Stanford International Symposium

Transitions from Foraging to Farming in Ancient China and Beyond: An Archaeobotanical Perspective

April 21-23, 2017

Sponsored by:
Stanford Archaeology Center
Confucius Institute, Department of East Asian Languages and Cultures
Freeman Spogli Institute for International Studies
Presentation Title

The Origins of Agriculture in China – A View from Western Asia

Bio

Since 1968, Ofer Bar-Yosef has been teaching various courses in archaeology at Harvard and Hebrew Universities. He organized several international conferences on the Natufian culture (Valbonne 1989, Paris 2010), on the Levallois Technique (Philadelphia 1995), the Aurignacian culture (Lisbon 2003), and the Neolithic demographic transition (Harvard, 2007). Ofer has worked as an archaeologist since 1959 and participated actively in a wide range of excavations of prehistoric sites illuminating human cultural evolution. The sites are located in Israel, Sinai (Egypt), Turkey, Czech Republic, Republic of Georgia, and the People’s Republic of China. His work added evidence for early human dispersals from Africa to Eurasia at the site of ‘Ubeidiya (ca. 1.5 Ma) in the Jordan Valley. More recently, as a co-director of a large Israeli-French-American research program, he spent two decades of field and laboratory research in Kebara, Qafzeh, and Hayonim caves in Israel (with B. Vandermeersch, L. Meignen, P. Goldberg, A. Belfer-Cohen and others) demonstrating the early arrival of Modern humans in the Levant and the late appearance of Neanderthals in the Near East. Ofer studied Upper Paleolithic assemblages from Sinai, Israel, Czech Republic, Georgia, and currently in China. He co-directed the excavations at Netiv Hagdud, an early Neolithic settlement in the Jordan Valley with Prof. Gopher. In 2004-5 he co-directed the excavations at Yuchanyan cave (Hunan Province) with Prof. J. Yuan. Currently Ofer is involved in field programs in Georgia and China. He has co-edited 16 volumes (including four major site reports) and authored, or co-authored over 300 papers and book chapters.

Abstract

The advantage of a comparative geographic approach to the study of an archaeological research subject is that a model built and tested in a reasonably well-investigated area may assist us in building a model for conducting excavations in a relatively new region. This is my basic approach in advocating the Levantine or the Fertile Crescent model, to the issue of the transition from foraging to farming in China. More than two hundred years of gathering botanical and zoological information in western Asia where employed by archaeological research accompanied in the last 80 years by archaeobotanical and archaeozoological research allowed us to build a framework for reaching an understanding of ‘when’ and ‘how’ hunter-gatherers became farmers. Even the question of ‘why’ foragers began cultivation was studied within the context of population growth and competition for resources coupled with climatic fluctuations. Inward migration of foreigners from North Africa, an issue recently under study, based on palaeogenetics, supports a model of ‘relative demographic pressure’ as the trigger for the emergence of the Natufian culture. Several reasons currently recorded in Western Asia are not unique to this region. In a recent survey I tried to indicate that cultivation of wild plants, known for hunter-gatherers for millennia, were systematically cultivated for some time. However, domesticated crops in a few Centers (sensu Harlan 1971) were adopted through transmission of either seeds, techniques or incoming migrants, where crop species did not naturally grow. Apparently, as the archaeobotanical Chinese evidence from sites in the north (millet) and the south (rice) keeps accumulating, similar trends can be discerned. Cultivation of various annual plants is becoming evidenced as it was shown in the Japanese archipelago. Examples from other continents, such as Africa can be cited. Once basic farming was established, additional annual and perennial plants become domesticated. The Neolithic Revolution in the Centers was a fast process when compared to the length of human evolution. Ambiguities caused by the first published radiocarbon dates (especially those made on charcoal samples) led to misunderstandings where did the Domestication Syndrome achieved. Moreover, studies concerning the archaeobotanical information as independent of cultural changes (evidence for seafaring, river transport, social structure, etc.) resulted in the unfounded proposal to suggest many (up to 14-22) centers of domestication. In sum, I will try to present in my lecture how the Fertile Crescent model may assist the future study of the origins of agriculture in China.
The Yuezhuang site is one of about 16 Houli Culture settlements in Shandong Province, China and dates to ca. 8000–7500 cal. BP. Shandong University has excavated two other Houli culture sites are in Jinan city, including Xihe and Zhangmatun from which plant remains have also been collected. Palaeoethnobotanical research documents human–environment interaction and the local subsistence economy soon after the initiation of food production in the region. This economy supported a sizeable community that occupied a kilometer stretch of floodplain along south bank of the Nandasha River. So far, the archaeological evidence consists of pits and ditches, animal bone, pottery and stone tools but no dwellings. The earliest Houli Culture presence dates to about 9000 BP at Zhangmatun. Earlier dates (ca. 10,000 BP) have been reported from other sites, but they appear to be outliers. One of the questions our research addressed was: “where along the trajectory between hunting-gathering and agriculture did the Houli Culture economy sit?” In other words, to what extent had the Yuezhuang population developed a food production niche? In order to do so, charred seeds from a variety of plant taxa were recovered by flotation of sediment from pits and cultural strata. About 30% of the seed assemblage is crops: rice (Oryza sativa), broomcorn/common millet (Panicum miliaceum), and foxtail millet (Setaria italica subsp. italica). Several other plants such as soybean (Glycine max subsp. max or G. max subsp. soja), perilla (Perilla sp.), and chenopod (Chenopodium sp.) that are also cultivated in East Asia are also part of the assemblage. It is not clear whether they were cultivated, but we cannot rule out the possibility. This proportion is similar to Late Neolithic plant remains assemblages in the area. Most of the other plant taxa are from open, sunlit, and anthropogenic, disrupted habitats, similar to those documented for the late Neolithic Longshan Culture in Shandong Province. A few arboreal (woody) plants appear in the Early Neolithic archaeological record of Shandong. Anthropogenic habitats and their formation, maintenance and use, wetland exploitation, cultivation, hunting–gathering–fishing, and animal management characterize the mature (late) Houli Culture niche. Although not identical to Late Neolithic assemblages, it is quite similar, indicating that the Late Houli culture was substantially invested in resource management and food production. The Houli presence on the landscape also facilitated new ecologicalopportunities for plant and animal populations, some of which would eventually become economically important.
Moving Agriculture onto the Roof of the World: What Computational Modeling Tells Us About Forager/Farmer Interactions on the Tibetan Plateau

