

**Progress Report**  
on the  
**2004 Memorandum of Understanding**

On  
Scientific Co-operation  
Between  
**The Mongolian Academy of Sciences (MAS)**  
**The National Museum of Mongolian History**  
**The Smithsonian Institution of the USA**



**Smithsonian Institution**

22 October 2007

The following is a progress report on the research that Smithsonian scientists have conducted since the signing of the above mentioned MOU in 2004 in co-operation with their colleagues at the Mongolian Academy of Sciences (MAS) and the National Museum of Mongolian History.

## I. Laser-Scanning and Documentation of Mongolia's Deer Stones

Harriet F. (Rae) Beaubien, Museum Conservation Institute

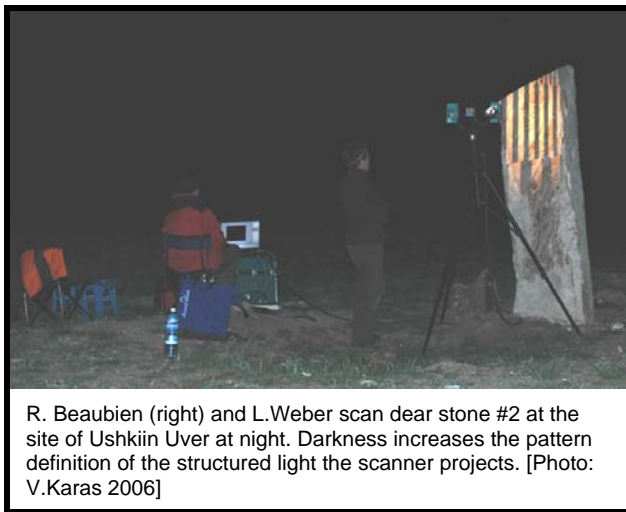
Conservators from the Smithsonian's Museum Conservation Institute (MCI) have participated in the Deer Stone Project's field seasons in Mongolia since 2004. There are two components, as described below.

### Documentation

Documentation activities – featuring the use of 3D scanning technology – have been carried out during the 2005, 2006 and 2007 field seasons, and are producing records that will become part of a national registry of these important and threatened monuments. MCI's efforts have been supported by funding from the Smithsonian Institution (including a grant from the Office of the Under Secretary of Science) and the Samuel H. Kress Foundation.

### *Results:*

3D digital files, produced for 40 deer stones at 9 sites, as follows:



R. Beaubien (right) and L. Weber scan deer stone #2 at the site of Ushkiin Uver at night. Darkness increases the pattern definition of the structured light the scanner projects. [Photo: V. Karas 2006]

- 5 – site of Ulaan Tolgoi [2005, 2006]
- 3 – site of Khushuugiin Dev (Erkhel East 1) [2005, 2007]
- 2 – site of Erkhel North 1 [2005]
- 1 – site of Evdt Valley 1 [2005]
- 14 (including 1 in 3 pieces) plus fragments of 3 – site of Ushkiin Uver [2006]
- 1 (in 2 pieces) from Ushkiin Uver – Hovsgol Museum, Muren [2007]
- 4 (including 1 in 2 pieces) – site of Avtiin [2007]
- 2 – site of Hort Uzuur [2007]
- 4 – site of Khyadag west group [2007]
- 1 – site of Khyadag east group [2007]

In addition to the files, 3D models and other graphic products are being produced experimentally, using 3D digital files for Ushkiin Uver DS #14 and Ulaan Tolgoi DS #5. Supplementing these records are photographs and condition notes for the deer stones listed above. Systematic photographs have also been taken at a variety of other sites,

including Khanuy Valley KYR 119 (Arkhangai aimag), Tsatstain Khoshuu, Olziyt, Khushuutii Am and Burdnii Ekh.

