

**Arizona State University  
School of Human Evolution and  
Social Change**

**Archaeology and Bioarchaeology  
Program  
Research Projects  
2006-2007**

**Director: David Abbott**

**Title: LABORATORY OF SONORAN CERAMIC RESEARCH (LSCR)**

**Graduate Students:** Andy Lack  
Josh Watts  
Chris Watkins

The Laboratory of Sonoran Ceramic Research (LSCR) investigates the lifeways of the ancient Hohokam people in the Sonoran Desert of central and southern Arizona, particularly through analyses of ceramic materials. To study the economic, political, and social lives of the Hohokam through specialized ceramic studies, the lab regularly collaborates with colleagues in the geological and chemical sciences and employs a suite of technological and stylistic analyses, including petrographic and electron microprobe analyses. A unifying research theme for various projects is the organization of pottery production and distribution across time and space, which is opening a window onto the economic and social networks that composed the Hohokam regional system. By determining where on the natural landscape the materials for pottery manufacture were collected and how those materials were combined for pottery manufacture, the movement of clay containers is traced among Hohokam neighbors across distances as short as 5 km, allowing the webs of social and economic ties to be reconstructed with unprecedented detail.

The LSCR employs three graduate student research assistants, who are funded by private-sector archaeological research projects and grants from the National Science Foundation and other granting agencies. Their work contributes to a long-term research program devoted to developing the unique contribution that ceramic research can make to study of prehistoric communities.

Projects include:

*Calderwood Butte:* An analysis of mostly plain ware pottery from one Classic period compound site, and several smaller habitation and non-habitation sites in the upland zone north of Phoenix. Emphasis placed on the organization of plain ware production and exchange along the lower Agua Fria River; for Soil Systems, Inc.

*Arroyo Seco:* An analysis of pottery recovered near the White Tank Mts. of the western Phoenix Basin. Emphasis on plain and buff ware provenance in the White Tanks area; for SWCA, Inc.

*Pueblo Viejo:* A ceramic analysis from the Pueblo Viejo site located northwest of South Mountain. Special attention paid to chronology and buff ware provenance; for Archaeological Research Services, Inc.

*SRP:* An analysis of ceramics from five sites spanning the late Preclassic and Classic periods in the Queen Creek delta and eastern Santan Mts. areas. Emphasis is on chronology and buff ware provenance and exchange; for Northland Research, Inc.

*Desert Rose:* An analysis of ceramics from six sites on the northern fringes of South Mountain. Emphasis placed on buff ware provenance; for Soil Systems, Inc.

*Superstition Mts.:* A study of pottery from three sites on the eastern edge of the Superstition Mts. on the east side of the Phoenix Basin. An emphasis was placed on chronology, site function and permanence, and buff ware provenance; for Soil Systems, Inc.

*Lakin, Morocco Ruin:* A mortuary analysis of whole and reconstructible vessels from Morocco Ruin, located in the western part of the Phoenix Basin near the confluence of the Salt, Gila, and Agua Fria Rivers. Emphasis placed on vessel form and technological characteristics, as well as temper identification to determine production source; for SWCA, Inc.

*Lake Pleasant:* A project solely focused on chemically characterizing plain ware ceramics from a small site near Lake Pleasant, north of Phoenix to study plain ware production along the lower Agua Fria River; for Northland Research, Inc.

*Saguaro Forest:* An analysis of plain ware ceramics from five small Classic period sites located in the uplands north of Phoenix, near Cave Creek. A heavy emphasis is on chemical characterization for pottery sourcing in the northern uplands; for SWCA, Inc.

*Caterpillar:* An analysis of ceramics from several sites near the White Tank Mts. on the western edge of the Phoenix Basin. Topics of special study include a design analysis of Hohokam buff wares, buff ware provenance, the function of Lower Colorado buff ware in the assemblage, and patterns of interaction with Yuman/Patayan groups; for Soil Systems, Inc.

*Cactus Forest:* An analysis specifically focused on Salado Polychrome designs from a late Classic period site along the middle Gila River, south of Phoenix. Emphasis placed on differences over time, and comparisons with other design studies. It is to be used in conjunction with a provenance study using INAA conducted by Northland Research, Inc.

*Phyllite Study:* This long-term project identifies specific pottery production sources in the upland zone north of Phoenix. Until now, all plain wares across this vast territory were classified as a single type, but chemical analyses are revealing multiple production sources and a substantial volume of ceramic transactions among the populations of the upland region.

*Alliance and Landscape: Perry Mesa, Arizona in the Fourteenth Century:* The portion of this NSF-funded project corresponding to ceramics is focused on the provenance of plain and red ware pottery from central Arizona and the movement of clay containers among the members of the Verde Confederacy.

## **Co-PIs: David Abbott and Katherine Spielmann**

### **TITLE: ALLIANCE AND LANDSCAPE: PERRY MESA IN THE FOURTEENTH CENTURY**

NSF, Archaeology program

**Graduate Students:** Chris Watkins

**New project; additional RA to be hired in coming months**

### **Project Summary**

Compelling evidence for endemic warfare during late prehistoric times has been documented in many areas of the American Southwest, and some models postulate hostilities at a macroregional level. Among them is the Verde Confederacy, which has been described as a highly coordinated alliance that encompassed 10,000-13,000 people at 135 sites in the middle Verde River valley, Bloody Basin, and Perry Mesa. This confederacy is believed to have been aligned for conflict against a larger Hohokam polity in the Phoenix basin to the south. Did macroregional warfare perpetrated by large-scale alliances truly exist during the 1300s in central Arizona? If it did, how was the Verde Confederacy organized and what was the web of relations within it? If it did not, at what scale(s) did alliances develop in the increasing hostile landscape of the late prehistoric period?

This project evaluates the scale at which conflict and alliance took shape in central Arizona during the 14<sup>th</sup> century. To address these questions, a three-component strategy is formulated, using ceramic, architectural, and paleoclimatic data. By tracing ceramic transactions, this project investigates the local, regional, and macroregional networks of social interaction among members of the proposed Verde Confederacy, and between them and their postulated Hohokam enemies. The Verde Confederacy model predicts numerous social and economic ties and the transfer of goods among the confederacy members. A ceramic compositional study, aided by petrographic thin section analysis and chemical assays with an electron microprobe, categorizes the pottery from different portions of the confederacy according to provenance, providing the means to trace the movement of pots across central Arizona.

In addition, architectural and paleoclimatic evidence is used to evaluate the extent to which the local and regional settlement patterns were dictated by a defensive strategy implemented by a large-scale confederacy. According to the Verde Confederacy model, numerous settlements were newly established in the late 1200s on Perry Mesa to guard the alliance's western flank. This project determines if settlements were constructed as a unit to accommodate a population moving en masse to take up defensive positions. It also considers an alternative model for the Perry Mesa occupation by examining paleoclimatic indicators to determine if Perry Mesa was more conducive to farming at that time, as compared to deteriorating conditions in an abandoned foothills zone immediately to the south.

The **intellectual merit** rests on the unprecedented opportunity to evaluate the scale at which alliances were formed in late prehistoric times in central Arizona. Two years of pilot archaeological research by Arizona State University (ASU), coupled with paleoclimatic reconstructions for the region, have set the stage for the comprehensive ceramic, architectural, and environmental analyses that we propose. Furthermore, the macroregional, regional, and local scales at which the inquiry is focused address a key question in Southwest

archaeology: What was the maximum scale at which polities organized themselves, and what were the forces and constraints that drove those developments?

The **broader impacts** come from enhanced interaction with Native American communities, the integration of education and research, and knowledge exchange with BLM and Tonto National Forest land managers who administer the Agua Fria National Monument (AFNM) and its immediate surroundings. The Hopi Tribe and the Yavapai people have expressed interest in scientific research into the past occupation of Perry Mesa in the AFNM, which is part of their ancestral territories. The project continues a highly successful ASU field research seminar involving both undergraduate and graduate students, in which students collect, analyze, write up and ultimately publish research. Finally, it improves land management and interpretation for the public about the history and nature of the prehistoric occupation in the AFNM and the regional and macroregional-scale processes that helped shape it.

**Co-PIs: Michael Barton, Steven Falconer, Patricia Fall (Geography),  
Ramon Arrowsmith (Geology), Hessam Sarjoughian (Computer Science  
and Engineering)**

**Title: MEDITERRANEAN LANDSCAPE DYNAMICS PROJECT**

NSF, Biocomplexity in the Environment Program

**ASU Senior Personnel:**

Geoffrey Clark, SHESC  
Sander van der Leeuw, SHESC  
Charles Redman, International Institute for Sustainability  
Ilya Berelov, SHESC  
Elizabeth Wentz, Geography  
Richard Aspinall, Geography  
Jana Hutchins, Geospatial Partnerships for Scientific Inquiry - GIS Services

**Graduate Students**

Isaac Ullah (SHESC)  
Alexandra Miller (SHESC)  
Sidney Rempel (SHESC)  
Eowyn Allen (SHESC)  
Mariela Soto (Geography/SGS)  
Angela Willis (Geography/SGS)  
Gary Meyer (Computer Science/SCI)  
Erin Dimaggio (Geological Science/SESE)

**Project Summary**

All of modern society depends ultimately on the products of agriculture and animal herding. This agropastoral economy first appeared in the Mediterranean basin in the early Holocene, nearly 10,000 years ago, and represented a dramatic reorganization of human ecology. It involved increasingly intensive efforts by farming peoples to control environmental factors favorable to the life cycle of domestic plants and animals, with a consequent cascade of complexly interlinked effects on regional landscapes and human society. Agropastoral landuse remains the most significant way in which humans impact natural landscapes, and the recursive social effects of these impacts are important global issues. However, landscape evolution takes place over the course of decades, centuries, and even millennia. Even the loss of a landscape's ability to support a people and their subsistence economy is often the result of longer term changes that are most apparent at the resolution of the prehistoric record. Only by studying this long-term record can we truly begin to appreciate the real consequences of past and present landuse decisions on earth's landscapes and society, and use this understanding to make more informed decisions today. The longest and best-studied record of the ways in which human activities have transformed the world is found in the Mediterranean Basin, encompassing both the earliest known agricultural landuse and the earliest civilizations to become dependent on these human-managed socioecosystems. Decades of intensive study by archaeologists, geoscientists, and ecologists, has amassed rich and diverse data about human-environmental interaction in this region. This information is

integrated with recent advances in geospatial modeling and agent simulation to create a natural laboratory for investigating the long-term social and ecological consequences of alternate landuse practices. In this project, the modeling laboratory is used to study: 1) the effects the of growth in agropastoral systems on biodiversity; 2) the changing impacts of landuse intensification and diversification on landscapes, their resilience, and vulnerability to degradation; and 3) the long-term sustainability of human maintained socioecosystems in varying environmental and social contexts. The study focuses on two ecologically diverse regions at opposite ends of the Mediterranean Basin, eastern Spain and the southern Levant in Jordan, that encompass much of the social and natural variability of the entire region.