Jade d’Alpoim Guedes is an assistant professor of Anthropology at Washington State University. She is a paleoethnobotanist and computational modeller who studies how humans adapted their foraging practices and agricultural strategies to new environments. Jade earned her PhD at Harvard University in 2013 and carried out a postdoctoral fellowship in Earth Planetary Science where she developed computational models that charted the spread of agriculture to Southwest China and the Tibetan Plateau. She directs the paleoethnobotany laboratory at Washington State University where she has analyzed material from a wide variety of contexts across China, Southeast Asia, Harappa and the Pacific Northwest. She currently directs an NSF funded interdisciplinary fieldwork project in the Jiuzhaigou National Park that uses a combination of computational modeling, ancient climate reconstruction and geomorphology to chart how humans adapted their lifestyles to the challenging environment of the foothills of the Himalayas. This project also involves experimental research and field trials of crop landraces aimed at improving the models used to understand ancient crop distribution and their resistance to climate change.

Abstract

Research on agriculture's spread in East Asia has followed an underlying assumption: that farming produced equally reliable returns across the vast expanse of territories into which it spread and always placed farmers at a demographic advantage. Significant ecological barriers to growing crops on the Tibetan Plateau meant that the opposite was true. Using ecological niche modeling to illuminate how foragers and farmers interacted in environments marginal to crop cultivation, this paper demonstrates that the higher elevation reaches of the “third pole” constituted a barrier for expanding millet farmers. In these areas foragers maintained a competitive advantage. Following the end of the climatic optimum, decreasing temperatures effectively ended millet farmer’s expansion. It was only following the introduction of a suite of new crops and animals that the Tibetan economy as we know it today was able to flourish, but also that pastoralists and farmers finally began to truly encroach on forager territory.
**Presentation Title**

*Stone tool function, plant exploitation and foraging histories in Asia and Australia*

**Bio**

Richard Fullagar is employed as a Professorial Research Fellow in the Centre for Archaeological Science, University of Wollongong, Australia, and is also director of an archaeological company. He previously held research positions at the Australian Museum and the University of Sydney and has extensive field experience. He pioneered research into residues and usewear on stone tools and current projects include analysis of stone tools from Denisova Cave (Siberia, Russia), Liang Bua Cave and Soa Basin (Flores, Indonesia) and an early bone breakage site (California, USA). Recent publications include studies of experimental methodologies, early agriculture in the New Guinea Highlands, the oldest Australian occupation site (Madjedbebe) and Pleistocene grinding stones from Lake Mungo (southeastern Australia).

