MODELING LATE PREHISTORIC AND EARLY HISTORIC PASTORAL ADAPTATIONS IN NORTHERN MONGOLIA'S DARKHAD DEPRESSION

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This dissertation investigates pastoral adaptations, multi-resource economic strategies and monument construction and use diachronically in the Darkhad Depression of northern Mongolia. This program of research has utilized GIS analysis, predictive modeling, pedestrian survey, targeted excavation, experimental archaeology and ethnoarchaeology. The results of this research contribute to a more detailed understanding of how this region contributed to broader social, political and economic change in the Bronze and Iron Ages through the Xiongnu period (ca. 2500 BCE – 200 CE). Numerous models have been proposed to explain the transition from an agricultural economy to an agro-pastoral or fully nomadic economy. However, there are far fewer explanatory models for the incorporation or adoption of pastoralism into existing hunting, gathering and/or fishing economies. Furthermore, a hyper-focus on connections between China and Inner Asia has dominated discussions of inter-regional, inter-economic relationships. Such trends have overshadowed potentially earlier important relationships with groups to the north, including the hunter-gatherers of Lake Baikal, and early pastoralists of the Minusinsk Basin and Tuva (Russian Federation). This dissertation research, in contrast, has employed a holistic landscape approach that examined both ritual and domestic activity areas in order to model the introduction and integration of herding practices with existing hunting-gathering-fishing economies. Recent archaeological research in the Darkhad Depression of north-central Mongolia has investigated the ritual landscape and has concluded that the monuments in this region, while not particularly large, are the oldest of their kind known in Mongolia and neighboring regions of Kazakhstan and Russia. If these monuments are connected with new forms of a pastoral economy and hierarchical social organization, as some have suggested, this underscores the importance of this region for modeling early pastoralist orientations in Mongolia and perhaps more broadly within northeastern Asia. This dissertation examines these important late prehistoric developments and situates this work in the context of other recent and important archaeology projects within Mongolia. The results of this research contribute to a growing trend in the scholarship of early multi-resource pastoralists that highlights the varied ways in which domestic animals were incorporated into existing economies, impacting local and supra-local social, political and ritual practices and lifeways.

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PREFACE

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1.0 INTRODUCTION: FUNDAMENTAL SHIFTS IN HUMAN SOCIETIES AND SUBSISTENCE ECONOMIES

For the vast majority of human history, people have lived in relatively small groups that relied on hunting, gathering and/or fishing for subsistence. Utilizing a variety of resources and innovative technologies to adapt to new environments, these early communities were so successful that they were able to inhabit many different regions of the world (Binford 1980, 2001; Murdock 1967). As populations grew and new regions were colonized, these adaptations had to include solutions not only to cope with environmental variability but also to manage demographic growth and potential internal and external pressures on resource sustainability (Bender 1978; Boserup 2005; Flannery and Marcus 2012; Salzman 2004:2). A variety of cultural, technological and environmental conditions dictated how different populations handled these challenges. As some groups continued to grow, they had to find new solutions to support increasingly larger and/or more geographically constricted populations. These adaptations often included major changes in the relationships between human populations and their environments, and the nature of internal and external socio-political relationships (Flannery and Marcus 2012).

To provide adequate resources to an increasing number of individuals, some populations intensified resource extraction and production. These processes ranged from specialization in exploiting natural resources (e.g. specialized fishing economies; Arnold 2001; Basgall 1987; Bender 1978) to the production of domesticated food sources (i.e. agriculture and/or pastoralism; Boserup 2005), to the 'secondary products revolution' that exploited non-meat resources (e.g. milk, wool, traction, riding, etc.) from domestic livestock (Sherratt 1981; 1983), thus substantially changing human relationships with the natural environment and domesticated animal herds. The emergence, diffusion, and refinement of processes connected with agricultural production have received the lion's share of the discussion in anthropological archaeology. Nevertheless, the role of pastoralism in world prehistory is garnering increasing interest by scholars, and an explosion of research and publication has emerged over the past two decades with much of this being centered in northern Eurasia (Boyle et al. 2002; Anthony 2007; Frachetti 2008; Hanks and Linduff 2009; Brosseder and Miller 2011).

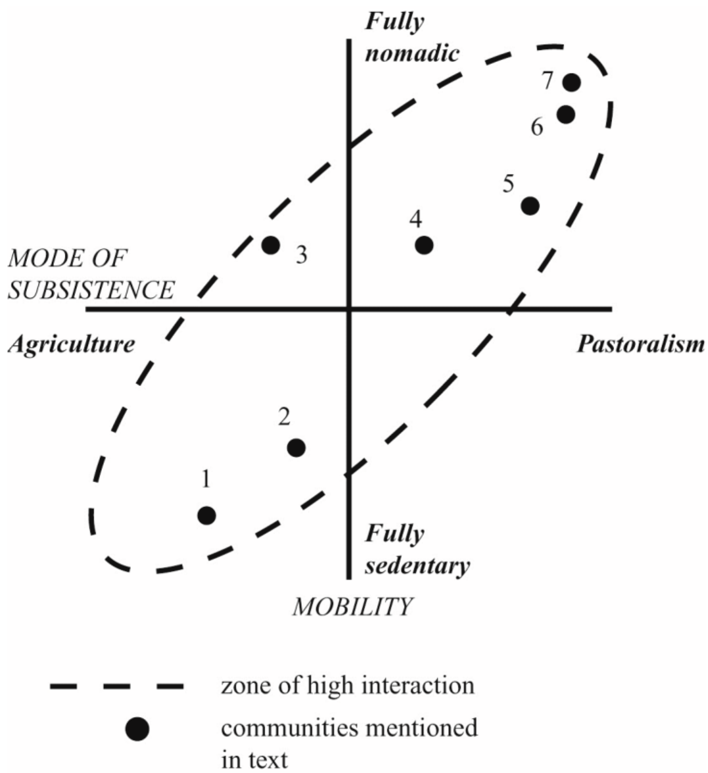
These important trends in research have increased scholarly understanding of the variability of pastoralist orientations through time and challenged the conventional definition for the emergence of pastoralism. Such advances are providing for a more nuanced understanding of social, political and economic processes and the important value that exists for comparative anthropological study of pastoralism and its development in many regions of the world.

Pastoralism, simply defined, has been understood as an economic strategy that relies primarily on domestic animals and their products and frequently employs elements of spatial mobility (Frachetti 2008:15; Homewood 2008:1; Ingold 1980:27; Salzman 2004:1). The causes and effects of nomadic pastoralism, in particular, have been discussed in great detail and various terms and definitions have been proposed to account for this orientation (Khazanov 1978, 1984, 2003; Kradin 2002). Anatoly Khazanov's publications, in particular, have had a substantial influence on many scholars studying pastoral nomads in the Near East and Eurasia. In these publications, he advocates a typological system that includes classifications such as nomadic pastoralism proper, semi-nomadic pastoralism, and semi-sedentary pastoralism (Khazanov 1984:17-21). Roger Cribb, in his seminal work "Nomads in Archaeology", critically evaluated Khazanov's typological schemes and argued that such rigid typologies should be dropped in favor of an approach that recognizes the "nomadic tendencies" within societies but does not seek to fit such groups into specific categories (Cribb 1991:15-18). In contrast to Khazanov's typological schemes, Cribb argued that:

> *"Nomadic pastoralism is a dual concept comprising two logical independent dimensions – nomadism and pastoralism. Within each of these dimensions dualisms such as nomadic/sedentary, agricultural/pastoral, the desert and the sown, perpetrate gross distortions of our ability to understand the relationship between the two. Each dimension may be viewed as a continuum, and the relationship between them is best represented in terms of a probability space in which groups or individuals are uniquely located with respect to each axis" (1991: 16).*

Cribb's ethnoarchaeological research, conducted in Turkey, plotted seven contemporary groups according to these dimensions and effectively highlighted the substantial variability of the communities he studied ( ). Cribb's study, and his conceptualization of a continuum for understanding the range of variance that may exist in mobility and subsistence remain substantial considerations for the investigation and modeling of pastoralist socio-economic patterns. Cribb's conceptual model, however, focused principally on problems connected with the dichotomy between agriculture and pastoralism but did not examine such dynamics in terms of the relationship between pastoralism and hunter-gatherer-fisher subsistence. Nevertheless, the merit of Cribb's approach is clear and provides an important foundation on which to build.

Figure 1: Relationship of subsistence and mobility (from Cribb 1991:17)



Other classic studies of pastoralist groups have also emphasized the relationship between agricultural and pastoralist orientations as dynamic, but stress either one economic strategy or the other without consideration of multi-resource orientations that include hunting and gathering strategies (Krader 1979; Johnson 1969). Indeed, most explanations for the emergence and spread of mobile pastoralism are premised upon this subsistence orientation developing out of an established sedentary agriculture economy (Flannery 1972; Irons 1975; Johnson 1969:2; Lees and Bates 1974; Renfrew 2002:6-7; Sherratt 1981, 1983; Wright 1977). As a result, approaches to agro-pastoralism, and more specialized forms of mobile pastoralism, often rely upon the same theoretical frameworks employed in the study of sedentary agriculturalists.

Though this approach has been productive in reducing the use of strict typologies, the strong emphasis on agricultural societies has had a tendency to overshadow the many ways that pastoralist adaptations may have emerged in various regions of the world, and how such orientations may relate to earlier traditional economic strategies employed by hunter-gatherer-fishers (Fitzhugh 2001:9, 21; Frachetti 2008:21; Ingold 1980:83). Importantly, both pastoralism and hunter-gatherer-fisher orientations commonly employ seasonal mobility, have relatively low population densities, are dependent upon a deep understanding of animal behavior and biology, and when in competition with more populous sedentary agriculturalists, both are often pushed to more marginal ecological zones.

In the past two decades archaeological research in the Eurasian steppe region has shown that the use of wild resources in conjunction with hunter-gatherer-fisher strategies persisted for millennia (Levine et al. 1999; Boyle et al. 2002). An important example of this is the work of Lillie and colleagues, which has focused on prehistoric dietary patterns by analyzing carbon and nitrogen stable isotopes (Lillie and Richards 2000; Lillie et al. 2011). These studies have examined human skeletal, faunal, and fish remains from thirteen cemeteries in the Middle and Lower Dnieper Basin of Ukraine. Ranging from the Upper Paleolithic to the Eneolithic, this research has emphasized the role of fishing, hunting and gathering even after domestic plants and animals became widely available in the region by 5000 cal BCE.

Further evidence from northwestern Kazakhstan, which stems from detailed archaeological and zooarchaeological research on the Botai culture, has illustrated very early patterns of horse domestication in conjunction with continuing traditions for the hunting and exploitation of wild horse populations by the Eneolithic ca. 3500 BCE (S. Olsen 2003; Outram et al. 2009). Utilizing multiple lines of evidence (metrical analysis and pathological characteristics of horse bones, and organic residues found in pots), these researchers have uncovered important evidence that suggests a very specialized equine economic pattern dependent on wild horses that led to horse domestication (the faunal remains are 99% horse). This appears to have been a unique, local innovation largely disconnected from the domestication events of southwest Asia that are believed to have subsequently influenced the introduction and diffusion of animal domesticates into the western Eurasian steppe.

While substantial archaeological evidence testifies to the fact that settled agriculture did precede pastoralism in many regions of the world, there are other regions where agriculture was never a firmly established economic strategy and pastoralism was introduced, auditioned, and adopted or integrated by existing hunter-gatherer-fisher populations. Many of these regions such as Siberia and northeastern Asia and parts of southwestern Asia and Africa are still host to pastoralist communities today as agriculture remains, for the most part, unproductive due to low rainfall, high elevation and/or high latitude that result in short growing seasons**.** Moreover, hunter-gatherer-fisher traditions continue among some communities in Africa, Siberia and northeastern Asia up to the present day, and this underscores the enduring importance and effectiveness of these long standing regional subsistence orientations.

This introductory section has sought to emphasize several key conceptual issues that challenge the current dichotomous theoretical framework that juxtaposes pastoralism with agriculture. A new agenda appears to be emerging in recent years that not only emphasizes the range of variation that exists within pastoralist lifeways and economic orientations but also the significance that hunter-gatherer-fisher strategies may have played in such transitions and longer term developments. This dissertation focuses specifically on these important conceptual and theoretical issues and targets such related processes and fundamental transitions that occurred within late prehistoric northern Eurasia. This region presents an outstanding opportunity to pursue such studies as scholars have initiated vibrant debate over the emergence and diffusion of a pastoralist way of life across the Eurasian steppes and adjacent areas. It is clear that much work remains to be done on this important issue (Anthony 2007; Frachetti 2008, 2012; Kohl 2007; Renfrew 2002**).**

The research presented in this dissertation offers an important new case study that employs an anthropological approach to investigating early pastoralist adaptations in Mongolia, their diachronic development, and how these factors impacted broader social, cultural, and political development. In fact, several scholars working within Mongolia have tied early pastoralist economic transitions to dramatic shifts in socio-political complexity that included the emergence of mounted warfare and new forms of political authority in the late second millennium to early first millennium BCE (Honeychurch 2004; Houle 2010; Wright 2006). It is argued that such political dynamics are represented by the appearance of new forms of ritual monument construction and use (Allard and Erdenebaatar 2005). The following section explores these important issues in more detail.

1.1 PASTORALISM: SOCIAL, ECONOMIC AND POLITICAL ORGANIZATION

Much of the current literature regarding social complexity in early human populations has focused on sedentary agricultural societies (Earle 1997; Haas 2001; Paynter 1989:374; Price and Feinman 1995; Smith 2012). In these cases, agricultural production encourages sedentism and population growth that in turn impacts social complexity. Some have argued that in order to manage the organization of agricultural labor as well as the inevitable conflicts of a growing, sedentary population, new forms of leadership emerge (e.g. Chapman 1990:211-219; Drennan and Peterson 2008; Smith 2012). Alternatively, others have suggested that aggrandizing leaders take advantage of new forms of wealth (i.e. agricultural products) and sedentary populations unable or unwilling to move away (e.g. Clark and Blake 1994; Smith 1987). This research has contributed significantly to the comparative study and analysis of different prehistoric trajectories and patterns of regional socio-economic change (Drennan et al. 2012).

As many studies have indicated, some populations responded to these pressures by organizing social relationships in remarkable new ways (Drennan and Peterson 2008:359; Earle 1997). The emergence of social inequality is often seen as being interwoven within such strategies as a way to reduce risk through the protection and management of resources (Spencer 1993; Bollig 2006). Other studies have highlighted the role that long distance exchange networks played – particularly in providing some subsistence security in years that the availability of local resources could not support local populations (Halstead and O'Shea 1989; Sneath 1993; Weissner 1982). These strategies have been investigated in many regions of the world and appear to have been an important part of longer-term patterns of social, economic and political change.

In contrast to these important case studies, dispersed populations of mobile pastoralists present a very different kind of opportunity allowing for a comparison and evaluation of factors contributing to social change that are not directly related to agricultural production or permanent sedentism (Barnard and Wendrich 2008; Chang and Koster 1994; Khazanov 1984; Salzman 2004). Historically, research that has examined pastoralists has done so in a way that highlights their relationships to, and often dependence upon, their sedentary neighbors – the classic "steppe and sown" dichotomy (Barfield 1989; Irons 1979; Johnson 1969:3, 12; Khazanov 1978; Lattimore 1988; Peake and Fleure 1928). However, in recent years this framework has been critically examined by several researchers in the northern Eurasian region who have recognized that pastoralists may sometimes have little or no direct contact with sedentary agriculturalists (Hanks 2003; Houle 2010; Popova 2006; Peterson et al. 2006).

Some problems faced by sedentary agriculturalists, such as shortages of land and the inability to readily relocate in times of stress, are more easily dealt with by mobile groups who can seek areas of more abundant resources when local conditions become unfavorable. Mobility, as a coping mechanism, is most successful when contacts (e.g. kinsmen or inter-regional allies) in other regions are willing to provide aid (Goland 1991; Stephens 1981). For example, some research that has been devoted to the interaction between pastoralists and their sedentary neighbors is based on the notion of the necessity of pastoralist populations having direct access to agricultural products in order to supplement their subsistence needs (Chang and Koster 1994; Finkelstein and Perevolotsky 1990; Khazanov 1984; Peterson et al. 2006; Zeder 1991).

Moving from a discussion of agriculture to pastoralism as a functional subsistence strategy, it can be stated simply that pastoralism is a form of food production that allows for the conversion of grass, which is unsuitable for the human digestive system, into products for human consumption and utility (Anthony 2007:137; Barfield 2011:109; Johnson 1969:8). Meat, dairy and textile products derived from livestock, in addition to using animals for riding and traction, may substantially increase the carrying capacity of many local landscapes (Khazanov 1984: 69; Sherratt 1983). Comparative anthropological discussions of social complexity rarely mention these crucial socio-economic developments in pastoral societies, and yet it is clear that such groups may exhibit complex features of social, political, and economic organization (Cribb 1991; Houle 2010; Wright 2007).

Importantly, mobile pastoralists often occupy vast territories and have relatively low population densities compared to their sedentary counterparts (Krader 1979:98). Seasonal mobility, under these conditions, acts as a socio-economic strategy and expands the availability of required subsistence resources. Socio-political integration under these conditions can be particularly challenging given the residential flexibility and long distances that may develop between populations. In sedentary societies, emerging leaders often are able to create leverage by encouraging investments in specific locations, therefore discouraging their followers from leaving the fruits of their hard-earned work behind (Gilman 2001; Kujit 2009). For many pastoralist communities, patterns of mobility may be a necessity and so strategic leaders must find other ways to convince their followers to remain socially and politically integrated. Evidence of elaborate burials, large-scale communal projects, and long distance trade networks all have been directly linked to such developments among early pastoral populations in the northern Eurasian region (Frohlich et al. 2008; Honeychurch 2013; Kohl 2007*)*. Such evidence may reflect the importance of new ritual traditions and monument construction among early pastoralist communities and the institutionalization of political authority and territoriality. In recent years, regional specialists have actively discussed these developments from the point of view of landscape archaeology.

1.2 CONCEPTUALIZING RITUAL LANDSCAPES

The development of a "landscape approach" in Eurasia has relied heavily upon the theoretical contributions of Tim Ingold, which emphasize *time*, *landscape* and a *dwelling perspective* (1993: 152). Ingold's framework underscores the interconnectivity of nature, culture and human social practice within a single system rather than conventional approaches that make use of dichotomous concepts such as "culture/nature" (2000: 42). Importantly, some scholars investigating the relationship between humans and landscapes among late prehistoric Eurasian hunter-gatherer-fishers and pastoralists have drawn intently on Ingold's theoretical perspectives (Frachetti 2008:22-24; Hammer 2014:272; Jordan 2011, and contributions in Jordan 2011). Furthermore, the broader significance of these themes is illuminated in an important recent publication edited by Peter Jordan (2011) that examines the significance of landscape and culture in northern Eurasia among traditional hunter-gather-fishers and reindeer herders. In the first chapter of this volume, Jordan sets out an ambitious theoretical agenda heavily conditioned by Ingold's ideas:

> *"During different periods in the history of anthropology, certain regions of the world have been associated with major theoretical developments: Africa with the development of kinship theory; Melanesia with theories of sociality and personhood; and Europe with theories of ethnicity, nationalism and state (Ingold 2003: 25). With the re-opening of Siberia to international scholarship might it now be the turn of the north to set a new theoretical agenda, with a renewed and truly circumpolar focus on human-animal relations, systems of spirituality, and human perceptions of the environment (Ingold 2002: 245)?"* (Jordan 2011:17)

This important statement underscores the potential importance of the northern Eurasian region and suggests that the study of human-animal-landscape relationships, as historically conditioned within the region, may contribute substantially to anthropological theory. Chapter contributions in Jordan's edited volume by regional specialists also outline the important links that exist between people, their activities, material culture, and the surrounding landscape(s). Importantly, the links perceived by indigenous populations in northern Eurasia have physical manifestations in the ritual landscapes that frequently can be detected archaeologically (Jordan 2011:17). Furthermore, the material aspect of the landscape and the environment are historical – that is, what comes before strongly conditions what comes after (Balée 2006; Jordan 2011:20). These views are especially important as they encourage a theoretical perspective that incorporates the social and symbolic significance of “landscape” in addition to important considerations of ecology and adaptation among northern latitude hunters and herders.

If landscapes both condition and are conditioned by the “lifeways” of indigenous communities, then a built monumental landscape may be a translation of local lifeways into a readable, material correlate. For example, scholars have suggested that ritual monument construction and repetitive use of such sites within northern Eurasia may have been an attempt to construct social ties through the corporate investment of labor and ritual practice (Allard and Erdenebaatar 2005; Anthony 2007; Houle 2010). Such perspectives have highlighted the relationship of monument construction specifically to the emergence of powerful elites and the institutionalization of new political structures by the Late Bronze Age.

Joshua Wright, in contrast to this view, has emphasized that social and ritual processes leading to the construction of monumental landscapes are connected with much smaller scale group affiliation, rather than individualized elite social power and authority, and these were “primarily spaces for transegalitarian or heterarchical interactions” (2014:141). Monumental landscapes, he argues, were built in order to stabilize the otherwise unstable mobile social landscape. The construction and use of monuments created group solidarity and built ties to particular parts of the landscape for populations whose low population density and seasonal mobility did not lend themselves easily to the formation of more institutionalized social, economic and political networks.

The theoretical perspectives outlined above, while not in total agreement, do productively stress connections between natural landscapes, the building of ritual monuments and associated activity areas, and their relationship to shifts in the social and political organization of late prehistoric hunter-gatherer-fisher and pastoralist societies. These key themes, and recent theoretical approaches to studying them, have significantly influenced the conceptual foundations of this dissertation research. The case study detailed within this dissertation offers an important new approach to modeling such dynamics and an original dataset with the potential of contributing to these broader theoretical themes and the important relationships that existed between humans, animals and local ritualized landscapes in northern Eurasia.

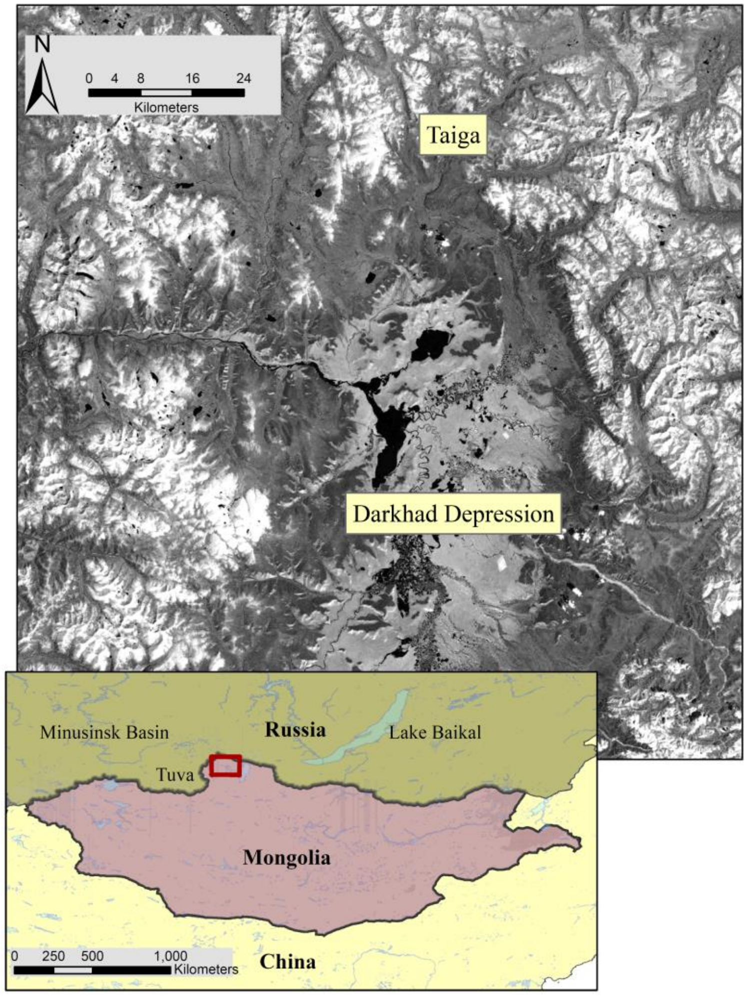
1.3 A NORTHERN MONGOLIAN CASE STUDY

This dissertation engages with the important theoretical and conceptual issues outlined above by examining the relationship between early pastoralist adaptations and the emergence of social complexity in northern Mongolia's Darkhad Depression (Figure 2). This research program has examined the ways in which this area contributed to broader social, political and economic change from ca. 2500 BCE– 200 CE. It approaches this topic through an investigation of human-animal-landscape relationships, specifically examining prehistoric subsistence strategies, habitation patterning along the shores of Targan Nuur (Targan Lake), and the emergence of new forms of ritual monument construction and use. To ensure that appropriate data sets were produced for analytical study and interpretation, a combination of the following methods were employed in the field research: (1) systematic pedestrian survey and test pitting, (2) integration of enthnoarchaeological data on contemporary herding and land use patterns, (3) analysis of recovered artifacts and ecofacts, and (4) GIS spatial and environmental analysis and modeling.

This program of research has contributed importantly to recent studies in Mongolia and, more broadly, pastoralist studies and Eurasian steppe archaeology by examining early mobile pastoralists and the key social, political and economic transitions that led to this way of life

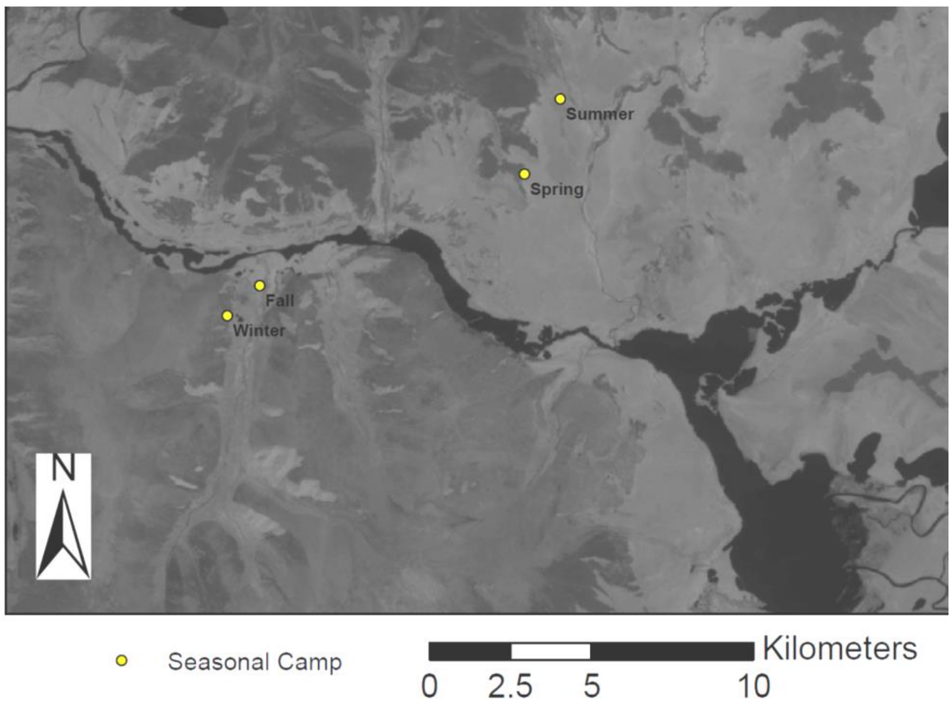
(Chang 2008; Cioffi-Revalli et al. 2010; Fitzhugh 2009a; Frachetti 2012; Hanks and Linduff 2009; Honeychurch 2004; Houle 2010; Rogers 2012; Wright 2006).

Figure 2: Map of Mongolia highlighting the Darkhad Depression



Mongolia provides a unique region in which to explore issues of both changing human-environment and social relationships in modern and archaeological contexts. Modern-day Mongolia has been the focus of numerous ethnographic studies of mobile pastoralist peoples - both during the Soviet period and more recently since the collapse of the Soviet Union (Batnasan 1972; Bazargur 2005; Humphrey and Sneath 1999). Herders in the rural regions of the country tend flocks of sheep, goats, camels, horses, yaks, and cattle, often live in *gers* (yurts) and move seasonally, although ethnographic research has shown that such movements may be habitually only a few kilometers per year (Figure 3) (Bazagur 2005; Houle 2009). This traditional lifestyle, lost in many other regions of the world, provides anthropological archaeologists a unique opportunity to study the economic strategies and life-ways of mobile pastoralists within specific types of landscapes and environments.

Figure 3: Seasonal round of one family living in the Darkhad Depression today



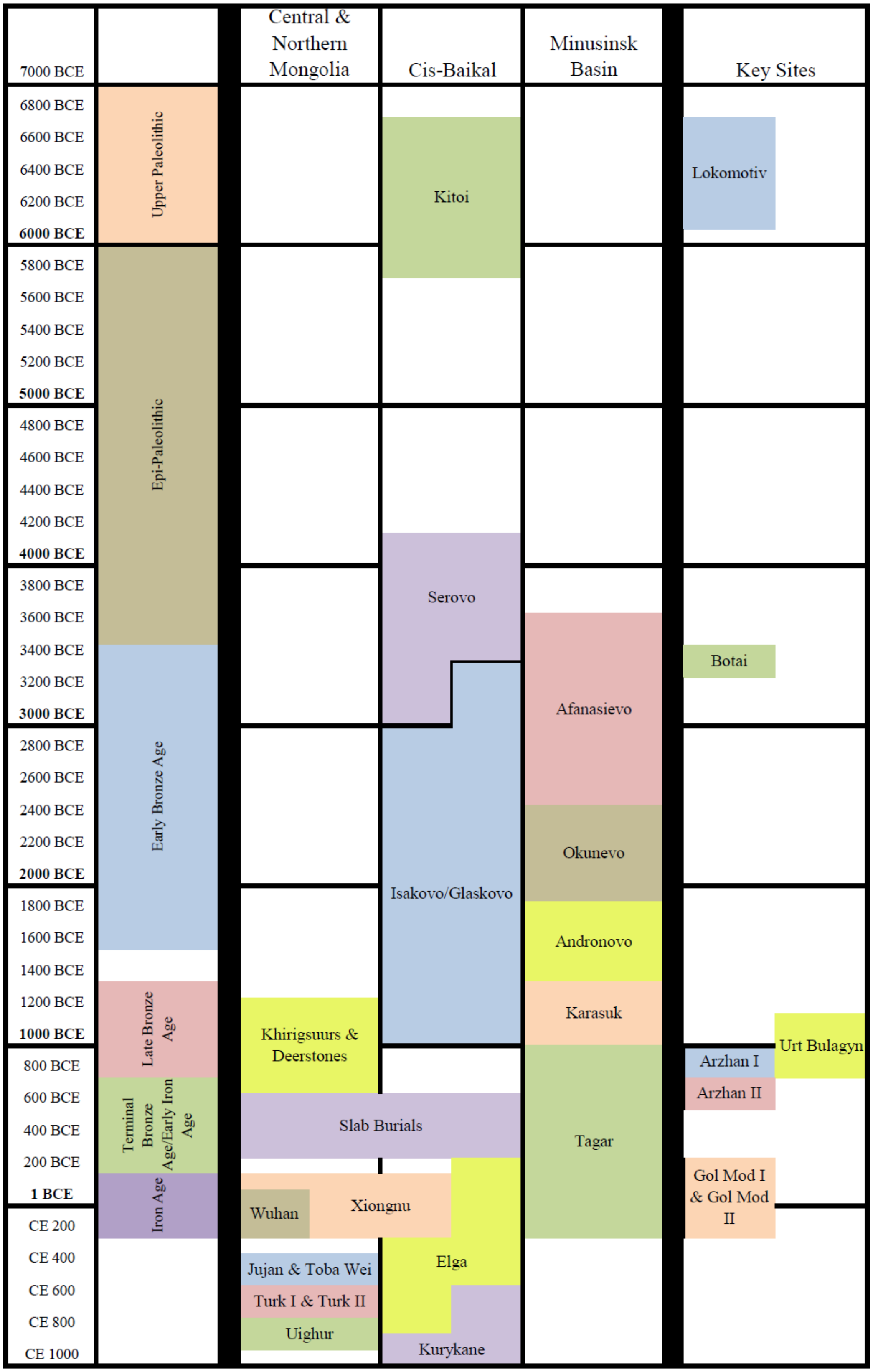
Ethnographic studies in Mongolia have frequently focused on cultural ecology (Blench 2005; Damdinsuren et al. 2008; Fernandez-Gimenez 1999b; Neupert 1999; Rassmussen et al. 1999; Sankey et al. 2006) and the interaction and integration of these dispersed populations in the context of the shifting Mongolian state (Soviet and Post-Soviet periods). The political upheaval after the transition from socialism to democracy in the early 1990's has allowed researchers to assess the impact of national political shifts upon small local communities and their environments (Fernandez-Gimenez 1999a, 2002; Sneath 2003; Upton 2008). Such studies have provided a wealth of information concerning local socio-economic strategies and broader scale networking and supra-regional integration tendencies of pastoralists.

In some cases, cultural ecologists have used a historical approach to better understand the trajectory of pastoral traditions in the region (Endicott 2012; Fernandez-Gimenez 2006). These analyses are able to use records stretching back to the Medieval period (ca. CE 1300) regarding land use and herd structures. There is great potential for archaeologists to work in an inter-disciplinary manner to push this back in time even farther. In particular, understanding how pastoralism first emerged and how it impacted the natural environment is of great importance in developing a fuller historical understanding of these important developments. It is somewhat surprising that in Mongolia, a place now known and celebrated for its pastoral traditions, so little is known about the origins of pastoralism (See Section 3.1.2).

The Darkhad Depression does not contain the largest, most impressive ritual monuments known in Mongolia, yet *khirigsuurs* and Deer Stones (Late Bronze Age monuments – 1400 BCE – 700 BCE; Table 3) in this region are numerous though relatively simple and small in scale. Large royal cemeteries from the Xiongnu empire (also sometimes called a confederation, it encompassed modern day Mongolia and the surrounding region from 200 BCE – CE 200) found in other regions are completely absent, though some royal Xiongnu tombs are found in the forest-steppe to the east of this region in southern Siberia (Brosseder and Miller 2011). While the Late Bronze Age monuments in the Darkhad Depression may be some of the earliest, it is unlikely that the region was ever the core zone of any great pastoralist or agro-pastoralist polities. The centers of such political formations are identified by the largest and most impressive ritual landscapes and settlements of central Mongolia. For instance, numerous identified settlements within the Orkhon Valley have been the focal point of several of

Mongolia's later polities including important settlements connected with the Xiongnu, the capitals of the Turkic, Uighur and Kidan empires, and Kharkhorum, the capital of the Mongol Empire. Importantly, it is in the far north of modern day Mongolia, in this perceived peripheral border region that the ebb and flow of Eurasian interaction networks might best be observed. Monuments in the Darkhad Depression, first abundantly present in the Late Bronze Age, and then scarce in the subsequent Xiongnu era, may be a more accurate reflection of ephemeral and alternating political, social and/or economic connections that were supra-local in character. The natural environment in this northern region of Mongolia is capable of supporting either pastoral or hunting-gathering-fishing economies. In this way, the inhabitants of the Darkhad Depression may have had more flexibility than their neighbors to the south that, once adapted to the grass-land steppes using domesticated animals, would have had fewer alternative subsistence strategies available throughout the year. Situated on the periphery of the vast steppe grassland zone, the inhabitants of the Darkhad Depression may have been quite selective about when to participate in the broader inter-regional networks that came to define the late prehistoric and early historic periods of northeast Asia.

Figure 4: Key cultures/periods/sites in eastern Siberia and Mongolia



1.4 PROBLEM FOCUS: PASTORAL ADAPTATIONS IN CENTRAL AND EASTERN ASIA

While the origins of agriculture in Central and Eastern Asia have warranted a great deal of interest (Bettinger et al. 2010; Crawford 2006; Glover and Higham 1996; Imamura 1996), the adoption of pastoralism in these regions is not well understood (Cavalli-Sforza 1996; Frachetti 2008:18-24; 2012). For the purposes of this dissertation, "Central and East Asia" is considered to be Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan, Uzbekistan and the directly adjacent territories of both Russia and China (Sabloff 2011). Not only is it unclear where pastoralism first emerged, so too is the context in which it diffused (Frachetti 2012; Harris 2010; Bendrey 2011) and the various ways in which it was adopted by populations that had, since the early Holocene, practiced a combination of hunter-gatherer-fisher subsistence patterns. For instance, how and why pastoralism was chosen over, or in conjunction with, other subsistence practices remains unexamined for many regions of Northern Eurasia. The decision may have been made voluntarily by local populations or was more forcefully imposed as in the case of colonization (Wright 2006:11-15). It also may have been selected as a means of procuring wealth and power or, alternatively, as a risk-reducing strategy.

In areas where agriculture was the primary economic strategy, the introduction of domesticated animals may have provided additional security against crop failures, as well as the added benefits of a reliable source of fertilizer. In other regions of Central and Eastern Asia, however, agriculture is not as viable a subsistence strategy due to environmental and climatic conditions (Khazanov 1984:44-45). The high altitude plateaus, steppes, and forests of this region generally have short growing seasons, long harsh winters, and little precipitation and these climate constraints inhibit many types of agriculture (Guedes and Butler 2014). While it may have been possible to grow certain crops, such as millet, agriculture would not have automatically been the most obvious or best choice to ensure success in food production. In these areas of limited agricultural productivity, pastoralism is one reliable method of food production that could have replaced, or supplemented, the pre-existing hunting, gathering and fishing strategies and contributed to a more robust multi-resource subsistence strategy (Khazanov 1984:69). Such orientations might have used patterned mobility to access seasonally available wild resources as well as to find new grazing opportunities for their flocks at different locations and altitudes, a scheme that among specialized pastoralists is known as transhumance (Cribb 1991:19).

Pastoral strategies, employed in the hypothetical scenarios outlined above, would have stimulated very different patterns of human-environment interaction, both economic and symbolic. However, they may also have had an influence on the emergence of new forms of socio-political relationships between populations. Domesticated animals would not only have represented an important source of calories, but likely included prestigious socio-economic value as well (Ingold 1980, 1984). In this regard, the adoption of pastoralism may have played a role in the development of new status differences, as some individuals or groups could have acquired social ‘prestige’ through owning larger herds and specific species such as horses. Furthermore, the ability to produce an economic surplus has been seen by many anthropologists as an important step in the development of complex social and political relationships among both agriculturalists (Clark and Blake 1994:18-19; Weissner 1982) and complex hunter-gatherer-fishers (Arnold 2001; Hayden 1995).

Among pastoralists, aggrandizing individuals may have used pastoral surpluses similarly to increase their socio-political power through trade and exchange and/or commensal politics (feasting) (Anthony 2009:62-64; Outram et al. 2011). Finally, changes in land-use patterns concurrent with a pastoral transition may have changed patterns of group territoriality in connection with the necessity of access to grazing. Herders, in order to secure pasture for their animals, may have taken steps to mark and protect these resources, potentially increasing levels of conflict and sociopolitical authority. Through the construction of ritual monuments and tombs, the burial of the deceased and their commemoration may have helped to underscore new forms of land tenure ensuring formal access rights to lands for grazing their herds (Wright 2006, 2007).

1.5 RESEARCH QUESTIONS AND DISSERTATION STRUCTURE

The important theoretical considerations outlined above informed the writing of a research grant submitted to the National Science Foundation (BCS NSF Grant # 1236939) in February of 2012. This research was undertaken in order to specifically investigate archaeological evidence of economic and political transitions during the late prehistoric and early historic periods (ca. 1300 – 300 BCE) in the Darkhad Depression of north central Mongolia. The key questions included within the research grant that structured the subsequent fieldwork were:

1. What environmental and cultural factors influence habitation site location and seasonal mobility in the Darkhad Depression today?
2. Is there a spatial correlation between ritual monuments and earlier hunter-gatherer-fisher activity/occupation zones? With Bronze Age habitation? With Iron Age habitation?

3. Is there evidence for specialization or non-local artifacts within identifiable habitation zones? Does this vary chronologically?
4. What was the nature of subsistence practices? Does this vary by period?
5. Is there a decline/absence of habitation in the Xiongnu period within the Darkhad Depression?

Employing these questions during the field research ensured the collection of a variety of important data during the 2012 summer season. The research questions also connected with the formulation of a predictive model that was employed in order to more effectively utilize a single season of fieldwork that combined pedestrian survey, subsurface archaeological sampling, and ethnoarchaeological study. These important considerations are discussed in more detail in subsequent chapters of the dissertation.

1.5.1 Dissertation Structure

Chapter One has introduced key theoretical issues connected with the development of prehistoric pastoralism in the Eurasian steppes, the anthropological implications of undertaking more detailed study and analysis of these key transitions, and value of this in the context of comparative archaeological study. The chapter also introduced the geographical location of the field research and stated the research questions that structured the fieldwork activities and data collection during the summer of 2012 that ultimately formed the foundation of this dissertation.

Chapter 2 discusses various approaches to modeling pastoral adaptation, particularly in northeast Asia. In this chapter, previous modeling approaches that have been applied specifically to Mongolia are summarized and evaluated. This chapter then presents the two types of modeling used explicitly in this dissertation: (1) predictive site modeling and (2) a conceptual model for the adoption of pastoralism.

Chapter 3 contextualizes the program of research by reviewing both inter-regional and regional developments as well as previous archaeological research in the area. It begins by briefly discussing and summarizing political, social and economic developments and describing the environmental context in Mongolia leading up to and including the Bronze and Iron Ages. Previous archaeological fieldwork in the region is outlined. The chapter then reviews the nearby regions of the Minusinsk Basin and Lake Baikal in order to look at similarities and differences in the environment and archaeological evidence and traditions of these regions. The central themes addressed by this research project are then enumerated and discussed.

Chapter 4 elaborates on the methodologies used by this project and outlines how and why the research region was chosen. The important characteristics of this are discussed as well as the importance of modeling in the research design. A detailed description of the predictive model and how it was implemented is included. The chapter concludes with an explanation of the methods of survey, excavation, ethnoarchaeology, and experimental archaeology used within the project.

Chapter 5 focuses on a detailed description and analysis of the archaeological material remains recovered during the 2012 field season through pedestrian survey and targeted excavations. Key artifacts recovered included ceramics, faunal remains, and lithics.

Chapter 6 evaluates the spatial patterning of both monuments and other activity areas within the survey boundaries. Of key importance is the relationship between early monument construction and habitation zones and how these appear to have changed over time. An evaluation of the success of the predictive model as used by this project is also provided in this chapter.

Chapter 7 reconsiders the material finds and spatial patterns produced from field research with respect to the original research questions and theoretical concepts that stimulated this program of research. In particular, the material evidence is considered in light of the major themes of inter-regional interaction, diachronic habitation shifts, and transitions to new economic forms. The comparative value of this work also is considered with cases from both within and beyond the Eurasian steppe region. This chapter concludes the dissertation by summarizing the main contributions of the research program and how this work has provided an important foundation for future studies that may employ both conceptual and predictive modeling to examine social, economic and political developments among early pastoralist communities in the Eurasian steppes region.

2.0 MODELING PASTORALIST TRANSITIONS

In order to examine such theorized transitions in subsistence and socio-political organization of mobile pastoralist communities in a more rigorous manner, it is necessary to collect detailed archaeological data on patterns of habitation, subsistence economies, and the character and location of new forms of ritual monument construction. Late prehistoric mobile pastoralist sites, particularly habitation sites, can be very challenging to locate as they are often dispersed, contain no permanent architecture, have low artifact densities, and are frequently subsurface. Therefore, a creative approach that utilizes a number of methodologies and lines of evidence is required to maximize the productivity of any such program of research. Of great importance in this approach is modeling, which can, of course, take a variety of forms (Kohler and van der Leeuw 2007; Winterhalder 2002). Explicitly stated, the modeling employed in this dissertation utilizes both *conceptual modeling* and *predictive modeling*.

Conceptual models help to build hypotheses that can be tested with empirical evidence collected by well-designed projects (discussed in detail in Section 2.2). Predictive models significantly aid more refined and effective approaches to sampling in the field by targeting key areas in the landscape. They draw on a combination of inductive and deductive elements related to theories and observations of land-use strategy based on ethnographic and archaeological data (discussed in detail in Section 4.2). Such approaches underscore the value of ethnographic and ethnoarchaeological study and data collection.

Today, the practice of pastoralism in Mongolia is often closely linked with notions of traditionalism (Humphrey and Sneath 1999:1; Johnson et al. 2006). While the ethnography of these groups provides many powerful analogies for archaeologists, an uncritical acceptance of a single traditional pastoralist strategy, unchanged by time and history, conceals much of the variety in pastoralist strategies that may have existed both temporally and geographically in historic and prehistoric times. This dissertation investigates mobile pastoralist land-use strategies (1) temporally from the first introduction of domesticates into existing hunter-gatherer economies through later empires that were built upon a pastoralist economic base, and (2) geographically by comparing central regions of mobile pastoralism with regions bordering hunter-gatherer territories.