This work will generate significant new knowledge about long-term consequences of alternative landuse practices that can help communities make more responsible and effective decisions about landuse today. It will also generate integrated archaeological and paleoenvironmental datasets, and dynamic landuse-landscape modeling algorithms that will be disseminated via the internet, conferences, and publications for use by researchers addressing other socioecological questions. The research is tightly integrated with an active educational program for undergraduate and graduate students especially geared towards hands on training in the research process, and collaborative transdisciplinary work. This includes a K-12 outreach partnership with the Arizona Geographic Alliance, and collaboration with educators to co-develop and disseminate curricula that enables science learning within the context of core requirements of the No Child Left Behind legislation.

**Co-PIs: Michael Barton and Marco Janssen (SHESC), Lillian Alessa (University of Alaska)**

**Title: INTEGRATING SOCIO-ECOLOGICAL SCIENCES THROUGH A COMMUNITY MODELING FRAMEWORK**

NSF, Human and Social Dynamics

**Senior Personnel:**

Sander van der Leeuw, SHESC

J. Steven Lansing, University of Arizona

**Graduate RAs: Eowyn Allen, New project, other RAs to be hired in next several months**

**Project Summary**

**Intellectual Merits:** The dynamic complexity that characterizes interactions between humans and the natural environment, has intersected over the past century with increasingly rapid population growth, urbanization, and technological development to make human society an important driver of environmental changes that threaten to exceed our abilities to adapt using traditional means. This makes it imperative that we find better ways to track these global socio-ecological systems (or ‘**socioecosystems**’), and anticipate their social and natural consequences if we are to lessen the risk of increasingly severe socio-natural catastrophes like those that shook the world in the past year. Late 20<sup>th</sup> Century advances in information technology offer powerful new tools to assist us in understanding—and hopefully even managing—these coupled social and natural systems. In this context, Agent Based Models (ABMs) have recently emerged as a promising cybertool to study the dynamics of complex human and biological systems, integrating individual perceptions and behaviors in the contexts behavioral ecology, game theory of decision-making, and geospatial representations of the world. While ABMs are much discussed and are rapidly becoming perceived as a requirement for cutting-edge research centering on human-environmental interaction, most social and natural scientists still have a limited awareness of their potential, and the experimental nature of most ABM platforms prevents them from being readily accessible to researchers. Furthermore, a lack of standards has inhibited the exchange of modeling expertise and cumulative model building among different research teams, and there has been little effort at systematically addressing problems of validation and verification in modeling algorithms and results.

**We propose to address these issues and accelerate the regular integration of ABMs for research in social-natural dynamics** by initiating a broad, community-wide agenda involving active researchers ranging from content experts in the social sciences, ecology, conservation biology and GIS, to computer scientists and mathematicians. To accomplish this, we will organize a workshop of leading practitioners to establish a **Community Modeling Framework for Socioecological research (CMFS)**, following successful examples of community frameworks for cybertool development in other research domains. We, as organizers—a geoarchaeologist, ecologist, and computer scientist—represent the diversity of fields we propose to articulate, and the workshop participants span the range scientists employing ABM in socio-ecological research and ABM platform developers. The workshop will be followed by a **proof-of-concept pilot project**, comprising a new

collaborative, scientific network to initiate the CMFS. The pilot project will establish a **modeling archive and component library** for jump starting new research using ABM, a **collaboration server (CVS)** for improving usability and usefulness of ABM for socioecological research, a **testbed** of standard data for developing model evaluation protocols, proposed **best practices** for model dissemination and frameworks for model interchange, and a **training program** in ABM aimed at social and natural scientists. The Center for Social Dynamics and Complexity (Arizona State University) and Santa Fe Institute will co-sponsor this endeavor.

**Broader Impacts:** The workshop will represent the first forum directed at establishing a community-wide framework to promote ABM use for socioecological research. It will encompass a broad diversity of researchers, including minorities, individuals with international and multicultural experience, and early career scientists. Students will be directly involved with organizing the workshop and developing the CMFS, and along with professionals, will be targeted with planned training in ABM applications. If existing community frameworks for cyberinfrastructure and related research serve as a guide, the community modeling framework we propose to establish has the potential for far-reaching impacts on the way we investigate the complex interactions of humans and the environment—through promoting a much wider expertise in cybertools directly aimed at studying complex systems. Because questions about the dynamics of socio-ecological systems lie at the heart of increasingly critical policy debates at global scale, the long-term agenda of the program we are initiating in this proposal has the potential to influence future environmental policy the way climatic modeling does today.

**Director: Michael Barton; Margaret MacMinn-Barton, co-director**

**Title: MOGOLLON REGION SMALL SITES PROJECT**

**Collaborators (Universidad de Valencia, Spain)**

Dr. Oreto Garcia

Dr. Teresa Orozco

Dr. Ernestina Badal

Dr. Yolanda Carrión

**Graduate Students**

Matt Peeples

Steve Swanson (Blue River Archaeological Project)

Steven Schmich

Julien Riel-Salvatore

Craig Fertelmes

**Description**

The Mogollon Region Small Sites project involves nearly a decade of study of changing landuse practices and their consequences for prehistoric foragers and farmers of the southeastern Colorado Plateau. This research focuses on the Holocene foragers and first, small-scale farmers of in the drainages of middle and upper Chevelon and Willow Creeks. Intensive, patch-based survey, systematic coring, and excavation indicate that Holocene foragers centered their settlements around the canyons of major watercourses. Along with the economic transition to farming, settlement shifted to focus on upland zones between the canyons. Each environmental zone had different suites of risks, vulnerabilities, and subsistence returns, affecting the organization and longevity of landuse practices and societies.

**PI: Jane Buikstra**

**Title: THE ANTHROPOLOGY OF HOST-PATHOGEN CO-EVOLUTION**

**ASU Senior Personnel:** Anne C. Stone, Alicia K. Wilbur, Amy W. Farnbach

**Collaborators:**

Dr. Noreen Tuross, Harvard University

Dr. A. Magdalena Hurtado, The University of New Mexico

Dr. Charlotte A. Roberts, University of Durham

Dr. Lisa Jones-Engel, University of Washington

**Project Summary**

This project examines the co-evolution of humans and our pathogens using an anthropological perspective that incorporates both evolutionary time depth, and short-term individual and species histories. Trends in host-pathogen relationships are analyzed using theory and data from ethnology and ethnohistory, human evolutionary ecology, archaeology, paleopathology, epidemiology, immunology, molecular and population genetics, primatology, ecology, and evolutionary biology. Issues of particular concern are the emergence and maintenance of diseases in human and nonhuman primate populations, and factors contributing to variation in host susceptibility/resistance to infectious disease.

**P.I.: Jane Buikstra**

**Title: BIOARCHAEOLOGY OF THE LOWER ILLINOIS RIVER VALLEY**

**Collaborators:**

Jason King

Douglas Charles

Juliann Van Nest

**Project Summary**

Presently, we are focusing upon establishing burial programs and inferring ritual liturgies. A second emphasis is the investigation of landform and meaning. The research focuses upon the rich archaeological resource base of the lower Illinois River valley.

## **Director: Jane Buikstra**

### **CENTER FOR AMERICAN ARCHAEOLOGY**

The Center for American Archeology (CAA), located in rural west-central Illinois, is an independent 501(c)3 not-for-profit organization dedicated to discovering and disseminating the unwritten story of earlier Americans' lifeways, accomplishments, and the changing natural environment. The CAA fulfills this mission through integrated programs in archeological investigation, educational outreach and cultural stewardship.

With more than a half-century of experience in archeological research, the CAA has documented some of the first settled communities in midcontinental North America. Such places of permanence anchor a 10 millennia record of human history that includes evidence of early indigenous plant cultivation and provides deep time perspectives on waterways and their management. The Center's researchers have also contributed to the development of methods for studying human groups within their environmental settings and have advanced bioarcheological knowledge of built landscapes, residence patterning and health across time and space.

The CAA is widely recognized for innovative educational initiatives that target diverse audiences. Our partnerships with regional secondary schools have encouraged "hands-on, minds-on" approaches to teaching critical thinking and communication skills. In the course of such efforts, we have been linked to classrooms across Illinois as part of a remote learning experience. More recently, a collaborative educational program, the Museum Tech Academy, has partnered the CAA with the Illinois State Museum. Sponsored by the National Science Foundation's ITEST initiative, this program focuses on teaching archeology, the natural sciences and information technology to underrepresented and underserved middle and high school students who are also potentially first-generation college attendees. We are presently aggressively developing additional institutional partnerships that will link creative programming with the recruitment of underrepresented groups from across the United States. In addition, the CAA's current outreach efforts include a Heritage Studies directive that documents the more recent history of rural America, one that is rapidly disappearing in the wake of urban expansion.

Ongoing research initiatives by both resident and visiting scholars continue to focus upon our systematic collections that include an estimated 12 million eco-facts, artifacts, scientific specimens and supporting documentation. A curatorial agreement with the Illinois State Museum ensures the quality curation and availability of these materials.

## PI: Christopher Carr

### Title: THE HOPEWELL ANCIENT NATIVE AMERICAN SOCIETIES PROJECT

**Graduate Students:** Mark Bahti, Wesley Bernardini, D. Troy Case, Ashley Evans, Anne Goldberg, Beau Goldstein, Cynthia Keller, Kitty Rainey Kolb, Tina Lee, Teresa Rodrigues, Ian Robertson, Chad Thomas, Rex Weeks, Jaimin Weets

### Project Summary

The Hopewell Ancient Native American Societies Project at ASU is a transdisciplinary archaeological endeavor that aims at reconstructing in unprecedented detail the social, ceremonial, and religious lives of Hopewell peoples who lived in the upper Ohio valley, and more broadly across Eastern North America, from 50 B.C. to A.D. 350. The Hopewell were extraordinary in their mastery of solar and lunar astronomy and Euclidean geometry, which they employed in designing massive 80 acre architectural works, in their artistic productions from copper, silver, and semiprecious stones obtained by journeys of up to 1400 miles across the North American continent, and in their intricate social order and world view, which allowed them centuries of peaceful coexistence without any skeletal evidence of traumas of combat.

