conceptualized in ancient Greece.

In his discussion of Greek fortifications, Lawrence uses the built character of defensive country settlements to classify their remains in accordance with ancient terminology, either as a *stratopedon*[24] or *phrourion*[25] (Lawrence 1979:159). The former generally refers to an area of ground occupied by an offensive force while on campaign and temporary in nature, something Kallithea certainly is not. The latter term includes permanent strongholds that were intended to house a garrison. Although Lawrence treats such outposts in categories distinct from walled cities, *phrouria* may have shared many qualities with residential and commercial centers. We see such an example in Goritsa if we maintain the view that the site functioned primarily as a military outpost despite evidence of civic buildings. Indeed, while the primary purpose of such sites may be tactical, in many cases the occupants, particularly of larger centers, could not have been purely military (Lawrence 1979:175), blurring the distinction between tactical and domestic. Matters are further complicated in the sources by various meanings of the term *teixos*. It is most commonly used to denote a wall or collection of fortifications surrounding a settlement regardless of the site's nature (defensive location, polis, and so forth; Frederiksen 2011:20–34). *Teixos* is also used more broadly to refer to the entirety of a military site, such as a fort, but can further denote settlements that are also described as poleis (Frederiksen 2011:24). Nevertheless, ambiguities are relatively few as the context of associated passages often prevents misinterpretation (Frederiksen 2011:24). While one can deduce a distinction between the functions of sites mentioned in written sources, there is not always a matching clarity in archaeological evidence. For example, Lawrence devotes an entire chapter to forts at cities, highlighting that fort-like structures could be nested within a true polis (Lawrence 1979:126–143; Winter 1971:43). The status of a given site may also change over time. Oenoe, a walled settlement near the boundary of Attica, was classified as a *phrounion* earlier than 431 BCE, yet possessed many civilian households. By 411 BCE Thucydides calls it a *teixos*, suggesting the site may have been upgraded in function and status (Lawrence 1979:173; Thucydides 2.18.2, 8.98.2). We therefore argue that the ancient labels attached to architecturally constructed spaces do not necessarily have a direct connection with actual use and therefore cannot be viewed as decisive factors in the analyses.

> ...phrouria may have shared many qualities with residential and commercial centers.

Regarding Kallithea, archaeological evidence can be linked with epigraphic clues to suggest that the site was a full-fledged polis in the fourth century. An inscription from Delphi relates two boundary arbitrations between a certain Peuma and Melitaia and Chalai in one case and Pereia and Phylladon in another (Ager 1996:99–103; Pouilloux 1976:III.4.351). On the basis of topographic details provided in these arbitrations, Stählin concluded that Kallithea was likely ancient Peuma, a polis (Stählin 1906, 1914, 1938).

23. Winter (1971:45) associates Goritsa with Orminion after Meyer (1956). Cf. Bakhuizen (1970, 1992), who retains the modern name.

24. στρατόπεδον: a military encampment, not necessarily permanent.

25. φρούριον: a fort or citadel.

Figure 8. The sites of the Othrys system. Poleis indicated in blue, forts and towers in red.

This hypothesis is supported by Helly (2001:244) and Decourt (1990:87) and maintained in the Copenhagen Polis Centre's Inventory (Hansen 2004:715–716). The only other references to Peuma are a number of coins minted during the late fourth and early third centuries BCE (Classical Numismatics Group 2011; Nomos AG 2011; Rogers 1932:nos. 442–443). Unfortunately, the only piece of evidence found at Kallithea in favor of an identification of the site as Peuma is a single coin discovered during the surface survey. With the city and its nature now considered, we turn to the surrounding environment.

ANALYSIS OF THE OTHRYS SYSTEM

Kallithea is surrounded by numerous contemporary walled cities, the closest being Pharsalos to the northwest and New Halos to the east. It also lies in close proximity to a number of isolated towers and forts located along the northern edge of the Othrys Mountains (Figure 8)[26]. These sites were initially documented via pedestrian survey by a Dutch team working at the site of New Halos, 20 km east of Kallithea, and its environs since the late 1970s (Haagsma et al. 1993; Reinders 1988; Wieberdink 1990). However, the publication of these surveys consist as yet of preliminary reports and, as we pondered questions concerning Kallithea and its connection with the surrounding environment, we were faced with the need to re-examine these minor sites and their possible relationship to Kallithea.

Two spatial analyses were performed: viewshed and line of sight. Viewshed results produced maps with highlighted areas denoting visibility from an indicated point of origin. In all cases, a viewing position 6 m aboveground was assumed in order to simulate a lookout posted atop a tower. As an example, Figure 9a visualizes how a fort near Karatzadali is situated so deep in a valley that it has limited visual connection with the immediate surrounding landscape. Although the northern plains are technically visible, we can assume that this post was concerned with the valley pass. In the case of Myli, we see how this location had excellent visual connection with neighboring forts. This characteristic is further supported by line of sight analysis, which shows that an observer at Myli would be in direct visual connection with all other forts in the Othrys system (Figure 9b). Furthermore, the two towers at Myli are ideally located approximately equidistant between Kallithea and Halos. Other than Halos, all sites are under 10 km distant.

Viewshed analyses of each location demonstrate that with the exception of the towers at Myli, the forts of the Othrys system are narrowly focused on their surrounding locations. They monitor the various passes of the Othrys Mountains against incursions but are not designed to bar access to the south. This tactic is clear when Myli is considered. Two small towers isolated on the plains could not have hindered any sizable force. Guarding the lowlands and main routes

26. These sites, from west to east, are Tsurnati Vrisi, Neochoraki, Myli, Karatzadali, Ayios Nikolaos, and Vrinen

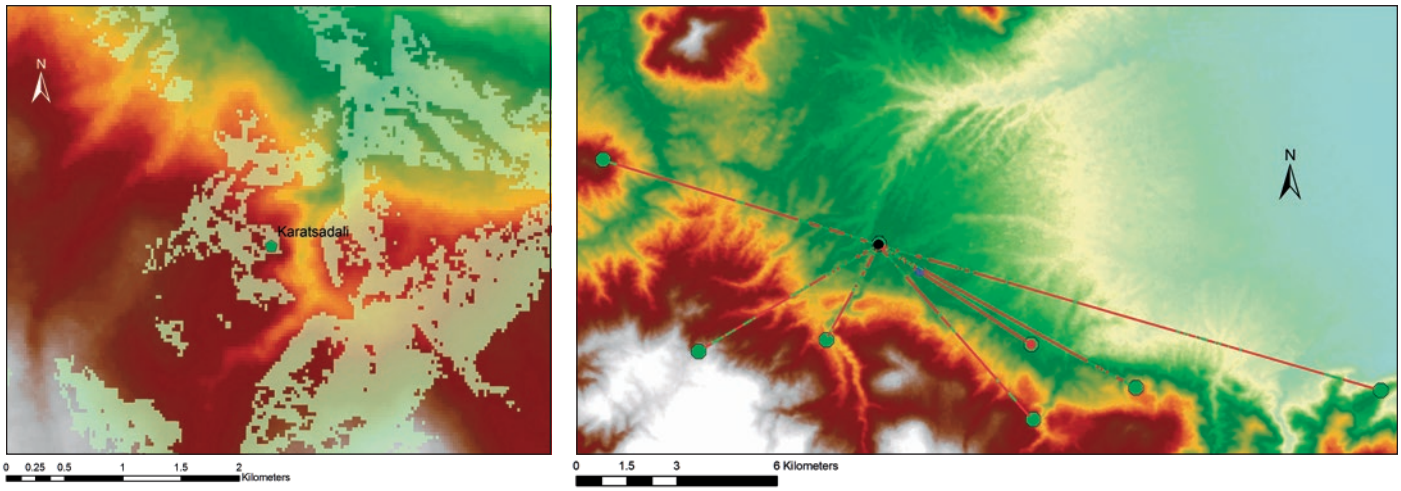


Figure 9. Left: Viewshed analysis of the Karatzadali Mountain fort. Note visual connection with the surrounding mountainous areas. Right: Line-of-sight analysis of Myli.

required much larger settlements, such as Kallithea and Halos, both of which are located in the middle of major passes that allowed access into Achaia Phthiotis from the south. Given the region's importance during the political turbulence of the late fourth century, it is likely that Demetrius fortified the region by constructing both large settlements and minor forts. We conclude that not only are the Othrys forts a complex defensive system constructed in the closing years of the fourth century but also that the system was constructed with the tactical innovations of the period in mind. The system included two towers at Myli to act as a communication linchpin of the entire system[27]. Any troubles identified in the mountain passes would be signaled to Myli and relayed to the larger centres of Halos and Kallithea. We are therefore presented with a network enabling communication beyond simple, prearranged messages to be conveyed over the length of the entire system.

However, could messages transmitted with multiple torches be intelligible over long distances? Forbes (1958:176) and Merriam (1890:14) suggest that 10 km is the maximum distance such technologies could serve. We believe that the solution for this problem of distance lay in one of the most interesting aspects of the towers at Myli—their arrangement. These towers are situated approximately 100 m apart, separated perpendicularly to the axis linking Kallithea and Halos. They would therefore appear as distinct entities from observation points at either poleis and could utilize the methods described by Aeneas and Polybius to pass along messages, each tower acting in tandem to ensure maximum separation of torches to ensure accurate conveyance of signals.

CONCLUSIONS

Examined individually, Kallithea, Halos, and other poleis of Achaia Phthiotis could be viewed as Greek city-states, operating relatively independently and each in possession of its own territory and—to a certain extent—diplomatic aims despite co-existing under the umbrella of a regional collective[28]. Given its conspicuous defensive architecture, Kallithea could easily be classified as a powerful polis whose strategic location atop a highly defensible hill allowed it to dominate the surrounding landscape, making it a key player in regional politics. However, the concept of total independence as a necessity for polis status has been challenged on numerous fronts (Morgan 2003; Vlassopoulos 2007). In Achaia Phthiotis, an examination of the landscape with its associated built environment helps us form a better understanding of how and on what level cities in this region interacted in the late fourth century BCE. The Othrys network in particular suggests that Kallithea and Halos acted cooperatively (or were compelled to do so) in the pursuit of defend-

27. Cf. Wieberdink (1990:50), who concluded that Agios Nikolaos did not have a defensive function and must have been the central point of communications.

28. Greek *ethnos*, ἔθνος, a term which can simply mean a group of people. Achaia Phthiotis is known to have been an *ethnos* that was politically active and held two seats in the Delphic Amphyctiony. The role of *ethne* in ancient Greek society and their manifestation in terms of policy and social organization are complex matters that are unfortunately beyond the scope of this study. The nuances of *ethne* and our understanding of their operation in Thessaly and Achaia Phthiotis necessitate further research from a broad range of perspectives: from the archaeological perspective, from the historical perspective, and from the perspective of landscape. We are presently investigating Kallithea's membership in the *ethnos* of Achaia Phthiotis and will be presenting our findings in May 2015 at a symposium concerning Greek ethnos states.

ing a broader region against military incursions from the south. GIS toolsets enable us to accurately test visual connections between these sites and propose that it was indeed a unified system suitable for the tactical realities of the late fourth century BCE. Further analyses of the region via GIS may reveal visual connections to other nearby sites, such as Pharsalos, a known key player in Thessalian politics. While extremely powerful in assessing landscapes (Kvamme 2003), remote GIS methodologies often require support via ground investigation (Parcak 2009:4). Regarding signaling methods, we acknowledge the arguments presented here rely on assumptions concerning distances of visibility. Future experimental archaeology will develop our operational knowledge of the defensive and signaling techniques described by ancient authors. Further exploration of the landscape may also lead to these towers being considered in alternative methods, such as foci of economic control and exploitation of the landscape (Morris and Papadopoulos 2005). Ultimately, it is anticipated that a broader understanding of the ancient landscape of Achaia Phthiotis will lead to a clearer picture of local development of urban centers and the techniques and methods employed in the defense of their territory, leading to further elucidation of the broader socio-economic milieu of fourth-century BCE Thessaly.

REFERENCES

Ager, Sheila. 1996. *Interstate Arbitrations in the Greek World, 337–90 BC*. Berkeley: University of California Press.

Bakhuizen, Simon C. 1970. *Salganeus and the Fortifications on Its Mountains*. Groningen: Wolters-Noordhoff.

———. 1992. *A Greek City of the Fourth Century BC*. Rome: "L'Erma" di Bretschneider.

Chandler, Lilian. 1926. The North-West Frontier of Attica. *The Journal of Hellenic Studies* 46.1:1–21.

Chapman, Henry. 2006. *Landscape Archaeology and GIS*. Stroud: Tempus.

Chykerda, Christopher. 2010. Kallithea to Halos: The Defensive Network of the North Othrys Mountains." M.A. thesis, University of Alberta.

Classical Numismatic Group, Inc. 2011. *The BCD Collection of the Coinage of Thessaly*. Triton XV. Lancaster, Pa.: Classical Numismatic Group.

De Boer, Arjan G., Walter N.H. Laan, Wouter Waldus, and Wilko K. van Zijverden. 2008. LIDAR-Based Surface Height Measurements: Applications in Archaeology. In *Beyond Illustration: 2D and 3D Digital Technologies as Tools for Discovery in Archaeology*, edited by Bernard Frischer and Anastasia Dakouri-Hild, pp. 76–84. Oxford: Archaeopress.

Decourt, Jean-Claude. 1990. *La vallée de l'Enipeus en Thessalie: Études de topographie et de géographie antique*. *BCH* Supplement 21. Paris.

Diels, Hermann. 1914. *Antike Technik*. Leipzig: Teubner.

Evans, Thomas L., and Patrick Daly. 2006. *Digital Archaeology: Bridging Method and Theory*. London: Routledge.

Fields, Nic. 2006. *Ancient Greek Fortifications*. Oxford: Osprey Publishing.

Forbes, Robert J. 1958. *Studies in Ancient Technology. Volume VI*. Leiden: E. J. Brill.

Fossey, John M. 1986. *The Ancient Topography of Eastern Phokis*. Amsterdam: J. C. Gieben.

———. 1988. *Topography and Population of Ancient Boiotia*. Chicago: Ares Publishers.

———. 1990. *Papers in Boiotian Topography and History*. Amsterdam: J. C. Gieben.

———. 1992. The Development of Some Defensive Networks in Eastern Central Greece during the Classical Period. In *Fortificationes Antiquae*, edited by Symphorien van de Maele and John M. Fossey, pp. 109–132. Amsterdam: J. C. Gieben.

Frederiksen, Rune. 2011. *Greek City Walls of the Archaic Period*. Oxford: Oxford University Press.

Frischer, Bernard. 2008. From Digital Illustration to Digital Heuristics. In *Beyond Illustration: 2D and 3D Digital Technologies as Tools for Discovery in Archaeology*, edited by Bernard Frischer and Anastasia Dakouri-Hild, pp. v–xxiv. Oxford: Archaeopress.

Haagsma, Berndt Jan, Zoï Malakassioti, Vasso Rondini, and Reinder Reinders. 1993. Between Karatsadagli and Baklali. *Pharos* 1:147–167.

Hansen, Mogens. 2004. *An Inventory of Archaic and Classical Poleis*. Oxford: Oxford University Press.

Helly, Bruno. 2001. Un décret fédéral des Thessaliens méconnu dans une cité d'Achaïe Phthiotide. *Bulletin de correspondance hellénique* 125:239–287.

Kvamme, Ken. 2003. Geophysical Surveys as Landscape Archaeology. *American Antiquity* 68.3: 435–457.

Lawrence, Arnold. W. 1979. *Greek Aims in Fortification*. Oxford: Clarendon Press.

Lieberwirth, Undine. 2008. Voxel-based 3D GIS: Modelling and Analysis of Archaeological Stratigraphy. In *Beyond Illustration: 2D and 3D Digital Technologies as Tools for Discovery in Archaeology*, edited by Bernard Frischer and Anastasia Dakouri-Hild, pp. 85–94. Oxford: Archaeopress.

Llobera, Marcos. 2006. What You See Is What You Get? Visualscapes, Visual Genesis and Hierarchy. In *Digital Archaeology Bridging Method and Theory*, edited by Thomas L. Evans and Patrick Daly, pp. 148–168. New York: Routledge.

———. 2007. Reconstructing Visual Landscapes. *World Archaeology* 39.1:51–69.

Lock, Gary, and Trevor Harris. 1992. Visualizing Spatial Data: The Importance of Geographic Information Sytems. In *Archaeology and the Information Age*, edited by Paul Reilly and Sebastian Rahtz, pp. 81–96. New York: Routledge.

Marsden, Eric W. 1969. *Greek and Roman Artillery Historical Development*. Oxford: At the Clarendon Press.

Merriam, Augustus C. 1890. *Telegraphing among the Ancients*. Cambridge: Cambridge University Press.

Meyer, Ernst. 1956. Goritsa. *Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung* 71:98–100.

Morgan, Catherine. 2003. *Early Greek States beyond the Polis*. New York: Routledge.

Morris, Sarah P. 2001. The Towers of Ancient Leukas: Results of a Topographic Survey, 1991–1992. *Hesperia* 70.3:285–347.

Morris, Sarah P., and John K. Papadopoulos. 2005. Greek Towers and Slaves: An Archaeology of Exploitation. *American Journal of Archaeology* 109.2:155–225.

Munn, Mark. 1993. *The Defense of Attica*. Berkeley: University of California Press.

Nomos AG. 2011. *Coins of Thessaly: The BCD Collection. Auction 4, Zürich, 20 May 2011*. Nomos Auction 4. Zürich: Nomos AG.

Nossov, Konstantin. 2009. *Greek Fortifications of Asia Minor, 500–130 BC*. Oxford: Osprey Publishing.

Ober, Josiah. 1983. Two Ancient Watchtowers above Aigosthena in the Northern Megarid. *American Journal of Archaeology* 87.3:387–392.

———. 1985. *Fortress Attica: Defense of the Athenian Land Frontier, 404–322 BC*. Leiden: E J Brill.

———. 1987. Early Artillery Towers: Messenia, Boiotia, Attica, Megarid. *American Journal of Archaeology* 91.4:569–604.

———. 1992. Towards a Typology of Greek Artillery Towers: The First and Second Generations. In *Fortificationes Antiquae*, edited by Symphorien van de Maele and John M. Fossey, pp. 147–169. Amsterdam: J. C. Gieben.

Parcak, Sarah H. 2009. *Satellite Remote Sensing for Archaeology*. New York: Routledge.

Pouilloux, Jean. 1976. *Fouilles de Delphes III: Les inscriptions de la terrasse du temple et de la région nord du sanctuaire, Nos 351 à 516*. Paris: E. de Boccard.

Reilly, Paul, and Sebastian Rahtz. 1992. Introduction: Archaeology and the Information Age. In *Archaeology and the Information Age*, edited by Paul Reilly and Sebastian Rahtz, pp. 1–28. New York: Routledge.

Reinders, H. Reinder. 1988. *New Halos: A Hellenistic Town in Thessalia, Greece*. Utrecht: HES.

Rogers, Edgar. 1932. *The Copper Coinage of Thessaly*. London: Spink and Son.

Savage, Stephen H. 1990. GIS in Archaeological Research. In *Interpreting Space: GIS and Archaeology*, edited by Kathleen M.S. Allen, Stanton W. Green, and Ezra B.W. Zubrow, pp. 22–32. Bristol: Taylor & Francis.

Scranton, Robert. 1941. *Greek Walls*. Cambridge: Harvard University Press.

Spencer, Nigel. 1995. Multi-dimensional Group Definition in the Landscape of Rural Greece. In *Time, Tradition, and Society in Greek Archaeology*, edited by Nigel Spencer, pp. 28–42. London: Routledge, 1995.

Sprawski, Slawomir. 1999. *Jason of Pherae*. Krakow: Jagiellonian University Press.

Stählin, Friedrich. 1906. Zur Landeskunde der Pthiotis. *Mitteilungen des Deutschen Archäeologischen Instituts, Athenische Abteilung* 31:1–37.

———. 1914. Die Grenzen von Melitaia, Pereia, Peumata and Chalai. *Mitteilungen des Deutschen Archäeologischen Instituts, Athenische Abteilung* 39:83–103.

———. 1938. Peuma. In *Paulys Real-Enzyclopädie der Classischen Altertumswissenschaft*, edited by Georg Wissowa and Wilhelm von Kroll, Vol. 19.2 "Petros–Philon," pp. 1399–1405. Stuttgart: J B Metzlersche Verlagsbuchhandlung.

Stamatopoulou, Maria. 2012. Thessaly (Prehistoric to Roman). *Archaeological Reports* 58:75–95.

Tomlinson, R. 1961. Emplekton Masonry and "Greek Structura." *The Journal of Hellenic Studies* 81:133–140.

Tziafalias, Athanasios, and Margriet J. Haagsma, Sophia Karapanou, and Sean Gouglas. 2006a. Scratching the Surface: A Preliminary Report on the 2004 and 2005 Seasons from the Urban Survey Project at Kastro Kallithea ("Peuma"), Thessaly. Part 1: Introduction and Architecture. *Mouseion* 6.2: 91–126.

———. 2006b. The Kastro of Kallithea in Its Historical Context. In 1 Διέθνες Συνέδριο Ιστορίας & Πολιτισμού της Θεσσαλίας. Larisa. 9–11, Nov. 2006, edited by Λίλα Π. Γλεγλέ, pp. 224–232. Θεσσαλονίκη: Περιφέρεια Θεσσαλίας Εκδόσεις Αλέξανδρος.

———. 2009. Preliminary Results of the Urban Survey Project at Kastro Kallithea, Achaia Phthiotis. In Αρχαιολογικό Έργο Θεσσαλίας και Στερεάς Ελλάδας *2 (2006)*. Πρακτικά Επιστημονικής Συνάντησης, Βόλος *16.3–19.3.2006,* edited by Αλέξανδρος Μαζαράκης Αινιάν, Vol. I: Θεσσαλία, pp. 217–244. Βόλος: Πανεπιστημίου Θεσσαλίας and Υπουργείο Πολιτισμού.

Vlassopoulos, Kostas. 2007. *Unthinking the Greek Polis: Ancient Greek History beyond Eurocentrism*. Cambridge: Cambridge University Press.

Westlake, Henry D. 1935. *Thessaly in the Fourth Century BC*. London: Methuen Limited.

Whitehead, David. 2002. *Aeneias the Tactician, How To Survive Under Siege: A Historical Commentary, with Translation and Introduction*. London: Bristol Classical Press.

Wieberdink, Ger. 1990. A Hellenistic Fortification System in the Othrys Mountains (Achaia Phthiotis). *Newsletter of the Netherlands Institute at Athens* 3:47–76.

Winter, Frederick. 1963. The Chronology of the Euryalos Fortress at Syracuse. *American Journal of Archaeology* 67.4:363–387.

———. 1971. *Greek Fortifications*. Toronto: University of Toronto Press.

The Tin Problem Reconsidered: Recent Archaeometallurgical Research on the Anatolian Plateau

Joseph W. Lehner[1]

THE EARLIEST INNOVATION and adoption of bronze technology in the late fourth and early third millennium BC had a strong impact on societies across Eurasia. Bronze is an alloy of copper and tin that has improved performance characteristics compared with pure copper, and it appears golden in color. This latter characteristic helped position bronze as a status marker, which is well demonstrated by the consumption of bronze and gold objects together in elite burials and hoards across the region during this time period, including those at Troy and Alacahöyük in Anatolia. Just as consumption of the metal allowed some members of society to display differential status, the production and exchange networks associated with the effectively integrated regional centers with resource areas.

Extensive scholarship has been devoted to the so-called "tin problem" in pursuit of the sources of tin that supplied the first thousand years of the earliest bronzes in Eurasia. Archaeologists, geologists, and historians have all variously sought to identify regions of production and the trade routes by which the metal was transported across the region. The earliest bronzes are generally known from the Near East, Anatolia, and the Balkans; however, in these areas of bronze consumption, there is a significant lack of prominent tin resources. Large deposits of tin are much scarcer than copper and are distributed in an irregular pattern across Eurasia, wherein the largest deposits are found in western/central Europe and central Asia. Multiple new discoveries of tin ores in Iran and western central Asia have been identified (Baroffka et al. 2002; Nezafati et al. 2011; Stöllner et al. 2011); however, utilization of these ores during the third millennium BC must still be verified. Dating several centuries later than the first tin bronzes, late third millennium BC Sumerian texts position the origin of tin somewhere to the east of Mesopotamia. This would make the highlands of Iran and central Asia potential candidates for the supply of tin to Mesopotamia, despite the fact that these sources are thousands of miles away. More recently, a renewed interest in the earliest metallurgy has given focus to localized processes of innovation and adoption, stressing that those small, expendable mineralizations of copper and tin would have been sufficient in the past. These small occurrences, currently known to only a couple

1. Cotsen Institute of Archaeology.

Figure 1. View of Erciyes Dağ from the early second millennium BC lower town of Kültepe-Kanesh.

of locations in Turkey and the Balkans, may actually provide the crucial data to help determine the initial sources of tin that the earliest bronze craft specialists used in antiquity. Initial investigations for tin in Anatolia, precisely in the region of the earliest tin bronzes in the region, yielded an important discovery in the Bolkardağ region of the central Taurus Mountains in southeastern Turkey. In this region, small amounts of tin were found associated with mining galleries and a residential processing site called Göltepe, complete with a suite of tin-smelting crucibles and processed ores, all of which dated to the third millennium BC (Yener et al. 1989; Yener and Vandiver 1993). The discovery prompted heated debate because the mines appeared to be totally expended, yielding only small amounts of low-quality tin ore. Furthermore, early tin metallurgy was thought to utilize alluvial placer ores and not hard-rock underground mined ores. The mining operations were then alternatively interpreted to be for gold extraction (Muhly 1993); however, this interpretation is based only on trace amounts of gold found in the vicinity.

Recent geological discoveries in the volcanic zone north of the Bolkardağ in modern Kayseri Province have yielded previously undescribed polymetallic ores in soft andesitic host rock, including oxides of iron, arsenic, and tin (Yazgan 2015). At first the discoveries went unnoticed by archaeologists, but in 2013 a team led by Fikri Kulakoğlu (Ankara University) and Aslıhan Yener (Koç University) identified a vast industrial landscape with remains of Early Bronze Age production sites near scores of mines associated with the deposits (Yener 2014, Yalçın and Özbal 2009). This renewed interest in the earliest metallurgy has given focus to evolutionary processes of innovation and adoption, stressing that small mineralizations of copper and tin would have been sufficient in the past.

In this short article, I would like to discuss this historical problem in relation to our new fieldwork in central Anatolia. The Anatolian Highland Metallurgy Group, consisting of an international group of archaeologists, geologists, historians, and archaeometallurgists, seeks to study the newly discovered occurrence of tin at Hisarcık. These deposits are also located within 30 km of Kültepe-Kanesh, one of the largest and most prominent Bronze Age regional centers in Anatolia (Figure 1). This landscape of industrial activity, complete with scores of mines and nearby processing sites, promises to upend some of our sim-

plistic assumptions about the nature of not only metal technologies but also the organization of production and trade during the formative periods of initial state formation in the region.

THE TIN PROBLEM AND MODELS OF BRONZE ADOPTION

Before the adoption of copper tin alloys in the Near East, numerous and diverse social constellations utilized specialized technologies and local resources to produce unalloyed copper, as well as arsenical copper, to make a wide range of objects (Lehner and Yener 2014). Arsenical copper has a long history of production, trade, and consumption in Anatolia, and its origins extend far into the fifth to the fourth millennium BC. Arsenical copper is typically characterized by a large range of arsenic content (0.5–7 percent, oftentimes more), which suggests that arsenic content was difficult to control. Furthermore, there are multiple possible trajectories to produce arsenical copper. Simplistically, arsenical copper could be produced intentionally by co-smelting or mixed-smelting copper and arsenic ores together or unintentionally by smelting arsenic-rich copper ores, thereby leading to copper metal rich in impurities of arsenic (Lechtman 1996). Data from analyses of slags and production debris associated with arsenical copper production at Early Bronze Age (EBA) Arisman in Iran, however, have demonstrated that intentional intermediate technological processes involved in the industrial production of speiss (an intermediate product composed of iron arsenide) existed (Rehren, Boscher, and Pernicka 2012). This material was later added as a mixed-smelting agent or in molten copper to produce arsenical copper intentionally.

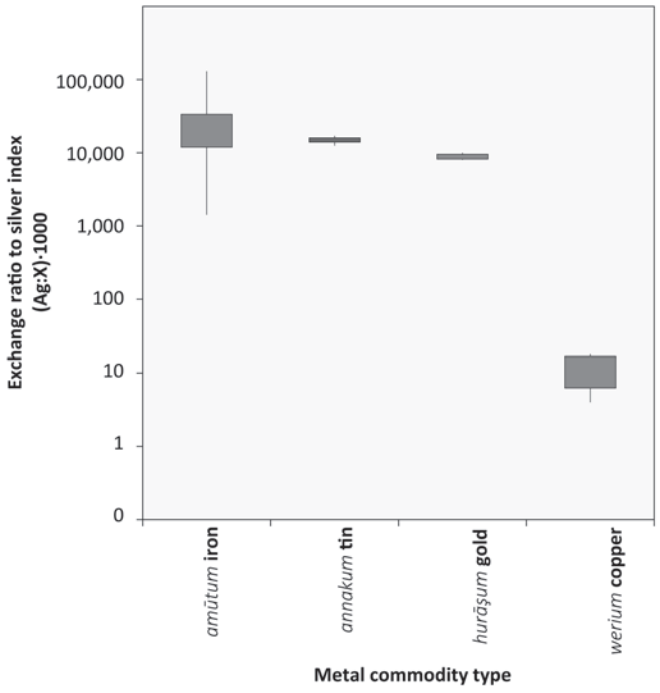


Figure 2. Quartile distributions of exchange ratios of silver to other metal commodities according to the early second millennium texts predominantly from Kültepe (data from Dercksen 1996, 2005).

It is traditionally thought that bronze alloys gradually replaced earlier copper technologies, like arsenical copper, because bronze metal has marginally better performance characteristics (Northover 1989), and it is easier to control alloying (Pernicka 1990). UCLA Archaeology alumnus ('14) Brett Kaufman has also provided convincing evidence that bronze production is more fuel efficient than arsenical copper (Kaufman and Scott 2014). Yet the replacement of arsenical copper by bronze is made somewhat problematic because tin bronzes were unevenly adopted or in some places never adopted, such as central Iran, which suggests that the decision rationale associated with adoption also differed. Additionally, in many regions of the Near East arsenical copper coexisted with bronze until as late as the Iron Age. The alloys differ the most noticeably in their color, where mid- to high-arsenical coppers appear silvery, while tin bronzes generally appear golden. Whereas production techniques of these two copper alloys share important technologies, they actually represent two distinct metallurgical traditions, and consumers along all parts of the production change would have recognized these differences. This is made most clear from burial traditions in central Anatolia, where tin bronzes were consumed alongside gold and silver status objects. In addition to the material and thermodynamic properties briefly described above, bronze production was therefore influenced by determinative social dimensions. This is also demonstrated in early second millennium economic texts from Anatolia, which show comparably similar exchange ratios of silver to tin and gold (Figure 2). These equitable values placed exotic tin and local gold together as fundamental commodities in long-distance exchange between Anatolia and northern Mesopotamia.

While the second-millennium BC texts attest to the mass importation of pure tin metal, we cannot assume the same was true for the third millennium.

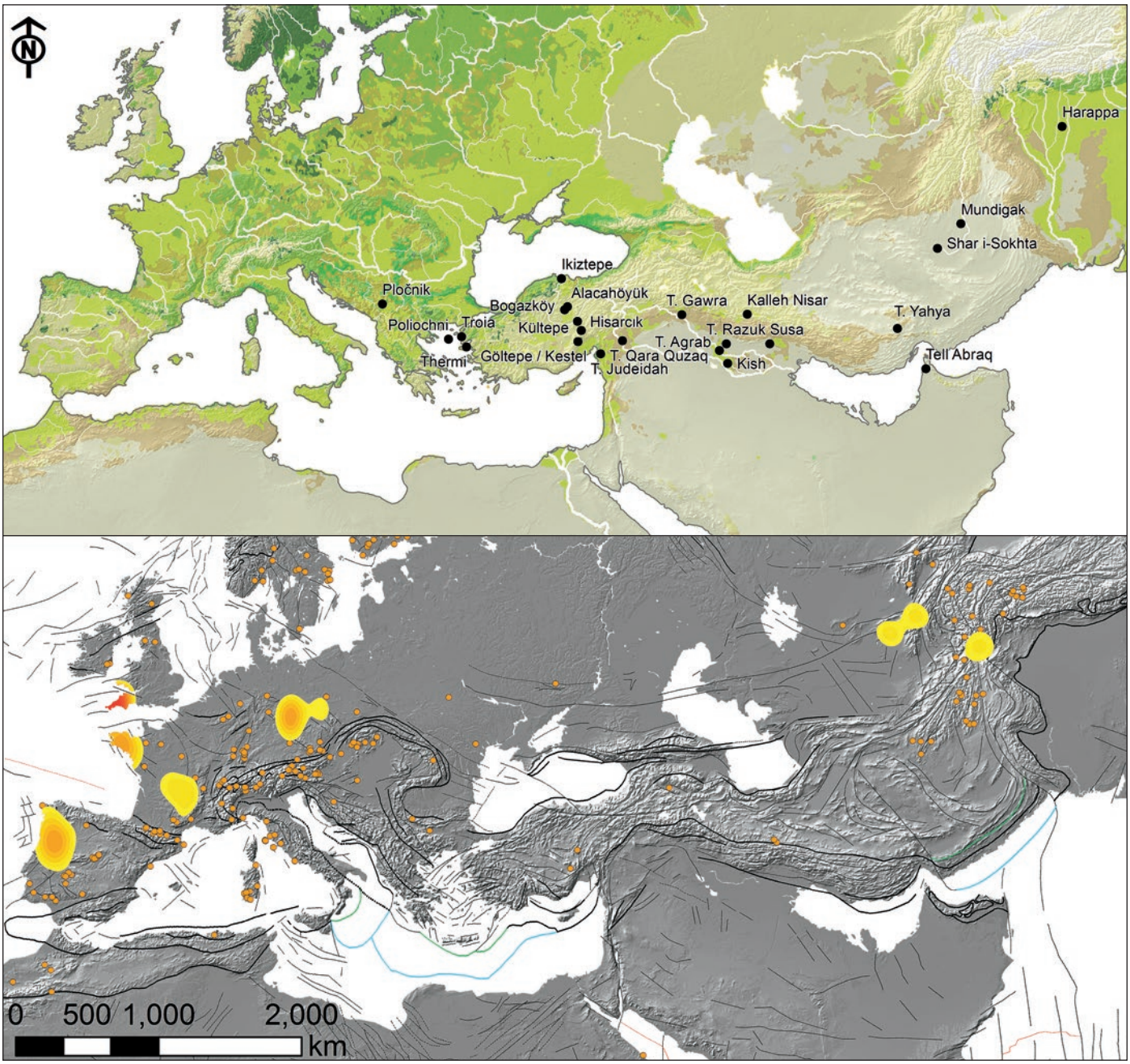


Figure 3. The distribution of known tin sources/occurrences and the earliest sites where past communities consumed tin metal across the Near East and Central Asia demonstrates a major geographic disparity. The earliest tin bronzes occur along the piedmont of northern Syro-Mesopotamia and western Iran (above). The largest tin-bearing regions (in gradients) occur in Europe and Central Asia, while smaller occurrences (points) are irregularly distributed throughout the region and tend to be more proximate to larger tin sources (below).

The tin problem has been discussed for nearly 140 years, perhaps first in 1876 by K. E. von Baer in an article titled "Von wo das Zinn zu den ganz alten Bronzen gekommen sein mag" (Pernicka 1990: 65). Figure 3 shows the distribution of the earliest sites associated with tin bronze and known tin resources in the Old World from Europe to central Asia. Presently there are two distinct, though related, models for understanding the adoption of tin use during the Bronze Age in the Near East. Extensively described by James Muhly (1985), the standard model hypothesizes that the irregular distribution and the size of copper and tin resources across Eurasia, as well as the nature of bronze technologies, determined the geographic scope of the metals trade. While small occurrences of tin are known in Turkey, this model predicts that these occurrences were economically insufficient or even unrecognizable to past communities (Pernicka et al. 1992). These geographic and technological parameters alone have led proponents of this

model to hypothesize that tin was traded, however indirectly, via many segments and long distances from central Asia into regional copper exchange systems to produce tin bronze (Muhly 1973). In this model, the demand for copper and tin in the production and consumption of bronze therefore had far-reaching effects across Eurasia and helped economically integrate distinct cultural geographies through varied networks of communication and exchange.

This model is supported empirically by evidence that demonstrates indirect interaction with central Asian polities, including the trade and processing of lapis lazuli, which is primarily from northeastern Afghanistan and northern Pakistan, and is found concurrently with many of the earliest bronzes in the Near East, including the regional centers of Ebla, Kültepe, and Troy on the Aegean coast (Baroffka et al. 2002). Sources of gold and nephrite are also known to central Asia, which gives further credence to its use in the third millennium BC. Late third millennium texts in Syro-Mesopotamia and second-millennium texts in Anatolia and Syro-Mesopotamia also refer to an eastern origin of tin (Akk. *annakum/annuku*, logographically AN.NA) by way of Susa in southwestern Iran (Larsen 1987). Additionally, lead isotope ratios of early bronzes from northwestern Anatolia and the Persian Gulf are highly variable, many samples of which are not compatible with eastern European, Aegean, and Anatolian sources of copper. This observation has led some authors to conclude that some copper and tin metals were likely imported from outside source(s), with some tin alloyed together with local copper (Pernicka et al. 2003). These data are consistent with an external source of tin but cannot alone logically falsify the possible local sources of tin.

> Demand for copper and tin in the production and consumption of bronze had far-reaching effects across Eurasia.

An alternative model suggests that local sources of tin better explain the origin of bronze metallurgy in the Near East. Proponents of this model question how the earliest bronzes, currently dating to the northern periphery of Mesopotamia, could have developed without local parallel innovations in early tin metallurgy (Yener 2000). This supplants a logical and empirical challenge associated with the standard model. According to the alternative model, third millennium BC communities intentionally used local tin occurrences in the production of the earliest bronze. This model is supported primarily by the existence of third millennium BC sites in close association with some of these occurrences. Aslıhan Yener and her colleagues first discovered small quantities of placer tin in the Bolkardağ of the central Taurus in the 1980s, and later investigations at the nearby third millennium BC Kestel mine recovered minor amounts of cassiterite (a tin oxide) associated with iron oxides (Yener and Özbal 1987; Yener et al. 1989). The specialized metal processing site of Göltepe, located in the vicinity of Kestel and contemporary with the workings, has evidence of tin-enriched hematite powders stored in vessels and crucible residues, which are consistent with tin processing. Further evidence from Pločnik, Serbia, where archaeologists have identified copper tin alloy objects dating to the mid-fifth millennium, suggests that these alloys were produced from the direct reduction of tin-bearing polymetallic ores (Radivojević et al. 2013). Comparable with the origins of arsenical copper, the development of tin bronze may have evolved from a co-smelting or mixed-ore smelting process, rather than the direct reduction of pure tin ores to produce tin metal.

From the perspective of cultural evolution, we are still missing key elements in the early adoption of tin bronze to confidently describe and explain the evolution of tin and bronze technological lineages. If the evolution of lineages of tin extraction is fundamentally related to the production of bronze, then we would expect the earliest bronzes to occur in the vicinity of tin sources. However if this is not the case, where the evolution of bronze and tin technologies are distinct, then we must examine the nature of knowledge transmission and resource networks involved in at least these two independent technological lineages. If bronze technologies evolved and were demanded in a social environment located in the Near Eastern geography without an initial local tin extraction knowledge, then there must be a reasonable explanation for the production of tin metal in central Asia prior to the adoption of bronze in that region. Realistically, multiple sources of tin were probably used over

time; however, by the second millennium BC, our data dramatically improve concerning the tin trade with clear, although not necessarily exclusive, associations with eastern sources in Iran and Central Asia.

THE DISTRIBUTION OF EARLIEST BRONZES IN THE NEAR EAST

The earliest bronze alloys occur in the Near East during the late fourth and early third millennia BC (generally the Late Chalcolithic and EB I), whereas the widespread consumption of bronze can be dated to the mid-third millennium BC and extends from the Persian Gulf to the Aegean. Examples of copper tin alloys across Mesopotamia include several objects dating to the early third millennium BC from Tepe Gawra, the Y cemetery at Kish, Tell Razuk, and Tell Agrab (Hauptmann and Pernicka 2004). Several more examples from a burial dating to the EB I at Tell Qara Quzaq along the Middle Euphrates show appreciable evidence for the use of copper tin alloys (Montero Fenollós 2000). Along the northeastern bend of the Mediterranean, sites in Cilicia, the Amuq Valley, and the northern piedmont of the Taurus all attest to an early third millennium BC adoption of tin bronzes.

Among the earliest examples of copper tin alloys in the Near East are a group of ornaments from Kalleh Nisar in northwestern Iran with tin contents ranging from 3.5 percent to 14.8 percent; these are considered to be purposefully alloyed (Fleming et al. 2005). These ornaments come from a burial excavated by Louis Vanden Berghe in the 1960s and date to the EB I in Luristan, which is roughly contemporary with the Jamdet Nasr to Early Dynastic I (ED I) periods in Mesopotamia. Even further examples of early third millennium bronzes have been found in sites in Armenia and Dagestan.

Empirical evidence for copper tin alloys in central and eastern Anatolia appears to date somewhat later. Several hundred analyses of weapons, tools, and ornaments dating to the Late Chalcolithic and EB I periods at Ikiztepe demonstrate the prolific consumption of arsenical copper and a near-conspicuous absence of copper tin alloys, which parallels patterns observed in most EBA contexts in Transcaucasia (Özbal et al. 2008). Analysis of Late Chalcolithic and EB I weapons and ornaments at the site of Arslantepe shows a somewhat different pattern of copper alloy production and consumption also without the use of tin (Hauptmann et al. 2002). Here we find the production of copper silver alloys and arsenical copper with significant lead, nickel, and antimony contents. The well-known metal assemblages associated with the Early Bronze Age

The development of tin bronze may have evolved from a co-smelting or mixed-ore smelting process, rather than the direct reduction of pure tin ores to produce tin metal.

burials at Alacahöyük provide some of the earliest examples of a well-developed tin bronze tradition in central Anatolia. Several so-called standards and other copper-based objects were first analyzed by Ufuk Esin in the 1960s. She was able to show that cast tin bronzes were consumed alongside with arsenical copper (Esin 1969). Recent surface analyses of several objects confirm the presence of tin bronzes, however, also revealing a remarkable diversity in metal compositions, including alloys of copper silver gold, copper silver, leaded tin bronze, and one example of an antimonial tin bronze figurine (Yalçın 2012). Stylistically and contextually similar objects from the nearby sites of Horoztepe, Mahmatlar, Kalınkaya, and Resuloğlu all attest to a similar profile of metal consumption.

Evidence for the adoption of tin bronze is comparably better understood in northwest Anatolia, where analyses of materials from the Troad and across the Aegean demonstrate the consumption of tin bronze by the mid-third millennium BC. Data from the Troad, primarily from the sites of Troy and Beşiktepe, show that bronze consumption is confirmed in the Troy I period during the first half of the third millennium BC, and with a rapid adoption in use by the Troy II period (Pernicka et al. 1984). A similar pattern can be observed in the Aegean at sites like Poliochni on Lemnos (Pernicka et al. 1990), Thermi on Lesbos (Begemann et al. 1995), and Kastri on Syros (Stos-Gale et al. 1984).

Lead isotope analysis of many mid-third millennium BC copper tin alloys roughly contemporary with Troy I and II from northwestern Anatolia and the Aegean demonstrate that the copper in the bronze is distinct from many of the copper ores from these regions and is characterized as highly radiogenic "old" lead. This lead could not have derived from the tin,

Figure 4. View of Erciyes Dagfrom the mound of Kültepe-Kanesh. Taken in early summer.

Figure 5. View of a large crystalline sample from Hisarcık. The large gray crystals are iron oxides (hematite) hosted on andesite visible in the lower left of the image. Tin oxide (cassiterite) is interspersed within and around the hematite and is visible as a bright red mineral here.

because alluvial tin often has no trace lead. Therefore the trace lead from the bronzes likely derives from the copper. This radiogenic lead probably comes from ores of at least Precambrian age, the rocks of which are almost entirely unknown to the Aegean, Anatolia, and the Near East more generally. This influx of imported copper is observed elsewhere in the Aegean and from sites as far as in Oman and the United Arab Emirates, which coincides with the rise of tin bronzes in the region. Lead isotope analysis of arsenical copper objects shows excellent consistency with local copper ores, demonstrating that the production of this metal was provisioned by local resources. This combined evidence suggests that the earliest bronzes of northwestern Anatolia and the Aegean regions were likely imported and not locally produced.