Importantly, northern Mongolia is one region in which it appears that agriculture did not precede pastoralism making it an ideal case study for examining transitional subsistence patterns connected with hunter-gatherer-fishers and pastoralists. In fact, short growing seasons, high altitude, low moisture, and poor quality soils may all have played a role in keeping agriculture a non-existent to minimal economic strategy even into the present day (Johnson 1969:2; Vainshtein 1980:128; for a discussion of these constraints on the spread of agriculture, see Guedes and Butler 2014). Furthermore, in Mongolia, disassociated research questions investigating *either* the study of pastoralists *or* hunter-gatherer-fishers leave a remarkable empty middle ground. The study of pastoralists often emphasizes later socio-political developments related to empire and state formation, while studies of hunter-gatherer-fishers are usually concerned with the earliest peopling of the region. Very little research has been devoted to understanding the articulation of these two economic orientations.

To date, numerous models have been put forward to account for the transition from an agricultural economy to an agro-pastoral or fully pastoral economy in prehistoric Eurasia (Anthony 2007:134-158; Khazanov 1984; Lees and Bates 1974). Unfortunately, there are far fewer explanatory models for the incorporation or adoption of pastoral strategies into hunting, gathering and fishing economies (Frachetti 2012:3; Ingold 1980:118; Popova 2006:172; Renfrew 2002:4; Wright 2006:11-15). Anthropological models developed for other regions, including those connected with the emergence of sedentism and the rise of food production systems in Southwest Asia during the Neolithic and their spread into Europe, provide effective, useful comparisons for study. A comparitive approach, rather than an uncritical application of these models, may highlight those elements that are similar across different case studies but also those that are more specific to the sedentary agricultural *or* mobile pastoralist forms.

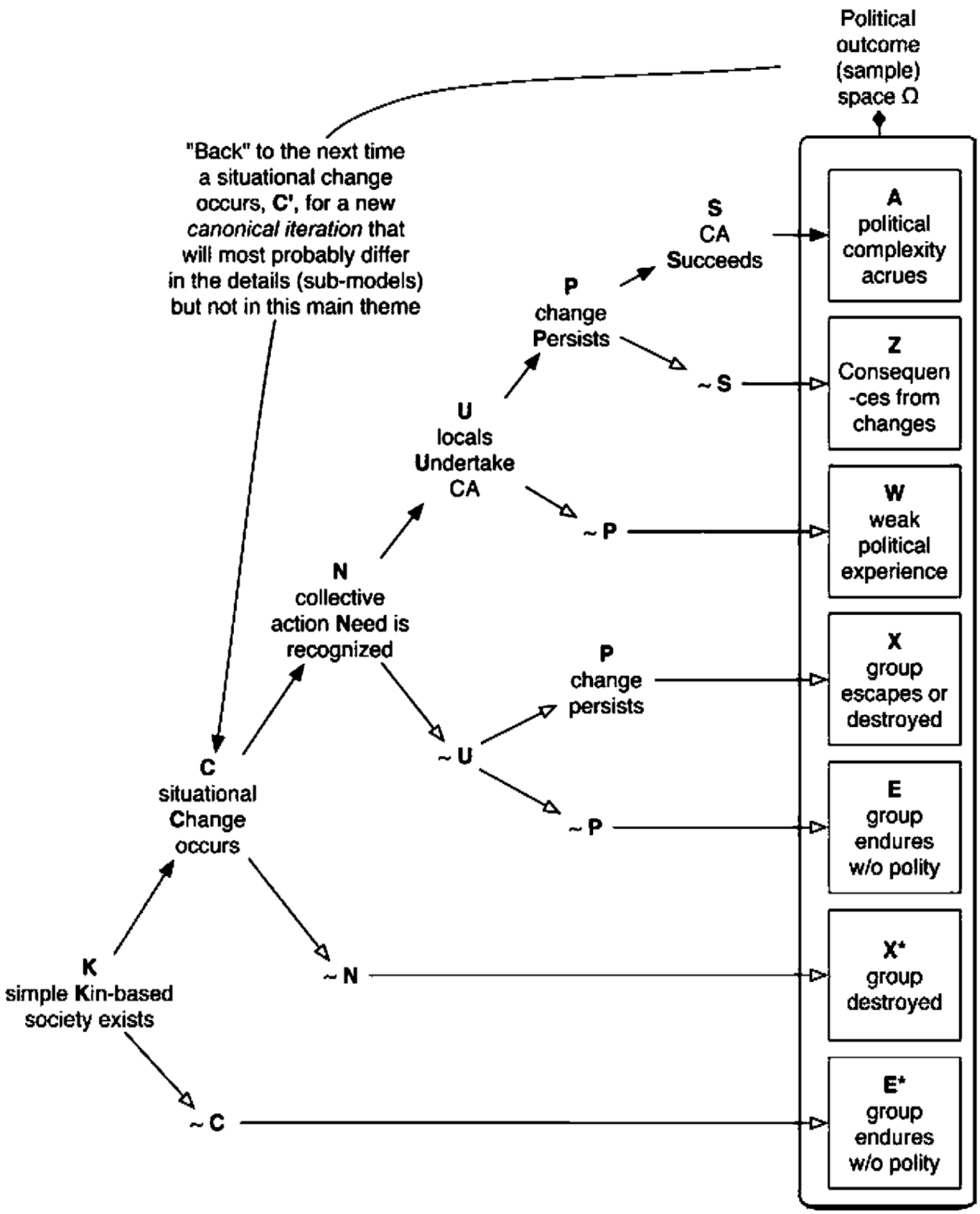
For many years, archaeologists working in Eurasia have attempted to characterize and track continent-wide developments and trajectories such as pottery styles, the introduction of pastoralism, metallurgy (e.g. Chernykh 2009), language (e.g. Gimbutas 1997) and genetics (e.g. Cavalli-Sforza 1996) which they then used to map out large archaeological cultural groups. More recently, this approach has been criticized in favor of micro-regional approaches aimed at illuminating the diversity of local developments and the integration of these technologies into existing cultural schemas (Frachetti 2008; Hammer 2014; Houle 2010). This approach recognizes that households and communities at the local level made choices about adopting and adapting to new developments, or in some cases modifying or rejecting them altogether.

While recent trends have seen archaeologists moving towards more micro-scale units of analysis, recent agent-based modeling projects in Mongolia have operated on the large, regional and inter-regional scale indexing the emergence and development of empires throughout Inner-

Asia (Cioffi Revilla et al. 2007, 2008, 2010; Rogers 2012). Researchers working with Mongolian case studies have created two agent-based computational models that specifically investigate the emergence and development of socio-political complexity among Eurasian steppe empires. This inter-disciplinary team of computational social scientists and archaeologists applied a "canonical theory" of social change to the emergence of complex socio-political polities in Mongolia, including the Xiongnu and Medieval empires (Figure 5; for a discussion of this theory, see Rogers and Cioffi-Revilla 2010 and Cioffi-Revilla 2005). These theoretical exercises were important for formulating hypotheses that could potentially contribute to social and anthropological theory more broadly. In order to test these hypotheses, the researchers utilized ethnographic, historical and archaeological data in order to build their agent-based models. The models produced were defined as: (1) *Hierarchies World* (a long duration, empire emergence model), and (2) *Household World* (a day-to-day household interaction model).

These models represent an important first step in the use of computational modeling in the region, and more broadly for the analysis of organizational changes among mobile pastoralist societies. However, the implications of this research have yet to be grounded more effectively in actual archaeological data from the region. Consequently, in practice, these agent-based approaches are based largely on ethnographic data and historical documents and necessitate more detailed empirical evidence from late prehistoric and early historic settlement patterning and human-environment relationships. This oversight is in large part due to the nature of the archaeological evidence and the current research done for the Mongolian region. Small, dispersed, seasonal habitations of semi-nomadic people can be difficult to locate and then investigate. This problem has been approached through this doctoral research program, and the results of this work contribute directly to such needs by offering a detailed, empirically validated case study in a region of Mongolia that has received very little systematic study to date.

Figure 5: Model of *canonical theory* (from Cioffi-Revilla 2005: 139)



Archaeologists whose research contributed to the formation of these agent-based models aimed to develop the following information for use in model building and evaluation (Rogers and Cioffi-Revilla 2010:453):

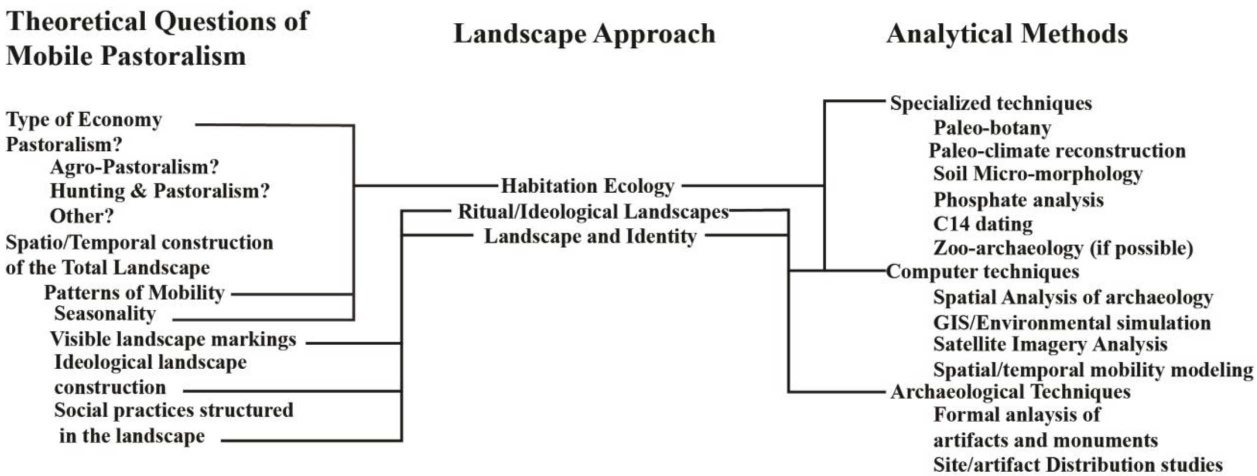
1. Chronology (as detailed as possible)
2. Demography (diachronic)
3. Climate model (of appropriate scale)
4. Ecological model of resources
5. Traditional Ecological Knowledge (TEK) about how resources are used
6. Ethnography of social interactions

Though these aims are admirable, in currently available publications it has not been made clear what items from this list have been addressed and how precisely they have been incorporated into the development of the model(s). The ambitious theoretical aims of the project were only tenuously connected to the archaeological activities and data sets it sought to incorporate. Nevertheless, all of the themes outlined above as part of the agent-based study are critical to the modeling approach that has been developed and employed as part of this dissertation research program.

The dissertation research also has endeavored to combine a number of lines of evidence to create a more comprehensive interpretation that includes the ritual and domestic landscapes, ethnographic land use patterns, and the natural landscape though an investigation of the distribution of valuable natural resources. Such an approach has been developed and employed by Michael Frachetti through his study of late prehistoric pastoralist groups in Kazakhstan (2008:31-71). In describing his own "landscape approach", Frachetti (2006:129-132:Figure 6) identifies *habitation ecology, ritual/ideological landscapes,* and *landscape and identity* as the building blocks of this framework. In the study of mobile pastoralists, these important elements are essential to link the theoretical questions to the analytical methods used by archaeologists

(Figure 6). This middle-range-theory is essential in order to empirically ground high level theory to the material evidence uncovered by archaeologists.

Figure 6: A model for the landscape approach to mobile pastoralism (from Frachetti 2006:131)



This landscape approach, as described by Frachetti, is predicated on the use of appropriate units of analysis (Frachetti 2008:24; Hammer 2014). A site-based approach may miss important nearby natural and cultural features that would have played a critical role in the lifeways of people at the site. An inter-regional approach does not have the resolution to see important local variation and adaptations. This dissertation research builds on Frachetti's approach by targeting multiple scales of analysis from the campsite scale (up to a single hectare) to the valley-wide scale (57 km^2), and finally to an inter-regional comparative scale by comparing the results to other archaeological projects of similar sizes in Mongolia (Honeychurch 2004; Houle 2010).

In Mongolia, as in many other regions, researchers have used natural and cultural features to indicate areas of higher and lower probability for the recovery of archaeological materials (Honeychurch 2004: 86-88; Houle 2010: 43-48; Wright 2008:65). Since many sites are shallowly buried (0-50 cm below the surface), they require an intensive methodological approach such as shovel probes or augering to locate. Since these laborious methods cannot feasibly be conducted over entire landscape-scaled survey areas, defined areas are selected and sampled while others are tested or excluded altogether. This sampling is essentially predictive modeling, though the modeling part has not been made explicit in many cases. The research presented here utilizes similar methods, but more explicitly develops a predictive model of occupational site location. This allows for a more rigorous evaluation of the model's efficiency and the validity of its assumptions that is just not possible in the implicit predictive modeling employed in other sampling strategies.

2.1 PREDICTIVE SITE MODELING

Predictive models are commonly used in archaeology to help researchers locate sites and test hypotheses about human behavior and land use (Barton et al. 2012; Kohler 1988; Kvamme 1990, 1992; Verhagen and Whitley 2012; Winterhalder 2002). In this dissertation study, the goal of the predictive model (Section 4.2) is to use it as a methodological tool, the results from which can be interpreted in a way that increases our understanding of human-environment-animal relationships through time. The predictive model provides a methodological tool with which to effectively and efficiently locate artifact scatters indicative of occupation and other activity areas. Mobile pastoralist occupational sites are notoriously difficult to locate (Chang 2006: 188-189; Cribb 1991:1-2; Houle 2010:36). They are often spatially distant covering large territories through seasonal moves, and compared to settled communities, they contain rather thin material deposits. Predictive models allow researchers to focus on those areas that are most promising in order to maximize productivity of field research activities. Once these areas are located, it is possible to discern the defining characteristics of socio-natural site catchments. In order to develop an effective predictive model, natural and cultural elements that impact occupation location must be correctly identified and mapped. The relative success of the model will illustrate if the input data (derived from other archaeology projects and ethnographic interviews) have been modeled effectively for the output data set (this archaeology project). If the model is successful, then the predictions built into the model have some basis in reality. However, even in the case of a relatively unsuccessful model, something can be learned since its failure indicates that the social and natural elements modeled do not correlate well with activity areas.

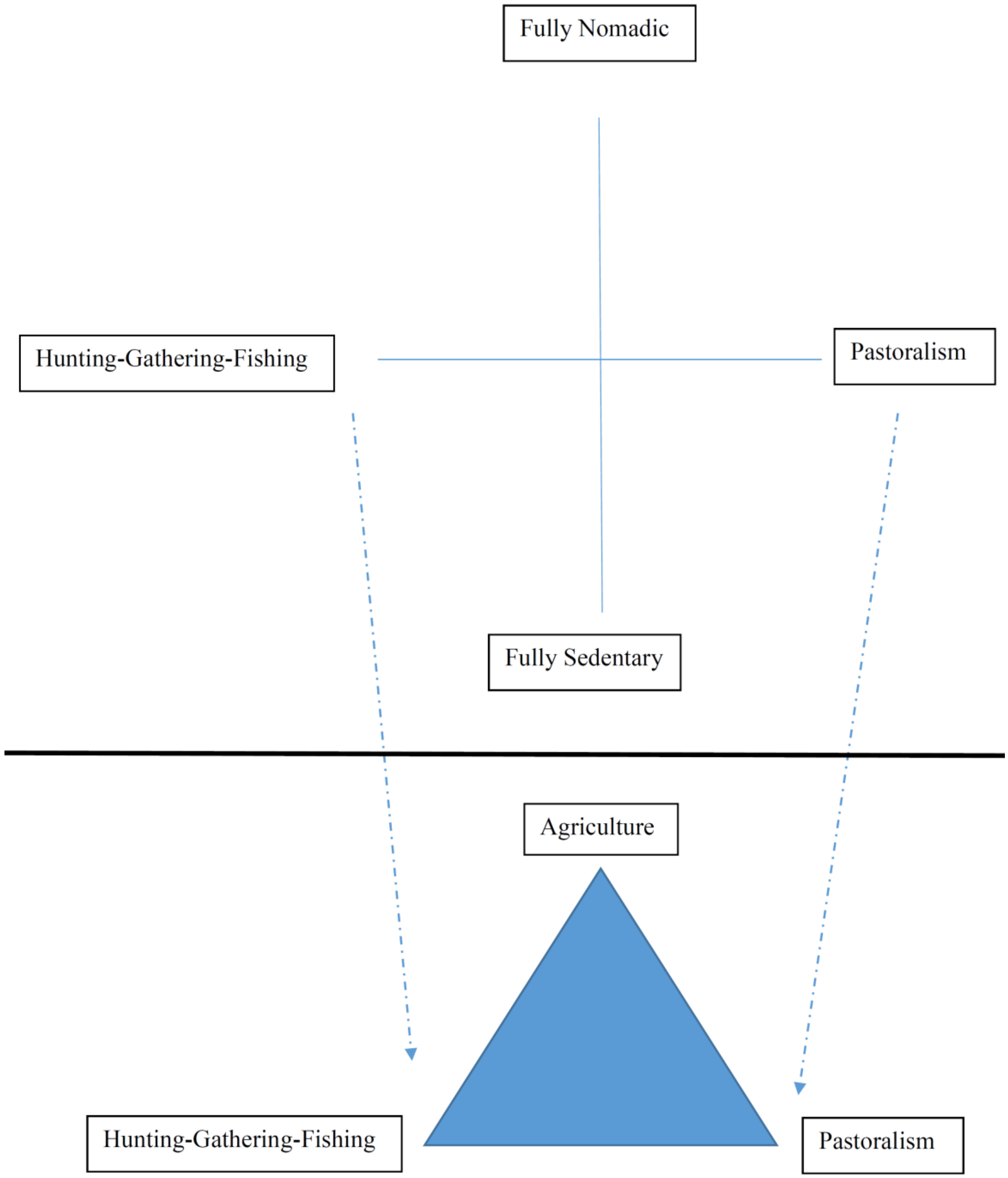
2.2 A MODEL FOR THE INTRODUCTION OF PASTORALISM IN MONGOLIA

Building on Cribb's 1991 conceptual model (Figure 1) for (agro)pastoralism orientations, it may be be suggested that specialized hunting-gathering-fishing and specialized pastoralism also can be conceptualized as the ends of a continuum (

Figure 7) wherein the space between is characterized by mixed economies that utilize both domestic and wild resources. Since agriculturalists can similarly mix with hunter-gatherer-fishers, a more accurate model has three endpoints (pastoralist, agriculturalist, hunting-gathering-fishing), with the possibility to map groups having any mix of these subsistence strategies (

Figure 7).

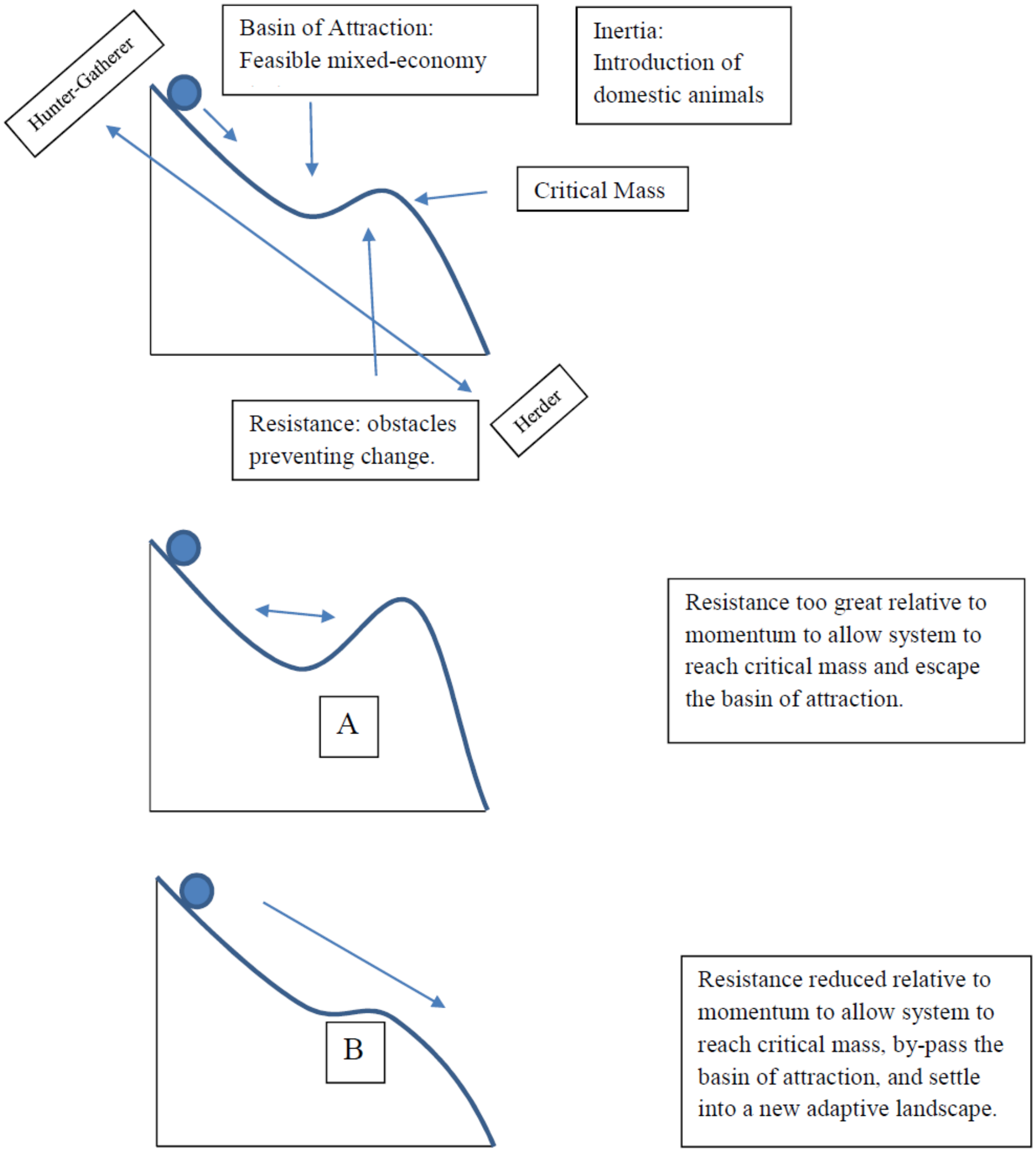
Figure 7: A revision of Cribb's continuum model to include hunting-gathering-fishing



While pure hunter-gatherer groups are common in prehistory, very few if any pastoralists rely only upon the products of their herds, instead mixing domestic animal products with plants and wild animals (Homewood 2008:86; Salzman 2004:7-8). Though there is some fluidity between these two categories, there comes a point at which obstacles exist that prevent pastoralists from returning to their previous hunting-gathering ways to any significant degree– a 'critical mass' (alternatively, 'tipping point' or 'point of no return'). These obstacles are both social and natural and include such factors as population density, grazing pressure and competition between domestic and wild animals, territorial land claims, inter-group competition and conflict, and systems of wealth and prestige based upon livestock holdings.

This transition is modeled in Figure 8 where the introduction of domestic animals creates an attractive force towards a pastoralist economy. The commonly used heuristic of a ball rolling down a hill, which has been utilized in complexity science (e.g. Scheffer et al. 2012, Scheffer and Carpenter 2003), provides a useful metaphorical basis for this model. The inertia is provided by the introduction of animals that *may* provide a more diverse economy, and therefore increased survivability and increased population levels. Higher populations are better able to defend themselves from neighbors who may already be experiencing population growth from the benefits of food production (pastoralism). Thus, despite the latent conservatism of any strategy, the 'push' towards a transition is the potential benefit of improved survivability and increased population/defense. The path from hunting and gathering towards a mostly pastoralist economy is not, however, direct nor the same in every case. A theoretical 'basin of attraction' may exist where pastoralism is known, and perhaps utilized in part or 'auditioned' (Price and Bar-Yosef 2011), but not adopted fully. In some cases, the obstacles presented will be too great to reach the critical mass or 'tipping point' and a hunter-gatherer or mixed economy will continue as long as those obstacles remain (Figure 8, A). In other cases, the obstacles are minimized by local conditions and critical mass is reached, propelling the population towards a more specialized pastoral economy (Figure 8, B).

Figure 8: Conceptual model of the introduction of pastoralism



In the case of the adoption of pastoralism in Mongolia, resistance to this transition is provided by both natural and cultural factors. First and foremost, perhaps, is the conservatism of traditional life-ways. Reluctance to make a complete change to an unknown, untested, completely novel economic mode is understandable. This is likely to occur, to greater or lesser degrees, in any context in which a new economic mode is presented. Second, ecological conditions dictating the amount of resources available may either help or hinder the transition. If pasture resources are scarce, but alternatives are available, resistance is great. If, however, the opposite is true and pasture resources abound, but alternative resources are scarce, then resistance is lowered. Third, Binford (2006:14) argues that in cases of low-subsistence diversity, subsistence insecurity is high and must be counterbalanced by social/kin-network augmentation. That is, without alternative subsistence strategies available, populations must rely upon familial, social, or political alliances in the case of subsistence failure. Pure pastoralism has very low-subsistence diversity relying only upon domestic terrestrial animals. Complex social networks alleviate some of the insecurity by creating allies to whom one can turn to in the case of subsistence failures due to herd loss from disease, theft, or environmental catastrophe.

In the case of the Darkhad Depression, alternative subsistence strategies were common because of because of high resource-diversity (Section 3.1.4). While pasture resources are present in this mountain-mountain-steppe-taiga zone, they are not as abundant as those of the steppe of central Mongolia where where pasture is plentiful, but few alternatives exist. The Khanuy Valley provides a concrete example of the example of the central Mongolian environment, and recent archaeological work in the region makes it a great makes it a great comparative case (for more on the Khanuy Valley, see Section 3.2; Figure 13). The lack of ecological diversity in central Mongolia would make this a relatively marginal environment compared to that of more northern Mongolia for hunter-gatherer populations. However, the case is reversed for specialized pastoralists – that which was marginal has become preferred, and vice versa. The northern region would have been an ideal location in which to introduce and audition pastoralism, but once specialized, the central steppe region becomes ideal. While social networks marked by the construction of integrative monumental complexes existed in northern Mongolia, their scale is rather small and could be accomplished by a relatively small number of people, such as an extended family. On the other hand, the large *khirigsuur* and Deer Stone complexes of central Mongolia would have required the work of many more people to construct and maintain beyond the level of even an extended family unit. This cooperation in monument construction may signal

cooperation in other ways, such as during times of subsistence stress, through well-developed social networks. In

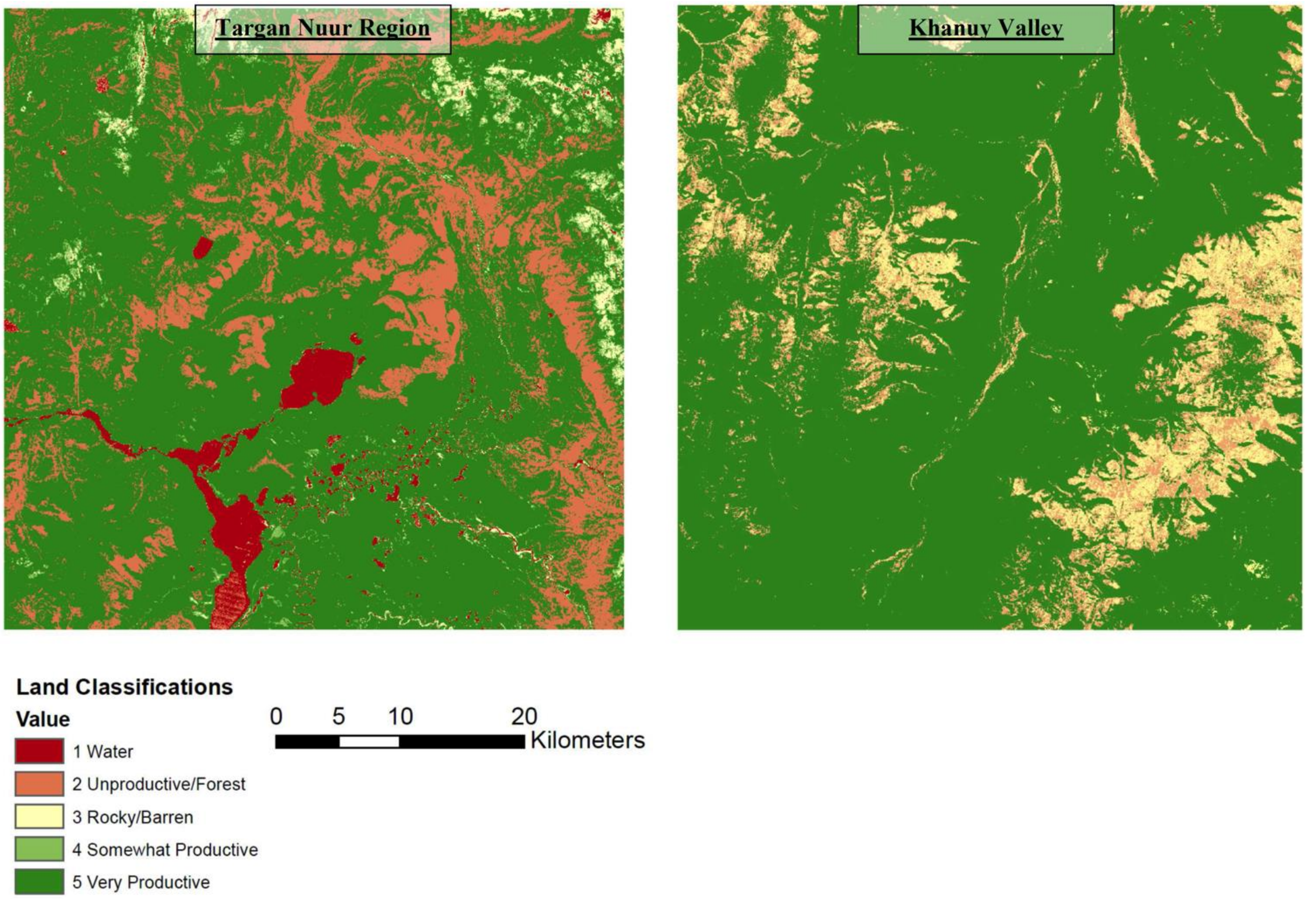
Figure 8, the Darkhad Depression may be more like model A wherein local conditions provide obstacles substantial enough to prevent a full transition, while the Khanuy Valley and more central regions of Mongolia are more reminiscent of model B and transition towards more specialized pastoralism with relative ease.

In support of this idea, an NDVI (Normalized Difference Vegetation Index) was created for the Targan Nuur region and the Khanuy Valley. A 2,500 km^2 block was centered over each project area (the Targan Nuur Archaeology Project and the Khanuy Valley Archaeology Project). The NDVI values were then used to distinguish five different land classifications based on their relative photosynthetic qualities (Figure 9). The classifications are as follows:

1. Water
2. Forest
3. Rocky/Barren
4. Somewhat Productive
5. Very Productive

It should be noted that "productive" is a relative term, and in this case is meant to indicate good pastures that are "productive" for pastoralists. Additionally, it is worth recognizing that the imagery used to create the NDVI was comprised of 30 m x 30 m cells. Due to the relatively narrow width of the Khanuy River relative to cell size in the imagery, the river does not appear, but rather, the gravelly shores and dirt embankments appear as a thin south west to north east trending yellowish line (Figure 9). In the Targan Nuur region, however, rivers and lakes often exceed the 30 m x 30 m cell size necessary to be detected in satellite imagery, and so these waterways are much more visible.

Figure 9: Land classifications based on NDVI



The classifications represented in the images in Figure 9 suggest that the Targan Nuur region is much patchier and more diverse while the Khanuy Valley's productive pastures dominate. This impression is validated by calculating the percentage of each type of classification (Table 1). The Khanuy Valley has 10% more "Very Productive" pasture than does the Targan Nuur region (31.7% compared to only 21.7%). Additionally, while there are patches of forest in the Khanuy Valley (39.8% of the total surface area), the majority of the Targan Nuur region is made up of forest cover (59.6%). The more numerous forests and lakes would provide hunter gatherers with ideal locations for fishing and hunting. While wood and water resources are important to pastoralists, the Khanuy Valley has *enough* of these resources to satisfy their needs while also maximizing pasture coverage.

Table 1: Percentage of each classification in the Targan Nuur and Khanuy Valley regions

Land Classification	**Targan Nuur**	**Khanuy Valley**
Large Body Surface Water	10.8%	<1%
Unproductive/Forest	59.6%	39.8%
Rocky/Barren	7.0%	28.5%
Somewhat Productive (Pasture)	9.3%	<1.0%
Very Productive (Pasture)	21.7%	31.7%

The use of NDVI to illustrate the vegetation differences between these regions is just one example of the ways in which the variables outlined in the model above (e.g. resistance and attraction;

Figure 8) can be translated into real-world subsistence orientations and realistically measured and compared. Future development of this model, which will be made possible in part through new archaeological data collection, will include defining, measuring, and comparing more of these key variables for these and other regions, thereby creating a more formalized, quantitative model.

3.0 CULTURE HISTORY OF MONGOLIA AND ARCHAEOLOGICAL APPROACHES TO ITS PREHISTORIC PAST

Mongolia has attracted the attention of adventurers, scholars, historians and archaeologists for over a century. In the early 20th century, exploratory expeditions to Mongolia were highly interdisciplinary and areas of interest included botany, paleontology, biology, geology, topography, and archaeology (Andrews 1943) among others. Just as Mongolia was gaining international notoriety for important scientific finds, such as the famous paleontological discoveries in the Gobi through the Central Asiatic Expeditions led by Roy Chapman Andrews (Andrews 1943; Gallenkamp 2001) and others, political developments cut short the research being undertaken by western scholars in the region. The rise of the Soviet Union, and Mongolia's close ties with it, prevented international intellectual interaction and such expeditions were no longer permitted. Early Mongolian archaeologists were trained in the Soviet archaeological tradition, and even now, over 20 years after the political revolution, many of the country's working archaeologists have been trained in Soviet universities. Once these geopolitical tensions effectively cut off international scholarly collaboration, both western and Soviet archaeological traditions continued to develop quite independently and followed different paradigmatic trajectories. In the Soviet Union, political pressures strongly influenced archaeological research and the interpretation of prehistory strictly followed Marxist approaches. A unilinear scheme was used to place different cultures into a set number of stages that represented progress towards the socialist ideal (Trigger 1989:207). Archaeology was used as a political tool to find evidence to support these claims and thus was strongly supported by the Soviet state. As Trigger has noted, this led to "the world's largest centralized network for archaeological research" (Trigger 1989:207). Despite strict guidelines and adherence to a political agenda, substantial archaeological field research was conducted throughout the Soviet Union, important methodological advances were made, and publication of results was well supported (Trigger 1989:207-242; Klejn 2012).

Numerous cemeteries and other ritual monuments were investigated in eastern Eurasia by archaeologists hoping to understand the region's ancient inhabitants and organize them into chronological cultural units (Okladnikov 1950, 1955; Svinin 1976; Volkov 1981). Meanwhile, the region's contemporary nomadic herders and hunters provided ample research opportunities for Soviet ethnographers (Vainshtein 1980). Soviet archaeological approaches emphasized settlement archaeology and this led to large-scale horizontal excavations in order to study the mode of production and to provide a more substantial cross-section of early societies. Nevertheless, the campsites of ancient nomads were unimpressive when compared with the more substantial domestic remains of ancient towns in other parts of the USSR (e.g. Novgorod – Trigger 1989:231). Among the "nomads", detailed ethnography served as a substitute for the excavation of ancient campsites (Nikolai Kradin personal communication), which were thought to be too difficult to locate and to not contain enough physical material to be of consequence.

After the collapse of the Soviet Union in 1991, research in the region by foreign arcdhaeologists greatly increased (Hanks 2010) and scholars already working in the region as well as those interested in initiating work there were faced with the difficult task of bringing together two distinctively different scholarly traditions. Theoretical dissimilarities, logistical difficulties, and language barriers have remained as significant challenges for archaeologists both within the territories of the former Soviet Union and foreign scholars wishing to work in these regions. Perhaps, most importantly, new research agendas had to be developed to direct archaeological investigations in this newly opened collaborative arena. Fieldwork and publications played an important part in developing these new approaches, but the impact of international conferences in providing opportunities to get scholars into the same rooms to discuss research agendas and results have had perhaps the greatest impact (e.g. Boyle et al. 2002; Hanks and Linduff 2009; Levine et al. 2003; Peterson et al. 2006).

3.1 MONGOLIA

Mongolia has been both the recipient and driver of many of the trends identified in the broader Eurasian region. While Chinggis (Ghengis) Khan's achievements quickly come to mind for many as the perfect example of this, late prehistoric inhabitants of the region of present day Mongolia had been key players in broader political, social, and economic trends well before the Mongol Empire formed. It was these early steps towards increasing social and political complexity that arguably set the stage for the later, larger empires that are historically known for this region (Honeychurch 2013).

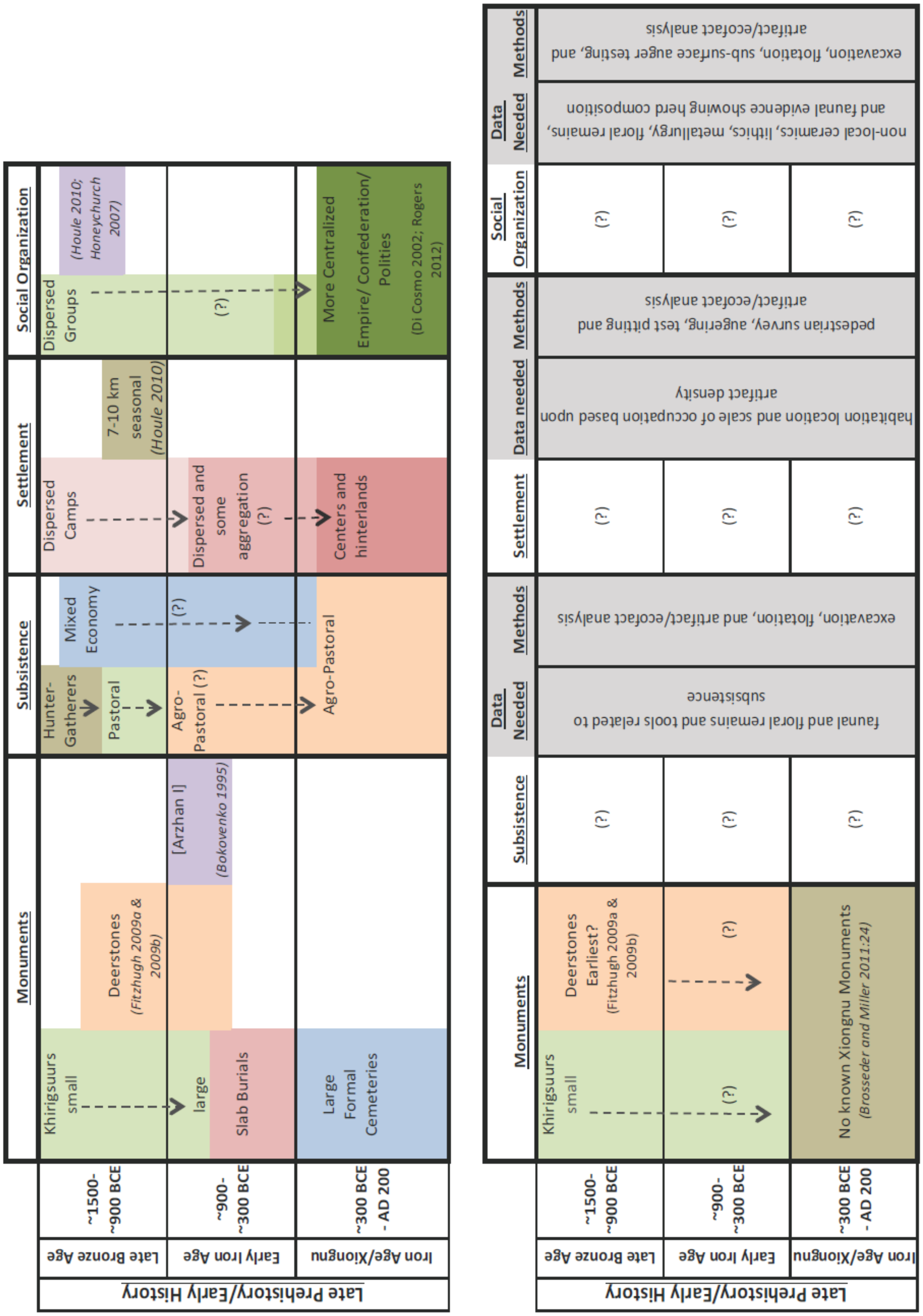
3.1.1 Culture History

Humans have inhabited Mongolia since the early Pleistocene, some 125,000 years ago (Olsen 2004). The earliest populations were hunter-gatherer groups whose presence has been detected primarily in caves and rock shelter sites. Pottery in the region dates back to at least 14,000 years ago (Kuzmin and Shewkomud 2003; Wright 2006: 135). The term “Neolithic” is commonly used in northeast Asia and Siberia to signify the adoption of pottery, but not the introduction of domestic plants and animals as it does elsewhere (Wright 2006). Importantly, scholars have recently suggested that some of the earliest pottery traditions actually emerged in the Far East and then diffused north and west across northern Eurasia, ultimately being introduced into prehistoric societies of Europe (Gibbs and Jordan 2013; Jordan and Zvelebil 2009). While accurate radiocarbon dates exist for the Far East there have been problems in substantiating the exact chronological diffusion of pottery across northern Eurasia, including the region of Mongolia (Gibbs and Jordan 2013).

Currently, for the earlier chronological phases of Mongolia, many researchers prefer to use alternative terms such as “Mesolithic” (Wright 2006) or “Epipaleolithic” (Janz 2012) rather than “Neolithic”. Microliths, which are widely dispersed throughout the region, are also thought to be an important material diagnostic of this period (Janz 2012: 34; Kuzmin and Shewkomud 2003: Wright 2006:154). It is generally thought that pastoralism must have emerged in this time between the Epipaleothic and Late Bronze Age (especially the Early/Middle Bronze Age) but very little is known about this period or how and why pastoralism emerged (more detailed discussion below in Section 3.1.2). As noted above, a few Early Bronze Age burials have been located in Mongolia and may actually situate the earliest form of monumental landscape within in the Darkhad Depression (Table 3; Fitzhugh et al. 2008: 31-33).

In the Late Bronze Age (1300-700 BCE), archaeological data substantiates that transformations were occurring in the social organization and ritual practices of populations across much of Mongolia. Monumental stone constructions (Table 3) dotted the Late Bronze Age landscape of central and western Mongolia and the surrounding regions (Allard and Erdenebaatar 2005; Erdenebaatar 2004; Frohlich et al. 2008). These monuments, known as *khirigsuurs* (Figure 11), vary in scale and distribution but are often consistent in many of their spatial organizational principles (central mound, 'fence', and satellite features; Wright 2007). Elaborately carved stone stelae known as ‘Deer Stones’ (Figure 12) were erected in these same regions (Fitzhugh 2009a; Savinov 1994; Volkov 1981). Monuments of these types were not built in previous periods and suggest that social relationships and the structure and character of ritual practice became radically re-worked by the late prehistoric period. By at least 300 BCE, the first of several steppe empires in the region, the Xiongnu, would emerge and further transform the socio-political landscape (Brosseder and Miller 2011; Di Cosmo 2002). Monumental construction efforts among Xiongnu groups (Table 3) were focused on tombs, the most impressive of which are royal burials much more complex and labor intensive than the *khirigsuurs* of the Bronze Age. The foundations of this mighty political force, and those that would follow, may be traced back to important structural changes taking place in the Late Bronze Age. Scholars have characterized the Xiongnu as the first widely recognized nomadic empire, or confederation, composed of several ethnicities and tribes within northeast Asia (Brosseder and Miller 2011; DiCosmo 2002:161; Hanks 2010:478-479; Rogers 2012). Much of the discussion of the Xiongnu development has been tied closely to political and economic interactions with China (Di Cosmo 2002). However, far less is understood about the earlier regional foundations that preceded the Xiongnu development within northeast Asia.

