

## PART VII

### Theories and Hypotheses Pertaining to Mongolian Bronze Age Khirigsuurs in Hovsgol Aimag, Mongolia

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#### Introduction

The Smithsonian Institution and the Mongolian Academy of Sciences have collaborated on several projects since 2003. These include: (1) surveys and excavations of Bronze Age burial mounds, also known as khirigsuurs, in the central part of the Hovsgol aimag; (2) excavation and analysis of Buddhist monk victims found in mass burials in Ulaanbaatar; (3) analysis of human mummified tissue; and (4) issues related to collection management, education, training and the exchange of data and other information (Frohlich et al. 2004; Frohlich et al. 2008a; Frohlich et al. 2008b; Frohlich et al. 2010). The first author's initial introduction to Mongolian antiquity studies was in collaboration with the Arctic Study Center at the National Museum of Natural History, Smithsonian Institution.

This report includes a review of our activities in the Hovsgol aimag as it relates to the surveying and excavations of Bronze Age burial mounds (khirigsuurs). It also presents a selection of defined topics derived from our extensive database and ends with a summary of some of the ideas and results obtained to date. We describe and discuss some of our results relating to the following topics: (1) burial chamber construction; (2) human remains; (3) burial desecration; (3) AMS dating; (4) demographic profiling and survivorship; and (5) external structures (stone rings).

#### Project Background

The 2009 season was our last full field season, and was completed with the excavation of one of the large mounds known as a Class I mound (Amgalantugs et al. 2007; Frohlich et al. 2008a). Since 2003 we have surveyed more than 2,000 mounds in the Hovsgol aimag and have excavated 40 khirigsuurs, all of which except for seven mounds yielded human remains. Having completed our fieldwork, the project is now in the analytical phase, focusing on the organization, analysis, and interpretation of the data collected. This phase is nearing completion and has resulted in new ideas, results, and hypotheses.

However, as with all new information and research, the results and the interpretation of results are directly dependent on the quality of the data collected. During the last three field seasons, we have implemented a series of quality-control procedures in order to verify and re-validate our data. For example, the original survey, which was meant to identify all the khirigsuurs within an 850 square kilometer area, proved to be flawed due to our initial inexperience in identifying smaller and barely

visible khirigsuurs (Frohlich and Bazarsad 2005). Nevertheless, one major advantage of working for years with a team of highly qualified and experienced members, most of whom have been with project since its beginning, is that we have been able to refine and adapt our techniques to better identify and record mounds. We have during the last few seasons gone over our previous survey numbers and noted that we have underestimated the total number of mounds in our previously surveyed areas. This has now been rectified, and we believe our database now accurately reflects the actual data available. We have also, throughout our years of field research, identified new architectural features which at first had been classified as a surrounding fence but which we later re-identified as an additional wall structure that surrounds the central burial mound (Frohlich et al. 2008a). Our planned 2010 season will accomplish two objectives: (1) complete the excavations of two un-finished structures, and (2) validate our present results by re-evaluating our previously surveyed and excavated features to ensure our original data collection and our more recent controls are as accurate as possible.

### Definitions

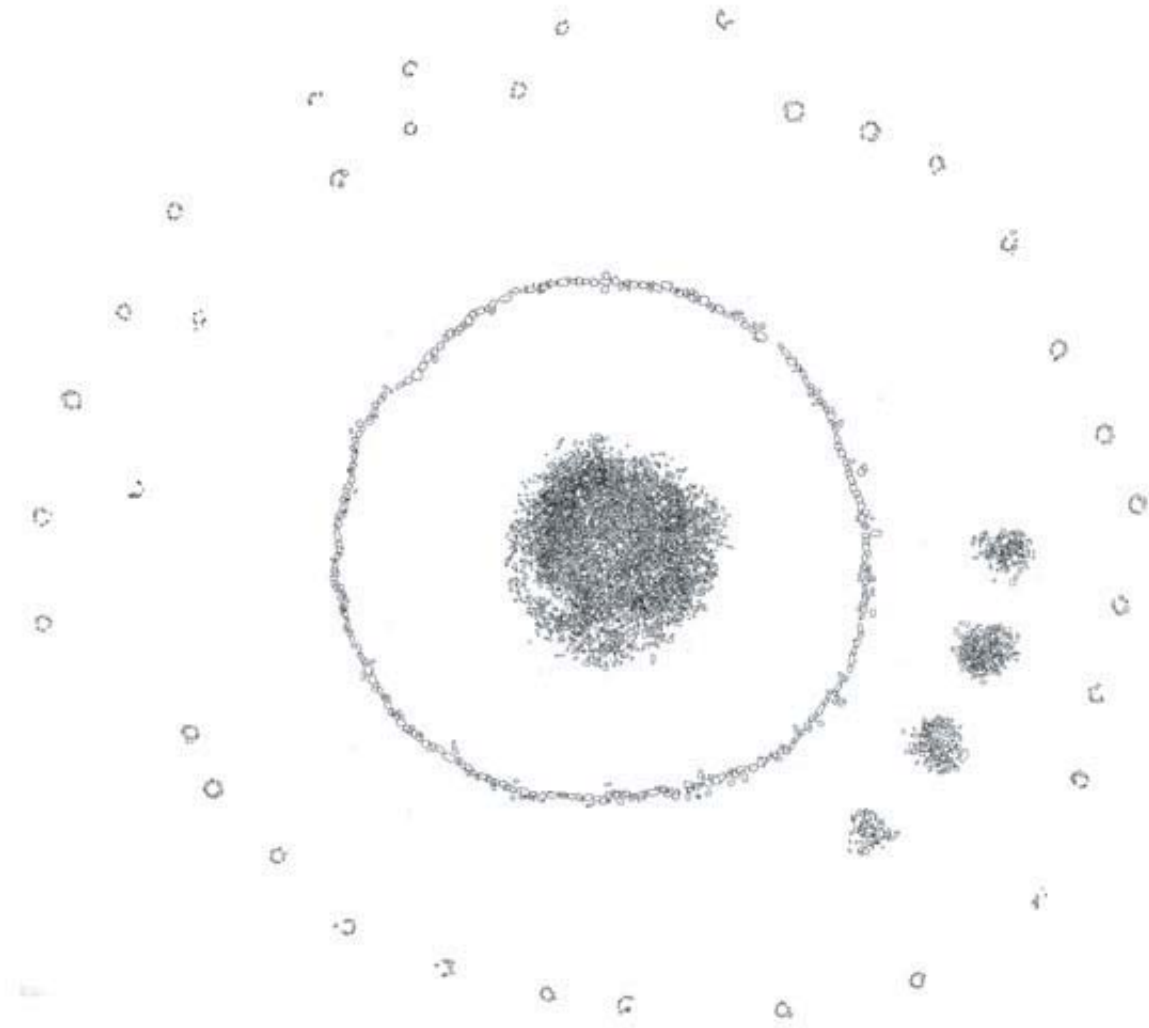
Khirigsuurs are mostly found in central and northern Mongolia, in western Kazakhstan, in north-western China, and in the Siberian areas north of the Mongolian territories. Khirigsuurs are also identified as kurgans by the Russian Federation. It is believed that khirigsuurs are found in most geographical areas, not necessarily randomly distributed in space, but rather in groups of several thousands. These areas may each be more than one thousand square kilometers in size. Several such macro-groups have been identified in the Hovsgol aimag (Amgalantugs et al. 2007; Frohlich et al. 2008b), in the Mongolian Altai regions (Jacobson et al. 2001; Jacobson 2002), in the Altai region of the Russian Federation, and in central and northern regions of Mongolia (Allard and Erdene-