*Publications:*

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- Beaubien, H.F., and B.V. Karas, 2006. "3D scanning Mongolia's ancient deer stones." *Arctic Studies Center Newsletter Supplement* (October 2006):12-14.
- Beaubien, H.F., B.V. Karas, and W.W. Fitzhugh, 2007. "Documenting Mongolia's deer stones: Application of digital imaging technology to preservation." In *Scientific Research on the Sculptural Arts of Asia, Proceedings of the third Forbes Symposium at the Freer Gallery of Art*, ed. J.G. Douglas, P. Jett, and J. Winter, 133-142. London: Archetype Publications, Ltd., and Washington, DC: Smithsonian Institution Press.
- Beaubien, H. F., B.V. Karas, and L.G. Weber, 2007. "Documentation of Mongolia's deer stones: 2006 field season. Part IV." In *American-Mongolian Deer Stone Project: Field Report 2006*, ed. W.W. Fitzhugh, 71-83. Washington, DC: ASC Field Report Series.
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- Karas, B.V., H.F. Beaubien, and W.W. Fitzhugh, In press. "Documenting Mongolia's deer stones: Application of 3D laser scanning technology to archaeological conservation." In *Conservation of Archaeological Materials: current trends and future directions*. Williamsburg, VA: Colonial Williamsburg Foundation.

*MCI reports* (distributed; archived at MCI, Suitland, MD):

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- Beaubien, H.F. and B.V. Karas. *MCI 5974*. Joint Mongolian-Smithsonian Deer Stone Project: Conservation report, 2005 field season (25 January 2006).
- Beaubien, H.F., B.V. Karas, and L.G. Weber. *MCI 6047*. Documentation of Mongolia's deer stones, 2006 field season: Conservation report (30 April 2007).
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- Karas, B.V. *MCI 6085*. 3D digital data post processing report: Ulaan Tolgoi, EL.01-EL.05 (27 March 2007).
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- Wachowiak, M.J. *MCI 6089*. Technical illustration of deer stone #14 from Ushkiin Uver, Hovsgol aimag, Mongolia (23 May 2007).

### Archaeological Conservation

Issues and techniques in the preservation of the material record, from the field to the museum, have been the subject of training seminars, offered by Beaubien and others, as part of the annual symposia organized by the Deer Stone Project, as well as in consultations with conservation colleagues at the Cultural Heritage Center, during the 2004, 2005, 2006 and 2007 field seasons. In addition, MCI conservators have provided hands-on conservation assistance with freshly excavated material during the field seasons of both the Deer Stone Project and the Khanuy Valley Archaeological Project (2005, 2006).

#### *Publications:*

Beaubien, H.F., 2005. "Workshop summaries – introduction." In *The Deer Stone Project: Anthropological Studies in Mongolia 2002-2004*, ed. W.W. Fitzhugh, 163-164 (English), 165-166 (Mongolian). Washington, DC: Arctic Studies Center, and Ulaanbaatar: National Museum of Mongolian History.

Beaubien, H.F., 2005. "Archaeological conservation: Collections care from the field to the museum." In *The Deer Stone Project: Anthropological Studies in Mongolia 2002-2004*, ed. W.W. Fitzhugh, 167-176 (English), 177-184 (Mongolian). Washington, DC: Arctic Studies Center, and Ulaanbaatar: National Museum of Mongolian History.

Beaubien, H.F., 2006. "Archaeological conservation with two field projects in Mongolia." *Arctic Studies Newsletter* (December 2005) 13: 26.

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## II. Botanical and Cultural Explorations in the West Darkhad Taiga

Paula DePriest, Museum Conservation Institute

### Project Summary

In the past several years the Smithsonian-Mongolian Deer Stone Project's botany team led by **Paula DePriest** and including American botanist **Steve Young** and Smithsonian staff **Deborah Bell**, **Sue Lutz**, and **Gregory McKee**, with Mongolian members **O. Sukbaatar**, **J. Oyumaa**, **J. Oyunbileg**, and **Ts. Tsendeehuu**, has explored the territories of the Mongolian Tsaatan, ethnic Tuvan reindeer herders living around the northern Darkhat Valley of Hovsgol Aimag in northern Mongolia. These territories include hunting grounds, plant-gathering places, and traditional, but now abandoned, reindeer seasonal pastures up to 100 km from the Tsaagannur, Ulaan Uul, and Renchinkhumbé sum centers.



Salag Davaa hunting ovoos in its impressive setting.  
[Photo: P. DePriest 2007]

The most notable destinations west of the Darkhat Valley and the West Taiga reindeer camps have included the extraordinary Salag Davaa hunting ovoos (N51°06.702' E 098°08.961') with over 60 carved images of knives, rifles, and animals dedicated to ceremonially requesting good fortune in hunting. The ovoos, visited with Tsaatan herders in 2005 and 2007, was initially established to ritually facilitate sable hunting after Mongolia's independence in the early 1910s and is maintained still by Dukha and Darkhat hunters traveling through the

pass on their way to the Bussingol Depression. In 2005 the botany team continued on through the Salag Davaa to the Bussingol Depression along the Tuvan border (N51°10.169' E 097°55.169'). The Depression is the spiritual homeland and burial grounds for Soyon clan shamans and, before the re-drawing of the border in the late 1950s, was part of their annual reindeer migration. Now, fifty years after closing of that border and the cessation of herding in the valley, the Bussingol Depression shows ecological succession with increase shrubs and trees and reduced grass steppe and provides an important comparison for studies of Darkhat pasture health.