**Abstract**

In 2009, Denham et al. (Quat. Int. 202: 29–40) published a review of archaeobotanical evidence from Australia and New Guinea. We aimed to understand modern human colonization of the Asian-Australian region and how generalist practices and patterns of behaviour became more regionally distinct. We documented sophisticated plant exploitation practices in the Pleistocene, and Holocene complexities, with transitions to agriculture emerging in only some locations. It is timely to review again these data in the light of new archaeological finds from the region, new methods of analysis and revised age estimates for modern humans (e.g. at Majeddebe, northern Australia, by 65 ka, and at Liang Bua, Indonesia, by 50 ka). The earliest evidence of occupation in Australia shows plant exploitation, grinding technologies including edge-ground hatchets, bifacially retouched tools and evidence of art with haematite crayons. Data from Madjedbebe confirm evidence for early seed grinding, tuber processing and nut exploitation. Polished flake tools from Liang Bua indicate a range of plant processing for at least the past 30 kyr. The model has implications for analyzing the Chinese stone artifact record, which potentially provides a much longer record of modern human plant exploitation.
Presentation Title

Updated Clues for the Spreading of Agriculture in SE China: Multi-disciplinary Evidences

Bio

Ge Wei is an associate professor at Xiamen University. He is also the lab director for Anthropology and Archaeology for the School of humanities. He received his Ph.D. from the University of Science and Technology of China for the dissertation on the Application of Starch Analysis in Chinese Archaeology in June 2010. Dr. Ge’s research work now mainly focuses on the reconstructing of subsistence economy of prehistoric SE China, by combining multiple evidences from botanical remains and isotopic analysis of animal bones.

Abstract

To investigate the development of prehistory agriculture of SE China, we conducted multi-disciplinary studies in Fujian Province. Researches on micro-botanical remains from Qihedong cave site indicating a tradition of tuber use from late Pleistocene to historical period, which could be the reason for lack of grass agriculture in SE China. Carbonized seeds found from Hulushan late Neolithic site proved the agriculture of rice and millet of 4000 BP. Stable isotope analyses of human and pig bones from Tanshishan, Pingfengshan and Huangguashan coastal shell midden sites suggest the existing of rice cultivation of 5000 BP and millet cultivation of 3700-3500BP. These findings provide new information for the spreading of prehistory agriculture in this area.

Presentation Title

Agriculture and Political Economy: Gordion in the Longue Durée

Bio

Lisa Kealhofer is a Professor in the Anthropology and Environmental Studies and Sciences Departments at Santa Clara University. She received her Ph.D. in Anthropology from the University of Pennsylvania. Her research areas include Anatolia and Southeast Asia, where she focuses on production and exchange (ceramics), land use, environmental change, and practices of power. Current projects include the study of political landscapes in Anatolia and in Southeast Asia, as well as collaborations in the western Pacific.

Abstract

Archaeologists have long argued that agricultural strategies, particularly ‘intensification,’ are a major factor in destabilizing environments. Narratives of societal collapse standardly point to a component of environmental degradation in discussions of political breakdown. Recent work in the Gordion region, central Anatolia, demonstrates that major environmental change is weakly connected to simple measures of agricultural intensification over the last 5000 years. Detailed stream histories, coupled with settlement intensity measures from survey data, show that major environmental changes predate significant settlement in small watersheds, while in the largest systems they post-date high intensity settlement. Soil, slope, climate, and management strategies matter for landscape outcomes. Integrated evidence of long term patterns in agricultural strategies, settlement changes, and soil erosion in the region shows that environmental tipping points are complexly related to the timing of political centralization.
Interpretations of Starch Grain Records for Dietary Transitions Must Account for Taphonomy, Contamination, Methods Variability and Reference Materials

Amanda G. Henry is an associate professor in the Faculty of Archaeology at Leiden University, where she is studying the role of plant foods in human evolution, and how a behavioral ecology framework can help us understand the foraging choices made by our hominin ancestors.

Abstract

Analyses of starch grains preserved on archaeological materials such as pottery, grindstones, and dental calculus can elucidate shifts in human dietary transitions, such as the origin and spread of agriculture. The appearance of starches from plants in regions outside of their native habitats, and the potential for shifts in starch morphology due to domestication both would be markers for early use of domesticated foods. However, the starch record includes a large number of possible problems. Starch grains are common in modern landscapes and laboratories, making modern contamination extremely likely. Starches are removed from the archaeological record due to bacterial action, high temperatures, water action, extremes of pH and other factors, and these factors may differentially effect various plant taxa, further biasing the record. Many of the methods used to isolate starches from archaeological samples are more effective on certain starch types, and are known to bias against damaged starches. Finally, the confident identification of ancient starches relies on having an extremely thorough reference collection that includes not only the plants of interest, but also a large number of closely- and distantly-related taxa from the same region. Any attempt to use starches to document domestication must first address these issues.
**Gyoung-Ah Lee**  
*University of Oregon*

**Presentation Title**

*Reconstructing prehistoric plant resource in the Korean Peninsula in the Holocene environment: comparing macroscopic and microscopic plant Remains*

**Bio**

Lee’s research focus is the origins of agriculture, cultural landscape, and human-environmental interaction in East Asia. She has been conducting interdisciplinary projects in the Yellow River valley of north central China, the border region between China and Korea, and southern Korea. Recently, she started an island archaeology project in Jeju with the National Geographic support to understand peopling and cultural connections over the oceans, island adaptation, and origins of pottery and farming in Asia.