**Figure 1.** Small Class III mound (M-55) with a center burial mound surrounded by a ring wall. No fence was recorded. Smaller rocks inside the ring wall have been removed exposing the burial chamber. Diameter of ring wall is circa 450 cm.

baatar 2005; Erdenebaatar 2000; Amartuvshin 2007; Volkov 1981). However, we do not, as of yet, have a complete depiction of the exact distribution of khirigsuurs. The basic architectural features are similar across the various groups of khirigsuurs located throughout the region, but local smaller variations are also present. This suggests that each area may include a limited number of architectural variants which could act as identifiers for each specific group.

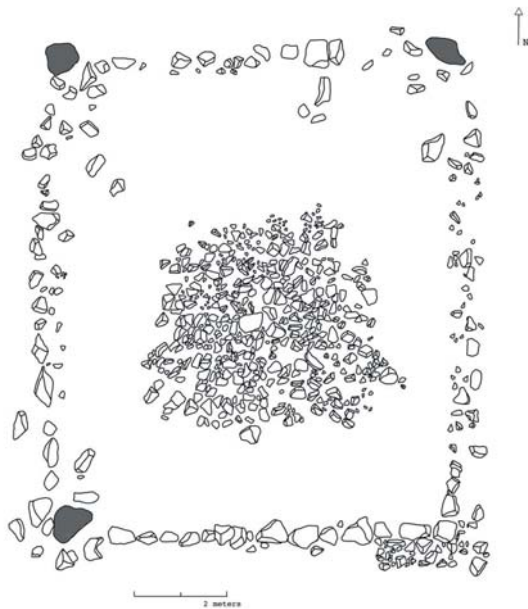
Khirigsuurs are places of human burial, each consisting of a single individual. The classical khirigsuur includes a central burial mound inside of which is a single burial chamber containing the remains of one deceased human being. The central burial mound may be closely surrounded by a ring wall made up of rocks that are often several times larger than the rocks making up the actual mound (Figure 1) (Frohlich et al. 2008a). Mound structures in the Hovsgol region are 85% of the time sur-



**Figure 2.** Large Class I mound (M-52). Mound includes center burial mound surrounded by a circular fence. No ring wall surrounding the center burial mound was found. Four external mounds are located to the southeast, and 34 stone rings are positioned in two irregular circles. Mound was fully excavated and yielded the body of one adult male (see Figure 6). The body has been desecrated by intruders; an action, which most likely took place short time after interment. The fence has a diameter of circa 37 meters. No horse skeletal remains were found in the external mounds.

rounded by a rock fence, which can be either circular or squared. The circular fence is a perfectly circular structure made up from medium size rocks placed very closely together on the original ground surface (Figure 2). The squared fence has four distinct sides, but its construction is otherwise similar to a circular fence. The four sides create a square or rectangular structure with four corners. The four corners of a squared fence can be marked by the intersection of perpendicular walls, a small rock mound, or a single upright stone of either large or small size. Contrary to the circular fences' perfectly circular architecture, the assumed parallel walls making up the squared fence are not always parallel, and likewise are not always straight lines (Figure 3). This basic architectural expression is how we define the 'classical' khiriguur (Amgalantugs et al. 2007; Frohlich et al. 2008a).