In 2006, the botany team traveled far north of the Darkhat Valley and the Shishged Gol to abandoned reindeer summer pastures along the Russian border (N51°55.873' E 099°23.482') just beyond the 30-meter Orton Hyyarh waterfall (N51°54.229' E 099°21.685'). These East Taiga camps were reached via the historic Tengis Gol (N51°28.926' E 099°03.007') with its Chinggis Rock and Fence (N51°28.808' E 099°03.050') reported to have been constructed during the Chinggis Khan era. Chinggis Khan (more likely his son Joci) is reported to have visited the confluence of the Tengis and Shishhid Gols to accept the peaceful surrender of the People of the Forest in 1207/08 leaving legendary footprints and a fence of stacked stones. The Tengis Gol is a doubly



important site for Mongolians as legend claims that the Mongol clan originated from a blue-grey wolf and a fallow doe along a body of water named ‘Tenggis.’

The team, with Tsaatan guide Sanjim and his sons Khalzan, Batmonkh, and Bayanaa of the West Taiga Dukha, conducts plant community reconnaissance and collects representative vascular plants and lichens with special emphasis on those used by the Dukha as pasture for reindeer or as medicinal plants. For example, in 2004 the team traveled along the Jams and Joloc Rivers to find the only reported Mongolian locations for Siberian fir (*Abies sibirica*) that was used as a healing plant by Dukha Shaman Suyan, now deceased, and in 2006 to the



Bayanaa collecting specimens for further analysis.  
[Photo: P. DePriest 2007]

Buddhist sacred site Renchinlkhumbe Mountain (N51°32.575' E 099°12.270') to find the traditional Mongolian medicinal plant sawwort – *Saussurea* sp. To date, hundreds of plant collections accumulated during the project have been accessioned in herbaria of the Mongolian Academy of Sciences, the Mongolian National Museum and the university at Moron, in addition to the Smithsonian Institution.

In addition, the group has visited and documented sacred sites — ovoos and ongons — and conducted ethnographic and ethnobotanical observations of Dukha traditional and religious practices. In 2007, the team visited and documented worship at Buddhist, Darkhat, and Dukha ongons (N51°20.451' E 099°14.693') and visited a Darkhat Shaman's *Asar* field ongon (N51°19.955' E 099°17.675') above the Harmay Valley west of Tsaagannur Soum Center. Most notably, the team observed and documented the guides' ancestor ongons, in their Tuvan language called *Ereen*, displayed inside their ortz (teepee). During the same field season, the botany team attended Tsaagannur Sum's first Tsaatan Festival. The Festival included a traditional horse race, reindeer race, a reindeer polo match, talent competition, and a Darkhat shaman's show. One unique element was the demonstration of traditional birch-bark covering for an ortz prepared by the team's guides. Birch bark was routinely used on ortz as a summer cover before the 1970s import of canvas, which was overseen by botany team member O. Sukhbaatar.

### Publications

DePriest, P. T., 2002. "Reindeer, reindeer lichens, and reindeer herding: Systematics for cultural survival." In *2002 Field Report and Project Description*. Washington, DC: Smithsonian Institution.

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- Young, S. B., 2005. "Modern vegetation of the Hovsgol region of Mongolia: A possible key to the demise of the Ice Age mammoth steppe of the Arctic." In *The Deer Stone Project: Anthropological Studies in Mongolia 2002-2004*, ed. W.W. Fitzhugh, Bayarsaikhan, and P.K. Marsh, 153-160 (in English with Mongolian abstract). Washington, DC: Arctic Studies Center, and Ulaanbaatar: National Museum of Mongolian History.
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- DePriest, P. T., 2007. "Botany team travels north of the Shishged Gol in East Taiga." In *American-Mongolian Deer Stone Project: Field Report 2006*, ed. W.W. Fitzhugh, 117-118. Washington, DC: ASC Field Report Series.
- DePriest, P. T., 2007. "Botany team travels north of the Shishged Gol in East Taiga." *Arctic Studies Center Newsletter Supplement* (October 2006), 40-41.