**Abstract**

Chulmun culture, documented by over 870 sites across the Korean Peninsula, presents a long-standing Neolithic cultural niche construction from the early Holocene. This presentation will overview environmental changes and concurrent socio-economic shifts from the Pleistocene-Holocene transition to the end of Holocene Optimum period. Increasing evidence on early plant management indicates Chulmun economy was not as simple as used to be thought. Data on macroscopic and microscopic plant resource use will be compared with changing settlement patterns and landscape choice. Departing from a one-way loop framework of environmental impacts and cultural consequence, this research will illustrate the Chulmun economic progress in a long-term evolutionary perspective.

**Xinyi Liu**  
*Washington University in St. Louis*

**Presentation Title**

*Between Fertile Crescents: Trans-Eurasian Exchange of Cereal Crops*

**Bio**

Xinyi Liu is an assistant professor of anthropological archaeology at Washington University in St. Louis. He is the director the Laboratory for the Analysis of Early Food-webs (LAEF). Liu previously taught and worked at the University of Cambridge upon he moved to Washington University in 2014. He was educated in China and UK, and obtained his PhD in 2010 at University of Cambridge. Liu’s main research interests lay in subjects such as the origins of food production, dispersal of agriculture, and the prehistory of China.

**Abstract**

Much has come to light about the timing and the pathways of food globalization in prehistory, pathways which range widely in altitude as well as in continentally. One issue in comprehending these movements is to understand the early human movements that carried them. A second issue is their persistence of these agricultural resources in novel habitats and the necessary adaptive responses, and the new possibilities of working with exotic plants.
Harvesting and Processing Wild Millet in the Upper Paleolithic Yellow River Valley, China: A pathway to domestication

Bio

Li Liu is the Sir Robert Ho Tung Professor in Chinese Archaeology in the Department of East Asian Languages and Cultures at Stanford University since 2010. Previously she taught archaeology at La Trobe University in Melbourne, Australia, for 14 years and was elected as Fellow of Academy of Humanities in Australia. She has a BA in History (Archaeology Major) from Northwest University in China, an MA in Anthropology from Temple University in Philadelphia, and a PhD in Anthropology from Harvard University. Her research interests include archaeology of early China (Neolithic and Bronze Age); ritual practice in ancient China; cultural interaction between China and other parts of the Old World; domestication of plants and animals in China; development of complex societies and state formation; settlement archaeology; urbanism; starch grain analysis; and lithic usewear analysis.

Abstract

The reconstruction of a long history of plant exploitation at Shizitan Locality 29 revealed the initial stage of wild millet exploitation in the middle Yellow River region. Residues and usewear traces on cutting tools and grinding stones indicate that Paleolithic hunter-gatherers began to harvest and process wild cereals (Triticaceae and Job's tears) some 28,000 years ago. They began to harvest wild millets around 24,000 years ago at the onset of Last Glacial Maximum, which was about 14,000 years before the morphologically domesticated millets occurred in the early Holocene in China. The intensified exploitation of wild millets during the LGM may have been a part of new subsistence strategy in response to the cold-dry conditions with an expansion of the steppe ecosystem. This long process of wild cereal collection indicates that the early stage of predomestication cultivation of millet may have been initiated by the hunter-gatherers on this part of China.
Phytolith remains of rice (Oryza sativa) recovered from the Shangshan site in the Lower Yangtze of China have previously been recognized as the earliest example of rice cultivation. However, due to the poor preservation of macro-plant fossils, many radiocarbon dates were derived from undifferentiated organic materials in pottery sherds. These materials remain a source of debate because of potential contamination by old carbon. Direct dating of the rice remains might serve to clarify their age. Here, we first validate the reliability of phytolith dating in the study region through a comparison with dates obtained from other material from the same layer or context. Our phytolith data indicate that rice remains retrieved from early stages of the Shangshan and Hehuashan sites have ages of ca. 9400 and ca. 9000 cal yr BP, respectively. The rice bulliform phytoliths indicate they are closer to modern domesticated species, suggesting that rice domestication may have begun at Shangshan nearly 10,000 years ago. The evidence also indicates that barnyard grass (Echinochloa spp.) was a major subsistence resource, alongside smaller quantities of acorn (Lithocarpus/Quercus sensu lato) and water chestnuts (Trapa). The early managed wetland environments might be initially harvested for multiple grain species including barnyard grasses and rice.
**Presentation Title**

*Chili Peppers in the Americas: Tracing Domestication*

**Bio**

Dr. Linda Perry is a Fulbright Senior Specialist in archaeobotany and a former Smithsonian Fellow, Research Collaborator, and Research Associate. She has been working with archaeobotanical samples for nearly twenty years, and has taught in the fields of biology, botany, environmental science, archaeology and anthropology. Linda’s work incorporates archaeobotanical analyses into ancient contexts to gain insight into the behavior, organization, and development of past societies. To study these subjects she employs many methods including microfossil analyses of both artifacts and sediments, macrobotanical analysis, and wood identification.