The khiriguur architecture may also include external structures. There are two types of external feature: (1) external mounds and (2) stone rings. External mounds are heaps of rocks making a smaller mound structure of between one and five meters in diameter. About 35% of external mounds we



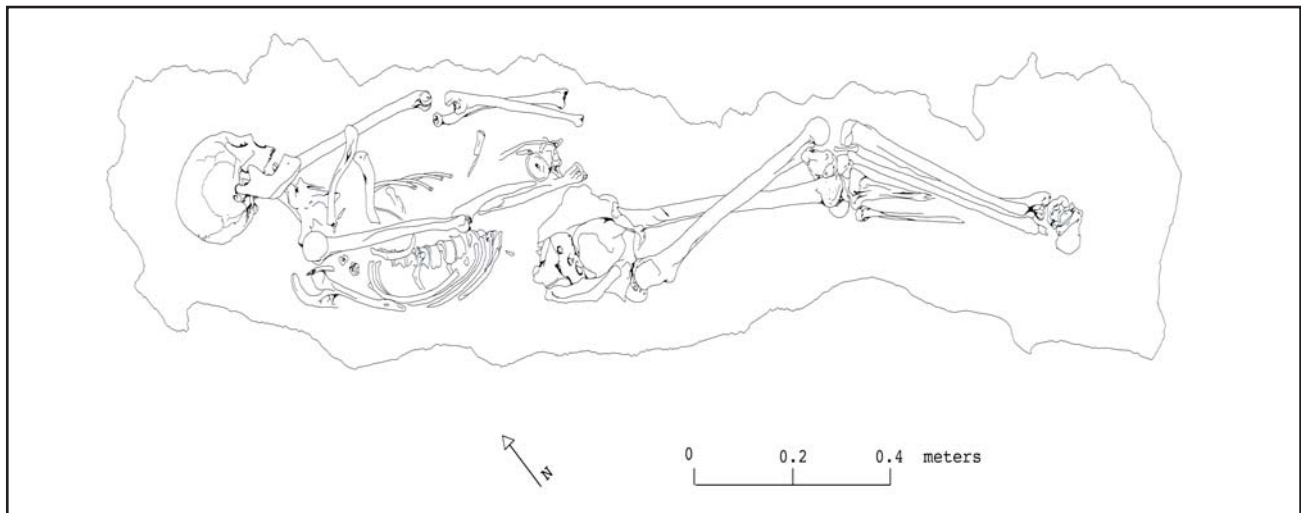
**Figure 3.** Medium size Class II mound (M-01). Mound includes a center burial mound with one burial chamber. The chamber, covered by nine capstones, was empty. One body (see Figure 4) was later found below the chamber floor. A squared fence surrounds the center burial mound. Maximum length of the eastern north – south fence side is circa 11 meters. Each corner is marked with a large boulder. A raised platform made from smaller rocks separates the center burial mound from the fence.

have excavated include horse skeletal remains. The remains may include cranial, mandibular, cervical, vertebrae, and hoof elements. These skeletal elements may be articulated, partly articulated, or completely disarticulated. In some cases the horse remains may have been disturbed by animals and/or desecrated by humans. Stone rings are made up of between seven and twelve stones. Each stone is positioned in such a way that the ring creates a perfect circle with a diameter of about a hundred cm (Figure 1). Our excavations of these stone rings have, so far, not yielded any objects or sediments associated with man-made activities that could supply factual information as to their purpose. However, the positive correlation between the general architectural size of the mounds and the number of both external mounds and stone rings may reflect the socio-economic and/or political status of the individual buried in the central mound.

### Burial Chamber Construction

Burial chambers are located at the middle of the central burial mound. They may be as simple as a roughly excavated pit or may have meticulously constructed stone walls. The chamber is covered with between one and twelve capstones. The capstones may also be one, two, or even three layers of

large, flat boulders (Frohlich et al. 2008a). We have found that all burial chambers include an almost perfectly horizontal chamber floor, and that in the case of mounds located on hillsides, all burial



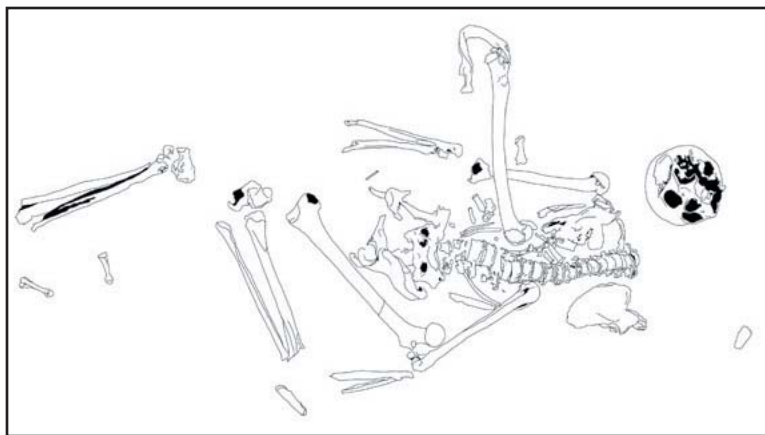
**Figure 4.** Skeletal remains of an adult male, circa 20 years old (M-01). Body is placed on its left side with the face toward the top of the hill. Body was placed below the floor of the burial chamber in order to hide the remains from potential intruders. Indeed, intruders removed capstones and entered the burial chamber from the southeast, but they never found the body below the floor. However, animals, possible marmots and/or other rodents found the body and removed a few smaller bone elements, which we later found in other locations within the center burial mound.

chambers are oriented with their long side parallel to the hill's contour lines. This makes sense from a practical point of view since a floor paralleling the contour lines of the hill would tend to be level and require the least amount of physical work. The body is then placed in either a supine position or lying on its left side facing toward the top of the hill, or toward the closest hill (Figure 4). Because khirigsuurs are generally located on the southern slopes of a hill, ranging from the western slope to the eastern slope, the orientation of the burial chambers range from an almost north to south direction when the khirigsuurs are located closest to the western and eastern slopes, and respectively, in an east to west direction when located at the most southern slope. Therefore it is hypothesized that if the body is placed on its left side facing in toward the hill, the head is oriented towards the north when located on the western slopes, towards the west on the southern slopes, and towards the south on the eastern slopes. Only when the body is supine is it possible to divert from the left side position rule (Frohlich et al., 2008a).