### III. Smithsonian Festival: *Chinggis Khan: 800 Years of Mongolian Statehood* William W. Fitzhugh, Arctic Studies Center/Dept. of Anthropology, NMNH

#### Project Summary

At the request of Mongolian Ambassador Bold, the Smithsonian organized a cultural festival titled *Chinggis Khan: 800 Years of Mongolian Statehood* from 6-8 October 2006. The festival commemorated the anniversary of Mongolia's long history as a nation, founded by Genghis Khan in 1206, and highlighted Mongolian history, arts, science, and performance.



The Mongolian Festival performances held in the NMNH Baird Auditorium were exuberant displays of the breadth of Mongolian arts and culture. [SI photo]

The festival included a symposium at the Woodrow Wilson Center for Scholars titled *Mongolia Matters: the Legacy of Chinggis Khan and Mongolia's Great Empire* organized by Alicia Campi.

Smithsonian presentations included an evening of dance and music by Mongolian performers and a spectacular historical and modern costume fashion show, *The Great Story of the Mongols*, produced by Mongolian artist and impresario, Gankhuyag Natsag, and the Smithsonian Resident Associates. The National Geographic Society prepared exhibitions of Mongolian photography by photographer Gordon Wiltsie, as well as native Mongolian photographers, for the halls of the National Museum of Natural History. In addition, there were musical performances, acrobatics, story-telling by local Mongolian children, and a reconstruction of a traditional Mongolian *ger*. Recent Smithsonian deer stone research and laser-scanning documentation and demonstrations of felt-making were also presented. The three-day event had spectacular results and drew large crowds to the museum and its evening events. The project was publicized by local media and by a special issue of the *Arctic Studies Center Newsletter*. One testament to the success of the Mongolian Festival was the Washington media 'buzz' about the need to erect a statue in downtown Washington, DC to honor the achievements of Genghis Khan!



A young visitor to the Mongolia Festival exploring the interior of a *ger*. [SI photo]



The Mongolia Festival would not have been possible without the support of the following groups and individuals: the Embassy of Mongolia; the Smithsonian Resident Associates; National Museum of Natural History; SI Museum Conservation Institute; The Mongolia Society; American Center for Mongolian Studies; National Geographic Society; Gordon Wiltsie; Ed Nef; Ed Story and Soco Oil; Alicia Campi and many others who made this event into a great success.

#### Publications

Fitzhugh, W., 2006. "Chinggis Khaan: 800 years of Mongolian statehood." *Arctic Studies Center Newsletter Supplement* (October 2006): 12 pp.

#### **IV. The Smithsonian-Mongolian Deer Stone Project**

William W. Fitzhugh, Arctic Studies Center/Dept. of Anthropology, NMNH

##### Project Summary

Since 2001 the Smithsonian's Arctic Studies Center has directed a multi-disciplinary research and cultural heritage and preservation project in Mongolia. Originally dedicated to exploring the archaeology of Mongolia's Bronze Age cultures and contemporary Tsaatan (Dukha) reindeer-herders of the Darkhad region of northern Mongolia, the project has expanded to include related research in botany, physical anthropology, paleoenvironmental studies, and ethnographic studies of Darkhad and Tsaatan cultures. Many of these projects are described elsewhere in this document, so I shall describe here only the activities relating to studies of deer stone art and Bronze Age ceremonialism.



Deer stone at Erkhel Ulaan Tolgoi site. [Photo: ASC 2002]

Deer stones, among the most beautiful and earliest examples of Mongolia's ancient past, have become an iconic symbol of the country's rich heritage. Many consider deer stones to be some of the finest examples of ancient monumental art in the world, and there has been speculation this art was instrumental in the formation of Scythian art and culture, and even of ancient Eskimo art and culture in the Bering Sea. However, because deer stones had never been dated by archaeological methods, their origin was speculative but was estimated at ca. 2000 years old.

Our work over the past five years, in collaboration with the National Museum of Mongolian History, has demonstrated deer stones date to a very narrow chronological

period fully one thousand years older, from 3200-2800 years ago. They are therefore several hundred years earlier than the earliest Scythian sites, like Arzhan, which dates to 2600-2700 years ago. Furthermore, we believe that our research will demonstrate that the earliest deer stones originated in northern Mongolia and spread westward into Russia and Kazakhstan, and from there spread to the Black Sea as part of Scythian culture, where it was first described historically by Herodotus in the 5th century B.C.