Figure 10: General model of broader late prehistoric change in Mongolia (left) and more specifically within the Darkhad Depression (right)



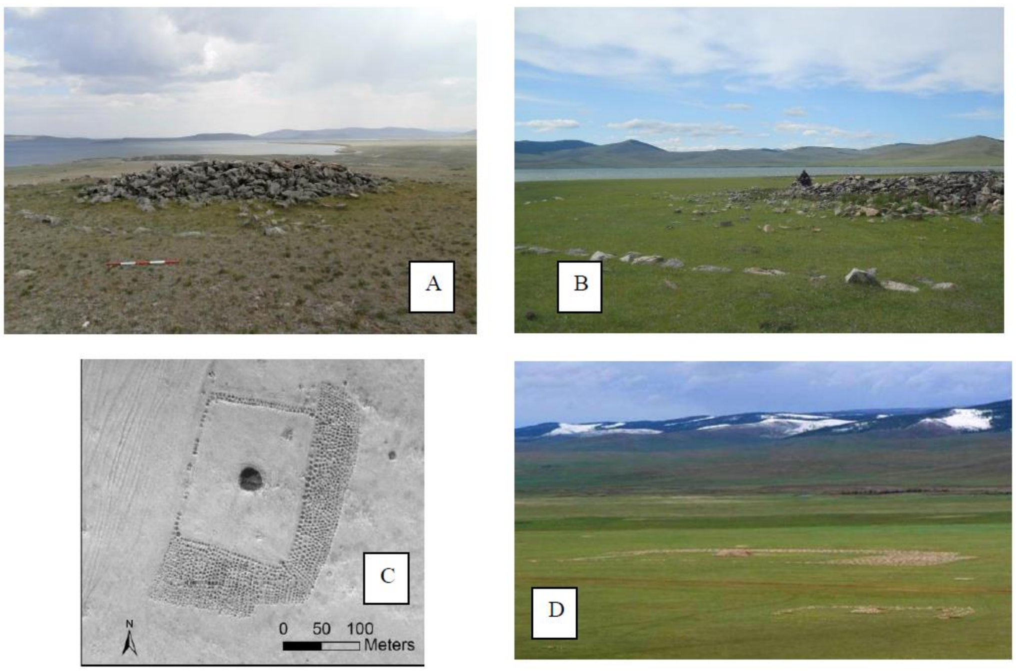
Given their relatively close proximity (Table 2) and environmental similarities, prehistoric populations in Tuva, the Minusinsk Basin, and the Baikal region could have developed and easily maintained relationships with groups inhabiting the steppes and forest-steppes of central and north-central Mongolia. Yet, Late Prehistoric social and economic developments had very different trajectories within these regions. While some regions continued to develop increasingly larger scales of socio-political integration into the Iron Age and beyond, it appears that others become more isolated, though the reasons for this remain unclear. To be able to understand these important socio-political and economic developments, several lines of archaeological evidence must be utilized and in many regions this remains to be done (e.g. systematic survey, test-pitting/excavation, GIS modeling).

Table 2: Distances of key regions from Targan Nuur

Region	Approximate Euclidean Distance from Targan Nuur
Tuva	120 km
Lake Baikal	290 km
Egiin Gol	370 km
Khanuy Valley	380 km
Minusinsk Basin	500 km
China (Great Wall)	1300 km
Tamsagbulag	1380 km

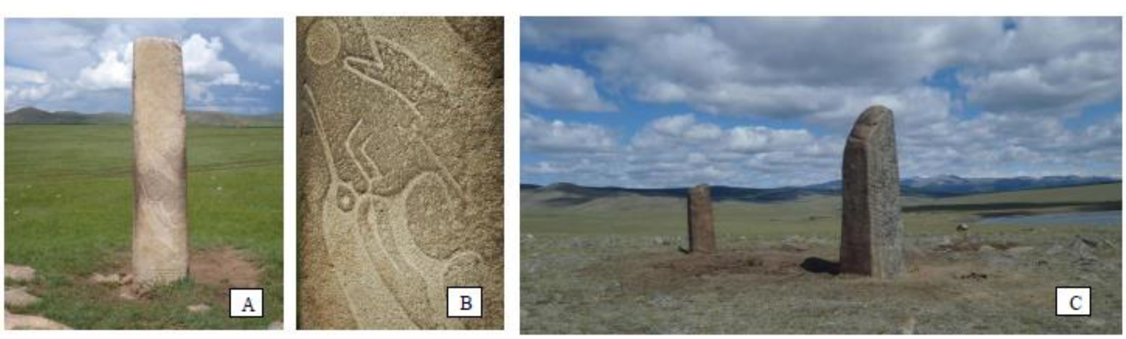
Today, the Darkhad Depression region is home to some of Mongolia's ethnic minority groups that have maintained a very distinct cultural identity. Though most Mongolians belong to the Khalkh ethnic group, two minority groups, the Darkhads and Dukha primarily inhabit the Darkhad Depression. The Darkhad peoples, like their Khalkh neighbors, herd sheep, goat, cattle, yaks, camels and horses and live in *gers* (yurts) made of felt. The Dukha, sometimes also known as the *Tsaatan*, traditionally herd reindeer and live in tipi-like structures known as *ortz*. Mongolia's most northern administrative unit, Tsagaan Nuur Soum, was created in 1985 specifically to accommodate the Dukha who had immigrated to the region in the 1940's seeking refuge from Soviet policies that they felt were hostile towards their mobile way of life and the hardships of World War II (Inamura 2005: 141-142).

Figure 11: *Khirigsuurs*



A and B = Targan Nuur Archaeology Project area khirigsuurs showing central mound and fences in foreground; C and D = Urt Bulagyn in Arkhangai Aimag showing central mound, and thousands of smaller satellite mounds (Houle 2010:34; Satelite imagery courtesy of GeoEye)

Figure 12: Deer Stones



A = Deer Stone at Jargalantiin Am site in Arkhangai Aimag; B = Detail of carving on stone 'A'; C = Deer Stones in Targan Nuur Archaeology Project area.

Table 3: Time periods and their associated monumental forms

Chronological Period	Associated Monumental Forms	Approximate Size Range
EBA/MBA	Circular graves	3-6 m diameter
LBA	*Khirigsuurs*	5-400 m long
	Deer Stones	0.5-2 m high
	Slope Burials	3-6 m diameter
LBA/EIA	Slab Burials	2-4 m long
Iron Age (Xiongnu)	Royal burial complexes (ramped)	8- 46 m long, up to 18 m deep (Honeychurch 2014:299)
	Circular/Ring burials	Up to 14 m diameter, 1.5-4 m deep (Honeychurch 2014:298)
Later Iron Age (Turkic Empires)	Bal-bals and other stone alignments	5- 100's of m long
	Stone boxes	2-5 m long
	Stone men	0.5-1.5 m high
Medieval	Cliff-side burials	2-5 m diameter

3.1.2 Early Pastoralism in Mongolia

The introduction and spread of pastoralism in Mongolia is not well understood. Sources written by non-archaeologists sometimes make passing claims about when the inhabitants of the region began herding, though they are rarely consistent with one another or with archaeological evidence. For example, Dalintai et al. (2012:52) state that, "Around the 9th century CE or possibly shortly before, Mongolians abandoned their hunter-gatherer existence and took up raising livestock." However, most archaeologists would place the beginning of pastoralism much earlier than this date for the following key reasons:

1. Faunal remains of horses, sheep and goats are found in deposits around ritual sites and in campsites dating from the Xiongnu period (Wright et al. 2009) and earlier sites from at least the Late Bronze Age (Broderick 2011:16; Houle 2010:12).

2. Pastoralism appeared in neighboring territories in Russia and Kazakhstan much earlier (Christian 1998:81-85; Frachetti 2012; Kiselev 1951).

3. Rock art depictions of livestock are believed to date to the early Holocene (Jacobson-Tepfer 2013; Richard Kortum personal communication).

4. Historical documentation from the Han Chinese period clearly describe the Xiongnu (300 BCE - 200 CE) economy as based on livestock herding (Christian 1998:184; Goldin 2011).

Why, then, is there so much discrepancy in the dates reported for the adoption of pastoralism for northeast Asia? In part, it might be that while archaeologists can state that the introduction of pastoralism obviously happened well before the 9th century CE, there is not a clear and concise answer for when, how and why it actually happened. Furthermore, the transition from hunting and gathering to specialized pastoralism was likely neither wholesale nor rapid, but rather represented a multitude of transitions based on various forms of multi-resource pastoralism over the course of millennia (Vainshtein 1980:39-40). Adding to this confusion, in some regions, it could be argued that the transition never fully took place as people continued to utilize both hunting and gathering strategies as well as herding right up to present times (Honeychruch and Amartuvshin 2007; Machicek 2011; Vainshtein 1980:52).

In 1980, Vainshtein (1980:51) produced a detailed ethnography of Tuva wherein he stated, “Unfortunately, the history of pastoralism in these parts remains virtually unexplored.” Though 35 years have passed since this publication, only small advances have been made on the subject. Many scholars suggest simply that pastoral nomadism has been the primary economic practice in Mongolia for "many thousands of years" (Barfield 2011:104) while others provide a somewhat more specific time frame such as the second millennium BCE (Fitzhugh 2009a:379), the mid-late 2nd millennium BCE (Honeychurch and Amartuvshin 2011:198), by the 3rd millennium BCE (Vainshtein 1980:51), the late Neolithic and early Eneolithic periods – 5th-early 2nd millennium BCE (Houle 2010:4), or the late 3rd-early 2nd millennium BCE (Honeychurch 2013:289). While there is some variation in these interpretations, most assessments cluster around the 2nd and 3rd millennium BCE and thus date to the Early to Late Bronze Age (Figure 4). It is clear that the Epipaleolithic is dominated by hunter-gatherers (Janz 2012), and that pastoralism is well developed in the Late Bronze Age (Houle 2010), and so by *default*, rather than by any kind of physical evidence and intense study, the middle ground, the Early/Middle Bronze Age emerges as a likely period when pastoralism is first introduced into the region.

The Tamsagbulag culture of eastern Mongolia's Dornod province is the primary early agro-pastoral Neolithic case known in Mongolia (Séfériadès 2003:139-140). Located just a few kilometers from the modern day boundary with Chinese Manchuria, the inhabitants of the Tamsagbulag lake-side sites lived in semi-subterranean dwellings and relied upon hunting, gathering, fishing, farming (millet), and stock raising (cattle and horses). Radiocarbon dates suggest a mid-5th millennium BCE occupation, similar to the Neolithic period in China (Séfériadès 2003:142). Interestingly, Séfériadès (2003:141) recognizes similarities to the material record of Neolithic groups living far to the north near Lake Baikal and the Amur region of Siberia, such as stone tools and ceramic types. Unfortunately, to date, no other sites exhibiting evidence of early farming or pastoralism in Mongolia have received such serious systematic study.

3.1.3 Northern Mongolia Paleo-Climate

Though the region has been periodically covered with glaciers, the last deglaciation event occurred about 18,000 BP (Horiuchi et al. 2000). The paleo-lake that occupied the Darkhad basin at that time disappeared sometime prior to 14,000 BP (Narantsetseg et al. 2013). Palynological analysis of lake cores taken from Tsagaan Nuur (‘White Lake’, also known as Dood Nuur and a part of the same lake system as Targan Nuur) suggests that the forest to steppe ratio has remained fairly constant for the entirety of the Holocene in the Darkhad Depression (Dorofeyuk and Tarasov 1998). However, deposits dating to 12-14,000 years ago suggest that the basin was much more forested just prior to the start of the Holocene. Lake cores analyzed for their pollen content indicate that fluctuating forest conditions following deglaciation became more stabilized, and from approximately 7,500 years ago to the present, forest composition has changed very little (Blyakharchuk et al. 2004).

A recent study conducted by Narantsetseg et al. (2013) suggests that there was no lake from 14,000 – 9,500 cal BP. Low lake levels resulted from increased precipitation and melting permafrost between 9,500 and 8,500 cal BP. Between 8,500 and 7,500 a cold and dry climate kept lake bioproductivity low. Instability in the lake environment is evident between 7,800 and 5,800 cal BP during a humid and warm climactic period. Finally wetter conditions around 5,800 cal BP brought the lake to its current level in the mid-Holocene. Direct evidence of relatively stable lake levels during the mid- to late Holocene is provided by the presence of Early Bronze Age monuments, *Khirigsuurs* and Turkish monuments on the first terrace above the modern lake level (0-25 m above lake surface), which suggest that lake levels could not have been much higher than they are today during these periods (Early 2nd millennium BCE – end of 1st millennium CE). Xiongnu and Medieval period monuments are often located at higher elevations and against cliffs, so these are not typically expected to be good indicators of lake levels during the period of their construction. Contemporary herders that we interviewed as part of the dissertation research program reported that the lake level has been falling in recent years, though this trend is not noted in the literature. Steep dirt embankments surrounding the lake suggest that this may be occurring at the scale of as much as a few meters, though it is important to note that we visited during a particularly dry year. Therefore, although some lake level fluctuations have occurred, climatic conditions in the late prehistoric and early historic periods were not all that different than those of the Darkhad today, and therefore did not likely influence settlement-patterning in any substantial way.

3.1.4 Northern Mongolia Geological and Environmental Context

The Darkhad Depression is a unique ecological zone that is surrounded by the Sayan Mountains (elevations range between approximately 1500 and 3200 m above sea level) and is adjacent to a thick forest zone (taiga) to the north. These conditions create an isolated basin about 140 km long and 40 km wide, which is interspersed with numerous lakes and rivers. The region's largest river, the Shishged Gol, drains to the northwest into the Yenisei River and Minusinsk Basin and away from central Mongolia and the largest known *khirigsuur* ritual monuments. The basin's many lakes and rivers provide habitat for numerous bird and fish species. Fish species include Baikal omul (*Coregonus autumnalis migratorius),* sharp-snouted lenok *(Brachymystax lenok),* arctic grayling *(Thymallus arcticus negrescens),* Siberian roach (*Rutilus rutilus lacustris),* minnows *(Phoxinus phoxinus),* Siberian spined loach (*Cobitis taenia sibirica),* European perch *(Perca fluviatilis),* and burbot *(Lota lota)* - (Akademija Nauk S.S. S. R. 1989:86-87). Northern Mongolia's wetlands, forests, and meadows are home to several hundred species of birds from the following families: hawks, kites and eagles (*Accipitridae*), long-tailed tits (*Aegithalidae*), larks (*Alaudidae*), kingfishers (*Alcedinidae*), ducks, geese and swans (*Anatidae*), swifts (*Apodidae*), bitterns, herons and egrets (*Ardeidae*), waxwings (*Bombycillidae*), nightjars (*Caprimulgidae*), treecreepers (*Certhiidae*), plovers and lapwings (*Charadriidae*), storks (*Ciconiidae*), dippers (*Cinclidae*), pigeons and doves (*Columbidae*), rollers (*Coraciidae*), crows, jays, magpies and ravens (*Corvidae*), cuckoos (*Cuculidae*), buntings (*Emberizidae*), caracaras and falcons (*Falconidae*), finches (*Fringillidae*), loons (*Gaviidae*), pratincoles and coursers (*Glareolidae*), cranes (*Gruidae*), swallows and martins (*Hirundinidae*), ibisbill (*Ibidorhynchidae*), shrikes (*Laniidae*), gulls (*Laridae*), wagtails and pipits (*Motacillidae*), Old World flycatchers (*Muscicapidae*), Old World orioles (*Oriolidae*), bustards (*Otididae*), osprey (*Pandionidae*), parrotbills (*Paradoxornithidae*), tits, chikadees and titmice (*Paridae*), sparrows (*Passeridae*), pelicans (*Pelecanidae*), cormorants (*Phalacrocoracidae*), pheasants and partridges (*Phasianidae*), woodpeckers, piculets, wrynecks, and sapsuckers (*Picidae*), grebes (*Podicipedidae*), accentors (*Prunellidae*), rails, gallinules and coots (*Rallidae*), kinglets (*Regulidae*), penduline tits (*Remizidae*), painted snipes (*Rostratulidae*), sandpipers (*Scolopacidae*), nuthatches (*Sittidae*), terns (*Sternidae*), typical owls (*Strigidae*), starlings (*Sturnidae*), Old World warblers (*Sylviidae*), wallcreepers (*Tichodromidae*), grouse (*Tetraonidae*), ibises and spoonbills (*Threskiornithidae*), Old World babblers (*Timaliidae*), wrens (*Troglodytidae*), thrushes (*Turdidae*), and hoopoes (*Upupidae*) - (Akademija Nauk S.S. S. R. 1989:86-87; Kozlova 1932a, 1932b, 1932c, 1933a, 1933b).

In fact, northern Mongolia has much wider species diversity than many of the surrounding regions (Dorofeyuk and Tarasov 1998). Extensive coniferous forests cover the mountainsides that border the basin and provide shelter for abundant species of game animals, including wolf (*Canis lupus),* corsac fox *(Vulpes corsac),* brown bear (*Ursus arctos),* short-tailed weasel *(Mustela erminea),* Siberian weasel *(Mustela sibirica),* steppe polecat (*Mustela eversmanni),* wolverine *(Gulo gulo),* lynx *(Felis lynx),* Eurasian Badger *(Meles meles),* wild boar *(Sus scrofa),* Pallas's cat *(Felis manul),* mountain hare *(Lepus timidus),* Tolai hare *(Lepus tolai),* red squirrel *(Sciurus vulgaris),* Siberian chipmunk *(Tamias sibirica),* long-tailed ground squirrel *(Citellus undulatus),* sable *(Martes zibellina),* Eurasian otter *(Lutra lutra),* red deer *(Cervus elaphus),* moose *(Alces alces),* Siberian musk deer *(Moschus moschiferus),* Siberian ibex *(Capra sibirica),* red fox *(Vulpes Vulpes),* beech marten *(Martes foina),* reindeer *(Rangifer tarandus),* roe deer *(Capreolus capreolus),* argali/mountain sheep *(Ovis ammon),* Tarbagan marmot *(Marmota sibirica),* Asiatic wild dog *(Cuon alpinus),* and snow leopard *(Uncia uncia)* – (Akademija Nauk S.S.S.R. 1989:92-93). These forests also contain edible mushrooms, berries, and timber for shelter, animal pens and fuel. Meadows filled with a variety of wildflowers and verdant grasses grow in the short summer months. It is clear that this region could have supported a variety of subsistence strategies from strictly hunter-gatherer-fishers to pastoralists, or, perhaps more likely, a mixed subsistence strategy utilizing both wild and domesticated species. While these resources are varied and abundant in the warm summer months, this is a region dominated by long, bitter cold winters in which many resources become limited or completely absent.

Mineralogical maps produced in the Soviet Union indicate that northern Mongolia has a variety of mineralogical resources. In and around the Darkhad Depression, significant deposits of gold, copper, iron, phosphorite and even rare deposits of jade are present (Akademija Nauk S.S.S.R. 1989; Crabtree et al., In Review). These are resources that were utilized during the Soviet Period and remain important to small scale miners in the region today (see section 4.4.2

for further discussion), though little is known of their use in prehistoric and early historic times due to lack of sourcing studies and identifiable ancient quarries.

The current climate of the region is recorded by a weather station located in the nearby settlement of Rinchinlhumbe in the east-central portion of the Darkhad Depression. The mean annual temperature between 1973 and 1990 was -7.8 ˚C with a high of 12.6 ˚C in July, and a low of -32.4 ˚C in January. The mean annual precipitation for the same time period was 263.1 mm with most moisture (234 mm, 89%) occurring in the months of May through September (WMO station number 44203). Droughts and *dzuds* (extreme winter conditions) present the most common form of environmental disasters in the area. Droughts impede plant growth and therefore negatively impact grazing opportunities. In fact, local herders reported a drought in the region during the summer of 2012. *Dzuds* occur occasionally, though this region of Mongolia is not often impacted as greatly as other regions of the country (Fernandez-Gimenez et al. 2011; 16). A *dzud* is a term used to describe adverse wintery conditions (such as deep snows, prolonged cold spells, impenetrable ice sheets, and minimal to no precipitation) that cause a lack of forage in winter or spring and results in the death of many herd animals (Batima et al. 2008:199; Fernandez-Gimenez et al. 2011:14). *Dzuds* and droughts are particularly deadly for Mongolia's herd animals when they occur in the same year together or in contiguous years.

3.2 PREVIOUS ARCHAEOLOGICAL RESEARCH IN MONGOLIA

Archaeologists from the Soviet Union or Mongolian scholars trained in the Soviet Union did much of the early ethnographic and archaeological work in Mongolia. These researchers, such as Batnasan (1972), Dorofeyuk and Tarasov (1998), Erdenebaatar (2004), Savinov (1994), Simukov

(1934), Vainshtein (1980), and Volkov (1981), have contributed substantially to what is known of the region in prehistoric and early historic periods. Since the dissolution of the Soviet Union and the Mongolian democratic revolution of the early 1990's, many teams of archaeologists representing a number of different nations and institutions have begun to conduct projects in the region.

3.2.1 Ethnography and Ethnoarchaeology

Ethnography is a vibrant field of study (Section 1.3) utilized by many different disciplines in Mongolia, including socio-cultural anthropology (Humphrey and Sneath 1999), archaeology (Houle 2010), ecology (Fernandez-Gimenez 2000), and agricultural studies (Damiran 2005). Though it is important to recognize that these populations are not necessarily representative of past lifeways, the Mongolian case is a unique opportunity to explore mobile pastoralism through ethnography. Topics of inquiry posed by researchers that closely intersect with archaeological studies include themes such as resource management (Fernandez-Gimenez 2012), herding practices (Fijn 2011), patterns of mobility (Bazargur 2005), and the impact of climate change (Batima et al. 2008). Though ethnography was once a replacement for archaeological research of habitation sites (Section 3.0), recent archaeological research has used ethnography to compliment ongoing archaeological research and have actively incorporated ethnoarchaeological methods into their project designs (Fitzhugh 2006, 2008; Honeychurch 2004; Houle 2010; Surovell et al. 2014; Wright 2006).

3.2.2 Monuments

The modern Mongolian landscape is dotted with stone and earth monuments from a variety of time periods. In many areas, they are the only remains of previous human activity visible on the surface of the ground. Archaeologists have long been interested in the prehistoric monumental landscape of Mongolia and the surrounding regions (Allard and Erdenebaatar 2005; Fitzhugh 2009a; Volkov 1981; Wright 2007). A distributional survey of Deer Stones has been the foundation of much of the recent work on these monuments (Volkov 1981). More recently, a series of surveys, excavations and radiocarbon dating schemes have been conducted on these monuments to determine their spatial and chronological distribution, regional differences, change over time, and organizational principles of construction (Fitzhugh 2009a; Wright 2007). As the most conspicuous evidence of prehistoric human activity on the modern landscape, these monuments have been the primary source of information on prehistoric life-ways in the region.

Of particular importance to this dissertation is the work done by the Mongolian-American Deer Stone Project between 2001 and 2009 (Fitzhugh 2001, 2005, 2006, 2007, 2008, 2009b). Centered in the Darkhad Depression, the geographical overlap with the research presented in this dissertation provides crucial data on the spatial distribution and form of monuments as well as a series of relevant C-14 dates (more on this in section 3.5.3; Figure 15). In conjunction with the important work completed by the Deer Stone Project in the Darkhad Depression, the dissertation research compliments this study by providing new data on habitation evidence within the valley.

3.2.3 Settlements

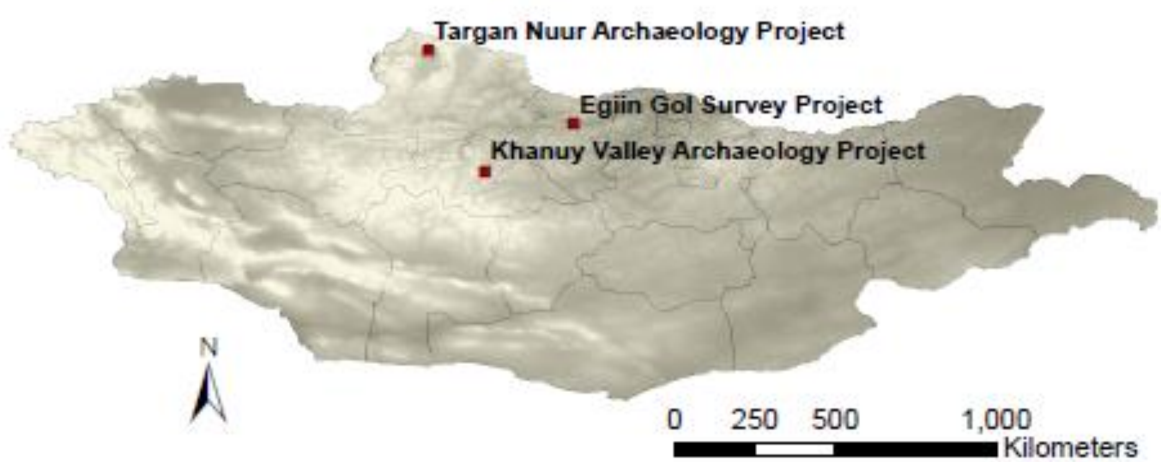
Only recently have archaeologists begun to systematically investigate evidence of prehistoric habitation and settlement in Mongolia. In particular, two systematic regional settlement surveys have provided the first glimpses of Bronze and Iron Age domestic life in central and north-central Mongolia (Figure 13) allowing for some understanding of demographic distributions and diachronic habitation patterning (Honeychurch 2004; Houle 2009).

Initially planned as a salvage project for the impending construction of a dam, the Egiin Gol Survey Project (Figure 13) was the flagship fieldwork scheme for modern systematic settlement survey approaches in Mongolia (Honeychurch 2004; Wright 2006). The dam project was never realized, and so ongoing research was made possible. In total, 310 km^2 were surveyed over 5 years, including 76 km^2 of intensive systematic survey (Honeychurch et al. 2007). A combination of surface survey and subsurface shovel probes were used to investigate the area. As the first systematic survey in Mongolia, this was an important project to prove that small, dispersed habitation sites could be located and that these sites are able to provide suitable data to researchers interested in domestic activities connected with early pastoralists.

Complimenting earlier archaeological investigation of the monuments in the valley (Allard and Erdenebaatar 2005), the Khanuy Valley Archaeology Project (Figure 13; Houle 2010) is located in one of the most impressive monumental landscapes in all of Mongolia. Two of the largest known *khirigsuurs* in Mongolia, including *Urt Bulagyn* (Figure 11), and *Jargalantyn Am*, the largest Deer Stone site (Figure 12), are located in the Khanuy River valley within the project boundaries of the Khanuy Valley Archaeology Project. Over the course of two field seasons, approximately 40 km^2, divided into two 'zones,' were systematically surveyed (Houle 2010). Surface survey was conducted over the entire project area, though sub-surface shovel probes were necessary to identify most habitation areas. A number of Bronze Age and Iron Age habitation areas were identified, most commonly directly associated with modern habitation areas suggesting that ethnographic analogy may be an important tool for investigating settlement patterns in the region.

Settlement research has become more common and there are now several ongoing projects whose aims include investigating habitation sites in Mongolia. A number of graduate students interested in these issues are currently conducting their field research in several areas of Mongolia (William Gardner personal communication; Bryce Lowry personal communication) in addition to the researchers mentioned above who continue to delve into this topic in new regions of the country. The geographic spread and continued interest in settlement archaeology is critical in order to provide valuable comparisons of settlement systems between regions.

Figure 13: Recent settlement archaeology projects in Mongolia



3.3 MINUSINSK BASIN

The Minusinsk Basin is a region of Southern Siberia along the Yenisei and Chulym Rivers (Figure 2). The first cultural chronologies were created by cross-correlating material culture with other regions, though more recently, C-14 dating has revised much of these earlier chronologies (Svyatko et al. 2009).

The earliest Eneolithic culture dating to approximately the 3rd millennium BCE was known as the Afanasievo, who many believe have some relation to the Yamnaya groups farther west in the Volga-Ural region (Figure 4; Anthony 2007:307-11; Koryakova and Epimakhov 2007:53; Posrednikov 1992). Although Frachetti (2012) has recently argued that the Afanasievo development may be connected with early pastoralist populations that diffused along the Inner Asian Mountain Corridor from Central Asia north and east along the edges of various mountain ranges. These groups practiced a specialized sheep/goat pastoralism, utilizing both the open steppe and mountain pastures in a form of vertical transhumance (2012:16).

The Afanesievo development was followed by the Okunevo culture at the end of the 3rd or beginning of the 2nd millennium BCE. The Okunevo culture may have persisted until the beginning of the Karasuk culture in some areas, but in others it was replaced by the Andronovo culture and the two may have co-existed in different regions (Svyatko et al. 2009:260). The Andronovo (a Fedorovo variant) culture was spread over a large area including western Siberia, Central Asia, Southern Siberia, and parts of Kazakhstan and China. The Karasuk culture (14th Century BCE) emerged in part of this region following the earlier Andronovo culture (17th century BCE) (Legrand 2006). While there is evidence of some continuity between these archaeological cultures, the Karasuk is associated with a rise in mobile pastoralism, demographic growth, and investment in tomb constructions (Legrand 2006:858). The Karasuk culture was then succeeded by the Early Iron Age Tagar culture (9 - 8th century BCE), with similarities to other so-called "Scytho-Siberian" cultures (Bokovenko 2006). Of particular importance is the site of Arzhan I – a large elite burial complex located in Tuva (ca. 9th century BCE) that has produced some of the earliest evidence of mounted warfare, large elaborate burial rituals, and the Eurasian 'animal-style' form of art (Bokovenko 1995, 2006; Hanks 2010:477).

3.4 LAKE BAIKAL AREA

The Lake Baikal region is located directly north of Mongolia (Figure 14) and many of Mongolia's largest river systems (i.e. the Selenge River and its tributaries) flow into Lake Baikal. Groups of hunter-gatherer-fishers have been documented in the area dating from the Late Mesolithic (ca. 6850 – 6050 BCE) to the Bronze Age (ca. 3250 – 1450 cal. BCE; Weber et al. 2010: 32). Much of the archaeological work in the region has been done in the Cis-Baikal, located in Southern Siberia along the western shore of Lake Baikal. The Baikal-Hokkaido Archaeology Project (BHAP) has undertaken substantial international research in the region and has combined multi-disciplinary studies in archaeology, physical anthropology, ethnography, molecular biology, geophysics, geochemistry and paleoenvironmental reconstruction (Weber et al. 2010). This important research program has indicated that the Baikal Lake region was home to at least two culturally, biologically and temporally distinct groups of prehistoric hunter-gatherers known as the Kitoi and Serevo (Mooder et al. 2003, 2005; Weber 1995). Environmentally, the region is quite rich in the number of different resources available. Open pastures, forests, rivers and Lake Baikal provide a number of spatially proximate ecosystems (i.e.

taiga-forest steppe ecotone). Lacustrine resources include many species of fish (such as *Perca fluviatilis*, *Esox Lucius*, *Thymallus sp.*, *Coregonus* a. m., *Coregonus* l. b. – for a more complete list see Weber et al. 2011:528) and the Baikal seal (*Phocasibirica*) (McKenzie 2006).Terrestrial resources include both large and small game and a variety of plant resources including roots, berries, grasses and mushrooms. As a large body of water (the largest freshwater lake in the world in terms of volume), Lake Baikal subdues the more extreme temperatures experienced in much of Siberia by as much as 7-10˚C (McKenzie 2006).

Figure 14: Key Baikal Area Project sites and nearby Mongolian archaeology projects

Early investigations undertaken by archaeologists in the 1800's suggested that there were 4 distinct cultures – the chronological order from oldest to most recent (based on similarities and the use of metal) was interpreted as: Isakovo, Serovo, Kitoi and Glazkovo. Okladnikov saw this as a progression from a simple egalitarian, matrilineal way of life supported by hunting to a more complex, patrilineal lifestyle based on fishing (McKenzie 2006; Okladnikov 1950, 1955). The introduction and application of radiocarbon dating in the 1970's showed that this evolutionary scheme had serious faults. New dating research by Mamonova and Sulerzhitskii (1986, 1989) indicated that the Kitoi culture, as some had begun to suspect (Gerasimov 1955), was the oldest in the sequence and the entire sequence was much older than Okladnikov had suggested (Figure 4). Using the dates from Mamonova and Sulerzhitskii (1986, 1989), and later from his own work, Weber (1995, but see also Weber et al. 2010) suggested that not only was the Kitoi culture first, but a hiatus of cemetery use, and possibly of occupation, lasting about 700 years during the 5th millennium BCE, separated the Kitoi from the Serevo. Furthermore, many archaeologists have ceased to differentiate Isakovo from Glazkovo due to many similarities and overlaps in radiocarbon dating (Weber 1995). This finding was further supported by biocultural and genetic analysis that suggested that the Kitoi and Serevo were biologically distinct populations (Mooder et al. 2003; Weber 1995; Weber et al. 2010).

While a number of cemeteries in the Cis-Baikal region have been investigated, including the well documented Lokomotiv cemetery (Figure 14), settlement data are scarce (McKenzie 2006; Weber 1995). Not only are the settlements of mobile hunter-gatherers difficult to locate, but once found, the domestic sites in this region have proven difficult to match to a corresponding burial tradition or phase. It appears that the artifacts used in burials are usually quite distinct (such as ceramic type and decoration, and the occurrence of some types of luxury goods) from those found in domestic contexts (McKenzie 2006; Weber 1995; Weber et al. 2010).

These hunter-gatherer-fisher groups were joined, and eventually nearly pushed out of the region, by pastoralist groups who first came to the region from southern Trans-Baikal and northern Mongolia about 3,000 years ago (Kharinskii 2001; Nomokonova et al. 2010; Pletneva 1982; Tsybiktarov 1999). Slab graves, and later a growing Xiongnu confederation, are evident in and around the region showing some form of contact or connection with the developments taking place farther south in Mongolia. The presence of mobile pastoralist groups in the region at this time is marked by a mortuary tradition known as *Elga*, present in Cis-Baikal from 300 BCE to CE 500/800 (Kharinskii 2005). Around 600 CE, as the Turkic Khanate formed farther south, another migration brought the Kurykane culture group into the Cis-Baikal region. These populations were pastoral nomads who are known to have worked with iron and practiced small-scale agriculture (Svinin 1976).

3.5 CENTRAL RESEARCH THEMES OF THIS PROJECT

The new archaeological agendas being employed within Mongolia and adjacent regions, as outlined above, have substantially challenged long held-beliefs about northern Eurasia and its prehistoric inhabitants. Northern Eurasia was not a peripheral "no-man's land" with nothing of consequence (Stein 1925:378), nor was it merely the backdrop to fierce, barbarian warriors who pillaged and terrorized nearby settled, civilized states in order to survive (as noted by Hanks 2010:470). While recent archaeological research programs have produced many different interpretations and research directions, it is important to note those that have substantially shaped the direction of this dissertation. These key research trends and projects include:

1. A stronger focus on local developments instead of continent wide trends (Drennan et al. 2011; Frachetti 2012; Honeychurch 2013).
2. The acknowledgement of internal political developments within nomadic societies that is important for anthropological comparative study (Hanks and Linduff 2009; Honeychurch 2004, 2013; Houle 2009; 2010; Rogers 2012).

3. The interplay between landscapes, both natural and built (Allard and Erdenebaatar 2005; Frachetti 2008; Fitzhugh 2009a, Frohlich et al. 2008; Wright 2007) and human-animal relationships (Hanks 2003; S. Olsen 2003).
4. The development of effective archaeological and ethnographic methods for investigating campsites and zones of reoccurring occupation as produced by early mobile pastoralists (Cribb 1991; Honeychurch et al. 2007; Houle 2010).

3.5.1 Scale

As archaeologists trained in these newly integrated archaeological traditions began to assemble and analyze datasets from around the region in the early Post-Soviet period, the focus of some researchers has shifted away from large, continent wide trends (e.g. Scythians and the reliance of nomads on states). Though sweeping large-scale approaches do still exist, a focus on more detailed and varied datasets emerging from many different areas in Eurasia allow for the investigation and comparison of the expression of these larger patterns at the local level (Drennan et al. 2011; Honeychurch 2013:314). Additionally, of key importance to the development of this dissertation's research program was a visit to Kazakhstan where I was able to participate on a project directed by Claudia Chang. This first-hand experience illustrated the important types of variation between different locals present in Eurasia, despite the tendency to homogenize the "steppe" into one great grassland belt stretching across Eurasia. Similarly, a greater number of young scholars, both local and western, working on dissertation projects in the region has dramatically increased the networking potential and available comparative cases of the region.

In northern Mongolia, part of the focus on local developments meant moving away from a Sino-centric view of inter-regional interaction, which has long been a dominant research interest in the region. In dependency hypothesis models, as discussed below (Section 3.5.2), nomads depended on interaction with settled, civilized neighbors. Written records and Chinese goods in Xiongnu sites in Mongolia attest to the prevalence of this interaction (Honeychurch 2013:311). While these relationships were undoubtedly important, they were not the only important inter-regional interactions. As noted above, hunter-gatherer groups are known from the Lake Baikal region and it is likely that these populations had some level of direct or indirect contact and interaction with the inhabitants of northern Mongolia. Some researchers have inferred such interactions due to the geographical proximity of the two regions as well as broader similarities of material culture and raw material sources (Fitzhugh 2001, 2009a; Hall et al. 1999b:133; Legrand 2006; Weber et al. 2010).

3.5.2 Internal Socio-Political Developments

Traditionally, it was thought that pastoral nomadic groups needed their settled, agricultural neighbors for the goods that they could not produce themselves (Barfield 1989; Irons 1979; Johnson 1969:3, 12; Khazanov 1978, 1984, 2003; Kradin 2002; Lattimore 1988; Peterson et al. 2006). In this model, which is often referred to as the 'dependency hypothesis', pastoral nomads gained not just agricultural products through trade or pillage, but also adopted other developments such as complex political formations and metalworking technology. However, a recent wave of research, as well as a conference and resulting conference volume (Peterson et al. 2006) has shown that internal socio-political developments are not necessarily prohibited by mobility or economic strategy (Hanks and Linduff 2009; Honeychurch 2013; Houle 2010).

These researchers have broken down the traditional 'steppe and sown' dichotomy that was historically pervasive in the way that nomadic societies were conceptualized (Peake and Fleure 1928). While the importance of inter-regional interaction is well recognized (Honeychurch 2013:311), important socio-political developments that occurred internally, often far from the direct impact of states such as China (Houle 2010), are now understood as being just as important for having stimulated social, economic and political change. While the complexity of pastoralist political entities such as the Xiongnu, Turk, and Mongol Empires has been widely recognized (Brosseder and Miller 2011; Rogers 2012), it is also important to recognize the earlier socio-political transformations that changed socio-political relations in the region well before the emergence of these later political forms (Houle 2010; Honeychurch 2013:313).

In place of the 'steppe and sown' dichotomy, a new and more nuanced view of inter-regional relationships has been acknowledged. Such relationships may have existed between pastoralists and their neighbors, be they agriculturalists, other pastoralists, hunter-gatherers, or populations with mixed economies. Researchers have focused on the local scale to determine the strategies of communities and households within micro-regions rather than focusing on simple dichotomies (*either* steppe *or* sown) and continent wide trends. A survey of these case studies from across Eurasia would reveal a great deal of variation in the forms that inter-regional relationships take (e.g. Frachetti 2008; Hammer 2014; Honeychurch 2004; Houle 2010). The variation uncovered by these projects goes well beyond the scope of inter-regional relationships to include such things as economic strategy, mobility patterns, ritual practices, social networks, and political organization.

Part of this substantial shift in research focus is due to improved methodologies for investigating mobile pastoralist campsites. Ethnographic and ethnoarchaeological investigations were once used to create direct analogies characterizing mobile pastoralists since archaeological examples of mobile pastoralist campsites were too time consuming and difficult to locate. Consequently, interpretations of earlier mobile pastoralist life were based only on modern examples and the easily visible ritual and burial sites rather than on direct evidence of occupation areas where prehistoric populations actually lived. However, the pioneering work of scholars like Roger Cribb (1991) emphasized the importance of investigating mobile pastoralist campsites through ethnoarchaeology not as blueprints of past life ways, but as a way of developing middle-range theoretical tools that could be used to locate and interpret archaeological remains (Cribb 1991:2,5). With this new foundation and body of middle-range theory, as well as improvements in technology and statistical application, even relatively thin artifact scatters can be used to learn a great deal about the activities of earlier mobile pastoralist groups.

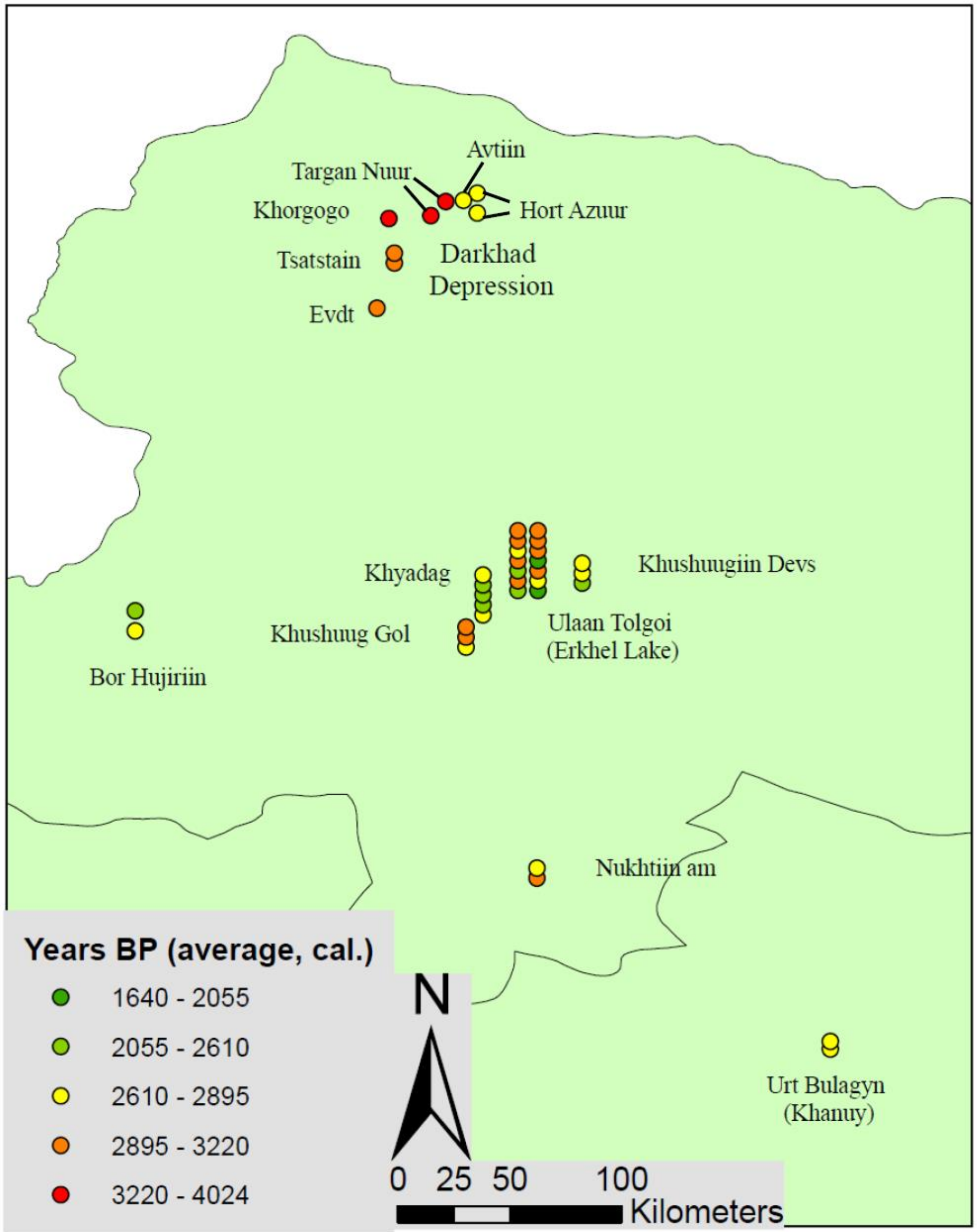
3.5.3 Approaching Landscapes, Environment, and Animals

Wide-open spaces and vast territories have been used to characterize northern Eurasia. It is no surprise then that elegant ways of dealing with concepts of space and environment are essential elements of productive archaeological study for this region. The interplay between landscape, human inhabitants, and resources is a key component to understanding the region. Though the modern Mongolian landscape is often romantically touted as a remote and untouched expanse of mountains, steppe and desert, the herders and their stock have had a great impact upon the landscape historically. Grass is uniformly cropped short by the many grazing animals. Erosional cuts caused by the hooves of many different animals bisect river crossings and hillsides. Herders cut wood for construction projects, fires, and to expand the coverage of pastures. While there are very few permanent structures of any significance, the landscape has, in many ways, been substantially modified. Perhaps the most significant change in the relationship between humans and their environment was the introduction of pastoralism. The types of changes in land-use practices, mobility patterns, social networks and an ideology of ownership over animals (Ingold 1980) could have drastically altered the relationships of humans and their surrounding landscapes (Frachetti 2008:2) as well as their relationship to animals in general (Hanks 2003; S. Olsen 2003).

While the focus of the research of this dissertation is primarily on the settlements and domestic contexts of early herders, a great deal of work has been undertaken on the monumental sites of the region by other scholars (Allard and Erdenebaatar 2005; Fitzhugh 2009a; Frohlich et al. 2008; Wright 2007). These studies have had a great impact upon current research efforts and interpretations of social and political change among late prehistoric pastoralist communities. Many interpretations have been posited for the importance of the construction and use of ritual monuments as cohesive forces in the communities that used them and as indicators for the emergence of the wealth and power of elites (Allard and Erdenebaatar 2005; Fitzhugh 2009a; Frohlich et al. 2008; Houle 2009; Wright 2007).

The distribution of these monuments over time has provided important clues about the possible diffusion of institutionalized ritual practices. Through a robust research program focused on radiocarbon dating, Fitzhugh (2009a: 402) has suggested that the earliest dated Deer Stones in Mongolia are found in the northern region, which includes the Darkhad Depression (Figure 15). Though Figure 15 is a rough representation of the dates of Bronze Age monuments, and more work needs to be done to contextualize these dates (such as considering the type of feature and material dated and overall length of date range), the trend is highly suggestive. Therefore, if new forms of monumental expression are tied with changing socio-political relations, as many scholars believe, then perhaps northern Mongolia is an important region for documenting early shifts in socio-political relations within and between populations. Pushing this one step farther, if such socio-political relations are tied to changing economic practices, then this region has great potential to explore the relationship between hunting and gathering and the introduction and adoption of pastoralism. Until more robust data on settlement patterns are achieved, monument and cemetery data remain the primary lenses through which social, economic and political practices are viewed for the Bronze and Iron Age phases.