The burials are primary, which means that the body of the deceased individual was placed in the burial chamber soon after death. We have evidence that burials may have been disturbed by both animal activities and by human intruders. Most of these disturbances have taken place early in antiquity, probably soon after interment, but a few of them have also occurred in more recent time. We are using a series of observation to separate animal disturbance from human disturbance. This includes the identification of tunnels created by smaller animals such as marmots, and the purposeful destruction of the mound structure due to human intruders.

### Human Remains

Both males and females of all age-cohorts, from newborns to elderly, have been identified in our excavations. The sample size of human skeletal remains, which encompasses 32 burials, is too small to produce a statistically significant representation of skeletal metric and non-metric observations. However, it is notable that the remains are morphologically consistent in size and shape with other Mongolian human skeletal collections from later and modern time periods (Lee 2008; Frohlich et al. 2008a). Tentative identifications of pathological conditions include congenital anomalies, infectious changes, and healed or healing fractures. Some individuals may have been handicapped to such a degree that he or she may not have been a fully productive member of the society. One individual suffered a peri-mortem trauma to the cranium, with at least one obvious penetrating wound and with associated fractures to the vault caused by compression blows to the head. In general, the presence of skeletal anomalies showing the successful healing of infectious diseases and traumatic events may suggest that the society had some knowledge of medicinal treatments, the resources, and the cultural obligation to provide for and support its medically disadvantaged members. Furthermore, upon their death, the surviving members of the society provided a burial relative to the deceased individual's



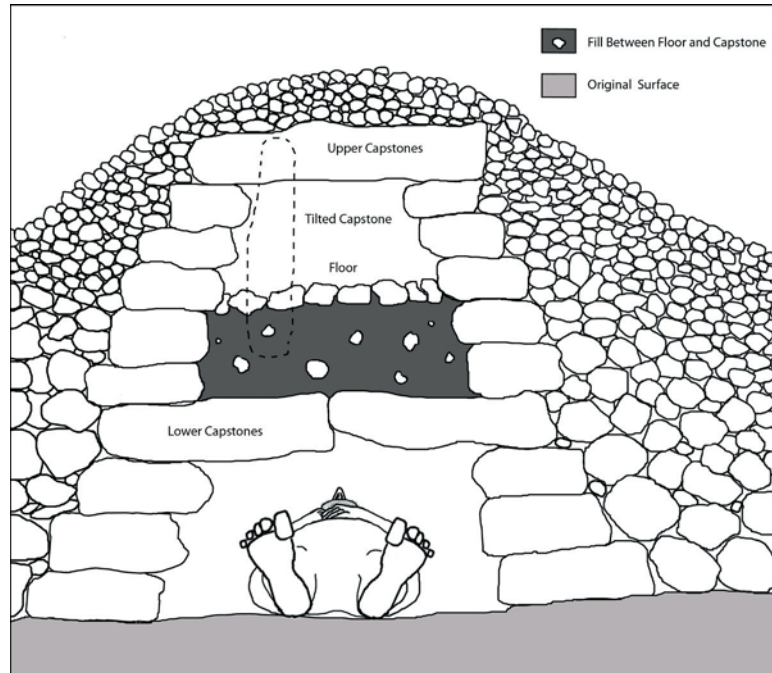
**Figure 5.** Skeletal remains of an adult female (M-08). The human body was severely disturbed by animals (marmots and/or smaller rodents) and by human intruders (desecration). The desecration by human intruders took place very shortly after interment, and the animal disturbance possible at both early and later times.

social, economic, and political status independent of sex and age.

### Burial Desecration

The disturbance of burials due to human activities is of special interest since no cultural burial objects or signs of cultural burial objects have been found in any of the excavated burial chambers. We have come to believe that no cultural objects were placed within the burials at the time of interment. We believe that if cultural objects had originally been placed within the 40 excavated burial chambers at least one object, complete or incomplete, or a sign of an object, either in a disturbed and/or non-disturbed chamber, would have been identified. This is further evident in relation to the excellent preservation of most of the human skeletal elements. Therefore, in conjecture, some discernible components made from wood, fabric, or any other delicate and less sustainable materials should have been found--even after about 3,000 years.

We have concluded that a large portion of the human-related disruption and damage caused to the khirigsuur occurred in early antiquity and for purposes other than looting. The early antiquity disturbance can be identified in the relocation of some or most of the human skeletal pieces in some of the burial chambers. Such overall disturbance, showing misplaced but still partly articulated skeletal structures, can only take place if the chamber has not yet been filled in with intruding sediments, and only if some of the ligaments and muscle tissue holding the skeleton together had not fully decayed (Figure 5). That puts the grave disturbances into a time frame from within months of the interment to probably no later than five to ten years after the interment -- all depending on other variables such as temperature, humidity, and coverage.



**Figure 6.** Schematic drawing of burial chamber from mound M-52 (Large Class I mound, see Figure 2) as it might have looked like just after the completion of the interment. Body was originally placed in a supine position with the head toward the west. In order to secure the body from potential intruders, the mound builders added small boulders around the chamber, two layers of capstones, and a faked chamber positioned on top of the real chamber. The lower layer of capstones is secured by being locked between the larger stones making up the chamber walls and the large boulders surrounding the chamber. Intruders succeeded in entering the upper chamber but failed to break through the upper chamber's floor and the locked capstones covering the lower chamber. Although they failed entering from the top, they later succeeded breaking into the lower chamber through the western sidewall. The body was severely desecrated. Later, some bone elements were removed by animals. Some of these elements were found between the rocks making up the center burial mound.