The Project, continuous from 1994 to present and directed by Christopher Carr, Professor, SHESC, has revealed Hopewell life by analyzing three kinds of archaeological remains—burial mound cemeteries, ceremonial paraphernalia, and artworks—and interpreting them in light of anthropological theory, ethnohistorical documentation of Woodland Native Americans, and detailed contextual studies. The mortuary data include over 1000 burials and 70 deposits of ceremonial paraphernalia in 35 cemeteries across Ohio. These data were gathered and systematized from century old records in a dozen museums over the course of seven years, and are rich in sociological information. Approximately 1000 ceremonial items and artworks have been photographed. They are being interpreted in culture-specific terms in part through their symbolic and representational content, and in part through diverse materials analytic techniques: infrared photography, digital image enhancement, mineralogical petrography, x-ray diffraction, scanning electron microscopy, electron microprobe, Raman spectrometry, and microscopic paleobotanical and textile structural identification.

The project has involved more than a dozen ASU students in analyzing and interpreting the mortuary, ceremonial, and artistic data. Some of the aspects of Ohio Hopewell life that have been reconstructed include: *leadership*, its shamanic sacred and secular power bases, recruitment, and formalization over time; systems of *social ranking* and prestige; animal-totemic *clan* organization, *kinship* structures, and *ceremonial sodalities* and societies; *gender* roles, prestige, work load, and health; *community organization* in its tri-scalar residential, symbolic, and demographic forms; intercommunity *alliances* and changes in their strategies and expanses over time; and *interregional travels* for power questing, pilgrimage, healing, tutelage, and acquiring ritual knowledge. These subjects are published in the book, *Gathering Hopewell: Society, Ritual, and Ritual Interaction*, edited by C. Carr and D. T. Case, Springer Publishers, New York, 2005.

There are many aspects of Ohio Hopewell life that remain to be studied with the mortuary and artistic data that have already been assembled and that are available to interested graduate students at ASU. The lives of specific Hopewell individuals could be described in biographical richness, and the lives of different individuals could be contrasted,

to create a dynamic, rich, personalized view of Hopewell life. This would be cutting-edge work conceptually in archaeology. Many hundreds of portraits of individuals, never published, remain to be line-drawn, described for costumery, and analyzed for the social and ceremonial roles of the depicted persons. The community and ceremonial organizations of peoples in different river valleys have yet to be compared and contrasted and related to regional differences in natural environmental richness and variability. Changes over time in social complexity and spiritual beliefs, which are closely interrelated in the Hopewell case, have much potential for rewriting and qualifying contemporary anthropological theory on societies of middling complexity. If you are interested in these or other topics, see Chris Carr.

**PI: Geoffrey Clark**

**Title: AYL-TO-RAS EN'NAQB SURVEY PROJECT**

**Project Summary**

The Ayl-to-Ras en'Naqb survey is a general survey for all time periods (the only kind the Jordanian Dept of Antiquities will issue a permit for) encompassing a good chunk of west-central Jordan between Ayl and Ras en'Naqb (near Petra) and extending from the western edge of the Jordan horst to the Desert Highway. My involvement in it is concerned with the 'lithic period' sites (everything from Lower Paleolithic to the PrePottery Neolithic). As I did with the Wadi Hasa Survey (1979-1983), I intend to use the lithic material survey to form the basis for a series of NSF grants involving excavation of 'lithic period' sites with buried, stratified deposits. This work, funded by 2 major NSF grants, 1 NGS grant, and 4 NSF Dissertations Aid Grants, was enormously productive, producing (so far) 3 monographs, >50 publications in the Wadi Hasa Paleolithic Project series, 5 PhDs and 7 MA degrees, and an NSF-funded 'daughter project' (Coinman & Olszewski's Eastern Hasa Late Paleolithic Project). In general, the work is oriented toward tracking changing forager adaptations to lacustrine environments through time.

**Co-PIs: George Cowgill and Deborah Nichols (Dartmouth)**

**Title: CERRO PORTEZUELO**

NSF, Archaeology Program

**Graduate Students:** Sarah Clayton  
Destiny Crider

This project focuses on the analysis of the ceramics and other materials from the site of Cerro Portezuelo, in the Basin of Mexico. This site is important because it was a major provincial center of the Teotihuacan state, and it is one of the few sites to span the transition to the post-Teotihuacan Epiclassic Period, still very poorly understood.

Cowgill supervises an ASU-managed archaeological research center at Teotihuacan, which houses massive collections of survey and excavation materials from that and nearby sites, as well as housing for up to a dozen students and other researchers. It has been a basis for many MA papers and doctoral dissertations, and the collections and facilities offer opportunities for many more.

In addition to the above activities, Cowgill is engaged in several writing projects, including a general book on ancient Teotihuacan, for Cambridge University Press.

## **Co-PIs: Steven Falconer and Patricia Fall (Geography)**

**Title: BRONZE AGE VILLAGE LIFE AND RURAL ECOLOGY ON CYPRUS: EXCAVATIONS AT POLITIKO *TROULLIA***

NSF, Archaeology program

**Graduate RAs: New project, RAs to be hired in next several months**

### **Project Summary**

With support from the National Science Foundation, Drs. Steven Falconer, Patricia Fall and an international team of colleagues will conduct field research in 2007 to study village agricultural development on Cyprus before the advent of cities. One of the most important legacies of early civilization is the establishment of the agricultural lifeways that have molded the natural and social landscapes we live in today. In the Near East, ancient agricultural intensification played a particularly important role in the evolution of urban-rural interactions and anthropogenic landscapes. A substantial body of theory and case studies highlights cities as the primary agents of agricultural change and landscape formation. New collaborative research on Cyprus will investigate pivotal aspects of agricultural change that may have proceeded independently of urban influences, reflecting paths of relatively autonomous rural change that lay at the foundation of agrarian civilizations.

Previous archaeological studies of farming villages in Jordan directed by Falconer and Fall (and supported by NSF) detail agricultural strategies and landscape changes during the advent of urbanized society in the Bronze Age (ca. 2300-1500 B.C.). New investigations will consider whether comparable independent trends characterize contemporaneous Bronze Age agriculture on Cyprus (ca. 2500-1700 B.C.) prior to the development of cities and their influences. The results of this new research in an island setting on Cyprus will be compared to those from mainland Jordan, where villages adopted changing agricultural strategies and modified their landscapes in the social context of city growth and collapse. Contrasting results from Cyprus and Jordan will suggest fundamentally distinct courses of rural development in pre-urbanized (Cyprus) vs. urbanized (Jordan) societies. More provocatively, if similar trends *do* emerge, this result will strengthen our understanding of the independent rural agricultural dynamics that lay at the heart of early civilizations societies, whether in the context of urbanization or prior to its emergence.

Research plans feature a detailed mapping of surface and subsurface (using soil resistivity) architecture and archaeological excavation of the Early/Middle Bronze Age village of Politiko *Troullia*, Cyprus. This project builds on previous insights from Bronze Age villages in Jordan, as well as the results of initial survey and excavations at *Troullia* in 2004, 2005 and 2006. The major project goal is to explore Politiko *Troullia* as it illustrates the economic development of an agrarian village in Bronze Age pre-urban society on Cyprus. Special attention will be devoted to maximizing the recovery and interpretation of plant and animal remains as a means to infer strategies of village agriculture and their potential effects on surrounding landscapes.

This research involves an international collaboration between Arizona State University, the Department of Antiquities, Cyprus and the Cyprus American Archaeological Research Institute,

Nicosia. This project will train American and Cypriot undergraduate and graduate students in archaeological fieldwork and analysis. Dissemination of project results will include scientific publications, international conference presentations, website access and public lectures in the US and Cyprus. The broader benefits of this new research on Cyprus lie in 1) its rural perspective on agriculture and landscape formation, 2) its emphasis on household evidence of agricultural behavior, and 3) its unique comparison of the development of rural agrarian life and associated environmental consequences on the island of Cyprus and the continental Near East.

## **Co-PIs: Michelle Hegmon and Margaret Nelson**

Title: **EASTERN MIMBRES ARCHAEOLOGICAL PROJECT**

**Graduate Students:** Stephanie Kulow, Karen Schollmeyer, Tiffany Clark, Jennifer Brady

### **Project Summary**

The Mimbres region, in southwestern New Mexico, has long been renowned for the beautiful Classic Mimbres pottery, mostly made in the 10<sup>th</sup>-12<sup>th</sup> centuries AD. It is also becoming known, in the archaeological literature, as an area where the concept of regional reorganization (in contrast to “abandonment”) has been defined and where social and ecological research go hand-in-hand. These new directions have been developed largely by research spear-headed by EMAP.

The eastern Mimbres area includes the drainages that flow eastward, from the crest of the Black Range, into the Rio Grande. In contrast to the Mimbres River Valley (at the center of the Mimbres region), the east is drier, has patchier arable land, and most of the sites are smaller. Also in contrast to the valley, many of the eastern sites are well-preserved, thus facilitating detailed research.

EMAP has been working in the eastern Mimbres area since 1993, building upon earlier work by Nelson in the area. Fieldwork has included both extensive survey and excavation, and various artifactual and analytical data are available for further analysis by interested students. Currently our primary efforts are being directed at analysis and synthesis, preparing EMAP data for comparative work through the Long-Term Coupled Socioecological Change in the American Southwest and Northern Mexico project (described below under Margaret Nelson). We are also involved in compiling a digital database of Mimbres pottery designs, and future field work is anticipated.

Among the specific research questions that have been and/or are being pursued by EMAP (many in comparative analyses with other regions of the Southwest):

-How can the movement out of large villages and into dispersed hamlets at the end of the Mimbres Classic period be reconceptualized as “Regional Reorganization” rather than “collapse and abandonment.” What social and ecological processes are involved?

-Traits we recognize as “Mimbres” becoming increasingly distinctive over the course of the Classic period (AD 1000-1150), such that the region appears to have become increasingly isolated from ongoing contemporary developments elsewhere. What social processes were involved, and how can those be understood from the perspective of ceramic analyses? To what extent might this isolation have contributed to the eventual transformation?

-There is strong evidence of environmental degradation in the relatively rich Mimbres River Valley, in contrast to the apparently sustainable land use in the east. How can we understand this apparent contradiction? What social processes contribute to environmental impact?

## PI: Keith Kintigh

Title: **PROTOHISTORIC ZUNI SOCIAL AND POLITICAL ORGANIZATION**

### Project Summary

The Zuni were the first Native Americans the Spanish explorers encountered when they entered the American Southwest nearly 500 years ago. Recent attention has been lavished on the transformations of Indian cultures following the Spanish *entrada*. Yet for the Zuni, the cultural developments of the 500 years *preceding* their encounter with Coronado were no less dramatic.