Figure 15: Older Bronze Age Monuments trending north using Mongolian-American Deer Stone Project and TNAP C-14 Dates



*Vertically 'stacked' dates are from the same site

3.5.4 Developing a Methodology for Investigating Pastoralist Domestic Activity Sites

As mentioned above, one of the reasons that the domestic contexts of nomads were not studied much by Soviet archaeologists is that the ephemeral campsites of mobile pastoralists can be difficult to locate and the few artifact remains recovered from such sites difficult to interpret. For this reason, many scholars have avoided study of mobile pastoralist sites in favor of the more easily located and studied remains of monuments, cemeteries, and the more well established settlements that appear by the Xiongnu period and later Medieval Age.

In recent years, however, two research teams working in Mongolia (and a few others whose work is still in progress) have developed effective methods for investigating late prehistoric settlement during the Bronze and Early Iron Age. This research also has helped to shift the descriptive language from the term "nomad", which implies both a mobility strategy and an economic strategy, to one that utilizes Cribb's continuum model ( ), separating mobility and subsistence into two highly adaptable variables. Despite the difficulty, there is a lot of data to be gained by studying the campsites of nomads (Cribb 1991). *Everyone* leaves something behind, and so two projects in central Mongolia have worked to develop methodologies to best investigate these sites. The Khanuy Valley Archaeology Project (Houle 2010) and the Egiin Gol Survey Project (Honeychurch 2004; Honeychurch et al. 2007; Wright 2006) utilized a variety of methods of surface and subsurface survey in order to locate artifact scatters indicative of Bronze and Iron Age campsites. The methodology for the Targan Nuur Archaeology Project's survey strategy (Section 4.3 below) was devised through the work of these scholars and these methods are now being tested and adapted in a number of regions throughout Mongolia to locate similar sites (Bryce Lowry personal communication; William Gardner personal communication).

Mongolia has become a popular location for ethnographic research. As noted above, Soviet scholars did a fair amount of ethnographic research as a part of a larger research scheme (Vainshtein 1980). Interest in ethnographic studies of the region may be the result of a number of things. While most people in the world have become essentially sedentary, in a few select regions, populations maintain traditional mobility strategies. In Mongolia, herders continue to follow the seasonal mobility patterns that have been practiced for generations, and possibly centuries and even millennia. Therefore, similar to Soviet era approaches, modern ethnographies may be used as analogies for a way of life that is all but gone in other parts of the world. In particular, the region provides substantial research opportunities for anthropologists, ethnoarchaeologists, and ecologists interested in pastoral land-use patterns and human-animal relationships. Furthermore, ethnographic research provides an opportunity to examine how such groups are impacted by local and global forces connected with international market economies for livestock products (wool, leather, meat, etc.), demographic expansion, and climate shift (e.g. Fernandez-Gimenez 1999a, 1999b, 2006; Fijn 2011). Yet, great caution must be exercised in order to ensure that these analogies are not indiscriminately applied to the past, but rather inform the interpretation of archaeological materials and patterns in a meaningful way. Archaeologists today are using ethnographic data to inform and direct the archaeological fieldwork of campsites rather than as a substitute for this kind of work (Houle 2010:24-27; Honeychurch 2004:76-84; Wright 2006:92-99).

3.5.5 Incorporating These Themes

This dissertation project aims to approach, incorporate, and contribute to the important research themes and directions outlined above for the archaeology of Mongolia. It examines the natural and social landscapes (Section 6.0) at a time when the relationships of humans and animals are changing dramatically and explores the ways in which the patterns observed in the monumental landscape are connected to possible shifts in both economy and society as seen through settlement patterning data (Section 6.2). While the technical skills for programming such complex models are beyond the skills of this author (but see Crabtree and Clark 2013 for a collaborative agent-based modeling project), a simpler GIS approach to locating potential campsites through predictive modeling has been employed within the dissertation research (Section 4.2). Ethnographic data were utilized in forming the model used in predicting site location while ongoing ethnographic research conducted by the Targan Nuur Archaeology Project was used to modify the model, investigate the use of wild-resources, and assess risk-management strategies used by herders in northern Mongolia today (Section 4.5).

4.0 METHODOLOGY

Archaeologists, perhaps particularly researchers working in the Eurasian region, are familiar with the need to find ways to "get more from less." The archaeological record is inevitably incomplete; and as researchers we must find ways to interpret materials that inform our understanding of the past, without making assumptions that are too generalized. Eurasia is one area in which this issue is particularly pertinent because the prehistoric/early historic hunter gatherers and mobile pastoralists who have occupied the region rarely left thick deposits of trash or standing settlement architecture. Often, the most visible sign of early human activity is the presence of ritual and burial mounds and monoliths. This has encouraged an over-emphasis of archaeological study on burials and monuments as sources of material culture rather than occupation zones and other activity areas within the landscape.

Researchers studying complex societies in other regions of the world, where more demographically concentrated populations created sedentary settlements, might lament the difficulty of working with the paucity of material artifacts and dispersed nature of such assemblages. However, scholars accustomed to working with the material record left by hunter-gatherer populations would immediately recognize the utility of working with small dispersed material assemblages and understand the potential value of this form of data. A few studies, including the ones noted above, are beginning to develop effective methodologies that can identify habitation sites and other activity areas among mobile pastoralists in addition to monuments and cemeteries. Perhaps the clearest way to do this is to use as many lines of evidence as time and budgets will allow. These lines of evidence may be archaeological, for instance integrating ethnoarchaeology, survey, and excavation, but also may be interdisciplinary. These approaches incorporate data collected by biologists, foresters, climatologists, and other researchers in related disciplines. This chapter will describe in greater detail the approach taken by the Targan Nuur Archaeology Project (TNAP) in northern Mongolia's Darkhad Depression that was employed to maximize the amount of information gained from relatively scant material remains.

4.1 THE RESEARCH AREA

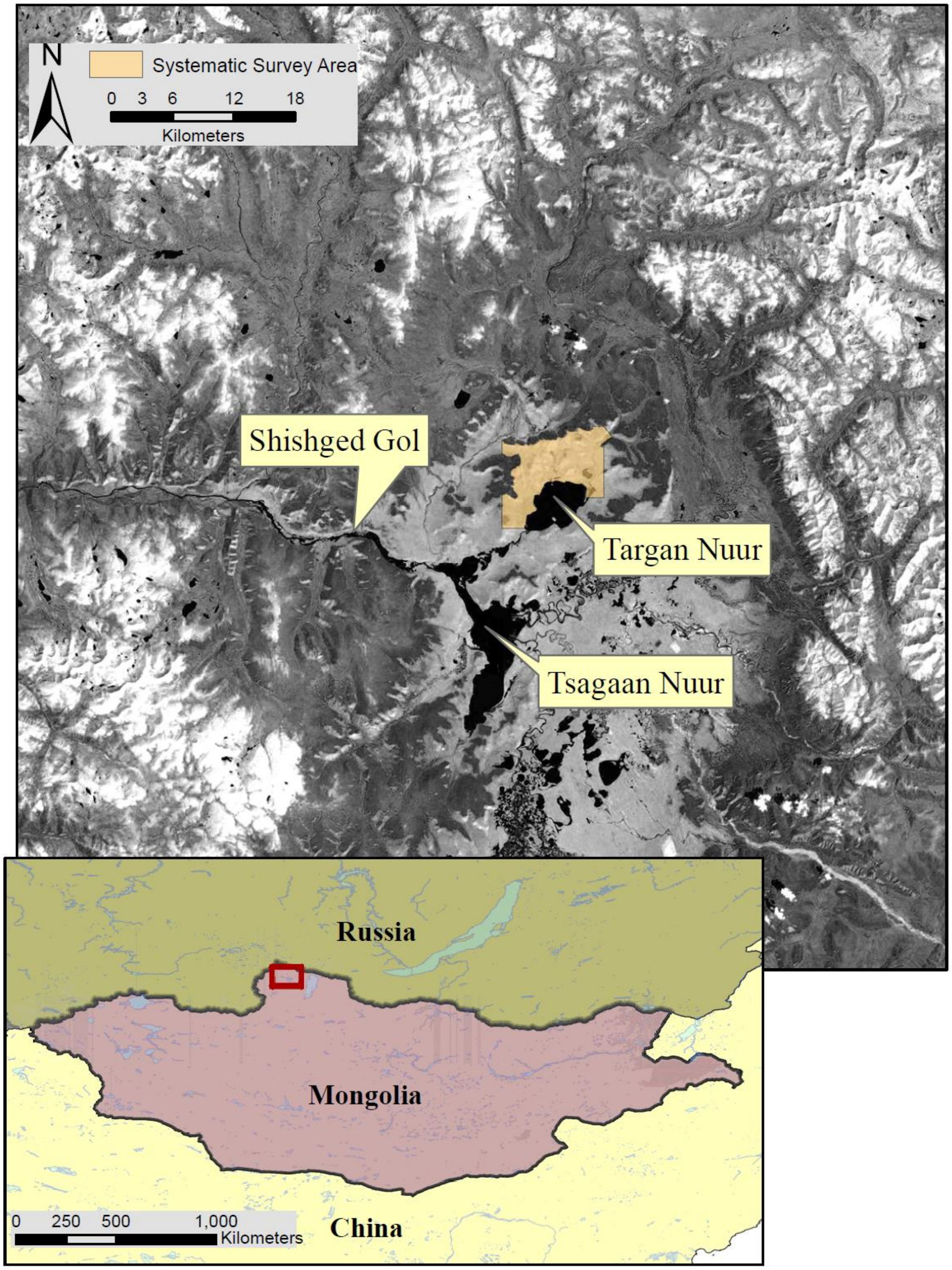
While shared ritual practice is indicated by the presence of prehistoric *khirigsuurs* and Deer Stones, Stones, it is presently unclear if the population of the northern Darkhad Depression were socially, politically socially, politically or economically integrated beyond their local area (

Figure 10). Not only are they geographically close, but also environmental and topographic conditions are more similar to conditions to the north in southern Siberia, such as the Lake Baikal region, Tuva, and the Minusinsk basin (Fitzhugh 2001, 2009a; Legrand 2006; Weber et al. 2010). These potentially important links between Siberia and central Mongolia have been underemphasized in much of the current literature for a variety of reasons, including a lack of habitation/settlement data (Fitzhugh 2009a:380), different burial practices, and an almost prevailing emphasis on southern connections between central Mongolia and China (Fitzhugh

2001:9, 12). Furthermore, while researchers in Siberia have excavated entire cemeteries (McKenzie 2006; Okladnikov 1955; Weber et al. 2010), Mongolia lacks comparable mortuary case studies, whether due to differences in burial practices or original objectives for the fieldwork. In the Darkhad Depression, interaction with the central Mongolian region, indicated primarily by similar stone monumental constructions in the Late Bronze Age appears to cease (based on present evidence) with the emergence of the Xiongnu by ca. 300 BCE. While the Xiongnu polities occupied many of the same areas that contain Late Bronze Age *khirigsuurs* and Deer Stones, the Darkhad Depression was not known to contain Xiongnu period sites prior to the author's dissertation research in that region (Brosseder and Miller 2011:24), though no full-coverage systematic survey had been completed. This made the Darkhad Depression a particularly interesting and important region to explore diachronic processes of local and non-local interaction and social, political and economic integration.

The Targan Nuur Archaeology Project focused on the northern shore of Targan Nuur (Targan Lake) on the north end of the Darkhad Depression (Figure 16). The area of systematic survey was selected during a pilot study conducted in the summer of 2011. The boundaries of the 40 km^2 study area were delimited based on topography, vegetation cover and the ritual landscape using satellite imagery and topographic maps. As the survey progressed, efficient survey crews and good ground visibility made it possible to expand the project area beyond the initially proposed sections for a total contiguous systematic survey area of 57 km^2. In addition, small, single day reconnaissance (i.e. non-systematic) surveys of several square kilometers were conducted in neighboring valleys to the north and east as well as on the southern shore of Targan Nuur in order to better contextualize the project area and examine the potential for future research in nearby regions.

Figure 16: Targan Nuur Archaeology Project boundaries



4.2 PREDICTIVE MODELING

It has been recognized by archaeologists working in the region that different scales of survey employed in tandem over the same areas have provided a useful way to explore large patterns of human activity while capturing the more limited patterns of the small campsites typical of mobile pastoralists (Honeychurch et al. 2007; Houle and Broderick 2011:141). In order to use these different scales, it is important to be able to effectively select areas where more finely focused investigation will occur. The Targan Nuur Archaeology Project used a simple predictive model to direct the attention of the survey to areas likely to contain evidence of habitation. While the entire project area was systematically covered with pedestrian survey transects spaced at 20-30 m (see section 4.3.1 below), the model highlighted areas where additional investigation would have a high probability of yielding materials related to prehistoric and historic settlement systems. Since very low-density artifact scatters most often characterize these domestic contexts, it is necessary to use more intensive methods to locate them. Over time, archaeologists working in a specific region start to understand which areas are more likely to contain sites and explore them more thoroughly, and so by creating a formalized model, the process by which these areas are selected is made more explicit.

Predictive models are often categorized as either *inductive* (also known as empirical) or *deductive* (also known as analogic). Inductive models rely upon previously gathered archaeological data to estimate the spatial distributions of sites in the landscape based on their relationship with natural or cultural features, while deductive models are developed using theories that explain human behavior and are often based on ethnographic observations (Bazargur 2005; Fernandez-Gimenez 2006; Kohler 1988:37; Winterhalder 2002; 205). The predictive model developed for this research project has both inductive and deductive elements.

It is inductive because it was created using the results of previous archaeological investigations (Houle 2010: Honeychurch 2004) from other regions of Mongolia. It is deductive because it also relies upon ethnographic observation, analogy and theories about how humans would have utilized the particular landscape being investigated.

Based on the ethnographic interviews done by the author, the most important factors thus far identified in determining campsite location in the Darkhad Depression are topography and natural resources such as wood or water. Winter habitation areas are easier to predict and model than summer habitations because they are influenced to a greater degree by topography (See list below). Ethnographically, summer campsites are located in relatively flat areas close to a water source (Bazargur 2005; Houle 2010: 43). Within the Targan Nuur Archaeology Project area, this would primarily be the flat area adjacent to the lake and along small drainages that empty into the lake. This assumption fits exceptionally well with the observed pattern in the region today based on ethnographic data collected during this project (Figure 18).

Using the inductively derived parts of the model, that is by referring to previous archaeological investigations in more central regions of Mongolia (Honeychurch 2004; Houle 2010; Wright 2006), the following characteristics are indicative of late prehistoric and early historic occupation areas:

1. Occupation areas can be recognized by artifact scatters primarily composed of ceramics, lithics, bones and rarely metals, which may be either on the ground surface or shallowly buried (i.e. within 50 cm of the surface).
2. The density of material remains range from isolated finds to artifact scatters that cover a few hundred square meters.
3. Artifact scatters may be located near, but never within, monument complexes. Almost no artifacts are found in the largest classes of monuments (biggest *Khirigsuurs*).
4. Occupation areas are found in relatively flat locations, with hillsides and hilltops never being utilized for settlement.

5. Settlements are located *either:* a) in the flat exposed plain near the river/water source *or* b) in the foothills in a protected area.
6. Occupation areas are often multicomponent chronologically and in many cases, modern campsites directly overlap prehistoric and historic sites.

Using the deductively derived parts of the model, that is ethnographic analogy and theories of human behavior, the following additional factors that characterize occupation areas can be added to the above list (see Section 4.5 and Table 5 below):

7. Campsites are occupied by a single *ail* (group of *gers* that is often comprised of extended families) and a distance of at least several hundred meters usually exists between different *ails.*
8. All campsites have *gers* (dwellings). Most campsites (and all winter campsites) also have sheds/animal shelters, corrals and manure piles. Some campsites have outhouses and middens (often burned).
9. Campsites cover a few hundred square meters, but their exact location may shift slightly from year to year.
10. Inhabitants move from 2-5 times per year covering distances anywhere from 3 – 100 km (average of 25 km) between moves. Camp sites are referred to specifically by their season of habitation (e.g. spring, summer, fall, winter) (See Table 5).
11. The winter campsite is used for the longest period of time (this varies but is usually several months).
12. Ideal winter locations have protection from the prevailing north and west winds, but open up to accessible, flat pastures to the south and east minimizing the need for weak animals to travel vertically.
13. It is important to have a nearby water source in summer, but less so in winter when melted snow and ice can be utilized nearly everywhere.
14. Preferred winter campsites have ample wood resources nearby.

Imagery grants from Geoeye and the USGS (Aster Imagery) allowed for the use of high resolution satellite imagery and a digital elevation model (DEM) to locate landscape cues (Figure 17; e.g. topography, location of natural resources such as wood and water) and current campsite locations (Figure 18) in order to locate areas with high likelihood of archaeological material related to occupation. Alternatively, these methods were also used to locate those areas that are less optimum for intensive investigation because of the degree of topographical slope or water inundation. These GIS layers were combined with on-site ground-truthing (2011 pilot study), ethnographic interviews, and extensive survey results from the 2012 project to create polygons where the intensive survey would be carried out. Handheld GPS units, printed satellite imagery, and maps were used to locate the real world equivalents of these polygons.

Figure 17: Aster DEM used to look for topographical cues indicating likely occupation areas

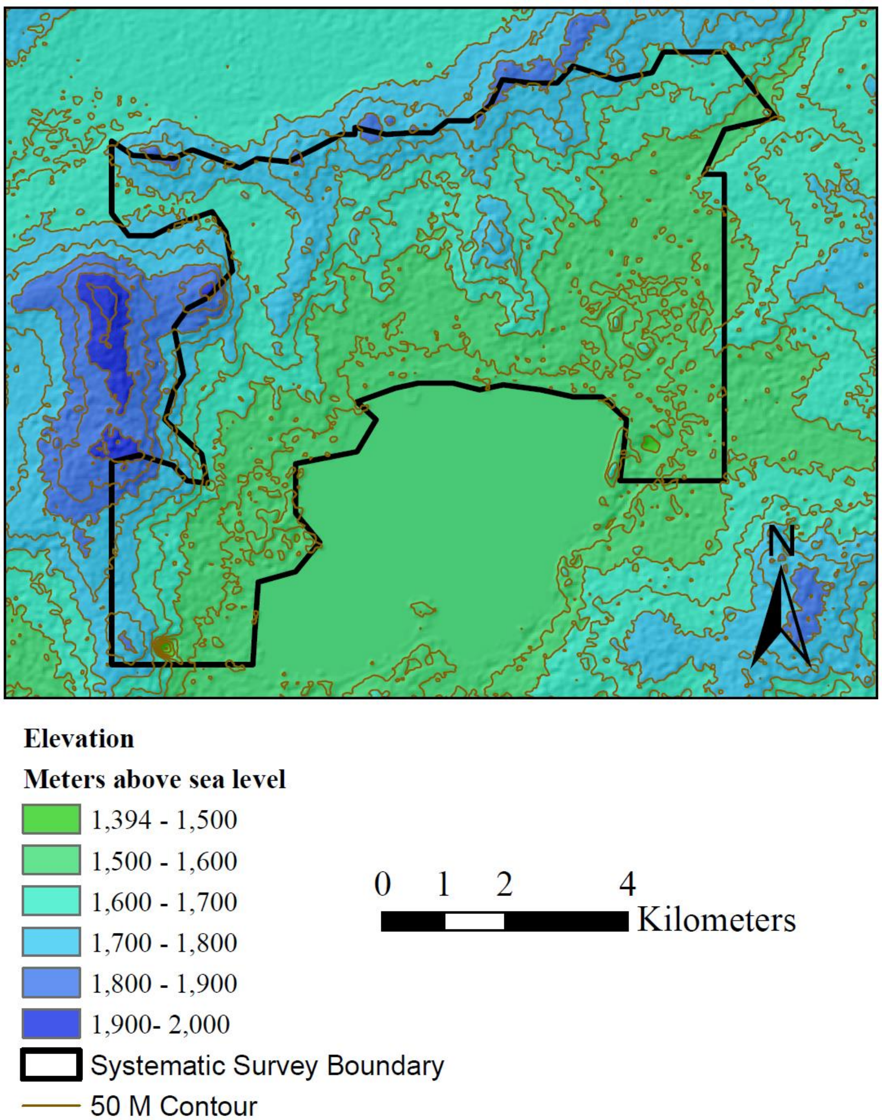
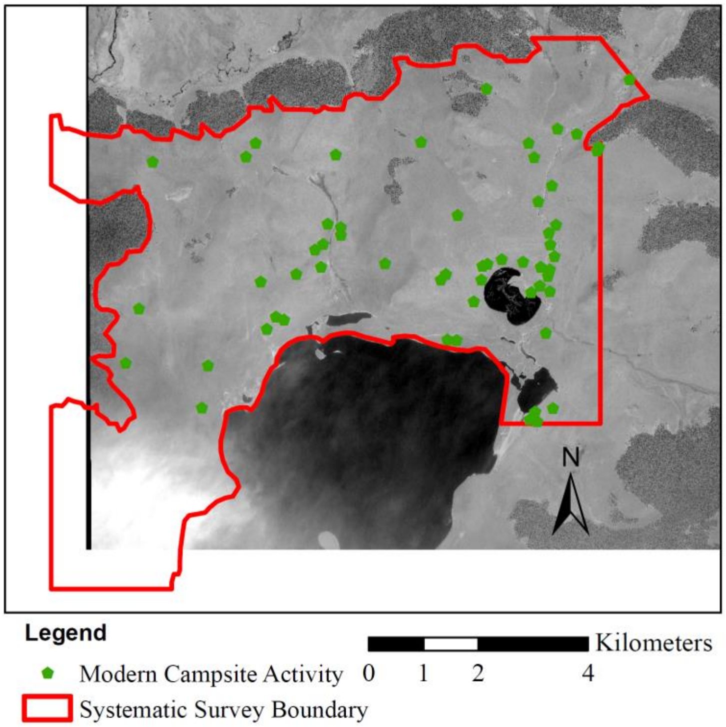
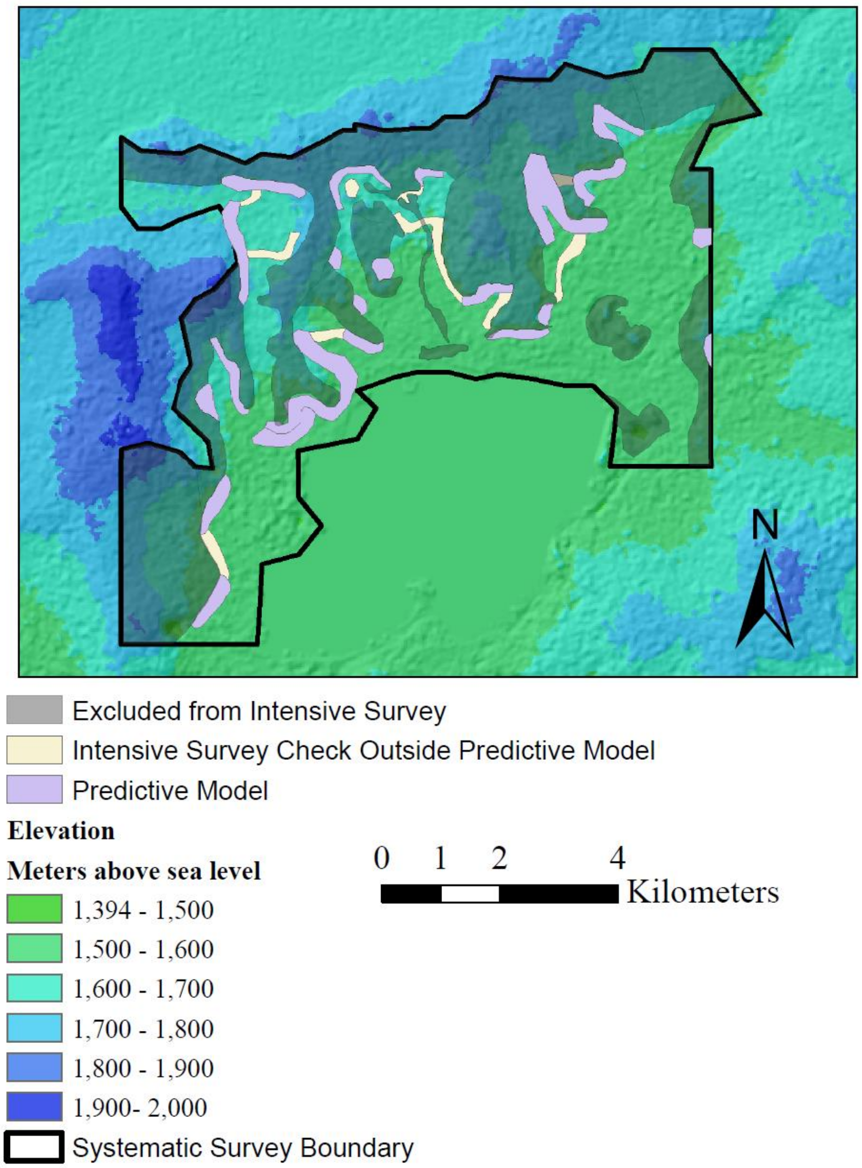


Figure 18: Location of modern day campsite activity visible in satellite imagery (Courtesy of Geoeye)



The predictive model utilized by the Targan Nuur Archaeology Project, thus, prioritized particular areas for investigation allowing more time and energy to be spent in areas likely to contain habitation. This also tested the sampling areas perceived to be less likely to contain habitation. In Figure 19 below, the predictive model area where intensive survey was conducted is indicated in purple as well as the area used to check the assumptions of the model (labeled as "Intensive Survey Check Outside Predictive Model"). Areas labeled "Excluded from Survey" were not eligible for intensive survey (i.e. shovel probes and arms-length pedestrian survey transects), though they were extensively surveyed (i.e. 20 m spaced transects for pedestrian survey) because of steep slopes or the presence of water (creeks and ponds). The "excluded" areas were effectively investigated in the same way that all other unmarked areas outside of the predictive model (i.e. only 20 m spaced transects). However, these polygons were largely based on slope, and so were useful guides in creating the predictive model since, as Figure 19 shows, the polygons indicating areas of interest for the predictive model are usually directly adjacent to these "excluded" polygons. Slopes were excluded because habitation is not likely to occur on a steep slope, and ponds were excluded for the same reason as well as the methodological impossibility of sampling these features, even if they did not exist during the late prehistoric and early historic periods.

Figure 19: Predictive model created and used by the Targan Nuur Archaeology Project



4.3 SURVEY

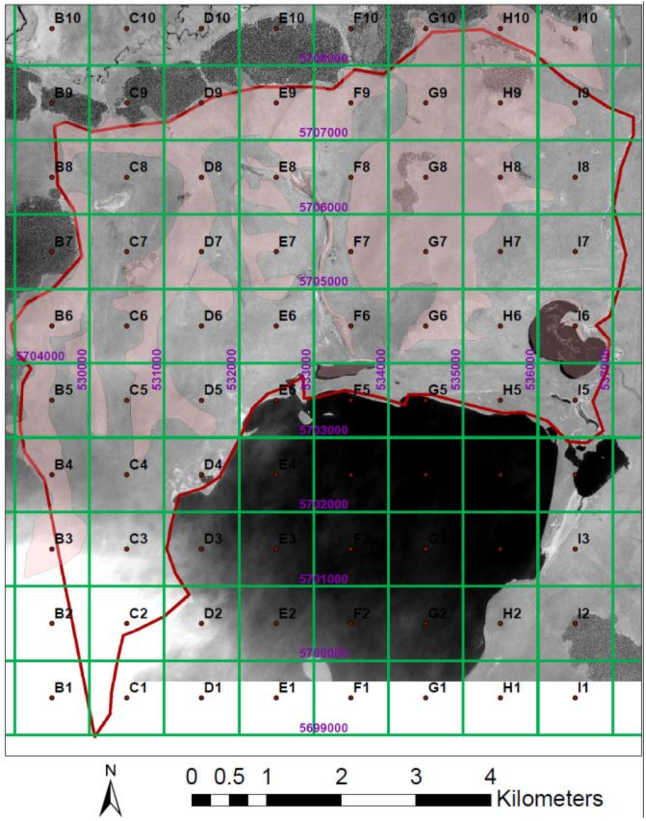
A systematic pedestrian survey was conducted over the entire 57 km^2 project area. A number of different survey strategies were used during the Targan Nuur Archaeology Project in order to locate both ritual and domestic archaeological remains. There are two main differences between the various methods employed. First, the different survey methodologies differed in scale, and so I have labeled these as "extensive" and "intensive" (defined above in Section 4.2). The second division is that between surface and subsurface survey methods.

4.3.1 Extensive Surface Survey

As mentioned above, the entire project area was systematically surveyed using 20-30 m transects. Teams of 4-6 individuals led by a project staff member used laminated maps (of the different survey teams.

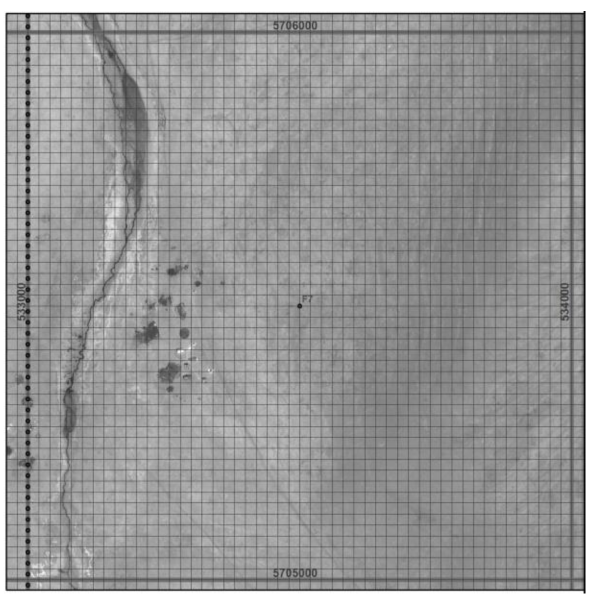
Figure 20, Figure 21), compasses, and a GPS to conduct this survey. The project area was broken into blocks labeled with an alpha-numeric code in order to ensure total coverage, organize survey efforts and prevent overlap of the different survey teams.

Figure 20: 1 km² blocks and alpha-numeric codes used during survey



Satellite imagery courtesy of GeoEye

Figure 21: 1km² maps used by field crew during survey with modern camp present



Satellite imagery courtesy of GeoEye

4.3.2 Intensive Sub-surface Survey

A pilot study conducted in the area during the summer of 2011 suggested that any domestic artifacts would likely be shallowly buried between 1 and 30 cm below the surface. The few artifacts found during this initial probe into the region were located in disturbed contexts (erosional cuts, road beds and rodent disturbances). Therefore, a sub-surface sampling strategy was proposed prior to the beginning of the 2012 field season as a part of the National Science Foundation's Doctoral Dissertation Improvement Grant proposal.

A similar project in the Tarvagatai Gol, situated approximately 300 km (close by Mongolian standards) to the south-east, had success in using 15 cm (6 inch) hand-driven bucket augers to locate subsurface scatters (William Gardner, personal communication), and so this method was pursued in the initial stages of my project. Initially, in those areas identified as potentially inhabitable by the predictive model (see above section 3.2), a 20 cm (8 inch) diameter auger probe was placed every 20 m in a grid pattern and augering was done until sterile soil was reached (1-30 cm below the surface). In order to test the viability of this method, a known site was tested first and this yielded poor results. Though sherds were found on the surface in a nearby erosional cut, none were unearthed using the augers. A second pass over the same area (shrinking the grid to 10 m spacing) similarly produced no material evidence of human activity except for some patches of darker colored soils. After an additional area was tested with this method and again was unsuccessful, the method was abandoned and no other areas were augered. In all, approximately 250 auger probes were dug, none of which contained any artifacts. These results suggest that the artifact scatters of the Targan Nuur region are much less concentrated than those of Tarvagtai Gol.

Once it was determined that auger probes were not effective in locating artifact scatters in this region of Mongolia, a shovel probing (Shott 1985) scheme was devised to replace it. This approach was modeled after the Khanuy Valley Archaeology Project's successful sub-surface methodology in which 50 cm x 50 cm shovel probes were dug until sterile soil was reached (1-30 cm) every 20 m in zones of potential habitation. This method did produce material evidence (e.g. sherds, burnt bone, lithic debris) in the very same locations that the augers had failed to detect any activity (potentially because of their larger overall volume and the thin cultural deposits), and so was adopted as the primary means of intensive survey. In order to direct field team members on where to dig, the survey leader planted pin-flags at each test-pit location. While planting flags and walking back and forth to check on team members, sherds and other artifact scatters were noticed on the surface. It soon became clear that more sites were being identified and identified more quickly by careful surface survey than by shovel probing. There are two likely reasons that the pilot study had failed to turn up much material during surface survey in 2011 while surface survey in 2012 was successful. First, localized drought conditions made surface visibility particularly excellent. Second, a much greater number of people, looking over a much longer period of time, and in a more systematic manner, led to the more productive recovery of scant artifact scatters. In either case, erosion and bioturbation had exposed sherds on the surface and removed them from their original context and so, in order to maximize efficiency, shovel probing was also abandoned as a primary survey methodology. Instead, it became a secondary strategy used to investigate the sub-surface nature of sites that had already been located on the surface through close-proximity, slow-paced pedestrian surface survey. This intensive pedestrian surface survey was then employed to initially identify sites (see below).

4.3.3 Intensive Surface Survey

Once initial augering and shovel probes proved to be less effective than a simple surface survey, a new surface survey was designed and employed. The extensive survey (20-30 m transects) had been successful in identifying some sites, but several others had been recognized only with closer inspection. Therefore, using the same predictive model (Figure 19) that was designed to be used with sub-surface probing techniques, the survey teams were sent back to these high-potential areas. In each area, the survey team walked slowly, an arm's length apart from one another looking for artifact scatters. Pin flags were placed where each artifact was found so that the extent of the scatter could be determined. After a few minutes of walking back and forth over an identified scatter, all artifacts were collected and the survey team was directed to the next area pinpointed by the predictive model. In order to 'test' the areas not highlighted within the model, survey crews would walk and continue to survey those areas between high-interest areas as a way of sampling regions not selected by the model. This method proved to be very quick and as a result, the project area was expanded from 40 km^2 to a larger, but still contiguous 57 km^2.

4.4 EXCAVATION AND FLOTATION

Targeted excavation was used as an even more intensive method of investigation following survey. Though the primary aims of the fieldwork were to investigate settlements, some ritual site excavation and investigation occurred in order to further contextualize the habitation related finds as well as to allow the National Museum of Mongolia personnel involved in the project to continue their ongoing research plans. This allowed for a more in-depth characterization of artifact scatters and the ritual sites that were selected for excavation.

4.4.1 Domestic Context Excavations

Once the systematic survey located an artifact scatter with either more than 1 type of vessel (i.e. not a single pot drop) or different kinds of lithics (i.e. not an expedient production site for a single tool), the area was considered eligible for potential excavation. In total, 4 such locations (labeled Excavation 1-4; Figure 23) were randomly selected for limited test-excavations, each of which had been previously tested with shovel probes. At each of the four locations (labeled Sites 1-4), 4 test units, each 2 m x 2 m, were excavated until sterile soil was reached. Initially, these units were excavated following the natural stratigraphic levels of the soil matrix. However, arbitrary 5 cm excavation levels were also used when the stratigraphy was unclear or if deposits were particularly thick and more resolution could be gained by dividing them further. Both random sampling and judgment based upon the results of shovel testing were used to determine the location of each excavation unit. Animal burrowing was common and also caused some confusion for excavators searching for distinct cultural layers and features because of the disturbance to the cultural and natural stratigraphy. A manual transit was used to map the locations of the excavations and level depths. Artifacts found *in situ* in these excavations were mapped within the units using measuring tapes from the edges of the excavation.

In each of the excavations, a number of soil samples were taken from each level of each unit. A large bulk sample of approximately 10 L was taken for flotation. Flotation was completed manually using buckets and geological screens (1 mm). Samples were dried and sorted on site. Additionally, a smaller sample of approximately 50 ml was taken from each excavation unit to be preserved for potential future analysis. No anthropogenic features, such as hearths or middens, were identified during excavation.

All excavations were photographed and drawn in plan-view before and after each level. After the completion of a level, the profiles were measured and drawn. As in other regions of Mongolia (Houle 2010), the excavations were shallow and the stratigraphy was mixed and not well differentiated. An example of the beginning and ending photographs and an example of a planview are provided in Figure 22. Photographs and plans have not been provided in this dissertation document for all the excavation units since there are very few differences between these units in terms of general appearance in photographs and plan-views. These photographs, plan-views, and profiles have been catalogued by the author and given to the National Museum of Mongolia for field reporting purposes.

Figure 22: Example of excavation photographs and plan-view

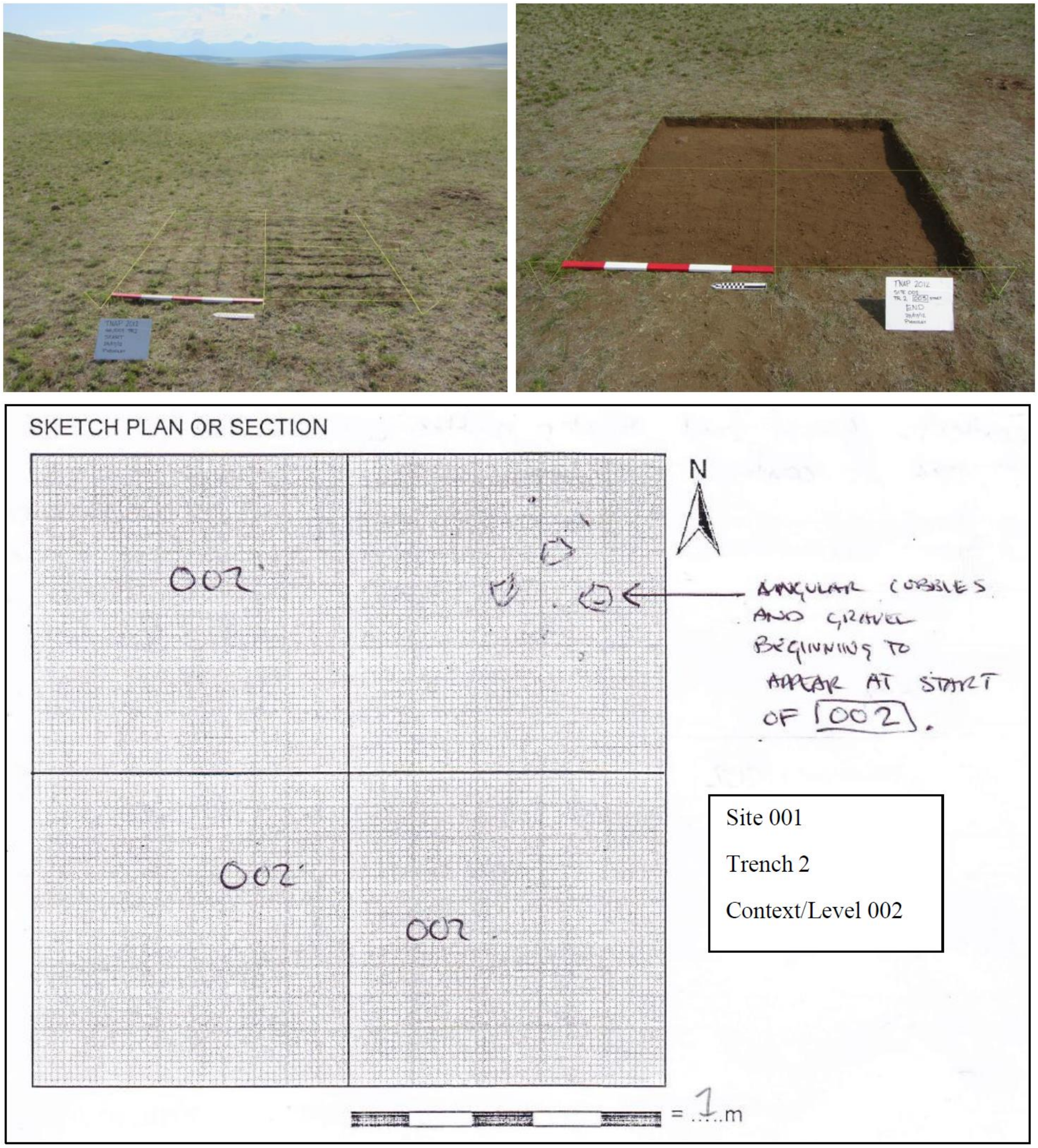
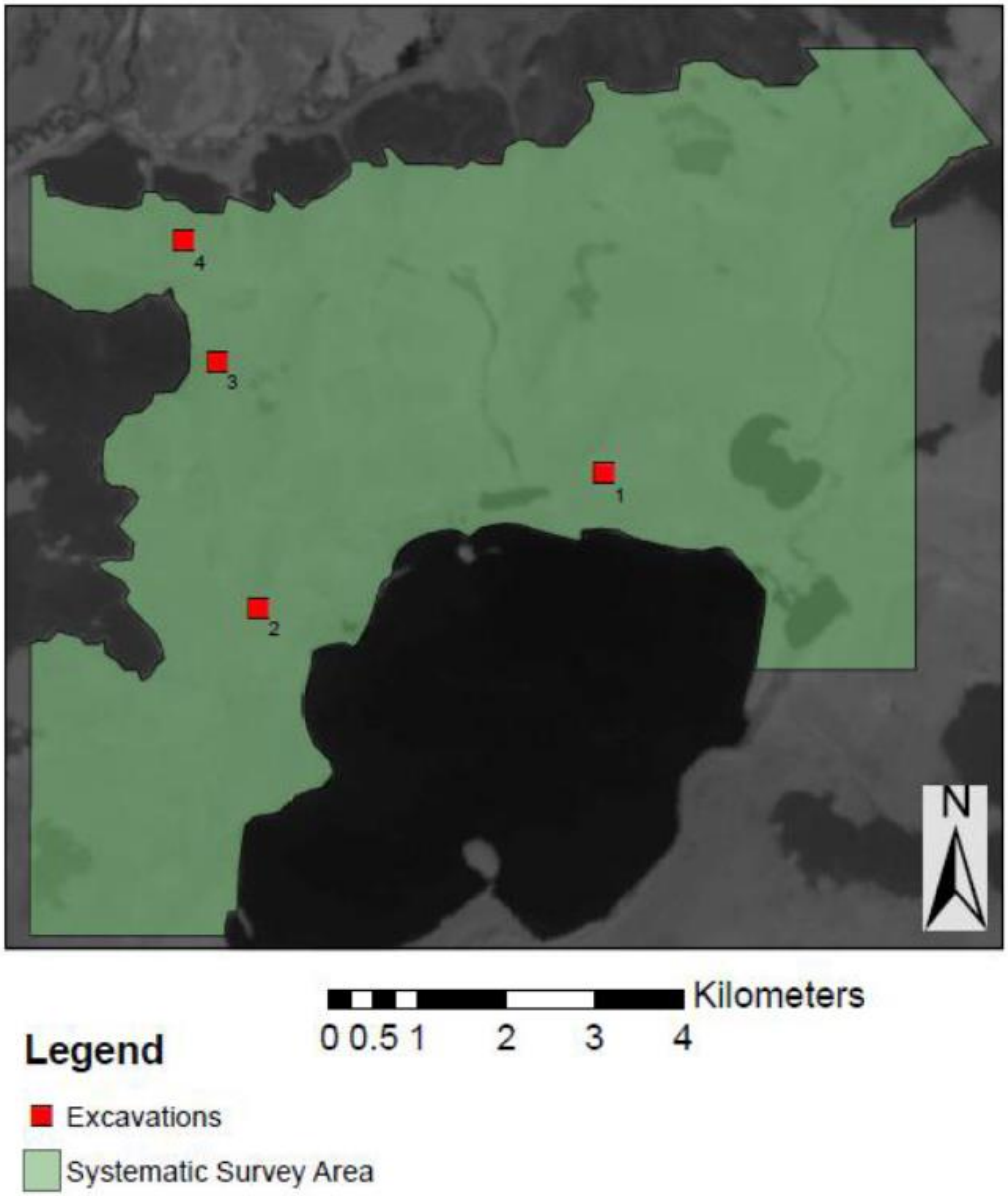
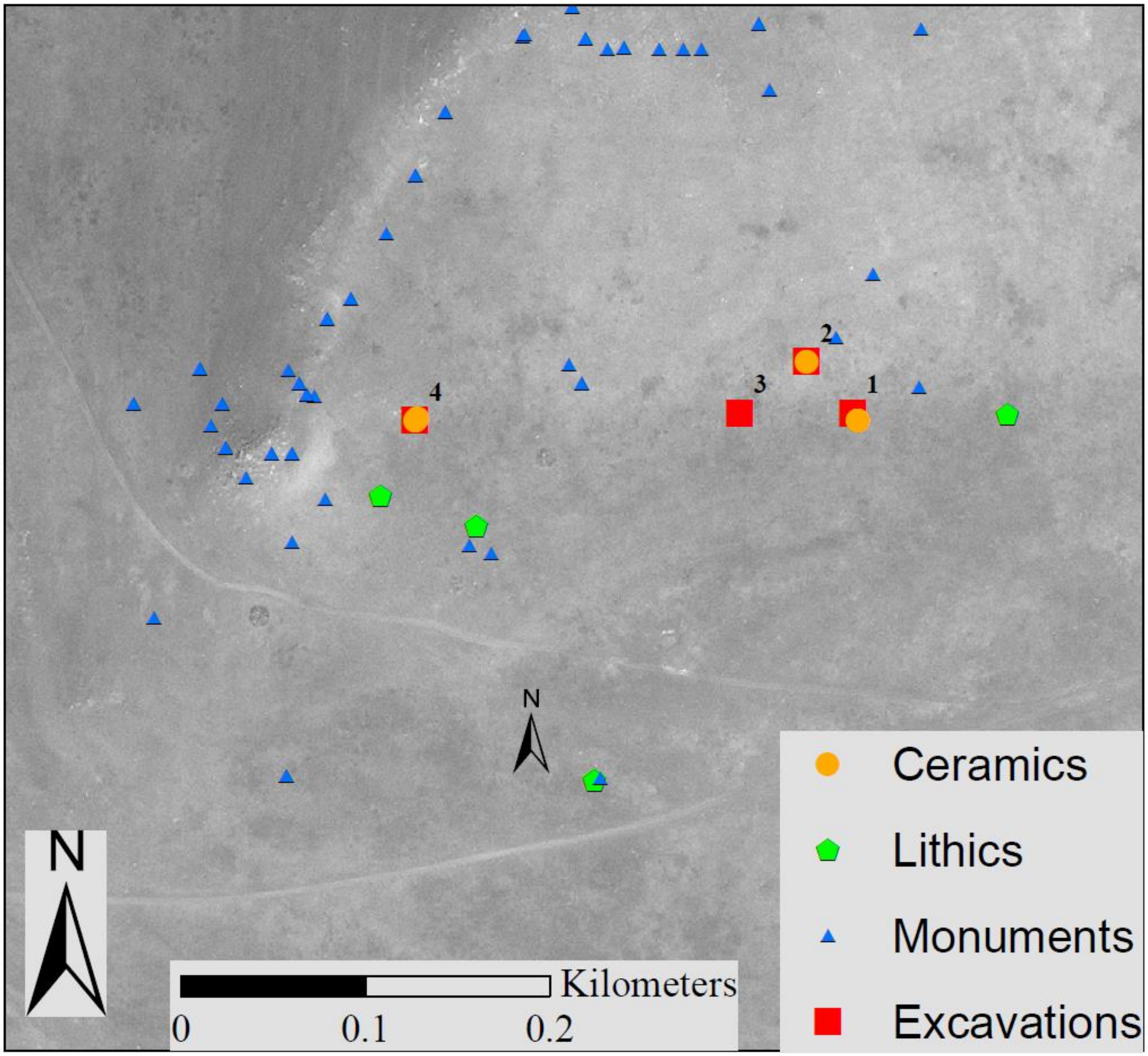