We have also demonstrated that deer stones are contemporaneous with another major Bronze Age archaeological expression: the khirigsuur burial complex. This complex was also thought to be a later development, independent of deer stones. However, many radiocarbon dates and excavations prove that both are part of a single

mortuary ritual tradition that included burial of many if not most of the members or this early horse-using society, ranging from small simple khirigsuurs to huge mounds accompanied by hundreds and even in some instances, thousands, of horse sacrifices. Both deer stones and khirigsuurs are surrounded by horse burials and family feasting sites dating to the same time periods.



Excavations in process at the Erkhel Ulaan Tolgoi site.  
[Photo: ASC 2002]

Recognition of our results has been presented in scholarly papers and popular media. Our results have also appeared on websites and in special exhibits at the Smithsonian's National Museum of Natural History, which displayed a cast of a Mongolian deer stone from the Ushkin Uver site near Muren, Hovsgol aimag. We also provided a cast to the National Museum of Mongolian History for its displays, and the NMMH has sent this cast on display to foreign exhibitions in Europe. The NMNH in 2003 also hosted a major exhibition titled, *Modern Mongolia: Reclaiming Genghis Khan*, prepared by the University of Pennsylvania and the National Museum of Mongolian History.

#### Museum Training and Conservation Seminars

Each year the Smithsonian Deer Stone Project has organized a scholarly symposium and museum studies workshop in Ulaanbaatar as part of its yearly research program. These seminars have attracted large numbers of Mongolian scholars, media professionals, museum specialists, and conservators. The proceedings have been published in English and Mongolian with assistance from the US Department of State Ambassador's Fund. The yearly events have been organized by the American Center for Mongolia Studies and the National Museum of Mongolian History. Museum studies workshops have presented the latest techniques in object and paper conservation, preventative conservation, exhibit

preparation, casting, laser scanning, and precision GPS mapping to students and professionals alike.

Deer Stone project research, training, and public programs have been made possible by generous grants and assistance from: Trust for Mutual Understanding; National Geographic Society; Arctic Studies Center; the Smithsonian's National Museum of Natural History Office of Exhibits Central and Museum Conservation Institute; the Department of State Ambassador's Fund; InlingualDc, and many private donors.

### Publications

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- Fitzhugh, W. F., In press. "Pre-Scythian khirigsuurs, deer stone art, and bronze age cultural intensification in Northern Mongolia." In *New Research Directions in Eurasian Steppe Archaeology: the Emergence of Complex Societies in the Third to First Millennium BCE*, ed. Bryan Hanks and Kathryn Linduff. Cambridge: Cambridge University Press.
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## V. Forensic Studies of Ancient and Modern Mongolians

Bruno Frohlich, Department of Anthropology, NMNH

### Introduction

Since 2004 Bruno Frohlich and his associates have collaborated with the Institute of Archaeology at the Mongolian Academy of Sciences on several archaeological and anthropological projects in Mongolia and in the US. This includes surveying and excavations of 3,000 year-old Bronze Age burial mounds, also known as khiriigsuurs in the Hovsgol aimag, the study of 300 to 400 year old human mummified bodies from the Gobi Desert, the forensic investigation of executed Buddhist monks found in mass burials at Hambiin Ovoo outside Ulaanbaatar, and the sponsoring of extensive training of Mongolian students and researchers at the Mongolian Academy of Sciences.



Bruno Frohlich supervising excavations at a small Bronze Age burial mound in Mongolia. [SI Photo]

### Hovsgol Burial Mounds

The major goal is to study and understand the temporal and spatial distributions of northern Mongolia's Bronze Age burial mounds and how such information can in turn help us better understand the people living in the Mongolian steppe landscape 3,000 years ago. Our project is divided into three phases: (1) surveying; (2) excavations; and (3) analysis. Phase 1 took place from 2003 to 2005, during which we completed the survey of more than 1300 mound structures in an 850 square

kilometer area between Ushkiin Uuver and Ulan Tolgoi west and northwest of Muron. This information has now been included in an advanced and informative geographical information system (GIS). Phase 2 was initiated in 2006 with the excavation of seven mounds all yielding human skeletal remains and which all dated to about 3,000 BP. Phase 2 continued in the summer of 2007 and resulted in the excavation of 15 additional mounds, all yielding human remains. Phase 3, the analytical stage, is in progress including the quantitative analysis of surveying data (GIS), and the study of mound architecture and the human remains. We expect to complete Phase 2 (excavation) next summer (2008). At this time, we believe the the Khiriigsuurs are indeed human burials and that they are representative of the people responsible for their construction. Hopefully our continuing research will enlighten us on many unanswered questions including the degree of nomadic and sedentary behavior.