What is at once noticeable in the distribution of early tin bronzes is the correlation of the chronological and regional proximity of adoption. Current evidence suggests that Syro-Mesopotamia, central and eastern Anatolia, and highland western Iran all adopted bronze technology around the same time in the early third millennium BC. Combined chronological and lead isotopic data suggest that the consumption of bronze dates a few centuries later in northwestern Anatolia and the Aegean and that the metal was

imported through long-distance exchange, which is more consistent with a diffusion model of adoption. Given the apparent rapidity of the transmission of bronze technology, we must assume that social groups were highly connected to allow relatively rapid transmission rates.

THE TIN PROBLEM RECONSIDERED: THE HISARCIK TIN DEPOSITS

The recent discovery of central Anatolian tin deposits in the vicinity of Kültepe has ushered in a reinvigorated research program regarding the tin problem. This new deposit of tin, located near the town of Hisarcık along the hilly flanks of the near-4,000-m stratovolcano Erciyes Dağ (Figure 4), is also associated with scores of ancient mining operations. The tin deposits were first discovered by the MTA (General Directorate of Mineral Research and Exploration), specifically by geologist Evren Yazgan (Yazgan 2015). Initial analyses of select samples from an outcropping demonstrated that cassiterite was associated with iron oxides and a rare iron-arsenic oxide mineral called yazganite (Figures 5 and 6). These deposits formed in a subsurface volcanic environment and were deposited on the soft andesitic walls of near-surface fumaroles as hot gases cooled when they escaped into air. As such, they differ substantially from tin ores more common to Europe and central Asia, which primarily derive from hard granitic lithologies.

During the 2013 field season, we were able to conduct a brief reconnaissance of the region to access many mineral outcroppings and ancient mines. We were also equipped with a portable x-ray fluorescence spectrometer, which was capable of calculating semiquantitative compositions of the ores, allowing us to immediately characterize them (Figure 7). Initial results, which are currently in press with *Antiquity*, show that the ores have up to 20 wt. percent tin oxide, together with significant oxides of iron and arsenic and traces of manganese and antimony (Yener et al. 2014).

The concurrence of tin and iron would have presented significant challenges to ancient smelters hoping to reduce tin metal from these ores. Tin and iron oxides have a similar reducibility, and in order to control for the amount of iron as an impurity in the tin metal, ancient smelters would have faced a trade-off (Smith 1996). Under low reducing conditions, nonmetallic tin would be trapped in slags, effectively reducing the efficiency of the smelt, even if metallic prills of tin could be retrieved. Conversely, tin metal extraction could be increased through high reducing conditions, a process which would also admit signifi-

Figure 6. Microphotograph of cassiterite and yazganite minerals on a different sample of Hisarcık ore. Photo courtesy of Evren Yazgan.

Figure 7. Taking in situ measurements of outcroppings at Hisarcık using a portable XRF. Photo courtesy of Gonca Dardeniz.

Figure 8. Ancient mining operations in the Senir Sırtı locality at Hisarcık.

Figure 9. Remnant metal minerals are still visible on the surface of the mining entrance.

cant quantities of undesirable iron. This results in a product called hardhead, an iron-tin alloy. Additionally, these natural deposits could have been used in a co-smelting or mixed-smelting technique, whereby smelters reduced the tin ores together with copper ores or directly in molten copper through a cementation process.

Preliminary archaeological surveys in the region, led by Fikri Kulakoğlu, Ryoichi Kontani, Yuichi Hayakawa, and Aslıhan Yener, also identified industrial sites and ancient mining operations in the region of the tin deposits (Figures 8 and 9). One such site, called Teknekayası Höyük, has been dated to the third millennium BC by associated pottery, suggesting that many of the ancient mining operations in the area may be related.

If the current interpretation of the region holds, then along with the Bolkardağ occurrences this would be the second known tin occurrence associated with Bronze Age industries in Anatolia. These results suggest that early metallurgy, especially given the highly dispersed nature of resources intrinsic to the craft, developed from the utilization of a diversity of deposit types, including smaller occurrences of metal deposits, many of which could have been totally exhausted. These results also have direct impact on the hypotheses of bronze adoption in the region. We must now consider the role of local tin in the earliest innovation and adoption of bronzes in the Near East; however, it is also important to remember that these results do not necessarily falsify the standard model, which is based on second millennium BC textual and archaeological data. Local small-scale production of tin during the third millennium BC could have conceivably operated alongside the importation of exotic tin produced from distant operations elsewhere in the Old World.

Recent advances in tin isotope geochemistry developed at the Curt-Engelhorn-Zentrum Archäometrie in Mannheim promise to add an independent line of evidence. Natural variations in tin isotopes, whose ratios are determined by non-radiogenic processes, appear to differ according to sources which would allow

their use as a tool in the provenance of tin in bronzes (Haustein et al. 2010). This work is currently ongoing, and we still do not understand if all the potential tin resources are distinct. Combined field research to document sites like those at Hisarcık, coupled with cutting-edge breakthroughs in isotope geochemistry, may solve this decades-old problem within the next few years.

ACKNOWLEDGMENTS

This work was primarily possible thanks to generous support from the Alexander von Humboldt Foundation German Chancellor Fellowship, the Curt-Engelhorn-Zentrum Archäometrie, the University of Tübingen, Koç University, and Ankara University. I am especially thankful to Fikri Kulakoğlu, the director of Kültepe excavations, and Aslıhan Yener, director of excavations at Tell Atchana, for inviting me to participate on this project. I would also like to personally thank Evren Yazgan for innumerable conversations about the geology of the Kayseri region and for providing me with some of the data used in this article. Thanks are also due to Ryoichi Kontani, Yuichi Hayakawa, Gonca Dardeniz, Güzel Öztürk, Mike Johnson, and Abdullah Hacar.

REFERENCES

Baroffka, Nikolaus, Jan Cierny, Joachim Lutz, Hermann Parzinger, Ernst Pernicka, and Gerd Weisgerber 2002. Bronze Age Tin in Central Asia: Preliminary Notes. In *Ancient Interactions: East and West in Eurasia*. Edited by K. Boyle, C. Renfrew, and M. Levine, pp. 135–159. Cambridge: McDonald Institute of Archaeological Research.

Begemann, Friedrich, Ernst Pernicka, and Sigrid Schmitt-Strecker. 1995. Thermi on Lesbos: A Case Study of Changing Trade Patterns. *Oxford Journal of Archaeology* 14(2):123–135.

Dercksen, Jan Gerrit.1996. *The Old Assyrian Copper Trade in Anatolia*. Istanbul: Nederlands Historisch-Archaeologisch Instituut te Instanbul.

———. 2005. Metals According to Documents from Kültepe-Kanish Dating to the Old Assyrian Colony Period. In *Anatolian Metal III*. Edited by Ü. Yalçın, pp. 17–34. Der Anschnitt 18. Bochum: Deutsches Bergbau-Museum.

Esin, Ufuk.1969. *Kuantitatif Spektral Analiz Yardımıyla Anadolu'da Başlangıcından Asur Kolonileri Çağına Kadar Bakır ve Tunç Madenciliği*. Istanbul: Taş Matbaası.

Fleming, Stuart J., Vincent C. Pigott, Charles P. Swann, and Samuel K. Nash. 2005. Bronze in Luristan: Preliminary Analytical Evidence from Copper/Bronze Artifacts Excavated by the Belgian Mission in Iran. *Iranica Antiqua* 40:35–64.

Hauptmann, Andreas, Sigrid Schmitt-Strecker, Friedrich Begemann, and Alberto Palmieri. 2002. Chemical Composition and Lead Isotopy of Metal Objects from the "Royal" Tomb and Other Related Finds at Arslantepe, Eastern Anatolia. *Paléorient* 28(2):43–69.

Hauptmann, Harald, and Ernst Pernicka (editors). 2004. *Die Metallindustrie in Mesopotamien von den Anfängen bis zum 2. Jahrtausend v. Chr*. Radhen: M. Leidorf.

Haustein, Mike, Carole Gillis, and Ernst Pernicka. 2010. Tin Isotopy—A New Method for Solving Old Questions. *Archaeometry* 52(5):816–832.

Kaufman, Brett, and David A. Scott. 2014. Fuel Efficiency of Ancient Copper Alloys: Theoretical Melting Thermodynamics of Copper, Tin, and Arsenical Copper and Timber Conservation in the Bronze Age Levant. *Archaeometry* doi: 10.1111/arcm.12127.

Larsen, Mogens Trolle.1987. Commercial Networks in the Ancient Near East. In *Centre and Periphery in the Ancient World.* Edited by M. J. Rowlands, M. T. Larsen, and K. Kristiansen, pp. 47–56. Cambridge: Cambridge University Press.

Lechtman, Heather. 1996. Arsenic Bronze: Dirty Copper or Chosen Alloy? A View from the Americas. *Journal of Field Archaeology* 23(4):477–517.

Lehner, Joseph W., and K. Aslıhan Yener. 2014. Organization and Specialization of Early Mining and Metal Technologies in Anatolia. In *Archaeometallurgy in Global Perspective*. Edited by B. W. Roberts and C. P. Thornton, pp. 529–557. New York: Springer Verlag.

Montero Fenollós, Juan-Luis. 2000. La Métallurgie du Bronze dans le Bassin Syromésopotamien au Début du IIIe Millénaire Avant J.-C. In *Proceedings of the First International Congress on the Archaeology of the Ancient Near East.* Edited by P. Matthiae, A. Enea, L. Peyronel, and F. Pinnock, pp. 1093–1104. Rome: Università degli Studi di Roma.

Moorey, P. Roger S. 1994. *Ancient Mesopotamian Materials and Industries: The Archaeological Evidence*. Oxford: Clarendon Press.

Muhly, James D. 1973. *Copper and Tin: The Distribution of Mineral Resources and the Nature of the Metals Trade in the Bronze Age.* Volume 43. New Haven: The Connecticut Academy of Arts and Sciences.

———. 1985. Sources of Tin and the Beginnings of Bronze Metallurgy. *American Journal of Archaeology* 89(2):275–291.

———.1993. Early Bronze Age Tin and the Taurus. *American Journal of Archaeology* 97(2):239–253.

Nezafati, Nima, Ernst Pernicka, and Morteza Momenzadeh. 2011. Ancient Tin: Old Question and a New Answer. *Antiquity* 85(330).

Northover, J. Peter. 1989. Properties and Use of Arsenic-Copper Alloys. In *Old World Archaeometallurgy: Proceedings of the International Symposium "Old World Archaeometallurgy," Heidelberg 1987*. Edited by A. Hauptmann, E. Pernicka, and G. A. Wagner, pp. 111–119. Bochum: Selbstverlag des Deutschen Bergbau-Museums.

Özbal, Hadi, Necip Pehlivan, Mieke Adriaens, Bilge Gedik-Uluocak, and Bryan Earl. 2008. Metal Technologies during the Late Chalcolithic and Early Bronze Age in North Central Anatolia: Ikiztepe. A Case Study. In *Ancient Mining in Turkey and the Eastern Mediterranean*. Edited by Ü. Yalçın, H. Özbal, and A. G. Paşamehmetoğlu, pp. 65–85. Ankara: Atılım University.

Pernicka, Ernst.1990. Gewinnung und Verbreitung der Metalle in prähistorischer Zeit. *Jahrbuch des Römisch-Germanischen Zentralmuseum* 37:21–129.

Pernicka, Ernst, Friedrich Begemann, Sigrid Schmitt-Strecker, and Apostolos P. Grimanis.1990. On the Composition and Provenance of Metal Artefacts from Poliochni on Lemnos. *Oxford Journal of Archaeology* 9(3):263–298.

Pernicka, Ernst, Clemens Eibner, Önder Öztunalı, and Günther A. Wagner. 2003. Early Bronze Age Metallurgy in the North-East Aegean. In *Troia and the Troad*. Edited by G. A. Wagner, E. Pernicka, and H.-P. Uerpmann, pp. 143–172. Berlin: Springer-Verlag.

Pernicka, Ernst, James D. Muhly, Önder Öztunali, and Günther A. Wagner.1992. Comment on the Discussion of Ancient Tin Sources in Anatolia. *Journal of Mediterranean Archaeology* 5(1):91–98.

Pernicka, Ernst, Thomas C. Seeliger, Günther Wagner, Friedrich Begemann, Sigrid Schmitt-Strecker, Clemens Eibner, Önder Öztunalı, and István Baranyi.1984. Archäometallurgische Unterschungen in Nordwestanatolien. *Jahrbuch des Römisch-Germanisches Zentralmuseum* 31:533–599.

Radivojević, Miljana, Thilo Rehren, Julka Kuzmanović-Cvetković, Marija Jovanović, and J. Peter Northover. 2013. Tainted Ores and the Rise of Tin Bronzes in Eurasia, *c*. 6,500 Years Ago. *Antiquity* 87(338):1030–1045.

Rehren, Thilo, Loïc Boscher, and Ernst Pernicka. 2012. Large Scale Smelting of Speiss and Arsenical Copper at Early Bronze Age Arisman, Iran. *Journal of Archaeological Science* 39(6):1717–1727.

Smith, Richard. 1996. An Analysis of the Processes for Smelting Tin. *Mining History: The Bulletin of the Peak District Mines Historical Society* 13(2):91–99.

Stöllner, Thomas, Zeinolla Samaschev, Sergej Berdenov, Jan Cierny, Monika Doll, Jennifer Garner, Anton Gontscharov, Alexander Gorelik, Andreas Hauptmann, Rainer Herd, Galina A. Kusch, Viktor Merz, Torsten Riese, Beate Sikorski, and Benno Zickgraf. 2011. Tin from Kazakhstan—Steppe Tin for the West? In *Anatolian Metal.* Edited by V. Ü. Yalçın, pp. 231–252. Bochum: Deutsches Bergbau-Museum.

Stos-Gale, Zofia A., Noel H. Gale, and G. R. Gilmore. 1984. Early Bronze Age Trojan Metal Sources and Anatolians in the Cyclades. *Oxford Journal of Archaeology* 3(3):23–43.

Von Baer, K. E. 1876. Von wo das Zinn zu den ganz alten Bronzen gekommen sein mag? *Archiv für Anthropologie* 9:263.

Yalçın, Ünsal. 2012. Alacahöyük İTÇ Kral Mezarları Üzerine II: Idoller. *Çorum Kazı ve Araştırmalar Sempozyumu* 2:111–122.

Yalçın, Ünsal, and Hadi Özbal. 2009. Ein Neues Zinnvorkommen in Kayseri-Hisarcık, Zentralanatolien: Ein Vorbericht. *TÜBA-AR* 12:117–122.

Yazgan, Evren. 2015. Cassiterite (Tin) Mineralization Related with Erciyes Volcanic Activities and the Mode of Formation of the Hematite-Cassiterite-Yazganite-Tridymite Paragenesis and Its Implication for Bronze Alloys. In *Proceedings of the 1st Kültepe International Meeting*. Edited by F. Kulakoğlu and C. Michel. Leuven: Subartu, Brepols.

Yener, K. Aslıhan. 2000. *The Domestication of Metals: The Rise of Complex Metal Industries in Anatolia.* Leiden: Brill.

Yener, K. Aslıhan, Fikri Kulakoğlu, Evren Yazgan, Ryoichi Kontani, Yuichi S. Hayakawa, Joseph W. Lehner, Gonca Dardeniz, Güzel Öztürk, Michael Johnson, and Abdullah Hacar. 2014. The Discovery of New Tin Mines and Production Sites near Kültepe, Ancient Kanesh in Turkey: A Third Millennium BC Highland Production Model. *Antiquity.*

Yener, K. Aslıhan, and Hadi Özbal.1987. Tin in the Turkish Taurus Mountains: The Bolkardağ Mining District. *Antiquity* 61(232):64–71.

Yener, K. Aslıhan, and Pamela B. Vandiver. 1993. Tin Processing at Göltepe, an Early Bronze Age Site in Anatolia. *American Journal of Archaeology* 97(2):207–238.

Yener, K. Aslıhan, Hadi Özbal, Ergun Kaptan, Necip Pehlivan, and Martha Goodway. 1989. Kestel: An Early Bronze Age Source of Tin Ore in the Taurus Mountains, Turkey. *Science* 244:200–203.

FEATURE

The Chincha Kingdom: The Archaeology and Ethnohistory of the Late Intermediate Period South Coast, Peru

Ben Nigra[1], Terrah Jones[2], Jacob Bongers[3], Charles Stanish[4], Henry Tantaleán[5], and Kelita Pérez[6]

IT IS UNCLEAR EXACTLY WHEN THE German naturalist and medical doctor Ernst Middendorf first heard of the monumental ruins in the lower Chincha Valley, but by the mid-1880s, he had determined to see them for himself. Middendorf became an early authority on pre-Hispanic cultures during his 25 years of work and travel across the Andes. Apart from amateur archaeology and ethnography, he had a penchant for linguistics and published volumes on Quechua, Aymara, and Mochica—the three major indigenous languages in western South America (Reina 2008). His travels in the Quechua-speaking regions outside of Lima exposed him to a host of archaeological sites that were previously unknown to European scholars. At the same time, his appetite for Peruvian prehistory led him to the Spanish chronicles, far fewer of which were known and published than are available today. By the time Middendorf reached Chincha, he had amassed notes and drawings from archaeological sites along the Peruvian coast. While Chincha was not an exceptionally novel exercise for Middendorf, his work there gave rise to a series of south coast explorations that made Chincha a key focus for some of the earliest major works in Andean archaeology.

1. Cotsen Institute of Archaeology, UCLA.
2. Cotsen Institute of Archaeology, UCLA.
3. Cotsen Institute of Archaeology, UCLA.
4. Department of Anthropology, UCLA.
5. Investigador Prometeo, Escuela Superior Politecnica del Litoral (ESPOL), Guayaquil, Ecuador.
6. Universidad Nacional de Trujillo, Peru.

Shortly after his arrival at the Chincha port of Tambo de Mora, a guide escorted Middendorf by mule to an area of what appeared to be a series of sandy hills rising out of the valley bottom. It was here that Middendorf made the first modern description of Chincha material culture:

> A half-kilometer north of the port begin the ruins of an ancient city, which consist of temples in the form of pyramids, great patios and small dwellings, all quite deteriorated and crumbling. The greater part of the existing walls and slopes are constructed of compressed mud and not with adobes, and therefore belong to more ancient times like the constructions of Cañete and of the Rimac Valley, which are materially similar. . . . The smaller ruins form clusters, both to the north and the south of the swampy depression, each one around a major structure, constituting, it would appear, temples. (Middendorf 1973 [1894]:105–106)[7]

The sheer size of these mounds impressed Middendorf. He reported that Huaca La Centinela (one of the larger *tapia*[8] platform mounds near Tambo de Mora) was some 40 meters high and divided into distinct sectors (Figure 1). Middendorf noted an odd adobe brick staircase on the southern end of the mound, which appeared out of place based on his previous observations of coastal architecture. Unknown to the pioneer,

7. Our translation.

Figure 1. Tambo de Mora, a cluster of Chincha structures occupying an earthen mound.

he had unwittingly stumbled across the remains of a small Inca administrative structure dwarfed within a much larger pre-Inca political center (Middendorf 1973 [1894]:106). Beginning with Middendorf's early explorations, the Chinchas would become an exemplary case in the diplomacy and geopolitics of the late pre-Hispanic Andes.

The Programa Arqueológico Chincha (PACH) is a multidisciplinary program of research on the prehistory of the Chincha Valley. While the majority of our work focuses on the first regional societies of the south coast, called Paracas (see our contributions to *Backdirt* 2012: Hill et al. 2012; and *Backdirt* 2013: Tantaleán et al. 2013), we regularly encounter materials associated with the Chincha Kingdom,[9] the peoples who inhabited the valley during the Late Intermediate Period (hereafter LIP; ca. AD 1100–1470). The results from our first year of intensive survey in the upper valley demonstrate a nearly continuous distribution of Chincha villages, cemeteries, and refuges, showing that Chincha peoples controlled not only coastal areas, but swaths of upper valley territory as well. This is a major contribution to our understanding of Chincha political geography and settlement practices outside of lowland coastal areas.

As we continue to explore the role of the Chinchas in LIP geopolitics, we offer introduction to one of the most fascinating case studies in ancient Andean political economy. Prior to the first descriptions of Chavín de Huantar in the eastern Andes, decades before the discovery of the Paracas Peninsula cemeteries with their spectacular burials, twenty years before Hiram Bingham stumbled into Machu Picchu, and almost a century before scholars even conceived of a Wari Empire, the Chinchas were a broadly known late pre-Hispanic society and a powerful draw for early students of Andean archaeology.

A CASE FOR INCA DIPLOMACY

The Chinchas provide a fascinating example of Inca imperial strategies in the coastal provinces and continue to serve as a contrast to Inca imperialism in other parts of the empire (Morris 1988, 1998, 2004; Morris and Covey 2006; Netherly 1988; Patterson 1987). Unlike the general state of political fragmentation that characterized the Andean highlands during the tenth through early fifteenth centuries AD (see Arkush 2005), broad swaths of the coast were controlled by powerful, politically centralized groups (Figure 2). Early Inca strategies in the heartland that proved so successful in consolidating decentralized chiefdoms into a unified Inca state did not work against the larger, wealthier, and better organized coastal states.

Given that Inca imperial strategy was multifaceted, opportunistic, and tailored to local conditions, coastal

8. *Tapia*, also known as rammed earth, is a poured mud construction technique common in coastal architecture.

9. As far back as the Spanish chronicles, "Chincha" has referred to the political entity from which the flat, coastal drainage watered by the San Juan, Matagente and Chico Rivers derives its name. Its constituents are referred to as the Chinchas.

Figure 2. Map of western South America, showing the Inca Empire at its greatest extent and major sites discussed in text.

campaigns under the emperor Pachacuti shifted between intense martial strategies and softer forms of diplomatic pressure (D'Altroy 1992). Subjugation through military coercion remained a norm. To the north, the massive and defiant Chimu state (Moore and Mackey 2008) was reduced in a series of military campaigns, its political hierarchy dismembered and large portions of its populace forcibly resettled across the Inca realm. Similarly, and only 40 km to the north of the Chinchas in the Cañete Valley, the Incas effectively destroyed the people of Huarco in a four-year military siege (Marcus 1987, 2008:2–4), followed by a general massacre of Huarco men. In Cañete and Pisco, the two drainages directly north and south of Chincha, the Inca built impressive way stations and administrative centers at Inkawasi and Tambo Colorado (Hyslop 1985; Protzen and Morris 2004; Protzen and Harris 2005). Inca sites such as these were integrated into the coastal road network to facilitate the movement of goods and troops. The subjugation of the coast was executed in a then-unprecedented scale of military conquest and administrative reorganization.

The ethnohistoric and archaeological story of the Chinchas does not follow this pattern, however. An atypically small Inca "palace" structure at Huaca La Centinela hides in the shadow of a much larger Chincha politico-religious building (Morris 2004); ethnohistoric accounts attest to an intact Chincha elite that operated in parallel with Inca representatives, going so far as to take advantage of their autonomy for their own gain (Lumbreras 2001; Morris and Covey 2006; Rostworowski 1970); and excavations of smaller villages from the pre- and post-Inca periods suggest that Chincha economic structures remained more or less intact (Sandweiss 1992). The fact that Chincha political autonomy, economic organization, and demographics remained relatively untouched is a fascinating anomaly that captured the attention of Spanish vicars and soldiers at an early date. Understanding the role of the Chinchas in Inca geopolitics, then, begins with the ethnohistorical record.

THE CHRONICLERS

Middendorf and other nineteenth-century explorers and archaeologists who described Chincha material culture were familiar with at least some of the Spanish chronicles. Most of these early ethnohistorical accounts concerned themselves with the politics, culture, and geography of the Incas, including the formation of the empire and the subjugation of non-Inca peoples. Spanish agents and missionaries established themselves firmly in Chincha within two decades of the conquest because it was close to Lima and highly desirable for its great agricultural potential. While we should take these writings with a healthy dose of skepticism, early discussions of Chincha are invaluable accounts rich in detail. As the kingdom remained independent until sometime during the reign of Topa Inca (beginning around 1475 AD), only a few generations separated an independent Chincha from the earliest Spanish writers.

Numerous chronicles reference the Chinchas, but three stand out. Pedro Cieza de León's *La crónica del Perú* was published in Seville by 1553, making it one of the earliest records of Inca history and political geography. Cieza is recognized as reliable, though some of his information may have come secondhand through a Quechua-speaking contemporary, Juan Díez de Betanzos (Pease 2008). An account by Pedro Pizarro, a cousin of the leader of the invading Spanish forces, Francisco, provides firsthand observations of the Spanish encounters with the Inca beginning in the early sixteenth century. His *Relación del descubrimiento y conquista de los reinos del Perú* (1571) covers his time spent under the command of Francisco Pizarro and describes Atahualpa's entourage during the 1532 confrontation in Cajamarca that precipitated the collapse of the Inca political system. Lastly, Fray Cristóbal de Castro and Diego Ortega Morejón interviewed older inhabitants of Chincha in a document

referred to in shorthand as the "*Relación*" (1558). Originally published for Spanish authorities (Castro was a church vicar and Ortega Morejón a local magistrate), the *Relación* describes diplomacy and political maneuvering between the intact Chincha leadership and Inca representatives. From these accounts come the earliest picture of Chincha economic power, social structure, and political acumen.

Cieza describes the realm of the Chinchas as a "great province, esteemed in ancient times . . . splendid and grand . . . so famous throughout Peru as to be feared by many natives" (Cieza de León 1959 [1553]:344–345). He claims that the land of the Chinchas was highly productive and desirable, full of game, and capable of supporting large-scale agriculture and a population of 25,000 persons. He notes that the Chinchas had access to an abundance of precious metals, both gold and silver, which the Spanish found and plundered in nearby tombs (Cieza de León 1959 [1553]:347). According to Cieza's informants, the wealth and power of the Chinchas served not only as the foundation of a regional coastal alliance, but also supported major Chincha incursions into the highlands. While the Incas were still consolidating the Cusco region, Cieza reports, the Chinchas had smashed the highland Soras and Rucanas, reaching the land of the Collas in the Titicaca Basin (Cieza de León 1959 [1553]:346).[10]

Part of the Chincha Kingdom's political capital derived from access to a powerful and prestigious oracle called Chinchaycamac (Cieza refers to it as a "demon"), who received offerings and spoke to the Chincha elders (Cieza de León 1959 [1553]:345). This was likely a branch oracle of the pilgrimage center of Pachacamac, near modern Lima, which the Inca also incorporated (Uhle 1991 [1903]). If this is true, then the Chinchas held a dual alliance with both the Incas and the sponsor oracle (Menzel and Rowe 1966:68). Chinchaycamac was referred to as a "child" of Pachacamac (Rostworowski 1977:106), and legitimizing a branch oracle in this way could come at great cost. Contributions of precious metals, manufactured goods, labor, and agricultural or animal products accompanied Pachacamac branch oracles elsewhere (Burger 1988:115). Supporting the oracle would require a significant level of surplus production beyond the basic subsistence needs of the Chincha population.

Understanding the role of the Chinchas in Inca geopolitics, then, begins with the ethnohistorical record.

The popularity of the Chinchaycamac oracle and the organized wealth of the Chinchas probably played key roles in negotiating for political autonomy in the face of mounting Inca pressure. Morris and Covey (2006:147) note some ambiguity in the chronicles with regard to how much military activity, if any, was involved in the absorption of the Chinchas, but suggest that real capitulation took several generations. When the Incas finally did annex Chincha, it was apparently as vassals and not through outright domination (Castro and Ortega Morejón 1934 [1558]:135). The Inca installed their own overseers, acquired lands for Inca specialist workers (*mamacona* and *yanacona*), built a palace for Inca dignitaries, and constructed a temple to the sun to serve the state religion. Valley bureaucrats conducted a census and introduced decimal-based administration (Castro and Ortega Morejón 1934 [1558]:136–139). A sort of dual-justice system was instituted wherein the local Chincha lord could prosecute crimes against Chincha elites and commoners, while an appointed Inca magistrate dealt with crimes against Inca personnel or the Inca state (Castro and Ortega Morejón 1934 [1558]:140–141). Overall, the Chinchas retained a major degree of political autonomy, an intact leadership hierarchy, and access to the Chinchaycamac oracle and were able to maintain a broader ethnic identity in the face of Inca incorporation. This is not to mention potential costs were saved on both sides by avoiding prolonged conflict.

In his description of the events at Cajamarca, Pedro Pizarro's observations support the idea that Chincha incorporation into the Inca Empire took place under politically amiable terms. He notes that the lord of the Chinchas accompanied Atahualpa and had access to several practices usually reserved for

10. This is perhaps an overstatement on Cieza's part. There is little physical evidence to suggest that the Chinchas carried out military incursions into the southern highlands. Nonetheless, defensive architecture in association with Chincha material culture in the upper valley suggests an active border zone and the possibility of military excursions into immediate upland areas.

Inca nobility or exclusively for the Inca himself. These included transportation by litter (while accompanying Inca nobles went on foot) and an honored position in the Inca royal procession close behind Atahualpa's person (Pizarro 1921 [1571]:180–181, 183). He was close enough to the royal party to be killed in the resulting fracas, stabbed in his litter by Juan Pizarro, Francisco's half-brother (Pizarro 1921 [1571]:184; Rostworowski 1999:130). The high position afforded to this lord and the Inca desire to keep the Chincha administration intact appear to be linked, in part, to the Chinchas' exotic economic practices. According to Pedro Pizarro, in a subsequent conversation between the Spanish and the captured Atahualpa, the Inca referred to the Chincha lord as a good friend and master of 100,000 sea-going craft (Pizarro 1921 [1571]:443). This was perhaps an obvious boon for a highland society with little regular access to large, open bodies of water or the experience and human capital to make use of them.

All in all, early ethnohistorical sources suggest that the Chinchas were fabulously wealthy and well connected. This included an unprecedented amount of maritime infrastructure, massive economic surpluses that could be mobilized for special purpose projects, a branch oracle associated with one of the oldest and most highly respected ideological centers in the Andes, a large and reliable subsistence base, and a burgeoning population. Their successful negotiation with the Inca preserved Chincha social structure and political hierarchy, at least by typical Inca standards. If anything else, the Incas testified to the importance of the Chinchas by naming one quarter of Tawantinsuyu after them: Chinchaysuyu was the largest and most populous province of the Inca Empire, extending from Chincha in the south to southern Columbia in the north.

CULTURE HISTORY AND THE CHINCHAS

If Middendorf was the first to describe Chincha material culture in a modern context, then Max Uhle, one of the founders of modern Andean archaeology, bears responsibility for bringing it to the attention of archaeologists. At the behest of the University of California, Uhle spent three years between 1899 and 1901 on the Peruvian coast excavating and organizing collections for a new Museum of Anthropology in Berkeley (Uhle 1924 [1901]). Uhle was familiar with references to the Chinchas in a number of chronicles, believing them to be a widely expansive state that carried out conquest throughout the sierra (likely based on a reading of Cieza de León). He placed the Chinchas at the beginning of a developmental sequence that eventually led to the formation of the Inca Empire (Chinchas-Chankas-Incas), making them the progenitors of all later polities composed of Quechua-speaking peoples. Uhle's model was reasonable, given the methods at the time; by linking formalized pottery styles with proposed historical events derived from sixteenth-century documents, Uhle was developing a basic chronology for Andean prehistory (Lumbreras 2001; Tantaleán 2014).

Figure 3. Pottery recovered from Chincha and Chincha-Inca sites during survey conducted by the UCLA/PACH team in 2013. Images on the left demonstrate local vessel forms and motifs common to pre-Inca times. Images on the right show nonlocal blackwares introduced after the arrival of the Inca.

Uhle conducted a series of excavations in Chincha-period cemetery lots in the northwest corner of the valley, near and within the Huaca La Centinela–Tambo de Mora complex (Uhle 1924 [1901]). Ceramics from six cemeteries allowed him to isolate a Chincha design style, later detailed and subdivided into two Chincha-period phases and a post-Chincha, Inca-related phase (Kroeber and Strong 1924). Uhle also uncovered a variety of non-ceramic artifacts, including silverwork, female figurines, spindles, and spindle whorls. This formed the basis of the Chincha reference material available to subsequent archaeological investigations.

The discovery of the Paracas Peninsula burials in the 1920s deflected much attention from the archaeology of the Chinchas, as much work on the south coast turned toward earlier periods and the beautiful ceramics and textiles recovered from Paracas and Nasca sites. Starting in the late 1950s, two major research endeavors reignited scholarly interest in the Chincha Kingdom. The first was a reevaluation of Uhle's Chincha ceramic collection (Menzel 1966, 1971, 1977; Menzel and Rowe 1966). Directed by John Rowe and his students, analysis of the Chincha materials was part of a larger program to bring together and standardize the dozens of independent Andean ceramic seriations into a single coherent chronology (our modern system of "Horizons" and "Intermediate Periods" is a product of this). In examining the Chincha collections, Menzel and Rowe (1966) and Menzel (1966) reasserted a basic distinction between pre-Inca Chincha wares and specimens associated with the period of Inca influence (Figure 3). In the former period, Chincha wares gradually incorporated traits from the broader south coast region, an indicator of growing Chincha cosmopolitanism. After the Inca incursion, Chincha-style finewares abruptly disappear in favor of foreign

styles and imitations. Menzel interpreted this stylistic shift as status imitation by Chincha elites. Menzel and Rowe (1966:67) suggested that Chincha power was increasing substantially across the south coast in the century prior to 1476, whereupon the expert tactical advantage, diplomatic pressure, and overwhelming force of the Inca led to the bloodless capitulation of the Chinchas and disappearance of Chincha styles in favor of Inca imitations.

A major survey project in the Chincha Valley by Dwight Wallace (1959, 1971), the first of its kind, contributed much to the reinvigoration of Chincha archaeology (Figure 4). Wallace's survey identified an unprecedented number of Chincha-associated sites, roads between site clusters, and massive *tapia* mounds throughout the lower valley.[11] He provided direct evidence for a Chincha primary center composed of La Centinela, La Cumbe, and Tambo de Mora mounds (Wallace 1998), surrounded by secondary mound clusters and tertiary hamlets. Of these secondary sites, at least 30 were major mounds, and at least 5

11. Of 112 sites recorded by Wallace (1971), 70 are now recognized as containing Chincha occupations. An additional 30 sites have since been added to that list (Canziani 1992, 2009; Engel 2010; Lumbreras 2001; Wallace 1971, 1991, 1998).

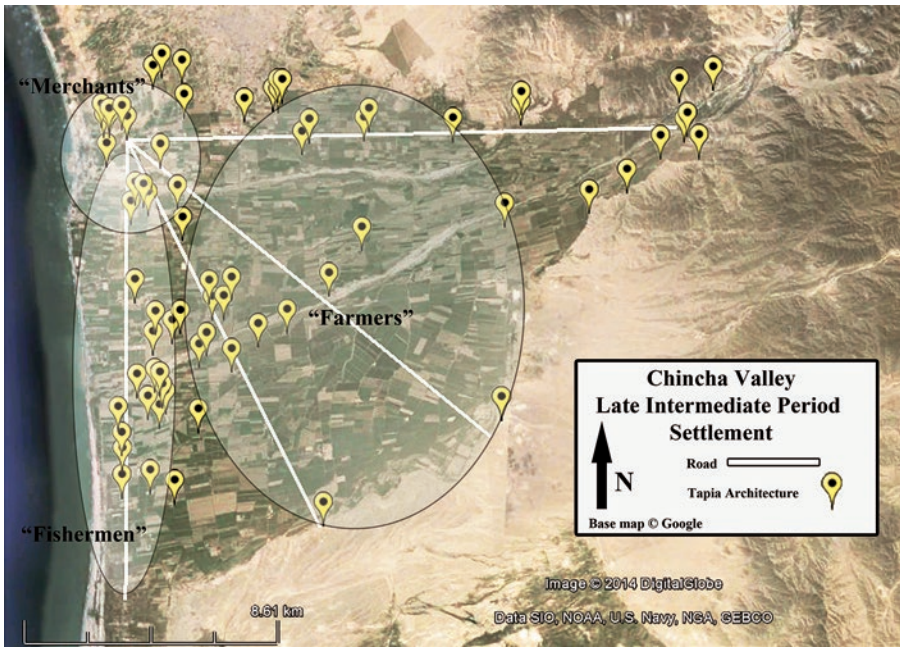


Figure 4. Map of the Chincha Valley showing Late Intermediate Period sites, infrastructure, and distinct economic communities as documented ethnohistorically and archaeologically. Synthesis from Canziani (2009), Engel (2010), Lumbreras (2001), and Wallace (1971; 1991). Base map ©Google.

major clusters contained 10 mounds apiece. A set of at least 4 straight roads radiated out from Huaca La Centinela, leading to major secondary clusters and connecting the valley to the eastern highlands and neighboring drainages to the south (Menzel 1959; Wallace 1991). Wallace distinguished between the *tapia* architectural techniques common to the Chincha and the rectangular adobe brick structures built by the Inca, clearly distinguished by double-jamb doors and trapezoidal portals (Wallace 1959).

THE "AVISO"

The first half of the twentieth century witnessed a florescence of fieldwork across the south coast and with it, a renewed interest in the material culture of the Chinchas. Multiple reassessments of Uhle's original collections produced a basic distinction between pre- and post-Inca assemblages, showing an increase in external contacts through time. Some core ideas taken from the chronicles were overturned in light of new archaeological fieldwork, such as the notion that the Chinchas took part in a military conquest of the southern highlands (no material evidence could be confirmed, from the Titicaca Basin or from the coast; Menzel and Rowe 1966). The first surveys of the valley concluded that the Chinchas were prosperous, perhaps even more so than was anticipated. The sheer size, number, and density of Chincha mound clusters suggested highly organized labor forces, and the clear presence of a three-tiered settlement system with linking infrastructure begged questions of political organization and territorial sovereignty. How much of this existed before the Inca incursion, archaeologists asked, and how much was a product of post-annexation opportunities? Furthermore, new theoretical paradigms in economic anthropology juxtaposed highland forms of socioeconomic organization with distinct coastal models, called "vertical" and "horizontal" complementarities (Murra 1972; Rostworowski 1977). The Chinchas provided a perfect laboratory to study the intersection of highland and coastal economic systems.

The publication of a previously unknown Spanish document in 1970, found in a Madrid archive by Maria Rostworowski de Diez Canseco (1970),[12] emphasized and addressed many of these questions. By cross-referencing personnel references in the "Aviso" with other known documentary sources, including Castro and Ortega Morejón and Reginaldo de Lizárraga (1968 [1901), Rostworowski concluded that the account dated to the early 1570s and was likely written by a Spanish clergyman stationed at the Dominican mission in Chincha. The document came at a most expedient time, linking information from the classic chronicles with emerging archaeological evidence.

The "Aviso" describes the Chinchas as managers of a massive maritime trading operation stretching from Ecuador in the north to the south coast of Peru (this articulates with Pedro Pizarro's claim that the Chincha paramount controlled 100,000 sea-going vessels). The Chinchas traded copper from the southern Andes for Ecuadorian commodities—gold, certain species of timber, emeralds, and, most significantly, shell (Marcos 2005:158; Pillsbury 1996; Rostworowski 1970:144–146, 152). Rostworowski suggests that demand for spondylus (*Spondylus princeps*) shells, important for state-sponsored rituals under the Incas, served as a major driver. Perhaps most unexpectedly, the "Aviso" claims fixed exchange rates for weights

12. This document lists neither date nor author. Its full name—"Aviso de el modo que havia en el gobierno de los indios en tiempo del Inga y como se repartian las tierras y tributos"—translates roughly into "Notice about the rules under the Indian government during Inca times and how they shared the land and taxes." Following common convention, we shorten it to the "Aviso."

of gold and silver (1:10) and the presence of copper "marks," a sort of price-fixing mechanism otherwise unknown in the pre-Hispanic Andes (Rostworowski 1970:152; Stanish 1992). It is, however, possible that early Spanish sources accidentally conflated the commodity itself, copper, with the mediums of exchange familiar to their own worldview.

Coastal traders filled a niche in the rapidly expanding Inca economy, whose centralized redistributive system was usually at odds with private trading enterprises (Rostworowski 1970:147). Patterson (1987) discusses the Chincha anomaly as an exercise in merchant capital. In this scenario merchants serve as debt financiers who mediate exchanges between independent commodity producers, in this case peoples on either side of the Inca frontier. Such a scenario is possible only when the means of production remain in local hands. Once supply and demand become rigidly coordinated through the introduction of a centralized redistributive system, such as was the case with the Inca, the role of merchant capital is reduced. Thus, merchant capital is inherently conservative; it relies on existing relations of production and the perpetuation of producer autonomy.

Such a system tends to be most effective in moving high-value, low-density goods, rather than bulk staples. Demand for gold, emeralds, and spondylus shell stemmed strongly from the central political apparatus of the Incas, yet reliable sources for these commodities lay beyond effective Inca economic control. As semiautonomous agents of the state, the Chinchas could operate efficiently in contested and unconquered areas. They commanded the seafaring skills, boats, and previously established partnerships that the Inca lacked and thus provided a more efficient vector for acquiring valued goods.

The "Aviso" suggests that specialized sea-traders existed in Chincha prior to the coming of the Inca (Rostworowski 1977:128) and that this was one component of a strictly organized domestic economy, which also included permanent fishing and farming communities (Rostworowski 1970:157). The document claims that economic specialization governed the local settlement system, with artisans, fishermen, and farmers each inhabiting distinct parts of the valley. It also provides population estimates for each major division, suggesting 10,000 fishermen, 10,000 farmers, and 6,000 artisanal specialists and merchants. Further subdivision of artisans is likely: the "Aviso" lists carpenters, pot-makers, shoemakers, and gold- and silversmiths as distinct occupations (Rostworowski 1970:158). This horizontal integration of economically separate components in the formation of a larger paramount political entity is referred to as a *señorío* and is a common form of economic organization elsewhere in Late Intermediate Period coastal societies in southern Peru (see also Knudson and Buikstra 2007; Lozada and Buikstra 2002, 2005; Lozada et al. 2009; Nigra 2009).

> Curiously, only small volumes of spondylus shell – supposedly the major driver of coastal trade – have been recovered in Chincha excavations.

THE DEVELOPMENT OF A COMPLEX CHINCHA SOCIETY

The "Aviso" provided powerful new information on Chincha geopolitics, economic organization, and settlement, supplying new hypotheses to test with archaeological data. Whereas earlier investigations sought to describe the universe of Chincha sites, architecture, and pottery styles, expeditions over the past 40 years have focused on processes of political incorporation, resistance, and empire-building across the period of Inca influence. The 1980s saw the arrival of a major archaeological program in Chincha under the auspices of the Instituto Andino de Estudios Arqueológicos (INDEA). These scholars—Luis Lumbreras, Craig Morris, and John Murra, among others—are responsible for taking Chincha archaeology beyond descriptive culture history and into the realm of modern anthropology.

Given the tantalizing description of economically distinct communities in the "Aviso," INDEA scholars dedicated much time to determining whether such strict occupational specialization existed before the arrival of the Inca. Sandweiss (1992) located and excavated a Chincha-period fishing community precisely where the "Aviso" predicted—along a lengthy, narrow strip of coast just west of the major Centinela mound cluster. He concluded that community members were indeed specialized fishermen who practiced no agriculture, though they likely produced some of their own basic equipment, and that economic

Figure 5. Inca "palace" at Huaca La Centinela. Tambo de Mora is in the left background.

specialization was in place before Inca incursion. Fishing peoples fell under the rule of a local lord who probably managed specialists of his own and did not participate in subsistence activities (Sandweiss 1992:145). He suggested that Inca influence would have a most profound effect on these local elites, who would articulate with Inca-installed administrators but would not affect the quotidian activities of subsistence-producing commoners (Sandweiss 1992).

While pure Chincha farming guilds have yet to be demonstrated archaeologically, Lumbreras (2001) suggests that these were located at the large mound cluster of Las Huacas, situated in the center of the Chincha alluvial plain. Far from the pre-Hispanic road system but in highly productive land between the Matagente and Chico Rivers, he argues that the site was not suited for fishing or mercantile activity (Lumbreras 2001:48–50). He supports the idea that fishing villages paralleled the majority of the coastline, identifying the Rancheria cluster as a potential candidate and suggesting that the San Pedro Complex, at the southern end of the Chincha settlement distribution, may have been a secondary center related to fishing villages (Lumbreras 2001:52). All in all, he lists three major urban centers within Chincha—Centinela, San Pedro and Las Huacas—each with its own set of satellite communities.