Figure 23: Location of excavation areas



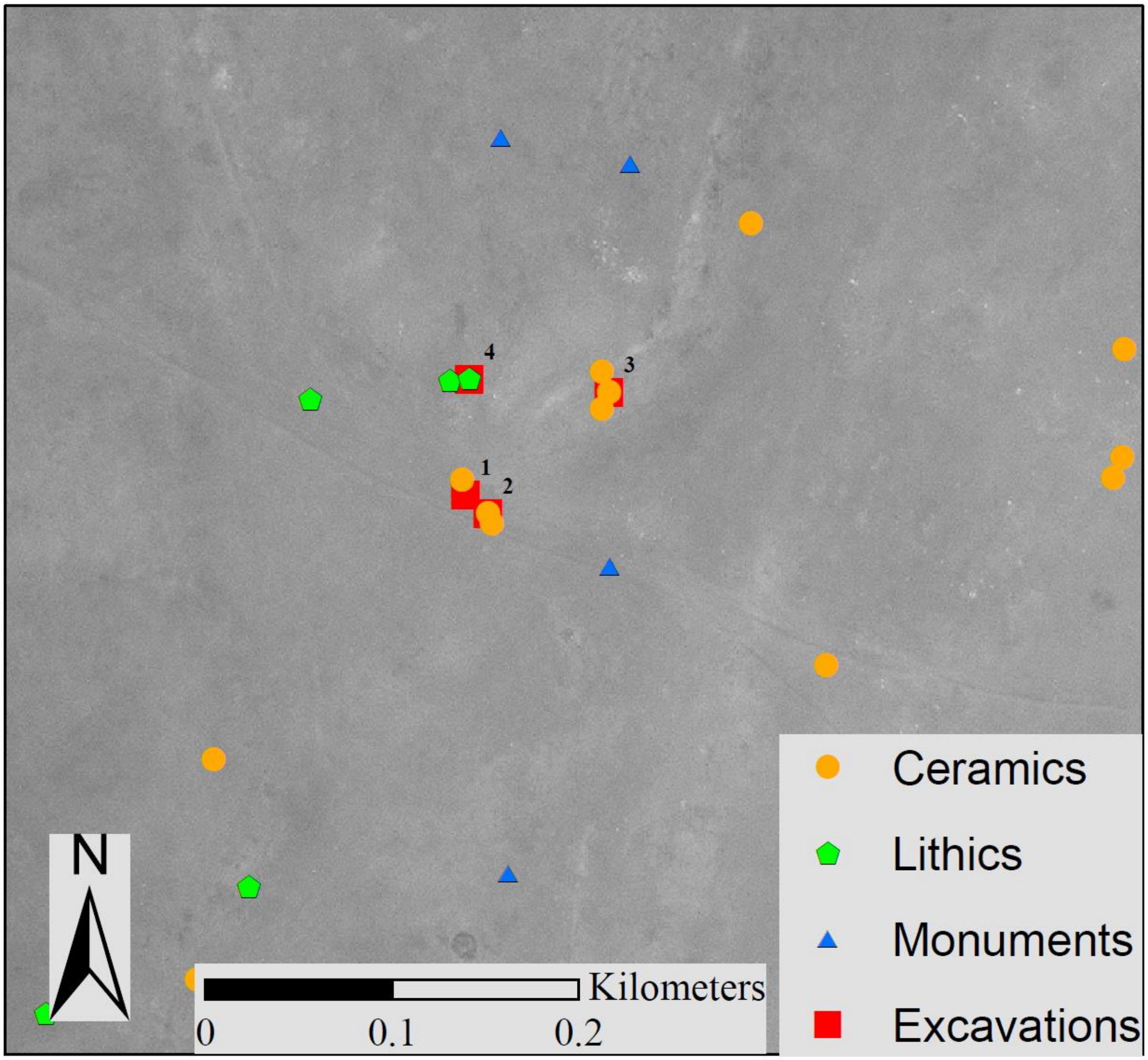
Excavation 1 is located on an east-west terrace at the base of a south-facing slope approximately 600 m from the northern edge of Targan Nuur near a cluster of prehistoric/ early historic stone monuments (n=68 within 500 m). *Khirigsuurs* are also located on the terrace while slope burials and some rock carvings (including one classic Mongolian style deer) appear on the slopes above. Excavation units varied from 30-50 cm in depth before reaching sterile soil. No clear cultural features were found. Artifacts included ceramic, bone (some of which was calcined), and charcoal fragments as well as a few pieces of lithic debitage.

Figure 24: Location of test trenches 1 through 4 in Excavation area 1



Excavation 2 is located approximately 850 m from the north-western shore of Targan Nuur. Like Excavation 1, it is located on a terrace at the base of south facing slope that contained stone monuments including both *khirigsuurs* and rock art (n=5 within 500 m). Once again, material remains included ceramics, bone, and charcoal fragments in addition to some lithic debitage.

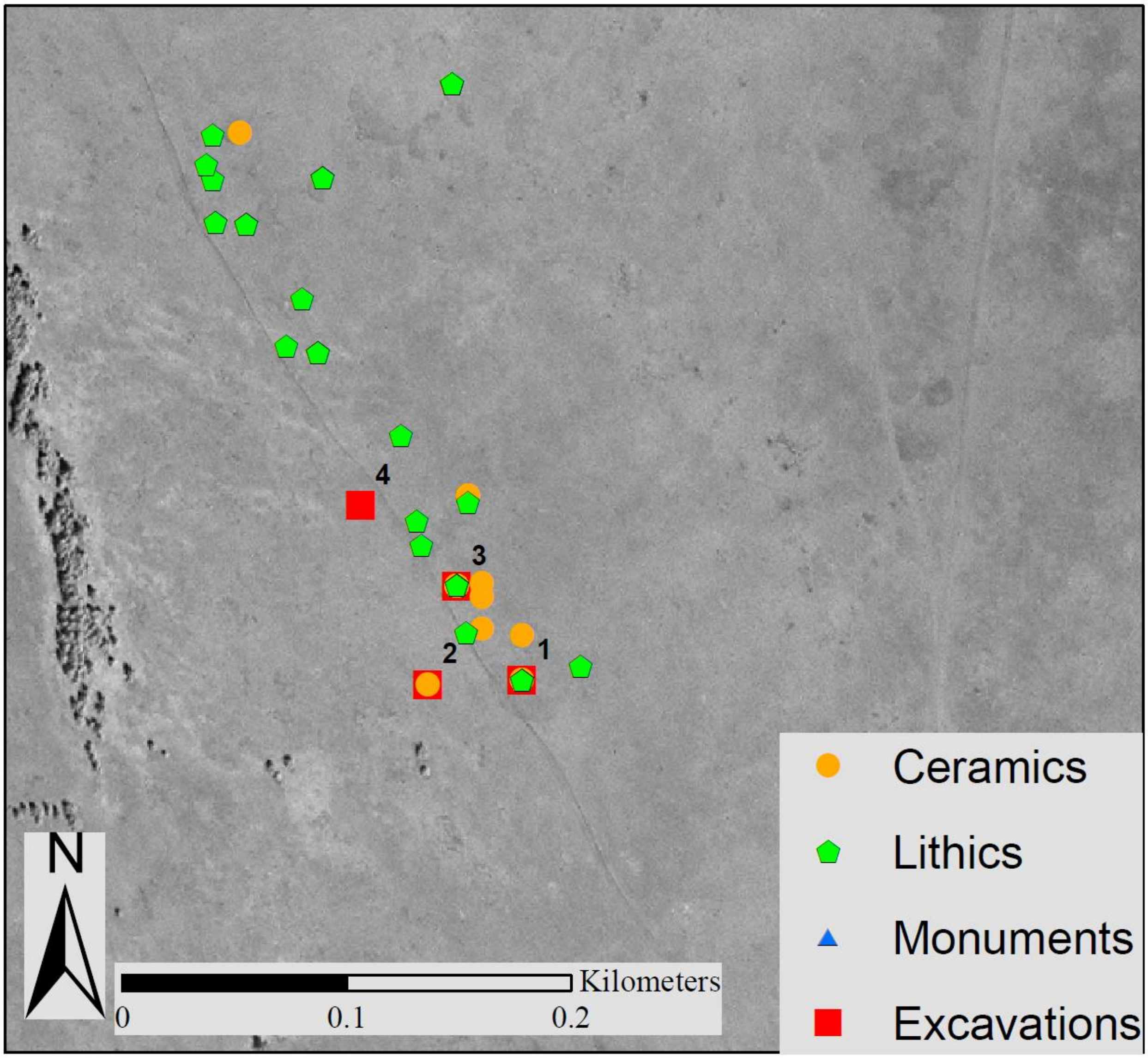
Figure 25: Location of test trenches 1 through 4 in Excavation area 2



In both of the above excavations (1 and 2), it was impossible to definitively say that these were campsites and not the result of other activities associated with the ritual monuments in the vicinity. Low artifact densities and a lack of cultural features did not allow for a more concrete interpretation (Table 4).

Excavation 3 was located in a very different kind of environment than the previous excavations. It was located on the south-west side of a high valley approximately 3.3 km from the shore of Targan Nuur. It was situated on a flat area about half-way up the east-facing slope just below the current tree-line. Unlike the previous excavations, it is not located in the vicinity of any kind of monumental complex (n=0 within 500m). It was identified in both the surface survey and through shovel probing and was noteworthy for the relative abundance of lithics, including microliths as well as ceramics. Excavation uncovered more lithics and ceramic material as well as faunal remains and a great deal of charcoal (Table 4). However, there was partially carbonized wood which would likely not survive long in nearly every context of every unit. It was clear that much of the burning was likely the result of a relatively recent forest fire that caused burning over the entire area and into the roots of the trees that had once stood there. Because of the potential for contamination, this site has no potential for dating through charcoal samples.

Figure 26: Location of test trenches 1 through 4 in Excavation area 3



Excavation 4 was located along the northern rim of the same high valley/basin as excavation 3 and was 4 km from the northern shore of Targan Nuur. A modern winter campsite along the base of a south facing hill currently occupied this space. There are prehistoric/early historic stone monuments in a flat area 300-400 m to the southeast of the excavations and artifact scatters (n=8 within 500 m), though none of these are clearly Late Bronze Age (i.e. *khirigsuurs* or slope burials) such as those recorded near the first 2 excavations. Artifact densities at this excavation were greater than those at excavations 1 and 2, and similar to that at excavation 3. Rodent activity as well as modern habitation activity did cause a great deal of bioturbation resulting in some mixing of stratigraphic layers. Ceramics, lithics, faunal remains and charcoal were all found in these excavations (Table 4).

Figure 27: Location of test trenches 1 through 4 in Excavation area 4

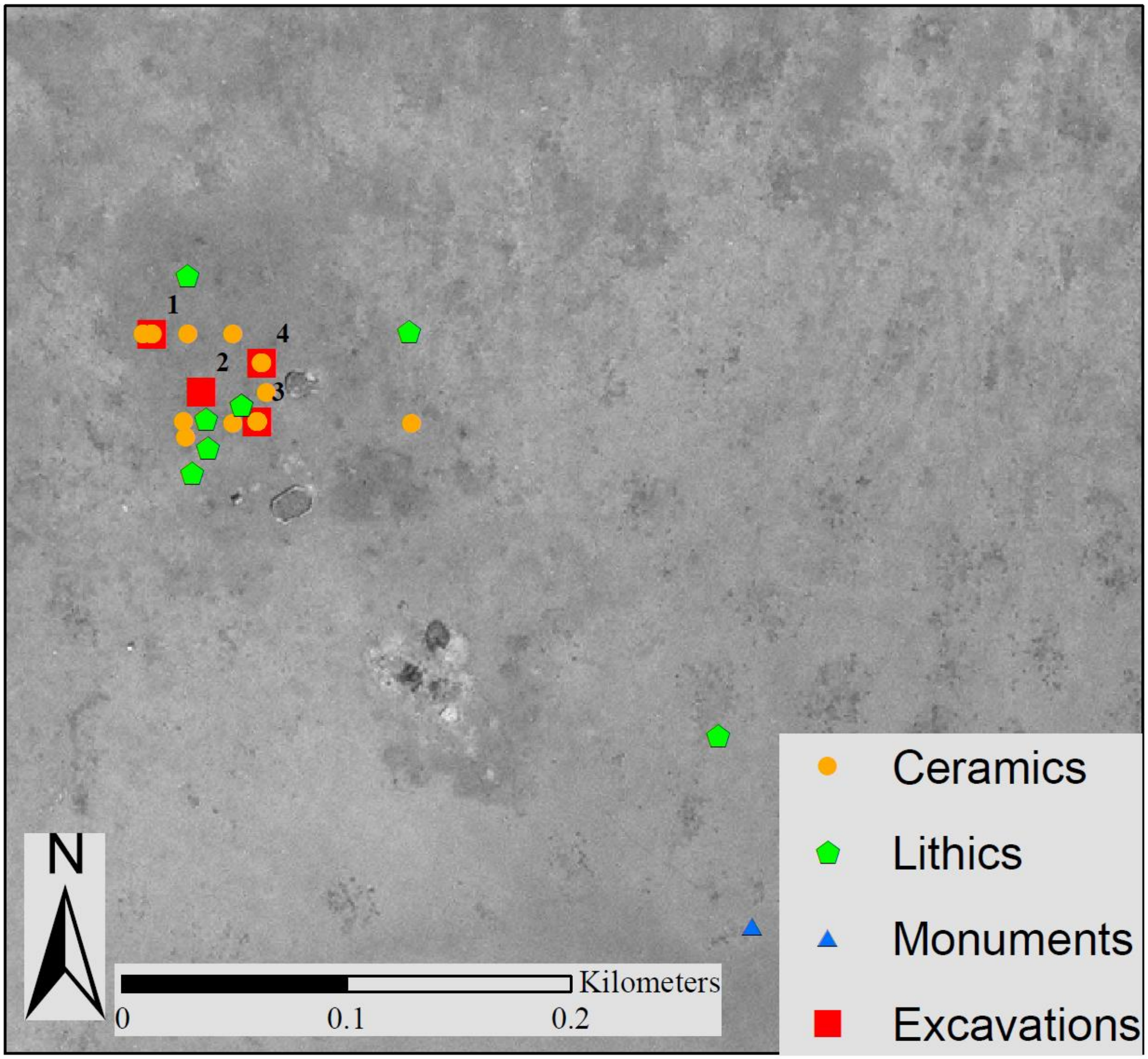


Table 4: Artifact counts for each excavation area

Excavation	Ceramics	Lithics	Bone (Total number of Fragments)	Metal
1	4	0	5	0
2	4	1	7	0
3	22	11	279	1
4	19	0	205	3

4.4.2 Ritual Context Excavations

Two ritual sites were selected for excavation by J. Bayarsaikhan of the National Museum of Mongolia as a part of the fieldwork of the Targan Nuur Archaeology Project. They were selected in large part for potential radiocarbon dating samples that might clarify the chronology of the ritual landscape and socio-political developments in the region.

The first ritual monument excavation was conducted on a circular stone mound thought to be an Early Bronze Age burial based on its similarity to another structure approximately 10 km away that was previously excavated by the Mongolian American Deer Stone Project. The 4.8 m diameter mound (*Dulgui Bulsh*-1, or "Circular Burial-1") selected for excavation is located approximately 1.5 km south of the southwestern corner of the systematic survey area. The stones were carefully photographed, sketched, cleaned and removed during excavation. While no human internment was found, a number of faunal remains (including unburnt, carbonized and calcined fragments), ceramic sherds, and charcoal were recovered. An internal somewhat circular stone feature was discovered, possibly lining an internal pit, though it was not entirely clear and nothing was found within or directly underneath the feature. To the side of this feature, a dark stained soil patch indicated the presence of a small pit within the burial structure, though very little was found here as well. Samples were taken for flotation, but nothing was recovered from these efforts. Ceramic sherds are consistent with the interpretation of this feature as an Early Bronze Age construction. A sample of the charcoal was submitted to the Accelerator Mass Spectrometry (AMS) Laboratory at the University of Arizona for radiocarbon dating, which also confirmed this interpretation. An uncalibrated date of 3,489 ± 45 years BP was obtained that yielded a calibrated date range of 1925-1691 calBCE (95.4% probability) using OxCal calibration software. This date is consistent with that obtained from a similar structure in the region excavated in 2007 by the Mongolian-American Deer Stone Project (Fitzhugh et al. 2008: 31-33; Fitzhugh et al. 2009b: i). This feature, Khorgogo 3, is located approximately 12 km to the west and yielded an uncalibrated date of 3450 ± 40 BP, which translated to a calibrated date range of 1884-1665 calBCE (95.4% probability) using the same calibration curve (IntCal 13) and OxCal software.

Figure 28: Before and during excavation of Dulgui Bulsh-1

Photo by J. Bayarsaikhan

Figure 29: Sketch of Dulgui Bulsh-1, or "Circlular Burial-1"

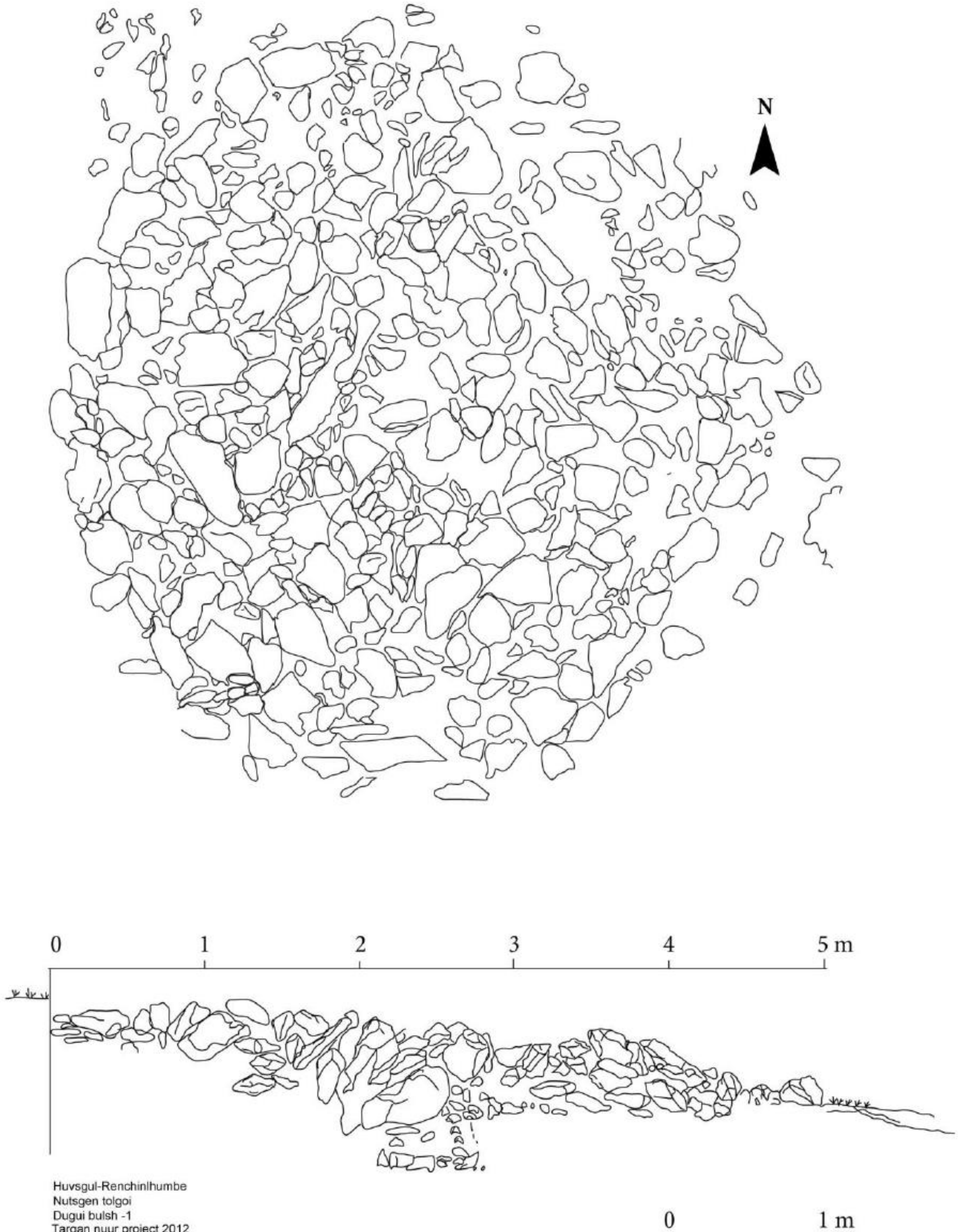


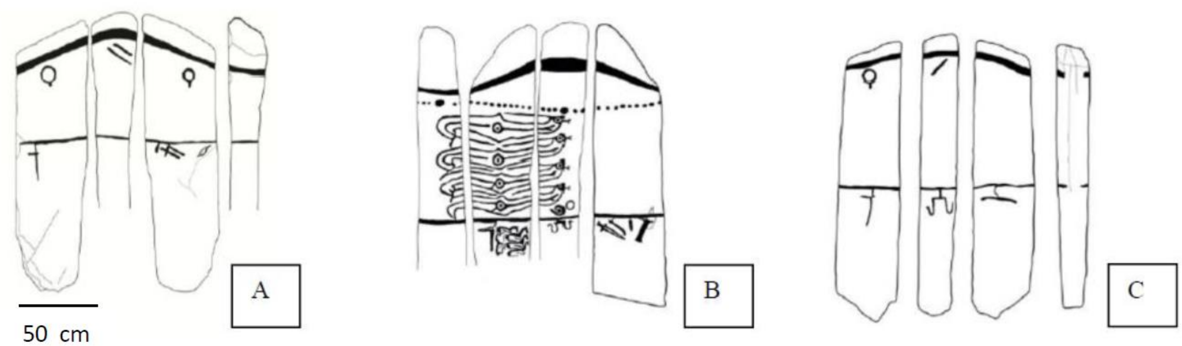
Illustration courtesy of J. Bayarsaikhan

The second ritual site selected for excavation was a circular rock feature about 1 meter in diameter that was associated with a Deer Stone complex found within the TNAP systematic project area boundary. Three Deer Stones (Figure 30), called simply Deer Stone 1 (1.75m), Deer Stone 2 (2 m) and Deer Stone 3 (1.55), had been found lying horizontally on the ground surface and were surrounded by several stone features (circles and mounds). Consistent with other National Museum of Mongolia projects (e.g. Fitzhugh 2009b), these stones were re-erected in their original positions and alignments during the 2012 field season. The associated stone features surrounding this complex were somewhat obscured by soil deposition, and so the excavation limits missed the entirety of the feature. Though no horse cranial remains were located, as is often the case in such features (Allard and Erdenebaatar 2005; Fitzhugh 2009a; Wright 2007), small charcoal fragments were recovered. A sample of this charcoal was submitted to the AMS Laboratory at the University of Arizona for radiocarbon dating. An uncalibrated date of 3,697 ± 54 years BP was obtained, which yielded a calibrated date range of 2211-1938 calBCE (92.5% probability) with additional intercepts at 2229-2222 calBCE (0.5%) and 2278-2251 cal BCE (2.4%) using OxCal calibration software. Compared to the dates published by Mongolian-American Deer Stone Project (Fitzhugh et al. 2009), this date is the oldest C-14 date associated with a Deer Stone. Previously, the oldest Deer Stone date was from a site in the Evdt Valley (also within the Darkhad Depression) and has a date of 1350-1090 calBCE (uncalibrated 3030±40; Fitzhugh et al. 2009b). While this would be exciting if true, caution should be utilized since it is a single date and it is considerably older (perhaps more than 800 years older) than other dates from similar sites. There are three possible interpretations of this date:

1. This is a very early Deer Stone and the date is correct.
2. The date was somehow contaminated and should be discounted.
3. The date relates to earlier activity at the site. The Deer Stone was a later addition to an existing monumental complex or other type of activity area, and our sampling strategy picked up material from the earlier site.

Only additional, future archaeological investigation will be able to determine which hypothesis is the most likely scenario. However, it seems unlikely that there was an 800+ year gap in the construction of Deer Stones and so the latter two options are more feasible given our current understanding of the region.

Figure 30: TNAP Deer Stones 1, 2, and 3



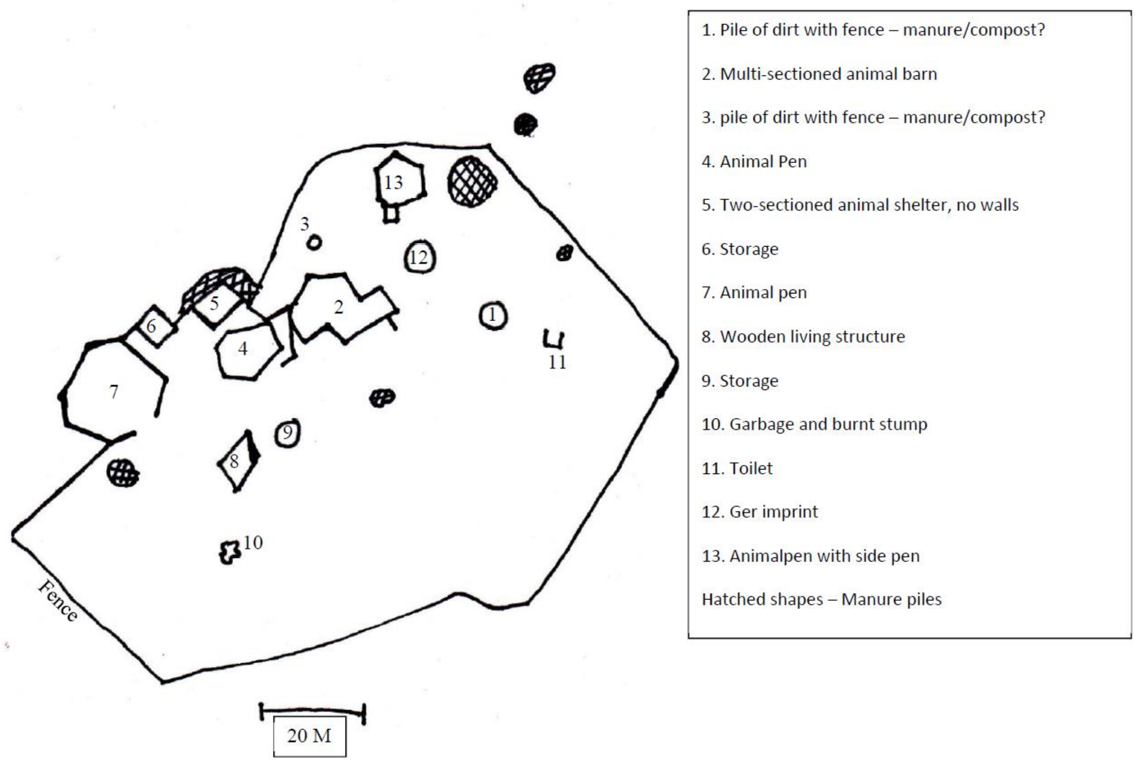
A=Deer Stone 1; B= Deer Stone 2; C= Deer Stone 3. Illustration courtesy of J. Bayarsaikhan.

4.5 ETHNOARCHAEOLOGY

The Targan Nuur Archaeology Project conducted a series of interviews with local herders. Initial work began during the pilot study in the summer of 2011, and continued more rigorously during the summer of 2012. Institutional Review Board (IRB) approval was obtained from the University of Pittsburgh to conduct this work. Teams of 3-5 people visited local families for informal conversations and observation. A questionnaire roughly guided these interviews (Appendix A), though the lead researcher generally directed these discussions as he/she deemed appropriate at the moment. The author and Stefani Crabtree (PhD Student, Washington State University) designed the ethnoarchaeological research program. J. Bayarsaikhan of the National Museum of Mongolia and the primary Mongolian collaborator of the Targan Nuur Archaeology Project, provided translation services. These interactions were also important for providing the opportunity for local herders to voice questions or concerns to the researchers about the activities of the Targan Nuur Archaeology Project.

During the 2011 and 2012 field seasons, ethnographic interviews were conducted with 21 families living along the northern shore of Targan Nuur. All family groups (*ails*) living within the bounds of the Targan Nuur Archaeology Project during July and August were interviewed as well as several families living nearby just outside the survey area. All interviewed families relied on herding as their primary economic activity. Most informants were ethnically Darkhad, and the Dukha respondents no longer herded reindeer or hunted as their primary economic activity. Residents who inhabit the project area during fall, winter or spring, but whose seasonal movements cause them to live outside the project area during summer, were not contacted at this time due to logistical and time restraints, though this is an avenue for possible future research. The primary goals of these interviews were to discern choices concerning settlement patterns (Figure 3; Table 5), record herd size and composition (Table 5), determine the level of use of wild resources for subsistence, discuss the current concerns of pastoralists in the region, and establish how pastoralists in the Darkhad cope with resource depression and dramatic climate swings. Additionally, maps were drawn for several of the modern campsites – both occupied and unoccupied (Figure 31).

Figure 31: Example of a winter campsite map from Winter Camp 2 collected in 2011



The primary resource of concern for herders in the region is pasture. During the summer of 2012, most herders remarked that the grass was very poor due to drought and many worried that a bad winter would decimate their herds. A number of strategies for counteracting bad pasture conditions were given. Some families suggested that they would move either farther or more often in order to find enough grass for their animals if conditions did not improve. Others would seek some type of fodder, either by purchasing it or collecting it themselves. Some of these families also mentioned supplementing their herding activities or abandoning them altogether for other jobs, mostly in the mining sector. Oyu Tolgoi, a large mining project in the South Gobi region of Mongolia, has been attracting workers, many of them former herders, from all over the country to join its large workforce (Bulag 2009; Webb 2008). Additionally, small scale artisanal miners, known as 'ninja miners' have been exploiting Mongolia's mineral resources on a much smaller scale (Appel 2005; Grayson et al. 2004; Murray 2003). While most 'ninja miners' are in search of gold, jade extraction and trade was reported by the informants of the Targan Nuur area to be an important alternative economy (Crabtree et al., In Review).

Table 5: Ethnoarchaeological interview responses regarding herd size and mobility

Number	Bag (Medium Herd Animals)	Bog (Large Herd Animals)	Max Move Distance (km)	Move Direction
1	40	22	10	NE
2	110	40	25	SE
3	40	35	25	E
4	150	50	40	E
5	70	30	8	E
6	200	38	20	S
7	60	43	30	W
8	0	14	60	E
9	110	40	30	E
10	0	15	20	E
11	100	52	30	E
12	60	20	30	E
13	100	20	-	-
14	-	-	-	-
15	300	30	100	S
16	37	10	10	W
17	400	100	8	-
18	-	-	3	W
19	20	23	15	-
20	160	34	5	W
21	100	-	15	W

Herd size and composition is reported using the Mongolian classifications of *bag* (smaller animals – sheet and goat) and *bog* (larger animals – camels, horses, cows/yaks). Informants' responses indicate that most families have many more *bag* than *bog.* Interestingly when one considers the importance of horse remains in ritual contexts (Section 3.1.1; Figure 11; Figure 12), compared with more central regions of Mongolia, there are far fewer horses – many of the *bog* reported are cattle. In this region, herder informants suggested that grass is not the limiting factor determining herd growth, but rather parasites that spread in the densely packed animal shelters and extreme winter conditions (cold and snow). Families with the smallest numbers of animals must also be participating in other economic activities (driving trucks, tourism, shop keepers, ‘ninja’ mining, etc.).

The seasonal mobility patterns of the Targan Nuur region are quite variable in the area, especially when compared to other regions of more central Mongolia where most herders follow a similar seasonal round between the foothills in winter and the riverside in summer (Houle 2010: 24-25; Honeychurch 2004: 76-77). Informant responses indicate that the maximum distance between campsites in a given year range from 3 km to 100 km with an average of 25 km (Table 5). Usually winter and summer are at the extremes with fall and spring camps located at intermediate locations between these two. Unfortunately, many informants were unable to effectively read maps and so the exact locations could not be determined and analyzed, though it is likely that estimates of distance and general direction were correctly reported. In one case, the informant was willing to take me to each of his four camp locations (Figure 3). All respondents were sheep/goat/cow/horse herders. Reindeer herders in the region have very different mobility patterns, but since they do not reside within a few kilometers of the Targan Nuur Archaeology Project boundaries, they were not interviewed during this research. A critical comparison of the two mobility patterns is an important future direction for this type of research.

While there are many variations on this pattern, the tour of one family’s camps did provide some insight into the mobility patterns of the region. The winter and fall camps were located along a tributary of the Shishged River. Access was difficult because of the river and steep sided hills in summer and spring and we had to use horseback, rafts, and hiking to get to it. However, once the river freezes at the onset of winter, access is improved. This was promoted as a natural obstacle discouraging the use of winter pasture reserves before their time. It was also noted that the exact families camped near one another changes in summer and winter and this provides for more varied social interactions throughout the year. Reasons given by the herder informants for following this particular seasonal migration pattern were both social (e.g. new and different neighbors, tradition passed through generations) and ecological (e.g. less snow cover, good grass growth, protection from wind).

It is interesting to note that there is little vertical movement during these seasonal rounds despite the fact that there is great topographical vertical variation in the region. In fact, in many cases, the elevation of campsites actually increases slightly in winter, the opposite of what one would expect in a classical vertical transhumant mobility strategy (Cribb 1991: 19; Frachetti 2008:10; Johnson 1969:16; Vainshtein 1980). In this region, the higher elevations are classified as taiga and are generally occupied by the Dukha reindeer herders. Interaction between basin sheep/goat/cow herders and taiga reindeer herders occurs fairly regularly through trade, tourism, migration, social or kin networks and school. The distinction between the two groups is for the most part rather clear and no *ails* were observed integrating the two types of herding or regularly exploiting both taiga and basin ecological zones beyond an occasional hunting trip or small scale jade and gold 'ninja' mining (described above; Crabtree et al., In Review).

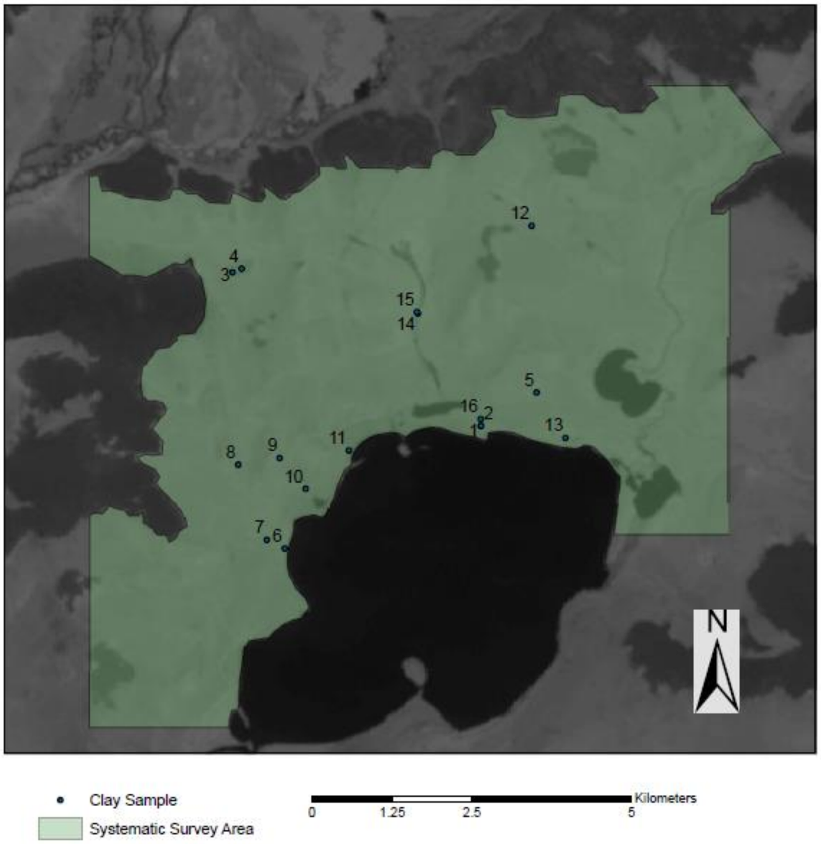
Overall, the mobility and economic strategies employed by populations in the Targan Nuur region are more variable than those observed by ethnoarchaeological studies in more central regions of Mongolia such as the Khanuy River. While this can give the impression of a more chaotic data set that in turn makes it difficult to compare the results to the archaeological record, it is indicative of a more diverse "*a la carte*" kind of strategy overall. These differences in the diversity of strategic approaches fits well with the model presented in Section 2.2– that is, central regions are specialized and show a low amount of diversity between families in their economic and mobility strategies, while more northern regions (Targan Nuur) show high economic and organizational diversity.

4.6 EXPERIMENTAL ARCHAEOLOGY

An experimental component to the Targan Nuur Archaeology Project was devised by the author and Camilla Kelsoe (PhD student, University of Pittsburgh) in order to test the quality of the clays available in the local area as well as to investigate different possible firing methods. These samples were then compared to archaeological samples in order to assess their similarities and differences. Since the Darkhad Depression was once a large lake, deposits of very fine clay sediments are quite plentiful. Clay samples were collected, evaluated, formed into vessels and fired in one of four different firing environments. In addition, a number of clay tiles were produced and fired in order to conduct further tests regarding heat transfer, permeability, and hardness.

In all, 16 clay samples (numbered 1-16) were taken for experimental purposes from around the project area (Figure 32). Clay deposits were not difficult to locate, particularly in lower elevation areas closer to the modern level of the lake. Areas higher in elevation and farther from the lake tended to be less promising sampling locations either because they were devoid of clay or failed to yield enough clay to make the minimum single sample size (0.65 L).

Figure 32: Clay samples taken



Clay samples were first sifted through a fine 1 mm screen in order to discard larger inclusions from the sample. Water was then added in order to hydrate the clays and make them workable. No additional inclusions or other tempering materials were added to the samples at this time, though this may be an area for future experimental research. Munsell color (wet) was recorded followed by three different tests that were used to assess the workability of each sample. The first test is known as the 'coil test' (McReynolds and Herbert 2004:4) and is used to score the clay's plasticity by rolling out a 1 cm diameter clay coil which is then wrapped around a finger two or three times. A numerical code was assigned to each sample based on the amount of cracking and breakage that occurred with a score of 3 denoting a 'good' clay with no or minimal cracking, a score of 2 representing 'moderately short' clays with some significant cracking, and a score of 1 indicating a 'short' clay that broke entirely.

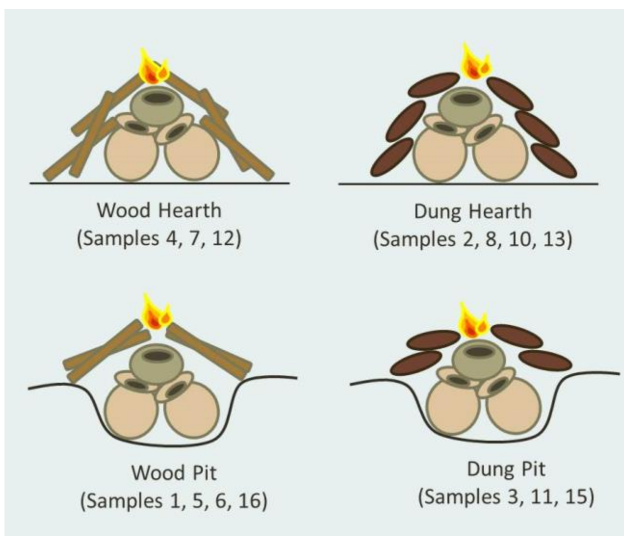
The second test is known as the ‘ball test’ and was used to test the clay’s resilience (McReynolds and Herbert 2004:4). An approximately 3 cm ball of clay is formed, and flattened repeatedly until it either becomes so hard that a ball can no longer be formed, or it begins to crumble. The number of cycles the clay could withstand was used to score the resilience of each sample.

The third and final test is known as the ‘loop test’ and also measures the plasticity of each clay sample. Like the ‘coil test’ above, a 1 cm thick clay coil was produced. It was then looped to create a circle of 5-6 cm in diameter. This clay loop was then stood upright and left for 30 seconds. A loop that retained its shape was given a score of 3, while an oval received a score of 2, and a flattened ellipse was assigned a score of 1.

Of the 16 samples, two samples, number 09 and 14, were found to be unworkable using the above tests and so no further experimentation or analysis was performed. The remaining samples were used to make small experimental vessels as well as a test tile, each labeled with the sample number. Test tiles were rectangular slabs incised with a line indicating 5 cm in length in the wet clay so that a measurement of the same line post-firing could be used to determine the rate of shrinkage. Participants of the Targan Nuur Archaeology Project made these vessels and recorded the forming processes and a qualitative judgment of the workability of the clay. All vessels and tiles were allowed to air dry for five days, after which they were weighed and photographed prior to firing.

To date, no definitive evidence of kiln firing has been detected at any prehistoric or early historic open-air campsite in Mongolia (Houle 2010:168; Hall and Minyaev 2002:136). For this reason, a number of different firing strategies were tested that did not use formalized kilns. Two surface fires and two pit fires were designed to compare these two strategies. One of the pits and one of the surface fires used wood as fuel, while the remaining pit and surface fire used animal dung (Figure 33). The vessels and tiles were randomly divided into four groups and placed into one of the four firing environments. All four firings occurred simultaneously so that the conditions, such as length of firing, wind speed and air temperature, would be identical. Pyrometric cones were placed in each firing environment to record the approximate highest temperature reached. An attempt was made to record the rate of increase, however, it became too difficult to maintain visibility of the cones in each fire and so no reliable measure was made. In each of the fires, the pyrometric cones indicated a high temperature between 690-790˚C. Of the 14 vessels fired, only four broke, and only one of those was severely shattered. The tiles and vessels created during this portion of the project were then further analyzed after the project concluded. A synthesis and discussion of the interpretations from this experimental research program and the resulting analysis is presented below in Section 5.4.