We have come to believe that disturbances occurring during the Bronze Age period are associated with retaliatory, revenge, or control-related measures, thus possibly defined as an act of body desecration. We support this hypothesis by both (1) the total absence of burial objects in all of the excavated burial chambers, and (2) by several architectural features that strongly suggest that the mound

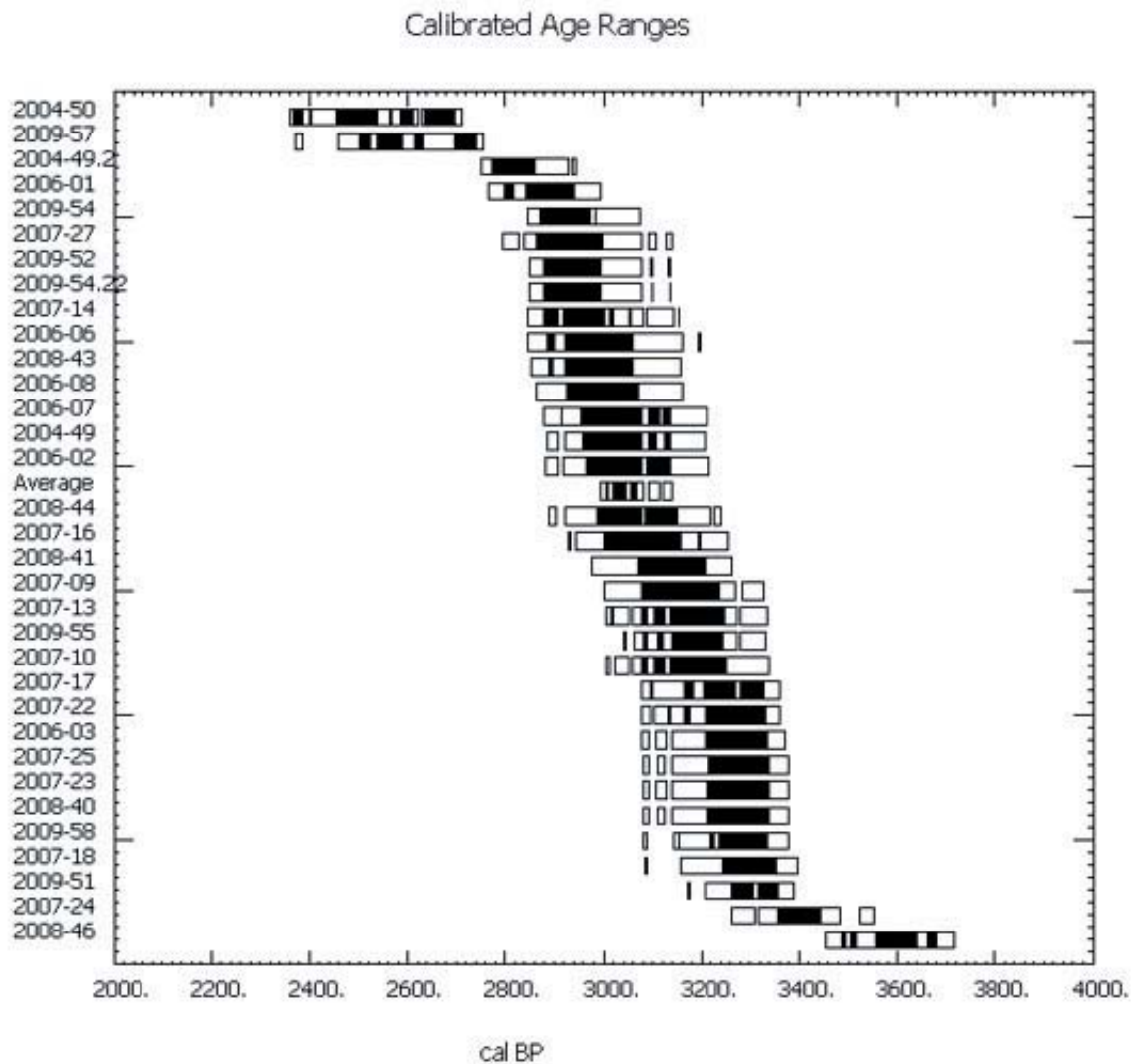
builders knew that the burials could be disturbed and, therefore, constructed the graves so as to protect the burials. For example, we have found that in some cases the mound builders intentionally placed the body outside of the allotted burial chamber space. In 2006, we excavated and identified a sophisticated and intricately constructed burial chamber that consisted of several layers of large rocks that made up the chamber walls and nine capstones. No human skeletal fragments were identified within the defined burial chamber. Eventually we found a perfectly articulated body of an adult male placed in a poorly defined pit 35 to 50 cm below the burial chamber's implied floor (Amgalantugs et al. 2007). In this case there is evidence that the burial chamber had been disturbed because of the slight displacement of the capstones. The intruders, however, never found the actual body. It is believed that utilizing such protective measures during the mortuary process, including the strong reinforcement of the burial structure through the adding of several different layers of capstones, was common during the time when *khirigsuurs* were constructed. This may also explain why some *khirigsuur* burial chambers have been reported as empty during previous archaeological excavations.

In 2009 we excavated a large mound that incorporated a series of elaborate architectural features in hopes of preventing potential intruders from entering the burial chamber. This included a fake burial chamber, a fake floor, two layers of heavy cap stones, and the locking of the lower capstones over the real burial chamber in such a way as to make them extremely difficult to remove (Figure 6). The intruders initially tried to enter the chamber from the top of the central mound, but they were not able to because of the structures' protective features. However, the same intruders or later ones succeeded in getting to the body by breaking into the mound from the side, and having to removed a large number of rocks and boulders (Figure 6).

The disturbance of the burials by humans in modern time will not be discussed in detail at this time. Briefly however,, recent grave robbery has been reported as early as the late 19<sup>th</sup> century (Andrews 1927; Campbell 1903). Lately, the 1992 introduction of an open market economy and the increased number of tourist activities has promoted and facilitated unlawful and widespread acts of vandalism on prehistoric and historic Mongolian monuments. More disturbing is the vast amount of unrecorded archaeological 'test excavations' which have taken place since the first recorded archaeological expedition to the area in about 1880 by Finnish and Russian 'scholars' (Campbell 1903). The desecration of human remains in a burial context is a common but rather poorly reported event in mortuary practice records. We have found that the desecration and disruption of graves is mostly found in the larger *khirigsuurs*, thus likely representing individuals with higher levels of socio-economic or political status.