Menzel and Rowe's (1966) suggestion that the triple-mound complex of Centinela, Tambo de Mora, and La Cumbe was the seat of Chincha political power is supported by Morris's excavations and architectural analyses at Huaca La Centinela—both at the Chincha palace and the Inca installation next to it (Morris 1988, 1998). This cluster contains large residential areas in low-lying spaces between massive *tapia* mounds, forming a core of more than 200 hectares. All available suggestions place the Chinchaycamac pilgrimage center at La Cumbe or at La Centinela itself (Menzel and Rowe 1966; Uhle 1924 [1901]; Wallace 1998). In addition to major Chincha structures, Inca influence is clearly present at La Centinela in the architecture of a small "palace" near the mound's principal edifice (Morris and Covey 2006; Morris and Santillana 2007). Unlike Inca royal architecture elsewhere in the provinces, the La Centinela structure stands out as relatively small, off-center with regard to the mound's main plaza, and executed in locally available mud brick (Figure 5). The layout and placement of the Inca palace suggests a strategy of imperial control based on notions of alliance and mutual respect, rather than heavy-handed imposition of Inca building practices as found elsewhere in the Andes (Morris 2004). This dampening of the imperial reality for purposes of positive diplomacy underlines the multifaceted and reflexive nature of Inca dominance and the usefulness of an intact Chincha economy. Beyond the cluster's role as a political nexus, craft specialists worked and perhaps inhabited the La Centinela, La Cumbe, and Tambo de Mora mounds. At Tambo de Mora, excavators recovered clear evidence of silversmithing contexts (Alcalde et al. 2002), and Morris's excavations suggests that textile producers inhabited parts of La Centinela during Inca times (Morris 1988:110).

Curiously, only small volumes of spondylus shell—supposedly the major driver of coastal trade—have been recovered in Chincha excavations. The INDEA excavations of the 1980s recovered small amounts (Morris 1988:109), but nothing on the scale suggested by the "Aviso." Sandweiss suggests that an emphasis on spondylus occurred quite late in Chincha times

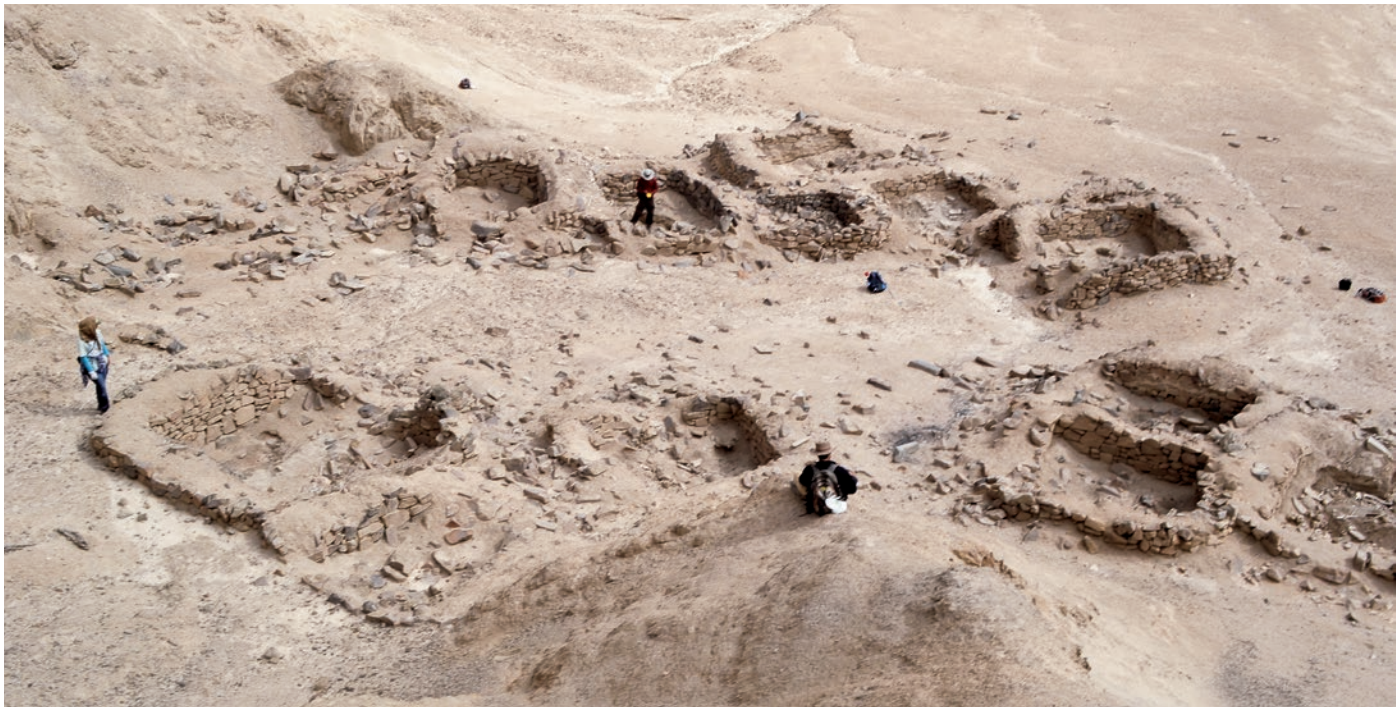
and perhaps did not accelerate until the period of Inca incorporation (1992:23). In Uhle's early collections, spondylus appears only sporadically and only in Inca-period contexts. Sandweiss suggests that Chincha trade contacts with Ecuador did not predate the Inca; instead, he offers the tantalizing suggestion that the trade monopoly enjoyed by the Chinchas was a privilege under Inca rule, made possible by the dismemberment of more powerful maritime states (such as the Chimu) (Sandweiss 1992:148).

MOVING FORWARD

The Chinchas are one of the Andes' best historically documented cases of a complex coastal polity and provide a unique perspective into Inca imperialism. Research on the Chinchas has advanced models of LIP socioeconomic organization, pre-Columbian maritime merchant operations, and Inca period diplomatic strategies. Yet, given the enormous amount of Chincha archaeological material packed into the valley, there is much work to be done. The upper valley, the corridor where the alluvial plain narrows to less than a kilometer wide, contains a continuous distribution of Chincha materials. This area has not been explored systematically, although Lumbreras (2001) mentions a few large sites in the area (see also Canziani 2009; Wallace 1971). No excavations of LIP sites have been conducted outside of the lower valley core. Yet current knowledge of widespread Chincha mercantile networks and geopolitical relations with highland groups suggests that this area may have been of great importance to the polity's territorial and economic integrity. Considering the upper valley's role as a likely avenue for coast-highland traffic in both pre-Inca and Inca times, concerted survey and excavation should further our understanding of Chincha exchange practices and the economic effects of Inca dominance.

The Programa Arqueológico Chincha (PACH) explores this transitional zone as part of a larger valley-wide research endeavor. We recently completed the first year of an ongoing full coverage survey of the upper valley neck, and we expect to cover significant ground in coming years. So far we demonstrate a continuous landscape of Chincha settlements, cemeteries, public spaces, and fortifications. We observe a decrease in settlement size and an increase in defensive measures as we progress into the highlands. We note a tighter clustering of settlements to cemeteries in contested areas. Our team is in the process of defining an upper valley mortuary tradition related to the Chinchas, the first fieldwork on Chincha burial contexts since Uhle's 1901 excavations (Figure 6). Ceramic distributions across the area suggest both pre- and post-Inca contexts, and stylistic and technological influences from other coastal groups are present in many pieces. Preservation is phenomenal, illicit activity in the area is limited, and sites are data rich. The door is wide open for an upper valley perspective into

Figure 6. The 2013 survey team documents a cluster of aboveground Chincha tombs.



the development of Chincha economic complexity. In coming seasons, we hope to add our own contribution to the archaeology of one of the Andes' most fascinating cases.

ACKNOWLEDGMENTS

We would like to thank the editors of *Backdirt* for inviting us to contribute this review. We thank our 2013 project staff and students—Michiel Zegarra, Camille Weinberg, Michael Rosales, J. C. Fasano, Marillyn Holmes, and the students of the 2012–2013 Chincha Fieldschool. We thank the Institute for Field Research and Ran Boytner for orchestrating the fieldschool component of our research. Nigra and Bongers thank the National Science Foundation Graduate Research Fellowship Program [DGE-1144087]. Bongers was generously supported by a Ford Foundation Fellowship, National Geographic Young Explorers Grant, and Sigma Xi Grant-in-Aid. Nigra, Jones, and Bongers thank Charlie Steinmetz for his generous support of student travel.

REFERENCES

Alcalde, Javier, Carlos R. del Águila, Fernando F. Fujita, and Enrique Retamozo. 2002. "Plateros" precoloniales tardíos en Tambo de Mora, Valle de Chincha (Siglos XIV–XVI). *Anales del Museo de América* 10:43–57.

Arkush, Elizabeth N. 2005. *Hillforts of the Ancient Andes Colla Warfare, Society, and Landscape*. Gainesville, Fla.: University Press of Florida.

Burger, Richard L. 1988. Unity and Heterogeneity in the Chavin Horizon. In *Peruvian Prehistory: An Overview of Pre-Inca and Inca Society*, edited by Richard W. Keatinge, pp. 99–143. Cambridge, U.K.: Cambridge University Press.

Canziani, José. 1992. Arquitectura y urbanismo del período Paracas en el Valle de Chincha. *Gaceta Arqueológica Andina* 6:87–117.

———. 2009. *Ciudad y Territorio en los Andes*. Lima, Peru: Fondo Editorial del Pontifica Universidad Católica del Perú.

Castro, Fray Cristobal, and Diego Ortega Morejón. 1934 [1558]. *Relación del sitio del Cusco y principio de las guerras civiles del Perú hasta la muerte de Diego de Almagro, 1535-1539: Relación sobre el gobierno de los incas,* edited by Horacio H. Urteaga. Lima, Peru: Librería e Imprenta Gil.

Cieza de León, Pedro de. 1959 [1553]. Crónicas del Perú. In *Incas of Pedro Cieza de León*, edited by Victor W. von Hagen, translated by Harriet de Onis, pp. 17–352. Norman, Okla.: University of Oklahoma Press.

D'Altroy, Terence N. 1992. *Provincial Power in the Inca Empire*. Washington, D.C.: Smithsonian Institution Press.

de Lizárraga, Fray Reginaldo. 1968 [1901]. *Descripción breve de todo la tierra del Perú, Tucumán, Río de la Plata y Chile*. Madrid, Spain: Real Academia Española.

Engel, Frédéric A. 2010. *Arqueología Inédita de la Costa Peruana*. Lima, Peru: Asamblea Nacional de Rectores.

Hill, Kevin, Benjamin Nigra, Henry Tantaleán, and Terrah Jones. 2012. Cerro del Gentil: A Paracas Mound Site in the Chincha Valley, Peru. Cotsen Institute of Archaeology, *Backdirt Annual Review* 2012:93–103.

Hyslop, John. 1985. *Incawasi: The New Cuzco*. Oxford, U.K.: British Archaeological Reports International Series 234.

Knudson, Kelly J., and Jane E. Buikstra. 2007. Residential Mobility and Resource Use in the Chiribaya Polity of Southern Peru: Strontium Isotope Analysis of Archaeological Tooth Enamel and Bone. *International Journal of Osteoarchaeology* 17:563–580.

Kroeber, Alfred L., and William Duncan. Strong. 1924. The Uhle Collections from Ica. In *American Archaeology and Ethnology Vol. 21*, edited by Alfred L. Kroeber and Robert H. Lowie. Berkeley, Calif: University of California Press.

Lozada, Maria Cecilia, and Jane E. Buikstra. 2002. *El Señorío de Chiribaya en la costa sur del Perú*. Lima, Peru: Instituto de Estudios Peruanos.

———. 2005. *Pescadores* and *Labradores* among the *Señorío* of Chiribaya in Southern Peru. In *Us and Them: Archaeology and Ethnicity in the Andes,* edited by Richard M. Reycraft, pp. 206–225. Los Angeles: UCLA Cotsen Institute of Archaeology Press.

Lozada, Maria Cecilia, Jane E. Buikstra, Gordon Rakita, and Jane C. Wheeler. 2009. Camelid Herders: The Forgotten Specialists in the Coastal Señorío of Chiribaya, Southern Peru. In *Andean Civilization: A Tribute to Michael E. Moseley*, edited by Joyce Marcus and Patrick Ryan Williams, pp. 351–364. Los Angeles: UCLA Cotsen Institute of Archaeology Press.

Lumbreras, Luis G. 2001. Uhle y los asentamientos de Chincha en el Siglo XVI. *Revista del Museo Nacional* 49:13–87.

Marcos, Jorge G. 2005. *Los Pueblos Navegantes del Ecuador Prehispánico*. Quito, Ecuador: Abya-Yala.

Marcus, Joyce. 1987. Prehistoric Fishermen in the Kingdom of Huarco: An Ancient Town on the Coast of Peru Exported Dried Fish as Part of a Regional Economic Network That Predated the Inca Conquest. *American Scientist* 75(4):393–401.

———. 2008. *Excavations at Cerro Azul, Peru: The Architecture and Pottery*. Los Angeles: Cotsen Institute of Archaeology Press.

Menzel, Dorothy. 1959. The Inca Occupation of the South Coast of Peru. *Southwestern Journal of Anthropology* 15(2):125–142.

———. 1966. The Pottery of Chincha. *Ñawpa Pacha* 4:77–144.

———. 1971. Estudios Arqueológicos en los valles de Ica, Pisco, Chincha y Cañete. *Arqueológia y Sociedad* 6:10–100.

———. 1977. *Pottery Style and Society in Ancient Peru*. Los Angeles: University of California Press.

Menzel, Dorothy, and John H. Rowe. 1966. The Role of Chincha in Late Pre-Spanish Peru. *Ñawpa Pacha* 4:63–76.

Middendorf, Ernst W. 1973 [1894]. *Perú: Observaciones y estudios del pais y sus habitantes durante una permanencia de 25 años*. Lima, Peru: Publicaciones de la Universidad Nacional Mayor de San Marcos.

Moore, Jerry D., and Carol J. Mackey. 2008. The Chimú Empire. In *Handbook of South American Archaeology*, edited by Helaine Silverman and William H. Isbell, pp. 783–807. New York: Springer.

Morris, Craig. 1988. Más allá de las fronteras de Chincha. *In La Frontera del Estado Inca,* edited by Tom D. Dillehay and Patricia J. Netherly, pp. 106–113. Oxford, U.K.: British Archaeological Reports.

———. 1998. Inca Strategies of Incorporation and Governance. In *Archaic States*, edited by Gary M. Feinman and Joyce Marcus, pp. 293–309. Santa Fe, N.Mex.: School of American Research Press.

———. 2004. Enclosures of Power: The Multiple Spaces of Inca Administrative Palaces. In *Palaces of the Ancient New World*, edited by Susan Toby Evans and Joanne Pillsbury, pp. 299–323. Washington, D.C.: Dumbarton Oaks.

Morris, Craig, and R. Alan Covey. 2006. The Management of Scale or the Creation of Scale: Administrative Processes in Two Inca Provinces. In *Intermediate Elites in Pre-Columbian States and Empires*, edited by Christina M. Elson and R. Alan Covey, pp. 136–153. Tucson, Ariz.: University of Arizona Press.

Morris, Craig, and Julián I. Santillana. 2007. The Inca Transformation of the Chincha Capital. In *Variations in the Expression of Inca Power*, edited by Richard L. Burger, Craig Morris, and Ramiro Matos Mendieta, pp. 135–163. Washington, D.C.: Dumbarton Oaks.

Murra, John V. 1972. El Control vertical de un máximo de pisos ecológicos en la economía de las sociedades andinas. In *Visita de la Provincia de León de Huanuco* Vol. 2, edited by Inigo Ortiz de Zunida, pp. 429–476. Huanuco, Peru: Universidad Hermilo Valdizan.

Netherly, Patricia J. 1988. El Reino de Chimor y el Tawantinsuyu. In *La Frontera del Estado Inca*, edited by Tom D. Dillehay and Patricia J. Netherly, pp. 85–106. Oxford, U.K.: British Archaeological Reports.

Nigra, Benjamin T. 2009. Cucharas of the Chiribaya: Socioeconomic Subsistence Patterns, Social Boundaries, and the Use of Wooden Spoons as Diagnostic Markers. Unpublished Bachelor's Thesis. Department of Anthropology, University of Chicago.

Patterson, Thomas C. 1987. Merchant Capital and the Formation of the Inca State. *Dialectical Anthropology* 12(2):217–227.

Pease, Franklin. 2008. Chronicles of the Andes in the Sixteenth and Seventeenth Centuries. In *Guide to Documentary Sources for Andean Studies, 1530–1900*, edited by Joanne Pillsbury, pp. 11–22. Norman, Okla.: University of Oklahoma Press.

Pillsbury, Joanne. 1996. The Thorny Oyster and the Origins of Empire: Implications of Recently Uncovered *Spondylus* Imagery from Chan-Chan, Peru. *Latin American Antiquity* 8(1):313–340.

Pizarro, Pedro. 1921 [1571]. *Relation of the Discovery and Conquest of the Kingdoms of Peru*, translated by Philip A. Means. New York: The Cortes Society.

Protzen, Jean-Pierre., and Craig Morris. 2004. Los Colores de Tambo Colorado: Una Reevaluación. *Boletín de Arqueología PUCP* 8: 267–276.

Protzen, Jean-Pierre, and David Harris (eds.). 2005. *Explorations in the Pisco Valley: Max Uhle's Reports to Phoebe Apperson Hearst. August 1901 to January 1902*. Berkeley: Contributions of the University of California Archaeological Research Facility.

Reina, Uta K. 2008. German Archaeologists and Anthropologists in the Andes: The Construction of the Andean Image in Germany and the German Identity in the Andes, 1950–1920. In *Color, Hair, and Bone: Race in the Twenty-First Century*, edited by Linden Lewis, Glyne A. Griffith, and Elizabeth Crespo-Kebler, pp. 102–120. Cranbury, N.J.: Associated University Presses.

Rostworowski de Diez Canseco, María. 1970. Mercaderes del Valle de Chincha en la Época Prehispanica: Un Documento y unos Comentarios. *Revista Española de Antropología Americana* 5:135–177.

———. 1977. *Ethnia y Sociedad: Costa Peruana Prehispanica*. Lima, Peru: Instituto de Estudios Peruanos.

———. 1999. *History of the Inca Realm*. Cambridge, U.K.: Cambridge University Press.

Sandweiss, Daniel H. 1992. *The Archaeology of Chincha Fishermen: Specialization and Status in Inca Peru*. Pittsburgh, Pa.: The Carnegie Museum of Natural History.

Stanish, Charles. 1992. *Ancient Andean Political Economy*. Austin, Tex.: University of Texas Press.

Tantaleán, Henry. 2014. *Peruvian Archaeology: A Critical History*. Walnut Creek. Calif.: Left Coast Press.

Tantaleán, Henry, Charles Stanish, Benjamin T. Nigra, Michiel Zegarra, and Kelita Pérez. 2013. Excavations and Survey in Chincha, Peru. Cotsen Institute of Archaeology, *Backdirt Annual Review* 2012:152–153.

Uhle, Max. 1991[1903]. *Pachacamac: A Reprint of the 1903 Edition.* Philadelphia: University Museum of Archaeology and Anthropology, University of Pennsylvania.

———. 1924 [1901]. Explorations at Chincha, edited by Alfred L. Kroeber. Los Angeles: *University of California Publications in American Archaeology and Ethnology* 21(1):55–94.

Wallace, Dwight T. 1959. Informe de reconocimiento del valle de Chincha. *Revista del Museo Regional de Ica* 10(11):31–40.

———. 1971. Valles de Pisco y de Chincha. *Arqueologicos* 13. Museo Nacional de Antropología y Arqueología. Lima, Peru.

———. 1991. The Chincha Roads: Economics and Symbolism. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 253–263. New York: Cambridge University Press.

———. 1998. The Inca Compound at La Centinela, Chincha. *Andean Past* 5:9–33.

FEATURE

Exploring Ancient Pastoral Mobility through Stable Isotope Analysis: A Case Study from Kenya

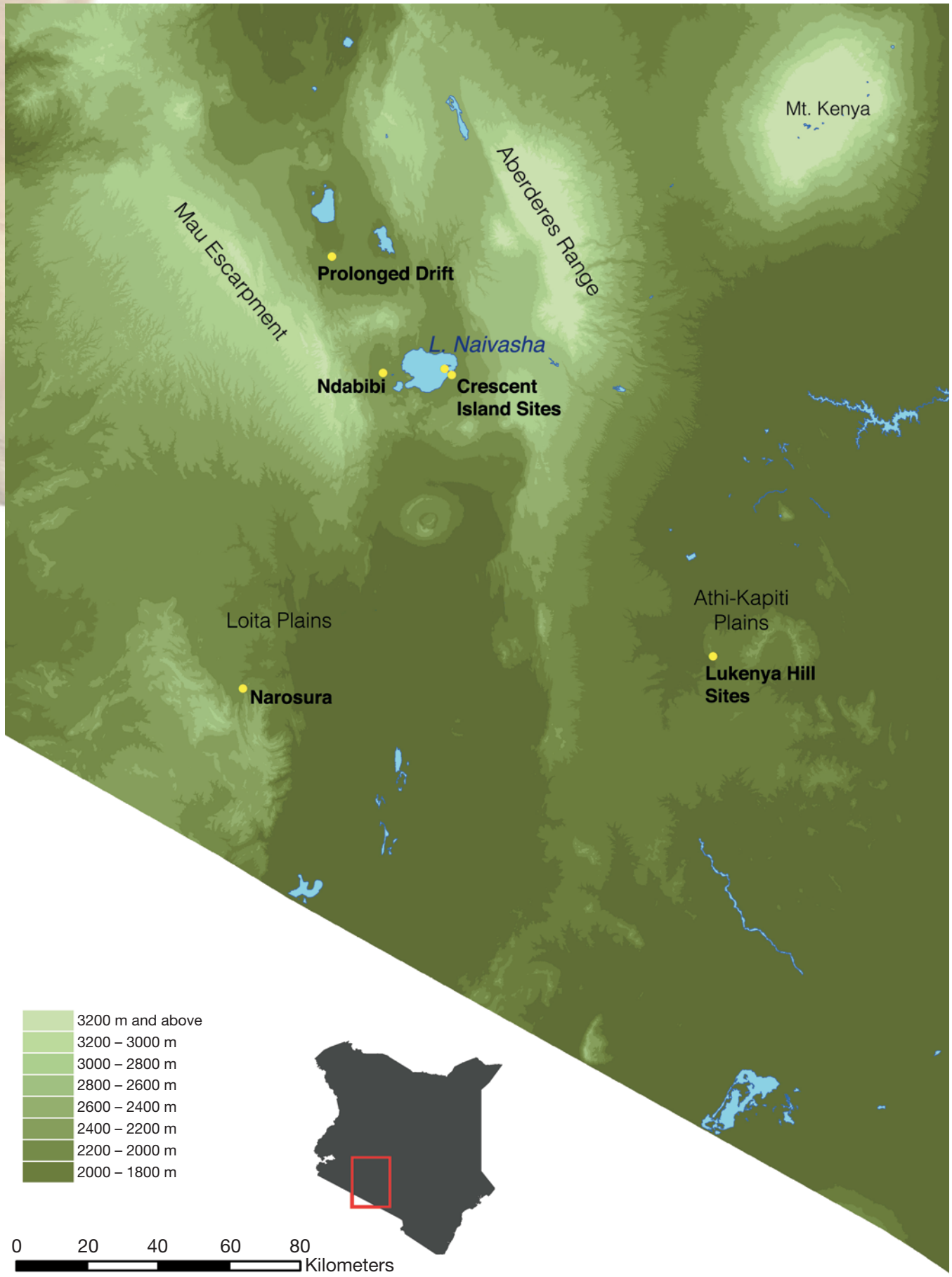
Anneke Janzen[1]

PASTORALISTS ARE PEOPLE who primarily depend on products of domesticated herd animals. Within this category there is significant variation, ranging from specialized nomadic pastoralists to those groups that also depend heavily on agriculture. Owing to seasonal variation in the distribution of resources, many pastoral populations rely on various migration strategies. Seasonal movements across the landscape are often crucial to maintaining herds and obtaining resources that are not available year-round. Such mobility has been extensively documented ethnographically, but identifying seasonal, or other types of mobility, is more difficult archaeologically, especially given the ephemeral nature of most pastoralist sites. For decades, zooarchaeologists have studied herd management through studies of herd composition, slaughter patterns, and livestock health (Gifford et al. 1980; Greenfield et al. 1988; Payne 1973; Pike-Tay et al. 2014). More recently, stable-isotope analysis has emerged as a powerful tool for exploring human and animal mobility and herd management strategies. This paper addresses how stable isotopes can be used to track ancient pastoral movements and livestock management and offers an example of how carbon and oxygen stable isotope analysis can be used to identify mobility patterns in the Pastoral Neolithic of Kenya. Isotopic methods have proved elsewhere to provide a finer-grained understanding of management tactics employed by herders and promise to shed light on early cattle/caprine pastoralism in East Africa, which initially developed without the presence of agriculture (Marshall 2000).

1. Department of Anthropology, University of California, Santa Cruz.

PASTORAL MOBILITY

Ethnographic accounts of pastoral mobility indicate the multitude of factors that may have influenced mobility decisions in the past. Today, particularly in East Africa, pastoralists must often move their herds to access seasonally available pastures and water sources. These movements may be highly patterned or variable year-to-year. A number of factors may influence these movements, including social and political factors (McCabe 2004; Mearns 1993; Stenning 1957). However, the dietary requirements of livestock are usually the primary concern affecting mobility strategies. Because of differing nutritional requirements, livestock may be divided according to species and productive status. For example, cattle are obligate drinkers, requiring roughly 60 liters of water daily. They are also strict grazers and therefore may be herded in pastures separate from more hardy species, such as nonmilking caprines (sheep and goats).


Mt. Kenya
Aberderes Range
Mau Escarpment
Prolonged Drift
L. Naivasha
Ndabibi
Crescent Island Sites
Loita Plains
Athi-Kapiti Plains
Lukenya Hill Sites
Narosura
3200 m and above
3200 – 3000 m
3000 – 2800 m
2800 – 2600 m
2600 – 2400 m
2400 – 2200 m
2200 – 2000 m
2000 – 1800 m
0 20 40 60 80
Kilometers

These requirements constrain herders to specific areas that can meet those criteria (Coppolillo 2000; Dahl and Hjort 1976; Fratkin and Smith 1994; Nicolaisen and Nicolaisen 1997).

Beyond seasonal movements, livestock may also move long distances between settlements or even between ethnic groups through exchange. In East Africa, such transfers have been extensively documented ethnographically. Livestock may be obtained through several types of transactions, including bridewealth payments, barter for food and other resources, gifts, and raiding (Evans-Pritchard 1940; Gulliver 1955; Kelly 1985; Spencer 1965). McCabe (2004) and Gulliver (1955) underline the importance of stock associations and partnerships among unrelated Turkana herders of northwestern Kenya, as well as partnerships based on kinship. Particularly in environments where precipitation is unpredictable, pastoral production is characterized by "boom and bust" population cycles, and such relationships are important for diversifying and maintaining herds if animals are lost to disease, drought, or raiding or for mobilizing surplus as needed for ceremonies. For the pastoralists, far-flung networks of mutual obligation can make up for shortfalls in livestock production and are crucial in times of environmental crises, such as drought, extreme flooding, or disease epidemics (Sobania 1991; Waller and Sobania 1994). Such pervasive exchange of livestock among pastoralist groups has not been documented archaeologically.

EARLY PASTORALISM IN KENYA

African pastoralism is unique in that, unlike herding in Southwest Asia, it developed much earlier than farming. In northern Africa, pastoralism developed around 8,000 years ago, first appearing in the Nabta-Kiseiba area of what is now southern Egypt (Gautier 1984). Over the next several millennia, the spread of domesticated animals from northeastern Africa in south- and westward directions is evidenced by a multitude of archaeological radiocarbon dates (Barthelme 1985; Di Lernia 2006; Haaland 1992; Marshall and Hildebrand 2002; Paris 1997; Wendorf and Schild 1998). Pastoralism appeared in the Lake Turkana basin by 4,500–5,000 years ago and spread to the rest of savanna East Africa by 3,000 years ago, continuing to change in response to shifts in the social and ecological landscape until the present. Between 1000 BCE and about 800 CE, when farming populations immigrated into the region, archaeology testifies to the existence of two culturally distinct pastoral groups in Kenya: the Savanna Pastoral Neolithic (SPN) and Elmenteitan (Ambrose 1984; Bower et al. 1977). In the Central Rift Valley, early pastoralist sites are situated across a range of altitudes, some at low elevations on the valley floor and adjacent plains, others at higher elevations on escarpments flanking the Rift (Figure 1). The placement of such sites raises questions about seasonal exploitation of these different environments by herding groups. SPN sites, the focus of this study, are primarily located in low-elevation, open-country settings, from the Central Rift Valley to the Serengeti and the Loita Plains in the southwest, to the Athi-Kapiti Plains in the southeast. Most SPN sites clearly result from pastoralist pursuits, with faunal assemblages composed of cattle and caprines, with cattle predominating (Gifford-Gonzalez 1984, 1998; Gifford-Gonzalez and Kimengich 1984).

Cattle and other livestock are seasonally moved considerable distances and widely exchanged in Kenya today, and they may have been extensively moved in antiquity as well. However, before the advent of agriculture in East Africa and increasing populations, pastoralist mobility strategies could have differed markedly from those of modern herders.

STABLE ISOTOPE ANALYSIS: INSIGHTS INTO DIET AND MOBILITY

Stable isotope analyses of archaeological livestock remains have shed light on mobility practices of pastoralists by revealing the individual health, dietary, and mobility histories of herd animals. Isotopic analysis of livestock teeth have provided a more textured view of seasonal mobility (Balasse and Ambrose 2005; Balasse et al. 2003; Dufour et al. 2014), animal diet and foddering (Balasse et al. 2012; Balasse et al. 2005), as well as well as weaning and birth seasonality (Balasse et al. 2003; Frémondeau et al. 2012; Henton et al. 2010; Towers et al. 2011).

Tooth Formation in Livestock

Dental enamel is an ideal material for isotopic analysis for several reasons. Teeth resist post-depositional physical and chemical alteration and are very common in the archaeological and paleontological record. Because tooth enamel is roughly 99 percent bioapatite (the inorganic mineral component of bones and teeth), it is especially resistant to these alterations, and, unlike bone, tooth enamel is never remodeled during life and thus preserves a record of the individual's history during its growth.

Enamel growth is incremental, and so over the course of an animal's growth, the isotopic signatures of their diet are incorporated into the forming dental

tissue. Most livestock, including cattle, sheep, and goats, have high-crowned molars that take at least one year to grow. Sampling enamel sequentially, from the top of the crown to its base, can show seasonal changes in the carbon, oxygen, and strontium isotopic composition of enamel (Figures 2, 3). These changes are in turn due to variations in diet, climatic aridity, and movement across geological substrates (Balasse et al. 2002; Frémondeau et al. 2012; Fricke and O'Neil 1996; Henton et al. 2010; Koch et al. 1989). The present study utilizes three sets of stable isotopes to track these changes: oxygen, carbon, and strontium.

Stable Isotopes

Isotopes of an element vary. They always have the same number of protons and electrons, but differ in the numbers of neutrons, and thus differ in weight. Stable isotopes do not undergo any radioactive decay, and thus their relative abundances in the tissues of long-dead organisms remain constant and can be measured to gain information about the animal's diet and the environment in which it was living. Stable isotopes measured in livestock tooth enamel in this study include oxygen, carbon, and strontium. Carbon isotope ratios reflect diet, and strontium isotope ratios indicate the geological substrate on which an animal feeds. In tropical regions, oxygen isotopes record seasonal changes in aridity and thus can provide information on how diet and location may be linked seasonally.

Stable isotope analyses of archaeological livestock remains have shed light on mobility practices of pastoralists.

Oxygen Isotope Ratios and Seasonality

Animals form bioapatite, the mineral portion of bone and teeth, in equilibrium with body water. The oxygen isotopic composition ($\delta^{18}O$) of body water is linked to that of ingested water. Drinking water can vary seasonally (Dansgaard 1964; Gat 1996; Gonfiantini 2001; Iacumin et al. 1996; Longinelli 1984). The $\delta^{18}O$ values of water vary due to seasonal changes in aridity and temperature. In warm and/or dry seasons

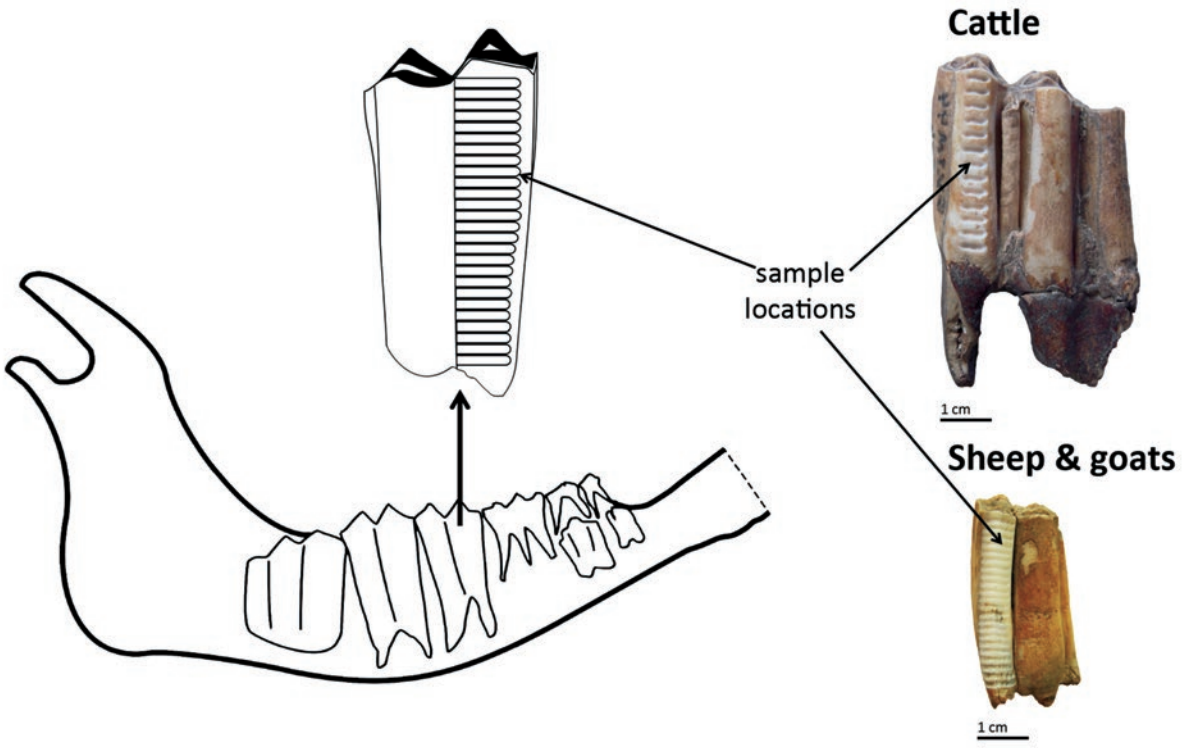


Figure 2. Cartoon of bovid mandible showing tooth growth and teeth with sequential sample lines.

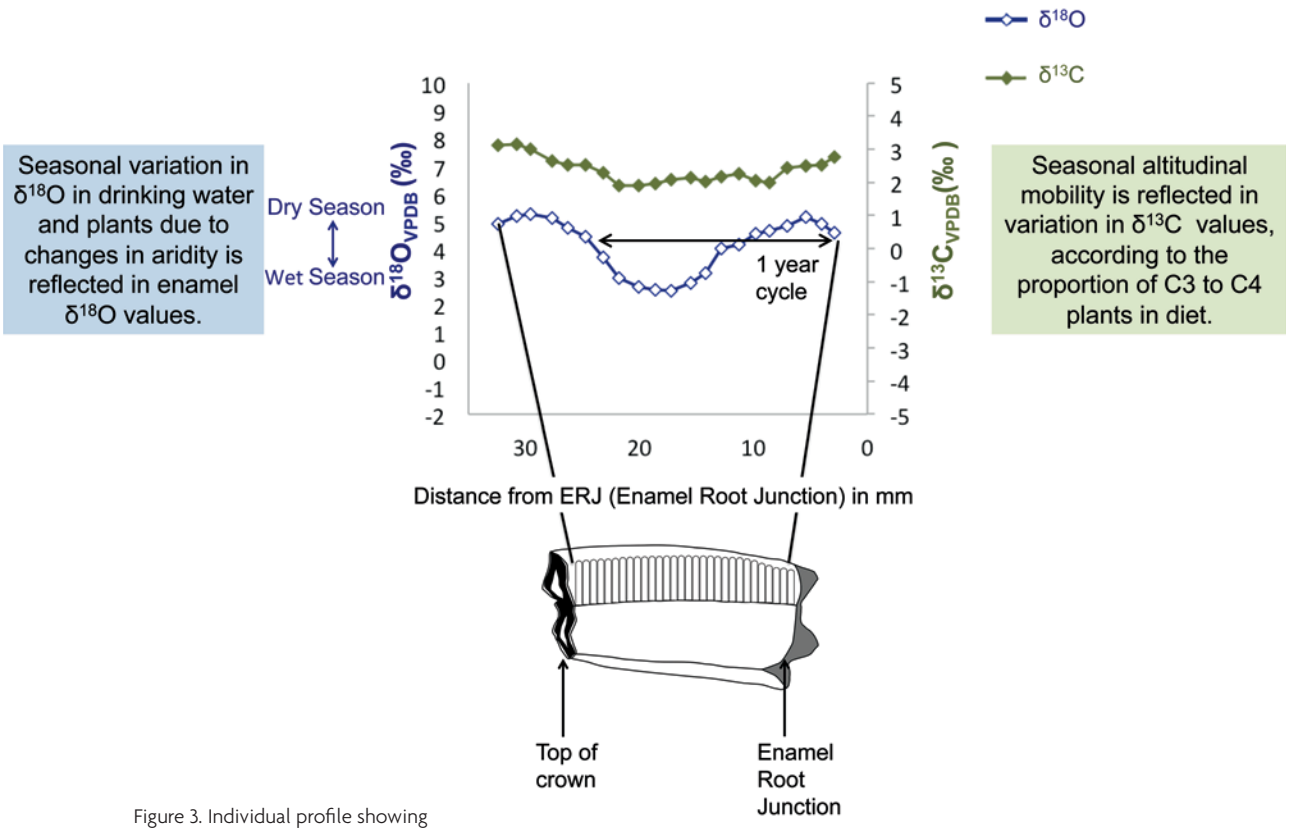


Figure 3. Individual profile showing seasonal changes in isotope ratios along the growth axis of the tooth.

the $\delta^{18}O$ values are relatively higher than in cold and/or wet seasons, as the lighter oxygen isotope (^{16}O) evaporates more readily. These seasonal changes manifest as cyclical changes in oxygen isotope ratios along the growth axis of teeth (Figure 3). This technique has been effectively employed to explore seasonal climate in many archaeological studies (Balasse et al. 2003; Frémondeau et al. 2012; Fricke and O'Neil 1996; Henton et al. 2010). It is often combined with analysis of other isotopes to link changes in diet and location during the seasonal round.

Carbon Isotope Ratios and Diet

The carbon stable isotope composition ($\delta^{13}C$) of bioapatite reflects whole diet. Variations in the $\delta^{13}C$ values are due primarily to the proportions of C3 and C4 plants in the diet, which have different carbon-fixing pathways, and thus different $\delta^{13}C$ values (Smith and Epstein 1971; van der Merwe and Medina 1991; Vogel et al. 1978). The geographic distribution of plants is related to their photosynthetic pathways: C4 plants are confined to arid regions where the growing season is warm, whereas C3 plants tend to thrive in colder, wetter areas. There is a strong correlation of grass species distribution and altitude: the transition from C4 grass dominance at low elevations to C3 grasses at higher elevations reflects changes in moisture and temperature with altitude. Therefore, vertical mobility may be traced by changes in carbon isotope ratios (Tieszen et al. 1979).

Strontium Isotope Ratios and Migration

Strontium isotope ratios in animal tissue reflect the local geology on which an animal was feeding. Strontium in soils and water is taken up by plants, and a small percentage of it substitutes for calcium in bioapatite. Strontium isotope ratios ($^{87}Sr/^{86}Sr$) vary with rock type and age, resulting in particular signatures for different geological substrates. In a given geological setting, bedrock, soils, ground water, and so forth all may have different $^{87}Sr/^{86}Sr$ ratios, and therefore local strontium signatures are determined by analyzing the remains of local plants or animals with small home ranges (Bentley et al. 2004). Strontium isotope analysis has been used to track mobility in wild and domestic animals, as well as humans (Britton et al. 2011; Koch et al. 1995; Tafuri et al. 2006).

TRACING ANCIENT MOBILITY IN THE EAST AFRICAN LANDSCAPE

The diversity of the East African landscape permits us to trace mobility through stable isotope analysis. The Kenyan Rift Valley is bordered on either side by steep escarpments reaching heights over 3,000 meters (over

10,000 feet). Along with this east-west altitudinal zonation comes considerable variation in vegetation and corollary variation in isotopic signatures. The Rift Valley floor is blanketed by C4 grasslands, while bush and woodland habitats dominate with increasing altitude, and C3 grasses thrive in alpine meadows at high altitudes atop the escarpments (Balasse and Ambrose 2005; Tieszen et al. 1979; Young and Young 1983). South and west of the Kenyan highlands lie the Athi-Kapiti, Mara, and Serengeti plains. These vegetation patterns allow for altitudinal movements to be identified through the analysis of the carbon stable isotope composition of tooth enamel. The various geological substrates range from Plio-Pleistocene volcanics and sediments in the Central Rift to Pre-Cambrian basement and granite geology to the east and west of the Rift. The strontium isotope ratios of these regions vary enough to permit application of strontium analysis to study movement across the landscape. If correlated with changes in oxygen isotope ratios, changes in diet and location may be a consequence of herders coordinating livestock migrations according to seasonal changes in forage and water availability.

THE STUDY AND ITS MATERIALS

Enamel samples were obtained from archaeological cattle and caprine teeth from seven SPN archaeological sites housed at the National Museums of Kenya, Nairobi, Archaeology Section. Teeth were cleaned with a hand-held Dremel drill with a tungsten-carbide drill bit, and enamel was sequentially sampled using a 1-mm-wide diamond drill bit. Enamel samples were then processed to remove possible contaminants and analyzed for carbon and oxygen stable isotope ratios in the at the Muséum National d'Histoire Naturelle in Paris, France.

RESULTS AND DISCUSSION

The results from two specimens from one site, Crescent Island Main, which are representative of the larger patterns of SPN mobility and herd management strategies are discussed below. Crescent Island Main is an SPN site located on Crescent Island, on Lake Naivasha at 1,890 meters above sea level (Figure 1). Radiocarbon dates place the occupation of the site between 600 and 400 BCE. Like most other SPN sites, the faunal assemblage is dominated by cattle.

Oxygen Isotope Ratios of Livestock Tooth Enamel

In the low latitudes, seasonal changes in aridity, rather than temperature, drive changes in $\delta^{18}O$ values of water (Rozanski et al. 1996). The $\delta^{18}O$ values of the cattle specimen presented here show very minor evidence for seasonal variation (Figure 4a). The caprine (Figure 4b), however, does show more significant intraannual changes in $\delta^{18}O$ values. The relatively low average $\delta^{18}O$ value and seasonal variation in the cattle specimen compared to the sheep may be explained by longer tooth mineralization rates in cattle (Balasse et al. 2013), which could dampen the strength of the seasonal changes in oxygen isotope ratios. Drinking behavior and physiology can also explain the lower amplitude of variation in $\delta^{18}O$ values. Cattle obtain most of their body water by drinking, while caprines, who are not obligate drinkers, obtain much more of their water from vegetation. Cattle at Crescent Island Main were likely drinking from Lake Naivasha, which is a large water source buffered from strong seasonal changes in oxygen isotope composition. In contrast, the sheep had higher and much more variable $\delta^{18}O$ values. This is a consequence of sheep ingesting primarily leaf water, which is highly evaporated and consequently has very high $\delta^{18}O$ values and is more sensitive to seasonal changes in aridity (Helliker and Ehleringer 2000).