Figure 33: Experimental firing environments (from Kelsoe and Clark 2013)



5.0 ARTIFACT ANALYSIS

Artifacts were collected from surface survey, sub-surface survey and excavation during the course of fieldwork. This chapter will summarize the results of the various types of analysis done on these remains. The main artifact classes were as follows: ceramics, lithics, and bones. Additionally, small amounts of charcoal and metals were recovered. Finally, during the course of the experimental archaeology, a number of material remains (tiles and vessels) were created that underwent analysis. In the following pages each of the artifact categories are presented in terms of their context and spatial location of recovery, however, more detailed discussion and interpretation of the spatial patterning of the artifacts is provided in Chapter 6.

5.1 CERAMICS

Ceramic sherds were found in the greatest proportion of contexts during the Targan Nuur Archaeology Project and totaled 518 individual sherds. These sherds ranged from the Early Bronze Age to Medieval Period. An attempt was made to collect all ceramics from all archaeological contexts. Sampling during collection was not deemed necessary since these artifact scatters were rather sparse. While some Medieval period sherds were collected, many crewmembers were either not able to differentiate them from modern sherds, or in the case of some of the Mongolian crew members, not interested in these ‘later’ periods and so these sherds are likely under-represented in the ceramic assemblage. Therefore, while a Medieval Period presence is noted, its relative abundance and overall distribution cannot be inferred from the work done by this project to date.

Figure 34: Example of ceramics from a single context

For each sherd, a number of data points were collected when the nature and quality of the sherd allowed it. The following is a list of these data points: part (rim, body, base, etc.), presence of decoration, type of decoration, thickness, weight, type of inclusions, average size of inclusions, inclusions per cm^2, rim diameter, interior color, exterior color, core color, and presence of residues. These characteristics were selected for analysis because they are easy to consistently collect by a non-specialist, are often telling of time period, may have some information about vessel formation, and are conventionally collected by other analysts in the region and so are highly comparable.

Of the 518 total sherds collected, 343 were large enough to label individually with their unique catalog number. These were all placed on a single table top sorted into 10 groups based on similarities in their characteristics such as overall texture, paste, finish, thickness, and color (Table 6; Appendix C).

Table 6: Description of ceramic characteristic categories

Description of Sherds	Relative Chronological Age
Somewhat smooth surfaces; med/large black inclusions and quartz inclusion among other small inclusions, relatively thin	EBA/MBA
Some surfaces smooth; med sized, abundant inclusions; relatively thick; often multi-color pastes	LBA
Hackly, rough paste; some smooth surfaces, some rough/weathered; 'bubbly' or 'platy' pastes	LBA
Course/lots of med-fine temper; moderately smoothed or unsmoothed surfaces	LBA
Hackly, rough paste; smoothed surface; large inclusions	LBA
Porous (fine hoes all over); fine inclusions	LBA/EIA
Rounded edges; soft chalky texture	LBA/EIA
Light color; smooth reddish exterior; rough interior; fine, well sorted, abundant inclusions	IA (Xiongnu)
Fine surface treatment; med-thin; finely made	IA (Xiongnu)
Relatively thin, smooth surfaces, large/course inclusions	Turk or Later

These groups were then designated as belonging to one of the following relative chronological periods: Early/Middle Bronze Age, Late Bronze Age, Late Bronze/Early Iron Age, Xiongnu/Iron Age, and Turkish/Later Periods (Table 7). The determination of which group belonged to which period was based on prior experience on other archaeology projects in Mongolia, the advice of Mongolian colleagues with years of experience sorting sherds, assemblages from other projects with associated C-14 dates, and a rough ceramic guidebook (Appendix C; Wright 2008). Over half of all of the sherds that were sorted into categories belong to either the Late Bronze Age or Early Iron Age. This is not surprising given the monumental landscape of the region with its abundant features from these same periods (See section 6.2)

Table 7: Ceramics by Period

Period Categories	Total Number of Sorted	Percentage of Sorted	Total Decorated	Percentage Decorated
Early/ Middle Bronze Age	28	8.16%	6	21.43%
Late Bronze Age	139	40.52%	16	11.5%
Late Bronze/Early Iron Age	47	13.7%	1	2.13%
Xiongnu/Iron Age	53	15.45%	5	9.43%
Turkish/Later	76	22.16%	6	7.89%
Total Sorted	343	100%	34	9.91%

The location of these sherds by period suggests a shift in land-use patterns between the Early/Middle Bronze Age and the Late Bronze Age. Early/Middle Bronze Age sherds are confined to a single draw in the western side of the project area while later periods are dispersed throughout the project area (Figure 35). A hypothesis regarding this patterning is presented in Section 6.4.1 and Figure 56.

Figure 35: Location of Ceramics by Period

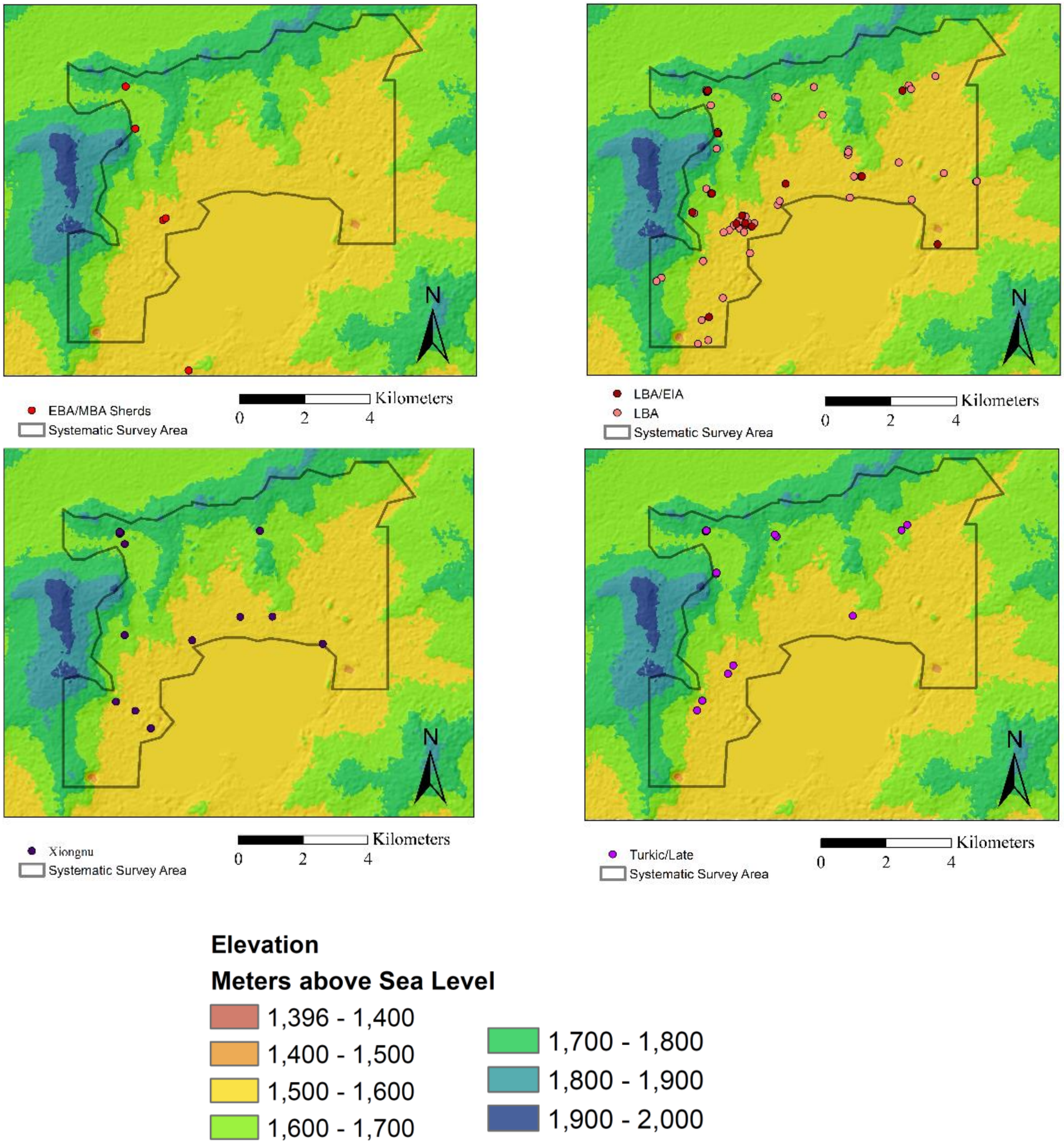


Table 8 below displays the relative dates of sherds within each context in each of the four 2x2 m trenches of each of the four excavations (for a total of 16 individual trenches). The contexts are presented as they would be encountered during excavation so that context 1 is closest to the surface, while context 6 is the farthest below the surface. When the distribution of sherds is looked at by individual excavation context (Table 8), it is clear that there is some mixing going on. For example, in excavation 4, trench 3, the chronologically later Turkish period sherds are located below Late Bronze Age and even Early/Middle Bronze Age sherds. Additionally, many of the contexts do not have ceramics at all and so cannot be dated in this manner.

Table 8: Ceramic periods present by excavation context

Excavation 1			
TR 1		**TR2**	
		ctx 1	
ctx 2		ctx 2	LBA, XIONGNU
ctx 4			
TR 3		**TR 4**	
---		ctx 1	LBA

Excavation 2			
TR 1		**TR 2**	
ctx 2		ctx 1	UNKNOWN
		ctx 3	TURK/LATE
TR3		**TR4**	
ctx 1		ctx 1	
ctx 2	LBA	ctx 2	

Excavation 3			
TR 1		**TR2**	
ctx 1	UNKNOWN	ctx 1	
ctx 2		ctx 2	Turkish
		ctx 3	
TR3		**TR4**	
ctx 1	EBA/MBA, LBA	ctx 1	
ctx 2	Turkish	ctx 2	
ctx 3	Turkish		

Excavation 4			
TR1		**TR2**	
ctx 1	UNKNOWN	ctx 1	
ctx 2		ctx 2	
ctx 3			
ctx 4	LBA		
ctx 5		ctx 5	
TR3		**TR4**	
ctx 1	EBA/MBA, Xiongnu, LBA	ctx 1	LBA
ctx 2	LBA	ctx 2	
ctx 3	LBA, Xiongnu		
ctx 4	Turkish	ctx 4	LBA
ctx 5	Turkish	ctx 5	
ctx 6	LBA/EIA		
wall clean	LBA/EIA		

TR = trench/unit; ctx = natural stratigraphic context; only those contexts with artifacts/materials shown.

Some scholars have used the presence of decoration to indicate special ‘fancy’ wares within an assemblage (Houle 2010:151; Smith 1987). In such a scenario, the total proportion of sherds with decoration as well as proportions between assemblages may suggest increased labor and social inequality. However, the decoration identified on the ceramic sherds recovered in this dissertation research was quite simple and usually in the form of incised lines or punctates, and so likely had only required a minimal investment of labor. While forming methods and overall investment did vary by period, within a single period there was very little observable difference. Certain decorations or styles may also show similarities in some cultural traits between regions. Finally, decorative styles may indicate time period. From the total ceramic assemblage (n=518), a total of 45 sherds (8.69%) have some decoration. Of the sorted diagnostic subset (i.e. sherds large enough to label and identified to period; n=343), 34 (9.91%) show some form of decoration.

While the majority of sherds are simply undecorated body sherds, the assemblage contained 33 rim fragments, 1 base fragment, and 1 possible handle fragment (Figure 63; Appendix C) These sherds are of particular importance because they are often more diagnostic in terms of time period and vessel form than fragmentary body sherds. Each rim sherd was photographed and sketched (in its proper alignment in both plan and profile view) in addition to the analysis conducted on all sherds.

There is little indication of the production of these wares. No kilns or workshops have been located. No specialized tools such as wheels or paddles have been identified. Most sherds are so fragmentary and poorly preserved production techniques can be difficult to confidently ascertain.

5.2 LITHICS

All lithics from all contexts were collected. A total of 270 lithics from 109 different contexts were located and collected. Of these, 146 were found outside the systematic survey area during pilot surveys in the regions directly adjacent to the research area – 130 of which came from a single artifact scatter approximately 3.5 km north of the project area. While a few groundstone and carved stone fragments were found, the majority of the lithic artifacts were chipped stone tools and the resulting debitage. Of the 124 lithic artifacts that were recovered within the systematic survey area, 111 were chipped stone tools or debitage, 8 were fragments of a carved stone (likely Buddhist and so relatively recent 19^{th} or 20^{th} century), and 5 were groundstone (Table 9). The small groundstone assemblage consists of rounded mano like stones (Figure 36), and ambiguous forms that show evidence of abrasion and polishing.

Figure 36: Example of groundstone

Figure 37: Example of chipped stone lithics from a single context

The chipped stone lithic assemblage was coded using a coding system developed for the project by Katie Harris (PhD student, Washington State University) based on a system developed by Dr. William Andrefsky (2005). The stone tool assemblage (Table 9) was divided into the following categories: bifaces (n=6), blades (n=1), choppers (n=3), end-scrapers (n=1), microblades (n=9), projectile points (n=1), and retouched flakes (n=1). The single projectile point fragment (Figure 38) was collected at the site mentioned in the paragraph above just beyond the edge of the systematic survey area and is of unknown cultural/period affiliation. Some of the unmodified flakes and microblades may have been used as expedient tools in addition to the more formal tool types.

Figure 38: Projectile point base fragment

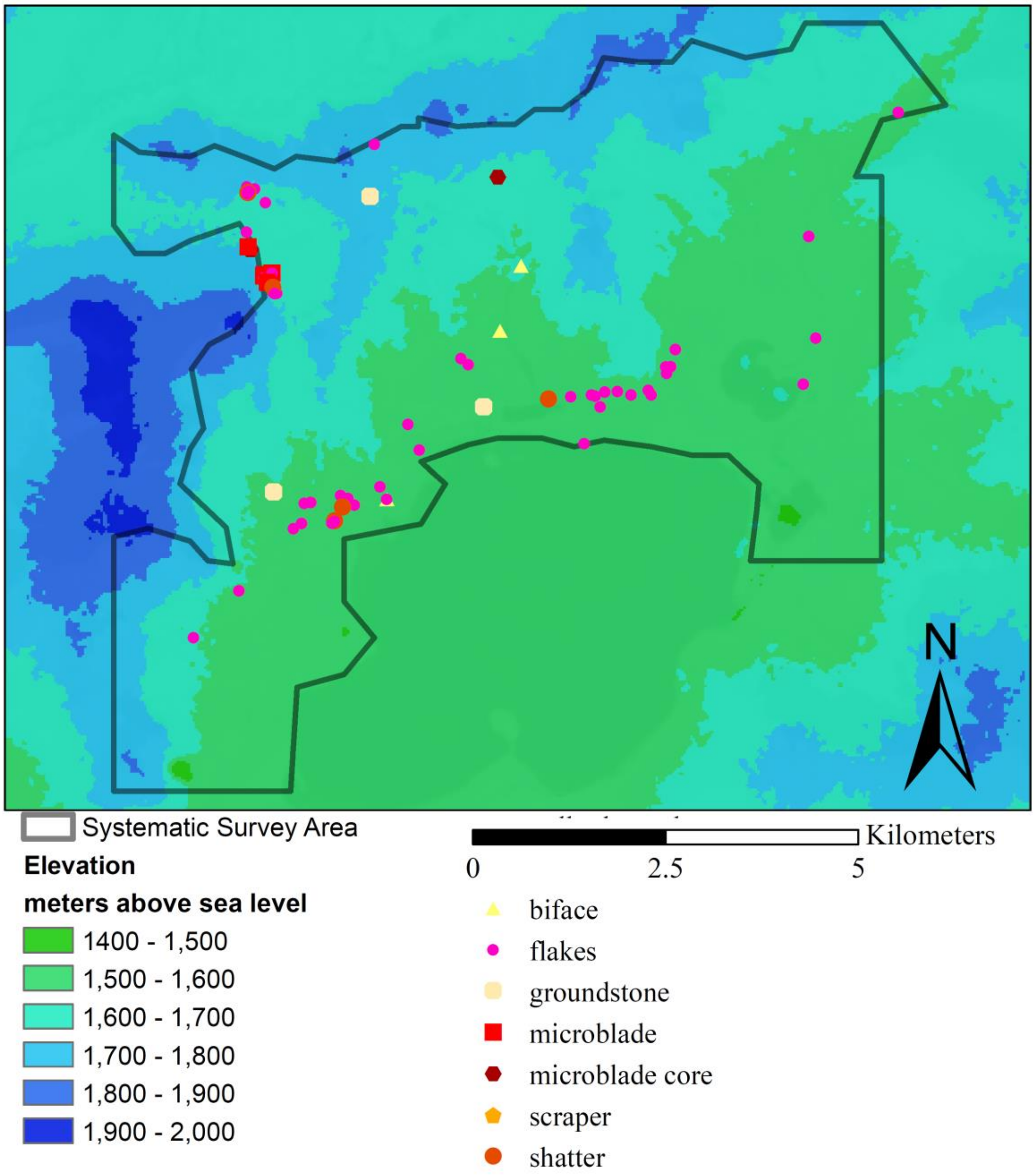
Table 9: Lithic tools and cores

Context	Type	Material	Weight	Length	Width	Thickness
Surface	Biface	chert	13.4	3.40	2.9	0.9
Surface	Biface	chert	32.3	5.50	2.9	1.3
Surface	Biface	chert	6.3	2.40	2.4	0.84
Surface	Bifacial Preform	chert	31.2	7.50	3.3	1.2
Surface	Bifacial Scraper	chert	21.1	5.80	3.04	1.13
Surface	Blade Fragment	chert	1.2	2.15	1.3	0.4
Surface	Chopper	slate	450.7	12.80	9.15	4.4
Surface	End Scraper	chert	8.4	3.20	2.7	0.77
Surface	Groundstone	slate	612.1	19.00	4.05	4.7
Surface	Groundstone	unidentified	375	13.47	4.68	2.05
Shovel Test	Groundstone	unidentified	975.9	21.50	6.1	4
Shovel Test	Microblade	chert	0.01	1.14	0.59	0.14
Surface	Microblade	chert	0.6	1.87	0.71	0.27
Surface	Microblade	chert	0.01	1.00	0.63	0.27
Surface	Microblade	chert	<.1	0.96	0.71	0.12
Surface	Microblade	chert	0.8	2.29	0.91	0.31
Surface	Microblade Core	chert	10.4	2.75	2.49	1.35
Surface	Microblade Core	chert	7.9	2.26	1.67	1.2
Surface	Microblade Core	chert	16.1	3.60	2.95	1.3
Surface	Microblade Fragment	chert	<.1	0.65	0.45	0.15
Surface	Projectile Point	chert	0.5	1.30	1.4	0.35
Surface	Retouched Flake	chert	19.7	4.75	2.3	1.8
Surface	Rough Biface	chert	22.1	4.00	2.9	1.3

Raw material type and source (lithic and otherwise) have been used to show trade routes, socio-economic interaction spheres, and seasonal movement and resource acquisition within Eurasia (for regional examples see Hall and Minyaev 2002; Kuzmin et al. 2002; McKenzie 2006:137-138). Most of the stone tools and debitage collected during the field season are composed of a black or dark grey chert (n=238, 88.15%). A small number of red and reddish brown chert artifacts were recovered (n=4, 1.48%). The remaining lithics were made of quartz, quartzite, slate, or were unidentified. Unfortunately, the sources of the lithic materials used for stone tool production are not known. There are no local outcrops of chert that are known at this time, though no systematic search has been done for these quarries. The quartz, quartzite, and slate may have been procured locally as natural outcrops of these materials are found in the region.

The abundance of lithic artifacts, both with and without associated ceramic artifacts, is interesting, especially when compared with the Khanuy Valley to the south. The Khanuy Valley Archaeology Project (See Section 3.2) found only one significant lithic scatter and the raw material here was a rather poor coarse-grained stone (Houle 2010:184). Conversely, lithic artifacts are found throughout the Targan Nuur region and compose one of the primary artifact types (more detail provided in Section 7.2.4).

Figure 39: Location of Lithics by Type



The recovery of lithics within the systematic survey area was primarily confined to areas along the lake shore and along small drainages that run up the west, middle and east parts of the project area. The locations of lithics do seem to be more restricted to particular zones within the survey area to a greater degree than other artifact and feature classes (Figure 35; Figure 48). A more detailed discussion and interpretation of this will be provided in Chapter 6.

5.3 FAUNAL REMAINS

Faunal remains were collected only from contexts in which other diagnostic artifacts were found. Since many of the same species are herded and hunted today, it is impossible to differentiate modern and recent historical bones from those of the more distant past. Therefore, only bones from within subsurface contexts in which other archaeological material was found were collected. Bones from subsurface contexts in which other archaeological materials were not found were not collected since rodent burrowing and other disturbances may have deposited them there and determining their chronological context would be impossible. While the possibility of disturbance and mixing modern contexts with more ancient ones is not wholly avoided by this method of sampling, this is the best way to select those faunal remains likely to be from the time periods of interest. The small rodent bones found in these buried contexts, regardless of associated archaeological material, are assumed to be intrusive unless evidence such as cut marks was present (no such cases were recorded).

Figure 40: Example of faunal material from a single context

Both wild and domestic fauna were represented in the faunal assemblage collected during fieldwork. A total of 1,081 bones (Number of Identified Specimens, or NISP) and bone fragments were collected over the course of the project. The Minimum Number of Individuals (MNI) of each context never exceeded 1. Each bone was coded using a faunal coding system designed for this project (Appendix D) by the author and an undergraduate assistant, Megan Conger (University of Pittsburgh), with inspiration from coding practices used by the Khanuy Valley Archaeology Project in central Mongolia (Broderick 2011), and the Pavlinovo System (Hanks 2003). Only the information in which the researcher could be highly confident was coded, with all fields having an "indeterminate/not clear" option. Bones that were similar and highly fragmented to the point that little additional information could be gained (i.e. mammal limb fragment; herbivore tooth fragment) were put into 'lots' and coded together. The condition of the bone varied from whole and strong to highly fragmented and friable. Burning (carbonized or calcined), cut marks, chop marks, gnawing, weathering, abrasion, root etching and breakage patterns were all coded and noted on at least some of the specimens. Metric data were recorded following the standards set by von den Driesch (1976), or in the case of lots, an average length was recorded. Weights for individual bones and lots were also recorded.

Because of the fragmentary nature of the faunal assemblage, only a relatively small proportion (NISP) of bones from the excavations were identified to the element (n=101; 9%) and the type of animal (n=52; 5%). Animals identified in the excavations included horses (*Equidae*), cows/yaks (*Bovinae*), sheep/goat (*Caprines*), deer (*Cervidae*) and rabbits/rodents (*Lagomorpha/Rodentia*) (Table 10). Most contexts contain bones that cannot be identified either because of their incomplete nature, or because the available comparative collection used during analysis was rather small and nearly entirely made of domesticated animals (the only exception being Marmot). As a result, the positive identification of wild species was nearly impossible in this analysis. Many of the unidentified bones were noted to be similar to a domestic species, though did not quite match the available collection. While these could be abnormal individuals, the more likely scenario is that they belonged to wild animals of similar size and shape to their domestic counterparts (see Section 3.1.4 for a list of possible wild animal taxa known to be indigenous to the region).

5.3.1 Determining Seasonality

Faunal remains can be used, in certain cases, to help determine seasonality. Ethnographically, domestic animals are typically bred to give birth in the late winter or early spring (similar to the schedules of many of their wild counterparts). Using age estimates based on tooth eruption and wear (e.g. Payne 1987; Levine 1982) and epiphyseal fusion for young juvenile animals (e.g. Myers and Emmerson 1966; Zietzschmann 1955), the season of death can be determined. For example, a 3-6 month old animal was likely killed during a warmer season (summer), while an older individual of 6 months to 1 year was likely killed during the autumn or winter. If a pattern emerges where a single location has mostly juvenile animals of a particular age class, then this site's seasonality can be determined.

A more subtle method of determining seasonality is suggested by Houle (2010:132-134) who observed that ethnographically, larger animals (e.g. cows, horses, yaks) are primarily killed during the cold winter months when meat does not spoil as it would in the warmer summer months. Therefore, if larger domestic animals are routinely found in one set of sites (for Houle, foothill/winter sites), then seasonality may be inferred. However, the topography around Targan Nuur is not as clearly divided (neither ecologically nor in terms of ethnographic settlement patterning) between foothill/riverside zones and winter/summer camps as it is in the Khanuy Valley (more on this in Section 7.2.3). Additionally, this pattern may not hold true for groups with different carcass sharing practices. That is, while animal carcasses are generally owned privately amongst pastoralists, they are often shared amongst hunter-gatherer groups (for a discussion of hunter vs. herder sharing practices, see Ingold 1980:5,152-162). If the group is large enough, a large animal can be consumed without risking meat spoilage. Additionally, there are examples, such as buffalo jumps in North America, where hunter-gatherer groups killed many more animals than were needed and let great amounts of meat spoil. Finally, a group practicing any economic strategy could utilize a number of preservation methods (such as drying, smoking or salting), which prevent spoilage even during warm seasons. The observation is suggestive, but not rigorous, particularly among groups straddling the hunter/herder divide.

5.3.2 Faunal Remains: Dulgui Bulsh-1

The assemblage from the excavated burial, Dulgui Bulsh-1 (see Section 4.4.2;) has a NISP of 543 bones and bone fragments, and weighs 488.6 g. This collection has a much higher faunal diversity than any of the excavations. While this could be related to the superior condition of the bones from this context, thus allowing for better identification, the weight of this collection relative to the other contexts suggests that these bones are even more fragmented than those of other contexts (Table 10). Animals from this context include fish (*Osteichthyes*; NISP=1), sheep/goat (*Caprines*; NISP=13), large and small/medium deer (*Cervidae*; NISP=6), bird (Aves; NISP=2), cattle/yak (*Bovinae*; NISP=1), and rodents (*Rodentia*; NISP=12). Horses (*Equidae*) are curiously absent in this context given the near ubiquity of this taxon in other contexts with identifiable faunal remains.

5.3.3 Faunal Remains: Excavation 1

Excavation 1 contained very few bones (NISP=4; Weight=4g), with bones found in units 1, 2 and 4. The single rodent mandible found in unit 1 was likely intrusive. Two mammal bones, a tooth fragment and a long bone fragment, were found in unit 2. The single bone in unit 4 was indeterminate.

5.3.4 Faunal Remains: Excavation 2

Similarly, excavation 2 produced relatively few faunal remains, all of which were located in unit 3. NISP was difficult to calculate as one collection (out of the 3 total) was composed of such small friable bones (weight <.1g), that counts would inevitably be inaccurate and changing with each handling of the bones. No analysis was practical for these fragments. The remaining bones (n=2; weight=.9g) were a tooth fragment (animal type indeterminate) and a single indeterminate fragment.

5.3.5 Faunal Remains: Excavation 3

Excavation 3 contained a NISP of 268 individual bones and bone fragments and had a total weight of 533.8 g. Horse (*Equidae*; NISP=6) and cow/yak (*Bovinae*; NISP=1) were identified, but no additional animal type determinations were made from this excavation. No teeth were included in this collection, and only 1 subadult bone was identified (one horse second phalanx missing its unfused proximal epiphysis). Since the second phalanx's proximal epiphysis fuses at 9-12 months (Myers and Emmerson 1966; Zietzschmann 1955), this animal was less than 12 months old, a determination that does not infer seasonality. An additional 4 bones (NISP) were determined to be likely from wild animals as they were identifiable, but not like any species in the comparative collection, 2 of which were sheep/goat sized, 1 that was cow/yak sized, and 1 that was larger than sheep/goat, but smaller than cow/yak.

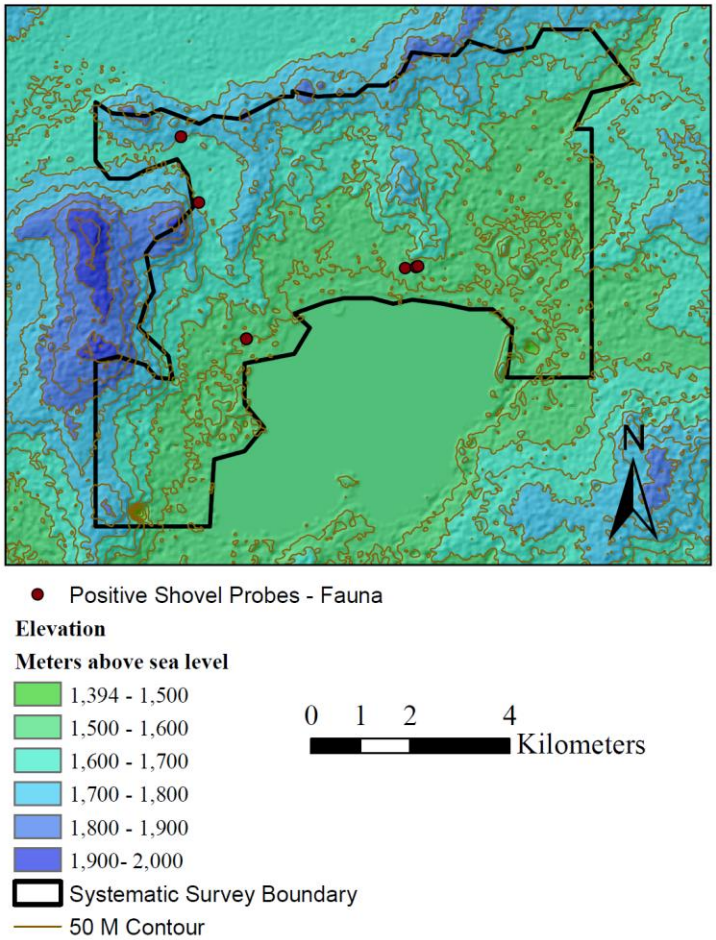
5.3.6 Faunal Remains: Excavation 4

Excavation 4 contained a NISP of 212 individual bones and bone fragments and had a total weight of 441.8 g. Horse (*Equidae*; NISP=12), cow/yak (*Bovinae*; NISP=1), sheep/goat (*Caprines*; NISP=3) and rodents (*Rodentia*; NISP=11) were identified. Among these, 7 (NISP) were horse teeth, but were too fragmented to get a reliable age and only 1 subadult bone (one horse second phalanx, unfused proximally) was found. As in excavation 3, the individual died some time before it was 12 months old (Myers and Emmerson 1966; Zietzschmann 1955), a range that does not indicate seasonality. Once again, the rodent bones may have been intrusive. An additional 2 bones (NISP) are thought to be from wild animals of approximately sheep/goat size.

5.3.7 Faunal Remains: Shovel Probes

Among the 6 shovel probes (Figure 41) that contained faunal remains (2% of the approximately 250 dug), there were a total of 52 (NISP) bones and bone fragments with a total weight of 23.9 g. A single sheep/goat bone (in the area of excavation 4) and a single rodent bone (possibly intrusive) were found, while all others were indeterminate as to animal type. Of note, one shovel probe among the three clustered in the south central portion of the project area (seen in Figure 41) located near a monument complex contained highly fragmented, calcined bones similar to those found in the stone circles that often accompany *khirigsuurs* and Deer Stones (Section 3.1.1), but did not have any associated stone feature. Though this cluster of faunal material provoked further exploration through excavation, the resulting excavation 1 contained few artifacts of any kind (Sections 4.4.1 above and 5.3.3 above)

Figure 41: Location of Positive Faunal Shovel Probes



5.3.8 Summary of Faunal Data

Seasonality was inconclusive based upon the faunal specimens identified. Mandibles/maxilla of domestic species with teeth were not found and so eruption patterns could not be determined. The two cases of unfused epiphyses, both from the second phalanx of a horse, suggest that the animal was less than 12 months old, though no more fine grained results could be ascertained.

The amount of faunal material at a site is a reflection of the kinds of activities that were going on at that location. Based on the density of faunal material per m^2 of excavation, and least 3 distinct groups of site types become clear (Table 10) – those with less than 1 NISP/ m^2 (excavation 1 and 2), those with more than 10, but less than 20 NISP/ m^2 (excavation 3 and 4), and the burial, with just over 30 NISP/m^2. Both excavations 1 and 2 were located near monument clusters, and so the material here (faunal and otherwise) may be a result of activity related to the construction and use of these monuments, and not, in fact, domestic activity. Excavations 3 and 4, with appreciably more faunal remains, are likely the result of domestic activities. In all cases, sub-surface stratigraphic contexts, based on the pottery chronology, were disturbed and mixed (Table 8), and so a diachronic analysis of faunal material was not possible.

Table 10: Summary of faunal data

	Excavation 1	Excavation 2	Excavation 3	Excavation 4	Shovel Probes	Dulgui Bulsh 1
NISP	4	3	268	212	52	543
Weight (g)	4	1	533.8	441.8	23.9	488.6
NISP/M^2	0.25	0.19	16.75	13.25	0.83	30.17
Animal Type						
Equidae			X	X		
Bovinae			X	X		X
Caprine				X	X	X
Aves						X
Cervidae						X
Rodentia	X			X	X	X
Osteichthyes						X

5.4 EXPERIMENTAL VESSELS AND TILES

Experimental vessels and tiles (Figure 42) produced from sample clays collected in the project area (as described above in Section 4.6) were analyzed using a variety of techniques used to assess their variability and functional characteristics. Color, hardness, percent shrinkage following firing, heat transfer, and absorbency were all analyzed for each of the samples (Kelsoe and Clark 2013; Appendix F). Due to the small number of samples and the observed similarity in the results of the various firing environments (wood vs. dung and pit vs. surface), this was not taken into consideration at this stage of analysis, though future study might approach these variables more rigorously.

Figure 42: Experimental tiles after firing

Color was recorded for clay samples, fired vessels and tiles since color was often radically altered during firing. Tile and vessel colors recorded using the Munsell Color System ranged from brown to reddish-orange. The brighter reds and oranges can be attributed to high mineral content, in particular, high iron concentrations in the sampled clays (Sheppard 1956). While somewhat more vibrant than the archaeological assemblages collected during fieldwork, the experimental assemblage is roughly similar and any differences might be attributed to taphonomic processes over time.

Hardness was recorded using a three part scale with “hard” being those that were not scratched by a copper wire, “medium” being those that were not scratched by a fingernail, but were scratched by a copper wire, and “soft” being those samples that were scratched by a fingernail. The hardness of a vessel has important implications for the vessels durability. The tiles and vessels were variable, and soft, medium, and hard attributes were recorded within the experimental assemblage (Table 16).

Percentage of shrinkage is an important characteristic of clays used in vessel production since it may impact the survival rate of vessels during firing. The survival rate of the tiles and vessels during the experimental firings was high – 24 out of 28 survived firing – especially for unskilled potters using a variety of clays, some of which were known to be of inferior quality. The average shrinkage of the experimental tiles (Mean=9.25%) was similar to that of the commercial clay control tiles (9%). Shrinkage was recorded by marking a 5 cm long incision on the unfired wet clay tiles (Figure 42) and then measuring the incision post-firing (Table 16).

Heat transfer was measured by using a thermometer to track the amount of change (˚C) to a standardized amount of water at room temperature when a heated tile was placed into it (Table 16). Little differences in the experimental assemblage and the control tiles were noted in terms of their thermal conductivity. While a more precise measuring methodology might find more subtle differences, it is unlikely that these differences would have been observable to the producers and consumers of these vessels.

Absorbency was recorded by measuring the amount of weight change of a dry tile placed into water. Absorbency has been related to the functional characteristics (e.g. response to thermal shock) of pottery vessels in use (Nelson 2010). The percentage of absorbency was calculated by dividing the difference between the wet and dry weights, divided by the dry weight (Table 16). The absorbency of the experimental assemblage was found to be quite high – on average twice as absorbent (mean 24.89%) as the commercially available clays (13.8% observed) used as controls. The most absorbent samples (42.6% and 39.7%) would not have made viable cooking vessels and so were likely not used for this purpose unless some form of alteration reduced its absorbency (e.g. mixing with less absorbent clays, waterproofing with sap or resin, or the addition of certain tempers).

Several preliminary conclusions can be drawn from this experimental archaeology program. First, it was designed with a limited budget in mind. While more traditional forms of analyses such as neutron activation analysis (NAA), X-ray fluorescence (XRF), and other similar sourcing programs may have provided more detailed sourcing information, this project was designed to limit costs, and explore the experiential characteristics of the clay that indigenous potters may have encountered when exploring and then exploiting the region for clay sources. Using almost no funds, the research design allowed the researchers of TNAP to conclude that local clays were perfectly suitable for vessel production with a minimal amount of processing and without elaborate kilns (Kelsoe and Clark 2013). The clays collected during fieldwork performed similarly to modern, commercially available clays and resembled those found in the archaeological ceramic assemblage of the region.

Some researchers have taken note of the seemingly negative correlation between mobility and ceramic production (Arnold 1985; Bright and Ugan 1999; Eerkens 2008). A number of theories have been put forth to explain why mobile populations are less likely to produce and consume pottery. First, pottery is heavy and a hindrance when moving. Second, pottery is fragile and likely to break during moves. Third, it is expensive to produce since specialization and mass produced pottery is not a viable form of production with the often low population densities that accompany mobility. Finally, pottery production can take a long time and interfere with other tasks such as herding and the gathering of wild resources. Clearly, pottery was a part of the cultural material tradition in this region and so the experimental data can be used to begin to productively approach this issue.

The first three theories cannot, at this time, be examined to any great depth with the existing experimental data from TNAP, however, it can speak to the final theory. The experimental potters of TNAP with a limited amount of experience, resources, and time were able to create functional vessels. Working only after other project duties (survey, excavation, ethnoarchaeology) were completed, all of the steps from scouting, clay acquisition, processing, vessel forming, drying and firing occurred in less than three weeks. While the frequency of mobility in the region during late prehistoric and early historic times is not known, available archaeological evidence, ethnographic analogy and historical land-use patterns suggest that in this region it is likely to be on the scale of two to several months between moves (TNAP ethnographic notes; Bazargur 2005; Fernandez-Gimenez 2006; Houle 2010:25; Simukov 1934), thus providing ample time for pottery production. Therefore, at least in this region, production time and serious conflict with other tasks is unlikely to have been an overwhelming obstacle for potters (Kelsoe and Clark 2013).

The most concrete finding of this experimental work was that pottery production was feasible, but it also has pointed to a number of promising directions for future research. A consideration of the harsh winter conditions led us to consider that seasonality of pottery production may have been a concern. It may be suggested that such activities were probably limited to warmer months since clay acquisition while the ground was frozen, in addition to drying pre-fired vessels in cold months, would be very difficult. The use of pottery may be related to subsistence practices that demanded ceramic vessels instead of baskets or skin bags, a topic which future residue analysis may shed more light on. In particular, the author collaborated on a conference paper (Kelsoe et al. 2014) that explored the likelihood that vessels in the region were expediently made, disposable vessels. Pots with less investment in their production could be used and thrown away, eliminating the need for transport or complex production logistics that would have presented unique challenges for mobile populations (Gibbs 2012). This pattern has implications on the patterning of the material record and potentially could aid in determining seasonality (Kelsoe et al. 2014). Furthermore, future geochemical sourcing may provide evidence of inter-regional interaction though ceramic transport and trade.

5.5 CHARCOAL

Charcoal was discovered in many contexts and all charcoal identified on the ground surface during survey was ignored and assumed to be a result of modern activity. Sub-surface deposits of charcoal were discarded if no associated artifacts or features were found in the same context. The primary reason for collecting charcoal was for its potential use in radiocarbon dating. It was therefore collected very carefully with tweezers and stored in tinfoil packets to prevent contamination. If the charcoal was inadvertently touched, or exposed long before recognition, it was noted but not collected to prevent the wasteful carbon dating of a contaminated sample.

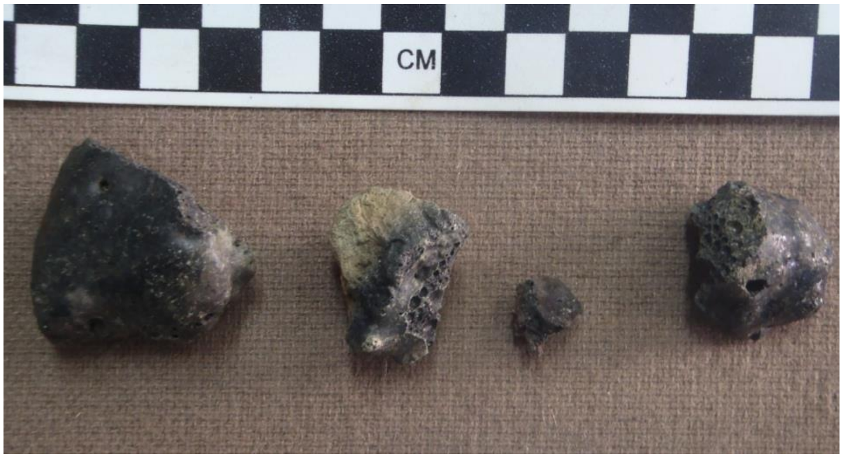
Two samples were selected for radiocarbon dating at the Accelerated Mass Spectrometry (AMS) Laboratory at the University of Arizona (Section 4.4.2). The remaining samples are being stored at the National Museum of Mongolia in Ulaanbaatar, Mongolia for use by future researchers. Though the research questions of this dissertation would benefit most from the systematic dating of habitation contexts, none of the domestic contexts found during the 2012 field season were deemed secure enough to warrant dating. Given the variation of depositional contexts as well as the small sample number (only 4 areas were selected for excavation), this should not be taken as an indication that future excavations of habitation areas in the region would be unable to produce reliable C-14 dating samples.

5.6 METALS AND METAL PRODUCTION WASTE

A number of metal artifacts and evidence of metal production were found in a variety of contexts. It can often be very difficult to provide relative dates for metal fragments and to separate contemporary and recent historical metals from more ancient types without more advanced methods of analysis. Many of the fragments collected during the survey were later determined to be recently discarded trash. Most of these were fragments of metal cooking vessels, auto parts, hardware such as nails and wire, and various broken or lost tools. A single iron projectile point was found in a shovel probe, likely dating to the Medieval Period (Figure 43).

Figure 43: Iron Projectile Point

Figure 44: Evidence of High Temperature Activity – Vitrified hearth lining



Though not common, in a few instances fragments of vitrified hearth lining were found within ceramic scatters (Figure 44). They were not found as a feature, that is, *in situ*, but rather as fragments on the surface. This material is attributed to features associated with high temperature industry (900-1250 ˚C) such as ceramic production and metallurgy, though without further chemical analysis, it is not possible to determine the specific industry or date (Derek Pitman personal communication).

6.0 SPATIAL PATTERNING

This chapter provides a more detailed discussion of the results of the survey data and an interpretation of possible spatial relationships between diagnostic artifacts, key topographical and environmental characteristics, and predictive modeling of land use based on inductive and deductive sources of information. One of the primary objectives of any survey is an understanding of these important spatial relationships, a critical component of the landscape approach laid out in Section 1.2. It is unlikely that prehistoric human activity was randomly distributed within the landscape and so identifiable spatial patterns of activity may contain a great deal of information. The ritual, political, and economic practices of a given group take place in the same landscape, and their relationship to one another spatially may be informative with regard to how these activities were organized. Furthermore, the implementation of a predictive model makes these relationships more explicit in terms of evaluating the model's success. That is, "were the hypothesized spatial relationships used to create the model reliable?"

6.1 EVALUATING THE MODEL

When using a predictive model, it is important to evaluate its success by determining how well it performed its primary goals. The goal of the predictive model used in this project was to locate late prehistoric and early historic habitation areas within the defined project area. Since the model was created using data from other projects conducted in other regions of Mongolia as well as current land use practices, evaluating the model may also contain important information about how similar or different late prehistoric and early historic habitation patterns in this region are to others in Mongolia, and how similar modern day patterns may be to earlier land use practices.

The most important characteristic of the model is its *flexibility* in terms of being evaluated and modified in order to improve its application in future research. For example, even though the predictive modeling methods employed within the dissertation research seemed to be effective in locating artifact scatters, it is important to question how much may have been missed through using such a predictive approach. By comparing the results of the intensive and extensive surveys, one can evaluate this important question. If areas not covered by the intensive survey (i.e. found during extensive survey or in the sample areas of low likelihood – see Section 4.2) are found to have significant evidence of habitation within them, then it is clear that the predictive model is not producing optimal results and needs to be revised. Additionally, intensive survey methods were used outside of the areas highlighted by the predictive model to be used as a 'check' on the assumptions of the model. If significant archaeological finds were located here, outside the model, it would suggest that the model was not very accurate. By noting the method of recovery (intensive or extensive survey) and location (within or outside the predictive model) for each artifact find, the overall success of the model can be determined.