Through analysis and interpretation of large-scale archaeological excavations of three late prehistoric Zuni towns, the proposed research will illuminate the dramatic organizational developments of the final three centuries preceding the Spanish *entrada*. It will compile archaeological documentation, and analyze and interpret previously unreported collections deriving from the excavations of two early scientific expeditions at three late prehistoric Zuni towns: Heshotauthla, Halona, and Kechipawan.

First, the Hemenway Expedition's 1888 excavations at Heshotauthla and Halona directed by Frank Cushing are far more extensive than more recent excavations of contemporaneous sites. Further, interpretation of those 19th century records has been greatly enhanced by ASU's recent excavation and survey at Heshotauthla. Second, The Cambridge University Museum's 1923 work at Kechipawan along with the Hendricks-Hodge Expedition's related work at Hawikuh are the *only* substantial scientific investigations of protohistoric Zuni towns. While less extensive than the Hawikuh excavation, the Kechipawan collection is better provenienced and more consistently documented. Comparison of Kechipawan and Hawikuh, two contemporaneous "Cities of Cibola," will allow assessment of the political relationships among the protohistoric towns.

Excavation on this scale (all together, more than 200 rooms and about 200 burials) will never again be possible. The proposed project capitalizes on these extensive excavations to provide new insights into prehistoric Zuni social organization and the processes responsible for the initial population aggregation about A.D. 1200, the nucleation into large planned pueblos about A.D. 1275, and the shift in settlement pattern about A.D. 1400. The resulting monograph will present both substantial interpretations and abundant data from these unpublished cemetery and room excavations.

The Zuni case is particularly significant because the area is one of very few in the United States where a fertile archaeological record documents 1000 years of cultural continuity with a modern group having a strong traditional culture and rich ethnographic record. Reconstructing the profound social changes between A.D. 1240 and 1540 will contribute to our understanding of the underlying processes involved in population aggregation and increasing organizational complexity. It will also bear on our understanding of the effects of the European invasion on modern Zuni social institutions. As late prehistoric social and political changes throughout the Southwest were apparently inter-related, a refined understanding of the Zuni situation will benefit many broader inquiries. This work will contribute substantially to the archaeological account of Zuni history, which is of interest not only to Southwest scholars, but to the Zuni people and broader public.

**Co-PIs: Keith Kintigh, Margaret Nelson, Katherine Spielmann, Selcuk Candan (Computer Sciences), Hasan Davulcu (Computer Sciences)**

**Title: AOC: ARCHAEOLOGICAL DATA INTEGRATION FOR THE STUDY OF LONG-TERM HUMAN AND SOCIAL DYNAMICS**

NSF, Human and Social Dynamics

**Graduate RAs: New project, RAs to be hired in next several months**

### **Project Summary**

A lack of millennial- or centennial-scale data seriously impairs scientific investigations of social and socioenvironmental systems. In developing and testing socioecological models, we must do more than project recent observations—reflecting at most a few decades—into the past or future. Archaeology can provide the long-term data on societies and environments that are needed to better illuminate such critical topics as demography, economy, and social stability. The complexities of archaeological data, lack of data comparability across projects, and limited access to primary data have crippled current efforts to understand phenomena operating on large spatiotemporal scales. Nonetheless, the potential for archaeological insights to contribute to the study of long-term human and social dynamics is enormous; the fundamental challenge is to enable *scientifically meaningful* integration and use of the expanding corpus of archaeological data.

***Intellectual Merit.*** A two-year long investigation of the information-integration demands of archaeology—supported by a NSF HSD exploratory grant—revealed fundamental technical challenges that cannot be handled by a straightforward adaptation of existing technologies. In response, a team of archaeologists and computer scientists proposes to implement a *Knowledge-Based Archaeological Data Integration System* (KADIS) that employs novel, query-driven, ad hoc data integration strategies. Once archaeologists have registered datasets through KADIS, researchers *across scientific disciplines* could, over the Web, extract sensibly integrated and appropriately scaled databases of analytically comparable observations from numerous archaeological datasets gathered using incommensurate recording protocols. Although initial development of KADIS will focus on fauna from archaeological contexts, it establishes an open-source, extensible foundation for a global, archaeological information infrastructure. The project will establish the capacity to build and access a worldwide archive of primary data representing the full history of human use of animals. Concept-oriented queries of this archive will advance socioecological modeling efforts and allow scientists to address large-scale and long-term social and natural science questions with empirical support that has heretofore been unthinkable. Testbed research will investigate the socioenvironmental conditions that lead to depressed abundance of preferred game—over two millennia in two US regions.

***Broader Scientific Impacts.*** Query-driven, ad hoc integration architecture will be applicable to many other science informatics domains in which complex inferences need to be made over multiple heterogeneous, inconsistent, and context-dependent sources. Using KADIS, specialists in other fields could use intermediate-level archaeological knowledge to obtain to primary data scaled to the scope of their inquiries. By providing scholars in diverse fields with meaningful access to long-term data on society, population, and environment, archaeology can help explain the complex human and social dynamics that have constituted today's social world and shaped the modern environment.

Impacts on the infrastructure of social and natural science extend far beyond the traditional boundaries of academia. KADIS addresses critical needs of private, tribal, and governmental archaeology programs. In addition, it enables serious archaeological research by individuals outside academia and those lacking physical or financial capacity to do fieldwork. It provides a means to maintain the long-term utility and accessibility of irreplaceable primary data in the face of inadequate metadata and rapidly changing technology.

***Broader Societal and Educational Impacts:*** This research will engage multidisciplinary a team of graduate assistants and undergraduate interns and will be a testbed for Computer Science students to explore key issues of science informatics. Undergraduates worldwide can become a new community of users as critical thinking exercises in anthropology courses are redesigned to employ large-scale research datasets using KADIS, rather than the artificial data usually analyzed.

**Co-PIs: Kelly Knudson and Christina Torres-Rouff (The Colorado College)**

**Title: COLLABORATIVE RESEARCH: A BIOARCHAEOLOGICAL APPROACH TO IDENTITY IN THE MIDDLE HORIZON TO LATE INTERMEDIATE PERIOD TRANSITION IN SAN PEDRO DE ATACAMA, CHILE**

Proposal under review, NSF Physical Anthropology program

**Project Summary**

Throughout the Andes, the Late Intermediate Period was a time of cultural restructuring and the flattening of social hierarchies. In the course of this period, individuals living in northern Chile's Atacama Desert endured the collapse of an influential foreign state, poverty, environmental decline, and the appearance of a culturally distinct group nearby, all of which may have affected how identity was portrayed in the body and the grave. This project will assess the relationship between biological and cultural identities through bioarchaeological analysis of skeletal remains (n=1,224) and their associated mortuary contexts from the late Middle Horizon (Coyo phase, AD 750-1000) and the Late Intermediate Period (Yaye phase, AD 1000-1200 and Solor phase, AD 1200-1470). The goal of the proposed research is to investigate the construction, projection, and manipulation of Atacameño identity during this tumultuous prehistoric transition.

Situated at the intersection of theoretical inquiry concerning biological and cultural identity, the proposed research is uniquely able to address two interrelated questions. First, is there evidence of ethnogenesis in the Atacameño population as it confronted significant cultural and environmental changes? Second, given that groups in the Loa River Valley crafted contrasting cultural identities to those in San Pedro de Atacama, are they in fact also biologically distinct populations? A bioarchaeological approach will be used to assess these questions. Demographic and biological affinity data will provide information on biological identity, strontium and oxygen isotope data will provide information on geographic origin, and cranial modification data and the mortuary context will be used to interpret different cultural indicators of identity. This research project will address these questions during three seasons of data collection from 1,224 skeletal remains and their associated mortuary context housed at the Museo Arqueológico R.P. Le Paige in San Pedro de Atacama, Chile and laboratory and statistical analyses at Colorado College and Arizona State University in the United States.

**PI: Kelly Knudson**

**Title: POLITICAL INTEGRATION AND EXPANSION IN THE ANCIENT ANDES: WARI RESIDENTIAL MOBILITY USING ARCHAEOLOGICAL CHEMISTRY AND BIOARCHAEOLOGY**

Proposal under review, NSF Archaeology program

**Project Summary**

Although current research on archaeological empires is becoming increasingly sophisticated, identifying imperial expansion in the archaeological record is still problematic. The Wari polity is imperative for understanding the archaeological manifestations of imperial strategies, particularly political integration and expansion, because the Wari were alliterate and there are no written records of their political system. Archaeological chemistry and bioarchaeology can contribute to an understanding of Wari imperial integration and expansion by identifying immigrants at Wari-affiliated sites in the Andes. More specifically, the goals of this research project are as follows: 1) to identify first-generation migrants at Wari-affiliated heartland and hinterland sites, 2) to investigate the role of Wari residential mobility in political integration and expansion, 3) to elucidate the role of local and non-local individuals in Wari ritual activities including trophy head taking, 4) to determine local isotope signatures for geologic and environmental regions in what is now central and southern Peru, and 5) to establish methodologies for strontium, lead and oxygen isotope analyses as well as the identification and elimination of diagenetic contamination in archaeological bone and tooth enamel samples. These goals will be accomplished by analyzing strontium, lead and oxygen isotopes and trace element concentrations in archaeological human tooth enamel and bone from the Wari-affiliated sites of Conchopata, Beringa, La Real, Cerro Baúl and Ancón at the Archaeological Chemistry Laboratory and W.M. Keck Foundation Laboratory for Environmental Biogeochemistry at Arizona State University and the Isotope Geochemistry Laboratory at the Field Museum of Natural History.

**Co-PIs: Kelly Knudson and Lisa Frink (University of Nevada at Las Vegas)**

**Title: ARCHAEOLOGICAL ACTIVITY AREA ANALYSIS IN COASTAL WESTERN ALASKA THROUGH SOIL CHEMISTRY AND ETHNOARCHAEOLOGY**

Proposal under review, NSF Polar Programs

**Project Summary**

Archaeologists employ a wide range of scientific methods to analyze the archaeological record of human existence, providing us with an important long-term perspective of the human experience on earth. Frequently, archaeological sites lack the material and physical evidence needed to answer the deeper questions about these important human behaviors. Traditionally, soil analysis has been used to identify the presence or absence of humans, plants and animals, and to delineate archaeological site boundaries. However, these analyses fail to illuminate how subsistence operations are organized and how subsistence behavior has changed over time. This project will develop methods and new data derived from chemical and genetic analyses of Arctic soils that will allow archaeologists to move beyond identifying the mere presence or absence of human activity to identifying the specific activities that took place thousands of years ago, leading to a more coherent understanding of the patterns and consequences of human behavior.