### **AMS Dating**

Thirty-nine of our human bone samples were submitted for traditional radiometric dating. Four samples were excluded due to their being of later or earlier dates, including Xiongnu and Mongol Empire periods, or were not directly associated with a burial chamber. One burial was dated twice. Of the remaining thirty-four samples, two come from horse remains found in external mounds, and one sample comes from a unique mound located between the center burial mound and the circular fence. Consequently the thirty-four *khirigsuur* dates recorded represent a total of thirty-two *khirigsuurs*. Eight *khirigsuurs* were defined as 'empty', and thus no samples could be used for dating. Most likely taphonomic processes, such as moving water, caused the complete decay of skeletal fragments. Four of the samples suggest a significant deviation from the expected age distribution of cal BP 3,403 to cal BP 2,818 (Reimer et al. 2009). This includes three with low sample quality, and one with unusual architectural features that might suggest a possible older *khirigsuur* variant.



**Figure 7.** Calibrated AMS age ranges. Y-axis: mound ID, and X-axis: calibrated age BP (Before Present, and where present is 1950). Horizontal bars include the Sigma 1 range in black and the Sigma 2 range in white. M-2004-50 and M-2009-57 yield significantly younger age estimates. This may have been caused by very poor sample quality. M-2008-46 is significantly older than all other dates. M-46 has been classified as a 'pre-khirigsuur' structure based on both mound architecture and AMS date. Radiometric dates have been produced by Beta Analytical, Miami, Florida (n=3), and the NSF AMS laboratory at the University of Arizona, Tucson, Arizona (n=31).

Based on the center values calculated from each of the 68.3% cal age ranges (Sigma 1), we can estimate that the range from cal BP 3,403 (cal BC 1,604) to cal BP 2,818 (cal BC 868 cal) is 585 years. The 'pooled mean radiocarbon age' is BP 2,946  $\pm$  9 with the 68.3% cal age ranging from cal BP 3,156 (cal BC 1,206) to cal BP 3,077 (cal BC 1,127). The accumulative 68.3% calibrated probability distributions, by year, is from cal BP 3,335 (cal BC 1,385) to cal BP 2,895 (cal BC 945) with a range of 440 years (Reimer et al. 2009) (Figure 7).

We have tentatively correlated the average 68.3% (Sigma 1) ages for each khirigsuur with the following variables; spatial locations, classes, types (circular or squared fences), sex (male or female), age (age cohorts from 0 yr to 45+ yrs), and sizes (metric dimensions of architectural features). No correlations have been established. This suggests that any expression of khirigsuurs by location,

class, type, sex, age, or metrics could have been constructed at any time within the 585 year range, for that reason distinctions found inside these variables may be caused by factors related to socio-economic and political status. Finally we do not find any age variations in the dates between khirigsuurs excavated in 2004, 2006, 2007, 2008 and 2009, representing five distinct areas with some spatial distances between them. This suggests that burial activities were the same at any given time and at varying locations within the surveyed area. However, we also find khirigsuurs with similar or close dates clustering into smaller assemblies. For example during the 2006 and 2007 excavation seasons we identified at least four potential clusters of between two and four khirigsuurs with less than 5 to 50 years between the interments of the individual burials based on the average 68.3% (Sigma-1) calibrated values. This may suggest kinship as an important factor in the selection of a specific location for a burial.

### **Demography and Survivorship**

One of our main objectives in this study is the reconstruction of a demographic profile based on both factual data and observation. With limited demographic and environmental information we are not, as of yet, able to incorporate important factors such as catastrophic events, migrations, sex ratios, population growth, birth and death rates, wars, famines, and other events affecting detailed demographic calculations. Our present evaluations are based on averages thus not taking into consideration any major variation that could be taking place within the discussed time span. However, if we had a known number of burials, an equal distribution of males and females, and a representation of all age cohorts from newborns to old age, we believe that the khirigsuurs studied in the Hovsgol aimag can be representative of the living Bronze Age population, and that the total number of deceased individuals produced by the living population equals the total number of khirigsuurs. This is of course somewhat unrealistic, but accepting and understanding the limitations, paleo-demographic reconstruction is a very powerful tool, which can be used for the future development of a working hypothesis. When additional information becomes available we can refine our demographic profile and generate a more realistic representation of the Bronze Age population (Frohlich and Ortner 2008).

We have calculated the averaged number of living people to be about 82 individuals within our designated group area, or in other words, it takes 82 live individuals, occupying that same area for about 585 years to produce 1600 dead individuals. Thus when applying the correct mathematics and using the following information we derive to the number of 82 based on the following: (1) an estimated life expectancy at birth of 30 years, (2) a time span of 585 years, and (3) the total number of deceased individuals of ca. 1600. In general that will represent around 12 households, or 12 gers/kurgans, each containing two adults and five children; of those five children three will most likely not survive into adulthood. This would be assuming that there is a sub-adult mortality rate of around 60%, which is typical for many pre-industrialized populations, both nomadic and sedentary (Frohlich and Ortner 2008; Littleton 1998; Ubelaker 2004).

We believe that an average population size of 82 individuals in a Hovsgol group is possible, although low. It corresponds with a population density of less than 0.1 people per square kilometer -- in reference to the 850 square kilometers of our surveying area. To obtain a more accurate and complete demographic profile we must utilize additional surveying data from other regions of Mongolia and possibly even develop an estimated count of the number of khirigsuurs that have been identified across multiple regions.