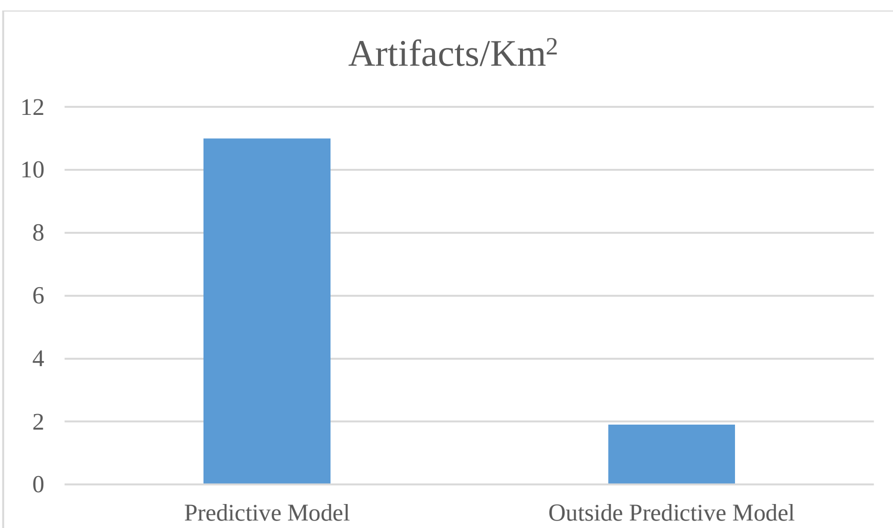
Table 11: Artifacts by survey method and location

	Total Project Area	Project Area NOT in Predictive Model	Predictive Model Area	Check Area
Km^2	57.245	52.238	5.007	1.204
Extensive Survey Artifacts	152	97	55	N/A
Intensive Survey Artifacts	281	N/A	276	5

The *reactive nature* of the predictive model might best be explained through a specific example of how the model was modified during fieldwork. The model initially targeted flatter areas nestled against hill slopes that provide protection against the wind. However, extensive survey located an artifact scatter on a relatively flat, but elevated area with no protection from the wind. An intensive survey was then conducted over this region (both surface and subsurface methods being employed) and this indicated that there was abundant evidence of burning below the surface (e.g. charcoal, burnt bone and discolored soil) in addition to the sherds that had been found on the surface. It was then hypothesized that these artifact scatters might be related to a specialized kind of site in which burning activities produced a lot of smoke, and the elevated, exposed nature of the site helped to clear the smoke away in addition to providing adequate levels of oxygen and airflow. Such a site, for example, could be used for metal production. Alternatively, if the population of the area was so great that the best campsites were taken, less than favorable locations may have been utilized, though given the thin, dispersed artifact scatters, this seems unlikely. A similar set of hypotheses had been suggested for a site (known as MAC) on the Khanuy Valley Archaeology Project (Houle 2010:54). Given this new evidence along with a known example from another region, the predictive model was revised to include flat, but elevated areas and at least one other similar site was then located with the revised model.

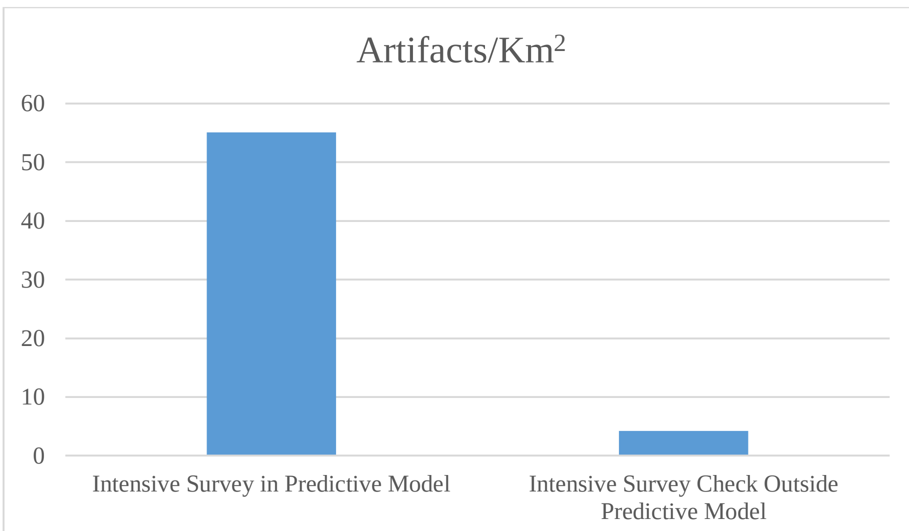
The intensive survey led by the parameters of the predictive model covered an area of 5 km^2, or just under 10% of the total 57.2 km^2 project area, the entirety of which was covered by the extensive survey (20 m transects). In addition, an area of 1.2 km^2 was intensively surveyed in areas not within the predictive model, thus providing a check on the predictive model methodology. Assuming that many of these sites could not have been found without the use of intensive survey efforts, this reduces the amount of area that must be approached with such a concentrated methodology by nearly 90%. In sum, 152 artifacts were located using the extensive survey technique – 55 of which were located within the predictive model area while the remaining 97 were located outside of these areas. Normalizing these artifact counts for the total area surveyed, the predictive model areas had an artifact density of 11 artifacts/km^2 while the remaining project area outside of the predictive model contained only 1.9 artifacts/km^2 (Figure 45). That is, the predictive model was successful in locating those areas most likely to contain artifact scatters.

Figure 45: Artifacts per square kilometer inside and outside of the predictive model



Another similar but slightly different way to assess the model is to look at the number of artifacts found within the predictive model per square km, and compare that to the number found in the check areas per square km outside the model. A total of 281 artifacts were found using the surface intensive survey methodology, of which 276 were located within the model and only 5 found in the checked areas. Normalized for area covered by each type of area, the predictive model area produced 55.1 artifacts/km^2 while the check area produced only 4.2 artifacts/km^2 when intensively surveyed (Figure 46).

Figure 46: Artifacts per square kilometer of intensive survey within predictive model and in check area



During an unsystematic survey of the valley directly to the north of the project area (Section 4.3.3), the predictive model was implemented but unaided by systematic survey as it was not in the official research area. Though only exploratory and cursory in nature, it was successful in locating several sites with very little effort. From the top of a hill with good visibility, natural ‘cove’ like locations were identified and marked as possible habitation locations. Figure 47 shows an example of one such ‘ideal’ location that proved to contain a relatively abundant lithic and ceramic assemblage.

Figure 47: "Ideal" campsite location identified with the predictive model

It is not likely that any predictive model would be able to catch every artifact in a given area. Some of these missed artifacts may be outliers, while others may be the result of activities that the predictive model does not account for. If these activities can be identified, then the predictive model can be revised in order to improve its recovery rate for these artifacts. One possibility is that the predictive model is capable of locating the camps of some seasons while missing the others. That is, if the parameters of selecting a winter campsite are different from those of a summer campsite, which they almost certainly are, the predictive model may more closely match one set of parameters thus doing a better job of finding sites of that season. A second possibility is that there may have been functional differences between sites and the predictive model has been calibrated to 'catch' only certain 'kinds' of sites. This seems to be the case with the two such elevated artifact scatters found during survey in areas that were outside the initial predictive model (discussed in this section above). If in fact they were placed in elevated areas in order to allow the wind to carry smoke away, then it is likely that some activity not carried out at other types of sites was taking place that produced an abundance of smoke.

However, it is important to keep in mind that no matter how refined the model becomes, it is unlikely that a 100% recovery rate could be expected. Nor should this result be sought since the predictive model would need to be so inclusive that it would likely reduce the efficiency for which it was implemented in the first place. A variety of activities and 'accidents' might explain some of the artifacts missed by the predictive model. Herders following their flocks or hunters searching for game may have fashioned their stone tools potentially kilometers away from their residences. Ceramic vessels may have been broken away from the home in accidental 'pot drops' either while herding, hunting, fetching water, or during seasonal moves.

The current version of the predictive model might be critiqued as relying too heavily upon the environment while ignoring the impact that the social and ritual landscapes may have played on habitation location. This is simply a product of the information available. It is hoped that the data collected on this project and future research might help to rectify this imbalance. On a larger scale, the project area was selected in part because of its proximity to an abundant ritual landscape. Thus, it incorporated ritual elements into the model at one level (the selection of the project area). It is the smaller scale relationships, those between settlement and ritual sites *within* a given landscape, which need to be explored in greater detail.

By matching the survey methodology to that of pervious projects focused on pastoralists, and by utilizing ethnoarchaeological data from modern day herders, this survey perhaps was not designed appropriately to target zones that would yield evidence of hunter-gatherer-fisher activity. Specifically, the 57 km^2 may not be big enough to 'catch' evidence of such subsistence patterns. While critics might suggest that this is a shortfall of the project design, there are a number of positive returns as a result of this approach. First, they are highly comparable to the results of other projects completed in Mongolia that have focused on late prehistoric pastoral evidence. If the methodology had been radically revised, comparisons between this project and the Khanuy Valley Archaeology Project and the Egin Gol Survey Project would have been greatly reduced. Second, the results of this dissertation research and survey do suggest that there is a major reorganization of land-use practices that occurs *after* the Early Bronze Age. Early Bronze Age artifact scatters and evidence for possible Meso-Neolithic activity (i.e. microlithics, lithic only scatters) correspond with each other but poorly with other periods (more on this below: Section 6.3, Figure 56, Figure 39). Late Bronze Age artifact scatters are organized in a much different way and occupy spatially much more of the landscape (see below: Section 6.2, Section 6.3, Figure 50).

Ultimately, it is envisioned that the results of this project will help to both construct and refine survey methods and predictive models for targeting hunter-gatherer-fisher activity areas. Currently, very little is known about such landscapes and activity zones in this northern region. Some work has been undertaken in the Gobi Desert and Eastern Mongolia (Section 3.1.2) while the northern region remains relatively understudied with the exception of some exploratory surveys (J. Olsen 2003). Ethnographic research of hunter-gatherer-fisher communities within the region is challenging since herders primarily occupy the region today (though see Surovell et al. 2014). Therefore, although the dissertation research recovered a small amount of evidence for hunter-gatherer activity, this can now be used as an important resource for the further development and refinement of more inclusive models that may be more effective in identifying broader patterning connected with late prehistoric hunter-gatherer orientations.

Simply put, the methodologies needed to efficiently identify each kind of prehistoric site are different. For example, highly concentrated artifact scatters may be investigated very differently than highly dispersed artifact scatters. Going into the Targan Nuur Archaeology

Project, it was unknown what might be recovered in terms of material remains left by hunter-gatherers, mixed economies, and herders. It might have been surmised, as it turned out, that hunter-gatherer seasonal activities, being earlier and perhaps more spatially distributed, might have left more dispersed, ephemeral evidence while later herders left a more permanent and less spatially distributed trace. This assumption, however, had not previously been tested for the region and this was a crucial first step that needed to be accomplished.

6.2 RELATIONSHIP OF MONUMENTS TO ONE ANOTHER

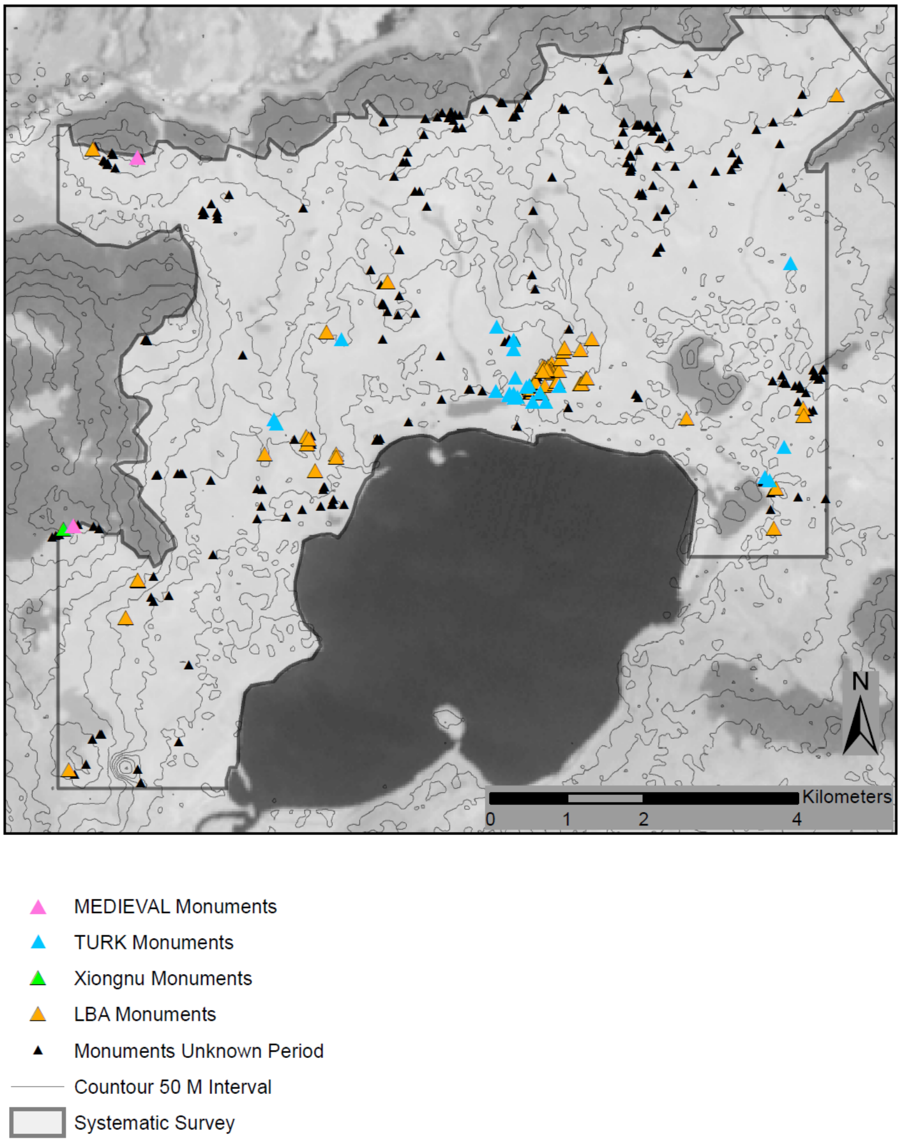
While important new work continues on the rich and fascinating ritual landscape of Mongolia, as noted in previous chapters within this dissertation, there is a growing body of work already produced from research on monuments in the region (Allard and Erdenebaatar 2005; Fitzhugh 2009a; Frohlich et al. 2008; Volkov 1981; Wright 2007). The Targan Nuur Archaeology project employed a full coverage survey and therefore all site types encountered during fieldwork were recorded. This important data allows for a more nuanced investigation and interpretation of the landscape incorporating both domestic and ritual features. Comparing ritual sites of different periods to one another allows for an investigation of the development of the ritual landscape in space and through time that, as discussed in Chapter One, has been strongly advocated by numerous scholars (Ingold 1980; Jordan 2011; Wright 2014). It is important to note that the predictive model was not designed to, and therefore does not, 'predict' locations of ritual activity. However, the 20-30 m transects used to survey the entire project area should have caught all monuments, and so it is expected that the predictive model did not influence the density of monuments recorded within these select areas. Monuments are located in many different kinds of areas and, at least at this scale, ecological and land use modeling does not suggest any clear cut patterning for the location of ritual zones as indicated by monuments.

As in many other parts of the world, it has been noted for Mongolia that monuments built in earlier periods are sometimes appropriated and altered or added on to by later inhabitants (Houle 2010:17; Wright 2006:212). Notably, in central Mongolia, slab burials are often placed in and around earlier constructed *Khirigsuurs* and Deer Stones. No clear slab burials were found within the Targan Nuur Project Area. While there may have been some association between monument clusters of different eras, there are no clear, or at least detectable, examples of their re-use or alteration (with the exception of some very recent, modern looting and reuse as a toilet!). Clusters of different periods may be near to one another, but do not seem to overlap directly.

While all stone features were recorded during fieldwork, most of them cannot be definitively assigned to one period or another (Figure 48). Though it is thought that many of them date to the Late Bronze Age, simple stone mounds, rings, and amorphous rock formations could have been created in any number of different periods. Taphonomic processes may have obscured some features that may once have been diagnostic. This creates a statistical problem since most of the cases are "unknown". Excavations in other regions have revealed that interments sometimes have little or no surface marking (Amartuvshin and Honeychurch 2010; Brosseder and Miller 2011:24; Minyaev 1998).

These features do not conform to the standard monument typologies and are not identifiable to period without further investigation (through excavation). The biggest and most elaborate burials, then, are identifiable to relative chronological periods while those burials and ritual sites with the least investment are labeled as "unknown" or possibly missed entirely. When it was possible, a time period was assigned based on previous research in Mongolia that has correlated certain feature clusters or forms with particular periods. Associated artifacts (such as ceramics) are rare within monument complexes and nearby scatters are often multi-component, and so monuments are not dateable through this type of correlation.

Figure 48: Monuments by period



It is clear that among the monuments that can be attributed to a particular period, Late Bronze Age (LBA) monuments are the most widespread with many distinct clusters being found in all corners of the project area (Figure 48). Monuments belonging to other periods are much more restricted in terms of number of clusters or topographical location (e.g. only along the edge of the forest). In terms of visibility on the landscape, the ubiquity of LBA monuments suggests that they communicated to inhabitants and passing visitors clearly and repeatedly. The exact content or purpose of this message is not known, but it likely had a combination of territorial, ritual, and political implications. The abundance in a variety of locals also implies relatively open access to ritual or at least the observation of ritual activities.

As in other areas of Mongolia where they are found peripheral to the main valley and pasturelands (Allard et al. 2002; Wright 2006:126), a single example of a clear Xiongnu-type cemetery with two classic ramped burials (Brosseder and Miller 2011:24) was found just inside the tree line on top of a ridge. It was reminiscent of the royal burial complexes of central Mongolia (Allard et al. 2002). This pair of burial monuments appears to be earthen rather than stone (though internal construction materials and methods are not known) and rather small (about 10 m across). It clearly was not meant to be highly visible from the campsites and trails or roadways in the basin as some of the other monuments on the basin floor might be argued to be, but rather was a special site with limited access. Unfortunately, these features had all been looted quite recently and human remains (MNI=3) and grave construction materials were strewn about the surface of the burial feature.

6.3 RELATIONSHIP OF MONUMENTS TO OCCUPATION AREAS

The ritual monuments of northeast Asia are a physical manifestation and reflection of some aspect(s) of the society that builds and uses them, whether that be spiritual, social, political, or economic (Allard and Erdenebaatar 2005; Jordan 2011; Wright 2014). The ritual landscape is often the *only* physical evidence of ancient activity on the surface, so being able to formulate hypothetical relationships between ritual and domestic spaces may help future researchers to select field sites and build predictive models that more accurately address their research questions.

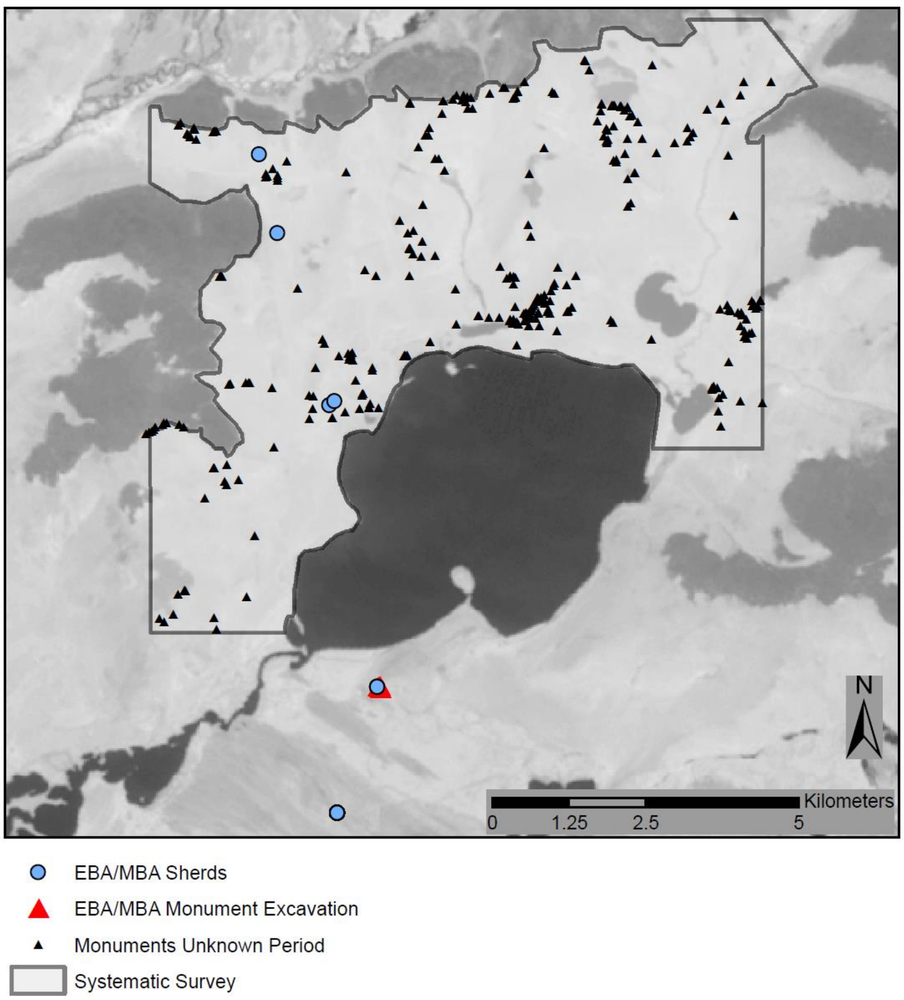
In many cases, the monuments are built in areas that are unsuitable for habitation because of their slope or exposure to the elements, and so these two types of use-areas do not overlap. While prominent as potential territory markers on the landscape, it would be difficult to live in these areas and so the monuments might act to signal to passing individuals and groups the territorial claims of the groups who chose to live for logistical reasons in the more hidden, sheltered locals of the basin.

In other cases, however, they may occupy the same area on the landscape, thus representing a palimpsest of occupation and ritual space. This may at times be contemporary, sometimes inducing remembrance and reverence via the monuments of ancestors or previous inhabitants of the region, and probably sometimes accidental or without clear association to the wider significance of the ritual landscape.

Thin artifact scatters were located in the vicinity of monument clusters. These deposits were so thin that further research will need to be done to determine their nature, that is, whether they can be attributed to domestic activity, ritual activity, or some other process. In other regions of Mongolia, domestic sites have been found near smaller ritual sites such as small *Khirigsuurs* and slope burials. However, artifacts other than bone offerings and occasionally a human burial are rarely found within these monuments. *Khirigsuurs* and Deer Stones are typically devoid of ceramics or metal goods suggesting that the domestic and ritual spaces are clearly separated spatially.

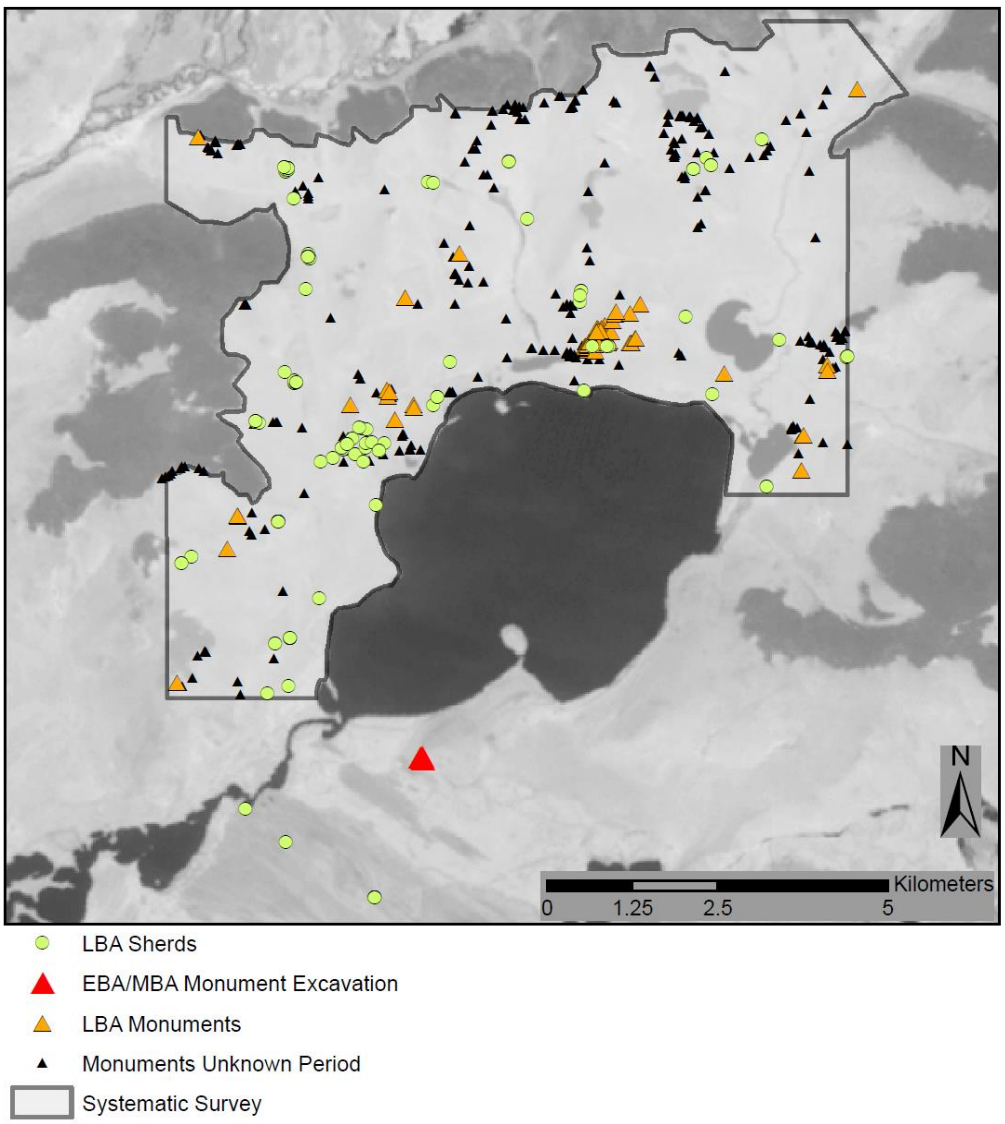
Monuments remain a visible part of the landscape, while activity areas of other types are more obscured soon after they are abandoned. Though it is true that there may have been social memory regarding where ancestors and former inhabitants lived, the impact of this kind of activity on the landscape is more subtle. Therefore, in the following maps (Figure 49, Figure 50, Figure 51, and Figure 52), the monumental landscape develops and remains visible while the artifact scatters appear and disappear with each period to explore the relationships of occupation areas and monuments in a historical way.

Figure 49: EBA/MBA Sherds and Monuments



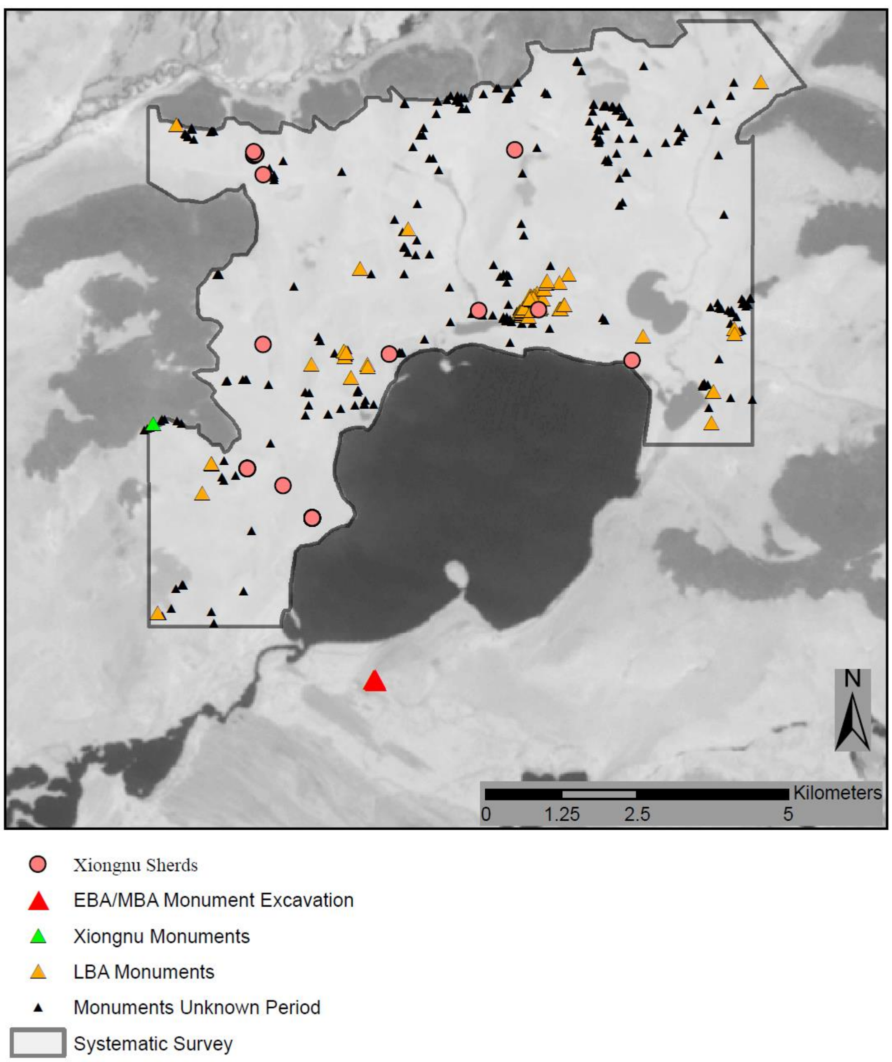
The single identified Early Bronze Age (EBA) monument was confirmed through ceramics and a C-14 date from charcoal recovered during excavation (Section 4.4.2). This monument was located just south of the western side of the systematic project area (Figure 49). It is possible that other monuments from this period exist among the remaining 'unknown period' monuments. All Early and Middle Bronze Age ceramics are restricted to a single draw on the western side of the systematic project area, as well as in and near the EBA burial (though these latter contexts were not part of the systematic survey). More on this distribution will be presented below (Section 6.4). It is possible that activity areas and monuments are spatially related, though more examples would have to be identified to strengthen this claim.

Figure 50: LBA Sherds and Monuments from the EBA through LBA



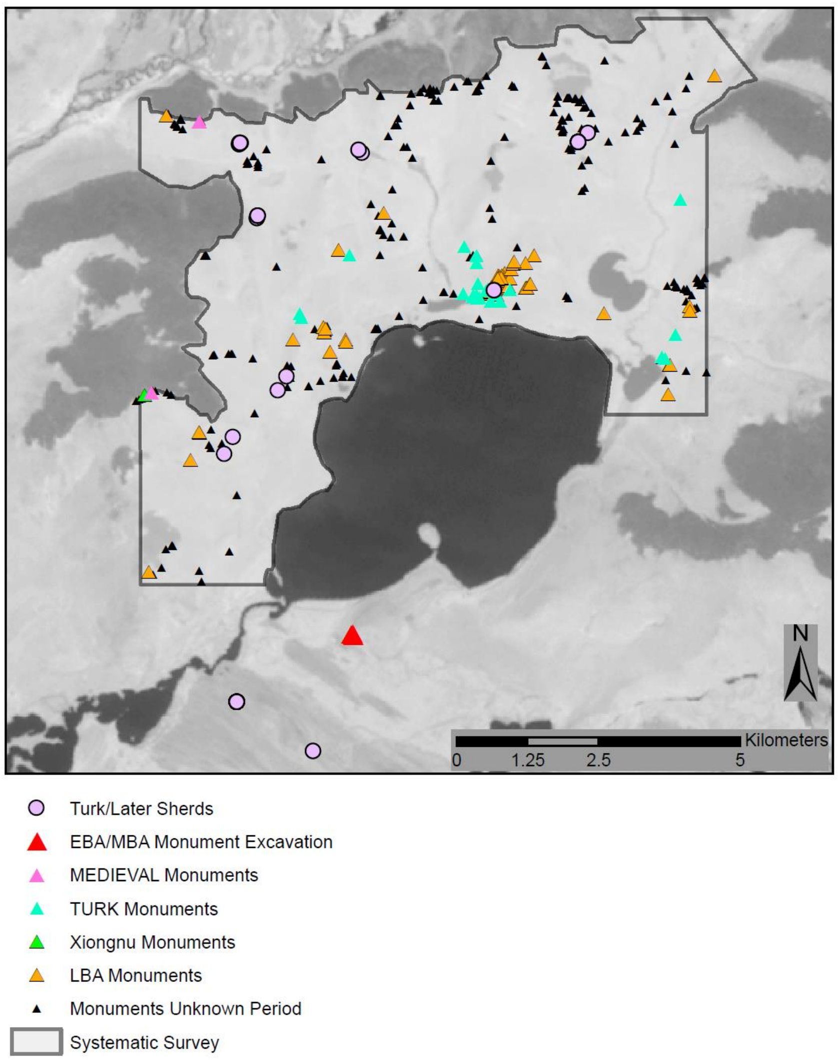
Late Bronze Age sherds and monuments are spread throughout the systematic project area (Figure 50). Clusters of both exist, and sometimes are situated in the same general area, although this is not always the case. The densest monument clusters do not occur near the densest ceramic clusters. Conversely, some LBA sherd scatters are not located near any monuments whatsoever. The location of monuments at this scale does not appear to be influencing, or to be influenced by, occupation or other types of activity areas. The draw with EBA/MBA activity does contain an LBA monument cluster at its mouth and clusters of LBA sherds, perhaps indicating its continued importance.

Figure 51: Xiongnu Sherds and Monuments from the EBA through Xiongnu Period



The only confirmed Xiongnu monuments lie along the far western edge of the systematic project area (Figure 51). Xiongnu sherds, however, are not similarly constricted. They are found throughout the project area. Monuments of the Xiongnu period do not appear to be heavily influencing the spatial location of other types of activities, including habitation. The location of these monuments is, once again, on the western edge of the systematic project area perhaps indicating its continued importance.

Figure 52: Turkic and Later Period Sherds and Monuments from the EBA through Medieval Period



Turkic monuments are densely clustered in the south-central portion of the systematic project area along the northern shore of Targan Nuur (Figure 52). Turkic and later period sherds are not located near this cluster with a single exception. Thus, it appears that in this period there is a clear delineation between ritual/monumental space and domestic/other types of activity areas.

The two examples of obvious Medieval period monuments are cliff burials located near tree lines along the western edge of the project area (Figure 52). Unfortunately, Medieval period ceramics were not collected (common practice in Mongolia) and so they cannot be correlated to other activities. However, they were located in areas unsuitable for occupation high on steep slopes at the bases of cliffs. They are once again along the western edge of the systematic project area, perhaps reinforcing the importance of this ridge or corridor diachronically.

It is important to note that the observed correlations (or lack of depending on the period) would surely be different when placed into a larger context beyond the scale of the systematic project area. The project area was selected in a region with a relative abundance of LBA monuments when compared with the surrounding region (Section 4.1). However, it's possible that at a larger scale, monuments are impacting settlement location (or vice versa). Future research in regions with relatively few monuments will have to be conducted to determine the validity of this hypothesis.

6.4 RELATIONSHIP OF OCCUPATION AREAS TO ONE ANOTHER

An understanding of the spatial organization of domestic space in a given period and through time has the potential to reveal much about the populations of a given region (Drennan and Peterson 2008, 2011; Houle 2010). Consistent with other regions of Mongolia, there appears to be no clear settlement hierarchy in terms of size or importance, but rather a series of small (<1 ha to a few ha in size) occupation areas. These occupation areas are dispersed around the landscape, usually in areas identified by the predictive model as being highly likely to contain habitation. Nearly every area identified by the predictive model does contain a prehistoric or early historic artifact scatter within it. Since the predictive model was constructed primarily on the basis of environmental parameters, it seems that natural features of the landscape strongly influenced decisions about campsite location and perhaps more so than social or political forces. That is not to say that social or political dynamics played no part in settlement decisions, or more importantly that social, political and economic spheres were not impacted by the spatial organization of settlements.

6.4.1 Intensity and Organization of Occupation

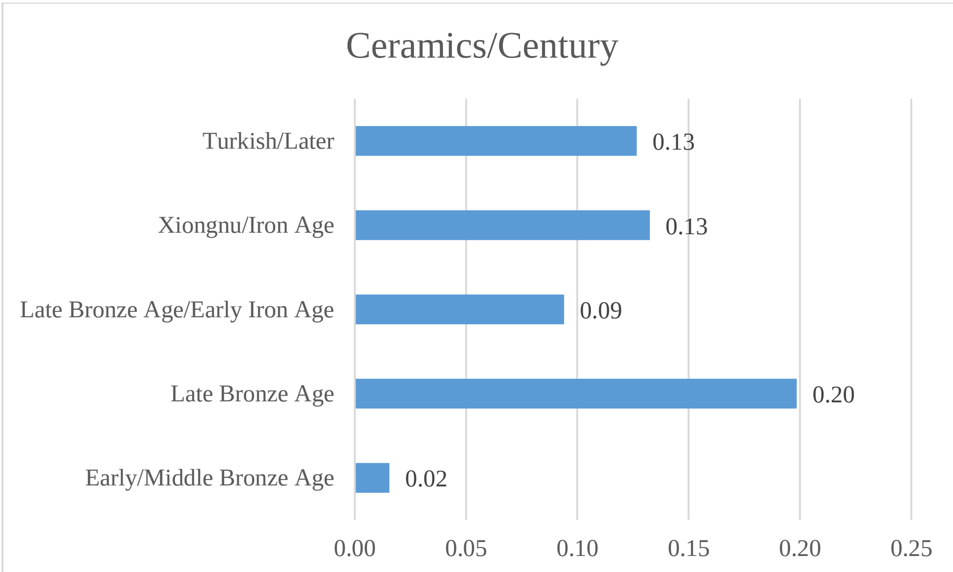
It is difficult to estimate the absolute number of people and even campsites on the landscape at any one moment in the past since occupation areas are seasonal, flexible and no specific features, such as hearths or tent rings, were identified in this research project. Ethnographic analogy in Mongolia suggests that campsites constructed by contemporary herders are used for only a few months at a time, and are occasionally abandoned and relocated altogether. The Khanuy Valley Archaeology Project estimated prehistoric population density based on artifact density at summer and winter campsites (Houle 2010:72-77). This is somewhat more difficult in the Targan Nuur region since it is not clear if the area covered by the systematic survey includes campsites from all seasons, that is, both winter and summer occupations. Furthermore, while there are several summer campsites observed today within the survey boundaries, only a few winter campsites are present and most residents report moving out of the vicinity of the lake during the winter months due to heavy snows and high winds.

What is clear is that relative to the abundance of artifacts in the Khanuy Valley, the deposits of artifacts in the Targan Nuur area are noticeably thinner suggesting a less intense, lower density occupation of the region. Not only do the absolute numbers of artifacts/km^2 reflect this, but simply the effectiveness of certain methodologies in locating artifact scatters is informative. While shovel probes were necessary to locate shallow subsurface deposits in the Khanuy Valley, they were less effective in Targan Nuur since deposits were so thin that even at 20 m spacing, some scatters were not detected without closer (i.e. intensive survey; see Section 4.3.3) surface examination. Similarly, projects in Egiin Gol (Honeychurch et al. 2007) and Tarvagtai Gol (William Gardner, personal communication) were able to use 20 m (or greater) transects of pedestrian survey, auger testing, and shovel probes, all of which proved only moderately successful in locating artifact scatters in Targan Nuur.

It appears that the Targan Nuur region was occupied continuously from some time in the Paleolithic until the present as evidenced by diagnostic artifacts from all time periods. While there may have been some small hiatus in occupation, it occurred at such a small scale that current data do not reflect this. However, the population, as evidenced by the density of artifacts located in the systematic survey area, was not static. Assuming a relatively consistent use, breakage and preservation of pottery, the relative number of sherds in a given period should give a relative approximation of the population when compared to periods of similar time scale. Since all sherds from the Early Bronze Age to the Turkic period were collected from all contexts, there should be no methodological bias towards one period or another. These were normalized for the length of the period by dividing by the approximate numbers of centuries in each period (Table 7). A quick look at Table 7 and Figure 53 reveals that there are many more sherds from the Late Bronze Age (n=139, .2/century) than any other period (the next greatest density is a tie between

Xiongnu with n=53, and Turkish/Later period sherds with n=76, each at .13/century). The density and ubiquity of Late Bronze Age monuments (Section 6.2) seems to corroborate the interpretation that the intensity of occupation was greatest during this period.

Figure 53: Ceramics per century by period



One way of comparing intensity of occupation is looking at the number of artifacts per unit of area. Since different survey methods were used, primarily shovel probes in the Khanuy Valley, and surface survey in Targan Nuur, the comparison between excavations is a more reliable indicator of relative settlement intensity. Since it is possible that different taphonomic processes may have impacted the depths of the deposits, the 2-dimensional area (not the volume) is used to calculate sherd density (in this case, per m^2). In the Khanuy Valley, 14 excavated sites contain an average of 6.02 sherds per m^2 (ranging from 11.06 to .61). Though using a smaller sample of 4 sites in Targan Nuur, the difference is clear with an average of .76 sherds per m^2 (ranging from 1.38 to .25) (Figure 54). Clearly the intensity of settlement in Targan Nuur (either the total number of people *and/or* the length of occupation) was much less than that of the Khanuy Valley. A similar pattern is found when only Late Bronze Age occupation is considered

(Figure 55). The Khanuy Valley Project contains an average of 2.4 LBA sherds/m^2 (ranging from 5.19 to .18) while the Targan Nuur Archaeology Project recovered an average of only .41 LBA sherds/m^2 (ranging from .69 to .19).

Figure 54: Khanuy and TNAP sherds per square meter in excavation

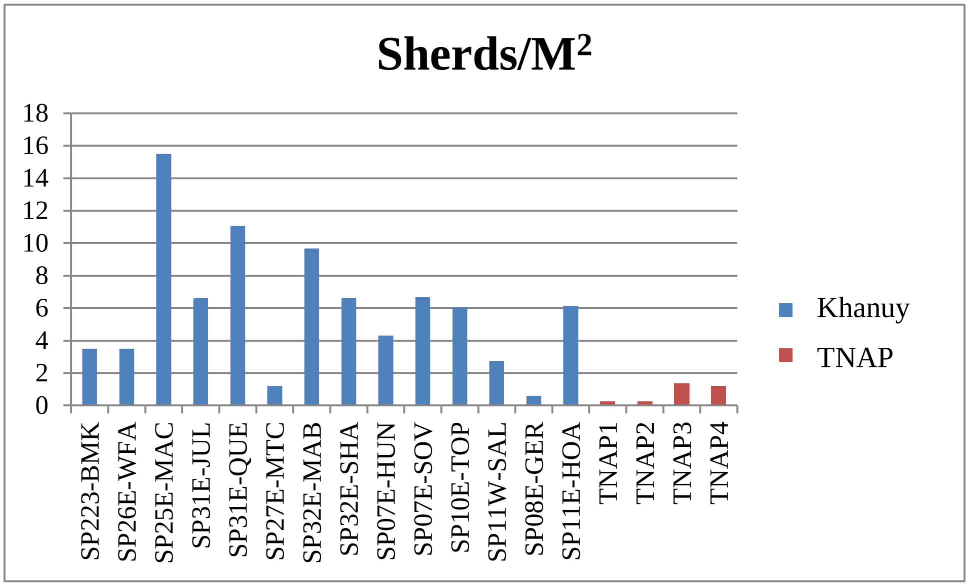
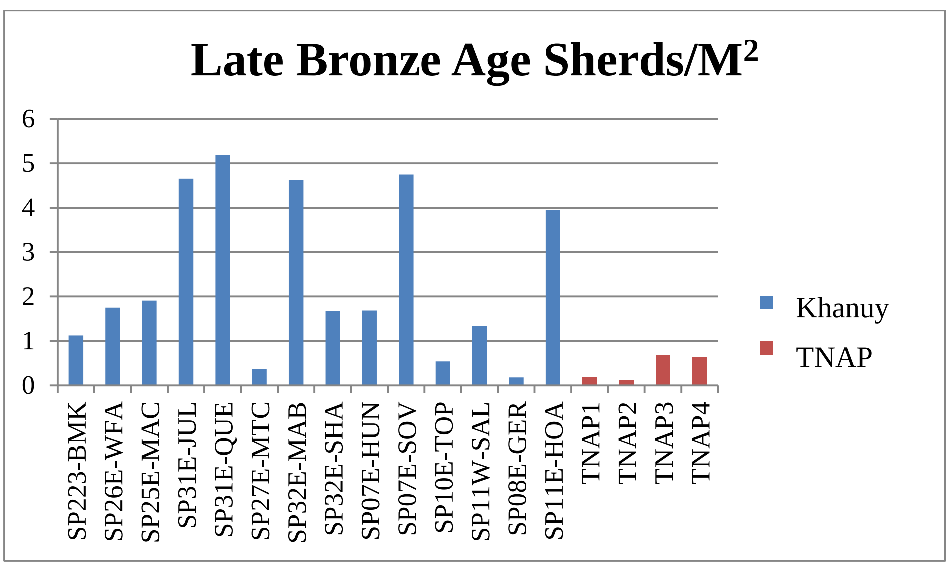


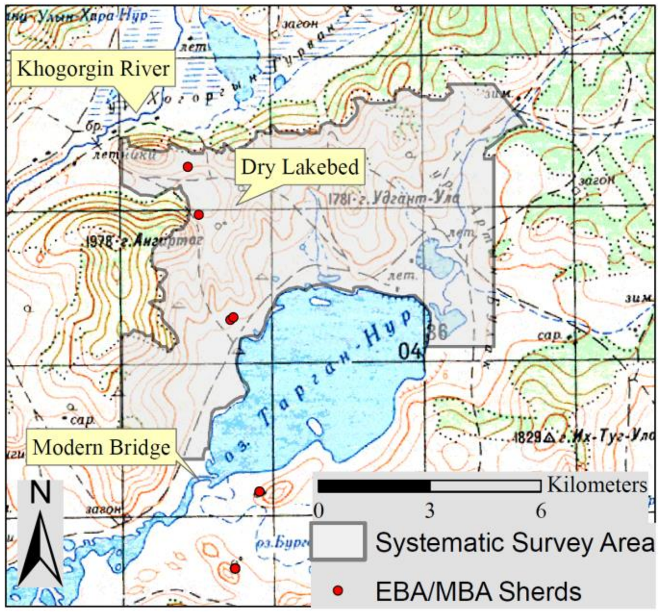
Figure 55: Khanuy and TNAP LBA sherds per square meter in excavation



Comparisons between these two projects are not applicable to other periods since LBA sites were targeted in both projects, thereby possibly selecting against sites with other periods represented. However, it is interesting to note that while sites excavated by the Khanuy Valley Project all contained Xiongnu period sherds, and in a greater proportion than any other period (usually only Xiongnu and LBA), only 4 Xiongnu sherds (less than 10% of the total; 2 sites had none) were recovered from excavations on the Targan Nuur Archaeology Project. In the Khanuy Valley, nearly all Bronze Age sites are located directly beneath Iron Age sites that are in turn under campsites that are occupied to this day. This evidence suggests occupation of nearly every valley draw in the foothills during the winter with a distribution of sites every few kilometers along the river in summer (Houle 2009). The spatial settlement data from the Targan Nuur Archaeology project are less patterned. While all sites are multi-component, there is no clear overlap of the Bronze and Iron Age in all sites and, in many cases, archaeological sites occur in areas where there is no detectable recent occupation. There are two possible explanations that might account for this observation, although they are not mutually exclusive. First, perhaps Xiongnu inhabitants did not occupy the same locations as the Late Bronze Age occupants of the region. Second, while the population of the Khanuy Valley remained stable or even increased in the Xiongnu Period, it decreased substantially in the Targan Nuur region. The second possibility is supported by the fact that many fewer Xiongnu period sherds were found using all methods (survey and excavation) – 186 LBA sherds compared to only 53 Xiongnu sherds.