Alaska is optimal for work that investigates cultural transitions, and has been likened to a “laboratory of change”. Ethnoarchaeological data will be collected and documented from the contemporary occupation of the village of Tununak and the historic occupation of Tununak, located on Nelson Island in the Yukon-Kuskokwim Delta of western Alaska. These data will be compared in order to 1) clarify how, where, why, and by whom descendent subsistence activities are performed, 2) elucidate how these activities and their meanings have changed or persisted over time, and 3) further develop methods to better identify specific archaeological activity areas through their biogeochemical signatures in the soil.

**PI: Curtis Marean**

**Title: THE MOSSEL BAY ARCHAEOLOGICAL PROJECT (MAP)**

NSF, Archaeology Program  
Hyde Family Foundation

**Graduate Students:**

Jessica Thompson  
Erin Thompson  
Jocelyn Bernatchez  
Hope Williams

The Mossel Bay Archaeology Project, led by Curtis W. Marean (ASU) and Peter Nilssen (Iziko South African Museums), is a long-term field study of the Middle Stone Age (MSA) in the Mossel Bay region. The MSA in South Africa has gained increasing attention due to the discovery of bone tools at Blombos Cave, the abundance of ochre suggesting artistic expression, the presence of a variety of lithic assemblages with advanced technological characteristics, and debates over the interpretation of the fauna. Linked to these findings are debates over the antiquity of modern human behavior, with some researchers arguing that the South African evidence suggests an early origin of modern behavior as far back as 120,000 years ago, while others argue for late origin at roughly 70-50,000 years ago. Resolution of these debates relies on two advances: improvements in our theoretical approach, and an improvement of the empirical record in Africa. We initiated fieldwork at Mossel Bay on the southern coast of the Cape to address the latter deficiency.

Our field research to date demonstrates that the Mossel Bay region has an unusually rich MSA record. We have conducted test excavations at 3 sites, and more extensive excavations at a site named 13B. At 13B we have identified the oldest known systematic evidence for the use of pigment, at least as old as 180,000 years ago, and perhaps older. Equally importantly, we developed a preliminary study of the rich archaeological and geological record for paleoenvironmental and paleoclimatic change, and that work led to the SACP4 project.

**PI: Curtis Marean**

**Title: SOUTH AFRICAN COAST PALEOCLIMATE, PALEOENVIRONMENT, PALEOECOLOGY, PALEOANTHROPOLOGY PROJECT (SACP4)**

NSF, HOMINID program  
Hyde Family Foundation

**Graduate Students:**

Jessica Thompson  
Erin Thompson  
Jocelyn Bernatchez  
Hope Williams

**Project Summary**

Studies of ancient climates and environments are two of the few scientific endeavors that neatly tie together our ability to understand past human evolution and the future human condition. SACP4 is the first large transdisciplinary project to target the southern reaches of the southern hemisphere in an attempt to develop a unified record of climate and environmental change over the last 400,000 years, with implications for understanding our past and future.

The warming of the earth, and its likely anthropogenic cause, are now widely recognized facts with potentially alarming implications for the future of the biosphere and its organisms. Past studies of climate change lay the foundation for our understanding of the relation between climate change (temperature, rainfall, winds and storms) and greenhouse gas levels. Paleoenvironmental studies provide us with the understanding of how the environment (vegetation, above and below-ground water, fauna, etc.) responds to climate change. The two together provide the framework for predicting the future of the biosphere.

Modern humans likely evolved in Africa between 300,000 and 100,000 years ago. It is well documented that the bio-behavioral adaptations of fully modern hunter-gatherers are intimately tied to climate and environment. Importantly, as human bio-behavioral complexity increased, Pleistocene climates became harsher during glacial stages and more variable, a pattern that terminates at 10,000 years ago with the introduction of the modern epoch, the Holocene.

There is an outstanding record for paleoclimates and paleoenvironments for this time slice in western Eurasia, but little is known for the contemporary African record where modern humans evolved. At the same time the Eurasian record has been the foundation for our understanding between climate and environmental change, and thus is the basis for many of the predictions for changes induced by global warming. That record tells us little about the tropics and southern hemisphere. This project jump-starts the development in Africa of a detailed paleoclimatic and paleoenvironmental record with a transdisciplinary and international project tightly integrated between researchers grounded by the same problem orientation focused on the south coast of South Africa.

We target three goals: 1) developing in the south coast of South Africa a *continuous* and detailed paleoclimatic and paleoenvironmental sequence from 400-30,000 years ago, 2) correlating that record to the global record for paleoclimatic change as reflected in the marine sediment and ice core records for the Northern and Southern Hemispheres, and 3) testing a

series of specific hypotheses about the relation between paleoclimate and paleoenvironmental change and hominin evolution.

We will conduct field and laboratory studies to generate long and tightly dated continuous sequences of continental paleoclimate and paleoenvironmental change, and embed within these long sequences, fine-grained sequences that document short term effects on vegetation of millennial to decadal-level global climatic change. Isotopic and trace-element analysis of speleothems (stalagmites, stalactites, and flowstones) dated by highly precise U-series techniques provide the best continental source for these sequences, and we will develop these from both coastal and deeper terrestrial (Cango Caves) locations, sampling systems that are under varying influence of marine and interior climatic systems. Placed within these sequences will be environmental information from archaeological materials and geologic features, thoroughly dated by hundreds of U-series and OSL dates. This will allow us to refine our understanding of floral and faunal changes that occur in reaction to larger scale regional and global climatic change. These include isotopic studies (of ostrich eggshell [OES], marine mollusks, and the teeth of grazing mammals), zooarchaeological and taphonomic studies of mollusks, fish, and mammals, and studies of geomorphic features such as beach rock, raised beaches, dunes, and aeolianites (cemented dunes). All will be integrated into 3-D GIS models of landscape and sea level change, and cave formation and infilling.

**PI: Ben Nelson**

**Title: CONNECTIONS AND IMPACTS OF NORTHERN AND WEST MEXICAN CULTURES**

**Graduate Students:** Christine Berney, Oralia Cabrera, Matthew Chamberlain, Sara Dvorak, Michelle Elliott, Michael Foster, Jaime Holthuysen, Loni Kantor, Rebekah Parks, Denise To, Paula Turkon, Christian Wells

**Project Summary**

Scholars and students from both sides of the U.S.-Mexico border are working on an ASU-based project to understand connectivity between developments in northwest Mexico and surrounding regions, especially the American Southwest, ca. A.D. 200-1500. Most research about how regions become globalized is conducted in contemporary contexts, but the ancient world was replete with cycles of interconnection. Peoples in different regions engaged in technology transfers and ideological shifts long before there was a Pony Express or a worldwide web. We are investigating the practices, symbols, and objects that were transmitted across the deserts of Zacatecas, Durango, Chihuahua, Arizona, and New Mexico, and along the coasts of Colima, Nayarit, Sinaloa, and Sonora. Practices as diverse as warfare and ball playing were important parts of this interaction process. We are reconstructing the temporal, spatial, and social contexts of crafted objects such as copper bells, turquoise, and shell trumpets. To understand these exchanges, we must examine the patterns of artifact occurrence as well as regional political histories and environmental conditions. We hypothesize that political leaders, priests, merchants, shamans, warriors, metallurgists and other craft specialists built distant relations to construct power, especially during local political transformations. In characterizing these actors, cycles, and systems, we seek to understand their systems of symbolic and economic interaction and to relate them the realities of today's indigenous world.

**PI: Ben Nelson**

**Title: ARCHAEOLOGICAL INVESTIGATIONS AT LA QUEMADA, ZACATECAS, NORTHERN MEXICO**

**Graduate Students:** Christine Berney, Oralia Cabrera, John Carpenter, Sara Dvorak, Michelle Elliott, Bradley Ensor, Glenn Stuart, Loni Kantor, David Kice, John Millhauser, Ramón Ortiz, Michael Rizo, Ian Robertson, Steve Swanson, Denise To, Paula Turkon, Victoria Vargas, Christian Wells

**Project Summary**

For over 15 years, Mexican and American archaeologists and students have dug ancient ruins, walked the high desert landscape, and worked in laboratories to understand the rise and fall of La Quemada, Zacatecas. We want to know why societies become complex, developing social hierarchies with specialized economic, political, and religious roles for their members. Why do civilizations expand? Northern Mexico's ancient past is an ideal context for studying these questions. During the period A.D. 400-1500, La Quemada and several other monumental ceremonial centers arose and collapsed in the region, coinciding with a geographic expansion and retraction of the cultural patterns of Mesoamerica. La Quemada (A.D. 500-900) is a monumental fortress and ceremonial center; its ruins include colonnaded halls, ball courts, causeways, grand staircases, and ordinary houses. Agricultural terrace systems and villages dot the surrounding valley. Archaeologists have proposed that La Quemada was a trading outpost on the turquoise trail to the American Southwest, or the castle of a central Mexican feudal lord who came to take advantage of improved climatic conditions, or a fortress to protect central Mexico from incursions from this northern territory, or a way station for marauding tribes who ultimately became the Mexica (Aztecs). Project members, in contrast, believe that the local indigenous populations played a large role in La Quemada's transformation. We have conducted seven seasons of excavation and numerous studies of sites, artifacts, and excavated materials to evaluate these propositions. The work continues with specialized analyses of polished stone mirrors, cut marks on human skeletons, animal bones, as well ethnoarchaeological, linguistic, and paleoenvironmental analysis. A comprehensive monograph on the excavations and analyses is in preparation. While the earlier explanations for cycles of social complexity in the region emphasized conquest and domination by foreign forces, the new evidence indicates that La Quemada grew as local religious leaders attracted followers and assumed regional importance. In doing so, they interacted with other similar actors across great distances, adopting and inventing key Mesoamerican practices, including ancestor veneration, monument-building, warfare, crafting, feasting, and long-distance exchange.

**Co-PIs: Ben Nelson and Chris Fisher (Colorado State)**

**Title: LANDSCAPE RECONSTRUCTION IN THE MALPASO VALLEY, ZACATECAS, MEXICO**

**Graduate Student:** Michelle Elliott

**Project Summary**

Scientists around the world have observed grasslands turning into deserts. How do human populations respond when this happens and to what degree are they responsible? Because the process may take centuries, even millennia, it is difficult to know. Archaeologists have the potential to document the desertification of grasslands on a time scale far grander than that of written history, and the Malpaso Valley, Zacatecas, is a strategic place in which to do so. Like several other valleys in northern Mexico region, it was occupied for a few centuries by a large farming population only to be abandoned. These valleys were a zone of frontier expansion and contraction for Mesoamerican civilization; the main Malpaso Valley site, La Quemada, dates to around A.D. 500-900. Our international, interdisciplinary research group is evaluating environmental conditions before, during, and after this occupation. We are interested to learn whether the abandonment was associated with a drying trend in the regional climate and whether there is evidence of degradation of the environment by the ancient farmers. In addition to the archaeological evidence excavated from the main site and subordinate villages, we have made backhoe trenches in the Malpaso River flood plain to collect sediments, pollen, phytoliths, paleomagnetic samples, and radiocarbon samples. We have detected changes in the streambeds indicating erosion and are using ancient pollen and phytoliths to characterize vegetative cover. These data allow us to reconstruct environmental conditions at different points in time and evaluate hypotheses about the extent of change, the human responses, and the human role in creating disturbances that may have contributed to environmental changes.