**Abstract**

Chili peppers (*Capsicum* spp.) are arguably the most widely cultivated food plants that originated in the Americas. Only five hundred years after the introduction of peppers into Europe, the spicy fruits have been incorporated into cuisines worldwide. Despite widespread interest in chili peppers, a combination of factors including the numbers of species involved (at least five) and the nature of the archaeobotanical record have not allowed for a comprehensive understanding of the histories of these important spice plants.

This problem can now be overcome due to our increasing understanding of a genus-specific starch microfossil that allows us to identify chili peppers from most archaeological contexts. We will also be able to use this microfossil to trace both the domestication and dispersal of chilies. Starch microfossils from chili peppers have been found at seven sites dating from 6000 years before present to European contact and ranging from the Bahamas to southern Peru. The starch grain assemblages from these sites also demonstrate that maize and chilies occurred together as an ancient and widespread Neotropical plant food complex that predates pottery in some regions.
Maureece Levin
Stanford University

Presentation Title

Agroforestry, Migrations, and Human Niche Construction in Central-Eastern Micronesia

Bio

Maureece Levin is a postdoctoral scholar at the Stanford Archaeology Center. Her research interests center on past food production systems, historical ecology, and human niche construction in the Pacific Islands and in East Asia. She is a paleoethnobotanist who employs phytoliths, starch, and plant macroremain analysis in her work, as well as ethnoarchaeology. Levin completed her Ph.D. at the University of Oregon in 2015, where she studied managed agroforests in Pohnpei, Micronesia using landscape survey, and ancient and modern botanical data. Her current work includes ongoing projects on Pohnpei and Pingelap islands in Micronesia, as well as collaborative work at Stanford on plant microremains from Paleolithic and Neolithic sites in northeast China.

Abstract

The islands of central-eastern Micronesia were originally settled about two millennia ago by descendants of Lapita peoples. Modern landscapes in the region are the result of intense ecological engineering by the initial settlers and their descendants; this process was facilitated by the transport of western Pacific cultigens to the region. Using a case study from the high island of Pohnpei, this presentation applies the theory of cultural niche construction to understanding the feedback between food production-related ecological engineering and the social and physical environment in this region. Phytolith, plant macroremain, and survey data show that Pohnpeians have engaged in intensive landscape management to develop landscapes amenable to tree and root crop production. Additionally, people were likely able to settle the more remote and ecologically impoverished coral islands in the central-eastern Micronesian region by engaging in similar practices.
Presentation Title

Refashioning China’s Nature: Microbotanical Evidence for the spread of Early Neolithic Agriculture to the Loess Plateau and its Impact on Middle Holocene Landscapes

Bio

Arlene Rosen is a Professor of Environmental Archaeology and Geoarchaeology in the Department of Anthropology at the University of Texas at Austin. She is working on human environmental relations during later prehistory and in early complex societies in the Levant, China, and Mongolia. She is the author of Civilizing Climate: Social Responses to Climate Change in the Ancient Near East (2007: Altamira Press), and numerous journal articles dealing with issues of human adaptations to climate change, early agricultural communities, and human impact on the environment, published in issues of PNAS, Current Anthropology, The Holocene, Journal of Anthropological Archaeology, Quaternary Research, Nature and Culture among others. She recently organized an international workshop entitled The Anthropocene in the Longue Durée which has since been published as a special issue of The Holocene in 2015.

Abstract

Most of our insights about the spread of early cultivation from centers where wild progenitors of crops originated to the hinterlands, come from on-site data from such contexts as ash pits, middens, hearths and milling stones. There is much to be learned as well from examining contexts at the interface between the peripheries of archaeological sites and the natural landscapes that were contemporary with Neolithic sites in these hinterlands. Geoarchaeological, phytolith, and starch studies of landscapes immediately adjacent to archaeological sites distant from the heartland, can contribute information on the direct impact of incipient cultivation and subsequent intensification of these early crops. This direct connection allows us to understand aspects of economic decision-making, and cultivation strategies of the earliest cultivators, and how these affected local site catchments.