### Gobi Desert Human Mummified Remains

In 2004 we collaborated with the Mongolian Academy of Sciences in the retrieval of nine human mummified bodies from an underground cave in the southern Gobi Desert. The bodies, males and females, including three infants, two children and four adults, were studied at the Smithsonian Institution for one year and then returned to the Institute of Archaeology in the summer of 2006. At this time we have completed radiological

procedures, biochemical sampling for dating, and nutritional analysis, and are presently completing the pathological analysis of all nine bodies. We anticipate that our combined research will result in the reconstruction of the event that led to the depositing of these bodies into the cave more than 300 years ago. We have concluded that all nine individuals were murdered by execution-style killings including strangulation, hanging, dismembering of extremities, and the fracturing of several bones.

#### Mass Burials at Hambiin Ovoo

In the fall of 2003 we were asked by the Mongolian Academy of Sciences to assist the Institute of Archaeology carrying out forensic investigations of a recently found mass burial outside Ulaanbaatar. The mass burial had been excavated and researched by monks from the Ghandar monastery in UB. A small team of forensic experts from the Smithsonian Institution supported by staff members from the Institute of Archaeology completed test excavations in places surrounding the area where almost 1000 executed monks had been identified by the Ghandan monastery. About 50 bodies were studied, and supporting data and information have been produced in an attempt to describe and reconstruct the event from a forensic point of view. At this time, we have concluded that the mass burial is far more extensive than previous anticipated and that the time span in which this specific place was used for executions may have been several decades before and after the initial dating to the late 1930s. Ballistic analysis of cartridges found in the excavated areas, and the study of the entry and exit foramina in the crania have helped identify the kind of ammunition and types of firearms used in the majority of the executions. The final report of our initial investigation is presently being prepared for publication. Because of the potential political sensitivity of this research we are collaborating fully with the Mongolian Academy of Sciences on the publication of our finds.

#### Training and Education

Our collaboration with both the Mongolian Academy of Sciences and the National Museum of Mongolian History has resulted in an expanded access to advanced analytical methods. This has included the evaluation and dating of human remains and advice on the interpretation of new finds. For example the recent find of a potential early hominid cranial calotte from Salkhiit in the Khentii aimag was brought to our attention last December by the Institute of Archaeology. We assisted the Institute in an early evaluation of the site, the finds, and also concluded the AMS/C-14 dating of potentially associated faunal remains. However, the most satisfying element of our collaboration is our interaction with Mongolian students and researchers. We are continuously involved in the exchange of ideas, data, and information. We are focusing on long-term plans, which include analytical procedures, teaching new research methods to students, and assisting in the planning of graduate studies both in Mongolia and in the US. We have been especially satisfied by the significant impact our sponsored English language training has had on improving students' and researchers' language skills. This training is ongoing and this fall we anticipate that about five persons from the Institute of Archaeology will be enlisted in this English language program.



Our collaboration with the Mongolian Academy of Sciences has proven to be very successful and productive. We are collaborating with our Mongolian colleagues, as well as with many scientists and organizations in the US and other countries. This includes the Deer Stone Project at the Smithsonian Institution, the University of Copenhagen, Emory University in Atlanta, Johns Hopkins University in Baltimore, New Haven University and Yale University in Connecticut, Auckland University in New Zealand, and Bradford University in England. We anticipate our collaborative research with the Mongolian Academy of Sciences will become much more productive in the future, and we are especially encouraged by the ongoing success we have observed in the educational progression of most of our Mongolian students and degree candidates.

### Publications

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## VI. Archaeology of Ancient Nomadic Political Organization in Mongolia

William Honeychurch, Dept. of Anthropology, NMNH (Yale University)

### Project Summary

My research in Mongolia has been directed at ancient nomadic political organization. Nomadic groups of the Eurasian steppe organized large-scale states and empires as early as the first millennium B.C. and are best known for the world empire constructed by the medieval Mongols under Genghis Khan. How and why relatively obscure groups of pastoral nomads assembled such monumental and complex polities is a topic that archaeology is well-suited to explore.