Needless to say, an isolated population of 82 individuals runs a higher risk for becoming extinct due to its increased vulnerability to the forces of genetic drift, where genetic drift is defined as the occurrence of change of random genetic variation. This occurs from generation to generation and may result in smaller populations with less diversity in the gene pool and therefore an increased chance for extinction. Genetic drift is the random effect on genetic diversity that is not associated with natural selection, environmental factors, or other kinds of adaptive pressures. Inbreeding, for example, could be defined as an adaptive or selective mode of reproduction and thus, especially in small population, minimize the genetic diversity within that gene pool. It can also be argued that inbreeding will take place more often in small population than in groups of very large populations (Mettler et al. 1988). Lee (2008) has shown that there is genetic continuity between Mongolian populations spanning different periods in time -- ranging from the Bronze Age all the way into modern times. As a result our demographic analysis should consist of a population size, a growth rate, and a social stability that will successfully create and maintain a population size suitable for continuity, transferring, and continuation of the gene pool. This would most likely not be possible with an average population size of 82 individuals because the presence of certain traits within the population would disappear due to its small size. Implementing a socio-economic relationship with other similar and contemporary population groups could have counteracted problems caused by an increasing genetic drift. Such population groups are represented by other similar groups of khirigsuurs now being identified in other locations throughout Mongolia. An increase in the gene flow between different groups may minimize the potential effect of the genetic drift. We hypothesize that the social, economical, and political interaction between groups, as represented by smaller and larger fields of khirigsuurs, increased the degree of gene flow between random groups, and therefore, ensured a more diverse gene pool. This would minimize the effect of the genetic drift, thus securing the groups' longevity and survivorship.

We conclude that social, economical, and political interactions between groups must have been both substantial and necessary for the group's survival. Even though the basic architectural features of khirigsuurs remain consistent throughout and between groups, minor architectural details appear to be unique within each individual group. This may also suggest a limited interaction between groups securing the phenotypical trait differences.

### **External features (Stone Rings)**

During our 2005 survey of about 1600 khirigsuurs in Hovsgol aimag we found that 15% of mounds included external structures such as external mounds and stone rings. The function of these structures has not yet been fully established. In 2009 we completed a pilot study encompassing the description of stone rings surrounding two large khirigsuurs. Our data collection included the following items: (1) complete photogrammetric and high resolution GPS surveying of all rings; (2) exact measurements of all rings and the number of individual stones; (3) measurement of the depths of the stones; (4) the positioning of stones (i.e. within the un-disturbed part of a circular ring or when moved either into or outside the defined ring); and (5) description of internal and external soil strata.

Two mounds, one including 35 stone rings and the other including 83 stone rings were included in the pilot study (Tables 1, 2). We can tentatively report the following results. Each stone ring represents a perfect circular structure made up by an average of 8.6 stones. The minimum and maximum numbers of stones used in the ring construction are respectively 7 to 12 stones. All stones have presumably been placed on the original 3,000 year old surface yielding a present accumulated depth of between 9 and 19 cm of sediment. Comparatively the average sediment build up for the fence is between 15 cm and 20 cm. Of the total number of 989 stones originally used in the construction of

115 stone rings, 155 stones are missing. Eighty four (84) of these stones were found adjacent to the original stone rings; with 14 stones found within the space of the rings and 70 stones found within one to two meters outside the original ring. The remaining 71 missing stones may be among other rocks scattered more than one to two meters away from the stone rings (Tables 1, 2). The establishment of the depth or thickness of sediments surrounding the misplaced stones is within the range of what is found both within the undisturbed stones and in the fences, thus the displacement of the stones most likely took place shortly after the construction of the mound and before the sediment build-up became too significant. Because the stones were placed directly on the ground, roaming animals could easily, over time, especially before the silt build-up became significant, have caused such displacement. However, if this was the only reason we would expect that the direction of the misplacement would over time become random, i.e. similar amount of stones relocated toward the interior of the ring as to the exterior of the ring would be the same. This is not the case, however. Of the 84 stones found away from the original rings but not farther away from the ring than two meters, only 14 (17%) have been found inside the rings and 70 (83%) have been found outside the ring, suggesting that the relocation is not random. Thus it is possible that the misplacement of stones could be a contemporary act of deliberate destruction that may be comparable to the intentional desecration of the body within the burial chamber.

### **Discussion and Conclusions**

Little is known about the density and distribution of khirigsuur groups throughout Mongolia and its surrounding areas. We estimate that there are between 50 and 100 groups each consisting of an average of 100 living individuals at any given time during the hypothesized 585 year time span. That would represent between 5,000 and 10,000 Bronze Age people living in the area of northern Mongolia. The estimate we have come up with is a very general scenario of the presence of khirigsuur groups in Mongolia, and the 50-100 groups we think existed might have been significantly lower. We also have not included any information relating to the presence of slab burials (Honeychurch and Amartuvshin 2003). We hope to establish more accurate numbers in our future research.

Finally, we have yet to fully explain why the desecration and destruction of graves took place, often within a very short time after the interment. However, we have developed one hypothesis that encompasses issues related to nomadic and sedentary behaviors, land-ownership, and warfare. Nomadic pastoralism is believed to be the common behavior of the people inhabiting most regions of Mongolia at the time, although it appears to occur only within a limited geographical space. Households would not have traveled very long distances, especially, when compared to other nomadic populations occupying more arid geographical areas. Households, or clusters of households, would reside in summer and winter camps. The distance between camps may not have exceeded six kilometers, and the locations of the seasonal camps would not have changed year after year. The necessity of daily movement for the animals is directly related to the grassland's ability to quickly recover from the destructive activities of the roaming animals. This is especially true in the Hovsgol area where the grassland regenerates quickly. The transient utilization of resources within a relatively small and defined geographical area may reflect a behavior, which in part, could be defined as sedentary or only partly nomadic. We argue that this very close bond to a specific geographical area might cause friction between groups and raises issues of land ownership. We suggest that the development of land ownership may have resulted in the creation of visible arrangements for the purpose of defending and marking land boundaries.