The origin and spread of the first farming communities onto the Loess Plateau of northern China provides a good example of this. Previously published sediment profiles along the Liujian Stream, immediately adjacent to the site of Huizui in the Yiluo River Basin, provided evidence for human land-use beginning with the early Mid-Holocene deposits which are consistent with stable hillslope soils, indicating that the first mixed forager-millet farmers of the Peiligang Neolithic had a very light ecological footprint on the landscape. This is in contrast to the later middle Neolithic Yangshao Period farmers. Sediments, phytoliths and starches from the Yangshao Period revealed evidence for the earliest Neolithic paddy farming well outside of the natural habitat of wild rice. In addition to evidence for massive deforestation and soil erosion, a 15 m deep alluvial sequence containing sets of gravels (beginning ca. 7200 cal BP) and gleyed soils dating from ca. 6600 cal BP, contained rice phytoliths and archaeological waste suggesting manuring. These signs of intensive landscape management went hand-in-hand with rapidly increasing social complexity from the earliest to latest Neolithic periods in northern China (Rosen et al. in press). A new geoarchaeological section further downstream on the Liujian stream, provides sediment, starch, and microbotanical evidence for early cultivation activities in the vicinity which go back to Early Holocene and record Peiligong Period landuse and cultivation.
Alison Weisskopf
University College London

Presentation Title

Foraging to Farming in the Wet Tropics: A Case Study from Southeast Asia

Bio

Alison is an archaeobotanist, currently the phytolith specialist on the third phase of the Early Rice Project at the Institute of Archaeology, University College London. 'The impact of intensification and deintensification of Asian rice production: transitions between wet and dry ecologies', exploring the origins, development and spread of rice agriculture across Asia. She has worked in East, Southeast and South Asia on this project, and also in the Pacific, the Eurasian steppes, Belize, Malta and the UK. Her main interests are human plant use in prehistory, food pathways, ethnobotany and economic botany and the relationships between plant use, trading patterns and social development.

Abstract

Distinguishing early farming from foraging is a challenge, especially in the wet tropics. Much of the plant diet is based on tubers, leaves and fruit, which are difficult to find archaeologically. While grain crops, such as rice and millets, are robust and can preserve as charred remains, in general preservation of organic materials is often poor due to soil conditions in mesic environments. This is where micro remains, such as phytoliths and starches, come to the fore. Ethnobotany can also provide insights on how plant material was used and disposed of. Several methods have been developed for distinguishing cultivation systems using ethnography, modern analogues and a sensitive versus fixed phytolith morphotype analysis. How these methods work in more temperate environments compared to the wet tropics will be discussed, followed by a case study discussing results from Southeast Asian sites.

Jiajing Wang
Stanford University

Presentation Title

From Field to Feast: Food, Drinks, and Rituals in the Shangshan Culture

Bio

Jiajing Wang is a Ph.D. student in the Department of East Asian Languages and Cultures at Stanford University. Her research interests include the origins of agriculture, ancient food processing, and alcohol production. She applies starch, phytoliths, and usewear analysis for her research.

Abstract

The Lower Yangtze valley of China is renowned as the origin of rice agriculture. Previous research based on archaeobotanical analysis and genetic data indicates that the evolution from wild rice to domestic rice was a continuous process that occurred between 11,000 - 6,000 BP. The Shangshan culture (11,400 BP – 86,00) has revealed the earliest evidence of rice cultivation in the region. However, we still have limited understanding about how rice cultivation emerged. This presentation applies a socio approach to understand the initial plant cultivation. Based on a recent residue analysis on Shangshan pottery, this presentation explores what “meals” and “drinks” were made and their associated social activities. By integrating plants into the social organization of the human life, this study aims to develop an explanatory model to better understand the transition to agriculture in the Lower Yangtze.
Xiaoyan Yang  
*Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences*

**Presentation Title**

*How and why did Hunter-gatherers select millets to domesticate in North China?*

**Bio**

Xiaoyan Yang is a Professor at Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences. She received her Ph.D. degree in Quaternary Geology from Peking University in 2003, focusing on environmental archaeology. Her research interests include human-environmental relationship, the origins and dispersals of dry farming in north China, rice domestication, and the role of sago palms in south subtropical China.

**Abstract**

Recent micro archaeobotanical evidence indicated that tribes of both Triticeae (including barleys and wheat) and Paniceae (including foxtail and broomcorn millets) were exploited together as early as Late glacial period (LGP) in North China. However, how and why the wild progenitors of millets were selected to domesticate while Triticeae was abandoned is less clear. Here, we document the development process of millet-based agriculture based on ancient starch data derived from nine archaeological sites dating from 25,000 to 5,500aBP in North China. Putting such process in the context of dramatic climate change from LGP to Holocene Optimum indicated that changes of pattern between temperature and precipitation, and CO2 concentration, coincided with the growing season for the Paniceae grasses but were unfavorable for growth of the Triticeae grasses. Favorable climate increased the yield stability, abundance, and availability of wild progenitors of millets, which further influenced the hunter-gatherers’ selection of Paniceae rather than Triticeae to domesticate. This study sheds light on the origins of millet-based dry-land agriculture in this region.
Dr. Jianping Zhang is an associate professor in Institute of Geology and Geophysics, Chinese Academy of Sciences. His research interests have mainly involved in phytolith morphology and archaeobotany. He recently used phytolith to distinguish between foxtail millets and its wild ancestor, revealed the earliest fine reedy textile in China, and identified decayed tea remains by calcium oxalate crystals. He has been carrying out on archaeobotanical and palaeoecological research in central and northwestern China, which include the origin and dispersal of crops in Neolithic China.