I study these questions through the archaeological material remains left by horse nomads over the past 3000 years on the steppes of Mongolia. My field projects emphasize regional survey to discover and map cemeteries, habitation sites, walled fortresses, rock art, and ceremonial areas. Field surveys carried out to date are located at the site of Egiin Gol, northern Mongolia, and at Baga Gazaryn Chuluu in the Mongolian Gobi desert. For the past four years this research has been conducted as part of the Smithsonian's Mongolian Studies Program in collaboration with the Mongolian Academy of Sciences and its Institute of Archaeology.



### Publications

- Honeychurch, W. and Ch. Amartuvshin, 2003. "An examination of Khunnu Period settlement in the Egiin Gol Valley, Mongolia." *Studia Archaeologica* 21: 59-65.
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## VII. Tracking Gazelle Movements Across Mongolia's Eastern Steppes

Peter Leimgruber, National Zoological Park

Thomas Mueller, National Zoological Park

### Project Summary

Scientists from the Smithsonian Institution's National Zoological Park are investigating movements of Mongolian gazelles in Mongolia's Eastern Steppes. This work has been performed in collaboration with the Wildlife Conservation Society (WCS) and the Mongolian Academy of Science. The Eastern Steppes constitute one of the largest remaining grassland in the world, even larger than the Serengeti, and support a diverse wildlife community. Perhaps most stunning are the huge groups of Mongolian gazelles – tens of thousands can be observed wandering across the steppe. However, these steppes are increasingly threatened by expanding industrial development, hunting, and hay production.

Using satellite-tracking, we have found that gazelles move over huge distances with a single individual requiring an area three times the size of Yellowstone National Park in a single year. However, unlike wildebeest in the Serengeti or caribou in Alaska, Mongolian gazelles do not move along well-established seasonal routes from known winter to summer grounds but are constantly wandering across the steppe in seemingly random ways.



Gazelles wandering across the steppes of Eastern Mongolia [Photo by: T. Mueller]

To understand why animals pursue this unique nomadic strategy we have used satellite imagery to map grassland quality and productivity at regular intervals through the year. We have established a tight link between vegetation productivity and gazelle movements and have developed a predictive model that determines good gazelle habitat for any particular time. By applying this model to map good gazelle habitats of the past 7-8 years, we found that good foraging areas for gazelle constantly shift and that these dynamic shifts are unpredictable instead of regular and seasonal. That's why suitable gazelle areas may sometimes be located inside protected areas, but at other times they may only be found outside park boundaries. Developing landscape-level strategies pertaining to the entire steppe rather than single protected areas will be key to effectively conserving Mongolian gazelles.

During our September 2007 trip to Mongolia, National Zoo scientists and WCS staff captured nine Mongolian gazelles and equipped them with GPS-satellite collars. Data transmitted from these collars will reveal how and why these gazelles follow this unique movement pattern. On our trip we observed the largest congregation of Mongolian gazelles ever reported. Over 200,000 animals were roaming the grasslands. We also



witnessed immediate threats to their steppe habitat, including large-scale oil exploitation and new road construction.

### Publications

- Leimgruber, P., W. J. McShea, C. J. Brookes, L. Bolor-Erdene, C. Wemmer, and C. Larson, 2001. "Spatial patterns in relative primary productivity and gazelle migration in the Eastern Steppes of Mongolia." *Biological Conservation* 102: 205-212.
- Olson, K. A., T. K. Fuller, G. B. Schaller, B. Lhagvasuren, and D. Odonkhoo, 2005. "Reproduction, neonatal weights, and first-year survival of Mongolian gazelles (*Procapra gutturosa*)." *Journal of Zoology* 265: 227-233.
- Olson, K. A., T. K. Fuller, G. B. Schaller, D. Odonkhoo, and M. G. Murray, 2005. "Estimating the population density of Mongolian gazelles *Procapra gutturosa* by driving long-distance transects." *Oryx* 39: 164-169.
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## VIII. Urban Centers and the Emergence of Empires in Eastern Inner Asia

Daniel Rogers, Dept. of Anthropology, NMNH

### Project Summary

This project, which began in 2002, investigates the emergence of urban centers and empires in Mongolia and adjacent regions of Eastern Inner Asia. In addition to Daniel Rogers (Smithsonian Institution), project partners include Erdenebat Ulambayar (Mongolian Institute of Archaeology), and L. Monkhubayar (Mongolian Institute of Archaeology).