> Dental enamel is an ideal material for isotopic analysis for several reasons.

CARBON ISOTOPE RATIOS OF LIVESTOCK TOOTH ENAMEL

To identify whether livestock were moving up in elevation seasonally, the diets of archaeological specimens are inferred by combining known $\delta^{13}C$ values of plants with what is known about how carbon isotopes are fractionated as they are incorporated from diet into dental tissues. Today, C4 plants have an average $\delta^{13}C$ value of -12.5 permil (Cerling et al. 2003; Vogel et al. 1978), which would have been approximately 1.5 permil higher in preindustrial times before the widespread burning of fossil fuels (Cerling et al. 1997). The $\delta^{13}C$ values of livestock tooth enamel is in general 14.1 permil higher than that of their diets (Cerling and Harris 1999). The cattle specimen had

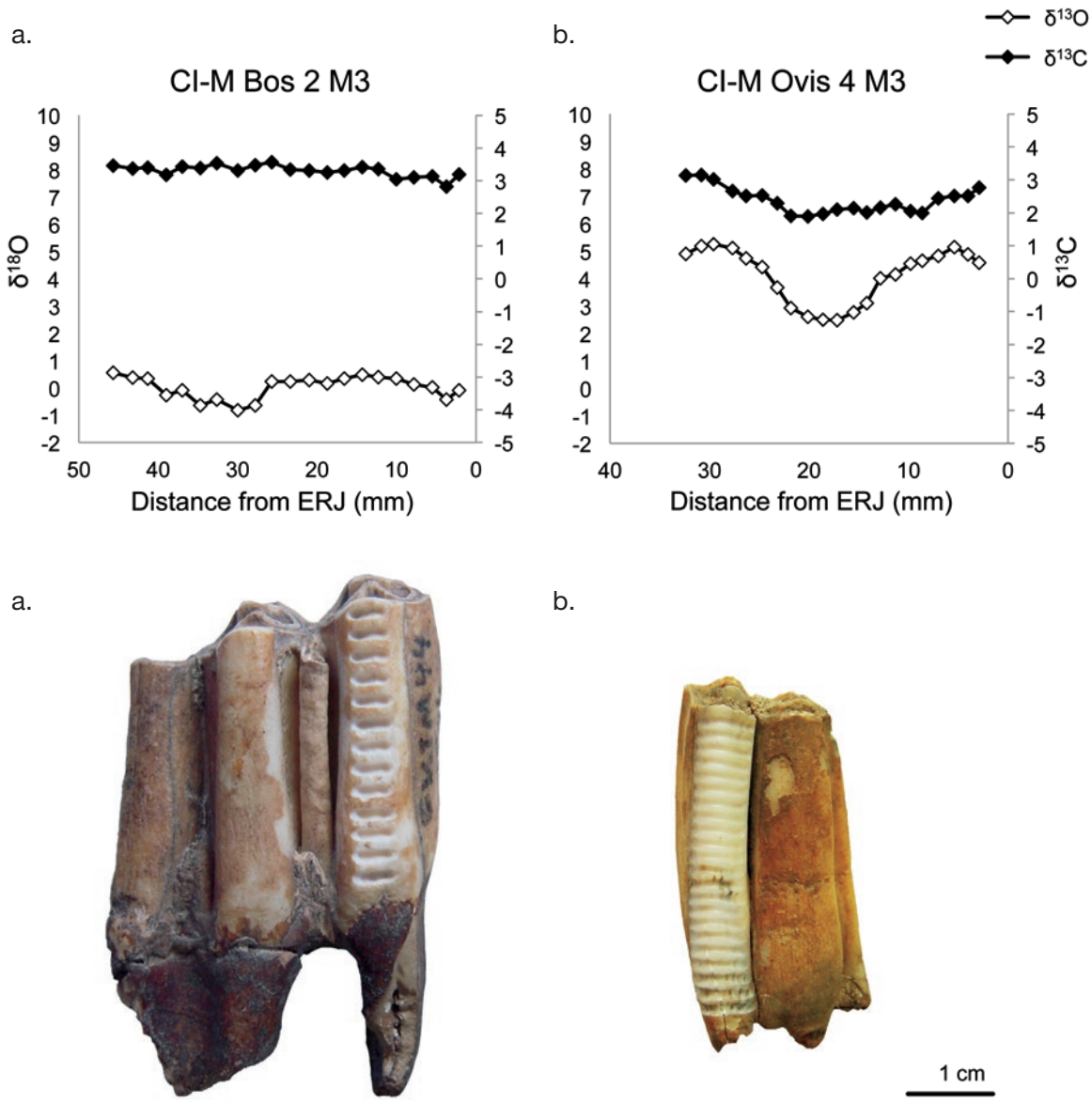


Figure 4. Individual carbon and oxygen profiles for a) cattle: CI-M Bos 2 M3; and b) sheep: CI-M Ovis 4 M3.

consistently high $\delta^{13}C$ values, around 3 permil. This indicates that the cattle specimen was consuming a near-100-percent C4 diet over the entire duration of tooth growth. There is no indication of seasonal changes in diet. In fact, the $\delta^{13}C$ values in the cattle specimen drop less than 1 permil over the course of tooth growth. In contrast, the sheep specimen, while also exhibiting very high $\delta^{13}C$ values, showed slightly more variation in $\delta^{13}C$ values, but this remains within the C4 range. The sheep shows evidence for some slight seasonal variation in diet, as $\delta^{13}C$ values covary with $\delta^{18}O$ values, indicating that in drier months (higher $\delta^{18}O$ values), the animal was consuming vegetation with higher $\delta^{13}C$ values. This does not point to seasonal movement to higher elevations but, rather, that the sheep was feeding at low elevations year-round and that the $\delta^{13}C$ values of vegetation, or the types of vegetation available, vary seasonally.

The carbon isotope results from livestock at Crescent Island Main, as well as other sites not discussed here, show that both cattle and caprines from SPN sites were not herded to higher altitudes seasonally. Nor is there evidence of long-term movement to higher elevations. Similar results have been reported by Balasse and Ambrose (2005) for Elmenteitan sites. This emphasis on herding at low elevations is interesting, as it suggests that the Rift Valley and neighboring plains may have been productive enough to support pastoralism year-round. If there was no need to herd animals seasonally to higher elevations, livestock

would be spared long journeys into mountainous areas, as cattle who move long distances have lower milk yields (Coppolillo 2000).

Next Steps: Strontium Isotopes

While this study shows no evidence for any altitudinal mobility among SPN herders, it is possible that livestock were herded long distances, but at low elevations. Therefore, strontium analysis may show whether animals were herded seasonally or exchanged long distances, across geological substrates. This portion of the project is still underway, as local $^{87}Sr/^{86}Sr$ ratios must be determined by analyzing local microfauna collected from protected areas and archaeological sites.

CONCLUSIONS

Sequential sampling of cattle and caprine teeth for stable isotope analysis illustrates the mobility strategies of early pastoralists in Kenya. Preliminary results indicate lack of altitudinal mobility among the early pastoralists, indicating that the more dynamic mobility patterns seen among East African pastoralists in the recent past were not followed 3,000 years ago. It is possible that before the encroachment of iron-using and -producing peoples into the region, population densities were low enough so that pastoralists did not need to move their animals altitudinally to access seasonally available pastures. However, this does not preclude movement of livestock long distances at low elevations. Long-distance mobility, including exchange, which may have developed in antiquity, would have provided herders with means to recover their herds in cases of disease, raiding, and so forth and would have been especially crucial for the earliest pastoralists encountering a new landscape and ecology. These preliminary interpretations await verification with results from strontium stable isotope analysis.

ACKNOWLEDGEMENTS

Funding for this research was provided by a National Science Foundation Doctoral Dissertation Improvement Grant (BCS-1240332), Wenner-Gren Dissertation Fieldwork Grant (#8630), UCSC CenTREAD grant, a Lewis and Clark Fieldwork Grant, and a UCSC Anthropology Department Fieldwork Grant. Research was conducted with permission of the National Council of Science and Technology, Republic of Kenya, under the sponsorship of the National Museums of Kenya, Archaeology Section. Permissions to collect modern fauna were obtained through the National Environmental Management Authority of Kenya and Kenya Wildlife Service. Samples were analyzed at the Muséum National d'Histoire Naturelle in Paris, France. I would also like to thank Purity Kiura, Emma Mbua, Rahab Kinyanjui, and Cecilia Ngugi at the National Museums of Kenya. Joël Ughetto-Monfrin and Richard Baldwin provided laboratory assistance, and Diane Gifford-Gonzalez, Marie Balasse, and Stanley Ambrose offered many helpful insights.

REFERENCES

Ambrose, Stanley H. 1984.The Introduction of Pastoral Adaptations to the Highlands of East Africa. In *From Hunters to Farmers: The Causes and Consequences of Food Production in Africa*, edited by J. Desmond Clark and Steven A. Brandt, pp. 212–239. Berkeley: University of California Press.

Balasse, Marie, and Stanley H. Ambrose. 2005. Mobilité altitudinale des pasteurs néolithiques dans la vallée du Rift (Kenya): Premiers indices de l'analyse du $\delta^{13}C$ de l'émail dentaire du cheptel domestique. *Anthropozoologica* 40(1):147–166.

Balasse, Marie, Stanley H. Ambrose, Andrew B. Smith, and T. Douglas Price. 2002. The Seasonal Mobility Model for Prehistoric Herders in the South-Western Cape of South Africa Assessed by Isotopic Analysis of Sheep Tooth Enamel. *Journal of Archaeological Science* 29:917–932.

Balasse, Marie, Adrian Bălăşescu, Anneke Janzen, Jöel Ughetto-Monfrin, Pavel Mirea, and Radian Andreescu. 2013. Early Herding at Măgura-Boldul lui Moş Ivănuş (Early Sixth Millennium BC, Romania): Environments and Seasonality from Stable Isotope Analysis. European Journal of Archaeology 16(2):221–246.

Balasse, Marie, Loïc Boury, Joël Ughetto-Monfrin, and Anne Tresset. 2012. Stable Isotope Insights ($\delta^{18}O$, $\delta^{13}C$) into Cattle and Sheep Husbandry at Bercy (Paris, France, 4th Millennium BC): Birth Seasonality and Winter Leaf Foddering. Environmental Archaeology 17(1):29–44.

Balasse, Marie, Andrew B. Smith, Stanley H. Ambrose, and Steven R. Leigh. 2003. Determining Sheep Birth Seasonality by Analysis of Tooth Enamel Oxygen Isotope Ratios: The Late Stone Age Site of Kasteelberg (South Africa). *Journal of Archaeological Science* 30(2):205–215.

Balasse, Marie, Anne Tresset, Keith Dobney, and Stanley H. Ambrose. 2005. The Use of Isotope Ratios to Test for Seaweed Eating in Sheep. *Journal of Zoology* 266(03):283–291.

Barthelme, John W. 1985. *Fisher–Hunters and Neolithic Pastoralists in East Turkana, Kenya*. Oxford: British Archaeological Reports.

Bentley, R. Alexander, T. Douglas Price, and Elisabeth Stephan. 2004. Determining the "Local" 87Sr/86Sr Range for Archaeological Skeletons: A Case Study from Neolithic Europe. *Journal of Archaeological Science* 31(4):365–375.

Bower, John, Charles M. Nelson, Albert F. Waibel, and Simiyu Wandibba. 1977. The University of Massachusetts Later Stone Age/Pastoral "Neolithic" Comparative Study in Central Kenya: An Overview. *Azania* 12:119–146.

Britton, Kate, Vaughan Grimes, Laura Niven, Teresa E. Steele, Shannon McPherron, Marie Soressi, Tegan E. Kelly, Jacques Jaubert, Jean-Jacques Hublin, and Michael P. Richards. 2011. Strontium Isotope Evidence for Migration in Late Pleistocene Rangifer: Implications for Neanderthal Hunting Strategies at the Middle Palaeolithic Site of Jonzac, France. *Journal of Human Evolution* 61(2):176–185.

Cerling, Thure E., and John M. Harris. 1999. Carbon Isotope Fractionation between Diet and Bioapatite in Ungulate Mammals and Implications for Ecological and Paleoecological Studies. *Oecologia* 120(3):347–363.

Cerling, Thure E., John M. Harris, Bruce J. MacFadden, Meave G. Leakey, Jay Quade, Vera Eisenmann, and James R. Ehleringer. 1997. Global Vegetation Change through the Miocene/Pliocene Boundary. *Nature* 389:153–158.

Cerling, Thure E., John M. Harris, and Benjamin H. Passey. 2003. Diets of East African Bovidae Based on Stable Isotope Analysis. *Journal of Mammology* 84(2):456–470.

Coppolillo, Peter B. 2000. The Landscape Ecology of Pastoral Herding: Spatial Analysis of Land Use and Livestock Production in East Africa. *Human Ecology* 28(4):527–560.

Dahl, Gudrun, and Anders Hjort. 1976. *Having Herds: Pastoral Herd Growth and Household Economy*. Stockholm: University of Stockholm, Department of Anthropology.

Dansgaard, Willi. 1964. Stable Isotopes in Precipitation. *Tellus* 16(4):436–468.

Di Lernia, Savino. 2006. Building Monuments, Creating Identity: Cattle Cult as a Social Response to Rapid Environmental Changes in the Holocene Sahara. *Quaternary International* 151:50–62.

Dufour, Elise, Nicolas Goepfert, Belkys Gutiérrez Léon, Claude Chauchat, Régulo Franco Jordán. and Segundo V. Sánchez. 2014. Pastoralism in Northern Peru during Pre-Hispanic Times: Insights from the Mochica Period (100–800 AD) Based on Stable Isotopic Analysis of Domestic Camelids. *PLoS ONE* 9(1):e87559.

Evans-Pritchard, Edward E. 1940. *The Nuer: A Description of the Modes of Livelihood and Political Institutions of a Nilotic People*. London: Oxford University Press.

Fratkin, Elliot, and Kathleen Smith. 1994. Labor, Livestock, and Land: The Organization of Pastoral Production. In *African Pastoralist Systems: An Integrated Approach*, edited by Elliot Fratkin, Kathleen Galvin, and Eric A. Roth, pp. 91–112. Boulder: Lynne Reinner Publishers.

Frémondeau, Delphine, Thomas Cucchi, François Casabianca, Joël Ughetto-Monfrin, Marie-Pierre Horard-Herbin, and M. Balasse. 2012. Seasonality of Birth and Diet of Pigs from Stable Isotope Analyses of Tooth Enamel ($\delta^{18}O$, $\delta^{13}C$): A Modern Reference Data Set from Corsica, France. *Journal of Archaeological Science* 39(7):2023–2035.

Fricke, Henry C., and James R. O'Neil. 1996. Inter- and Intra-Tooth Variation in the Oxygen Isotope Composition of Mammalian Tooth Enamel Phosphate: Implications for Palaeoclimatological and Palaeobiological Research. *Palaeogeography, Palaeoclimatology, Palaeoecology* 126:91–99.

Gat, Joel R. 1996. Oxygen and Hydrogen Isotopes in the Hydrologic Cycle. *Annual Review of Earth and Planetary Sciences* 24:225–262.

Gautier, Achilles. 1984. Archaeozoology of the Bir Kiseiba Region, Eastern Sahara. In *Cattle-Keepers of the Eastern Sahara: The Neolithic of Bir Kiseiba*, edited by Angela E. Close, pp. 49–72. Dallas: Southern Methodist University.

Gifford, Diane P., Glynn L. Isaac, and Charles M. Nelson. 1980. Prolonged Drift. *Azania* 15:57–108.

Gifford-Gonzalez, Diane. 1984. Implications of a Faunal Assemblage from a Pastoral Neolithic Site in Kenya: Findings and a Perspective on Research. In *From Hunters to Farmers: The Causes and Consequences of Food Production in Africa*, edited by J. Desmond Clark and Steven A. Brandt, pp. 240–251. Berkeley: University of California Press.

———. 1998. Early Pastoralists in East Africa: Ecological and Social Dimensions. *Journal of Anthropological Archaeology* 17:166–200.

Gifford-Gonzalez, Diane., and John Kimengich. 1984. Faunal Evidence for Early Stock-Keeping in the Central Rift of Kenya: Preliminary Findings. In *Origin and Early Development of Food-Producing Cultures in Northeastern Africa*, edited by Lech Krzyzaniak and Mical Kobusiewicz, pp. 457–471. Poznan: Polish Acadamy of Science.

Gonfiantini, Roberto. 2001. The Altitude Effect on the Isotopic Composition of Tropical Rains. *Chemical Geology* 181:147–167.

Greenfield, Haskel J. 1988. The Origins of Milk and Wool Production in the Old World: A Zooarchaeological Perspective from the Central Balkans [and Comments]. *Current Anthropology* 29(4):573–593.

Gulliver, Phillip H. 1955. *The Family Herds: A Study of Two Pastoral Tribes in East Africa*. London: Routledge.

Haaland, Randi. 1992. Fish, Pots, and Grain: Early and Mid-Holocene Adaptations in the Central Sudan. *African Archaeological Review* 10:43–64.

Helliker, Brent R., and James R. Ehleringer. 2000. Establishing a Grassland Signature in Veins: ^{18}O in the Leaf Water of C3 and C4 Grasses. *Proceedings National Academy of Science* 97(14):7894–7898.

Henton, Elizabeth, Wolfram Meier-Augenstein, and Helen F. Kemp. 2010.The Use of Oxygen Isotopes in Sheep Molars to Investigate Past Herding Practices at the Neolithic Settlement of Çatalhöyük, Central Anatolia. *Archaeometry* 52(3):429–449.

Iacumin, Paola, Hervé Bocherens, André Mariotti, and Antonio Longinelli. 1996. Oxygen Isotope Analyses of Co-Existing Carbonate and Phosphate in Biogenic Apatite: A Way to Monitor Diagenetic Alteration of Bone Phosphate? *Earth and Planetary Science Letters* 142(1–2):1–6.

Kelly, Raymond C. 1985. *The Nuer Conquest: The Structure and Development of an Expansionist System*. Ann Arbor: The University of Michigan Press.

Koch, Paul L., Daniel C. Fisher, and David Dettman.1989. Oxygen Isotope Variation in the Tusks of Extinct Proboscideans: A Measure of Season of Death and Seasonality. *Geology* 17:515–519.

Koch, Paul L., Jennifer Heisinger, Cynthia Moss, Richard W. Carlson, Marilyn L. Fogel, and Anna K. Behrensmeyer. 1995. Isotopic Tracking of Change in Diet and Habitat Use in African Elephants. *Science* 267:1340–1343.

Longinelli, Antonio. 1984. Oxygen Isotopes in Mammal Bone Phosphate: A New Tool for Paleohydrological and Paleoclimatological Research? *Geochimica et Cosmochimica Acta* 48(2):385–390.

Marshall, Fiona B. 2000. The Origins and Spread of Domestic Animals in East Africa. In *The Origins and Development of African Livestock: Archaeology, Genetics, Linguistics, and Ethnography*, edited by Roger M. Blench and Kevin C. MacDonald, pp. 191–221. London: UCL Press.

Marshall, Fiona B., and Elisabeth Hildebrand. 2002. Cattle before Crops: The Beginnings of Food Production in Africa. *Journal of World Prehistory* 16(2):99–143.

McCabe, J. Terrence. 2004. *Cattle Bring Us to Our Enemies: Turkana Ecology, History, and Raiding in a Disequilibrium System*. Ann Arbor: University of Michigan Press.

Mearns, Robin. 1993. Territoriality and Land Tenure among Mongolian Pastoralists: Variation, Continuity, and Change. *Nomadic Peoples* 33:73–103.

Nicolaisen, Johannes, and Ida Nicolaisen. 1997. *The Pastoral Tuareg: Ecology, Culture, and Society*. New York: Thames and Hudson.

Paris, François. 1997. Les inhumations de Bos au Sahara méridional au Néolithique. *Archaeozoologia* IX:113–122.

Payne, Sebastian. 1973. Kill-off Patterns in Sheep and Goats: The Mandibles from Asvan Kale. *Anatolian Studies* 23:281–303.

Pike-Tay, Anne, Xiaolin Ma, Y. Hou, F. Liang, Minghao Lin, and Veronica Peterson. 2014. Combining Odontochronology, Tooth Wear Assessment, and Linear Enamel Hypoplasia (LEH) Recording to Assess Pig Domestication in Neolithic Henan, China. *International Journal of Osteoarchaeology*:n/a–n/a.

Rozanski, Kazimierz, Luis Araguas-Araguas, and Roberto Gonfiantini. 1996. Isotope Patterns of Precipitation in the East African Region. In *The Limnology, Climatolog,y and Paleoclimatology of the East African Lakes*, edited by Thomas C. Johnson and Eric O. Odada, pp. 79–93. Amsterdam: Gordon & Breach.

Smith, Bruce N., and Samuel Epstein.1971. Two Categories of 13C/12C Ratios for Higher Plants. *Plant Physiology* 47(3):380–384.

Sobania, Neal W. 1991. Feasts, Famines, and Friends: Nineteenth Century Exchange and Ethnicity in the Eastern Lake Turkana Region. In *Herds, Warriors, and Traders: Pastoralism in Africa*, edited by John G. Galaty and Pierre Bonte, pp. 118–142. Boulder, Colo: Westview Press.

Spencer, Paul. 1965. *The Samburu: A Study of Gerontocracy*. London: Routledge.

Stenning, Derrick J. 1957. Transhumance, Migratory Drift, Migration: Patterns of Pastoral Fulani Nomadism. *The Journal of the Royal Anthropological Institute of Great Britain and Ireland* 87(1):57–73.

Tafuri, Mary Anne, R. Alexander Bentley, Giorgio Manzi, and Savino Di Lernia. 2006. Mobility and Kinship in the Prehistoric Sahara: Strontium Isotope Analysis of Holocene Human Skeletons from the Acacus Mts. (Southwestern Libya). *Journal of Anthropological Archaeology* 25(3):390–402.

Tieszen, Larry L., Michael M. Senyimba, Simeon K. Imbamba, and John H. Troughton. 1979. The Distribution of C3 and C4 Grasses and Carbon Isotope Discrimination along an Altitudinal and Moisture Gradient in Kenya. *Oecologia* 37(3):337–350.

Towers, Jacqueline, Mandy Jay, Ingrid Mainland, Olaf Nehlich, and Janet Montgomery. 2011. A Calf for All Seasons? The Potential of Stable Isotope Analysis to Investigate Prehistoric Husbandry Practices. *Journal of Archaeological Science* 38(8):1858–1868.

van der Merwe, Niolaas J., and Ernesto Medina. 1991. The Canopy Effect, Carbon Isotope Ratios, and Foodwebs in Amazonia. *Journal of Archaeological Science* 18:249–259.

Vogel, John C., Annemarie Fuls, and Roger P. Ellis. 1978. The Geographical Distribution of Kranz Grasses in South Africa. *South African Journal of Science* 74:209–215.

Waller, Richard, and Neal W. Sobania. 1994. Pastoralism in Historical Perspective. In *African Pastoralist Systems: An Integrated Approach*, edited by Elliot Fratkin, Kathleen A. Galvin, and Eric A. Roth, pp. 45–68. Boulder, Colo.: Lynne Reinner Publishers.

Wendorf, Fred, and Romuald Schild. 1998. Nabta Playa and Its Role in Northeastern African Prehistory. *Journal of Anthropological Archaeology* 17:97–123.

Young, Helen J., and Truman P. Young. 1983. Local Distribution of C3 and C4 Grasses in Sites of Overlap on Mount Kenya. *Oecologia* 58:373–377.

FEATURE

Prehistoric Urban Archaeology in the Americas: A View from Cusco, Peru

Alexei Vranich[1], Stephen Berquist[2], and Thomas Hardy[3]

IN JANUARY 2010, images of a collapsed railway, of hotels tumbling into a swollen river, and the plight of trapped tourists waiting to be helicoptered out of Machu Picchu went viral across major Internet news pages. Less noticed by the world media were the ruined colonial houses and the flooded sewers and streets in nearby Cusco, the former capital of the Inca Empire and a World Heritage City. The Inca engineers and architects had a merited reputation for building firm structures that could withstand earthquakes and remain perched on the side of mountains, unmoved despite centuries of tropical downpours. However, much had changed since the Spanish invaded and created their own city with the stones torn from the former palaces and—most significantly for the present-day disaster—from the terraces that revetted the surrounding hills into a beautiful and hydraulically stable hillside.

The archaeological investigation of Cusco is complex for a variety of reasons; foremost is the fact that the modern city continues to exist and grow directly on the foundations of the Inca capital. Discontinuous wall foundations are embedded in presently inhabited buildings, and portions of terraces, as well as substantial ritual structures—such as the temple of the sun (the Qoricancha) and the monumental Saqsayhuaman complex perched over the northwest portion of the city—attest to a rich historical past.

The goal of this project is to combine 150 years of architectural and archaeological survey and thereby to produce a spatial database that will allow us to project a hypothetical three-dimensional form of the indigenous city at its apogee. Methodologically, the project is a feasibility study that reevaluates previous work while incorporating new information. At a broader theoretical level, this research reconceptualizes the form and the experience of this most important pre-Columbian city of the South American continent.

THE CITY OF CUSCO

Cusco is similar to other continuously occupied cities, such as Rome and Jerusalem, where visitors can walk along ancient architecture and imagine what the site might have been like in the past (Figure 1). The unfortunate reality, notwithstanding, is that a near half-millennium of gradual processes and destabilizing events

1. Cotsen Institute of Archaeology, UCLA.
2. University of Toronto.
3. University of Pennsylvania.

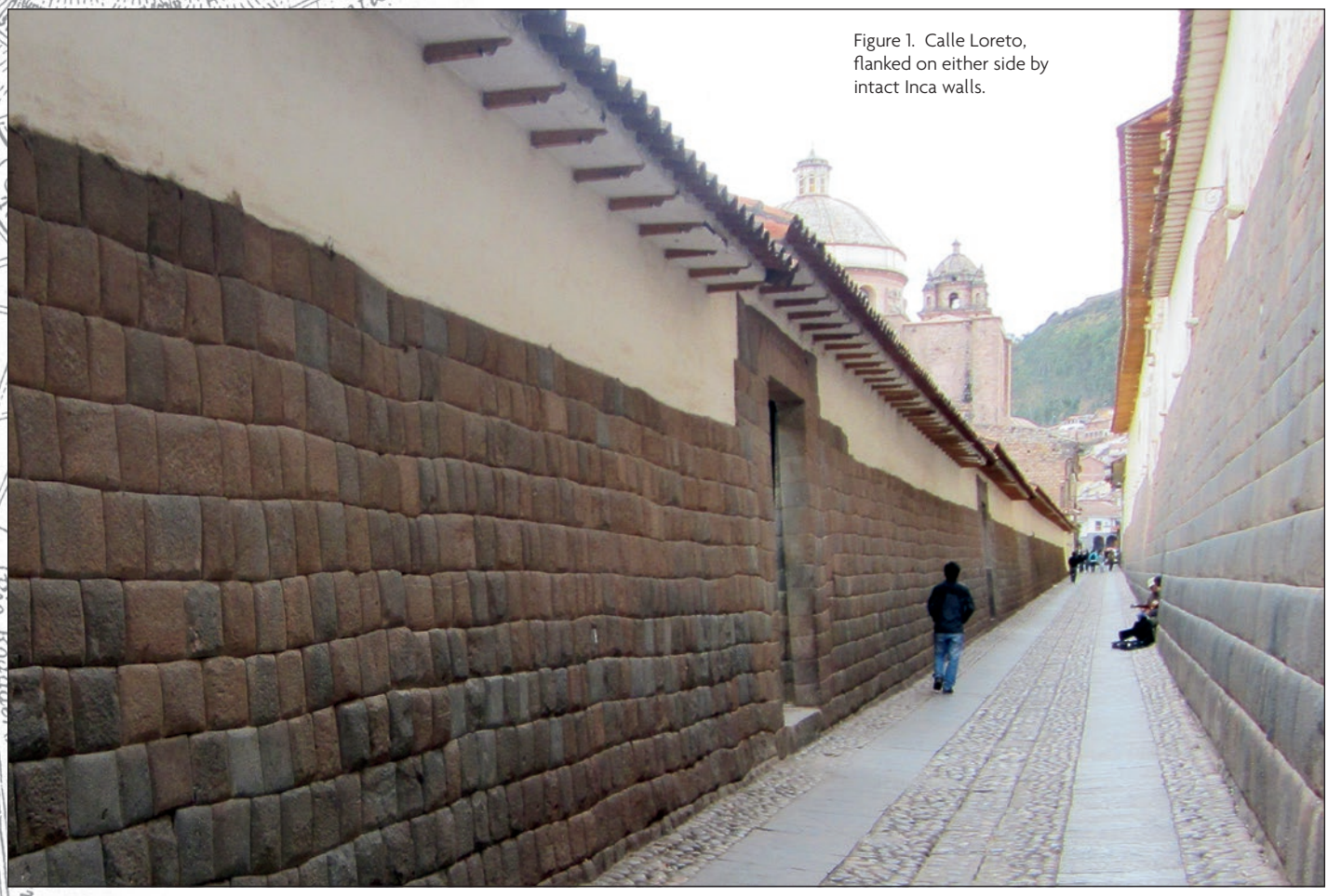


Figure 1. Calle Loreto, flanked on either side by intact Inca walls.

has completely transformed the architecture and topography of the ancient metropolis (Bauer 2004). Alterations to the original design of the Inca capital began soon after the imperial city was sacked and burned in the late 1530s during the struggle between the Spanish Conquistadors and the Incas. Royal palaces and sacred temples were torn down in order to provide stone for colonial buildings, and streets and plazas were modified to fit European ideas of urban space. Consequently, the original Inca city survives as discontinuous fragments of masonry incorporated into the walls of inhabited buildings, often "floating" above or buried below the modern surface. Among scholars there is no consensus on a map of the Inca city, and popular representations in books and tourist guides are incomplete and misleading. As a result, a city that should be appreciated as a testament to the genius of the pre-Columbian people who created an innovative form of urbanism is experienced as a series of disembodied architectural fragments embedded within a European Old World city form.

In the historical bibliography, the early descriptions of Cusco are invaluable, such as that of Pedro Sancho de la Hoz, one of the few who saw and wrote about the city before it was burned during the Great Inca Revolt in 1536. Later descriptions were penned by other chroniclers, such as Polo de Ondegardo, governor and magistrate of Cusco during the Toledo Viceroy; Juan de Betanzos, married to an Inca coya; Felipe Guaman Poma de Ayala, the first indigenous ethnographer to write about his culture; and "El Inca" Garcilaso de la Vega, the first mestizo writer to exalt his indigenous origin. This information, combined with more than a century of archaeological surveys and excavations, provides enough to divide the site into separate areas (Figure 2): The center of the city (A), which contained one of the temples of the sun and the primary residences of the Inca nobles and associated administrators and provincial lords. A large plaza in the center serves as the locations of important ceremonies and opens to the west to (B), an expanse of high and broad agricultural terraces. To the east of the center of the city and on the other side of the river was another section of terraces (C), although these were smaller and closely stacked together. To the northwest and perched over the city was the Saqsay-huaman (D), an expansive monumental complex that served multiple purposes from ritual to storage. The early descriptions further mention that an open space surrounded the city, and outside the boundary were

the houses for other, lesser citizens (attendants, workers, minor nobles) of the empire.

The Cotsen Research Project

In the summer of 2005, the author and researchers from the Center of Advanced Spatial Technologies from the University of Arkansas (CAST) conducted a high-density survey of the Inca ruins of Machu Picchu using a 3D laser scanner. From this introduction into the politically complex world of the "archaeological capital of South America," the Cotsen-based research project expanded to include multiple related collaborative efforts: excavations in select locations in the immediate environs of the city in collaboration with AECID, a Spanish development organization; a survey and study of the surrounding pre-Columbian road system with Virginia Tech and the National Museum of the American Indian; and a survey of the modern and ancient hydraulics of the endangered Saqsayhuaman monument with the University of Virginia. The joint Cotsen / CAST team returned again in 2009 with the purpose of surveying the historic core of the city as part of a summer field school. The results presented here are the continuation of the later efforts conducted in 2011 and 2012.

> Cusco is similar to other continuously occupied cities, such as Rome and Jerusalem.

Over the past 150 years, Cusco has hosted a variety of archaeological investigations that range from individual efforts to complex multidisciplinary projects lasting several years. As is the case at many complex archaeological sites with a long history of research, the results of the various efforts are not always compatible. Equally damaging is the loss of much of the primary field data. One crucial and time-consuming aspect of the project was to find and gain access to the reports and surveys archived in the various public and private collections across the city. One survey in particular conducted in the 1970s (Arguto 1980) was the most thorough. This single publication contains several detailed maps of modern and Inca architecture and samples of the formal and detailed field forms; however, the bulk of the records are missing. A large foldout map of the entire center of the city was first made digital using scanners at a high resolution. Modern city and Inca walls were traced (vectorized) and separated into different layers. This became the common map to add additional information to from recent professional surveys conducted by Monica Paredes (1999) and Ian Farrington (2013). From a number of citywide surveys conducted prior to the 1950 earthquake that devastated the city, we selected two maps—one from Ephraim Squier (1877; see Figure 2) and a second made by Max Uhle a few decades later—and included them in the database. A third map, made in 1900 by hydraulic engineers, did not mark the location of Inca remains but did have regular elevation points across the entire historic core of the city (Silgado 1900). This hydrological survey became key for creating the three-dimensional form of the terraced city.

Figure 3 presents a composite image of all the important architectural surveys of the historic center of Cusco. Several of these remains no longer exist but were included based on the description, other evidence such as photography, and the reputation of the scholar. As expected, none of the maps corresponded exactly to the others, and a great deal of manipulation (rubber-sheeting in computer terminology) was necessary to have even the modern architecture from each map correspond. The location of the Inca remains varied from map to map owing to various factors, the most interesting being the distinction between pre-Columbian and the early colonial walls constructed by Inca masons. For example, the wall marked "A" in Figure 3 appears in nearly every map of Cusco as Inca; notwithstanding, more recent analysis indicates that this wall is early colonial. Graced with a monumental entrance complete with classical Mediterranean architectural motifs, it tells the story of the effort of the Inca masons to conceptualize and construct a proper European doorway for their foreign rulers. A number of recent architectural studies have refined the differences between Inca and colonial period Inca (Protzen 1993), but there remains ample room for debate. Case in point: the structure known as Casa Concha (Figure 3B) continues to confuse specialists as to its form and proper chronological period.

The other difference is the timing of the study. The Inca walls are part of a living built environment, and their visibility is directly tied to the fate and function of the city. Substantial transformations of the city and landscape of the last century are the result

Figure 2. Cusco with sections referred to in the text. The underlying image is a map by Ephraim Squier (1877).

Figure 3. Composite map of Inca remains over the modern city form of Cusco.

of a dramatic increase in population. A watershed moment was the aforementioned earthquake of 1950. An important decision to maintain the historic form of the city during the reconstruction process saved the character of the city, though many more Inca walls fell unnoticed as new buildings were constructed and the interiors of dilapidated houses were modernized. At the same time, Cusco has become a sought-after destination attracting thousands of global travelers. Social and physical transformations have led to the exposure of new remains through salvage excavations (Farrington 2013) and the loss of architecture both within and in the immediate environs of the city. This devastating process has been gradual throughout the twentieth century but has accelerated in the last few decades. More recently, there has been a change in general attitude (along with a stricter enforcement of the law) toward the Inca remains. The value of an Inca wall, in particular in a restaurant, hotel, or any other tourist facility, is considered high enough such that care is now taken to highlight its presence in an aesthetically pleasing manner. As more houses are converted into hotels and restaurants, more remains come to light.

Ground Truthing

The survey was divided into the three separate areas: (A) the center of the city defined by the two rivers; (B) the region to the west of the core; and (C) the sector to the east of the center. Section D, Saqsayhuaman, was not included in this study, although a recent architectural survey and three-dimensional modeling presents the best-informed view of the most impressive of the Inca buildings reduced to its foundations

by centuries of quarrying (Mar and Beltran 2015). The composite map of all the recorded Inca remains was printed out into small sections and taken into the city for ground truthing. Areas of particular concern were marked for special investigation. Confirming previously recorded architecture, measurements and other observations were marked directly on the map and later transferred back to the database in the lab. In addition, we recorded certain details that would later be important for creating a 3D model, such as the elevation of the base and, in rare cases, the original height of the walls. Another aspect crucial for three-dimensional modeling was the difference between freestanding walls of a building and a terrace that originally faced fill. Both have been marked on the maps as "Inca," but the implication for city form and design are significant. Distinguishing between the two was a tricky task since terraces and revetted platforms have been gutted of fill to create interior spaces for colonial buildings. Local guides tout the megalithic wall that holds the famous twelve-sided stone as the palace of an early Inca emperor. In fact, this structure had been a freestanding platform that had been gutted to form the foundations for the walls of a colonial building (Figure 4).

Social and physical transformations have led to the exposure of new remains through salvage excavations.

Cusco provides an overwhelming amount of data, and this effort made use of such material as published sources, historic photographs, and aerial photography. During the course of walking around the city and into individual properties, we had the opportunity to interview long-term residents and present and former owners of historic properties. Our regular meetings

Figure 4. The entrance to a colonial building built into a former Inca ritual platform.

Figure 5. View of a monumental terrace revetment (A) that runs along the present market of San Pedro; (B) modern building on the approximate surface of the terrace; (C) modern store formed by vacating the fill behind the terrace; (D) original location of an Inca street.

at the Institute of Archaeology also brought us into contact with archaeologists and workers who participated in salvage excavations throughout the city. Their observations and recollections were also noted on the plan map.

Core Section A: Central Area Defined by the Two Rivers

Several reputable chroniclers mention the area between the two rivers, marked area "A" in Figure 2, as the area that contained the imperial palaces, as well as the largest public space and the most sacred ritual structures. Around the central plaza—now known as the Plaza de Armas, but originally named Haucaypata—were four large buildings referred to as "palaces." The dimensions, functions, and owners of these monumental compounds are noted by early chroniclers, albeit discrepancies exist in their accounts. Although substantially modified over the last 500 years, this area still contains the most impressive fragments of Inca architecture, many of which are openly visible and form part of the itinerary of daily city tours. These impressive walls were quickly confirmed from the street or by casually entering the hotels and restaurants that had previously been private property. In places where new construction or renovation had destroyed historic remains, extensive collections of photographs from several Peruvian photographers presented views of the architecture and city life from the early twentieth century (Chambi 1990).

Section B: West of the Plaza

The farther away from the center and the primary religious and palatial monuments, the less monumental the remains became and, as a result, either did not survive or were completely subsumed into the new constructions. There also appears to be few buildings in the area immediately outside the boundaries established by the two rivers. Several chroniclers describe the area to the west as an expanse of terrace whose broad and wide surfaces were ideal locations for later colonial constructions. Besides a celebrated revetment that extends for nearly a kilometer (Figure 5), little other traces of Inca masonry remain. Figure 5 shows a portion of this Inca terrace (A) and the manner in which the Spaniards either built on top of the solid face of the revetment (B) or carved out spaces from the fill (C). The location of the street (D)

is mostly likely Inca[4], but the original steps have been graded into a steep slope. Grading the stepped and terraced Inca surface to accommodate wheeled traffic is a process that started when the Spanish first entered the city and continues even in recent times with the introduction of the automobile.

Nevertheless, the former stepped pattern of level surfaces and precise vertical boundaries can be noticed in the undulating form of flat streets and sudden steep inclines. For a more quantifiable method, a digital elevation model was made of the 1900 hydrological survey. Regularly spaced elevation points taken along several major streets and intersections were accurate to within a hundredth of a meter. Transforming these points into a three-dimensional form map presented preautomobile surfaces closer to the original Inca topography of the city. We reconstructed the likely location of the terraces based on the digital model and from observations from the pedestrian survey in the present-day neighborhood.

Section C: Northeast of the Plaza

Toward the east of the center of the city is the colorful barrio of San Blas (Figure 2C). This area was also covered in terraces, though, in contrast to Section C, the material and masonry style were distinct. The terraces were smaller and contoured to the natural form of the hill. These terraces had collapsed and been rebuilt many times over in the past, but in situ Inca foundations could be noticed along the base. After the colonization of the city by the Spanish, this area became an indigenous neighborhood where houses were built over or against the terraces. As a result, the winding streets and irregular house plans, visible from the air photography, betrayed the underlying Inca terraces. Several of the present stepped streets appear to be in the original location.

This area also contained more private houses and properties, which required the time-consuming process of gaining permission. In this case, and in other locations throughout the city that could not be personally visited, a recent extensive effort by the city of Cusco and AECID to document in detail the entire historical heritage of the core of Cusco provided the necessary insight. Within the thick folders for each sector of the city were standardized forms, checklists, and historical descriptions of the properties and, most relevant to this study, plan maps that ranged from the city block to the individual house. These simple and clear ground plans had notable sections of architecture marked with broad categories such as "colonial," "modern," and "Inca," along with a number linked to a digital photograph.

The winding streets and irregular house plans, visible from the air photography, betrayed the underlying Inca terraces.

In most cases, the photographs allowed for quick confirmation of cultural / chronological category. The municipal project data were collected by dozens of individuals—many young and enthusiastic university students of archaeology and related fields—who made every effort to be as objective as possible. However, as noted above (Figure 3A and B), designating a culture and period for architecture in Cusco can be problematic even for an expert. One category that required revisitation was "colonial with Inca stones," a label that essentially includes every construction within the historic core not made of cement. In most cases, the walls were colonial or republican period built with Inca stones; however, careful review of the bases of the walls occasionally revealed their Inca foundation.

Plan View

The plan view of the historic area of Cusco (Figure 3) with modern buildings and streets is an accurate and useful record of the important resources that could be preserved in this growing World Heritage city. While the two-dimensional plan can be and has been the basis for rewarding spatial analysis (Moore 1996), scholars recognize that plan views are not capable of conveying the experience and conceptual form of the city. This problem is of special concern in the pre-Columbian Americas where research indicates that basic canons of settlement design were radically different from the Old World (Smith 2007).

There is, of course, an established tradition of presenting three-dimensional drawings of archaeological sites (Pillsbury 2012). Computer-assisted modeling, recently accessible even to those without drafting and architectural training, has both practical and theoreti-

4. The present corner has been dismantled and reconstructed in recent times. A historic image of this same corner shows a well-built corner that appears to be original Inca constructions.

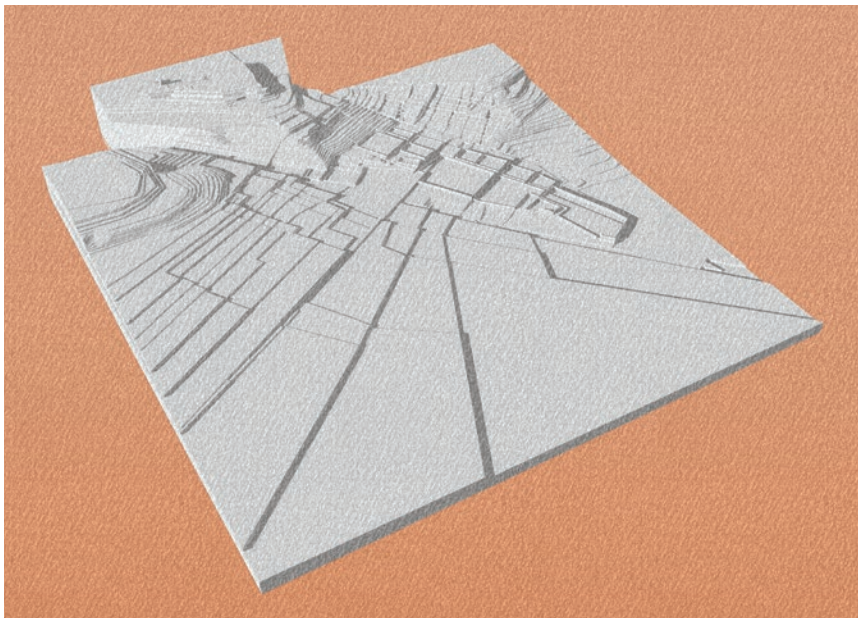


Figure 6. Three-dimensional view of the city of Cusco at the apogee of the Inca period.

Figure 7. Original extension of the Cusicancha into the modern street of Maruri.

cal purpose for the field of archaeology. The simple act of working in a 3D virtual environment—extruding wall heights, connecting architectural fragments—inspires new ideas. For the archaeologist, to draw is to understand, and questions along with long running points of contention are quickly resolved when the spatial relationship between architectural fragments and their hypothetical forms are clearly seen in virtual space. Figure 6 is a combination of the reconstructed terraced topography and freestanding building during the apogee of the Inca. For the purpose of this publication, the architecture has been simplified to represent the basic boundaries of the buildings.