**PI: Margaret Nelson, Marty Anderies, Michelle Hegmon, Keith Kintigh, Ben Nelson**

**Title: LONG-TERM COUPLED SOCIOECOLOGICAL CHANGE IN THE AMERICAN SOUTHWEST AND NORTHERN MEXICO**

NSF, Biocomplexity in the Environment Program

**Faculty collaborators at ASU:** David Abbott, Marco Janssen, Ann Kinzig, Kate Spielmann

**Graduate students:** Stephanie Kulow, Scott Ingram, Matt Peeples, Karen Schollmeyer, Robert Cox, Cathryn Meegan

### **Project Summary**

Each generation transforms an inherited social and environmental world and leaves it as a legacy to succeeding generations. Long-term interactions among social and ecological processes give rise to complex dynamics on multiple temporal and spatial scales—cycles of change followed by relative stasis, followed by change. Within the cycles are understandable patterns and irreducible uncertainties; neither stability nor transformation can be taken as the norm. But, what fosters stability or contributes to transformation over long cycles? What vulnerabilities can be tolerated and which tip a system into transformation and at what scale? Resilience theorists have built an understanding of social and ecological vulnerabilities, stability, and transformation based on studies of contemporary socioecological systems. This project will be an interdisciplinary collaboration of archaeologists, mathematical modelers, ecologists, and environmental scientists that questions and examines some of these understandings by applying archaeological and ecological analyses and formal dynamical modeling. Archaeology is attuned to cycles of change over the lifespan of a society -- heightened inter-societal interaction, economic intensification, and large-scale anthropogenic environmental change -- thus, it extends scientific observation of stability and transformation beyond all social memory. Archaeologically documented case studies in the American Southwest and Northern Mexico provide the information for investigating long-term human-environmental interactions. The project will proceed by 1) compiling documentation on up to four archaeological cases, 2) examining their pan-regional connections, and 3) employing mathematical modeling and subsequent archaeological and ecological analysis to abstract the key variables and processes underlying periods of cultural stability and both rapid and protracted transformations. The empirical investigations provide substantive contexts for the models, while the models will foster insight into generalizations that are then examined in empirical contexts. This iterative process will lead to insights that could not be derived from any single approach nor can they be derived from the short time span available in contemporary study of social or ecological change.

This project will influence the refinement of theory and understanding of processes of socioecological change. First, an intensive collaboration of archaeologists specializing in the American Southwest and Northern Mexico will contribute a new level of understanding of the social and environmental interactions underlying important episodes in human history. Second, through archaeology's deep time perspective, this project will examine the utility of resilience theory as applied to coupled socioecological systems, demonstrate the value of archaeology to ecological theory, and further scientific understanding of current socioecological problems through refinement of concepts and theory. Third, this project will identify the dynamics of transformation and stability as conditioned by cultural and environmental contexts, strategies for coping with uncertainty, and

varying constraints of long-term legacies. At the most practical level, this study will promote awareness of some of the human strategies for dealing with uncertainty and change, as well as awareness of how human actions leave legacies of resilience or degradation. In addition, this project will immerse students in an interdisciplinary research community that will spark development of professional skills and encourage them to exchange knowledge about coupled human and environmental systems. Global perspectives and international collaborations will be fostered by engaging students and researchers from the US, Mexico, France, and the many nations represented in the Resilience Alliance.

## **Co-PIs: Arleyn Simon and George Cowgill**

**Title: COLLABORATIVE RESEARCH:  
RADIOCARBON DATING OF MESOAMERICAN LIME MORTARS AND PLASTERS**

NSF, Archaeology Program

**Graduate Student:** Tatsuya Murakami

### **Project Summary**

With National Science Foundation support, an interdisciplinary and multi-institutional team including faculty and students from the University of Arizona (Dr. Greg Hodgins and Ms. A.J. Vonarx) and Arizona State University (Dr. Arleyn Simon, Dr. George Cowgill, and Mr. Tatsuya Murakami) will explore a method for directly dating mortars and plasters within Mesoamerican monumental structures based upon their radiocarbon content. Mortars and plasters harden by the incorporation of atmospheric carbon dioxide into their structure, thus fixing the  $^{14}\text{C}$ -content of the material at the time of construction and offering the possibility of dating construction events. Refinement of Mesoamerican chronology will provide insights into technological style, regional variation, and temporal change and continuity.

At present, the radiocarbon dating of lime-based construction materials has been carried out predominantly within European and Middle Eastern contexts. Yet, the application of the approach to Mesoamerican materials is ideal, given the widespread use of lime-based products and our growing knowledge of prehispanic lime plaster technology. Our previous research indicates that the optimal strategy for method development requires simultaneously dating mortar or plaster carbonates along with organic inclusions isolated from them. The project will analyze materials with well established organic inclusion contents selected from a variety of archaeological contexts to investigate the robustness of the method.

The project proposes to date materials from three sites within Mesoamerica: El Naranjal, Quintana Roo, Mexico, and Tecalote, Guatemala, in the Maya Lowlands; and, the Pyramid of the Moon, Teotihuacan, in Highland Mexico. From the first two sites, we will obtain mortar or plaster samples containing organic inclusions that can be radiocarbon dated in parallel with mortar and plaster carbonates. Plaster samples from numerous construction phases of the Pyramid of the Moon have also been obtained. Several have stratigraphic association with both ceramic and radiocarbon dated layers.

The interdisciplinary team has expertise in Mesoamerican archaeology, artifact and materials characterization, studies of ancient technology, and radiocarbon dating. Accessible facilities are ideal for this work and include the Archaeological Research Institute and Goldwater Center for Solid State Science at Arizona State University and the NSF-Arizona Accelerator Mass Spectrometry Laboratory and the Department of Anthropology Archaeometry Laboratories at the University of Arizona.

The broader impacts of the study are that it will advance the application of AMS radiocarbon dating to lime mortars and plasters in Mesoamerica allowing archaeologists to date construction episodes. This method has potentially broad application given the widespread use of lime plasters and mortars throughout Mesoamerica over long periods of time. The

development of mortar dating methods within the NSF-Arizona AMS Laboratory will potentially allow such analyses to be offered to the archaeological community on a regular basis and will make substantive contributions to the refinement of Mesoamerican chronology and interpretation of this complex and fascinating region.

Two graduate students will be trained in radiocarbon sample preparation procedures and will utilize this research as part of their doctoral dissertations in anthropological archaeology and archaeological science. Undergraduate students will participate in the compositional study of the samples and their preparation for dating. The characterization and collection of datable plasters will involve continued cooperation with colleagues and institutions in Mexico and Guatemala. These findings will be shared on an international level through presentations and publications in natural science, archaeology, and social science.

**PI: Michael Smith**

**Title: URBANIZATION AND EMPIRE AT THE AZTEC-PERIOD SITE OF CALIXTLAHUACA (TOLUCA VALLEY, MEXICO)**

NSF, Archaeology Program

**Graduate students:** Angela Huster, Juliana Novic

**Several new students to be added for 2007 field season.**

### **Project Summary**

This project will conduct archaeological fieldwork at the Aztec-period urban center of Calixtlahuaca in the Toluca Valley. A sample of houses and terraces will be excavated, and the urban settlement will be analyzed with spatial and built-environment methods. As one of the few Aztec cities with both excavated public architecture and open residential areas available for fieldwork, Calixtlahuaca holds unique promise to advance understanding of two of the major research themes in Aztec archaeology: imperialism and urbanization.

Calixtlahuaca was the political capital of the Toluca Valley prior to Aztec conquest in 1478. Archaeologist José García Payón excavated public buildings and burials in the 1930s. The proposed project builds upon this earlier work in two ways. First, project members will analyze the remains from the 1930s excavations, most of which remain unstudied and unpublished. Second, this project will pursue a different kind of archaeology, focused on houses and domestic activities, which will complement the earlier focus on temples and palaces.

The initial field season will be devoted to systematic collection of surface artifacts and the development of a GIS (geographical information system) to pursue a variety of spatial analyses. A second, longer, field season will focus on excavations of residential features and agricultural terraces. These will allow the reconstruction of domestic activities and conditions within the context of the site's hillslope setting. Two specialized methods will aid the archaeological fieldwork: geoarchaeological investigations of terracing; and geophysical prospecting (ground-penetrating radar) to help locate and study buried structures. The standing monumental architecture will be remapped electronically, permitting the 3-dimensional virtual reconstruction of the city and its natural and built-environment settings. A third season will be devoted to the analysis of excavated artifacts.

### ***Intellectual Merit***

This research will extend the PI's program of archaeological research into the effects of Aztec imperial expansion on provincial peoples to a new region. As a frontier zone between the Aztec and Tarascan empires, the Toluca Valley presented the former empire with benefits and challenges very different from Morelos, where the PI worked previously. By comparing the results with the earlier fieldwork in terms of key research questions, the process of Aztec imperial expansion will be illuminated. The project will also apply a new approach to four dimensions of ancient urbanism: urban form, urban life, urban functions, and urban meaning. Research questions on the form and urban organization of Calixtlahuaca will be answered by combining data from surface collections, house and terrace excavations, and reanalyses of

García Payón's excavations. This project will contribute to the revitalized field of "household archaeology" by investigating variability among domestic settings within the social context of the urban built environment. Results on Aztec imperialism and urbanization will contribute to a growing body of comparative data on these processes in ancient states worldwide.

***Broader Impacts***

The Postclassic ceramic chronology developed by this project can be applied to other sites in future research in the Toluca Valley. This is the start of a long-term commitment to scientific research in the Toluca Valley by the PI, his students, and U.S. and Mexican colleagues. Collaboration with local scholars and institutions, including the establishment of an archaeological laboratory facility at the Colegio Mexiquense, will help improve the scientific infrastructure of the Toluca area. Publicity and a variety of specific actions of the project will improve public access to the site of Calixtlahuaca (an official archaeological zone now open to the public, but rarely visited). Publication in print and internet venues will contribute to the public appreciation of the site, and publication in standard scholarly formats (including a scientific internet site) will disseminate results to the wider community of scholars.