Abstract

Phytolith analysis provides a viable method in identification of millets, especially when these grains decayed in the archaeobotanical context. Although the diagnostic criteria used to distinguish common millet (Panicum miliaceum), foxtail millet (Setaria italica) and green foxtail (Setaria viridis) has quickly gained terrain, however, to date, the identification of millets and relative wild weeds has still been questionable. This study surveys the issues concerning inflorescence phytoliths from Setaria species in China and discuss the problems related to phytolith diagnostic criteria used to distinguish millets, common Setaria grasses and species from Trib. Paniceae. We found that according to the morphology of the undulated patterns, the presence of papillae, and the width of endings interdigitatio, Trib. Paniceae can be distinguished in genus or species level. Particularly, ΩIII epidermal long cells in the upper lemma and palea differentiate S. viridis from other Setaria species with 85% accuracy. Considering that typical ΩIII type is unique to S. italica and S. viridis, we can differentiate S. viridis from S. italica and other common Setaria species. The five diagnostic criteria proposed by Lu et al. (2009) in PLoS ONE can be safely used to distinguish S. italica from P. miliaceum.
Zhijun Zhao
Institute of Archaeology, Chinese Academy of Social Sciences

Presentation Title

Barnyard-millet Farming Zone in Northeast Asia -- Archaeobotanical evidence from Northeastern China

Bio

Zhijun Zhao is a professor at the Institute of Archaeology, Chinese Academy of Social Sciences. He received his Ph.D. degree in anthropology in 1996 from the University of Missouri-Columbia at USA, with advanced work emphasizing archaeology, principally in archaeobotany. His research interest is focused on the origin of Chinese agriculture and economic background of the formation of Chinese civilization. This involves a range of approaches from fieldwork to laboratory experiments. In the past years, he has participated in archaeological fieldworks to carry out flotation that involved hundreds of archaeological sites distributed all over China. Zhao has published about 90 publications including articles and archaeological reports. His book entitled “Paleoethnobotany – Theories, Methods and Practice” was published by Scientific Press in Beijing.

Abstract

Northeastern China is described by Ancient Chinese literatures as a wild land, characterized by subsistence of hunting/gathering. However, farming appeared in this region as early as in the prehistoric time based on archaeological data. In recent years, flotation works have been carried out in archaeological sites located in this region. The sites are dated from Neolithic to historical periods, while most of them belong to the time of Liao/Jin Dynasties in Chinese history (AD 907~1234). A large number of soil samples were processed, and a tremendous amount of plant remains were recovered. The majority of the plant remains are crops, including foxtail millet (Setaria italica), broomcorn millet (Panicum miliaceum), barnyard millet (Echinochloa esculenta), soybean (Glycine max), adzuki bean (Vigna angularis), buckwheat (Fagopyrum esculentum), wheat (Triticum aestivum), barley (Hordeum vulgare), hemp seed (Cannabis sativa), oat (Avena sativa), perilla (Perilla frutescens), and sorghum (Sorghum vulgare). The barnyard millet is the most significant finding, due to not only the abundance but also the first found in China. Considering the archaeobotanical data from northern Japan and Far East of Russia, I propose that an identical agricultural zone once existed in Northeast Asia around 1000 years ago, with barnyard millet as a mark of unique crop.
<table>
<thead>
<tr>
<th>Date/time</th>
<th>Activities</th>
<th>Participants</th>
<th>Presentation Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 21:</td>
<td>Conference Day 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9:00-9:30am Morning Reception</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9:30-9:40</td>
<td>Welcome speech</td>
<td>Li Liu (Stanford Arch. Center)</td>
<td></td>
</tr>
<tr>
<td>9:40-10:20</td>
<td>Presentations</td>
<td>Ofer Bar-Yosef (Harvard University)</td>
<td>The Origins of Agriculture in China – a View from Western Asia</td>
</tr>
<tr>
<td>10:20-10:50</td>
<td>Presentations</td>
<td>Zhijun Zhao (Institute of Archaeology, Chinese Academy of Social Sciences)</td>
<td>Barnyard-Millet Farming Zone in Northeast Asia – Archaeobotanical Evidence from Northeastern China</td>
</tr>
<tr>
<td>10:50-11:05</td>
<td>Coffee break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:05-11:35</td>
<td>Presentations</td>
<td>Xiaoyan Yang (Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences)</td>
<td>How and Why Did Hunter-Gatherers Select Millets to Domesticate in North China?</td>
</tr>
<tr>
<td>11:35-12:05</td>
<td>Presentations</td>
<td>Li Liu (Stanford University)</td>
<td>Harvesting and Processing Wild Millet in the Upper Paleolithic Yellow River Valley, China: A Pathway to Domestication</td>
</tr>
<tr>
<td>12:05-12:30</td>
<td>Discussion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12:30-1:45</td>
<td>Lunch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Session 2: Origins of Agriculture in China: New Approaches and Discoveries