The hypothetical remains are based on various lines of evidence. Certain aspects of the grand Inca design are evident from the aerial photographs, such as the straight streets that define the center that had, until only a few decades ago, held open channelized rivers. Overlaying the digital elevation model generated from the 1900 survey helped visualize the relationships between the architecture, and changes in elevation further helped confirm the location of terrace walls. On a smaller scale, justification for conjoining architecture fragments into a single form was based on a combination of attributes, such as the type of stone, the quality and style of masonry, and most significantly, the alignment and orientation of the architecture spread across multiple properties. Inca architecture is surprisingly regular, so one way to reconstruct form is comparisons with more complete sites or, as in the following case, from more complete parts of the site. For example, the Inca cancha—a rectangular enclosure with three or more rectangular buildings placed symmetrically around a central patio—was a regular feature of Inca sites. In the case of Cusco, the cancha can be seen in its most elaborate form in the Qoricancha, to the more "modest" housing for minor officials and lords. Only a few choice walls and corners are necessary to extrapolate the rest of the complex. For example, directly north of the Qoricancha is the Cusicancha, a large compound of repeated cancha forms. The excavations revealed how a widening of Maruri Street at some point in the past resulted in the destruction of the northern side of the Cusicancha. The minimal remains of one side of the cancha are sufficient to extend the compound into the modern street (Figure 7). The size of the Inca street corresponds to a surviving section on a better-preserved block of the city, further lending support to the accuracy of this reconstruction.

CONCLUSION

There is a change of elevation of approximately 200 meters from the top of the Saqsayhuaman complex to the southern tip of the city. Building in such a steep environment was an engineering challenge to the Inca, for whom it was a practical and aesthetic opportunity. In contrast to the present situation that has damaged both archaeological remains and inhabited homes, the stepped form of the city was an effective means to manage the distribution and evacuation of water.

From a logistical and conceptual perspective, changes in elevation were an efficacious means of structuring movement and creating unique views of the city and its environs. The experience of navigating Cusco would be less like the streets and avenues of the modern city and more like stadiums where changes in elevation serve to separate people, structure movement, and frame vision.

To continue the metaphor, if the architecture of the city is the seating, the performance takes place in two general locations. One would be the nearly continuous political-ritual pageantry in the public and private setting within the city. An elevated and honored place for the elite and the emperor himself was located to view the festivities and for the audience and participants to have a view of their rulers. The other would be the views of sacred mountains and the interaction of astronomical bodies with the natural and modified horizon (Zuidema 1964). The most-researched example would be the stone towers (now missing) placed along the horizon to measure the movement of the setting sun from solstice to solstice. Several open spaces across the city provided places to gather and observe similar important dates.

Archaeologists tend to have scant training on the appropriate use of ethnohistorical sources and even less patience when it comes to immersing themselves in archival research on the excavations of the very recent past. Archaeologists do, of course, consult previous works as part of their due diligence, but time-consuming bibliographic research is often reduced to citations in the brief and obligatory section on "previous works" or "history of investigations" in dissertations and other publications. Fortunately, the changing technology of the last few years provides the means to reevaluate different aspects of previous labors. Crucial to maintaining pace with changing circumstances, and to the lifecycle of the data, will be the creation of a viable archival database that is both recursive to and inclusive of the various research and management efforts in this historical and modern city. An effective database will need to incorporate several centuries of descriptions of Cusco with a substantial amount of new data generated by specialists of various fields and nonacademic agencies in charge of city planning (Limp et al. 2010).

REFERENCES

Arguto Calvo, S. 1980. Cusco: La Traza Urbana de la Cuidad Inca. Proyecto Per 39–UNESCO– INC.

Bauer, B. 2004. *Ancient Cusco: Heartland of the Incas*. Austin: University of Texas Press.

Chambi, Martín. 1990. *Martín Chambi: Photographs, 1920–1950*. Washington, D.C.: Smithsonian Institution Press.

Farrington, Ian. 2013. *Cusco: Urbanism and Archaeology in the Inka World*. Gainesville: University Press of Florida.

Limp, W. F., A. Payne, S. Winter, A. Barnes, and J. Cothren. 2012. Approaching 3D Digital Heritage Data from a Multi-Technology, Lifecycle Perspective. Paper presented at the *Proceedings of the 38th Conference on Computer Applications and Quantitative Methods in Archaeology Granada.*

Mar, R., and A. Beltrán-Caballero. 2015. El Conjunto Arqueológico de Saqsaywhaman (Cusco). Una Aproximacion a su Arquitectura. *Revista Española de Antropologica Americana,* Universidad Complutense de Madrid.

Moore, J. D. 1996. *Architecture and Power in the Ancient Andes: The Archaeology of Public Buildings.* Cambridge University Press.

Paredes, Monica. 1999. Registro Informatizado de Restos Prehispánicos en el Centro Histórico del Cusco. Diagnóstico e interpretación. Unpublished thesis. Cusco: Universidad Nacional San Antonio Abad del Cusco

Pillsbury, Joanne (ed). 2012. *The Past Presented*. Washington, D.C.: Dumbarton Oaks Press.

Protzen, Jean-Pierre. 1993. Inca Architecture and Construction at Ollantaytambo. New York: Oxford University Press.

Silgado, E. 1900. Plano del Cusco: Estudio de la Conduccion del Agua por los Ingenieros Erique E. Silgado y Mauro Valderrama.

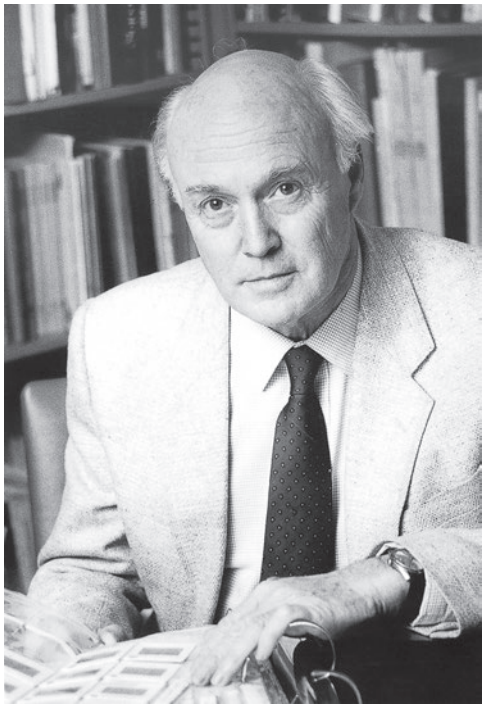
Smith, Michael. 2007. Form and Meaning in the Earliest Cities: A New Approach to Ancient Urban Planning. *Journal of Planning History*, Vol. 6, No. 1:3–47

Squier, Ephraim. 1877. *Peru: Incidents of Travel and Exploration in the Land of the Incas*. New York: Harper & Brothers.

Zuidema, T. 1964. *The Ceque System of Cuzco: The Social Organization of the Capitol of the Inca*. Leiden: E. J. Brill.

Max Mallowan and Agatha Christie Mallowan: Some Memories from Iraq and Iran

David Stronach



David Stronach was the founding Director of the British Institute of Persian Studies from 1961 to 1980. He is presently Professor Emeritus of Near Eastern Archaeology at the University of California, Berkeley.

FOLLOWING MY RECEIPT of a first degree at Cambridge University in 1955, and after I had subsequently received a scholarship from the British Institute of Archaeology at Ankara, one of my former mentors at Cambridge suggested that I might like to apply for a fellowship at the British School of Archaeology in Iraq. Not too long afterward I learned that the application (which I had been quite nervous about submitting) had been accepted. This meant that I could not only look forward to joining the excavations at Nimrud (Figure 1) early in 1957, but that I could expect to do so as a member of a team that would be led by the director of the school, Professor M.E.L. Mallowan. Not that I had any way of knowing it at the time, but this was the beginning of a long and close association with Max Mallowan—as well as with his wife and constant companion in the field, Agatha Christie Mallowan—that was to last for nearly two decades.

M.E.L. MALLOWAN

As the Professor of Western Asiatic Archaeology at the University of London since 1947, Max Edgar Lucien Mallowan was already a considerable figure in Mesopotamian archaeology. He had dug in both southern and northern Iraq; he had directed excavations at two major sites in Syria,; and his comprehensive knowledge of the archaeology of Western Asia—even stretching to the region of the Indus Valley—was widely acknowledged. More than this, it was possible to think of him as one of the last active members of the more notable archaeological expeditions of the recent past. At a very young age, he had been selected to join Leonard Woolley's team at Ur of the Chaldees and, several years later, had taken part in one of the British Museum's last major excavations at Nineveh.

Figure 1. Places in Iraq and Iran that are mentioned in the text.

All in all, he seemed to me at the time to represent an almost palpable link to the not-too-distant nineteenth-century origins of Mesopotamian archaeology.

Fortunately enough, Professor Mallowan was also willing, from the very beginning, to regale me with stories drawn from his early days in Iraq. I should perhaps preface these remarks by saying that a detailed account of his long career can be found in his *Memoirs*, published in 1977 (Mallowan 1977). However, at least a few of his early recollections (such as find a mention here and which necessarily predate the years in which I can claim to have had a direct acquaintance with him) may serve to illustrate the kind of challenges that a young archaeologist could be confronted with in the 1920s and the early 1930s.

UR OF THE CHALDEES

When Mallowan completed his bachelor's degree at Oxford in the summer of 1925, he had very little idea of what the future held for him. But shortly thereafter D. G. Hogarth, the keeper of the Ashmolean Museum at Oxford (who had earlier dug at Carchemish, with both Woolley and T. E. Lawrence among his assistants), recommended Mallowan for the position of archaeological assistant on the dig at Ur. In those days there were of course no readily available "stepping stones" toward a professional career in Near Eastern archaeology. In Mallowan's own modest recollection, he had "no qualifications for the job beyond a classical degree, an interest in Greek sculpture, and the enthusiasm of a man aged twenty-one."

As the youngest member of Woolley's small staff of five or six persons, Mallowan was more than happy to meet whatever demands were made of him. That is to say that on those occasions when he was given charge of one of the more outlying mounds, he was perfectly content to rise at 4 a.m., to walk for a distance of several kilometers, and to be ready to start the day's work—together with the local workers who had often walked for even longer distances—soon after the sun rose.

The fact that Max, as I must call him in the rest of this informal account, was expected to drive to the nearest town in order to obtain supplies at regular intervals was also something that he was more than willing to do. Indeed, such trips (undertaken in one of the original Ford trucks "that was as good as a mule on rough ground" [Mallowan 1966:21]) became all the more enjoyable after Katharine Woolley invited her friend, the noted author, Agatha Christie, to make an extended visit to Ur in 1930, during his fifth season at the site. Since Agatha was not an archaeologist and, therefore, had no fixed duties to perform within the context of the ongoing work, it became only natural for her to accompany Max in the weekly expeditions to purchase supplies. And if the vehicle happened to stick in the deep ruts of some muddy track, Agatha was always ready to "get out and push" or to try to find some other way to remedy the immediate situation. In this way their friendship grew until one day—back in Britain—Max proposed.

Agatha relates that when she took the news of Max's proposal to Katharine Woolley, her good friend received the tidings with something less than heartfelt approval. Almost certainly dubious about the wisdom of a marriage between a young man in his mid-twenties and a divorced woman in her late thirties, she advised Agatha that it might be a good idea to keep Max waiting "for at least two years" (Christie 1977:418). With some spirit, Agatha writes of her dismay at the nature of this response. Whether or not this moment of discord finds a distant reflection in the

It was also while she was on the dig at Nineveh that Agatha decided that she would continue to practice her craft as a writer.

plot of one of Agatha's celebrated detective stories, *Murder in Mesopotamia* (1936), can only be a matter of opinion. But it may be recalled that, in this tale of dark deeds on an archaeological excavation in Iraq, the wife of the director of the dig (an individual who appears to have been modeled, in part, on certain traits in the character of Katharine Woolley) does not fare too well.

At all events, Max himself was of a firm view that, from that point onward, there could be "no more than one woman at Ur." Accordingly, after he and Agatha had proceeded with their wedding in September 1930 (with the full approval of Agatha's young daughter, Rosalind, who apparently relished the thought of putting Max through his paces on the tennis court!), the Mallowans decided that, following a short holiday in Greece, Agatha would return to Britain while Max continued onward to Ur for his sixth and final season at the site.

Then, in Greece, Agatha fell quite ill. Greatly worried by this development, Max told me that he was unable to obtain any precise information about the nature of his wife's illness. Yet when the time came for him to depart, he had no choice but to do just that. He had agreed to serve for a fixed number of seasons at Ur, and, regardless of any other considerations, he knew he would be expected to appear, without fail, at the appointed day and time.

When he reached Baghdad, however, the Woolleys were nowhere to be seen. Instead there was a message: the Woolleys had decided to travel a week later, and he was instructed to proceed to Ur, where he was to supervise the construction—of all things—of an extension to Katharine Woolley's bedroom! Even if Max was obviously aware that the Woolleys could have had no knowledge of Agatha's recent difficulties, he told me that he was so angered by the awkward situation in which he had found himself in Greece that he could hardly bring himself to complete the trivial task that was asked of him.

In broad terms, however, the six seasons that Max spent at Ur represented an exceptional apprenticeship. The excavations themselves were enthralling, and much was to be learned from the example set by Woolley. He was a skilled excavator, a man of great tenacity and drive, and as Max never tired of stressing, he was a master of exposition, whether spoken or written.

NINEVEH

Digging at Ur gave Max a taste for excavating at large sites, and this may have been one of the reasons why when he was at liberty to look for another site at which to work he elected to take part in the British Museum's excavations at Nineveh. In all respects, Max's single season at Nineveh was a decidedly happy one. Agatha, long since recovered from her indisposition in Greece, was at his side (as she would continue to be on each of his subsequent field projects), and it emerged that he found a singularly congenial colleague in the director of the dig, R. Campbell Thompson (whom Max usually referred to as "Thomp").

In the winter of 1931–32, Thompson engaged him to take charge of an unusually challenging project. This was to sink a vertical sounding from the surface of Nineveh's tallest mound—Kuyunjik—down to virgin soil. The Nineveh "pit" (as Max liked to call this deep, ever-narrowing shaft) was a forbidding and dangerous place by the time that the earliest archaeological deposits were exposed almost 30 meters below the mound's surface. The brief seven weeks that were occupied by this considerable undertaking left little time to explore "the occasional scraps of wall" that were encountered, but this single operation still provides the only broad brush picture of the full prehistoric sequence that lies beneath Nineveh's vaunted Assyrian palaces. It might be added that Max was not a little pleased to find that, when he at last reached virgin soil, he still was left with a quite creditable trench, "at least 2 x 2 m in size." From the start, in other words, the overall size of the trench could hardly have been more finely judged.

It was also while she was on the dig at Nineveh that Agatha decided that she would continue (at least when she wished to do so) to practice her craft as a writer, even at the same time as her husband was occupied with his own separate researches. As she put matters to an initially horrified Dr. Thompson (who was doing his best to excavate a vast site on a very tight budget), "I am a writer and I need to have a proper chair and a proper table—and I propose to arrange for these items to be made for me in the Mosul bazaar." Until that moment, Thompson, a noted

Assyriologist, who had been very largely of the view that "dig furniture" consisted of temporarily empty packing crates, variously arranged to meet the not-too-demanding requirements of his steadfast staff!

For his part, Max was especially taken by the presence, toward the base of the deep sounding, of elegant sherds of finely painted Halaf ware. Always on good terms with his workers, many of whom hailed from adjacent villages, he was soon apprised of the fact (both by his workers and by Thompson himself) that painted pottery of exactly the same kind was scattered over the surface of a low mound that stood only a few kilometers to the northeast of Nineveh.

ARPACHIYAH

With this critical information in hand he decided (in 1933, after Thompson had decided that his digging days in Iraq were over) to embark on his first independent excavation at the prehistoric site of Arpachiyah. The mound was shrewdly chosen. Directly beneath the modest structures of a prehistoric village of 'Ubaid date, he uncovered six superimposed levels of a prosperous Halaf settlement that was distinguished by stone-footed circular buildings—presumed to have consisted of domed "tholoi"—as well as by spectacular examples of painted polychrome pottery. As most readers of this journal will know, Arpachiyah can now be counted as one of the better-known sites of the celebrated Halaf culture that appears to have spread out over much of present-day north Iraq and north Syria soon after 6000 BC.

Quite remarkably, Max's entire staff consisted of himself, Agatha, and a skilled draftsman, J. Cruikshank Rose. Also, notwithstanding the myriad duties that fell to his lot, Max still found time to introduce a series of lively events that were designed to sustain the high spirits of his substantial work force. One of the more memorable of these events cannot escape mention here. It consisted of a "cross-country race," which was three and a half miles in length and was open to all who worked on the dig. The carefully predetermined course of the race wound its way through many of the villages from which the workers came (where partisan crowds cheered on their respective runners), and the participants—up to one hundred in number—were rewarded at the end of the day by varying prizes of livestock, eggs, or dates according to the order in which they finished.

NIMRUD

At this point I propose to pass over a considerable interval until I myself started to work with Professor Mallowan (later Sir Max Mallowan) in various capacities, first in Iraq, between 1957 and 1960, and then in Iran, from 1961 until the late 1970s. These interludes provided many vivid recollections, and I hope to convey at least some sense of our interactions that still stand out in memory from these active years.

When I arrived at Nimrud in March 1957, I remember being considerably taken aback by the number of workers that were present. Max made no apology for often having well over two hundred men on the payroll. Indeed, he took no little delight in insisting that he was "an unabashed supporter of the bygone days of digging." This statement did not equate with the whole truth, however. Little by little, he had gradually expanded the staff at Nimrud to include a number of younger but also seasoned archaeologists headed, most notably, by David and Joan Oates.

At the same time, the excavations at Nimrud were characterized by certain distinctive features. Among other things, Max liked to employ no less than two charismatic foremen. One of the many duties of these ever-vigilant individuals was to keep an eye on the mood of the workers. If some degree of lethargy could be detected, they would burst into song, and with one voice the rhythmic cadences of the song would be taken up by each and every one of the men. In an instant, the whole temper of the dig would be transformed.

Beginning in the1957 season, Max began to turn more and more of his attention to the outlying remains of a huge structure that he chose to call "Fort Shalmaneser" after the name of its redoubtable founder, Shalmaneser III (858–824 BC). This complex building proved to be an Assyrian royal residence, arsenal, and treasury, where many of the storerooms contained an exceptional range of carved ivories that dated back to the early first millennium BC. In no time the safe recovery of these exquisite objects became one of the prime concerns of the expedition. Toward the end of each long morning/early afternoon session of excavation, those individuals whose duties required them to stay in the dig house would gather on the terrace outside the building to examine the speed at which the expedition Land Rover was approaching. If it came quickly bouncing back along the track, everyone would turn away and go in to lunch. But if it proceeded slowly and carefully—an evident indication of the presence of some precious burden resting on a soft bed of cotton wool—everyone would patiently wait to see what fresh source of wonderment had just emerged from the earth.

Once the ivories began to stream into the dig house, Agatha not only continued to work on developing film in the dig house's small dark room, but she also joined in the work of cleaning individual ivories as well. On one occasion she elected to carry out an experiment. Since she owned a jar of moisturizing cream that was supposed to "draw out the dirt," she decided to find out if this advertised property might apply in the case of an ancient carved ivory. Such was the success of this unlikely treatment that, in no less than two weeks, every bit of Agatha's face cream had been "donated" to the greater good of the excavation (Christie 1977:456).

As for Max, he was never happier than when he was engaged in composing a description of one of the finer ivories. Toward the end of each afternoon, he could be found, sitting in an open office near the middle of the dig house, where he could be heard dictating a detailed, miraculously fluent description of a given ivory while a harried registrar scribbled frantically to try to preserve each golden word. It was almost, I thought, as if the whole of his prior field experience had prepared him for just these moments.

The evening meal at Nimrud still preserved certain notes of formality. That is to say that, even if there was no standard seating arrangement, Max always sat at one end of the long dining table and Agatha would sit at the opposite end. And since Agatha was always the first person to be served, the different dishes would proceed down the outer side of the table to where Max sat, and they would then return on the inner side of the table until they reached the last place on Agatha's right. Needless to say, this latter place was where it was often difficult to find enough food to fill the whole of one's plate. It was consequently known as "starvation corner."

On the other hand, the Nimrud table was no stranger to occasional, improbable delights, one of which —as often as not—was the presence of a large drum-shaped Stilton, bought at Harrods. Indeed, as I learned early on, starvation corner was not without its compensations. Above all, the Stilton would inevitably end its wanderings at this very same corner, where, under the benign protection of Agatha's just detectable smile, you were usually encouraged to take a second helping of cheese.

Max—careful not to neglect the education of a junior assistant in one of the finer points of life—also once surprised me at the end of one especially good dinner by suddenly producing a bottle of port. At that same moment he asked, "David, do you know how to feed a Stilton?" I confessed that I did not. "Like this," said he, all the while decanting a quantity of fine port into what was still left of the majestic Stilton.

BAGHDAD

Before and after the dig at Nimrud, quite a few members of the team usually stayed at the school's comfortable Expedition House in Baghdad. Life in this traditional example of a Baghdad home was largely centered on the building's two-storied central courtyard and, most particularly, on the courtyard's spacious second-floor balcony, part of which was always cool and shaded.

With no need to make constant visits to the archaeological museum, Agatha would occupy a part of the balcony each morning for the start of her own daily writing activities. She would place a comfortable chair in a suitable, shaded position, lift her feet onto a low stool, and pull out a hard-backed notebook. Totally absorbed in her own thoughts, she would then make notes—and sometimes diagrams—that helped to clarify the events that would take place in whatever chapter she had chosen to work on at the time. In the middle of the day she would take a long break. During this interval, Ibrahim, our cook, would serve a late lunch (timed to coincide with the end of the working day at the museum). Then, at least when the weather was on the warm side, time was taken for an hour's siesta, and a little later Ibrahim would ring his gong to indicate that tea was served. At promptly 5 p.m., Agatha would head for the library on the second floor, where the school's only typewriter was housed. The library was strictly off limits to all others at this time, and for the next two hours the sound of rapid, more or less continuous, typing would issue from behind a closed door. Amazed by the speed with which a whole finished chapter would be regularly produced within a single day, I once had the temerity to ask Agatha if she ever needed to revise what she had written. She considered the question for a few moments and then responded, "No, I don't think so!"

In the evenings the Mallowans occasionally enjoyed going out to exhibitions of work by contemporary artists. Tariq Madhloom, one of Max's former students, was not only an up-and-coming archaeologist in the Iraqi Department of Antiquities, but also a successful painter, and the Mallowans possessed a number of paintings by Iraqi artists. Also, as I can personally attest, one of Agatha's principal relaxations before and after each season at Nimrud was to ferret out choice Persian carpets (in addition to modern jewelry of a kind that she especially favored) in Baghdad's atmospheric bazaar.

Visits to the bazaar were memorable undertakings. Since the house we lived in stood directly on the west bank of the Tigris, and the bazaar stood exactly on the opposite bank of the river, each of our "expeditions" (in which yours truly was always more than content to be the designated "carpet-bearer") would start outside our front door at the river's edge. From this location we would hire one of the local rowing boats, nearly always riding at anchor somewhere nearby. The boatmen would row us across the wide sweep of the Tigris (duly shielded from the sun by a large canopy), and to cap each outward crossing, we would land at the nearest "river entrance" to the bazaar.

Once inside the bazaar, it was instantly obvious that Agatha was a familiar figure. There would be competing shouts and gesticulations from all directions to attempt to attract her attention. But the hullabaloo was to no avail—Agatha knew where the most arresting carpets were to be found—and we would head for her long-familiar haunts. On one occasion when I saw that she liked a specific carpet, I felt it my duty to inject a word of caution. I pointed out that, while the carpet was undoubtedly an interesting piece, it was also rather worn. "I can see that," she replied. "But I am perfectly certain it will outlast me!" Needless to say, the carpet was acquired without further ado.

In the jewelry shops her eye would always be caught by brooches with big stone settings. At first glance I found many such brooches quite unappealing. But, once again, Agatha knew what she was looking for. I would notice, for example, that a certain piece that I had dismissed in my own mind as "impossible" would suddenly look "just right" on Agatha's own quite generous frame. In time, in fact, I never hesitated to say, when called upon for an opinion, that I believed a given brooch "would look very well when worn."

A NEW VENTURE IN IRAN

Owing to various circumstances that do not stand entirely within the compass of the present account, my associations with the Mallowans continued long after the end of the1960 season at Nimrud. First, Max made sure that I received the necessary funding from the British School of Archaeology in Iraq in order to be able to conduct an independent excavation, in late May and early June 1960, at the newly discovered 'Ubaid site of Ras al 'Amiya, located 80 km south of Baghdad. Then, partly as a result of the British Academy's wish to set up a new British Institute in Tehran at the time of Her Majesty the Queen's visit to Iran in March 1961, the Council of the Academy, at its meeting on February 15, 1961, resolved to appoint a "Governing Council of the new Institute with Professor Max Mallowan as President and David Stronach as Director" (Wheeler 1970:83). In this way, Max and I found ourselves committed to a continuing, close, working relationship, albeit one that was now transferred to the newly founded—and recently named—British Institute of Persian Studies.

> The Nimrud table was no stranger to occasional, improbable delights, one of which — as often as not — was the presence of a large Stilton, bought at Harrods.

In the early days of the institute, Max was very much a hands-on president. Always inclined to be something of a worrier, I think he decided that, at 29, I was too young to be trusted to choose a suitably representative site for the institute's first excavation. Accordingly, he drew up a short list of three major sites that I could choose from. One was the major prehistoric site at Rayy (Figure 1), the second was the early Islamic site of Nishapur, and the third was Pasargadae, the capital and last resting place of the Cyrus the Great (559–530 BC), the founder of the Achaemenid Empire. After I had carefully weighed the prospects for work at each site, I told Max that my choice had fallen on Pasargadae. I noticed that this decision seemed to give him an unusual degree of pleasure, and he then recounted a piece of personal history that conceivably deserves a place in this brief chronicle.

Early in their marriage Max and Agatha apparently decided to make a late spring visit to Iran. It was a visit that coincided with the end of Max's sixth season at Ur and one that Max viewed as their "honeymoon." After they had flown from Baghdad to Hamadan in a single-engine airplane (with only one pilot), they eventually flew down to Shiraz, where they began a road journey back to Tehran *via* Persepolis, Pasargadae, and Isfahan, "the most beautiful city in the world." One special highlight, moreover, was their visit to Pasargadae. Thanks to earlier, heavy rains the surface streams near the tomb of Cyrus were in flood. And as Agatha stood uncertainly on the edge of the inundated area, a friendly local guard appeared out of

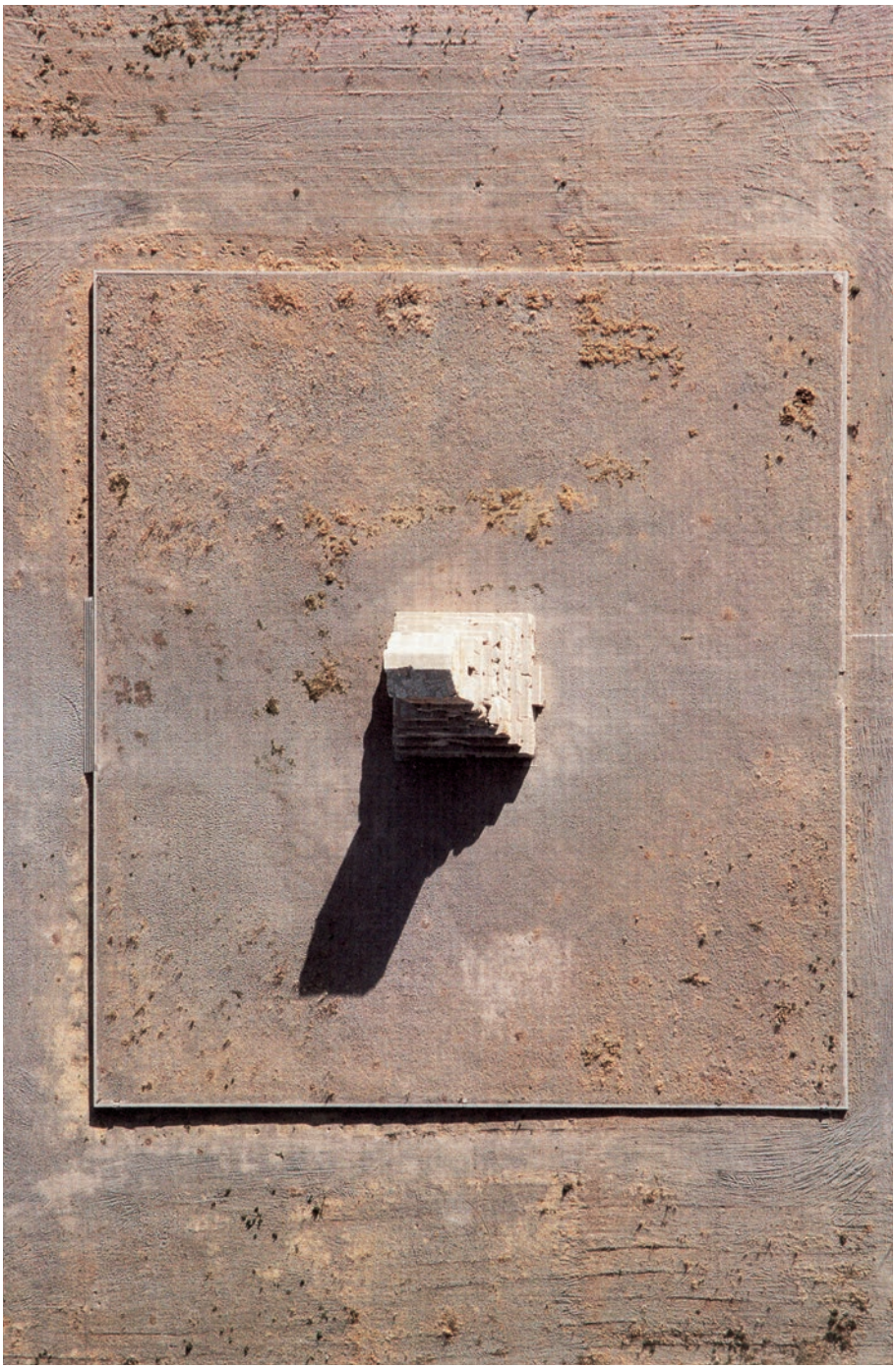


Figure 2. An aerial view of the tomb of Cyrus the Great, as the monument appears today. The tomb is located near the southern limit of Pasargadae (after Stronach and Mousavi 2012:plate 35).

nowhere and volunteered to carry her to the tomb and back again (Figure 2). With this gallant assistance, the Mallowans assuredly had extra reason to think well of their visit to Cyrus's capital, and I have to confess that, notwithstanding Max's well-documented interest in the events of Cyrus's career (see, e.g., Mallowan 1972), I have not seldom wondered if this incident clinched Pasargadae's appearance on the all-important "short list."

In any event it was hardly unexpected when I learned that Max and Agatha would pay a further visit to Pasargadae, late in 1961, during the first of the institute's three seasons of excavation at the site (cf. Stronach 1978:*v*). More than this, they would be accompanied (as they were on at least one other occasion) by Sir Mortimer Wheeler, the secretary of the British Academy. Sir Mortimer, who can be said to have done more than anyone else to bring the new institute into existence, was probably also keen to see how the institute's first excavation was proceeding. In 1958 he had taken me with him to Charsada, in Pakistan, so that I had had the benefit of excavating under both his guidance and that of Max Mallowan in the late 1950s. I will confess to being just a little nervous in advance of such a formidable "field examination," but in the end I believe our hard-working team earned a positive report (Figure 3).

I might also note that Max and Agatha were frequent visitors to the institute's longtime premises in Tehran. In particular, this was where Agatha's sleuthing instincts can be said to have made themselves manifest from time to time. Toward the end of the working day, for example, the institute's quite commodious library became a place where people staying in the hostel would help themselves to tea from the Russian samovar and settle down to relax. At the same time this was also where Agatha liked to sit at this time of day, normally in a chair in one corner, seemingly concentrating on her knitting—and seemingly paying no attention to whatever else was happening. Except that she was paying close attention! Thus, at some later point in time, she would ask me: "David, is anything going on between the young man with a beard and the girl who sits and reads for most of the day?" On such occasions I would usually look utterly blank and say, "I have no idea." And then, two weeks later, the same couple would announce their engagement.

Despite Max's self-described "autocratic tendencies," I am happy to say that we had only one full-scale "skirmish" during the many years that we worked together. Not surprisingly, perhaps, this was related to

the role that Max thought I should play with respect to the institute's next archaeological excavation after the dig at Pasargadae had run its course in December 1963.

Although the Governing Council in London had decided, under Max's deft chairmanship, that the institute's next excavation ought to take place at Siraf, the great medieval seaport on the Persian Gulf (Figure 1), it never occurred to me at the time that anyone but a qualified archaeologist with medieval interests would be invited to lead the work there. With this single proviso in mind, I more than welcomed this significant proposal, which promised to do so much to raise the profile of early Islamic archaeology in Iran. Unfortunately, Max had other, very different ideas. In his view it was my unquestionable duty to agree to take charge of this new "flagship" operation, even if it stood well outside the sphere of my own, earlier interests. Always a shrewd tactician, Max only chose to acquaint me with his plan to nominate me as the director of the new dig on the day before Council was due to meet to consider the final, detailed plans for the work at Siraf.

Figure 3. Sir Mortimer Wheeler (sitting, facing camera), Professor Max Mallowan (sitting, preparing to make notes), and Agatha Christie Mallowan (sitting, with her back to the camera), photographed on a visit to Pasargadae in October 1961. Members of the Pasargadae team (standing in the background) include David Stronach (wearing a light blue sweater) and standing next to him, Ms. Parvin Barzin, the representative of the Iranian Department of Archaeology.

Not to be outdone, I decided to let two key members of Council know what was afoot and to ask them if they would support my position that it was inappropriate to ask me to take on a task that lay outside the bounds of my major academic interests. I then telephoned Max to say that two members of Council were, in fact, of the same view as I was. "With whom did you speak?" he demanded to know. "To Mortimer Wheeler and to Seton Lloyd," I replied. "Oh!" he responded and rang off at once.

Half an hour later Max rang with a note of resignation in his voice. "It seems," he reported, "that they do agree with you. So… we better have lunch tomorrow." Over lunch I went out of my way to stress that I knew a very able medieval specialist: a young archaeologist named David Whitehouse. I added that I thought he would leap at the chance to excavate at Siraf if he were invited to do so. Suffice it to say that the post was duly offered to Whitehouse, who more than repaid the confidence that was placed in him.

In this way, in the end, Max gracefully conceded the day (a rather rare event, it has to be said). Also, with this brief contretemps put safely behind us, the two of us continued to work together for many a further year "both happily and furiously" as one perceptive mutual friend chose to put matters.

Space does not allow me to draw on too many other recollections, but I cannot omit some reference to a subsequent journey that took the Mallowans, Wheeler, and myself to Siraf in order to visit David Whitehouse during the first season of excavations that were conducted at that site in 1966. Early winter rains had swept through southwestern Iran shortly before our journey began, and when we reached Shiraz we were greeted with the dire news that the bridge over the Mand River (Figure 1) had been swept away. Nothing daunted, we proceeded to the north bank of the swollen river, where I parked and locked the Land Rover. Then, one by one, the three distinguished individuals, for whom I felt myself to be hugely responsible, were lowered into a perilously small boat that then conveyed the four of us to the opposite bank. Throughout this operation a series of horrendous "headlines" swam before my eyes—a situation that only ended when I could see David Whitehouse extending a firm hand to Agatha, and then to each of his other two important guests.

Just when we had reached Tahiri, the small village

Figure 4. An aerial view of the extensive site of Siraf . While certain excavated areas can be made out in the middle distance, the modern village of Tahiri hugs the shoreline near the top of the photograph (after Stronach and Mousavi 2012:plate 96).

that hugs the curved shoreline within the southern half of the extensive ruins of Siraf (Figure 4), a further problem arose. Since the Siraf team had not yet had time to erect an excavation house, the only available accommodation for the site's distinguished visitors from London consisted of a series of rooms located on the prestigious top (that is to say, fourth) floor of the towerlike residence of the local sheikh. And since each step in this structure's single, steep staircase was almost a foot in height, Agatha knew that she would have to ask for help. I could see her first look at Max before deciding that he could hardly be expected to come to her aid in this quite strenuous context. Next her eyes fell on Sir Mortimer, but he was still older! Inevitably, she finally turned to where I was standing, and called me to her side. Somehow we managed to reach the fourth floor, whereupon she delivered the following well-remembered speech: "Now that I have arrived on this fourth floor, David, you will be very glad to know that I am not coming down again until it is time for us to leave."

EPILOGUE

While I have fond memories of accompanying the Mallowans to other archaeological sites in Iran, including Hasanlu, Godin Tepe, and Tepe Nush-e Jan (Figure 1), the various almost unbelievable elements of the Siraf venture may represent a suitable note on which to end these random reflections. For one other account of this stay at Siraf, see especially David Whitehouse's reference to the visit of "Sir Mortimer, Sir Max and Dame Agatha, who endured the tribulations of winter on the Persian Gulf as though they were everyday occurrences" (Whitehouse 2009:4).

It may also be appropriate at this point to note that Sir Max Mallowan died at his old home at Greenway in Devon on August 19, 1978, at the age of 74. His wife, Dame Agatha Christie Mallowan, predeceased him by two years after what he referred to as forty-five years of loving "and merry" companionship (Mallowan 1977:311).

Author's Note: I would like to thank Professor Gregory Areshian for inviting me to contribute an article on the present topic to the pages of Backdirt. I am also grateful to Ms. Anna Harkey for the preparation of the map that appears here as Figure 1.

REFERENCES

Christie, Agatha.1977. *An Autobiography.* London: William Collins and Sons.

Mallowan, Max Edgar Lucien. 1966. *Nimrud and Its Remains.* Vol. 1. London: William Collins and Sons.

———. 1972. Cyrus the Great (558–529 BC). *Iran* 10:1–17.

———. 1977. *Mallowan's Memoirs*. London: William Collins and Sons.

Stronach, D. 1978. *Pasargadae: A Report on the Excavations conducted by the British Institute of Persian Studies from 1961 to 1963*, Oxford: Clarendon Press.

Stronach, D., and A. Mousavi (eds.). 2012. *Ancient Iran from the Air: Photographs by Georg Gerster*. Darmstadt/ Mainz: Philipp von Zabern Verlag.

Wheeler, Mortimer. 1970. *The British Academy, 1949–1968*. London: The British Academy.

Whitehouse, D. 2009. *Siraf I: History, Topography, and Environment*. Oxford: Oxbow Books.

ARCHAEOLOGY AND CONSERVATION GRADUATE PROGRAMS

REPORT FROM THE CHAIR

The Archaeology Interdepartmental Graduate Program, 2013–2014

John K. Papadopoulos[1]

THE ACADEMIC YEAR 2013–2014 was another successful one for the students of the Archaeology Interdepartmental Program. Six of our students, all working in very different parts of the world, completed and filed their doctoral dissertations: Dr. Esmeralda Agolli, Dr. Anne Austin, Dr. Jack Davey, Dr. Kelly Fong, Dr. Brett Kaufman, and Dr. Catherine Pratt. They join a long and distinguished group of UCLA Archaeology Ph.D.s. One other student, Bethany Simpson, an Egyptologist, is planning to file her dissertation in the course of the fall.

Many of our continuing students were successful in procuring funding. No fewer than six of our students (Jacob Damm, Maryann Kontonicolas, Rachel Moy, Chelsey Fleming, Rose Campbell, and Terrah Jones) won Graduate Summer Research Mentorships for the summer of 2014. Jacob Damm and Deborah Sneed were awarded year-long Graduate Research Mentorships for 2014–2015, and three students—Joseph (Seppi) Lehner, Christine Johnston, and Kanika Kalra—were awarded Dissertation Year Fellowships for 2014–2015. Chelsey Fleming also won a Lenart Fellowship.

In February 2014, the IDP students sponsored another successful Graduate Student Conference, with the theme: "People in Motion: Mobility, Migration, and Exchange." The keynote speaker was Professor David Anthony of Hartwick College, Oneonta, New York. The conference was funded by the Archaeology IDP, the Cotsen Institute of Archaeology, with additional funds from the Deans of Social Sciences and the Humanities.

We also look forward to welcoming our new first-year cohort in the fall. Five students will be joining the program (for full biographies see page 00 in this volume). Anna Bishop (B.A., USC) will work with Professor Richard Lesure in Mesoamerican archaeology; Brandon Braun (M.A., Cal State San Francisco) will work in Classical archaeology with Professors Sarah Morris and John Papadopoulos; Karime Castillo Cardenas (B.A., Universidad des las Américas Puebla; M.A. University College London) will work on New World glass with Professors Ioanna Kakoulli and Richard Lesure; Adam DiBattista (B.A., Boston University, where he studied with Assistant Professor John [Mac] Marston, a UCLA Archaeology IDP graduate) will study with Professors Aaron Burke and John Papadopoulos; and Georgi Kyorlenski (M.A., Columbia University) will study Andean archaeology under the guidance of Professors Stella Nair and Charles Stanish. Two of our incoming cohort are international students: Karime Castillo is the first student in the Archaeology IDP from Mexico, and Georgi Kyorlenski hails from Bulgaria. We wish them every success!

In addition to welcoming our incoming graduate students, the Archaeology IDP is delighted to welcome, among its ranks, Assistant Professor Stephen Acabado as the most recent member of our Core Faculty.

1. Department of Classics; Cotsen Institute of Archaeology, UCLA.

ARCHAEOLOGY AND CONSERVATION GRADUATE PROGRAMS

INCOMING GRADUATE STUDENTS AND NEW ACADEMIC APPOINTMENTS

Archaeology Graduate Interdepartmental Program First-Year Doctoral Students, 2014-2015

KARIME CASTILLO
is originally from Mexico City. She received her B.A. in Archaeology from Universidad de las Américas Puebla and her M.A. in Artefact Studies from the Institute of Archaeology, University College London. She is primarily interested in Mexican historical archaeology and colonial material culture. Her master's thesis proposes a typology of pharmaceutical glass from London. As a historical archaeologist, she has done research on Colonial Mexican majolica and the Hacienda San Miguel Acocotla, Puebla, Mexico. She has worked for archaeological projects in different parts of Mexico, including Sonora, Mexico City, and Puebla, and has collaborated with the Franz Mayer Museum in Mexico City and London Archaeological Archive and Resource Center in London. At UCLA she will study glass production in Colonial Mexico.

ADAM DIBATTISTA
originally hails from New Jersey. He received his B.A. in Archaeology from Boston University in 2014. In his honors thesis Adam analyzed sheep and goat molars for their strontium isotope content, proposing new approaches to understanding the decision-making processes of mobile pastoralists in Anatolia based on isotopic analysis and GIS. He has conducted fieldwork in Italy and, most recently, in Turkey at the site of Kaymakci. In addition to excavation, Adam worked extensively to help catalog and analyze the faunal material at Kaymakci. He hopes to continue to explore the interactions between imperial and resident populations there while at UCLA, where he will be working with Dr. Aaron Burke.

BRANDON BRAUN
was born in San Diego, California. Although he has traveled throughout the United States and Greece, he has lived in California his entire life. Brandon earned a B.A. in Classics and Mathematics at San Diego State University and an M.A. in Classics with an emphasis in Classical Archaeology at San Francisco State University. He is primarily interested in state formation in Archaic Greece, particularly in the interactions and competitions between state monuments. He is also interested in the relationships between Greek and Near Eastern states, and his master's thesis examined the monumental nature of stone terraces at Athens, Delphi, and Persepolis. Outside of academia, Brandon enjoys watching, playing, and thinking about basketball.

New Academic Appointments

GEORGI KYORLENSKI is possibly the only representative of a crossbreed between two rather large groups—Bulgarian archa eologists and U.S.-trained Andeanists. He received a B.A. in Anthropology and History from Beloit College and an M.A. in Museum Anthropology from Columbia University. Georgi is primarily interested in Inca imperial control through nonviolent means and nonhuman interactions. He is academically invested in the art of institutional manipulation, propaganda, and the power of the collective imagination. His M.A. thesis proposed a new model of an on-site open-air archaeological museum, which reunites objects, architecture, and site into a more comprehensive tool for interpreting and experiencing the past than the current heterotopic state of archaeological collections. Georgi has previously excavated in Peru and Bulgaria and will work with Dr. Stella Nair at UCLA. He is an avid Manchester United fan, a mediocre bassist, and a casual fiction writer.