The focus of the project is on archaeological study of the role of settlements in the development of empires in Mongolia, beginning with the Hunnu empire (200 B.C.) and continuing through the Mongol empire. Field work has involved broad regional surveys, visits to major urban centers of the different cultural periods, studies of early maps and plans, consideration of ecological variables, and historical documents as well as published literature.

These studies have enabled us to better understand the inner mechanisms of Mongolian empires. The large political confederations of high mobility which traditionally characterize the great Mongol empires of the first and second millennia A.D. are shown to have made use of highly sophisticated urban places, which feature advanced planning and design, and impressive monumentality serving a variety of specific functions. Research continues on these and related projects, including a large multi-institutional research grant from the National Science Foundation (NSF) involving agent-based modeling of cultural change through time using data collected in the field programs described above, and in more detail below.

### Publications or reports citations

Rogers, J.D., E. Ulambayar, and M. Gallon, 2005. "Urban centers and the emergence of empires in Eastern Inner Asia." *Antiquity* 79: 1-18.

Rogers, J.D., 2007. "The Contingencies of State Formation in Eastern Inner Asia." *Asian Perspectives* 46, no. 2: 249-274.

## IX. Agent-Based Dynamics of Social Complexity: Modeling Adaptive Behavior and Long-Term Change in Inner Asia

Daniel Rogers, Dept. of Anthropology, NMNH



The stupa at Kherlem Bars City #1 is approximately 1,000 years old, making it a very important treasure of Mongolian history. [SI Photo]

### Project Summary

This long-term National Science Foundation (NSF) research grant began in January 2006 and will continue until January 2009, with partners including: (1) C. Cioffi-Revilla (Principal Investigator), S. Luke, and D. C. Parker of George Mason University, Fairfax, VA, U.S.A.; (2) J. D. Rogers, W. W. Fitzhugh, W. Honeychurch, B. Frohlich, and P. DePriest, of the Smithsonian Institution, National Museum of Natural History, Washington, DC, U.S.A.; (3) C. Amartuvshin, of the Mongolian Academy of Sciences, Ulan Bataar, Mongolia; Malkov, of the M. V. Keldish Institute for Applied Mathematics, Moscow, Russia; and (4) Domenico Parisi, Inst. of Psychology, Italian National Research Council (C.N.R.), Rome, Italy.

The project addresses fundamental questions in theory, methodology, and data concerning human and social dynamic responses to social and environmental challenges in Inner Asia and the Eurasian world system over the past 4,500 years.

Inner Asia played an essential catalytic role in the history of human and social dynamics in Eurasia. This system produced the largest territorial polity to emerge in the evolution of civilizations – the Mongol Empire of the 13th and 14th centuries – as well as the largest scale economy – the Silk Road network – before present-day globalization.

For each of the last two years, three archaeological teams have been in Mongolia under Smithsonian sponsorship, through collaborations with the Institute of Archaeology and the National Museum of Mongolian History. The fieldwork has produced many new discoveries, especially on Bronze Age deer stones and burial mounds and systematic recording of archaeological sites in several regions. Work is also ongoing with the Institute of Archaeology to produce a database of archaeological sites in Mongolia.

A computational model of social change has been produced that focuses on the development of early tribal confederations and how clans and lineages may have merged to form more complex societies.

Publications or Report Citations

Numerous publications have been produced in archaeology and computational social science. Selected examples are listed below:

- Cioffi-Revilla, C., S. Luke, D.C. Parker, J.D. Rogers, W.W. Fitzhugh, W. Honeychurch, B. Frohlich, P. DePriest, and N. Bazarsad, 2006. "Agent-based dynamics of social complexity: Modeling adaptive behavior and long-term change in Inner Asia." *Proceedings of the First World Congress on Social Simulation*. Kyoto, Japan.
- Cioffi-Revilla, C., S. Luke, D.C. Parker, J.D. Rogers, W.W. Fitzhugh, W. Honeychurch, B. Frohlich, P. DePriest, and N. Bazarsad, 2006. "Agent-based dynamics of social complexity: Modeling adaptive behavior and long-term change in Inner Asia." *Proceedings of the North American Association for Computational Social and Organizational Science*. Notre Dame, Indiana, U.S.A.