In conjecture to the above reasoning, the rationale behind the construction of khirigsuurs becomes

at least threefold: (1) they act as the intricate physical cache for the deceased members of the group, (2) they act as monuments defining the land the group wants to preserve, and (3) they act as a forewarning to unwelcome visitor who may become hostile toward the group. The later rationale can be seen as reflected in the larger mounds that were often constructed in areas where outside groups would have to trespass in order to enter the land controlled by the group. The large mounds inform the intruders that the landowners are strong and powerful, and that the authoritative spirit of a deceased person reflected by the large size of the mound is protecting the group's land. The inclusion of external mounds and numerous stone rings could be seen as an added symbol supporting the group's desire to protect their rights to the land. This power is further enhanced by the presence of the physical remains of a deceased group member whose spiritual power may still, even in death, be a quantifying element in the protection of the land. Therefore in order for an intruder to trespass successfully onto that land, they must break or interrupt its power. One way of accomplishing this may be through the successful destruction or desecration of the body. Likewise, to ensure success, the intruders may extend the desecration of the burial chamber to include other architectural entities of the mound. This may include external mounds and stone rings. Such actions, if successful, will prove the superiority of the intruder.

Our reconstruction of Mongolian Bronze Age burial practices has been, and continues to be, a very cautious process. We have encountered several problems throughout our studies that have yet to be fully investigated. This includes issues related to possible changes in the regions climate, which might have led to the migration and movement of groups within the region possibly contributing to the necessary infringement on another group's known territory. Another set of issues we have yet to completely delve into are problems pertaining to population pressure and increased population sizes.

The reconstruction of the biological and social histories of the Hovsgol aimag is just the beginning. Some of the information we are looking for may never be available to us, and thus we must combine our factual information with the discussion of various potential scenarios that will explore many of the unknown factors. We are, in collaboration with George Mason University developing agent-based computerized models exclusively adapted to Central Asia nomadic pastoralist populations. Agent-based modeling is used to identify possible social and demographic interactions that may have occurred, due to landscape and weather variability, at a variety of social and temporal scales. Temporal scales ranging from just a few days up to 1,000 years. Studying such models will allow us to use factual data in order to obtain knowledge concerning the effect of possible climate variations, demographic information, population continuity, and ethnographic information in order to study the validity of our information and to understand the possible short-term effects of changes and how such changes could have influenced the homogeneity and continuity of the population (Rogers 2010; Rogers and Cioffi-Revella 2010).

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**Table 1: Basic metric descriptive statistics from the analysis of small stone rings from two Class I mounds (M-52 and M-54). All distance variables are metric (cm).**

	<b>M-52</b>	<b>M-54</b>	<b>M-52 &amp; M-54</b>
<b>NORTH - SOUTH DISTANCE</b>			
<b>SAMPLE SIZE</b>	35	82	117
<b>MINIMUM</b>	63	55	55
<b>MAXIMUM</b>	135	151	151
<b>SUM</b>	3421	7958	11379
<b>MEAN (CM)</b>	97.7	97.1	97.3
<b>SD</b>	15.4	18.7	17.7
<b>EAST - WEST DISTANCE</b>			
<b>SAMPLE SIZE</b>	34	82	116
<b>MINIMUM</b>	70	60	60
<b>MAXIMUM</b>	140	155	155
<b>SUM</b>	3284	7988	11272
<b>MEAN (CM)</b>	96.6	97.4	97.2
<b>SD</b>	17.3	19.3	18.7
<b>DEPTH OF SEDIMENTS</b>			
<b>SAMPLE SIZE</b>	14	4	18
<b>MINIMUM</b>	9	10	9
<b>MAXIMUM</b>	19	15	19
<b>SUM</b>	218	50	268
<b>MEAN (CM)</b>	15.6	12.5	14.9
<b>SD</b>	3.2	2.4	3.2

**Table 2: Basic frequency descriptive statistics from the analysis of small stone rings from two Class I mounds (M-52 and M-54). Numbers represent counts.**

	<b>M-52</b>	<b>M-54</b>	<b>M-52 &amp; M-54</b>
<b>NUMBER OF RINGS</b>	33	82	115
<b>OBSERVED STONES</b>			
<b>MINIMUM</b>	4	4	4
<b>MAXIMUM</b>	10	10	10
<b>SUM</b>	252	582	834
<b>MEAN</b>	7.6	7.1	7.3
<b>SD</b>	1.4	1.4	1.4
<b>MISSING STONES</b>			
<b>MINIMUM</b>	0	0	0
<b>MAXIMUM</b>	5	6	6
<b>SUM</b>	39	116	155
<b>MEAN</b>	1.2	1.4	1.4
<b>SD</b>	1.4	1.5	1.5
<b>TOTAL NUMBER OF STONES</b>			
<b>MINIMUM</b>	8	7	7
<b>MAXIMUM</b>	12	12	12
<b>SUM</b>	291	698	989
<b>MEAN</b>	8.8	8.5	8.6
<b>SD</b>	1.1	0.9	0.9
<b>STONES IN INTERIOR SPACE</b>			
<b>MINIMUM</b>	1	1	1
<b>MAXIMUM</b>	2	2	2
<b>SUM</b>	3	11	14
<b>MEAN</b>	1.5	1.1	1.2
<b>SD</b>	0.7	0.3	0.4
<b>STONES EXTERIOR TO RINGS</b>			
<b>MINIMUM</b>	1	1	1
<b>MAXIMUM</b>	2	5	5
<b>SUM</b>	5	65	70
<b>MEAN</b>	1.3	1.8	1.8
<b>SD</b>	0.5	1	1