ANNA BISHOP was raised in Connecticut and moved to Los Angeles to attend the University of Southern California, where she received a B.A. in Archaeology with a minor in Geographic Information Systems Technology. She has conducted fieldwork in Peru, Italy, Belize, and California's Channel Islands and after graduating worked as an archaeologist in Australia. Anna's research focuses primarily on Mesoamerican archaeology, visual culture, iconography, and authorship. This is combined with an interest in GIS and spatial analysis. Her senior thesis examined the significance of the iconography of the body in Classic Maya artwork. Outside of the lab Anna draws on her background in studio art and likes getting out of her apartment/cubicle. At UCLA Anna will be working with Dr. Richard Lesure.

STEPHEN ACABADO received his Ph.D. and M.A. in Anthropology from the University of Hawaii-Manoa and his B.A. in Anthropology from the University of the Philippines-Diliman. His archaeological investigations in Ifugao, northern Philippines, have established the recent origins of the Cordillera Rice Terraces, which were once thought to be at least 2,000 years old. Dr. Acabado directs the Ifugao Archaeological Project, a collaborative research program between the University of the Philippines-Archaeological Studies Program, the National Museum of the Philippines, the University of California,Los Angeles, and the Save the Ifugao Terraces Movement, Inc. (SITMo). He has published several articles based on his work in the highland Philippines. His book manuscript, *Antiquity, Archaeological Processes, and Highland Adaptation in the Northern Highland Philippines: The Ifugao Rice Terraces* (Ateneo de Manila University Press), is scheduled to be published by the end of 2014.

The UCLA/Getty Program in Archaeological and Ethnographic Conservation

Ioanna Kakoulli[1]

CONSERVATION IS A FASCINATING FIELD. Conservators work hands-on with beautiful and unique cultural heritage objects that present interesting challenges to scientists and curators alike. To deconstruct an object in order to understand its complex nature requires creative, critical thinking and expertise in integrating ideas, concepts, and principles from many different fields. For the conservation of an object, various factors need to be considered: provenance, aesthetics, artist's intent, original technique, physical condition, and conservation history. Understanding the physical properties of materials and exploring ways to characterize original techniques, as well as defects caused either by faulty construction or as a result of aging and weathering, is key to the conservation of artifacts.

The UCLA/Getty Conservation Program in the Conservation of Archaeological and Ethnographic Materials provides an excellent platform for education and research in the preservation and management of material culture. It supports discovery and innovation through research that transcends the boundaries of traditional disciplines. It uniquely trains the next generation of conservators in the best practices and methods of cultural heritage conservation through various pedagogical approaches, including, but not limited to, core teaching and learning, independent research, and laboratory experience in museums and in the field. Finally, it positively impacts the community by engaging with a more informed public that would seek to protect cultural heritage from imminent threats.

Figure 1 . Lesley Day, a first year conservation student, gap filling losses in a Minoan pithos after reconstructing the fragments at the INSTAP Study Center for East Crete this past summer.

The three-year program leading to a master's degree consists of two years of coursework and laboratory work on artifacts, emphasizing research-based practice, combined with two internships: a-ten-week summer internship between the first and second years and a nine-month-long internship in the third year. A master's research paper is completed at the end of the second year of study to allow students to concentrate on their internship duties and conservation work in the third year.

1. Materials Science and Engineering Department, UCLA/Getty Interdepartmental Program.

Figure 2. William Shelley, a first year conservation student, applying a plaster bandage during block-lifting of a piece of charred wood excavated in the early bronze stratum at Kaman-Kalehöyük, Turkey.

Figure 3. Tom McClintock, a first year conservation student, removing paint from the beak of a bald eagle exhibit, during his summer internship at the Alaska State Museum in Juneau, Alaska.

WE ARE PROUD TO ANNOUNCE the following recently completed Masters (Class 2014):

BRITTANY DOLPH – "Experimentation with and Evaluation of Ethyl Silicate-Based Group Formulations for Potential Application to Weather and/or Porous Silicaceous Stones" (Advisor: Prof. Christian Fischer).

AYESHA FUENTES – "Technical Examination of a Ritual Bone Ornament Ensemble from the Himalayan Region, with Notes on Treatment and Handling" (Advisor: Prof. Ioanna Kakoulli).

GENEVA GRISWOLD – "Treatment of a Tuscarora Headdress: Consultation and Material Selection" (Advisor: Prof. Ellen Pearlstein).

CAITLIN MAHONY – "Examining Two Novel Consolidants for the Treatment of Powdering Leather Suffering from the Acidic Deterioration Commonly Referred to as 'Red Rot'" (Advisor: Prof. Ellen Pearlstein).

CASEY MALLINCKRODT – "The Technical Analysis of an Ancient Egyptian/Ptolemaic Sarcophagus Lid from the Collection of the San Diego Museum of Man" (Advisors: Prof. David Scott and Prof. Ellen Pearlstein).

MADELEINE NEIMAN – "The Alteration of Cinnabar in Archaeological Roman Wall Paintings" (Advisor: Prof. Ioanna Kakoulli).

ALEXIS NORTH – "Biomimetic Hydroxyapatite as a New Inorganic Consolidant for Archaeological Bone" (Advisor: Prof. Ioanna Kakoulli).

CARINNE TZADIK – "Conservation, Analysis, and Treatment of Jaina Figurines" (Advisor: Prof. Christian Fischer).

SPOTLIGHT ON 2013–2014 FIRST-YEAR CONSERVATION IDP STUDENTS

The 2013–14 class of first-year IDP graduate students consisted of six highly talented and promising people: Elizabeth Anne (Betsy) Burr, Lesley Day, Colette Khanaferov, Tom McClintock, William Shelley, and Heather White.

All students have successfully completed the first year of their three-year degree program with average GPAs of 3.8–9. Furthermore, first-year graduate student of the program Betsy Burr received an Honorable Mention by the National Science Foundation for a graduate research grant proposal. This is considered a significant national academic achievement.

To read more about our program, students, faculty, and staff, please visit our newly redesigned website: www.conservation.ucla.edu.

FOLLOW US!

https://www.facebook.com/UCLAGettyProgram

https://twitter.com/UCLAGettyCons

Blog:
http://uclagettyprogram.wordpress.com/2014/06/02/class-of-2014-final-presentations/

Ten Years in the Tropics: Archaeological Research and Education in Bocas del Toro, Panama

Thomas A. Wake[1]

IT HAS BEEN APPROXIMATELY ten years since I embarked on the Proyecto Arqueológico Sitio Drago on Isla Colón in coastal Caribbean Panama. I was initially drawn to the Bocas del Toro region of Panama for a variety of reasons, not the least of which was to be in the same country as my wife, Christina Campbell, who studies spider monkeys (*Ateles geoffroyi*) in Panama every summer. My love for Neotropical marine and terrestrial biodiversity and a burgeoning interest in isthmian archaeology also spurred me into action. An additional motivation was my desire to run a long-term archaeological field and lab project. My interest was piqued!

Little was known about the archaeology of Bocas del Toro, Panama, when I began the project in 2003; in fact, only two books and a handful of articles on the region were available (Gordon 1982; Linares and Ranere 1980). The first of these was based on work by Matthew and Marion Stirling (1964), who led the first archaeological expedition to the region in 1949, identifying several sites. Subsequently, Burton Gordon (1982) conducted fieldwork on human geography in the region and noted several archaeological sites in addition to those located by the Stirlings (Gordon 1962).

By the 1970s and 1980s there was much speculation about cultural affinities in Bocas del Toro, but no real consensus (Haberland 1984). Only one major archaeological field investigation had been carried out in Bocas del Toro prior to 2003, led by Smithsonian Tropical Research Institute (STRI) archaeologist Olga Linares in 1970. Her project at Cerro Brujo led to one book and several journal articles on the project's findings in the region (Linares 1971, 1976, 1977; Linares and Ranere 1980).

According to Linares: "The archaeological settlements of Bocas province appear to represent marginal populations organized on the basis of small family (?) groups, without status differentiation or political organization of any recognizable kind" (1977: 311). She further suggested that the mainland populace of the mainland Aguacate Peninsula existed in a "backwater area," especially when compared to the better-known Panamanian chiefdoms on the Pacific coast (Linares 1980a:66). Cerro Brujo, she added, "was fairly typical of settlement and subsistence patterns in Bocas" (1977:310), while noting that larger sites may exist in the region.

I was curious as to whether this part of the land connecting North and South America were really so isolated and relatively unexploited in the past as commonly believed and set my sights on a field project in Bocas del Toro. It just so happened that my wife had been teaching primate field ecology courses in 2001 and 2002 at the Institute for Tropical Ecology and Conservation (ITEC) on Isla Colón (Figure 1).

1. Assistant Adjunct Professor of Anthropology, UCLA; Director, Zooarchaeology Laboratory, CIOA-UCLA; Research Associate, STRI —Panama.

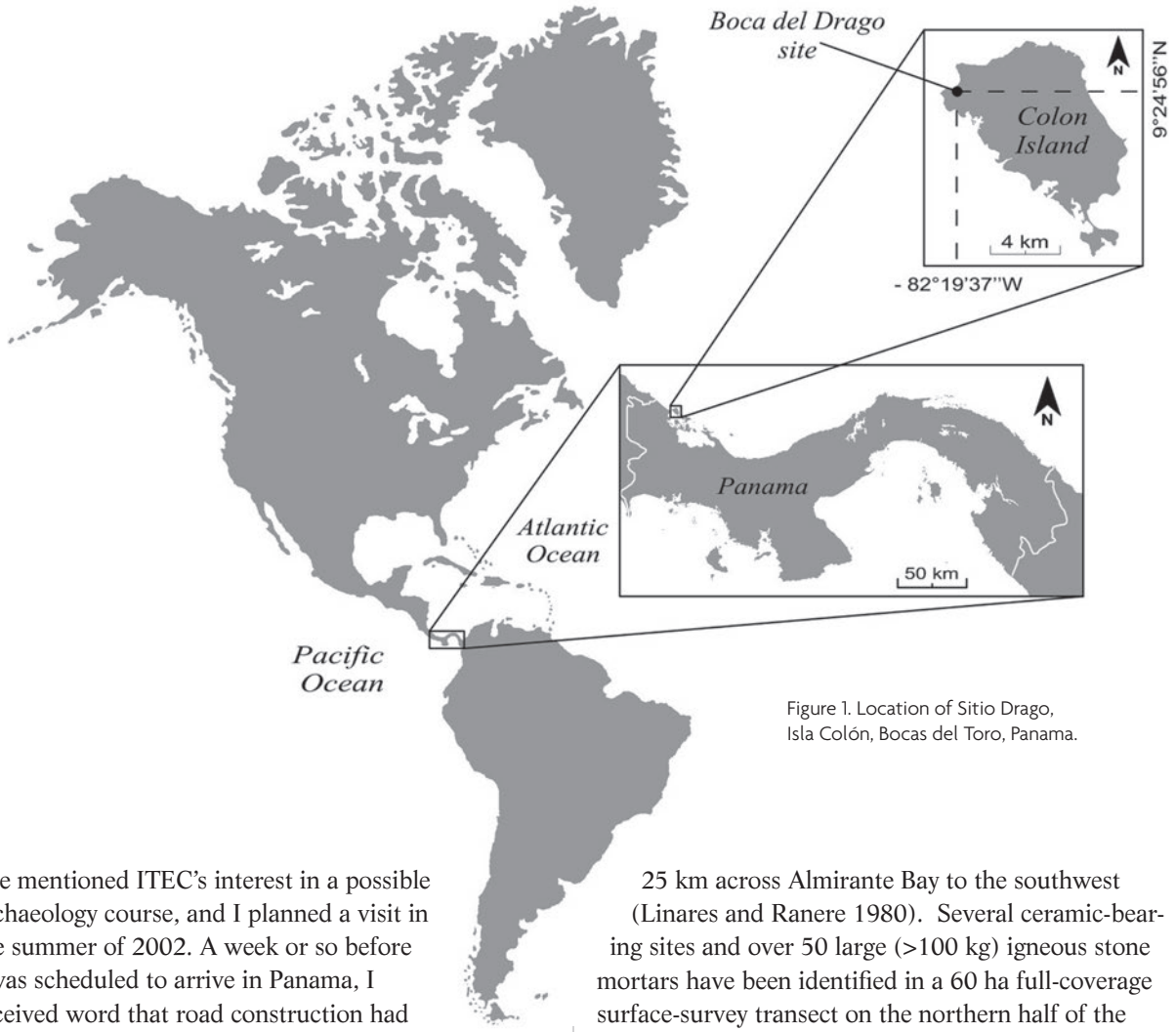


Figure 1. Location of Sitio Drago, Isla Colón, Bocas del Toro, Panama.

She mentioned ITEC's interest in a possible archaeology course, and I planned a visit in the summer of 2002. A week or so before I was scheduled to arrive in Panama, I received word that road construction had exposed an astonishing archaeological site right in Boca del Drago, virtually underneath the ITEC field station. Upon my arrival it became clear to me that Sitio Drago (BT-IC-1) represented a large coastal habitation site with excellent preservation, a dense shell midden, and a variety of artifacts that included ceramics, ground stone, chipped stone, and shell beads.

Fieldwork began in June 2003 with a UCLA summer archaeology field school run in collaboration with ITEC at Sitio Drago (BT-IC-1; Figure 2). The class included 5 students, with UCLA alumnus and current University of Michigan Assistant Professor Jason de Leon as Teaching Assistant. Various iterations of field schools continued through 2014. In total, at least 65 undergraduate students, 10 graduate students, 10 volunteers, and 6 Panamanian archaeologists have participated in the project over the past 12 years. The collaboration of my Panamanian colleagues Tomas E. Mendizabal and Alexis O. Mojica has been especially fruitful.

RESULTS

Recent excavation and analysis of material from Isla Colón has demonstrated a deeper and more complex prehistory than is evident on the Aguacate Peninsula, 25 km across Almirante Bay to the southwest (Linares and Ranere 1980). Several ceramic-bearing sites and over 50 large (>100 kg) igneous stone mortars have been identified in a 60 ha full-coverage surface-survey transect on the northern half of the island. Radiocarbon dates from this transect and three associated caves range from approximately 60 CE to 1850 CE. Several other sites on the island also bear ceramics and large igneous stone mortars and date from 1000 CE to 1700 CE.

Sitio Drago

Preservation at Sitio Drago is excellent, and our investigations (involving excavation and wet-screening through 3 mm mesh) have recovered a staggering number of artifacts. The site is constituted primarily by an artifact-rich dark anthrosol built up over a stabilized beach ridge made of coralline sand. The result is a well-drained, pH neutral, fine sandy soil full of artifacts, carbon, bones, and shell. At the end of the 2012 season, 58 1 m^2 excavation units had been placed across the site. Many of these units represent stratigraphic test pits designed to sample divergent areas of the site. Three areas were then selected for broader excavations with contiguous units exposing 21 m^2, 9 m^2, and 8 m^2.

Some 40 radiocarbon dates are now available for Sitio Drago. These dates range from 750 CE to 1410 CE, with the majority between 900 CE and 1300 CE. These dates and the corresponding ceramic affini-

ties and characteristics place the site culturally in the broader Chiriquí Phase of western Panama and southeastern Costa Rica (Corrales 2000; Linares de Sapir 1967a, 1967b).

Surface Features and Site Organization

Several low (2–3 m) earthen mounds are visible across the surface of the central area of the site (Figure 2). These mounds have proved to be elevated concentrations of domestic trash interspersed with remnants of older surfaces. The relatively level beachfront area where the site lies has a high water table and is regularly inundated, so an elevated mound could keep both people and their possessions out of floodwaters. These mounds tend to have denser accumulations of dietary remains (carbon, shell, and bone), ceramic fragments, broken stone tools, lithic flakes, and the occasional piece of worked shell or bone. No human remains other than isolated teeth have been found in any of these presumably domestic structures.

Funerary remains have been recovered from a single mound in the center of the site, which contains at least five tombs made of coral slabs. The architecture of the *cajones* (large boxes or coffins) consists of a rectangular layer of flat coral slabs forming a floor and one course of vertical slabs at each edge forming a wall. Each tomb contains the skeleton of a single individual. The tombs were then filled with beach sand and covered with a layer of overlapping coral slabs, followed by a thin layer of soil. Four of the burials contain the more or less complete skeletons of single individuals, one of which is missing the head. A tightly wrapped headless secondary burial was later placed between two of the tombs, disturbing one of the graves. None of the tombs found to date has contained any associated grave goods.

The area surrounding the tombs tells a different story. Units placed close to the tombs (Units 14, 39–42) have produced dense artifact accumulations, ceramic and stone tool caches, and many shell beads and ornaments. A cache of stone artifacts was recovered from Unit 14, directly adjacent to one of the tombs. This collection of stone and bone artifacts represents a recycling kit for making smaller ground

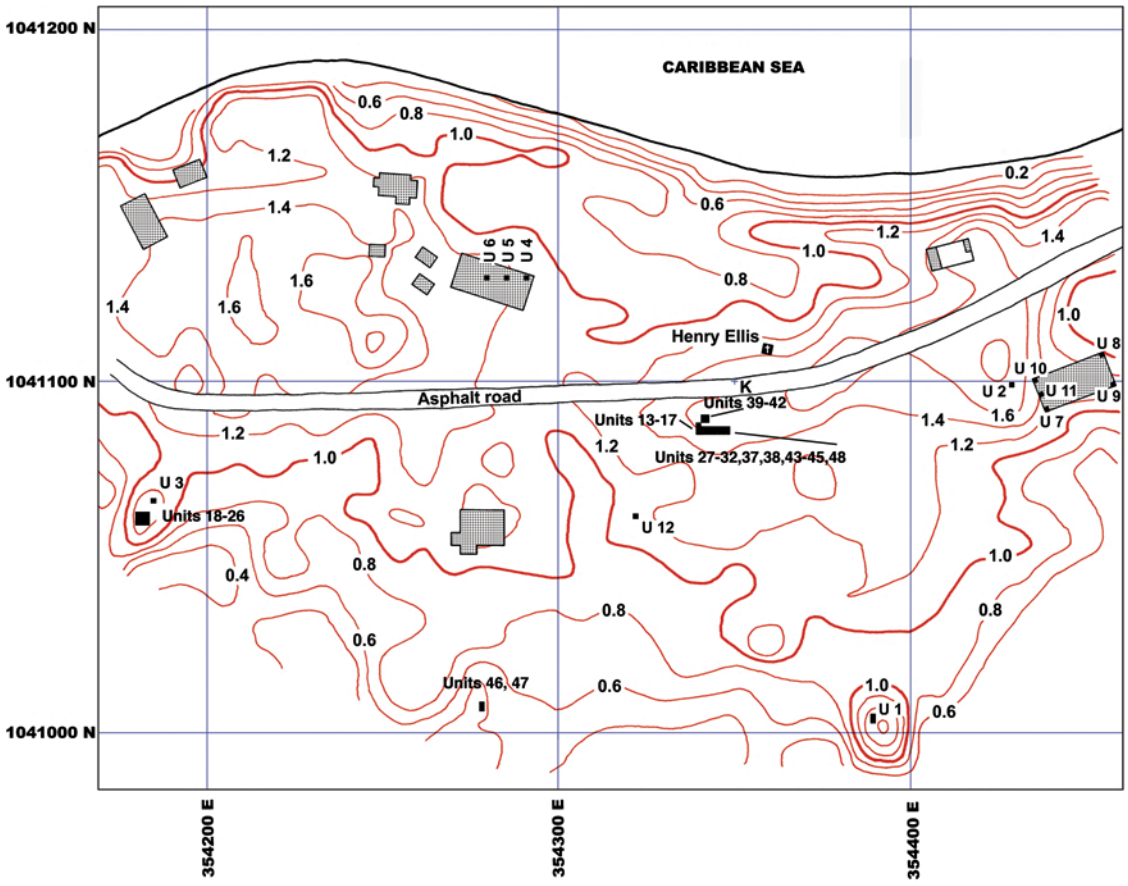


Figure 2. Sitio Drago, site core. Black quadrangles represent excavation units.

stone woodworking tools from broken large axes. The cache consists of at least 50 artifacts, including broken large celts (as sources of raw material), large and small hammer stones, several large primary flakes, large flakes worked into preforms, pressure-flaked finished preforms, two finished small groundstone tools, two hand-sized chunks of pumice, two hand-sized spoon-shaped concreted volcanic ash polishing stones, and three brocket deer (*Mazama americana*) antler pressure flakers.

Old ground surfaces in Units 39–42 are covered with numerous broken ceramic vessels and large shells, and dense concentrations of animal bone lie directly adjacent to the tombs. Many of the ceramics are exotic fine-ware drinking cups and serving vessels associated with larger ollas (curved sherds 6 cm thick), and cooking vessels—all broken in situ. This evidence suggests the occurrence of ritual feasting events associated with the dead. The delicate placement of a secondary burial directly between two tombs also suggests a social memory of who is buried where.

Ceramics

A diverse array of ceramic wares and vessel forms are found at Sitio Drago, including huge ollas round-bottomed liquid and/or cooking containers of variable sizes, small-to-medium tripod cooking and/or drinking vessels, and low open serving vessels. A variety of pastes, tempers, slips, and surface treatments are represented. Some sherds bear traces of red painted designs, and others show designs rendered in red and black or even polychrome.

The ceramic assemblage has yet to be analyzed in detail, but preliminary results suggest that the occupation at Sitio Drago can be divided into two broad ceramic phases. The most recent occupational phase is characterized by the presence of Bisquit Ware (Linares de Sapir 1967a,b; Linares 1980b), which is a quite distinctive high-fired, thin, self-slipped fine ware with a generally pastel beige paste and fine sandy temper. Restricted-necked vessels often have detailed, low-relief plastic circle and chevron decorations on the neck. Open vessel forms can have tripod bases, can have molded naturalistic figures as feet and handles, or are shaped in an animal form. Bisquit Ware sherds are found only in the upper 40 cm of the Sitio Drago deposit in all units across the site.

The most common ceramics, various Bocas Brushed wares, are found throughout the deposit and are characterized by a brown paste with coarser sand or crushed stone tempers. Bocas Brushed Ware decoration includes red slip at the rim, often with groups of an odd number of stripes descending into the vessel at the cardinal directions. Many of the globular vessel exteriors are roughly finished, probably brushed with a palm frond or leaf. Modeled, high-relief marine animal figures, including crabs, octopuses, starfish, fish, dolphins, and birds are often present on the shoulders of Bocas Brushed Ware vessels.

Several different ceramic wares are present at Sitio Drago in addition to the apparently local and more utilitarian Bocas Brushed Ware. Elaborate Chocolate Incised Ware sherds represent vessels imported from the Pacific Coast of S.W. Costa Rica's Diquis region.

This evidence suggests the occurrence of ritual feasting events associated with the dead.

The Chocolate Incised Ware includes self-slipped brown paste with relatively fine tempers. Design elements include application of a black micaceous slip to the interior of some vessels. Complicated geometric designs were incised into the vessel rims after firing, as well as elaborately modeled hollow vessel supports in the form of standing mammal figures or heads. Each support contains clay balls inside, probably to generate a rattling sound when used.

A few diagnostic sherds representing trade wares from throughout lower Central America have been identified from Sitio Drago, including central Panama (Coclé and Macaracas), central Costa Rica (Irazu Yellow-on-Red), N.W. Costa Rica (Mora Polychrome and Asiento Polychrome), and possibly S.W. Nicaragua (Papagayo Polychrome; Figure 3). Some of these exotic ceramics may have traveled up to 400 km to end up at Sitio Drago.

Stone artifacts

Stone artifacts recovered from Sitio Drago include ground stone celts and other possible woodworking tools, mortars, and carved metates. Flake artifacts include projectile points made on large prismatic basalt flakes, a few chert-cutting tools, and *débitage* indicative of recycling broken tree-felling axes into smaller ground stone tools. Small (60–120 gm)

notched pebble net-weights are also fairly common.

Fragments of several finely worked, carved stone metates bearing complicated geometric designs and feline heads have been recovered from the site. These artifacts are similar to complete feline-effigy metates commonly found in upland western Panama and adjacent Costa Rica. Because there were no local sources available, these cumbersome stone artifacts would have had to have been transported over land and water to get to Isla Colón. It is likely that the celts and projectile points came to Sitio Drago as finished artifacts or late-stage preforms.

Figure 3. Exotic Ceramics recovered from Units 39–42, Sitio Drago: upper left—Irazú yellow-on-red (central Costa Rica); upper right—Papagayo polychrome (S.W. Nicaragua-N.W. Costa Rica); lower left—Coclé polychrome (central Pacific Panama); lower right—Mora polychrome (N.W. Costa Rica).

Bone and Shell Artifacts

Various bone artifacts representing projectile points, piercing tools (awls), and ornaments have been recovered at Sitio Drago. Lanceolate ground and polished large-mammal bone fragments, honed to a keen edge, are interpreted as projectile points. Pointed deer-bone metapodial fragments and a worked complete brocket deer (*Mazama americana*) antler are interpreted as piercing tools. Bits of worked bone waste indicate at least some bone tool manufacture at the site. Three carved white-tailed deer (*Odocoileus virginianus*) antler ornaments have been recovered as well (Figure 4). Two of these represent animal figures, and another is more abstract. The two animal figures were recovered from Unit 14, associated with the lithics cache mentioned previously.

Shell ornaments include a variety of large and small disk beads in white, red/orange, and purple. Several bivalve and snail shells of a variety of species have holes ground in them, presumably for suspension. Carved shell pendants (Figure 5) made of spiny oyster (*Spondylus*), conch (*Strombus*), and pearl oyster (*Pinctada*) shell have been recovered but are rare compared to the small disk beads. While worked shell artifacts have been found across the site, the vast majority of small-shell disk beads have been recovered from soil overlying the tombs in the mortuary area of the site (Units 13–17, 27–32, 37–43, and 48).

Plants

Lana Martin, a UCLA Anthropology graduate student, is currently conducting a detailed paleoethnobotanical analysis of the carbonized plant remains, phytoliths, and pollen recovered from Sitio Drago. Prior analysis of selected carbonized plant remains suggests that Raffia Palm (*Raffia taedigera*) nuts were used as a food source at the site (Wake 2006). Preliminary findings by Martin (n.d.) indicate that a wide range of tree fruits and nuts is present in the samples available for analysis, but her forthcoming research will further refine the vegetal and arboreal sequences.

Shell

Shells are probably the most common item encountered on the surface and during excavation at Sitio Drago. To date, at least 86 genera and 76 species of bivalves and gastropods have been identified from Sitio Drago (Wake et al. 2013). Of these, 15 species are most common in the collection, all used as food sources, some as sources of raw materials for artifacts. Many of the smaller, less numerous species may represent "riders" not specifically collected for food.

Bone

Well-preserved animal bone is also common at Sitio Drago (Wake and Mendizabal in press). In total, at

least 96 genera and 80 species of vertebrates have been identified at Sitio Drago, representing 68 families. Fish remains are the most numerous, with marine and terrestrial higher vertebrates well represented. Fifty-two genera and 43 species representing 34 families of fish have been identified (Wake et al. 2013).

Amphibians, reptiles, birds, and mammals are present in the Sitio Drago bone collection as well. Bones from the smoky jungle frog (*Leptodactylus savagei*) are relatively common in Units 19–27 and 39–42 in the mortuary area. Sea turtle bones, mostly green turtle (*Chelonia mydas*), represent the most common large reptiles identified, followed by terrestrial turtles, iguanas, and snakes. Bird bones are the least common, but include parrots, cormorants, and songbirds.

The identified mammal remains are dominated by terrestrial species, especially rodents, including agouti (*Dasyprocta punctata*), paca (*Agouti paca*), and spiny rat (*Proechimys semispinosus*). Artiodactyls, including white-tailed deer, brocket deer, and peccaries (*Pecari tajacu*), are the most common large terrestrial mammals. Three species of monkey (howler—*Alouatta paliatta*, spider—*Ateles geoffroyi*, and white-faced capuchin—*Cebus capucinus*) are present in the Sitio Drago collection. West Indian manatee (*Trichecus manatus*), the largest living New World mammal, is also present in low numbers.

Sitio Abuelitas (BT-IC-15)

In 2004, project participants were led to a site now known as Sitio Abuelitas (IC-15), some 4 km inland from Sitio Drago at roughly 50 m elevation. Surface artifacts were collected in 2004 and the site was tested in 2005 and again in 2010. I submitted several carbon samples for AMS dating, with the results ranging between 60 CE and 420 CE, driving back the occupational history for the region another 600 years.

Upon inspection, the ceramics recovered from this site were puzzling—they were completely different from those encountered at Sitio Drago. The IC-15 ceramics compared favorably with those termed "Bugaba" by Linares (1980b) from Cerro Brujo, dating to approximately 600 CE. These ceramics are

Figure 4. Carved white-tailed deer (Odocoileus virginianus) antler pendants from Sitio Drago.

Figure 5. Selected carved shell ornaments from Sitio Drago: Red-orange—Spondylus; White—Strombus; Mother-of-pearl—Isognomon.

representative of a broader Aguas Buenas (AB) style that occurs in western Panama and eastern Costa Rica between 500 BCE. and 700 CE. The Aguas Buenas style complex is defined by liberal usage of a bright red slip and modeled naturalistic terrestrial animal and human figurines on vessel exteriors, both well-represented at IC-15 (Figure 6).

Ground stone artifacts from IC-15 included a couple of polished igneous celts, basaltic discoidal choppers, and basaltic milling-stone fragments. We also recovered a small greenstone disk bead, as well as a hard greenstone pebble with a suspension hole and modification reminiscent of a perched bird—one of very few provenienced greenstone artifacts known from Panama. A formal analysis of the IC-15 ceramics and other artifacts is currently underway. Unfortunately, organic preservation at IC-15 is poor; no shells were present, only shadows of burned fish vertebrae were documented, and small pieces of charcoal were recovered (Wake 2014).

One of the more prominent archaeological features at Cerro Brujo is a line of four large basaltic boulder mortars.

ARTIFACT TRENDS

Ceramic distributions

While the Aguas Buenas Phase ceramics (Bugaba style) from Cerro Brujo and IC-15 have yet to be sourced, it would not be surprising if they were produced in the highlands surrounding Volcan Barú—the apparent Bugaba / Aguas Buenas heartland (Linares 1980a). Visibly, the two Bocas del Toro Aguas Buenas–style ceramic collections from CB and IC-15 appear virtually indistinguishable from those described in Linares (1980a).

The ceramic collection from IC-1 is different from that of Cerro Brujo and IC-15 in terms of diversity and quality. The Cerro Brujo and IC-15 sites do not appear to include ceramics from outside the local region other than the highlands around Volcán Barú. The ceramic assemblage from IC-1 includes a variety of ceramics from throughout lower Central America, including examples from central Panama (Coclé, Macaracas, Parita), the Pacific slope of western Panama (Linarte Zoned Red Line), the Diquís region of S.E. Costa Rica (Chocolate Incised), Costa Rica's Valle Central (Irazu Yellow-on-Red), the Tempisque region of N.W. Costa Rica (Mora and Asiento Polychromes), and possibly the Rivas region of S.W. Nicaragua (Papagayo Polychrome; Figure 3).

Stone Artifacts

With the exception of a few small flat limestone pebbles that were notched and likely used as net-weights, no tool-quality stone is available on Isla Colón (Coates et al. 2005). All of the igneous stone used for celts, smaller woodworking tools, projectile points, carved metates, and boulder mortars at Sitio Drago was transported across at least 7 fathoms (12.81 m) of water to get there. The presence of flat igneous milling stone fragments at both IC-15 and Sitio Drago indicates continuing importation of finished products from somewhere on the mainland, probably in the highlands. The stone tool assemblage from IC-15 (celts, choppers, and cutting tools) also indicates earlier continued contact with the mainland.

One of the more prominent archaeological features at Cerro Brujo is a line of four large basaltic boulder mortars. Boulder mortars are relatively common on Isla Colón as well, found across the island. These boulders are igneous in nature and also from off-island. Many of these stones cannot even be turned over by an individual and must weigh well over 100 kg. To obtain stones such as these would require an organized group of people with access to watercraft, presumably from a mainland stream course. The stones would have to be loaded into a boat, transported across Almirante Bay, unloaded, and then hauled to localities several km inland over rough terrain. Exactly when boulder mortars were first transported to Isla Colón remains undetermined.

The lithic assemblage from Sitio Drago is further testimony to the continued importation of various prepared and/or finished stone tool classes from the mainland. All of the large axes, celts, adzes, chisels, and other chipped, ground, and polished stone tools recovered on Isla Colón are made of igneous rock, primarily basalt, found on the mainland. The production of these tools is a specialized process that requires an abundance of raw material, none of which is available on Isla Colón. The relative value of tool-quality basalt at Sitio Drago is indicated by the intensive recycling of

Figure 6. Selected Aguas Buenas Phase ceramics from Sitio Abuelitas (BT-IC-15, AD 0-400), Isla Colón, Bocas del Toro, Panama.

large pieces of stone, in the form of broken axes, into smaller adzes, celts, and chisels found in the stone tool cache from Unit 14 described above. Someone certainly had the knowledge and capability to reprocess broken axes into useful smaller stone tools at Sitio Drago.

All of the projectile points and some of the smaller woodworking tools recovered from Sitio Drago are made on prismatic basalt blades. The production of prismatic blades is a fairly specialized process, well documented in Mesoamerica, that leaves tell-tale quarries, *débitage*, and exhausted cores behind. The lack of obsidian in Lower Central America necessitated the use of local cherts and fine-grained basalts for blade production.

Samples of basaltic flakes recovered from Sitio Drago have been subjected to portable X-ray florescence spectroscopy (pXRF) analysis under the direction of Christian Fischer in the UCLA / Getty Conservation Program at the Cotsen Institute of Archaeology. Preliminary analysis suggests at least one primary source of material, along with several outliers possibly representing other sources (Figure 7). The location of this source and any others is currently unknown but almost certainly lies somewhere on the mainland, quite possibly on Volcán Barú. Locating and characterizing the source(s) of the stone artifacts from Sitio Drago presents an exciting future research avenue.

Ornaments

The stone, shell, and bone ornaments from both IC-15 and Sitio Drago represent potential objects of exchange. The stone ornaments from IC-15 certainly came from the mainland. The jadelike stone bird amulet may be from Costa Rica or perhaps Mesoamerica: it remains to be chemically characterized.

The shell beads and ornaments recovered from Sitio Drago represent objects that could be manufactured at the site in order to be traded or exchanged for items from the mainland. Limited evidence of shell-ornament production is documented from Sitio Drago, primarily in the form of unfinished shell ornaments and bits of worked shell. Evidence of intensive shell-bead production, such as that documented from the California's Channel Islands and at Cerro Juan Diáz (CJD—Mayo 2004, 2007), has yet to be found at Sitio Drago.

Shell ornaments virtually identical to those from Sitio Drago illustrated in Figure 6 have been found to be fairly common in burials at CJD, especially the red/orange *Spondylus* (spiny oyster) frogs and

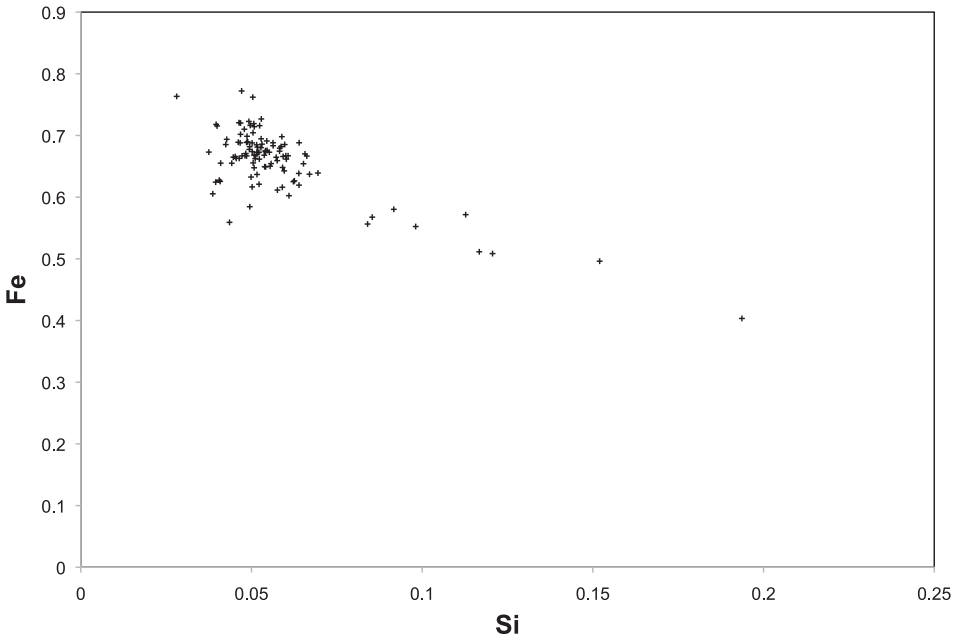


Figure 7. Results of PXRF analysis of 66 basaltic flakes recovered from Sitio Drago.

white ground-shell biperforate triangles (Cooke et al. 1998:192, Figure 9; Mayo 2004). Similar shell ornaments have been recovered from other central Panamanian archaeological sites (Cooke, Pers. Comm. 2012).

The bone ornaments from Sitio Drago are intriguing. All have large holes, presumably for suspension, and two are carved to represent animals. These two figurines reveal iconographic similarities to central Panama. One amulet resembles a skeletal human figure from one aspect. However, when viewed from the side, the same figure resembles a crocodile. Lothrop (1937:171–172, 198) recovered several similar carved bone crocodile figurines from Sitio Conte, in Central Panama. The other amulet resembles a felid with a long tail, possibly a puma, and appears to be in the "Gran Coclé" style (Lothrop 1937). Carved antler ornaments from Jalaca, Diquís, Costa Rica (Stone 1963) also bear a strong resemblance to those found at Sitio Drago. It should be noted that many bone artifacts recovered from central Panama, Sitio Conte in particular, are made from manatee bone (Lothrop 1937)—available only on the Caribbean coast.

Subsistence

The subsistence evidence from Isla Colón leads to several interesting interpretations concerning plant and animal use and the human impacts on animal resources. In terms of plant use, it seems clear that the IC-1 inhabitants exploited raffia nuts and other tree resources. The boulder mortars and rocker *manos*, common across the island, are consistent with the proposed mixed "vegeculture" plant use pattern suggested for Cerro Brujo (Linares and Ranere 1980).

The presence of flat milling stone fragments at both IC-15 and Sitio Drago are indicative of seed processing and may represent a greater use of maize in the region than previously thought. The results of Lana Martin's dissertation (Martin n.d.) will shed much light on plant use on Isla Colón and hopefully provide some answers as to which plants were used in what frequencies.

Study of the animal remains from Sitio Drago is ongoing, but analysis of selected samples has demonstrated evidence of human impacts on local animal resources. Wake et al. (2013) demonstrate a significant reduction in the trophic level of fish represented at Sitio Drago between the lower levels of the site, and the upper 40 cm Bisquit Ware-bearing levels. Fishing at Drago shifted from a focus on larger predatory species during the earlier occupation to a wider range of more generalist species in the later occupation.

Detailed analysis of fighting conch (*Strombus pugilis*) shells from Sitio Drago elsewhere in the Bocas del Toro Archipelago shows a significant reduction in size at maturity over the past 7,000 years (O'Dea et al. 2014). This trend began prior to the occupation of Sitio Drago, continues into the modern era, and is indicative of the long-term effects of human harvesting pressure on the conch resource. The indications and implications of human impacts on various animal resources invite a great deal of further research.

Chronology

The results of excavation at Sitio Drago and IC-15 have provided a great deal of information on the settlement chronology of Isla Colón and Bocas del Toro. Linares and Ranere (1980) suggest that the mainland Aguacate Peninsula was settled around 600 CE. Our project has shown that the IC-15 site clearly indicates that Isla Colón was occupied at least 2,000 years ago. The occupants of this site had access to

stone tools and raw material not found on Isla Colón, derived from the mainland. The ceramics from IC-15 bear clear affinities to the Bugaba / Aguas Buenas–style collections from Cerro Brujo and the highlands surrounding Volcan Barú (Linares and Ranere 1980). Earlier settlement of the Bocas del Toro region is not surprising given the evidence from Black Creek (3830-2355 BP), just 25 km to the west in adjacent coastal Costa Rica (Baldi 2001, 2011; Chavez et al. 1996).

The findings from Sitio Drago also help clarify the settlement chronology of the region. The presence of Bisquit Ware ceramics in only the upper 40 cm of the Sitio Drago deposit clarifies that Linares and Ranere's Bocas Phase can be divided into two distinct occupation phases, at least at Sitio Drago. The post-contact (post-1500 CE) radiocarbon dates from ceramic-bearing sites in the interior of Isla Colón indicate occupation of the region continued through the historic period. However, the ceramic collections from these sites appear locally manufactured, less diverse in terms of types, varieties, and vessel forms, and bear little affinity to those from IC-15 or Sitio Drago, suggesting a different material cultural horizon.

Educational Ramifications

The results described above offer a great deal of new information concerning the prehistory of Caribbean western Panama. Several articles have been published documenting various parts of the project, including project overviews (Wake et al. 2004; Wake 2008; Wake and Mendizabal in press), remote sensing (Wake et al. 2012), marine shell and bone (O'Dea et al. 2014; Wake et al. 2013), and plant remains (Wake 2006).

To date the Proyecto Arqueologico Sitio Drago and associated field schools have brought at least 65 undergraduates to Bocas del Toro, Panama. Several of those undergraduates returned to the site as graduate students. Four of these students have finished, or are completing, master's theses on various aspects of the archaeology of Sitio Drago and Isla Colón (Bond 2008—CSUN; Kay 2010—U. Florida; Doughty 2011—U. Birmingham; Davis n.d.—Kansas U.). A field season in 2010 and study season in 2011 allowed UCLA Anthropology graduate student Lana Martin to familiarize herself with the site, Panama, and STRI and to provide paleoethnobotanical data for her dissertation on plant consumption practices (Martin n.d.). In 2012, an Institute for Field Research field school run through CSUN in collaboration with UCLA allowed current UCB graduate student and UCLA alumnus Jerry Howard to generate the final set of field data for his dissertation on historical archaeology, creolization, and ethnic identity (Howard 2014).

Conclusions

Conducting research in Caribbean coastal Panama has produced excellent dividends. Over the past ten years we have learned that Isla Colón was settled earlier than previously thought. Evidence of continuous contact with the highlands on the mainland to the south for the past 2,000 years suggests also that the region was less isolated than assumed. The material culture recovered from Sitio Drago shows contact with a variety of culture areas covering much of lower Central America: Gran Coclé to the east, Gran Chiriquí to the south, and Gran Nicoya to the northwest.

Evidence of continuous contact with the highlands on the mainland to the south for the past 2,000 years suggests also that the region was less isolated than assumed.

The people living at Sitio Drago were not isolated and had a level of social organization that allowed them to actively interact with other local and regional populations and to organize the requisite number of people and watercraft necessary to transport large boulders from the mainland to island hilltops. In addition to the regionally diagnostic trade ceramics, the stone and shell artifacts recovered from Sitio Drago are evocative of an active exchange network operating between Isla Colón and different parts of the mainland, up to 400 km away. Bocas del Toro was part of a larger lower Central American trade and exchange network from at least 2,000 to 500 years ago.

Data recovered from survey, surface collection, and limited excavation suggest that this changed radically in the sixteenth century CE, perhaps soon after Columbus's October 5, 1502, visit to Bocas del Toro. The material culture recovered from postcontact sites on Isla Colón appears less technologically sophisticated and more insular. These sites have been

located on interior hilltops and caves, away from the coast and hidden from view. Few exotic ceramics were found, and those recovered appear less diverse and more crudely made compared to those from a century earlier. Few basaltic tools were found.

All indications suggest an early historic period collapse of the earlier far-flung network, resulting in a more isolated local population. As Howard (2014) discusses, this situation began to change in the eighteenth and nineteenth centuries CE with the influx of pirates, Anglophone Afro-Caribbeans, different Indian groups, and banana plantations, ultimately producing the diverse community that is modern Bocas del Toro.

The past 10 years of field work in Panama has been a wonderful experience. Research collaborations have blossomed and are bearing academic fruit in terms of new knowledge and interested students. The Proyecto Arqueológico Sitio Drago has served to educate North American university students about Panamanian archaeology and the vibrant culture of Bocas del Toro and Panama in general. Many participants have remarked to me how enjoyable and eye-opening their experience in Panama turned out to be. Panamanian participants in the project have honed their professional skills and continued their careers in archaeology. Several project participants have returned to conduct further research into the archaeology of Bocas del Toro. I look forward to at least another ten years of enjoyable fieldwork in Panama.