Chair: Gary Crawford
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:45-2:15</td>
<td>Presentations</td>
<td>Gary Crawford (University of Toronto Mississauga)</td>
<td>Early Neolithic Palaeoethnobotany in Shandong Province, China: Lessons from the Yuezhuang Site</td>
</tr>
<tr>
<td>2:15-2:45</td>
<td>Presentations</td>
<td>Houyuan Lu (Institute of Geology and Geophysics, Chinese Academy of Sciences)</td>
<td>Timing of Shangshan Culture and the Process of Rice Domestication</td>
</tr>
<tr>
<td>2:45-3:15</td>
<td>Presentations</td>
<td>Jiajing Wang (Stanford University)</td>
<td>From Field to Feast: Food, Drinks, and Rituals in the Shangshan Culture</td>
</tr>
<tr>
<td>3:15-3:40</td>
<td>Coffee break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3:40-4:10</td>
<td>Presentations</td>
<td>Wei Ge (Xiamen University)</td>
<td>Updated Clues for the Spreading of Agriculture in SE China: Multi-Disciplinary Evidences</td>
</tr>
<tr>
<td>4:10-4:40</td>
<td>Presentations</td>
<td>Alison Weisskopf (University College London))</td>
<td>Foraging to Farming in the Wet Tropics: A Case Study from Southeast Asia</td>
</tr>
<tr>
<td>4:40-5:05</td>
<td>Discussion</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**April 22: Conference Day 2**

**9:00-9:30am Morning Reception**

**Session 3: Ancient Landscapes and Ecology**

**Chair: Arlene Rosen**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:30-10:00</td>
<td>Presentations</td>
<td>Arlene Rosen (University of Texas at Austin)</td>
<td>Refashioning China's Nature: Microbotanical Evidence for the Spread of Early Neolithic Agriculture to the Loess Plateau and Its Impact on Middle Holocene Landscapes</td>
</tr>
<tr>
<td>10:30-11:00</td>
<td></td>
<td>Maureece Levin (Stanford University)</td>
<td>Agroforestry, Migrations, and Human Niche Construction in Central-Eastern Micronesia</td>
</tr>
<tr>
<td>11:00-11:25</td>
<td>Coffee break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:25-11:55</td>
<td></td>
<td>Xinyi Liu (Washington University in St. Louis)</td>
<td>Between Fertile Crescents: Trans-Eurasian Exchange of Cereal Crops</td>
</tr>
<tr>
<td>11:55-12:25</td>
<td></td>
<td>Lisa Kealhofer (Santa Clara University)</td>
<td>Agriculture and Political Economy: Gordion in the Longue Durée</td>
</tr>
<tr>
<td>12:25-12:40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Session</td>
<td>Presenters</td>
<td>Title</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>12:40-1:45</td>
<td>Lunch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1:45-2:15</td>
<td>Presentations</td>
<td>Amanda Henry (Leiden University)</td>
<td>Interpretations of Starch Grain Records for Dietary Transitions Must Account for Taphonomy, Contamination, Methods Variability and Reference Materials</td>
</tr>
<tr>
<td>2:15-2:45</td>
<td>Presentations</td>
<td>Jianping Zhang (Institute of Geology and Geophysics, Chinese Academy of Sciences)</td>
<td>Phytoliths Analysis for the Discrimination of Millets and Related Wild Grasses</td>
</tr>
<tr>
<td>3:15-3:40</td>
<td>Coffee break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3:40-4:15</td>
<td>Presentations</td>
<td>Linda Perry</td>
<td>Chili Peppers in the Americas: Tracing Domestication</td>
</tr>
<tr>
<td>4:15-4:145</td>
<td>Presentations</td>
<td>Richard Fullagar (University of Wollongong)</td>
<td>Stone Tool Function, Plant Exploitation and Foraging Histories in Asia and Australia</td>
</tr>
<tr>
<td>5:10-5:40</td>
<td>Discussion and Closing Remarks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>