**PI: Michael Smith**

**Title: CURATION OF ARCHAEOLOGICAL MATERIALS FROM MORELOS, MEXICO**

NSF, archaeology program

Over the past quarter-century, David C. Grove, Kenneth G. Hirth, and the author have directed a series of archaeological field projects in the Mexican state of Morelos. These surveys and excavations at sites such as Chalcatzingo, Xochicalco, and Yautepec have made important contributions to knowledge on several levels. They have revolutionized our knowledge of the prehistory of Morelos; they have helped illuminate the nature of ancient Mesoamerican cultures and their changes through time; and they have contributed to methodological and theoretical advances in modern archaeology. One measure of the scientific merit of these projects is that the National Science Foundation has provided the bulk of their funding.

The collections of archaeological materials from these projects constitute a unique database that continues to produce new research and insights long after the completion of the initial fieldwork. These collections have been stored haphazardly in a variety of facilities controlled by Mexico's Instituto Nacional de Antropología e Historia (INAH), ranging from a sixteenth-century convent to small storage sheds to open-air shelving. The curation of the collections has now reached a crisis stage (for a variety of reasons), and if a solution is not found soon much of the material will have to be discarded or else stored under conditions that will cause the rapid deterioration of bags, boxes, and notes, leading to the loss of crucial information.

This proposal is to construct a new storage facility to curate the collections from past and future U.S. archaeological fieldwork projects in Morelos. There will also be space to store collections from Mexican projects in the state. The facility will be built on the property of the Centro INAH en Morelos in Cuernavaca, and control and maintenance will be in the hands of a governing board composed of both U.S. archaeologists and INAH officials. Construction of this facility will ensure the long-term preservation and viability of scientifically important artifact collections, and thereby contribute to ongoing archaeological research in Morelos. Nearly all of the existing collections from completed U.S. fieldwork projects have been used for new analyses after the fieldwork, and this will continue for current and recent projects as well. The proposed facility will become a crucial part of the archaeological infrastructure of Morelos, and its construction at this time will be amply repaid with the results of current and future analytical research on these important collections.

***Intellectual Merit.*** This project will permit continuing scientific analyses of important primary archaeological collections, thereby contributing to a wide variety of intellectual issues and areas.

***Broader Impacts.*** This facility will benefit many future researchers, including U.S., Mexican and other scholars. It will improve the scientific infrastructure of the Centro INAH en Morelos by providing space for both storage and work on collections.

**PI: Katherine Spielmann**

**Title: OHIO HOPEWELL CRAFT PRODUCTION PROJECT**

**Graduate Students:** Sophia Kelly, Melissa Kruse, Scott Ingram, Scott Thompson

**Project Summary**

The project is investigating how the production of ritual paraphernalia was organized at the Ohio Hopewell earthwork of Seip, outside of Chillicothe, Ohio. The known Ohio Hopewell (200 B.C. – A.D. 400) archaeological record is largely comprised of the structures and artifacts that were used in ritual performance. Geometric earthworks were the loci of communal rituals; preparation, performance, and subsequent discard of ritually charged objects took place there. Very little production of ritual icons, ornaments, and garments appears to have occurred in the residential hamlets. Instead, production was concentrated in the ritual precincts. What makes Ohio Hopewell unique among contemporaneous societies is the immense geographic scale on which the procurement of raw materials for the production of ritual items took place, as large quantities of raw materials were acquired from geographically distant and difficult to access places (e.g., Isle Royale and the Yellowstone Basin), and brought back to the earthworks for fashioning into ritual paraphernalia of various kinds.

The hypothesis that the project is addressing is whether non-mound structures within the circular earthwork at Seip were the loci of craft production. If they were, this would advance our understanding of the organization of Hopewell ritual craft production, and would have more general implications for the organization of crafting in small-scale societies. Data from the 1970s excavations of several structures (Baby and Langlois 1979) suggest that some may have been the locus of workshop-scale craft production of mica cut-outs and possibly of copper ornaments. Workshop-scale production is particularly interesting in the Ohio Hopewell context because such production is generally typical of more complex economic systems, particularly in urban settings (Rice 1987:184-186). Household production generally characterizes less economically and politically complex societies. Workshops, in contrast, involve greater concentration and intensity of production and recruitment of craftspeople beyond an individual household (Costin 1991). The Hopewell data from Seip may thus challenge our traditional notions about links between degree of political complexity and the intensity and scale of craft production (Spielmann 2002).

At Ohio Hopewell earthworks, most craft-related debris (e.g., mica cut-out pieces, obsidian debitage) has been found in deposits under mounds or in midden debris, and not in the context of production. At Seip, however, excavations by Raymond Baby in the 1970s revealed a number of large structures (ca. 10 x 12 m in size) within the area encompassed by the circular portion of the earthwork (Baby and Langlois 1979). The structures were covered with a thick layer of midden, beneath which were intact floors, often containing pits. Baby and Langlois suggested that the lack of domestic debris, the variability in assemblage content across the structures, and their placement within the earthwork enclosure indicated that the structures were specialized workshops.

**PI: Katherine Spielmann**

**Title: SOUTHWESTERN PUEBLO SUBSISTENCE, DIET, AND HEALTH UNDER SPANISH COLONIZATION**

**Graduate Students:** Tiffany Clark, Katharine Rainey

**Project Summary**

The proposed project is concerned with the impact of Spanish labor and tribute demands on Pueblo subsistence practices, diet, and health in seventeenth century New Mexico. Beginning in 1598, when the first Spanish colony was established in New Mexico, Pueblo populations were faced with demands on their land, labor, and products. Although Spanish documents discuss the extraction of resources and labor, they do not explain how Pueblo populations modified their subsistence practices and diets in response to these demands. Nor do they discuss the degree to which Puebloan health was affected. Moreover, gender and age differences in colonial period activity patterns and health are poorly understood.

Systematically collected data are available for the project from seven seasons of excavation directed by the applicant at three Pueblo villages (Gran Quivira, Quarai, and Pueblo Blanco) in the Salinas area of central New Mexico, as well as from earlier projects at these sites which were sponsored by the National Park Service and the Museum of New Mexico. These villages were occupied both prior to and during the Spanish colonial period. One significant difference among them is the degree to which each had a resident Spanish friar and associated mission complex. These data thus provide a unique opportunity for a fine-grained analysis of the degree to which there was variation in Puebloan subsistence practices, given variation in the degree of Spanish presence. In addition, we know that tribute in the Salinas area was taken in corn and antelope hides, but we do not know whether or how the Salinas populations modified their subsistence practices in response to these demands. Moreover, governors of the province required Salinas Pueblo residents to collect and transport pinyon nuts and salt to Santa Fe and northern Mexico. This labor reduced the amount of time and effort Salinas Pueblo peoples could allocate to their own subsistence.

In order to evaluate the nature and degree to which Salinas Pueblo peoples modified their subsistence practices and their diet under Spanish colonization, macrobotanical, pollen, and faunal data both from the period preceding colonization and the period of Spanish colonization will be analyzed. Midden deposits dating from these periods have been excavated at all three pueblo sites. The subsistence analyses will address whether 1) corn production intensified, 2) the catchments from which food and fuel were harvested decreased, and 3) the intensity of large mammal procurement and hide processing increased after Spanish colonization. The degree of access to European domestic animals and plants will also be evaluated in the project. Osteological and dental data, which are available from prior studies of the human remains recovered during National Park Service excavations at Gran Quivira, will be used to assess the nature of changes in activity patterns and health between the pre-colonial and colonial periods. Attention will focus in particular on similarities and differences by age and sex.

The project will provide a synthetic analysis and publication of the floral, faunal, and human osteological and dental data collected from Salinas Pueblo sites over the past 60 years by various agencies and projects. Regionally, the project will provide a wealth of data on Puebloan seventeenth century subsistence that can be compared to the growing body of archaeological subsistence information on other components of the Spanish colonial empire in New Mexico and Arizona. The data generated by the project also provide an unparalleled opportunity to compare indigenous responses to Spanish colonization between the southwestern and the southeastern United States, where a great deal of interdisciplinary research has focused on the impact of Spanish colonization on native peoples. Given that the timing and histories of missionization and the products extracted from the native populations of the southeast are virtually identical to those in the southwest, such a comparison should prove highly illuminating.

**[Senior Personnel]: Katherine Spielmann, Keith Kintigh**

**Co-PIs: Sharon Hall and John Briggs (School of Life Sciences)**

**Title: LEGACIES ON THE LANDSCAPE: PREHISTORIC HUMAN LAND USE AND LONG TERM ECOLOGICAL CHANGE**

NSF, Ecosystems Program

**Graduate Students:** Melissa Kruse, Catherine Meegan, Matt Peeples, Karen Schollmeyer, Jason Sperink

### **Project Summary**

Ecologists have begun to realize that many previously-considered “pristine” ecosystems have been altered by past land use activities. While large-scale, post-colonial land use changes are expected to some extent to leave an ecological imprint, more surprising has been the discovery that prehistoric human communities, even ones that disappeared from the landscape centuries ago, can have significant impacts on the structure and functioning of modern ecosystems. While the literature shows that the legacies of disturbance likely differ depending on vegetation type, population dynamics, and speed of nutrient cycling through ecosystems, only a handful of studies have explored long-term ecological legacies of human disturbance through the archaeological record, with few of these focused on slow-growing arid land systems that take centuries or more to develop (Briggs et al. 2006). Furthermore, it is likely that different prehistoric land use activities or duration of those activities have left more or less persistent imprints on the landscape, but few studies are able to test the importance of prehistoric land use intensity without the confounding effects of recent land use events. This proposal builds upon an ongoing collaboration between ecologists and archaeologists at Arizona State University (ASU) focused upon the cultural and ecological effects of recursive human-environment interactions. **In this work, we propose to examine the long-term ecological legacies of land use intensity in two different ecosystem types of the southwestern US which supported agroecologically active and well studied populations of humans until 1200-1400 AD.** This unique perspective, accessible only through the archaeological record, will provide us with an understanding of the importance of humans and their varied land use activities as drivers of persistent ecological patterns and processes.

We will focus our investigations across a gradient of known prehistoric human activity in arid and semi-arid ecosystems of central Arizona that represent two ends of a spectrum of human occupation in population and duration. Our first site will be located at Cave Creek, located in the Sonoran desert of the northern Phoenix basin, which supported relatively large human populations for approximately four centuries using both irrigated and dry land farming techniques. Our second site is at Perry Mesa, located at higher elevation in the semi-arid desert grasslands of Agua Fria National Monument. Populations at Perry Mesa were smaller and more ephemeral than at Cave Creek, and were supported by only dry land agricultural fields and house gardens. In each system, we will evaluate the importance of land use intensity on modern ecological properties and processes by comparing areas of high intensity use (irrigated fields at Cave Creek, rain-fed terraces at Perry Mesa) with areas of relative low use (rain-fed terraces at Cave Creek, house gardens at Perry Mesa) and nearby areas where there is no archaeological evidence of human land use (off-site controls).