ACKNOWLEDGEMENTS

I would like to acknowledge the Serracín Family of Boca del Drago, especially Don Aristides "Bolo" Serracín, Ana Serracín de Shaffer, Juany and Willy Serracín, and Brenda Serracín de Álvarez, for their permission to excavate at at Sitio Drago, and their accommodation and support. I also acknowledge the support and participation of Alonso Iglesias, who provided permission to excavate on his family's portion of Sitio Drago. I want to thank Joanne Snowden, Helen Campbell, Marillyn Holmes, and Marta Perez for their volunteer efforts on the project. Important extramural support for the project has come through private donations and support of the American Philosophical Society's Franklin Fund (2005, $5,000). The 2003 class and the subsequent project would not have been successful without the institutional support of Carlos Fitzgerald (Director, Departamento Nacionál de Patrimonio Histórico – INAC, Panamá) and Pete Lahanas (Director, ITEC) and the support and participation of Christina Campbell (California State University, Northridge (CSUN—Anthropology). For the 2007 season, thanks are due to the Panamanian government, which provided support to Tomas Mendizabal, my co-director, and myself for the UCLA project in order to collaborate with Instituto Nacional de Cultura's (INAC) Departamento Nacional de Patrimonio Historico (DNPH) staff in the field and the lab through the Secrataria Nacional de Ciencia y Tecnología (SENACYT, $49,800). I thank the Smithsonian Tropical Research Institute (STRI), and David and Marvalee Wake, for financial and material support.

REFERENCES

Baldi, Norberto. 2001. Black Creek (UCR No. 467): Primeras Interpretaciones de un Modo de Vida Costero en el Caribe Sur de Costa Rica. Unpublished Licenciatura Thesis, Department of Anthropology, University of Costa Rica.

Baldi, Norberto. 2011. Explotacion Temprana de Recursos Costeros en el Sitio Black Creek (4000-2500 BP), Caribe Sur de Costa Rica. Revista de Arqueología Americana 29:85–121.

Bond, Jeannette C. 2008. A Ceramic Analysis at Sitio Drago, Bocas del Toro, Panamá. Unpublished Master's Thesis, Department of Anthropology, California State University, Northridge.

Chavez, Carlos, Oscar Fonseca, and Norberto Baldi. 1996. Investigaciones arqueologicas en la costa Caribe de Costa Rica, America Central. *Revista de Arqueología Americana* 10:124–161.

Coates, Anthony G., D. F. McNeill, M-P. Aubry, W. A. Berggren, and Laurel S. Collins. 2005. An Introduction to the Geology of the Bocas del Toro Archipelago, Panama. *Caribbean Journal of Science* 41(3):374–391.

Cooke, Richard G. 2005. Prehistory of Native Americans on the Central American Land Bridge: Colonization, Dispersal, and Divergence. *Journal of Archaeological Research* 13(2):129–187.

Cooke, Richard G., Luis-Alberto Sánchez, Ilean I. Isaza, and Andres Pérez. 1998. Rasgos Mortuarios y Artefactos Inusitados de Cerro Juan Diaz, Una Aldea Precolombina del Gran Coclé. *La Antigua* 53:127–196.

Corrales, Francisco. 2000. An Evaluation of Long Term Cultural Change in Southern Central America: The Ceramic Record of the Diquís Archaeological Subregion, Southern Costa Rica. Unpublished Doctoral Dissertation, Department of Anthropology, University of Kansas, Lawrence.

Davis, Kristina E. No Date. Analysis of the Prehistoric Human Skeletal Remains from Sitio Drago, Isla Colón, Bocas del Toro, Panamá. Unpublished Master's Thesis, Department of Anthropology, University of Kansas, Lawrence.

Doughty, Douglas R. 2011. An Analysis of Molluscs Recovered from Excavations at Sitio Drago, Isla Colón, Panamá. Unpublished Master's Thesis, Institute of Archaeology and Antiquity, University of Birmingham, U.K.

Gordon, Burton L. 1962. Notes on Shell Mounds near the Caribbean Coast of Western Panama. *Panama Archaeologist* 5:1–9.

Gordon, Burton L. 1982. A Panama Forest and Shore: Natural History and Amerindian Culture in Bocas del Toro. Pacific Grove, California: The Boxwood Press.

Haberland, Wolfgang. 1984. The Archaeology of Greater Chiriquí. In *The Archaeology of Lower Central America,* edited by Frederick W. Lange and Doris Z Stone, pp. 233–254. Albuquerque: University of New Mexico Press.

Howard, Jerome. 2014. Culture Change and Identity in Bocas del Toro, Panama: An Example of Community-Engaged Scholarship in Historical Archaeology. Unpublished Doctoral Dissertation, Department of Anthropology, UC Berkeley.

Kay, Michael. 2010. Zooarchaeology and Human-Environment Interactions at Pre-Columbian Sitio Drago, Panama. Unpublished Master's Thesis, Department of Anthropology, University of Florida, Gainesville.

Linares, Olga F. 1976. "Garden Hunting" in the American Tropics. *Human Ecology* 4(4):331–349.

Linares, Olga F.1977. Adaptive Strategies in Western Panama. *World Archaeology* 8(3):304–319.

Linares, Olga F. 1980a. The Ceramic Record: Time and Place. In *Adaptive Radiations in Prehistoric Panama,* edited by Olga F. Linares and Anthony J. Ranere, pp. 81–117. Cambridge: Harvard University, Peabody Museum Monographs, Number 5.

Linares, Olga F. 1980b. Ecology and Prehistory of the Aguacate Peninsula in Bocas del Toro. In *Adaptive Radiations in Prehistoric Panama*, edited by Olga F. Linares and Anthony J. Ranere, pp. 57–66. Cambridge: Harvard University, Peabody Museum Monographs, Number 5.

Linares, Olga F, and Anthony J. Ranere (eds.). 1980. *Adaptive Radiations in Prehistoric Panama.* Cambridge, Mass.: Harvard University, Peabody Museum Monographs, Number 5.

Linares de Sapir, Olga F. 1968a. Ceramic Phases for Chiriquí, Panamá, and Their Relationship to Neighboring Sequences. *American Antiquity* 33(2):216–225.

Linares de Sapir, Olga F. 1968b. *Cultural Chronology of the Gulf of Chiriqui, Panama.* Smithsonian Contributions to Anthropology, Number 8. Washington, D.C.: Smithsonian Institution Press.

Linares de Sapir, Olga F. 1971. Cerro Brujo: A Tiny Guaymi Hamlet of the Past. *Expedition* 13(2):27–35.

Lothrop, Samuel K. 1937. Coclé: An Archaeological Study of Central Panama, Part 1. *Memoirs of the Peabody Museum of Archaeology and Ethnology* 7. Cambridge, Mass.: Harvard University Press.

Martin, Lana. No Date. Reconstructing Late Ceramic Period Food Production and Political Complexity in Western Caribbean Panama. Unpublished Doctoral Dissertation, Department of Anthropology, UCLA.

Mayo, Julia. 2004. La Industria Prehispanica de Conchas Marinas en "Gran Coclé," Panamá. Unpublished doctoral dissertation, Departamento de Historia de América II (Antropología de América), Facultad de Geografía e Historia, Universidad Complutense de Madrid.

Mayo, Julia. 2007. Conchas y Especialización artisanal en Gran Coclé, Panamá. *Arqueología del Área Intermedia* 7:89–112.

O'Dea, Aaron, Marian L. Schafer, Douglas R. Doughty, Thomas A. Wake, and F. Rodriguez. 2014. Evidence of Size-Selective Evolution in the Fighting Conch from Prehistoric Subsistence Harvesting. *Proceedings of the Royal Society B* 281:20140159. http://dx.doi.org/10.1098/rspb.2014.0159.

Stirling, Matthew W., and Marion Stirling. 1964. Archaeological Notes on Almirante Bay, Bocas del Toro, Panama. *Anthropological Papers* 72:255–284. Washington D.C.: Smithsonian Institution.

Stone, Doris. 1963. Cult Traits in Southeastern Costa Rica and Their Significance. *American Antiquity* 28(3):339–359

Wake, Thomas A. 2004. Exploring Sitio Drago. *Backdirt: Newsletter of the Institute of Archaeology, University of California, Los Angeles* Fall/Winter:1, 4–5.

Wake, Thomas A. 2006. Prehistoric Exploitation of the Swamp Palm (*Raphia taedigera*:Arecacae) at Sitio Drago, Isla Colón, Bocas del Toro, Panamá. *The Caribbean Journal of Science* 42(1):11–19.

Wake, Thomas A. 2008. Reflecting on Fieldwork in Bocas del Toro, Panama. *Backdirt: Annual Review of the Cotsen Institute of Archaeology, University of California, Los Angeles* Fall/Winter:46–47.

Wake, Thomas A. 2014. *Proyecto Arqueológico Sitio Drago: Prehistoric Subsistence and Society in Northwest Caribbean Panama, 2010 Archaeological Investigations at Sitio Abuelitas (BT-IC-15), Isla Colón, Bocas del Toro, Panamá*. Report submitted to Sandra Cerrud, Directora, Dirección Nacionál de Patrimonio Histórico, INAC, República del Panamá.

Wake, Thomas A., Douglas R. Doughty, and Michael Kay. 2013. Archaeological Investigations Provide Late Holocene Baseline Ecological Data for Bocas del Toro, Panama. *Bulletin of Marine Science* 89(4):1015–1035.

Wake, Thomas A., Jason de Leon, and Carlos Fitzgerald. 2004. Prehistoric Sitio Drago, Bocas del Toro, Panama. *Antiquity* 78(300) June 2004: http://antiquity.ac.uk/ProjGall/wake/.

Wake, Thomas A., and Tomas Mendizábal. (In Press). Sitio Drago (Isla Colon, Bocas del Toro, Panama): Un Aldea y Centro de Intercambio en el Caribe Panameño. In *Mucho Más que un Puente Terrestre: Nuevos Datos Sobre la Vida Aldeana an Panamá*, edited by Juan-Guillermo Martín and Richard G. Cooke. Barranquilla, Colombia: Universidad el Norte.

Wake, Thomas A., Alexis O. Mojica, Michael H. Davis, Christina J. Campbell, and Tomas Mendizabal. 2012. Electrical Resistivity Surveying and Pseudo-Three-Dimensional Tomographic Imaging at Sitio Drago, Bocas del Toro, Panama. *Archaeological Prospection* 9(1):49–58.

Research at the Ancient Town of Talapada, India, 2014

Monica L. Smith[1] and Rabindra Kumar Mohanty[2]

Our research projects in eastern India have provided a rare opportunity to examine both the heart and the periphery of an ancient city.

THE PROCESS OF URBANIZATION has profound economic and social effects, not only on people who live in cities, but also on inhabitants of the surrounding countryside. For example, farmers often have to work harder to produce the food needed by urban residents while facing the loss of agricultural workers who would rather go to the big city themselves. Even when they do not move, rural residents become familiar with urban customs and language as friends and family members engage in cycles of migration to the city and back again.

Our research projects in eastern India have provided a rare opportunity to examine both the heart and the periphery of an ancient city. Having had the benefit of conducting research in the region's premier archaeological metropolis of Sisupalgarh for a decade, we wanted to look at the surrounding region in order to study its hinterland domino effect. Thanks to our enterprising students' study of Google Earth imagery, the team located two settlements that had enclosing walls constructed on the same pattern as Sisupalgarh's kilometer-long rampart, but on a smaller scale. These town-sized settlements, measuring about one-quarter the size of Sisupalgarh, provided the ideal location to evaluate the ways in which concepts ranging from urban planning to household economies were materialized at hinterland sites.

We selected the site of Talapada for an intensive series of investigations. In 2014 we were able to implement our biggest season thus far, with six areas simultaneously excavated at various locations on the ramparts, gateways, and habitation areas. The research group included students and faculty from UCLA and three Indian institutions, including the entire first-year M.A. cohort of Deccan College. A team of geophysical surveyors, coordinated by Professor Timothy Matney from the University of Akron, also returned to Talapada to continue the pioneering research of the previous year.

This past season's work was carried out with a particular focus on the rampart's formal gateways. Visible from satellite images, as well as on the ground, these

1 Professor, Department of Anthropology; Cotsen Institute of Archaeology, UCLA.
2 Professor, Department of Archaeology, Deccan College Post-Graduate and Research Institute, Pune, India.

Figure 1. Excavations in progress, Talapada gateway (UCLA graduate student Hannah Lau with baseball hat at right).

gateways are identical in shape to those at Sisupalgarh, but on-the-ground reconnaissance immediately showed that they were much more modest in scale. The rampart itself was only 2-3 meters in height, and likely to have constituted a social rather than a defensive perimeter. Our excavations of the gateways and one of the rampart corners indicated that the town's residents were savvy about embellishment: only the gateway that faced Sisupalgarh had formal stone steps and passageways, a nod to the influence of the "big city" that was both aesthetic and cost-effective.

The town's residents were savvy about the embellishment of their symbolic rampart.

Figure 2. Students with electrical resistivity meter conducting geophysical survey.

Excavations sometimes catch ancient builders in the act of preparing for constructions that never materialized.

Figure 3. Evening paperwork, Talapada field camp.

Figure 4. R. K. Mohanty and excavated gateway at Talapada.

Figure 5. Field crew with students and local village workers, Talapada.

Other areas were excavated to follow up on geophysical signals of subsurface constructions. In one area—now utilized as agricultural fields—that lacked any visible trace of archaeological remains, the geophysics team found a strong pair of signals running approximately 20 meters long, like two tracks or walls. Expecting a kiln or a structure, excavators instead revealed carefully stacked bricks that appear to have been a depot of construction material.

The discovery was a good reminder that excavations sometimes catch ancient builders in the act of preparing for constructions that never materialized (a snapshot of unfinished business that supports our earlier insights that Talapada might have been built "on spec" and never fully realized or even occupied—see our report in *Backdirt* 2013). Excavations also followed up on geophysical signals of structural remains in one area within the ramparts associated with iron production and also another area whose enigmatic circular constructions recalled similar structures from Sisupalgarh.

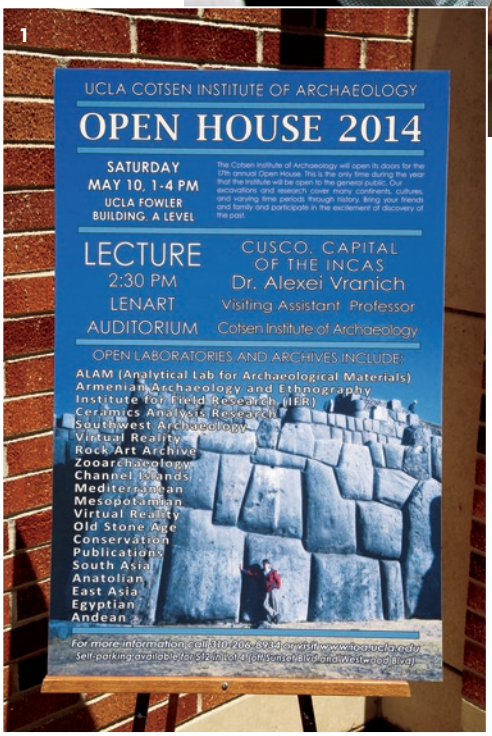
Our large scale of investigations was made possible by the hard work and team spirit of the many students who participated in the project. Their collective good cheer was evident every day, as well as their sense of humor and innovation: they borrowed bicycles for the project directors to move from one excavation to another, a daily round-robin of cycling that provided a constant source of village bemusement.

Talapada might have been built "on spec" and never fully occupied.

As always, we are highly appreciative to the many agencies and individuals who made the fieldwork possible, notably the Archaeological Survey of India and the National Science Foundation, along with many state and local supporters. The teamwork from the season was dynamic and integrative, made possible by the generous accommodations of two village families, who moved in with relatives and made their houses available so that our team could work and live together. We also had a wonderful support team of cook, driver, and household workers, who have been with us over the seasons and who contributed greatly to the harmony and smooth working of the field camp, enabling us to devote full-time attention to the many exciting discoveries of the research season.

PHOTO ESSAY

2014 Open House



The yearly Open House at the Cotsen Institute of Archaeology welcomes the community, college students, high school students, and anyone who has a fascination with archaeology. Our faculty, students, staff, and volunteers work together like a well-oiled machine to make this event a success. This should not come as a surprise, as the Institute has opened its doors for seventeen years to the public (Figure 1).

Upon entering our underground labyrinth, our visitors are greeted with an introduction to Stone Age tools (Figure 2). There is a strange familiarity when holding these hand tools as they were held thousands of years ago—they have the right weight and shape for cutting or scraping. More tools are found in the Old Stone Age laboratory, although many of these are for finer work, such as making crafts of leather or fibers (Figures 3, 4).

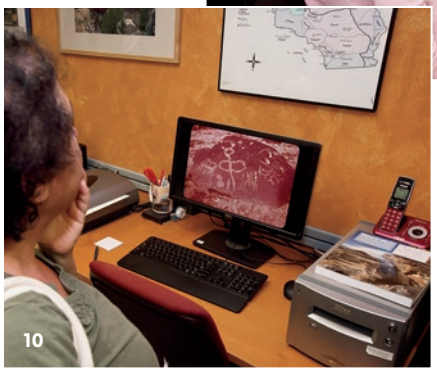
Hunter-gatherer groups are the focus of the Channel Island laboratories, where thousands of bead shells are found in various stages of production (Figure 5). These were used as currency for trading with mainlanders.

The Zooarchaeology laboratory is also a popular spot for visitors. Here, miniscule bone fragments indicate which animals were hunted and butchered and how different parts of animals were utilized by people in the past (Figures 6, 7).

All photographs by
Reed Hutchison/PhotoGraphics

2014 Open House


8


10


9


11


12

Still in the Neolithic period is the Mediterranean Laboratory, where Scaloria Cave is giving up its secrets from the mid-sixth millennium BC (Figure 8).

The Ceramics Analysis Research Group studies the production and use of ceramic vessels. Visitors have a chance to see and handle clay in various stages of fabrication (Figure 9).

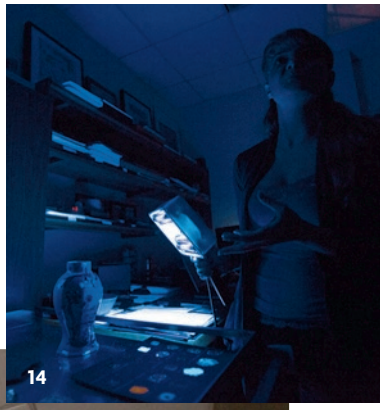
The Rock Art Archive presents images of humans, animals, and many curious shapes that only the cultures that made them would be able to identify (Figure 10).

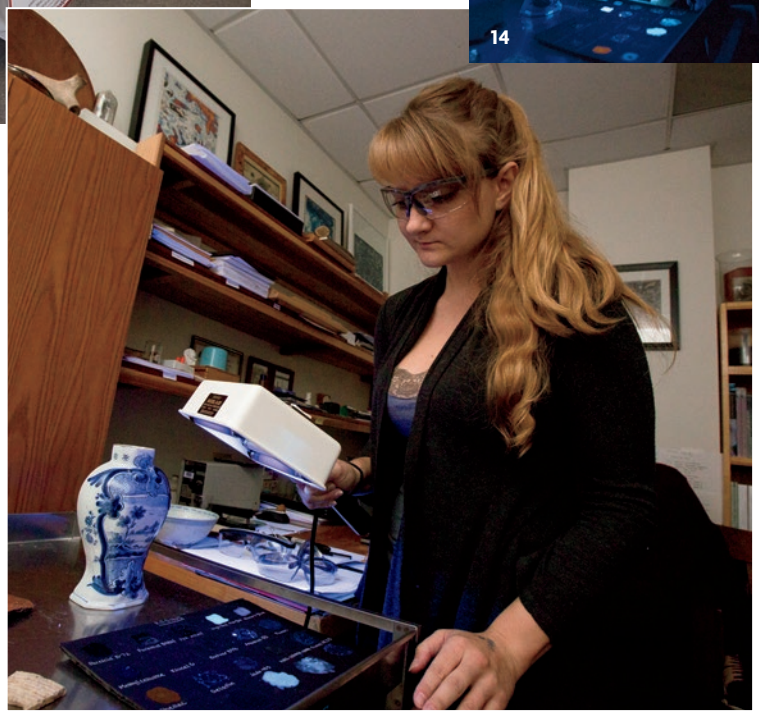
The Mesopotamian Laboratory presents 20 years of scholarship in Syria. We hope archaeological research in this region will resume when all the warfare comes to an end (Figure 11).

We have a number of faculty and students who are actively doing research in Egypt (Figure 12). Another troubled spot, but archaeology continues!

Other laboratories made accessible for the Institute's Open House accommodate scholars studying such areas as Armenia, the American Southwest, South Asia, Anatolia, East Asia, and the Andes.


13


14



The final phase of scholarship, after the excavations, is the publication of results (Figure 13) and conservation of the finds for exhibiting in museums for all people to learn and enjoy (Figure 14).

The public lecture is the culmination of the process of sharing the data with all interested individuals. This year's lecture, by Alexei Vranich, was titled "Cusco, Capital of the Incas."

For our small visitors, the Open House provides a children's room, where the young (and not so young) can try their hands at arts and crafts of a variety of cultures (Figure 15).

For all of you who have been fascinated with our past, our Open House will give you a glimpse of what knowledge is still in the ground for us to discover. We hope to see you in 2015!

Helle Girey,
Cotsen Institute of Archaeology,
UCLA


15

All photographs by
Reed Hutchison/PhotoGraphics

OPINION

As archaeologists attempting to engage with the past, we often find ourselves confronted with realities of the present that are not always academic in nature. The Backdirt editorial committee wanted to find a way to provide scholars with a conduit to communicate these kinds of experiences and is therefore pleased to initiate a new section to our Annual Review — **Opinion**. The assertions or opinions expressed below are not necessarily those of the editorial committee or Institute.

Courage among the Ruins: A Sustainable Conservation Program in Time of War

Giorgio Buccellati[1]

A MORAL PRESENCE

An archaeological project explores the past. But it lives in the present. It is not only that history, extracted from the ground, unravels their experiences, of the humans of yesteryear, it is also that our collective identities rest on the vertical sense of self that only our past can give us. We are our past. And caring for it is the responsibility we share, whether archaeologists or not.

It is, then, with tender care that we must nurture a project like ours—aimed at a remote Syrian past, and yet so full of meaning for the troubled Syrian present. We had to design wholly new ways of showing how much life there is in the remoteness of a buried past. *It is a moral presence.* But not in the rhetorical and sentimental sense that we only *speak* about it. Rather, in the very concrete and real sense that we are transforming culture into a social glue.

We were ready, though we had clearly not been expecting war. And yet it was as if we had. With the clearest sense of purpose. It was the attention we gave, over the years, to a central concern: the need to raise local awareness for the subtle richness of a long since hidden culture.

Training in conservation and education at all levels were the mechanisms to meet these concerns. And we were enabled to live up to our readiness through grants, among others, from the Cotsen Institute of Archaeology and from the Office of the Vice-Chancellor of Research at UCLA. Through their support, our moral presence has become ever more real on the ground where ancient Urkesh stood millennia ago and where today's inhabitants are keeping guard, with our help, protecting the silent witness of their ancient territorial forebears.

The results are far-reaching. From politics to economics, from social awareness to, certainly, the *scholarly* dimension as well, our project has set new standards and has become a model for other such projects. Putting together all the strands that derive

1. Professor Emeritus of History and Near Eastern Languages and Cultures.

Figure 1. Presentations on Syrian archaeology at Rimini "Meeting," with about 5,000 people in attendance.

from it reveals the richness of its message and defines the uniqueness of its scope.

THE ABIDING RELEVANCE

During a recent major event in Rimini, Italy, we highlighted our current work in Syria to a vast public. The occasion was a cultural festival that is quite unique and certainly the largest of its kind anywhere: during a single week, over half a million people attend a vast array of exhibits, lectures, and art events. Admission is free, and the public is drawn from the widest imaginable segments of society, from artists, intellectuals, and politicians, to families, students, and children.

This year, we were able to present a series of events on our project and Syria in general. My wife, Marilyn, curated an exhibit for which our son Federico and I were the co-curators. The format of the Rimini exhibits is very participatory: it requires the presence of a guide who explains the contents of each room to individual groups, and a large number of videos, audios, and special graphic devices explain the central concept in detail. This year there were five large exhibits and a dozen smaller ones. The one we proposed was one of the larger ones, alongside one on space exploration, another on social work in developing countries, two on Peguy and Tolstoy, and two on recent events in the Ukraine and in Egypt.

Our exhibit, entitled *From the Depth of Time: Communication and Community in Ancient Syria* (Figures 1–3), dealt with the past, but the last room addressed the significance of archaeology for today, especially this Syrian "today" so tragically immersed in war and bloodshed. The exhibit remained open each day during the week from 9 A.M. until midnight, with groups averaging 60 people starting on a tour every 15 minutes. By the end, some twenty thousand people had visited the exhibit. We also organized three conferences (Figure 1): the first two, addressing, respectively, the contents of the exhibit and the situation in Syria today (*Archaeology for Peace* was the title), were attended by several thousand people, while the third was restricted to a limited technical audience.

We brought to Rimini three regional directors of antiquities from Aleppo, Idlib (the province of Ebla), and Qamishli (the province of Urkesh); in addition, we also had four Syrian students. The Director General was unable to come but sent a video in which he addressed the central concerns of the meeting. The entire program made a great impact, because it gave a sense of the immense vitality and profound relevance of archaeology.

Figure 2. Entrance to the Exhibit on Urkesh at Rimini "Meeting."

Figure 3. Exhibit on Urkesh at Rimini "Meeting": about 2 0,000 people visited the exhibit during the one week it was open.

THE NATIONAL SYRIAN RESPONSE

In Rimini, we wanted to highlight the positive—the "*courage* among the ruins"—in two ways: on a larger scale, the work being strenuously done by the Directorate General of Antiquities and Museums (DGAM); on a smaller scale, our own work at the site of ancient Urkesh.

With great energy, the DGAM has been conducting a successful battle for the preservation of the national cultural heritage and the motivation of the people to defend it. Given the circumstances, and the long duration of the hostilities, one would expect the functionaries to withdraw into a sort of intellectual and procedural limbo. But the opposite is true, and within the tragedy, the DGAM is living a moment of hidden but real glory. It was always in the vanguard of all the systems in the Near East—rigorously professional, in the service of archaeology first and foremost, whether done by Syrians or foreigners. And in the current crisis, this tradition emerges in a new light, because of the courage with which the functionaries remain faithful to their task at the very moment when personal interest might suggest an escape into despair. There is a strong will to maintain the national values and even to innovate. In so doing, they are indeed offering a model to the world of how to cope with tragedy, a model from which the world may well learn, especially in comparison with what has happened in other countries under similar circumstances.

In a statement of June 2013 the Director General, Dr. Maamoun Abdulkarim, writes:

> Within the framework of the campaign of the Ministry of Culture "Syria—my homeland," the DGAM has launched a national campaign targeting 23 million Syrians to engage them all in protecting ancient Syrian antiquities and cultural heritage, which they take pride in, against

theft, vandalism and distortion as it is everyone's responsibility, and they should work together to protect those antiquities.

The national campaign started its activities on 15-10-2012 by means of putting up road advertisements in all Syrian cities and governorates and showing films on national televisions encouraging Syrians to defend their Syrian cultural identity.

As for interaction with the local community, workers in all directorates of antiquities are collaborating on protecting Syrian antiquities with volunteers, interested people, opinion leaders, and intellectual, cultural, and religious elites in order to create a feeling in every Syrian that damaging antiquities is an assault against their civilization, national identity, and history.

The key issue for the DGAM is to play its role in *protecting the Syrian cultural heritage and all its components, seeing that it belongs to all Syrians regardless of their political views, which do not concern the DGAM at all since the battle is about safeguarding the history and heritage of a nation.*

Thus, the DGAM has been seeking to *unify the visions of all Syrians concerning the antiquities so as to defend and protect them, given that they represent the thing which has always brought our people together.* Thanks to that, the DGAM's performance has been professional, scientific and effective, and its cadres have remained united in all governorates.

Figure 4. Large poster exhibited in Damascus and other Syrian cities to motivate people to defend their cultural heritage.

The measures taken reflect a wide range of initiatives, in five different directions: (1) Ensuring the *cohesiveness of the staff* is a strong priority, because their solidarity is essential to a capillary effectiveness of the program. While often personally at risk in their work, the staff, all the way to down to the guards at the sites, can be in touch directly and at any time with the Director General; to this end, a variety of new items has been provided, from portable telephones to computers. Also, members of the staff at all levels have taken part in international meetings, whether or not the Director General could attend alongside them. (2) To maintain a high level of *professionalism* is difficult, given the isolation in which the DGAM has found itself. But this they have done, continuing excavations and the publication program within the severe limits imposed by the events. What should not be forgotten is that the DGAM is safeguarding the sites for which foreign missions (more than 60!) hold a permit of excavation. (3) *Damage prevention and control* is, of course, the most direct means to be present in the territory, wherever access is possible. A great number of projects have been undertaken in this regard, with a major effort at documentation: this seems often to be underestimated at a time when several other projects are being started from the outside to do just what the DGAM has bravely been carrying out on a daily basis. (4) Far from accepting isolation, the DGAM has aggressively pursued a policy of very active collaboration with a large number of *international organizations*, from the UNESCO, ICOM, and ICCROM, to NGOs like the World Monuments Fund and various universities. (5) Last, but certainly not least, a strong campaign intended to *raising national awareness* has been waged, with a number of activities, from the display of enormous posters in all major cities (Figures 4 and 5), to training conferences for the staff, public meetings involving local communities, and conducting a policy of supplying information to local authorities, as well as strengthening cooperation with them.

In Rimini we witnessed all of this first hand. We received the directors of three of the most vulnerable areas, and while far from being Pollyannaish about

Figure 5. Large poster exhibited in various Syrian cities.

it, they displayed the full measure of plain and simple courage that the media seem to have come to disregard in their coverage of Syrian affairs. Some of us at the meeting had been talking about courage and even heroism. When I asked for comments from Yasmine Mahmoud, one of the Syrian students on our staff who had just arrived from Damascus on opening day, she only said: "I hear words such as heroism, but in truth we all feel, in Syria, that we are doing with simplicity what is needed and is important." She blew a kiss to the audience, and she sat down.

THE "ARTE POVERA" OF CONSERVATION AT MOZAN

Deliberately, the system of conservation I had set up in Mozan had used the simplest approach, devoid of technological sophistication, but rich on training for maintenance at the local level and totally dependent on local resources. The localized shelter approach to mud brick walls is our trademark (Figure 6): a system of iron trellises (Figures 7 and 8) that support a roof of either metal or mud, flanked on the sides by burlap panels (Figures 9 and 10). These panels may be drawn like curtains, in which case they show the walls as

Figure 6. The system of localized shelters used to protect the mud brick walls of Urkesh.

Figure 7. Detail of trellis, showing link among components.

Figure 8. Detail of trellis, showing modularity of system.

Figure 9. Trellis above mud brick wall (with stone substructure).

Figure 10. Tarps being draped above trellis.

Figure 11. An "arte povera" approach to wall conservation: individual panels replacement.

Figure 12. Patching of holes in panels.

Figure 13. Patches on panels.

they were when first excavated. With the curtains in place, one gains a sense of the architectural volume. When they are drawn, one has a perfect view of the monument in its full documentary sense. More than twenty years since they were excavated, the walls remain essentially undamaged.

Our long absence (it is now four years since our last excavation) has proved the full validity of this approach. Panels deteriorate and need replacing. My choice was to opt for local patching (Figures 11–14), which had the advantage of giving work to our local assistants, if at the cost of aesthetics. But the very humility of this "arte povera" approach speaks well in support of the system: the sense of involvement and responsibility is increased even more.

In one case, I opted instead for a more drastic solution. The burlap on the cupola-like cover of the necromantic shaft, one of the most remarkable structures in third millennium Syro-Mesopotamia, had disintegrated. Instead of replacing it, I supervised (via a complex communication network that relied on e-mail, telephone, Skype, and Viber) the covering of the cupola with metal sheeting (Figures 15–17). It was a better solution in terms of long-terms goals. But especially I wanted to send a signal that our commitment to the site was serious and for the long duration. And it worked that way, with a renewed sense of identification with our goals on the part of the local stakeholders.

We have six individuals working on the project in Mozan, and we are in touch on a regular basis with them. We receive detailed reports and a great quantity of photographs over the internet so that, for sure, the site of ancient Urkesh is by far the best documented during this period of crisis.

THE AWAKENING OF CONSCIOUSNESS

Mozan, as a hill, has always been there, for over three millennia. It has become Urkesh again thanks only to archaeology. The evidence is so fine and fractured that no one but an archaeologist would have been able to recognize the reality deeply hidden in the ground.

The next question was how to preserve this fragile gift of time. Preserve it physically, so that it is not destroyed by rain and snow. But preserve it morally as well, so that it is not destroyed by war.

The answer is that the site has to be embedded in the consciousness of the people who are now the immediate heirs to this remote richness. We had been nurturing this consciousness, with a very explicit and concrete program long before the troubles started in

Figure 14. Patches on panels.

Figure 15. The disintegrated tarp above the necromantic pit (abi) in summer 2013.

Figure 16. The new metal cover for the abi in the fall of 2013.

Figure 17, The abi shelter in winter 2013–2014.

Figure 18. A doll produced by the women of Mozan.

2011. This meant eliciting a sense of importance for a seemingly evanescent, and certainly very remote, past. It also meant training. For a patterned maintenance system is the indispensable human ingredient for the success of any such project.

Our local collaborators, Kurds and Arabs, are working together with the sense of a common goal. What is extraordinary is the complete lack of a feeling of fatigue and disaffection.

It is four years now since there have been excavations at the site. A civil war has been raging in the country. And we get picture upon picture of damages to the mud brick; of plastic that shrivels and needs to be replaced; of tarp covers that slowly disintegrate. All of this is carefully documented on a floor plan or with marks on a photograph to highlight the nature of the problem. More than ten thousand pictures have been received by the middle of 2014.

It may seem either epic or surrealistic, depending on the point of view. . . . And it is instead the result of a most admirable sense of commitment to a job well done, the sense of pride in their effort, "*in order to see the hill Mozan of the most beautiful and the best archaeological sites in the world,*" as our photographer, Diadin, writes in one of his reports.

Motivation is one of the main ingredients of this whole enterprise. We had nurtured it while we could work together; we are nurturing it now from a distance with our intense correspondence. But it is ultimately nurtured by the sense of accomplishment that comes from seeing the results. There is a marked tone of victory in these pictures, with which they show us, and really show to themselves in the first place, how the site can continue to be managed and maintained in spite of all odds.

At the Rimini Meeting, I presented a small but meaningful accomplishment: a guidebook to the site written in English, Arabic, and Kurdish. Our signage at the site, which adds up to more than 200 pages, had been in English and Arabic from the beginning. We would, however, give presentations in Kurdish to the children and had started working on a translation of the written texts as well when the troubles started. I decided that now it was important to complete this task, and with the help of a number of people from Syria, Europe, and Canada, it was possible to finish this guidebook in time for the meeting. It will be printed in Syria and distributed widely. Another sign of our commitment to our values.

GRASSROOTS EMPOWERED

In our Mozan experiment, terms like "stakeholders," "sustainability," "grassroots," and "bottom-up" come across with a whole new forcefulness. No theory, here. Or rather, theory is vindicated by the natural impulse that life brings to the fore. Reality precedes the words.

One of the goals had been to encourage local activities that could eventually develop into a venue

of interest to visitors. We suggested that the Mozan women might be able to produce their artifacts so they would be available for tourists as we developed the site for tourism. Our plans could not proceed beyond the concept, but colleagues from the Directorate General of Antiquities in Damascus went to Mozan in our absence, further strengthening the resolve of the local women. Through their own initiative, they set things up as a well-organized system. We are now interfacing directly with them so as to maximize the potential of their work. By all standards, this is a remarkable accomplishment.

The group numbers some 30 women, working on a variety of items, and their pride shows not only in the actual products, but also in statements like the following one from a video in which Amena speaks of their work:

> Earlier we used to work but it was normal things. We used to make normal pieces for my neighbor, my sister, but it was not of good quality. Then a group of people came from Damascus and told us: we have micro projects! We applied for the grant. It was a little, but it helped us materially and morally.
>
> After that they sent experts to teach us, among them was Ms. Reem who taught us a lot. We were 30 girls. Some learned how to make accessories, others dolls [Figure 18], clothes, and embroidery.
>
> Earlier, we could not send our products because its quality was poor. After this training we became able to improve the quality. . . . . We have so many good things!

The thrust comes from the base, with a strong sense of commitment and purpose. The women of Urkesh—Urkesh is the ancient name, but we use it for the larger enterprise that subsumes the villages around the archaeological site. So, it is the women of "Urkesh" who have picked up with vigor when no more guidance could be provided from the outside.

It is a model of an initiative at the grass root level. *We* can now be partners in *their* initiative. And we have found a way. We have "ordered" a number of items produced by them and have received our first shipment. It was with great emotion that we opened this modest little package. They had placed products inside a typical black garbage bag and sent them to Damascus, from where they were in turn sent abroad.

The quality of these products is no less astonishing than the simple fact that they were produced and

Figure 19. The packaging of another doll produced by the women of Mozan.

shipped under the circumstances we all know so well. We are now preparing ways to make them available to our common friends and to place an order for more. The photos speak for themselves.

But there is another small and yet significant detail. The packaging and the logo (Figures 19 and 20)! Some of the items are carefully wrapped in a bag with a burlap backing and a cellophane cover. In the corner, there is a beautiful logo, which uniquely identifies the project and gives in beautiful handwriting the name of the "Urkesh Atelier of Handicrafts" and their telephone number!

CONCLUSION: UNPLANNED PLANNING

The developments that have taken place at Mozan in the wake of the tragic Syrian upheaval have been remarkable. We had planted a seed. And a consciousness took root that validated our efforts. We had of course never anticipated the disaster that would ensue. But the commitment to the goal was so profound, that there was no question about the results. Our planning was unplanned as to words. But it could not have been more clearly planned as to the intent.

This was possible because there was, in the first

place, a dimension of trust. We had laid out concrete mechanisms for maintaining contact with our local collaborators, whom we expected to carry out various activities while we were there. But we could not anticipate all details, nor could we micro-manage the situation from afar, once it became impossible for us to return regularly. What made up for it was the reciprocal trust, which helped us, on both sides of the great chasm, to interpret the essence of what was needed, even when explanations could not be forthcoming.

The heart-warming and comforting result was the realization that out of the worst can come the best. The dynamics of human situations are like a spiral, and the initial direction of the movement is perhaps the defining moment. If it spirals downward, one is sucked into a progressively more negative trend. It is therefore important to lay the groundwork so that the thrust is upward from the beginning. That is what happily happened in our case.

I will close with two e-mails dated November 2013, from Ibrahim and Kameran of our Mozan staff.

Figure 20. The logo on the packaging.

They shed more light onto the attitude with which they see the joint commitment we share for the site.

> Excavations good, but always lacking materials and most of the time I do I bought on my account such as threads, needles and oil and other materials.
>
> Ibrahim

> Hello Dear Samer
>
> We the workers we bought materials, such as nylon and other materials debt, from when our friends [they bought plastic sheets with their own money] in order to cover the walls And Abe before the rains, to come Mr. Sabah and covering Abe well
>
> We've temporarily covered with nylon and also some of the walls [they wanted to cover the underground structure in anticipation of heavy rains expected before Sabah, the smith, could complete his new cover for this structure].
>
> After we finished the coverage was really there was a heavy rain, but we got back up In a timely manner and there was no damage to the site.
>
> Thank you,
>
> Kameran

Fourth Annual Cotsen Institute of Archaeology Graduate Student Conference

Archaeologists are well acquainted with the difficulties of reconstructing patterns of movement and migration in the past. The Fourth Annual Cotsen Institute of Archaeology Graduate Student Conference, titled "People in Motion: Mobility, Migration, and Exchange," sought to address this complex problem and to explore current methods for understanding the ways that people and objects move through space and time. Continuing in the tradition of previous years, the conference planning committee (Rose Campbell, Richard Ehrich, Terrah Jones, Ben Nigra, Ben Shepard, and Trevor Van Damme) sought to attract high-quality work from both U.S. and international graduate students, not only in archaeology, but also in other related disciplines.

The conference, held February 7–8, 2014, opened Friday evening with an interesting and informative keynote lecture by Dr. David Anthony (Hartwick College, Oneonta, NY) about mobility patterns and pastoralism in the Eurasian Steppe. On Saturday, twelve graduate students presented their research on variations of the conference theme. UCLA presenters included Cotsen IDP students (Rachel Moy, Maryann Kontonicolas, and Christine Johnston), as well as students from the departments of Anthropology (Ben Shepard), and Near Eastern Languages and Cultures (Amy Karoll). Topics ranged widely across time and space, including such themes as fire use and mobility strategies among Neanderthals and early humans, the movement of archives during the fourteenth to seventeenth centuries C.E., the transportation of agricultural products in Egypt during the Greco-Roman period, and patterns of trade in the Indian Ocean from the third century B.C.E. to the seventh century C.E. UCLA's own Dr. Hans Barnard wrapped up the conference with insightful closing comments and valuable feedback for the graduate student presenters.

Figure 1. Friendly discussions in the galleries of the Fourth Annual Cotsen Institute of Archaeology Conference.

Support for the Fourth Annual Conference surpassed all expectations. In particular, the generosity of the Armenian Archaeology and Ethnography Program allowed us to implement a cash prize for the best student paper, challenging the student presenters to contribute their very best work. After careful consideration by the conference planning committee and the UCLA faculty moderators (Dr. Willeke Wendrich, Dr. Sarah Morris, Dr. Gregson Schachner, and Dr. Gregory Areshian), the prize was awarded to Anneke Janzen (UC Santa Cruz) for her excellent presentation, titled "Early Pastoral Mobility in Kenya Assessed through Stable Isotope Analysis," which is showcased in article form in this volume (see page 48).

Owing largely to the generous support and tireless efforts of the UCLA graduate students and faculty, the conference continues to grow exponentially each year, and I look forward to the Fifth Annual Cotsen Institute of Archaeology Conference in 2015!

— *Rose Campbell,*
Cotsen Institute of Archaeology, UCLA

Archaeology and Multidisciplinarity in a Regional and Ethnic Context: An International Conference at the Cotsen Institute

The inaugural international conference of the UCLA Research Program in Armenian Archaeology and Ethnography at the Cotsen Institute of Archaeology took place May 30 to June 2, 2014, on the UCLA campus in order to assess the pitfalls of compartmentalization within area studies and the potential impact of integrative approaches to archaeology and regional studies. The conference focused on Armenian Studies for several reasons. First, among the academic subfields which constitute that area, there are about a dozen, including archaeology, history, philology, comparative historical linguistics, art history, cultural anthropology, and diaspora studies, that have long traditions of intellectual development with conflicting research paradigms and that have stemmed from different sociopolitical and cultural contexts. Second, Armenian Studies are a good example of commingled regional and ethnic studies, which necessitates a theoretical and methodological disentanglement of research questions, as well as a strengthening of critical approaches. Finally, the public visibility of created knowledge should be of great concern to scholars, and Armenian Studies highlight a number of exemplary pitfalls from that perspective.

These interrelated issues were the inspiration for the title of the conference: *Current Practices in Armenian Studies: The Creation and Visibility of New Knowledge*. Scholars from ten countries, belonging to different intellectual traditions and spanning three generations—from members of National Academies of Sciences to recent recipients of Ph.D. degrees—presented papers and participated in discussions.

The conference was structured into three distinctive, yet interconnected, parts. The fourteen major position papers presented in one day summarized different aspects of what is currently perceived as Armenian Studies by the global academic community. They addressed not only the most recent achievements in each subfield, but also unsolved issues and emerging research questions. The identification of gaps in knowledge and the necessity of interdisciplinary dialogue that could bridge those gaps were major concerns reflected in the majority of papers. Several papers also addressed the increase in public visibility of created or constructed knowledge, including the political impact of academic research. This in turn allowed a critique of the dominant modern historical narratives and of the short-term nature of historic memory, as well as of the widespread antiholistic research attitudes characterized by the cherry picking of data. Some of the papers criticized superficial and/or unfounded attempts to debase well-established empirical knowledge.