**The intellectual merit of this research** includes a unique, interdisciplinary experimental design in the spatially extensive and understudied arid and semi-arid ecosystems of the US Southwest where prehistoric human populations were some of the largest in North America. In addition, our proposal will contribute to an emerging literature that promotes an interdisciplinary approach to ecology and archaeology and will provide a framework to aid land managers in setting goals for maintaining and restoring archaeologically rich lands in the Southwest. **The broader impacts of this research** include interaction and knowledge exchange between students (both undergraduate and graduate students), faculty, members of local Native American communities for whom these lands are ancestral, and land managers at the Agua Fria National Monument and Tonto National Forest.

**PI: Barbara Stark**

**Title: ARCHAEOLOGICAL RESEARCH IN SOUTH-CENTRAL VERACRUZ, MEXICO**

**Graduate Students:** Chris Garraty, Alanna Ossa, Antonio Curet, Todd Howell, Thanet Skoglund, Lynette Heller, Barbara Hall, Neil Miller, Mike Ohnersorgen, Kevin Johns, Pam Showalter, Kris Sullivan, Oralia Cabrera, Mark Brodbeck, Sue Lewenstein, Linda Smith, Samantha Thornton, Brad Ensor, Erin Chase-Lingard

**Project Summary**

Long-term social, political, and economic change in an area of south-central Veracruz, Mexico, provides a research window into tropical Mesoamerica in the Gulf lowlands. The Proyecto Arqueologico La Mixtequilla, directed by Barbara Stark, is ongoing, with investigations that have enjoyed two major funding cycles with NSF and NGS support. The project research design has emphasized settlement pattern investigations, using systematic survey along with residential excavations. The characteristics and reasons for tropical urbanism, the proliferation of craft industries, the elaboration of a segmental social hierarchy, and the interruption of a long cultural tradition at the end of the Classic period are some of the domains of investigation. In particular, the regional information has been crucial in clarifying the local role of Teotihuacan, an expansionist highland state, and of the Aztecs, who absorbed the region into their empire. Project data have revealed a key role for the cotton industry, the timing and location of prismatic blade workshops using imported obsidian, pottery and figurine production, an intrusive ethnic enclave in the Middle Postclassic period, and ceramic trade and styles during Aztec times along with their implications for provincial (as opposed to imperial) strategies.

Research currently in the planning stage is focused on urban gardening and how it may account for aspects of settlement pattern as well as its role in complex society. Field research will be developed around this theme, offering additional student opportunities.

The project collections are mainly housed in a rental laboratory in Xalapa, Veracruz, Mexico, and are available for research projects. Importantly, the project data are almost entirely computerized and linked to a GIS mapping program, which allows a variety of research endeavors at ASU. A number of graduate students have participated in fieldwork and analyses, with many of them seeing their work to the publication stage. The project has supported several MA and PhD degrees.

**Co-PIs: Chris Stojanowski, Kelly Knudson, and Alicia Wilbur**

**Title: BIOARCHAEOLOGICAL FIELDWORK AND EXPLORATORY BIOCHEMICAL TESTING AT GOBERO, REPUBLIC OF NIGER**

NSF, Physical Anthropology Program

### **Project Summary**

This proposal seeks funding for high risk excavation of an early Neolithic cemetery containing 200-300 individuals located in the heart of the Ténéré Desert, Republic of Niger. The site of Gobero was first recorded in 2000 by Paul Sereno of the University of Chicago and was re-visited in 2003 when its true significance was determined. A large, international team of scholars has been assembled to mitigate the site in October and November 2006. Gobero is at risk for complete destruction by Saharan sands and looting by local peoples; the information contained at this unique site will be lost if not excavated immediately in collaboration with the Center for Bioarchaeological Research at Arizona State University.

Stojanowski will travel to Niger and serve as field osteologist and implement appropriate recovery and preparation methods for the human burials. Skeletons most at risk for exposure, erosion and looting will be excavated and returned to ASU's Center for Bioarchaeological Research for descriptive analysis. Baseline laboratory analysis of select materials recovered during surface survey in 2003 will inform Stojanowski's field sampling methodology. Co-PI Wilbur will attempt to extract DNA from four tooth roots and sequence two individuals using appropriate ancient DNA extraction protocol and PCR. This exploratory analysis will generate expected frequencies of DNA preservation. Co-PI Knudson will produce strontium, oxygen, and carbon isotope signatures for four individuals to assess diagenetic change in bone chemistry. Baseline data on underlying geological signal variability will be generated using modern and archaeological faunal samples.

### **Intellectual Merit**

Gobero is unique in northwestern Africa because of its antiquity (ca. 10000 – 6000 bp), large human skeletal sample (200-300 individuals), pristine preservation of utilitarian and symbolic material culture, presence of domestic *Bos* and caprine remains, as well as environmental ecofacts of the early Holocene lake environment which existed in the Sahara during the early Neolithic. While archaeological sites of this antiquity are not uncommon in the western Sahara, none have large cemeteries with associated habitation features. No other site preserves both Kiffian fishing and Ténérien pastoral skeletal samples. The average Neolithic skeletal sample numbers 12 individuals and dates to ca. 4500 ybp, considerably smaller and later than Gobero. The presence of a large early Holocene cemetery will allow, for the first time, inference of demography, community health, paleodiet, mobility, and biological relationships for populations living at a critical juncture of our history when new subsistence economies were adapted and communities shifted toward a sedentary orientation.

### **Broader Significance**

Excavation of Gobero will add a human component to the outreach initiative of Project Exploration, a Chicago-area non-profit organization that targets at risk youths from under-represented communities for science education and discovery. Lectures, museum exhibits, and supervised hands-on lab experience center this organization's outreach efforts. Material recovered from Gobero will also serve to establish a national museum in Agades, Niger. The

excavation includes scholars from three continents and will produce publications in English and French. The online hosting of osteological data anchors ASU's efforts to broadly disseminate human skeletal data for comparative research.

**PI: Chris Stojanowski**

**Title: LA FLORIDA BIOARCHAEOLOGY PROJECT**

**Collaborators:** Clark Spencer Larsen, Bonnie McEwan, Tiffany Tung

**Project Summary**

This project examines the biological signatures of post-contact changes in Native American social organization. Using microevolutionary models, the effects of population aggregation and demographic collapse are evaluated in the context of colonial ethnogenetic theory. Morphological data are used to reconstruct patterns of mate exchange, evaluate the effects of demographic collapse, and reconstruct mortuary patterns in mission communities associated with three distinct ethnic or linguistic groups in southern Georgia and northern Florida. The time period represented is ca. AD 1300 to 1750.

**P.I.: Saburo Sugiyama**

**Title: THE ORIGIN OF PLANNED CITY, TEOTIHUACAN, AND MONUMENTS: ANALYSES AND INTERPRETATIONS OF THE EXCAVATION DATA FROM THE MOON PYRAMID**

**Graduate Student:** Tatsuya Murakami

### **Project Summary**

By AD 250, the city of Teotihuacan had become one of the largest cities in the world, with three vast pyramid compounds, numerous minor public complexes, an extensive grid of well planned streets, and multi-apartment compounds housing a population of 100,000 residents. Today, Teotihuacan is recognized as one of the world's most significant cultural sites whose influence shaped later civilizations in the Americas and remains a major legacy of the Mexican past. Our understanding of Teotihuacan has fundamentally shifted as a result of the exciting discoveries from excavations over the last two decades at the major monuments of the ancient city. Although these large-scale excavations have produced a wealth of materials, several fundamental questions remain largely unresolved due to the fragmented and incomplete nature of the data. These include questions pertaining to the origin of pre-industrial urbanism, the social transformation process, and the nature of rulership in this pristine state. In order to fully comprehend the rich social, political, religious and economic life of Teotihuacan, the findings of the excavations must be catalogued, analyzed and disseminated before the pyramid offerings are required to be returned to the Mexican national authorities.

To accomplish this, an international team of experienced Mesoamerican researchers will thoroughly document, analyze, and interpret the excavation data and materials recovered from the Moon Pyramid Project, whose excavations concluded in December, 2004, as well as from other major excavations. It will include formal analyses of ceramics, stones, shell, human and animal bone, botanical remains, and other materials, in addition to C14, oxygen and strontium isotopic, DNA, provenance, and GIS studies. The second component will conclude the three-dimensional digital mapping of the city's central area. This mapping program has already been accomplished for the Moon Pyramid Plaza and will be extended to cover the whole central ceremonial zone, allowing for greatly enhanced interpretations of all of the major monuments within their city-wide contexts.

In addition, comprehensive databases will be developed to create a corpus of information on the pyramids of Teotihuacan employing multiple media to reach all interested parties, from Mesoamerican specialists to the lay-public.

***Intellectual Merit.*** The excavations of the Feathered Serpent Pyramid project uncovered sacrificial burial evidence that highlighted the important roles of institutionalized state military authority and the sacrificial rituals critical to the proclamation of powerful divine rulership at Teotihuacan. Findings at the Moon Pyramid complex provided an additional set of abundant and exceptional data that illuminate the formation and transformation processes of early political organization within the ancient urban center. The completion of the documentation of the excavation data, along with the expansion of the digital mapping program will greatly improve and broaden the current understanding of the major monuments at Teotihuacan. The preserved data will be of exceptional value to the wider scientific community and serve as an invaluable resource for future researcher projects. It is the aim of the research team to combine support from NSF with concurrent support from the Mexican and Japanese governments to complete the project within the present window of opportunity before the materials must be returned. Failure to do so would result in the permanent loss of invaluable data needed to form a complete analysis of Teotihuacan.

**Broader Impacts:** This project features a comprehensive dissemination plan for the data generated by the Moon Pyramid Project that includes published monographs in both English and Spanish, a comprehensive database for organizing the material analysis and 3D mapping, and an upgrade of the existing internet site on Teotihuacan through Arizona State University (ASU). Project data may be used for a diverse range of inquiries including the origin of ancient states, pre-industrial urbanism, prehistoric monuments and symbols, human sacrifice, and the role of warfare in human history. Ultimately, the data will become part of a larger archaeological cyberinfrastructure being created by the School of Human Evolution & Social Change at ASU. The completion of this collaborative, international project will represent a tremendous scientific accomplishment leading to the enhanced scientific value and socio-economic significance of Teotihuacan, which was designated as a World Cultural Heritage by UNESCO in 1987. Equally important, the project will enable modern civilizations to discover and connect with their history, cultural heritage and ethnic identity.