The day of summarizing papers was followed by three sessions of roundtable discussion. The first session was devoted to a critical analysis of emergent Armenian Studies in countries where this area of academic inquiry did not exist until very recently, such as in Mexico and South America, where, relevantly, some Armenian diaspora communities are located. In that respect, the topics of international institutional collaboration, together with deficiencies in institutional structures, were specifically addressed. The second roundtable session was completely devoted to the discussion of the politics and policies concerning the archaeological cultural heritage in Turkey, both from the standpoints of long-term trends and specific recent developments in that area. Finally, the third session was largely theoretical-methodological, addressing both traditional and newly emerging topics. Among the traditional themes, correlations between archaeological and linguistic data were discussed in light of new discoveries made by both archaeologists and comparative-historical linguists. The question was brought to the table: to what extent do continuity and disruptions in culture affect constructions of ethnic identities?

Two more days of the program included four breakout sessions

Round-table discussion during the Armenian Studies Conference.

that pursued specific practical goals within broad theoretical perspectives. The central breakout session addressed the positive role that archaeology can play in the zones of current conflicts in the Middle East by promoting an understanding of ownership of cultural heritage by local communities and shared ownership of sites by conflicting parties. Mentioning the positive experience of several such projects in Israel/Palestine and in Syria (Tell Mozan), the discussants focused on Ani, a storied archaeological site located in Turkey on the border with Armenia. During the tenth and eleventh centuries, Ani was the capital of the Armenian Bagratuni Kingdom and a major urban center of the Byzantine Empire on its eastern border. The development of an international research project at Ani with the participation of Turkish and Armenian scholars will clarify research questions related to the study of medieval urbanism as one of the central components of the "Silk Roads" Trans-Eurasian network. At the same time, it has the potential to make a major contribution to the improvement of mutual understanding between modern Turkish and Armenian societies. Another breakout session discussed the emerging role of philanthropy in the preservation, study, and popularization of the multicultural archaeological heritage of Turkey. The active participation of the leadership of the influential Turkish Hrand Dink Foundation in this discussion was very important for the success of this session. Two other sessions addressed other newly emerging opportunities. One discussed the prospects of collaboration between the archaeologists of the Republic of Armenia and the Iraqi Autonomous Region of Kurdistan. The other analyzed the prospects for an interdisciplinary study of settlements destroyed and abandoned in Turkey during World War I in the course of the Armenian Genocide, Muslim-Christian intercommunal struggle, and the Greek-Turkish "exchange of population." Such a study would combine the exploration of archaeological remains, archival documents, oral histories, and perspectives from current historic memories.

The main message of the conference is that ethnic studies in a regional context should be interdisciplinarily anchored around topics of social identities that shift through the ages in changing cultural, sociopolitical, ideological, and economic environments. One result of the conference is the affirmation that archaeology today has the potential to bridge the social sciences, humanities, and natural sciences in its examination of human societies. Consequently, it is in a position to address theoretical, methodological, and practical issues concerning the creation of interdisciplinary knowledge. The holistic approach of archaeology is essential to the goal of integrating disciplines, and it can and should be applied on varying scales to different areas of knowledge concerning human societies. The integrative methodological capacity of archaeology is necessary to counterbalance the spread of compartmentalization, which unfortunately tends to be characteristic of many regional studies.

The conference was sponsored by the Chitjian Foundation, Los Angeles.

— *Gregory E. Areshian, UCLA Research Program in Armenian Archaeology and Ethnography at the Cotsen Institute of Archaeology and Department of Near Eastern Languages and Cultures*

COTSEN COMMUNITY EVENTS

Noon Talks, 2013–2014

This year's annual noon lecture series, or Pizza Talks, as they are more colloquially known, featured a grand total of 28 presentations, showcasing the research of both faculty, students, and alumni of the Cotsen Institute of Archaeology, as well as esteemed scholars from other institutions, national and international. The talks showcased the interdisciplinary and collaborative nature of the Cotsen Institute, with topics spanning 5 continents and over 7,000 years of human culture. The near-full-capacity attendance of most talks throughout the year is a testament to the continued interest in the Cotsen Institute's research among members of the general public and outside departments.

The Pizza Talks benefited greatly from concurrent exhibitions, research programs, and conferences in the Los Angeles area. From the Getty Scholars program, *Connecting Seas: Cultural and Artistic Exchange*, came several participants we were fortunate to have deliver Pizza Talks. In the fall quarter, Alex Knodell (Carleton College) presented the results of a survey project in the urban hinterland of Petra, Jordan, entitled "Beyond the Rose-Red City: Deep History in the Landscapes North of Petra." This was followed later in the same quarter by Gert van Wijngaarden's (University of Amsterdam) presentation of his ongoing archaeological investigations on the island of Zakynthos in Greece, "Discovering a Prehistoric Maritime Landscape: Zakynthos Island in Greece." Finally, in the winter quarter, we heard from Karl Knappett (University of Toronto) about the first season of renewed excavation at the site of ancient Palaikastro on Crete titled, "Urbanization in Minoan Crete: A Palace at Palaikastro?" Additionally, Elena Phipps (Textile Society of America) kindly spoke about the intersection of cosmology and technology in Andean cloth production, "The Four-Selvaged Peruvian Cloth: Ancient Threads/New Directions"—the subject of an eponymous exhibition at the Fowler Museum from October 13, 2013, to February 2, 2014. In addition, during the spring quarter, we were fortunate to have Sturt Manning (Cornell University) speak on his current research into climate change in the archaeological record of the third millennium BCE. Levant. This was thanks to his involvement in the *International Symposium on Archaeometry*, held in Los Angeles from May 19 to 23, 2014.

Several Cotsen faculty members presented us with updates on their research. In the fall, Charles Stanish (UCLA–Anthropology) updated us on his ongoing research into the spatial distribution of geoglyphs and platform mounds in "The Archaeological Treasures of Chincha, Peru," and Li Min (UCLA–Anthropology / Asian Languages and Cultures) discussed "Political Experimentation and Expanded Horizon in Longshan China (circa 2300–1800 BC.)." Also in the fall, Ye Wa (UCLA–Research Associate) spoke about "Yangguanzhai: Settlement of the Fourth Millennium BCE. and Site of the Sino-American Field School 2013," and Deanna Kiser-Go (UCLA–NELC) captivated us with some of the finer details of Egyptian tomb paintings in a talk titled "Theban and Memphite Private Tombs of the Post-Amarna Period." This was followed by Aaron Burke (UCLA–NELC), who filled us in on "The 2013 Excavations of the Egyptian Gate Complex in Jaffa, Israel," during the winter quarter.

We also heard about several new Cotsen projects. In the winter quarter, Abigail Levine (UCLA–Instructor) presented the initial results of her new project high in the Peruvian altiplano, "The Early Andean Village: Examining Emergent Complexity in the Northern Lake Titicaca Basin, Peru," while Ben Nigra, Terrah Jones, and Jacob Bongers (all UCLA–Archaeology IDP) presented "Survey and Settlement on the Peruvian South Coast: The LIP Chincha Kingdom (and a Little Paracas, Too)." In addition, we heard about new faculty member Stephen Acabado's first season of excavation in the Philippines, "Defining Ifugao Social Organization: 'House,' Field, and Self-Organizing Principles in the Northern Philippines." Also in the winter quarter, Sarah Morris and John Papadopoulos (both UCLA–Classics) presented an overview of the aims and goals of their new project in "The Ancient Methone Archaeological Project: New UCLA Research at a Harbor City in the North Aegean." This was followed

in the spring quarter by a presentation by Vanessa Muros (UCLA–Getty Conservation Program) on conservation efforts already underway on material previously excavated at Methone by the local Greek ephorate titled "Conservation and Research at the Methone Archaeological Project." Last but not least, in the spring quarter, Hans Barnard (UCLA–NELC) and Brett Kaufman (UCLA–Archaeology IDP) discussed the "Results of the First Season at Zita ('Olive City'): A Punic and Roman Urban Center in Southern Tunisia." All of these projects are in their initial stages and will continue to provide exciting results and opportunities in the coming years, so stay tuned!

Several current graduate students in the Archaeology IDP presented on their current dissertation projects. These included Anne Austin, "Tutcare! A Discussion of Health-Care Systems in the Egyptian New Kingdom Town of Deir el-Medina," and Joseph (Seppi) Lehner, "Anatolian Tin Reconsidered in Light of New Discoveries at the Hisarcik Mines and Early Bronze Age Kültepe-Kanesh," in the winter quarter, as well as Hannah Lau, "A Movable Feast: Mobility, Cooperation, and Emergent Political Complexity at Halaf Domuztepe," in the spring quarter.

Several talks addressed more contemporary concerns. Craig Goralski (Cypress College), Alexis Gray (Norco College), and Captain Kevin Lacy (Sheriff-Coroner, San Bernardino County) delivered a talk entitled "Forensic Research at San Bernardino: Combining Archaeology, Medical Legal Death Investigation, and Taphonomic Studies," which highlighted the intersection of archaeological methods and modern criminology, while Ran Boytner (Institute for Field Research) discussed "The Study of Archaeology at the Age of Big Data." In addition, David Scott (UCLA–Getty Conservation Program and Art History) discussed some of the contemporary issues regarding forgeries and restorations, challenging our conventional notions of authenticity in "Restoration and Fakery: Sculptures from Ancient Egypt, Greece, and Rome." Last but not least, Lothar Von Falkenhausen (UCLA–Art History) and Charles Stanish (UCLA—Anthropology) updated us on their experiences at the first *Shanghai Archaeological Forum*, held August 23–September 3, 2013, with "Putting China on the Map: A Report from the First Shanghai Archaeological Forum."

We were also fortunate to have several notable guests from other institutions, both near and far, stop in to fill us in on their research projects. These included Julian Henderson (University of Nottingham), who discussed the details of "Tracing Glass along the Silk Road Using Isotopic and Chemical Techniques," Salam al Kuntar (University of Pennsylvania), who gave a talk on "Tell Hamoukar and the Mesopotamian Economic Boom in the Late Chalcolithic (4200–3100 BCE)," as well as Ahmed Hamden (UCLA–Fulbright Scholar), who presented "An Iconographical Study of the Royal Ka during the Middle and New Kingdoms." In addition, Anthony Barbieri-Low (UC Santa Barbara) took us on a digital exploration in a hyper-real talk titled "Virtual Tombs: Computer-Assisted Reconstructions of Burial Sites in Ancient China and Egypt," and Dawn Lohnas (Metropolitan Museum of Art, Andrew W. Mellon Fellow) took us into the vaults of the Fowler Museum collection with "Paracas Ceramics: A Material and Technical Examination."

Cotsen Institute Pizza Talks are open to the public. They are held on Wednesdays at noon in Fowler A222 during the fall, winter, and spring quarters.

— *Trevor Van Damme, Cotsen Institute of Archaeology, UCLA.*

COTSEN COMMUNITY EVENTS

Friday Seminar Series

The 2013–2014 Cotsen Institute Friday Seminar Series featured a number of varied guest speakers who provided diverse, cross-cultural perspectives on a number of empirical and theoretical issues. In celebration of the recent successes of the Cotsen Institute of Archaeology Press (see this volume's Institute in the News: "Cotsen Titles Win Big Awards"), the seminars in the fall quarter featured three presentations by authors of recently published volumes. The series began with a talk by UCLA's own Richard Lesure, Professor of Anthropology and author of *Formative Lifeways in Central Tlaxcala: Excavations, Ceramics, and Chronology, Volume 1*, published by the CIoA Press in July 2014 (see page 120). His presentation, titled "Macroregional Structure in Central Mexico: Large-Scale Implications of Formative-Period Lifeways in Central Tlaxcala," touched on the rapid political evolution that took place in central Mexico after 900 BC, which built on a legacy of organizational innovations in settled communities to the south.

Gregory Areshian, Director of UCLA's Research Program in Armenian Archaeology & Ethnography and editor of volume *Empires and Diversity: On the Crossroads of Archaeology, Anthropology, and History* (CIoA Press, June 2013), spoke on "The Creators of the Silk Roads: Empires, Nomads, and Cities in Light of New Multidisciplinary Observations from Central Asia and the Near East." This presentation summarized the author's research in this subject, carried out between 2007 and 2013 in the Near East and Central Asia. He focused particularly on the archaeology of cyclical nomadization and sedentarization in conjunction with interregional and transcontinental trade and exchange. He also proposed a new periodization of the "Silk Road" systems from the perspective of imperial management of regional and international commerce.

Roderick Campbell (New York University), the author of *Archaeology of the Chinese Bronze Age: From Erlitou to Anyang* (CIoA Press, August 2014), presented a talk titled, "New Paradigms for the Chinese Bronze Age." Touching on many of the themes from his book, he discussed Shang archaeology and epigraphy as related to the emergence and development of complex polities, violence, history, and production.

Two other renowned scholars delivered presentations during the fall quarter. Anita Cook (Catholic University of America) spoke on "Feasting in the Andes: To Eat for Others," which addressed how archaeological remains of imperial Andean feasts from pre-Inca times can be interpreted through the lens of ethno-history and ethnography. Finally, John A. Peterson (University of Guam), presented a lecture titled, "The Archaeology of Climate Change: Case Studies in Guam and the Philippines."

During the winter quarter we hosted five scholars who each spoke on varied topics. Hans Bernard (UCLA) opened the series with a lecture titled, "The Anthropology of Chess," in which he showcased his innovative ideas on the archaeology of movement. The second lecture of the quarter coincided with the first day of the Graduate Student Conference, which featured David W. Anthony as the keynote speaker (see page 113). Next, Christine Hastorf (UC Berkeley) spoke on "Maize in the High Mountains," which detailed a paleoethnobotanical perspective on maize agriculture in the Andean area.

Michael Harrower (Johns Hopkins University), who was the Cotsen Postdoctoral Scholar in 2008–2010, compared ancient Yemen (3200 BC–600 AD) with the American West in his presentation, "Water Histories of Ancient Yemen and the American West." This lecture provided a fascinating juxtaposition of two geographically and temporally distinct cultures that shared a pressing similarity—lack of water resources. This comparison effectively highlighted how agriculture practiced in hyper-arid areas led to a focus on water scarcity and how the need to colonize water-scarce areas rationalized massive state-constructed irrigation schemes that helped generate state identities, religiosities, and sovereignties.

The penultimate presentation of the winter quarter was given by Michael Galaty (Mississippi State University), who spoke on "What Ethnography Can and Cannot Teach Us about the Prehistoric

Mediterranean: Lessons Learned From Ten Years of Research in High Albania." Galaty is the co-author of *Light and Shadow: Isolation and Interaction in the Shala Valley of Northern Albania* (CIoA Press, 2013), which was named the Winner of the 2014 Society of American Archaeology Book Award in the Scholarly category (see page 5). Finally, Jade d'Alpoim Guedes (Washington State University) presented a paper titled, "Modeling Ecological Niches and the Spread of Agriculture to Southwest China."

There were four speakers in the spring seminar series. The first presentation was by Guzden Varinlioglu of UCLA. Titled "From Zero-D to 3-D: The Voyage of a Virtual Nautical Archaeology Project in Turkey," this talk addressed the lack of systematic methodology for the collection, preservation, and dissemination of data in underwater cultural heritage studies in Turkey, and offered novel solutions—including archaeological surveys and public awareness projects of the nautical archaeological remains—to this urgent issue.

Kathryn A. Bard (Boston University) and Radolpho Fattovich (University of Naples) co-presented a paper titled "Egypt and Punt, An Archaeological Perspective." Ernst Pernicka (University of Heidelberg) spoke on "The Scenery of the Iliad: Cultural History and Archaeology of Troia."

The final presentation of the year by Geoff Emberling (University of Michigan, Ann Arbor) discussed recent attempts to identify and excavate settlement remains around the pivotal Kushite royal cemetery at El Kurru, in northern Sudan, which date from the ninth century BC and later. It also addressed recent (and ongoing) excavation of a pyramid and mortuary temple at the site that, together, provide insight into political competition among elite families of Kush.

— *Abigail Levine,*
Cotsen Institute of Archaeology, UCLA

Friends of Archaeology Dinner Lectures, 2013–2014

November 5, 2013

Professor Stella Nair
Department of Art History, UCLA

Behind Closed Doors: Reconsidering the Architecture of Inca Private Life

February 11, 2014

Professor Emerita Barbara Voorhies
Anthropology Department
University of California Santa Barbara

The Tlacuachero Shellmound: A 5,000-Year-Old Off-Shore Casino in Southern Mexico?

April 8, 2014

Professor Charles Stanish
Director, Cotsen Institute of Archaeology at UCLA

The Global Effect of Fakes in Antiquities Trade

October 28, 2014

Professor Stephen Acabado
Department of Anthropology, UCLA

Rethinking History, Conserving Heritage: Archaeology and Community Engagement in Ifugao, Philippines

Forthcoming in 2015

February 10, 2015

Professor Sarah Morris
Steinmetz Professor of Classical Archaeology and Material Culture
Department of Classics, UCLA

Ancient Methone Archaeological Project, Pieria (Macedonia), Northern Greece

April 7, 2015

Three selected graduate students will present their ongoing research. The work of these students has been supported by the Friends of Archaeology.

Academic Excellence at the Cotsen Institute of Archaeology

— *Helle Girey,*
Cotsen Institute of Archaeology, UCLA

PUBLISHER'S DESK

New Titles from the Cotsen Institute of Archaeology Press (CIoA)

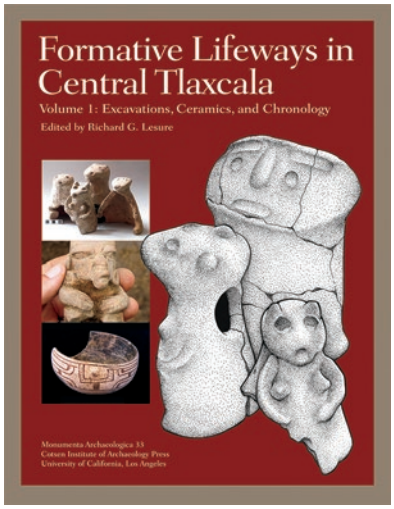
Randi Danforth[1]

AS WE CONTINUE TO develop and expand our program with the publication of significant research in archaeology, anthropology, and art history, we at the CIoA Press are pleased to announce our 2014 publications, as well as our forthcoming titles for Spring 2015.

Ordering Information:

Cotsen Institute of Archaeology Press books are distributed by the University of New Mexico Press, www.unmpress.com, telephone 800-249-7737. They are also sold through our Publications Office, ioapubs@ucla.edu, telephone 310-825-7411.

1. Publications Director, the Cotsen Institute of Archaeology Press



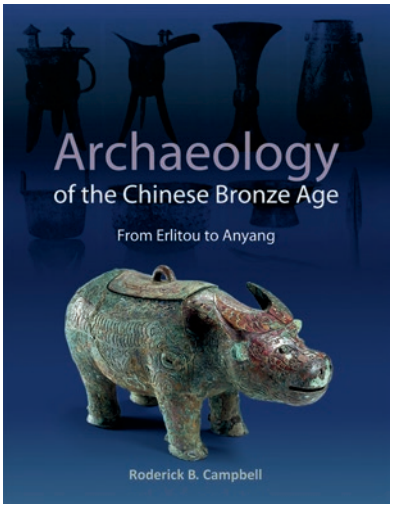
Formative Lifeways in Central Tlaxcala

Volume 1: Excavations, Ceramics, and Chronology

Edited by Richard G. Lesure

ISBN: 978-1-931745-69-7
Publication date: June 2014
Series: Monumenta Archaeologica 33
Price $75.00 (hardbound)

This book, the first volume of a projected three, reports on excavations at Formative-period sites in the state of Tlaxcala, Mexico. The transition to the Formative in the relatively high-altitude study region is later than it was in choice regions for early agriculture elsewhere in Mesoamerica. From 900 BCE, however, population growth and sociopolitical development were rapid. A central claim in the research presented here is that a macroregional perspective is essential for understanding the local Formative sequence. In this volume, the data from excavations at three village sites (Amomoloc, Tetel, and Las Mesitas) and one modest regional center (La Laguna) are examined. The ceramic typology is described in detail. An innovative approach to the classification of figurines is presented, and a Formative chronology for the region is proposed based on seriation of refuse contexts and radiocarbon dates. The work concludes with a macroregional framework to be used in the analysis of subsistence, social relations, and political economy in Volumes 2 and 3, now in preparation.

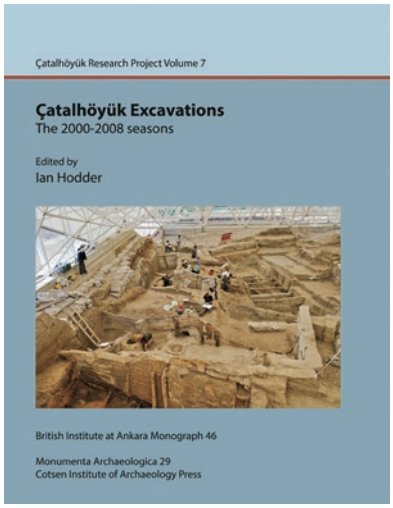


Archaeology of the Chinese Bronze Age: From Erlitou to Anyang

Roderick B. Campbell

ISBN: 978-1-931745-98-7
Publication date: August 2014
Series: Monograph 79
Price $55.00 (paper)

Archaeology of the Chinese Bronze Age is a synthesis of recent Chinese archaeological work on the second millennium BCE—the period associated with China's first dynasties and East Asia's first "states." With a focus on early China's great metropolitan centers in the Central Plains and their hinterlands, this work attempts to contextualize them within their wider zones of interaction from the Yangtze to the edge of the Mongolian steppe, and from the Yellow Sea to the Tibetan plateau and the Gansu corridor. Analyzing the complexity of early Chinese culture history and the variety and development of its urban formations, Roderick Campbell explores East Asia's divergent developmental paths and re-examines its deep past to contribute to a more nuanced understanding of China's Early Bronze Age.



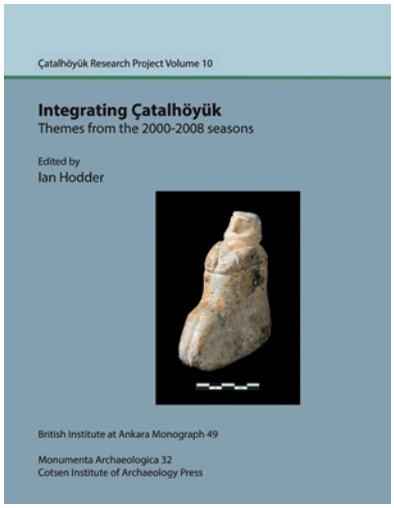
Çatalhöyük Excavations: The 2000–2008 Seasons

Volume 7

Edited by Ian Hodder

ISBN: 978-1-898249-29-0
Publication date: June 2014
Series: Monumenta Archaeologica 29
Price $89.00 (hardbound), $299.00
for all four volumes 7–10

Çatalhöyük Excavations presents the results of the excavations that took place at the site from 2000 to 2008, when the main aim was to understand the social geography of the settlement, its layout, and social organization. Excavation, recording, and sampling methodologies are discussed, as well as dating, "levels," and the grouping of buildings into social sectors. The description of excavated units, features, and buildings incorporates results from the analyses of animal bone, chipped stone, groundstone, shell, ceramics, phytoliths, and micromorphology. The integration of such data within their context allows detailed accounts of the lives of the inhabitants of Çatalhöyük, their relationships, and activities.



Integrating Çatalhöyük: Themes from the 2000–2008 Seasons

Volume 10

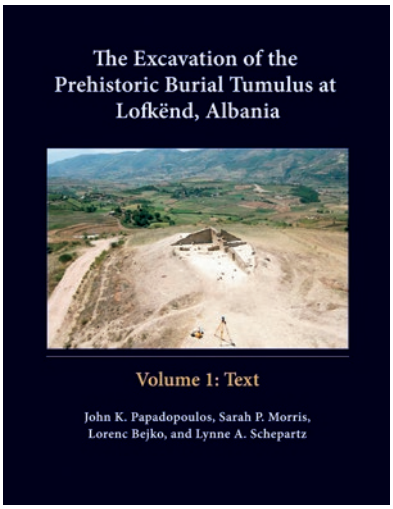
Edited by Ian Hodder

ISBN: 978-1-898249-32-0
Publication date: September 2014
Series: Monumenta Archaeologica 32
Price $69.00 (hardbound), $299.00
for all four volumes 7–10

This volume discusses general themes that have emerged in interpretation of the results of the 2000–2008 excavations, synthesizing the results of research described in other volumes in the same series. Subsistence analysis and the examination of human remains yielded data on landscape use and mobility and the storage and sharing of food. The ways in which houses were constructed, lived in, and abandoned leads to a broad discussion of settlement and social organization at Çatalhöyük and of change over time. For example, shifts in the themes that occur in paintings in houses evolve as part of a wider set of social, economic, and ritual changes in the upper levels. The social uses of materials and technologies are explored, as well as the roles of materials in personal adornment. Finally, the discussion of variation through place and time is recognized as dependent on scales of analysis and social process.

PUBLISHER'S DESK

New Titles from the Cotsen Institute of Archaeology Press (CIoA)

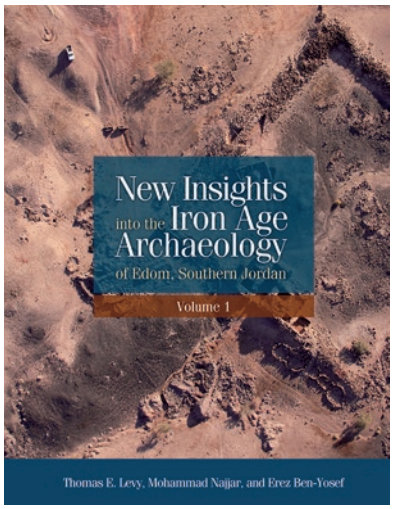


The Excavation of the Prehistoric Burial Tumulus at Lofkënd, Albania

John K. Papadopoulos, Sarah P. Morris, Lorenc Bejko, and Lynne A. Schepartz

ISBN: 978-1-938770-00-5
Publication date: December 2014
Series: Monumenta Archaeologica 34
Price $169.00 (hardbound, 2 volumes)

The burial tumulus of Lofkënd lies in one of the richest archaeological areas of Albania, ancient Illyria, home to a number of burial tumuli spanning the Bronze and Iron Ages of later prehistory. Some were robbed long ago, others reused for modern burials, and a few excavated under scientific conditions. Modern understanding of the pre- and protohistory of Illyria has largely been shaped by the contents of such burial mounds. What inspired its systematic exploration by UCLA was more than the promise of an unplundered necropolis; it was also the chance to revisit the significance of this tumulus and its fellows for the emergence of urbanism and complexity in ancient Illyria. In addition to artifacts, the recovery of surviving plant remains, bones, and other organic material contributed to insights into the environmental and ecological history of the region. The analysis of all the skeletal remains, inhumed and cremated, enhanced knowledge about the demography and human population in this region of Albania.



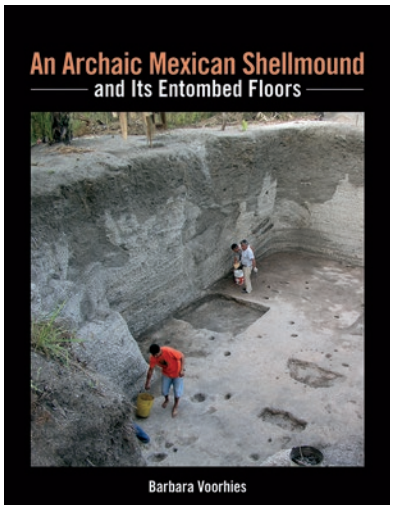
New Insights into the Iron Age Archaeology of Edom, Southern Jordan

Thomas E. Levy, Mohammad Najjar, and Erez Ben-Yosef

ISBN: 978-1-931745-99-4
Publication date: September 2014
Series: Monumenta Archaeologica 35
Price $169.00 (hardbound, 2 volumes)

Situated south of the Dead Sea, near the famous Nabatean capital of Petra, the Faynan region in Jordan contains the largest deposits of copper ore in the southern Levant. The Edom Lowlands Regional Archaeology Project (ELRAP) takes an anthropological archaeology approach to the deep-time study of culture change in one of the Old World's most important locales for studying technological development. Using innovative digital tools for data recording, curation, analyses, and dissemination, the researchers focused on ancient mining and metallurgy as the subject of surveys and excavations related to the Iron Age (ca. 1200–500 BCE), when the first local, historical state-level societies appeared in this part of the eastern Mediterranean basin. This comprehensive and important volume challenges the current scholarly consensus concerning the emergence and historicity of the Iron Age polity of biblical Edom and some of its neighbors, such as ancient Israel.

Forthcoming in 2015



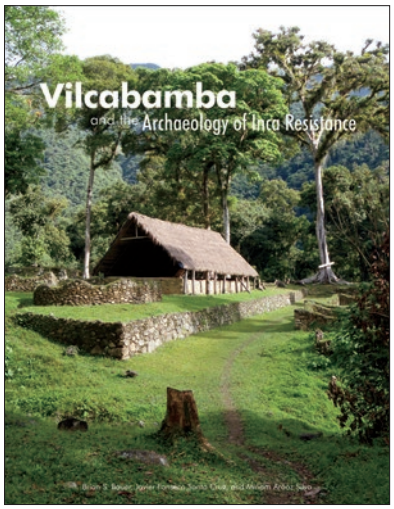
An Archaic Mexican Shellmound and Its Entombed Floors

Barbara Voorhies

ISBN: 978-1-938770-02-9
Publication date: January 2015
Series: Monograph 80
Price $55.00 (paper)

Tlacuachero is the site of an Archaic-period shellmound located in the wetlands of the outer coast of southwest Mexico. This book presents investigations of several constructed floors, built during the 600–800 years of site formation in the Archaic period (ca. 8000–2000 BCE), the crucial timespan in Mesoamerican prehistory when people were transitioning from full-blown dependency on wild resources to the use of domesticated crops. The constructed floors at the site are among the region's earliest permanent architecture and are now deeply buried in a limited area within the shellmound. The authors explore what activities were carried out on their surfaces, discussing the floors' patterns of cultural features, sediment color, density, and types of embedded microrefuse and phytoliths, as well as chemical signatures of organic remains.

The studies conducted at Tlacuachero are especially significant in light of the fact that data-rich lowland sites from the Archaic period are extraordinarily rare. The wealth of information gleaned from the floors of the Tlacuachero shellmound can now be widely appreciated.

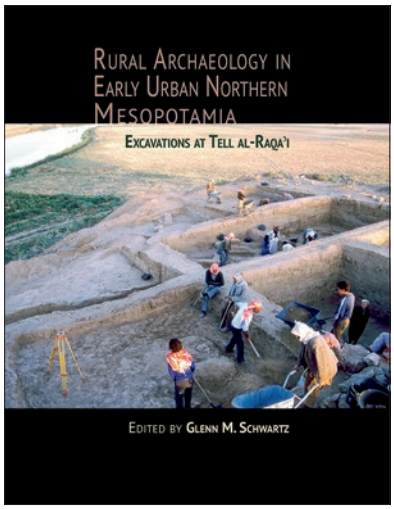


Vilcabamba and the Archaeology of Inca Resistance

Brian S. Bauer, Javier Fonseca Santa Cruz, and Miriam Aráoz Silva

ISBN: 978-1-938770-03-6
Publication date: May 2015
Series: Monograph 81
Price: $55.00 (paper)

The sites of Vitcos and Espíritu Pampa are two of the most important Inca cities within the remote Vilcabamba region of Peru. The province has gained notoriety among historians, archaeologists, and other students of the Inca, since it was from here that the last independent Incas waged a nearly forty-year-long war (AD 1536–1572) against Spanish control of the Andes. Building on three years of excavation and two years of archival work, the authors discuss the events that took place in this area, speaking to the complex relationships that existed between the Europeans and Andeans during the decades that Vilcabamba was the final stronghold of the Inca empire. This has long been a topic of interest for the public; the results of the first large-scale scientific research conducted in the region will be illuminating for scholars, as well as for general readers who are enthusiasts of this period of history and archaeology.



Rural Archaeology in Early Urban Northern Mesopotamia

Excavations at Tell al-Raqa'i

Glenn M. Schwartz

ISBN: 978-1-938770-04-3
Publication date: June 2015
Series: Monumenta Archaeologica 36
Price: $89.00 (hardbound)

This book presents the results of the extensive excavation of a small, rural village from the period of emerging cities in upper Mesopotamia (modern northeast Syria) in the early to middle third millennium BC. Prior studies of early Near Eastern urban societies generally focused on the cities and elites, neglecting the rural component of urbanization. This research represents part of a move to rectify that imbalance. Reports on the architecture, pottery, animal bones, plant remains, and other varieties of artifacts and ecofacts enhance our understanding of the role of villages in the formation of urban societies, the economic relationship between small rural sites and urban centers, and status and economic differentiation in villages. Among the significant results are the extensive exposure of a large segment of the village area, revealing details of spatial and social organization and of household economics. The predominance of large-scale grain storage and processing leads to questions of staple finance, economic relations with pastoralists, and connections to developing urban centers.

IN MEMORIAM

Harold Adelson, Ph.D.

Jo Anne Van Tilburg

Hal Adelson (back row, far right) and Anne Adelson (front row, right) with the Rock Art Archive team at Little Lake Ranch. Front row, from left, Audrey Kopp and George Spangler. Back row, from left, Alice Hom, Doug Brotherton, John C. Bretney, Clarus Backes, Jr., Ed McIntyre, Tony Hull, Jo Anne Van Tilburg, Gordon Hull, Noel Van Slyke, Bill White, and Chuck Vezzetti.

SINCE ITS INCEPTION in 1979, the UCLA Rock Art Archive has had the good fortune to enjoy the support of a cadre of dedicated and talented volunteers, among whom was Harold Adelson. One of the Rock Art Archive's founders, the late Professor Clement W. Meighan, was a masterful recruiter of Extension Division students as volunteers, and Clem believed that combining such people as Hal with others of diverse interests produced good rock art research.

The rock art that has come down to us can be viewed as kaleidoscopic remnants of human creativity. Perhaps that is why so many of our volunteers over the years have been drawn from such varied fields as mathematics, art history, graphic design, film, and especially what everyone in Southern California used to call the "space industry." Hal was a physicist and spent his highly productive and very creative professional life as an engineer at TRW before he joined our Rock Art Archive research staff in 1995. A profile of Hal and his work at the Archive was published that same year in *Backdirt.*

Hal was looking for something in which he could participate but also to which he could make a meaningful contribution. He didn't just want to donate his time, he wanted his time to be used well and valued. Archaeology and rock art interested him. Working in the Rock Art Archive with Gordon Hull, another long-term volunteer and one of Hal's many friends, he made sure that our jerry-rigged computer systems were on-line and the data protected from loss. A bonus for us was that his wife, Anne, joined Hal in his rock art interest. Hal and Anne brought brains, beauty, and their own elegant sense of style to the Rock Art Archive.

Hal and Anne took part in our Little Lake research teams to help survey, locate, and document the elusive and challenging rock art at Little Lake Ranch in the Rose Valley. Then Anne joined her volunteer compatriot Audrey Kopp to spend hours in front of the computer screen minutely analyzing and quantifying the hundreds of rock art motifs we had recorded each field season.

Hal and Anne participated in the Cotsen Institute's Friends of Archaeology (FOA). From 2000 to 2001 Hal served as president of the FOA. When it came time for us to publish our *Rock Art at Little Lake* monograph, Hal attended every editorial meeting. He was supportive, diplomatic, and assertive in seeking solutions to issues or problems. He took careful notes, listened intently, and commented sagely. Hal, like others of our colleagues at the Rock Art Archive, brought a fresh eye and a broad perspective to questions that arose every day but which, when Hal was involved, never received ordinary answers. Hal was a scholar, a gentleman, a friend, a colleague, and a good companion in all things archaeological. He is sorely missed.

Friends of Archaeology

COTSEN INSTITUTE OF ARCHAEOLOGY AT UCLA

GET INVOLVED

Do you find yourself spending your vacations wandering among ruins and visiting archaeology museums across the globe? At the Cotsen Institute, there are a number of ways to get involved in archaeological research in Los Angeles and beyond.

FRIENDS OF ARCHAEOLOGY

Join the Friends of Archaeology, the Cotsen Institute's support group dedicated to sponsoring graduate student education, faculty research, publications, and many other initiatives. There are three levels of membership—Basic Members ($300–$999/year), Director's Fellows ($1,000–$4,999/year), and Director's Council Members ($5,000+/year)—with many benefits, including special guided trips to archaeological sites, domestic and international tours with faculty, and behind-the-scenes events at UCLA. *(See membership/renewal form on reverse side.)*

	BASIC MEMBERSHIP ($300–$999 per year)	**DIRECTOR'S FELLOW** (1,000–$4,999 per year)	**DIRECTOR'S COUNCIL MEMBER** ($5,000+ per year)
NEWS	• ***Backdirt*** Annual Review Magazine • Email news about Cotsen Institute • Public Lectures & events	• ***Backdirt*** Annual Review Magazine • Email news about Cotsen Institute • Public Lectures & events	• ***Backdirt*** Annual Review Magazine • Email news about Cotsen Institute • Public Lectures & events
EVENTS	• Invitations to private receptions (e.g., faculty book launches) • Invitation to one private dinner lecture with Cotsen Institute faculty or affiliate at UCLA venue • End-of-academic-year party with faculty and graduate students (June)	• Invitations to private receptions (e.g., faculty book launches) • Invitation to one private dinner lecture with Cotsen Institute faculty or affiliate at UCLA venue • End-of-academic-year party with faculty and graduate students (June) • Invitation to the Cotsen Institute reception at the annual Society for American Archaeology Meeting • Behind-the-scenes tour at Cotsen Institute research facilities or affiliated institution, followed by cocktail reception	• All prior benefits plus the opportunity to personally sponsor Archaeology Program graduate students with the establishment of a $500 award (included in donation). • Private salons hosted by Cotsen Institute faculty
TRAVEL and FIELD TRIPS	• Opportunity to attend field trips and/or museum excursions in the LA area with Cotsen Institute faculty and/or affiliated archaeologists	• Opportunity to attend field trips and/or museum excursions with Cotsen Institute faculty domestically or abroad • Tours of 7–15 days, including access to archaeological sites	• All prior benefits plus additional opportunities to participate in international travel and research with Cotsen Institute faculty • Customized tours of 7–20 days, including access to archaeological sites. Tailored itineraries and services
DISCOUNTS	• 20% off Cotsen Institute Publications	• 30% off Cotsen Institute Publications	• All prior benefits plus a free copy of new Cotsen Institute Press Publications

Photo: Emily Uyeda Kantrim

Friends of Archaeology

MEMBERSHIP/RENEWAL FORM

MEMBERSHIP OPTIONS

CHOOSE ONE

- ☐ Basic Membership ($300–$999/year)
- ☐ Director's Fellow ($1,000–$4,999/year)
- ☐ Director's Council ($5,000+/year)

METHOD OF PAYMENT

☐ Check: Please make check payable to: **The UCLA Foundation**

Credit Card: ☐ Visa ☐ MasterCard ☐ American Express ☐ Discover

Amount of Donation: ______________________

Credit Card #: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Expiration Date (mm/yy): ☐☐☐☐

Name on card: PLEASE PRINT

____

DONOR INFORMATION

Name (Mr. | Mrs. | Ms. | Dr.):

____

This is a joint gift. Spouse/Partner name (Mr. | Mrs. | Ms. | Dr.):

____

Preferred mailing address: ☐ Home ☐ Business
Preferred email address: ☐ Home ☐ Business

HOME ADDRESS:

CITY/STATE/ZIP

PHONE

EMAIL

BUSINESS ADDRESS:

CITY/STATE/ZIP

PHONE

EMAIL

For information about donations, please contact:
Lisa Mohan, Director of Development, Division of Social Sciences
(phone 310-825-8930; email: lmohan@support.ucla.edu) 5043 LS322

✂ -

Please send payment and this completed form to:
The UCLA Foundation, PO Box 7145, Pasadena, CA 91109-9903

For additional information, please contact:
Lisa Mohan, Director of Development, Division of Social Sciences
(phone 310-825-8930; email: lmohan@support.ucla.edu)

Please review UCLA and The UCLA Foundation's Disclosure Statements for Prospective Donors at: www.uclafoundation.org/disclosures or contact the development officer listed on this form.

COTSEN INSTITUTE OF ARCHAEOLOGY AT UCLA

impacting the academic, local, and global community
www.ioa.ucla.edu

Special Thanks

Donors and Funders of Projects July 1, 2013 – June 30, 2014

($300 or more in support of the Institute)

The Cotsen Institute of Archaeology at UCLA expresses its deepest gratitude to LLOYD and MARGIT COTSEN for their commitment to the creation of knowledge and continuous support of the faculty, researchers, students, and other affiliates of the Institute.

OUR SPECIAL THANKS GO ALSO TO THE FOLLOWING SUPPORTERS

Anonymous
Adelson, Harold E.* and Anne
Anawalt, Patricia R.
Apache Corporation
Arnold, Deborah and Walter Zipperman
Arvey, Margaret C.
Babian, Avo
Bailey, Jeanne M.
Baldwin, Dana M.
Bartley, Pamela
Bass, Harris and Margaret
Beaudry-Corbett, Marilyn P. and Don Corbett
Bendat, Millie R. and Julius S.
Berberian, Roupen and Graziella
Bernard, Nancy S. and Allan H.
Boochever, David and Kathleen
Bost, Kurt W.
Bretney, John C. and Louise C.
Bristol-Myers Squibb Foundation, Inc.
Brooks, Elizabeth J.
Cahill, William and Frances
California Community Foundation Boochever Family Fund
Cameron, John J. and Karen
Cascadden, Neil R.
Chen, Sharon S.
The Harry & Ovsanna Chitjian Family Foundation
Chitjian, Zaruhy Sara
Civalleri, Roger and Patty
The Coca-Cola Company
Conger, Jay A. and Nadege
Conte, Courtney and Gina
Cooper, Helene and Edwin L.
Cotsen, Lloyd and Margit
Dalian, Dikran and Arpy
Duque, Mercedes and James
Falcon, Donna J. and James Myers
Fowler, Eileen and Gary
J. Paul Getty Trust
Girey, Helle
Godwin, Beverly
Gottesman, Sonia A.
Grancell, Norin T. and Nona
Ham, Richard and Judy
Harris, Arlene S.
Hector, Bruce P. and Justina
Henderson, David M. and Susan T.
The Henry Luce Foundation
Housing Development Services Inc.
Holmes, Marillyn H.
Holz, John and Marguerite Maynard Holz
Hullett, Katherine
Jacobson, Michelle and Anthony Caldwell
Kay, Jean Steinmetz
Kershaw, Norma
Kopp, Audrey
Lee, Howard and Norma
Sammy Yu-Kuan Lee Foundation
Lesser, Stephen O.
Lieberfarb, Gail Kamer and Warren N.
Lin, Agnes
Lipner, Sharon
Estate Of John W. Lissack
Lucas, Herbert L. and Ann S.
Lynton, Jamie and Michael
MacCary, William and Karla
Magalousis, Nicholas M.
Marott, Janet
McAndrews, Colleen C. and Robert E. Wood
McClelland, Donald and Karen Profet
The Andrew W. Mellon Foundation
Miller, Jordan and Felice
Mohan, Lisa S.
Moriarty, Phyllis Endowment
Morris, Sarah P.
Munitz, Barry
Muir, Arthur H.
Myers, Mary Jane
National Endowment for the Humanities
National Geographic Society
National Science Foundation
Nettleship, Patricia
Norris, Tania
Orellana, Sandra L.
Orrange, William W. and Susan
Ostroff, Anita J.
Papadopoulos, John
Pine, Benjamin L. and Rue C.
Porath, Anne and Arnold
Porcasi, Judith F. and Peter P.
Robertson, Deb and Tom Chwalek
Rugge, Dale
Sherwood, Fran and Arthur L.
Joan Silsbee Revocable Trust
Silton, Jill
Stanish, Charles
Steensland, Ronald E.
Steinmetz, Charles and Ellen K.
Steinmetz Family Trust
Steinmetz Foundation
The Joseph and Fiora Stone Foundation
Elbridge & Evelyn Stuart Foundation
Sweitzer, Noel L.
Vaughn, Dennis H. and Linda
Wake, David B. and Marvalee H.
The Waters Foundation
Zaki, Ihab M.

*In memoriam

UCLA COTSEN INSTITUTE OF ARCHAEOLOGY

Cotsen Institute of Archaeology
University of California, Los Angeles
405 Hilgard Avenue
Box 951510,
Los Angeles, CA 90095-1510

www.ioa.ucla.edu