In terms of location, there are some differences in settlement patterning through time. The most obvious of these is seen in the location of Early and Middle Bronze Age deposits (Figure 56). The earliest Bronze Age sherds found during 2012 fieldwork are confined to a single draw along the western portion of the project area. Throughout the various time periods represented in the ceramic assemblage, this particular corridor continues to yield ceramic material. However, in all periods following the Middle Bronze Age, the ceramic deposits are also found elsewhere in the project area both along the lake and in the surrounding draws. This draw also is the only location where micro-blade lithics, thought to be indicative of the Epipaleolithic/Neolithic (Section 3.1.1; Janz 2012:34) were recovered (Figure 39).

Figure 56: Landmarks in draw with disproportional activity



With the present data it is difficult to say with certainty the reason for the importance of this corridor, but there are several reasons that can be posited as to why it might be utilized more heavily than others by early inhabitants. A seasonal pond is found at the head of this draw. During the time of fieldwork (a drought according to locals) it was dry, though previous water levels may have been higher or it may have been an important seasonal resource. This draw is topographically convenient for movement (Figure 56), as the presence of a modern bridge at this location indicates. The location also is situated at a point where the water is most narrow between the connected lakes of Targan Nuur and Tsagaan Nuur. Following the draw to the north, there are elevation passes to the Khogorgin Gol (river) to both the west and north. Views from the ridge here have a great vantage of both the Targan Nuur and the surrounding area, and the Khogorgin Valley. This location does not contain the densest concentration of monuments, though there are monuments distributed throughout and a clear cluster of Late Bronze Age monuments is found at the mouth of the draw. The restriction of these sites to this particular corridor could be indicative of a different pattern of mobility, of which this survey project identified only one portion of a larger seasonal round of movement.

7.0 THEORETICAL IMPLICATIONS OF THIS RESEARCH PROGRAM

Fieldwork activities undertaken by the Targan Nuur Archaeology Project were structured according to explicit research questions. At the end of the 2012 field season, some research questions can be answered, at least partially, while others remain elusive and in need of a different approach. Each research question is addressed in the following sections based on its key theme as follows: comparison (Section 7.2), inter-regional interaction (Section 7.3), diachronic economic shifts (Section 7.4), and demography (Section 7.5).

7.1 EVALUATING THE RESEARCH QUESTIONS

The research questions presented above in Section 1.5 of Chapter One are here addressed in terms of what the research program has accomplished.

1. What environmental and cultural factors influence habitation site location and seasonal mobility in the Darkhad Depression today?

Ethnoarchaeological investigations undertaken during the fieldwork of the Targan Nuur Archaeological Project directly addressed this question by collecting data on modern and historical land-use practices in the region. Important cultural and environmental factors influencing habitation site location and seasonal mobility include: proximity to kin (fictive and genealogical) networks, familial traditions regarding camp locations and seasonal movement timing, the presence of alternative economic opportunities (e.g. small scale jade mining), historical precedents (e.g. resettlement during the Soviet era), accessibility of resources (wood, water, pasture), and topographical and climatic considerations (e.g. protection from winds and micro-regions with less snow-pack). These data were then successfully incorporated into the predictive model in order to direct archaeological survey towards promising locales for habitation. This information also acts as a powerful tool for comparison with ethnoarchaeological data collected in other regions when considering shifts in social, economic and ritual organization.

2. Is there a spatial correlation between ritual monuments and earlier hunter-gatherer-fisher activity/occupation zones? With Bronze Age habitation? With Iron Age habitation?

While both ritual monuments and activity/occupation zones have been found within the project area a clear spatial pattern has not emerged. Artifact scatters of different periods appear to be scattered within the 57 km^2 project area as are the monuments of these same periods. Early/Middle Bronze Age artifact scatters are limited to a single clearly distinguished north-south trending draw (Figure 56), while artifact scatters from later periods (Late Bronze Age, Iron Age, Turkic and later periods) are more dispersed throughout the project area. Most artifact scatters are multicomponent showing some consistency regarding land-use practices, with the exception of this Early/Middle Bronze Age to Late Bronze age shift.

3. Is there evidence for specialization or non-local artifacts within identifiable habitation zones? Does this vary chronologically?

While non-local artifacts appear to be present, the full extent to which artifacts are local or non-local is unknown. Specialization does not appear as most sites contain the same set of artifact classes in roughly similar proportions. At this time, a diachronic assessment is not possible since all sites and all stratigraphic layers within excavations appear to be multi-component, that is, they produced materials from more than one chronological period. Targeted excavation revealed poor stratigraphic contexts and evidence of mixing between levels due to bioturbation and other cultural and natural processes. The experimental archaeology that was conducted, as a part of this project, has been very beneficial as it provides evidence that good clay sources exist locally and that pottery *could* have been produced, though no chemical sourcing has been done at this time.

4. *What was the nature of subsistence practices? Does this vary by period?*

While there is clear faunal evidence of both wild and domestic taxa, small assemblages from mixed, multi-component sites do not allow for a more nuanced, diachronic interpretation at this time. Flotation did not produce any botanical remains, and so the contribution of different plant species remains unknown. Ecological modeling and collected ethnoarchaeological data do suggest that a mixed hunting-herding strategy is feasible for this region and future work can build on this.

5. *Is there a decline/absence of habitation in the Xiongnu period within the Darkhad Depression?*

The proportion of sherds from the different periods suggests that the Late Bronze Age has the most intensive occupation, which then declines during the Iron Age/Xiongnu period (Table 7). Data on monument features were indicative of substantial Bronze Age activity, but produced only 3 burial features (recently looted) that are likely to date to the Xiongnu Period (Section 6.2; Figure 48). Thus it would appear that though habitation does decline during the Xiongnu period, the Darkhad Depression is not completely abandoned. It also appears that activity increases after the Xiongnu, but it never reaches the intensity of activity that is found in the Late Bronze Age (Figure 35).

7.2 COMPARATIVE VALUE

In order to evaluate the importance of this project, it is essential to put the results into a context that compares them with the results of projects in neighboring regions. Since archaeological patterning of neighboring regions is often lumped together into a single archaeological cultural unit, these comparisons may also aid in understanding variation within these large units, for example, within the Deer Stone-*Khirigsuur* ritual complex, or within the Xiongnu polity. The two primary cases that will be compared here are the Khanuy Valley (Houle 2010) and Egiin Gol (Honeychurch 2004, Wright 2006). These cases were selected because the archaeological programs carried out here are comparable to the work done in Targan Nuur, and comparable data from these projects are available in print.

7.2.1 Comparing the Monumental Landscapes

Similarities in ritual architectural forms have been commonly used to create cultural units within Mongolia. Monument form and chronologies in the region are often very closely related with many defined periods having unique, recognizable monumental features (Table 3).

Monuments from the Late Bronze Age dominate the ritual landscape of the Targan Nuur Region. Though monuments from other periods are scattered throughout the region, Deer Stones, *Khirigsuurs*, and slope burials, which are all distinctively LBA, are the most numerous and visibly *identifiable* monumental forms on the landscape (Table 3), though it is important to remember that *most* features on the landscape cannot be definitively classified into particular chronological periods (Section 6.2).

The scale of individual monuments, both the physical footprint and effort required for construction, also varies by region. The 400 m x 400 m *Khirigsuur* known as Urt Bulagyn in the Khanuy Valley, which contains over 1,700 stone mounds with associated horse crania (Allard and Erdenebaatar 2005), dwarfs even the largest of the *Khirigsuurs* in the Targan Nuur region. The largest *Khirigsuur* observed within Targan Nuur Archaeology Project's systematic survey was approximately 20 m x 40 m (200 times smaller by area than *Urt Bulagyn* in the Khanuy Valley), though most were in the 5-10 m long size range. None of the monuments in the project area had more than a handful of mounds, though some nearby contained 10-20 satellite mounds.

It is clear that less energy and resources were being put into the construction of the monumental landscape in northern Mongolia. If the monuments have a functional purpose, such as marking territory or integrating communities through ritual practice, the necessity of this is of a different scale in northern Mongolia than in more central regions such as the Khanuy Valley. The monuments of the Darkhad Depression do not require large networks of people with abundant resource bases (i.e. large horse herds). It may be suggested that the occupants of this region have a diverse subsistence economy and a more dispersed mobility pattern. Such a pattern would cover a larger area, thus decreasing the need for, but also the opportunity to, construct large monuments. Nevertheless, the early dates for the monuments in the Darkhad Depression suggest that they may have been experimenting with the use of monuments at a very early chronological stage. In this way, they may have influenced the later construction and use of large scale monuments in the south (Khanuy Valley) among groups that were economically more specialized in terms of herding (i.e. with less diffuse patterns of mobility). Furthermore, groups that first constructed monuments in the Darkhad Depression may have had relatively long migrations that would have given them the chance to spread these ideas over longer distances through interactions with more distant populations.

7.2.2 Comparing the Economy

At this time, it is difficult to say what the balance of wild and domestic species in the subsistence strategies of the different periods actually is. Ethnographic, historic and archaeological evidence suggests that there is a mix of wild and domestic animal resources being utilized today and through time (see below Section 7.4; Table 12). However, a lack of single component contexts, that is stratigraphic layers with material from only one chronological time period, prevents a diachronic exploration of the proportions of wild and domestic resources being used in any one period. In the Khanuy Valley, Houle (2010:130) suggests that wild resources were used opportunistically and made up a very small part of the subsistence economy. Conversely, in Egiin Gol, Honeychurch (2004:83, 151) and Wright (2006:93, 124) see evidence for a mixed domestic-wild resource base, though the balance of these resources is not elaborated further. The Targan Nuur region is more similar to the latter in this respect, though future studies might reveal more nuanced differences. The search for potentially stratified sites, and the use of other lines of evidence such as bioarchaeology, isotopic studies, and residue analysis could provide for a more robust comparison. Until then, the currently available evidence is compatible with the working hypothesis that a mixed hunting-gathering-herding orientation was an important and consistent subsistence strategy within the region.

7.2.3 Comparing the Topography

Topographically, this region is rather different than other regions of Mongolia where similar settlement-patterning projects have taken place. Archaeology projects in Egiin Gol, Khanuy Gol, and Tarvagtai Gol (Figure 13) are all in river valleys (*Gol* means 'river' in Mongolian). Ethnographic interviews and predictive modeling suggest that topography is an important factor in determining site location, and so this distinction is not trivial.

Topography can directly impact habitation areas, as in the case of sheltered areas or areas with great visibility, as well as a more indirect relationship in the way that topography might influence which resources are available and during which seasons, as shown in the NDVI comparisons in Section 2.2 (Figure 9). Seasonal movements between foothills and the floodplain near the river (Houle 2010:52; Wright 2006:94) have been observed elsewhere, but when the relationships between these topographical features is not similarly organized, the settlement patterning will differ. Herders living in the Darkhad Depression today move seasonally around the lake basin and between the basin and tributary drainages, although there is much variation in the specific movement patterns followed by local herders. Ethnographic interviews in the Darkhad showed that the number of moves per year was variable (between two and five) as well as the distance between camps (ranging from a few km to over 100 km; Table 5). This same degree of variation is not observed in central Mongolia where herders move between foothills and floodplain, typically in the range of 4-5 km apart (Houle 2010:25). The observation that people employ different mobility strategies is not novel (Bazargur 2002; Koryakova and Hanks 2006:278; Lattimore 1962:73; Simukov 1934). It is important, however, to recognize topographical differences and the resulting environmental differences when developing a predictive model and locating archaeological sites. Consequently, population mobility as connected specifically to seasonality is much more difficult to determine in the Targan Nuur region since a seasonal round is unlikely to be captured in a single study area. This issue, as challenging as it might be for project design, highlights the different nature of land-use patterns and truly illustrates that these regions do exhibit a great deal of variation, despite other similarities that they may have had such as monument forms and pottery assemblages.

7.2.4 Comparing the Lithic Assemblages

One of the most striking differences found through comparison is that between the Targan Nuur and and the Khanuy River projects in the size of the lithic assemblage. As mentioned above, the intensity of intensity of settlement seems to be much less in the Targan Nuur region than in the Khanuy River based on River based on total number of recovered ceramics (Section 6.4.1). However, the intensity of occupation occupation based on the number of lithics tells a much different story. In the Khanuy Valley, only 55 lithics only 55 lithics were recovered in total, many of which came from a single site (n=23) and were made of very made of very poor quality stone (Houle 2010:172). Therefore, ceramic sherds were the primary artifact artifact category recovered. In Targan Nuur, however, lithics were found in many places on the landscape landscape and in much higher proportion to other artifact classes including ceramics (i.e. 518 ceramics and ceramics and 270 lithics were recovered). While lithics are not exclusively a pre-metallurgy phenomenon, the phenomenon, the difference in lithic representation between these two regions might be associated with a associated with a greater intensity of earlier hunter-gatherer occupation. While Khanuy appears to have a to have a higher population in the Bronze and Iron Ages, there may have been much more human activity in activity in Targan Nuur prior to the introduction of pastoralism and metallurgy. This is an idea that fits well that fits well with the conceptual model introduced in Chapter 2 (Section 2.2;

Figure 8). Alternatively, lithics could be used for different types of tasks, which would suggest a different economy that was more associated with earlier hunting-gathering practices. A combination of the two, that is earlier occupation and a different set of tasks, is also possible. Egiin Gol appears to be more similar to Targan Nuur with lithics being a fairly ubiquitous artifact class (Honeychurch 2004:112). The availability of suitable raw materials for lithic production may also be greater in Targan Nuur and Egiin Gol when compared with the Khanuy Valley, a hypothesis bolstered by the variety of sources of mineral wealth targeted by small scale mining operations ('ninja miners') occurring in northern Mongolia (Crabtree et al., In Review).

7.3 INTER-REGIONAL INTERACTION

Linkages between Mongolia and China throughout history and prehistory are well documented (DiCosmo 2002; Honeychurch 2013). While this relationship was undoubtedly influential, its importance likely varied by region (perhaps relating to geographical proximity) and through time. Connections with groups to the north of modern Mongolia are not well documented (Fitzhugh 2001:9, 21). Modern geopolitical borders separating Russia and Mongolia sometimes make regions of southern Siberia, such as Tuva, the Minusinsk Basin, and Lake Baikal appear much farther and more removed from northern Mongolia than they actually are (Table 2). While the distances presented in Table 2 do not necessarily *prove* anything in particular regarding interaction, it is likely that the populations of geographically close regions had more opportunities for interaction than those of much farther regions. The longer, more frequent moves (Table 5) of northern Mongolia populations would have allowed for more opportunities to cross paths and interact with a more diverse set of mobile groups. Also, since the inhabitants of the basin are located near the ecotone between steppe pasture, mountains and taiga, they would have had more opportunities to interact with groups who utilized very different economic strategies.

One possible reason for inter-regional interaction is the trade of material goods and resources between regions. The experimental archaeology component of this dissertation research was able to show that local clays were suitable for making the types of vessels recovered in the archaeological record (Section 5.4). That is, the inhabitants of the region did not have to rely upon their neighbors for any of the raw materials (clay, inclusions, fuel, water) needed to produce pottery. However, just because they did not need to acquire pottery or raw materials from other regions does not mean that they did not. Shared ceramic designs might indicate some type of interaction. Ceramic composition and decoration is broadly similar throughout much of Mongolia and Siberia with plain earthenware that sometimes exhibits simple decorations such as cord-marks, incisions, punctates, stamps, or appliques (Hall et al. 1999b:133; Bokovenko 2006; Legrand 2006).

Some artifacts do appear to be of non-local origin based on their relative rarity in the assemblages and distinctive appearance. Future chemical studies will need to be conducted in order to test this hypothesis. One suggestive example is found in the lithics assemblage. Though the majority of lithic tools and debitage were made of a dark grey or black chert, 14 lithics (of the 270 total lithics collected; 5%) were made of very different kinds of materials, including high quality black chert, brown, yellow, red, striped, and pink cherts, and quartzite. While no quarries of any kind were found within the survey area, similar stones to the common black chert material and quartzite were found locally. It is highly likely that the more exotic, high quality cherts originated elsewhere, though at this time, their geographical origin is not known.

Figure 57: Common dark grey and black chert (right) and examples of more rare colors (middle and left)

As outlined above, the monuments of the Targan Nuur region are similar in form (Wright 2007), but on the whole, much smaller than those of central Mongolia. Radiocarbon dates collected by the Mongolian-American Deer Stone Project (Fitzhugh 2009a) suggest that the northern monuments may predate the larger monuments identified in central Mongolia. Similarity in monument structures suggests some type of interaction. The nature of this interaction is not known and could have taken several different forms. Social or kin networks may have connected the regions and potentially played an important role in transferring both ritual and economic practices. If economic and ritual practices are related, new forms of ritual features may be reflective of new economic strategies employed by the populations that built and used these ritual sites. If the size of the ritual monuments (both the area covered and number of sacrificial horse head and cremated bone deposits) in some way reflects the social or kin networks that may have been called upon to build the monuments, and then later used them, then it is possible to say that these networks were much stronger and larger in central Mongolia than in the north. Despite being older, the networks, and therefore ritual monuments in the north, did not expand and flourish as they did in central Mongolia.

7.4 DIACHRONIC CHANGES IN ECONOMY AND SCOIETY AND THE SPREAD OF PASTORALISM

Though the Late Bronze Age may contain a shift in the sociopolitical and economic practices of the region, it does not coincide with the introduction of pastoralism. Domesticated animal remains found in burials of the Early Bronze Age (Fitzhugh 2008; Figure 15) show that the inhabitants of the region were aware of and had access to domestic species well before the onset of the Late Bronze Age. The introduction of pastoralism did not cause the shift of sociopolitical relations in the Late Bronze Age, though intensification or shift of an existing economic system may have played an important role. The impact of the *introduction* of pastoralism on sociopolitical organization should be sought in earlier periods – at least as early as the Early Bronze Age, if not earlier. The seeds of major sociopolitical shifts may have been planted at this time, in which case the lag time between the introduction and the pinnacle of Late Bronze Age monumentalism and sociopolitical complexity becomes very illuminating. Additionally, it is important not to conflate ritual and subsistence patterns. The presence of these species in ritual contexts does not reveal the degree to which these people utilized and relied upon these domesticated animals for their subsistence.

Based on the faunal assemblages of burials, late prehistoric habitation areas, and modern campsites, the Darkhad Depression's inhabitants seem to have consistently relied upon a mixed economy of both wild and domestic species (Table 12). Today, this region of Mongolia is home to occupational hunters who live (at least part time) in remote mountain cabins or *gers* and whose primary economic venture is based on wild animals. Herders in the region will sometimes supplement their diets with fish and wild game. A Soviet era fish processing plant (primarily whitefish – *Coregonidae*) was located in the nearby settlement of Tsagaan Nuur. Though the large scale commercial fisheries have closed, small-scale fishing ventures do sell jars and cans of fish from the region.

Table 12: Common locally obtained domestic and wild resources used in northern Mongolia by modern populations today (TNAP Ethnographic Interviews and Observations)

Domestic	Meat	Sheep, goat, cow, yak, and less often horse and camel
	Milk	Sheep, goat, cow, yak, horse, and less often camel
	Fuel	Dung from all domestic animals
	Traction and Transportation	Horse, yak, and camel
	Trade/Sale	Skins, meet and milk from domesticates; tourism on horseback
Wild	Meat	Deer, wild boar, mountain sheep, fish
	Medicine (for humans and animals)	Lichens, flowers, bulbs, grasses, etc. (See Fijn 2011:249)
	Plant foods and seasonings	Berries, mushrooms, wild onions, pine-nuts, water cress, salt
	Fuel	Wood and brush
	Trade/Sale	Berries, mushrooms, precious, semi-precious and utilitarian minerals (e.g. jade, gold, phosphorous), skins

It is quite possible that the introduction of horses, sheep, goats and cows was not the first example of domestication in the forest-steppe and taiga regions of northern Mongolia. Alternatively, reindeer herding might have emerged as taiga dwellers observed their steppe neighbors' herding practices (Fitzhugh 2002:14). Reindeer herding in the local area, as well as regions further to the north, is thought to be quite ancient (Keay 2006), though the nature and timing of the origins of this adaptation are unknown. Reindeer herding economies today are easily combined with hunting and gathering activities as well as other pastoral systems. Families who identify themselves as reindeer herders (*Tsaatan* or *Dukha*) utilize a number of wild and domestic resources for consumption and income, with only a fraction of their economy being dependent upon the milk, meat, antlers and traction of their reindeer stock (Inamura 2005:150-151).

Plants utilized by the past and present inhabitants of the region seem to follow a similar mixing of wild and domestic varieties. While the flotation of soil samples did not produce botanical remains (other than charcoal), both ethnographic and historical data suggest that wild plants were used in addition to available domesticated plant foods. Today, flour, potatoes, rice, onions, carrots, beets, turnips, garlic, and other plant products are imported and sold in small shops, albeit in rather small quantities compared to western culinary standards.

Historically, small-scale farming projects have been implemented and ultimately abandoned in northern Mongolia. These projects include Soviet era state farms, Chinese immigrants, and Danish dairy farmers fleeing political instability in Russia during the revolution (Haslund 1995). The repeated attempts of such ventures suggests that while difficult, it is not impossible, or at least not so impossible as to prevent people from trying out farming now and then. Currently, Mongolian entrepreneurs and foreign aid groups worried about nutrition and food security are spearheading farming efforts in the north (Hickmann 2006). These range from low-intensity fodder collection for livestock to high-intensity irrigation farming of foods such as potatoes and wheat. Additionally, small garden plots are sometimes observed in the *Khashaas* (fenced yards) of sedentary residents of the small and scattered settlements.

7.5 DEMOGRAPHY

The area surrounding Targan Nuur seems to have been occupied continuously from the Paleolithic to the present. That is, while this occupation is low density and likely seasonal, it is comprehensive. A spike in the number of ceramic sherds collected from the Late Bronze Age is indicative of an increase in the intensity of occupation at this time (Table 8). This increased intensity could be due to either an increased population and/or an increase in the relative amount of time spent in the area during the seasonal round. In any case, this region was used more intensively at this time than any other period examined during this study. The Late Bronze Age was followed by a reduction in the intensity of activity in the Xiongnu period, and then a slight increase in the following Turkic and later periods. These trends are relative population shifts and have not, at this time, been translated into absolute population numbers with available survey data.

7.6 CONCLUSIONS AND FUTURE DIRECTIONS

The research conducted for this dissertation has produced a robust dataset for an important region in northern Mongolia that is also highly comparable with other studies in Mongolia and further afield in the northern Eurasian region. This work will provide a crucial foundation for future projects investigating early pastoralist orientations and employing conceptual and predictive modeling. In reviewing this experience, it is important to recognize the limitations of this research as well as its outcomes. This type of reflection is intended to strengthen future research design by understanding the feasibility of various research methods, to identify key theoretical implications, and to suggest some new directions for implementing them.

One key concern is that similarities in the ritual landscape of Mongolia are perhaps masking other types of variation between different regions. Since these regions are seen as homogenous because of a similar ritual pattern, the differences in strategies between populations, such as subsistence practices and socio-political organization, are diminished or completely unrecognized. A closer look at these elements on their own might reveal a more nuanced view of similarities and differences between regions. Though they may have a relationship, it is important not to conflate different elements of late prehistoric and early historic groups such as economy, social complexity, and ritual expression. Some scholars working in the Eurasian steppe have approached late prehistoric societies as if innovations come in comprehensive packages with multiple aspects of socio-political organization, subsistence strategies, and ritual activity occurring in tandem (Anthony 2007:160; Christian 1998:99). While such dynamic shifts may happen it is more likely that change at the local level varies substantially in both the types and timing of these changes.

It also is important to recognize the inherent constraints of the datasets compiled in the region of this research program. One of the biggest issues that researchers must confront is the small sample size of artifacts recovered during surface survey and targeted excavation. The campsites studied in this dissertation project do not contain thick, well-stratified archaeological contexts. The density and number of artifacts recovered is quite low, even when compared with assemblages of semi-mobile pastoralists from other regions (Houle 2010; Honeychurch 2004; Wright 2006). Nevertheless, situated within easy reach of the taiga, mountains and steppe the Darkhad Depression is a geographical and environmental zone that has great potential to answer the research questions set out in this dissertation (among others), and so a well thought-out research design that utilizes many different lines of data is crucial.

Future research in the region also would benefit from the use of the predictive modeling approach used in this dissertation, but should also be expanded to include other lines of evidence such as geophysics, trace element analysis, agent-based modeling, and isotopic analysis of bone and tooth remains from faunal assemblages. Creative uses of standard archaeological techniques as well as archaeometric techniques may help in this effort. For example, trace element chemical analysis (energy dispersive X-ray fluorescence – EDXRF) conducted by Hall et al. (1999a and 1999 b) on samples from the Egiin Gol Survey Project showed that as many as five different chemically unique clay sources were identified from a single valley's pottery assemblage. Further use of such studies is needed in order to make more meaningful interpretations of patterns connected to trade, exchange, and migration processes. Such studies may help to source raw materials used in lithic and ceramic artifact production. More detailed isotopic studies of the teeth and bone from faunal remains may help to understand seasonal mobility patterns of late prehistoric herds (Makarewicz 2014).

The Eurasian steppe also is frequently treated like a large homogenous zone where specialized pastoralism thrived because of uninterrupted grasslands (the steppe 'belt') and through time late prehistoric populations became part of larger integrated systems (Anthony 2007:412; Chernykh 2009; Christian 1998:102; Johnson 1969:14; Kohl 2007:126). These scholars have argued that new innovations and adaptations rippled across the steppe zone, passing from one culture to the next. Yet, the topography, archaeological remains, climates, histories, politics and cultures of the region reveal a much more heterogeneous mosaic (Atwood 2011). In order to observe and appreciate the variation present across this vast region, scholars must stop treating it as an ecologically unified zone. Broader regional and inter-regional trends might be observed through archaeological patterning, but it is their impact at smaller local scales that must be understood better. This will provide for more robust interpretations of the complex relationships that exist between human populations, natural and built landscapes, and the animal species that are such an important part of both subsistence economies and human-animal symbolic associations.

This dissertation has illustrated that even relatively close regions like northern and central Mongolia have great variation in terms of settlement patterning despite a shared ritual monumental tradition. Rather than simply concluding that these are very different populations, it is perhaps even *more* interesting to consider how and why they would have been ritually integrated using the same material monumental forms, and furthermore, if this integration had any political or social implications. Such questions remain as important challenges for future scholarship in the region and it is clear that more detailed study of settlement patterns is needed in conjunction with the investigation of ritual monuments.

Additional refinements are needed in the predictive model presented here, particularly related to seasonality. The expansion of this model into the regions surrounding the north shore of Targan Nuur, as suggested by pilot/test surveys in 2012, has the potential for great success in some contexts (north and west of the project area), while refinement will be needed in others (east of the project area). Furthermore, the model is based on pastoral practices (ethnographic, historic, and archaeological) and so it is able to reliably locate sites related to this form of economy. Therefore, a second, or modified model must be developed in order to locate the hunter-gatherer adaptations that are likely more ephemeral and cover a greater area (Section 6.4.1). Hunting and gathering was obviously the primary economic mode prior to the introduction of pastoralism, and continues to be used by the neighboring inhabitants of the taiga today. However, it is important to recognize that these hunting-gathering adaptations might have persisted to one degree or another among late prehistoric pastoralist populations. Such subsistence strategies might have relied on hunting and gathering at different times of the year (seasonally), in years of poor pastoral productivity (multi-year opportunism), or by different segments of the same cultural groups (Barnard and Wendrich 2008; Binford 1980; Kent 1992).

The fieldwork conducted for this dissertation research also has inspired the development of a new agent-based model. Preliminary results are promising as the model, known as *Ger Grouper*, continues to be developed. This collaboration between the author and Stefani Crabtree (PhD student, Washington State University) aims to use computational modeling to investigate cooperation and risk management strategies using empirical, ethnoarchaeological and archaeological data at a scale of analysis that is compatible with the landscape approach incorporated within this dissertation (Section 1.2).

Archaeological research in Mongolia has been increasing in intensity and volume (Hanks 2010) with many international projects conducting important new fieldwork and pursuing a variety of research questions. Future research is sure to help paint a much clearer picture of the various lifeways and patterns of social, economic and political organization that have existed in Mongolia through the ages. If northeast Asia, and northern Eurasia, are to emerge as a leader in the development of the anthropological theory of human-animal relationships, systems of spirituality, and human-landscape dynamics, as Jordan (2011:17; Section 1.2) advocates, then it is important that archaeological project design, fieldwork, and interpretation be compatible with these important themes. Such theoretical orientations must be clearly and explicitly linked to the methodologies used by archaeologists through a strong set of middle-range-theory and practice (Frachetti 2006; Section 2.0).

For the time being, however, many basic questions remain unanswered. The origin of some of the most fundamental characteristics of Mongolia and how it developed into the country it is today, as well as the role it played in regional socio-political and economic developments, remain unclear. Only through continued archaeological and ethnoarchaoelogical fieldwork, responsible reporting and publishing of data, and communication between researchers will we begin to fill in these important gaps. It is hoped that this dissertation has helped to lay the groundwork for these continued efforts in Mongolia, as well as elsewhere in the northern Eurasian region.

APPENDIX A

TARGAN NUUR ARCHAEOLOGY PROJECT ETHNOARCHAEOLOGICAL QUESTIONNAIRE

The following questionnaire was used as a rough guide during ethnoarchaeological interviews conducted in the summer of 2012 on the Targan Nuur Archaeology Project. Institutional Review Board (IRB) approval for research with living subjects was obtained prior to this research through the University of Pittsburgh. It is a modified version of a similar questionnaire produced by Jean-Luc Houle on the Khanuy Valley Archaeology Project (Houle 2010).

Table 13: Ethnoarchaeological Questionnaire

Questionnaire
Hovsgol Survey

Researcher:___________________________ Location:______________________________________

Date:_______________ GPS:_____________________ Elev:________________
d m y

Description:____
____
____
____

Question	Response
Number of people in household and their age?	Head of Household:____________________________
Groups identify with? (Ethnic, national, etc.)	
Identifying characteristics?	
Herd size and composition	Total:________ Horses:________ Sheep:________ Yaks/Cows:_____ Goats:_________ Other:_________ (type:_________)
How many animals did you lose last winter? How do you make up for losses? Why/how lost?	
How many years herding? How many years living in this place? Previous employment?	
Seasonal movement patterns, lengths of time and locations	Winter: Spring: Summer: Fall:
How many other household do you camp with? (head of each household) Related?	1:____ 2:____ 3:____ 4:____ ____
Historical movement patterns?	

How has the number of livestock changed in the last…? How has the number of herders changed in the last…?	Livestock / Herders 5 years + or - + or - 10 years + or - + or - 15 years + or - + or - 20 years + or - + or -
Do you have family in UB? Moron?	Yes No
You or any family gone to the city and returned?	Yes No
Where do you go for supplies?	
Where do you go for Naadam? Other festivals?	
Forms of land use management/community groups to avoid grazing conflicts?	Yes No Comments:____
Do local communities work with government at any level? Collaboration successful?	Yes No Comments:____
Quality of pastureland? 1=optimum, 5 = overgazed	1 2 3 4 5
Condition of pasture changed over the last…? Availability of wild resources? Use of wild resources?	Condition / Availability / Use 5 years + or - + or - + or - 10 years + or - + or - + or - 15 years + or - + or - + or - 20 years + or - + or - + or -
Do you gather winter fodder?	
Is stealing animals a problem here?	
Do you hunt? Yes No Do you fish? Yes No Do you gather plants? Yes No Do you grow food? Yes No	What?____ Where?____ When?____ Why?____ How much?____________________________________
Are there any restrictions on the procurement of wild resources?	

APPENDIX B

TARGAN NUUR ARCHAEOLOGY PROJECT CERAMIC CATALOG

Below is the ceramic catalog for the Targan Nuur Archaeology Project. Ceramics were analyzed and data points recorded by the author at the National Museum of Mongolia in Ulaanbaatar Mongolia at the conclusion of the field season in the fall and winter of 2012.

Table 14: Ceramics from the Targan Nuur Archaeology Project

Ceramics   Page: 1

UTM (zone 47)	Unit/Coll. #	Level	# Items	Part	Decoration	Type Decoration	Thick	Weight	Type Inclusion	Size Inclusion	Incl/cm^2	Rim diam.	Color Int	Color Ext	Core	Residue
530864 5702990	C4	SUR	1	body	no dec.		0.82	3.1	sand	0.08	5		brown	red-brown	2-color	
530640 5702760	C4	SHOV	2	body	no dec.		1.3	5.8	sand	0.087	10		red-brown	red-brown	black	
530640 5702740	C4	SHOV	1	body	no dec.		1.3	20.6	sand	0.108	7		black	buff	2-color	
530581 5702679	C4	SHOV	1	body	no dec.		1.1	4.8	sand	0.07	8		red-brown	gray-brown	black	
530565 5702702	C4	SHOV	1	body	no dec.		1.2	10.4	sand	0.07	6		red-brown	red-brown	black	
530780 5703033	C5	SHOV	1	rim	no dec.		0.49	4.4				14	white	white	homogenous	
530720 5702839	C4	SUR	1	body	no dec.		1.7	10.9	sand	0.014	11		red-brown	buff	2-color	maybe
530760 5702603	C4	SHOV	2	body	no dec.		0.8	5.2	sand	0.062	21		brown	red-brown	black	
530914 5702703	C4	SUR	1	body	no dec.		0.79	3.1	sand	0.059	12		red	red-brown	homogenous	
530884 5702497	C4	SUR	1	body	no dec.		1.1	6.8	sand	0.054	10		brown	brown	2-color	
531116 5702670	D4	SUR	1	body	no dec.		0.9	6.4	sand	0.052	8		red-brown	worn away	homogenous	
530920 5702772	C4	SUR	1	body	no dec.		1.2	3.3	sand	0.05	27		red-brown	red-brown	2-color	
529743 5696878	OUT	SUR	1	body	Dec.	linear incisions	1.45	20.8	sand	0.17	9		brown	buff	2-color	
531006 5702781	D4	SUR	1	body	no dec.		0.8	3.2	sand	0.079	12		red-brown	red-brown	black	
530040 5705040	C7	SHOV	1	body	no dec.		1.12	9.7								
529749 5706789	B8	SUR	1	body	no dec.		0.82	3.6	sand	0.114	6		gray	red-brown	homogenous dark gray	
53080 5705520	C7	SHOV	1	body	no dec.		0.73	4.7	sand	0.076	25		black	brown	black	
531981 5703500	D5	SUR	2	body	no dec.		0.91	5.1	sand	0.033	40		gray	red-brown	2-color	
529972 5705721	B7	SUR	1	body	no dec.		0.51	5.5					buff	brown/black	white/grey	
530040 5705040	C7	SHOV	1	body	no dec.		0.89	9.6	sand	0.071	14		black	black	black	
530080 5705520	C7	SHOV	2	body	no dec.		0.93	7.5	sand	0.08	21		grey/black	buff	dark grey	yes
530080 5705520	C7	SHOV	1	body	no dec.		0.88	22.5	sand	0.04	11		red-brown	black	sandwich	maybe
530080 5705520	C7	SHOV	1	body	no dec.		-	2.4	sand	0.07	5		buff	-	homogenous brown	
529861 5706375	B5	SUR	1	body	no dec.		0.87	7.2	sand	0.074	19		red-brown	red-brown	dark brown	
535775 5704602	H5	SUR	1	body	dec.	ridges	0.74	17.6					buff	brown	white	
535775 5704602	H5	SUR	3	body	no dec.		0.33	1.2					brown	black	white	
530929 5702977	C4	SUR	1	body	no dec.		0.9	6.6	sand (and shell?)	0.02	3		brown	red-brown	homogenous brown	
530080 5705500	C7	SHOV	2	body	no dec.		8.5	6.2	sand	0.047	17		brown	red-brown	homogenous reddish	
529898 5706460	B8	SUR	1	body	no dec.		0.7	8.2	sand	0.054	6		red-brown	red-brown	homogenous grey	
no gps	F5	SUR	1	body	no dec.		0.68	5.9	sand	0.059	18		light gray	light gray	black	
531828 5706619	D8	SHOV	1	rim	dec.	punctate	0.9	19	sand	0.096	6	32	buff	brown	homogenous brown	
529350 5703076	B5	SUR	1	body	no dec.		0.83	6.4	sand	0.075	11		gray	brown	2-color	
530820 5703000	C5	SUR	1	body	no dec.		0.78	2.9	sand	0.025	23		brown	red-brown	2-color	
533462 5704217	F6	SUR	1	body	no dec.		0.87	3.4	sand	0.03	30		gray	buff	homogenous brown	
534241 5704201	G6	SHOV	1	body	no dec.		0.61	1.9	sand	0.085	15		black	red-brown	black	
534241 5704201	G6	SHOV	2	body	no dec.		0.89	8.3	sand	0.134	14		black	buff	2-color	
529870 5703680	B5	SHOV	2	body	no dec.		0.86	3.4	sand	0.065	17		red-brown	red-brown	homogenous orange/red	
530432 5702553	C4	SUR	1	body	no dec.		0.74	4.2	sand	0.069	13		brown	brown	black	
535910 5706980	H8	SUR	1	body	no dec.		0.92	9.6	sand	0.08	18		red-brown	brown	2-color	
531904 5706628	D8	SUR	1	body	no dec.		0.7	5.1	sand	0.043	10		red-brown	buff	dark brown	
529150 5697370	OUT	SUR	1	body	no dec.		1.04	9.9	sand	0.07	30		gray	gray	2-color	
530423 5702435	C4	SUR	1	body	no dec.		0.66	1.3	sand	0.09	14		buff/red	red-brown	homogenous gray	
529775 5706814	B8	SUR	1	body	no dec.		1.04	7.3	sand	0.083	18		red-brown	red-brown	2-color	

UTM (zone 47)	Unit/Coll. #	Level	# Items	Part	Decoration	Type Decoration	Thick	Weight	Type Inclusion	Size Inclusion	Incl/cm^2	Rim diam.	Color Int	Color Ext	Core	Residue
529738 5706801	B8	SUR	1	base	no dec.		1.13	11.6	sand	0.068	17		brown	brown	homogenous brown	
529739 5706794	B8	SUR	1	body	no dec.		0.69	3.1	sand	0.069	27		red-brown	red-brown	2-color	
531190 5702764	D4	SUR	1	body	no dec.		1	6.9	sand	0.067	18		brown	red	black	
530098 5705497	C7	SUR	2	body	no dec.		1.03	10.4	sand	0.084	12		black	gray	gray with reddish stripe on ext	
529870 5703659	B5	SHOV	1	rim	dec	applique ridge	1.16	22.2	sand	0.084	13	14	gray-brown	gray-brown	homogenous gray	
529870 5703659	B5	SHOV	1	body	no dec.		1.17	13.2	sand	0.085	18		black	buff	2-color	yes
529871 5703669	B5	SUR	1	body	no dec.		0.85	2.5	sand	0.066	5		red-brown	gray	homogenous gray	
529869 5703691	B5	SUR	1	body	no dec.		1.15	11.5	sand	0.096	14		red-brown	buff	homogenous red-brown	
535893 5706979	H8	SUR	1	body	no dec.		0.72	3.2	sand	0.063	10		red-brown	brown	2-color	
535999 5703486	H5	SUR	1	body	no dec.		0.7	3.8	sand	0.063	27		brown	red-brown	black	
535997 5703394	H5	SUR	1	body	no dec.		0.84	3.1	sand	0.045	9		buff	red-brown	homogenous gray	
529300 5703099	B5	SUR	1	rim	dec	imprint	0.99	5.3	sand	0.193	16		red-brown	red-brown	homogenous gray	
529300 5703099	B5	SHOV	2	body	no dec.		6.4	0.99	sand	0.193	16		red-brown	red-brown	homogenous gray	
531850 5706680	D8	SUR	1	rim	no dec.		-	1.8	sand	0.08	11		brown	brown	homogenous brown	
531850 5706680	D8	SUR	4	body	no dec.		0.53	2	sand	0.058	7		buff	buff	homogenous buff	
531110 5702660	D4	SUR	3	body	no dec.		1.1	16.1	sand	0.1	15		red-brown	red-brown	black	yes
531110 5702660	D4	SUR	1	rim	no dec.		-	1.2	sand	0.1	15		red-brown	red-brown	black	yes
529892 5703658	B5	SHOV	1	body	no dec.		0.94	6.4	sand	0.083	24		brown	buff	homogenous brown	
site 002/C4	TR2/A1	1	1	body	no dec.		1.95	5.2								
534480 5704200	G6	SHOV	5	body	no dec.		-	1.6	sand	0.062	16		red-brown	red-brown	homogenous red-brown	
531910 5706613	D8	SUR	1	body	no dec.		0.71	1.9	sand	0.04	26		red-brown	red-brown	homogenous red-brown	
530258 5702490	C4	SUR	1	body	no dec.		0.91	8.7	sand	0.046	16	30	buff	buff	sandwich	
534077 5705010	G7	SUR	1	body	dec.		1.27	14.4	sand	0.16	17		red-brown	red-brown	homogenous brown	
534077 5705010	G7	SUR	1	rim	no dec.		1.3	7.8	sand	0.16	17	28	red-brown	red-brown	homogenous brown	
529897 5703673	B5	SUR	1	body	dec.	applique and punctate	0.68	4.4	sand	0.64	19		red-brown	red-brown	homogenous brown	
529897 5703673	B5	SUR	1	body	no dec.		1.11	18.1	sand	0.85	16		brown	red-brown	homogenous gray	
529897 5703673	B5	SUR	2	body	no dec.		0.93	7.2	sand	0.28	3		red-brown	gray-brown	homogenous gray	
529897 5703673	B5	SUR	3	body	no dec.		0.81	3.2	sand	0.47	5		red-brown	red-brown	homogenous gray	
529783 5699189	C1	SUR	1	body	no dec.		0.94	7.9	sand	0.043	12		gray	buff	2-color	
535608 5704628	H6	SUR	1	body	no dec.		0.92	9.1	sand	0.072	12		red-brown	red-brown	dark brown	
535725 5706817	H8	SUR	22	body	no dec.		0.98	39.1	sand	0.065	12		black	red-brown	homogenous gray	maybe
535725 5706817	H8	SUR	1	rim	no dec.		0.8	13	sand	0.088	14	24	black	red-brown	homogenous gray	
529473 5699083	B1	SUR	1	body	no dec.		0.78	5.4	sand	0.064	15		gray	red-brown	dark brown	
531907 5703328	D5	SUR	1	body	no dec.		0.68	2.1	sand	0.028	8		gray	red-brown	black	
534056 5704859	G6	SUR	1	body	no dec.		1.08	4.8	sand	0.064	30		gray-brown	brown	homogenous gray	
530223 5701330	C3	SUR	1	body	no dec.		0.75	4.6	sand	0.042	11		gray	buff	black	
533285 5706075	E8	SUR	1	body	no dec.		1.1	5.5	sand	0.063	27		gray	red-brown	2-color	
532151 5703974	E5	SUR	1	body	no dec.		0.8	3.6	sand	0.043	23		brown	red-brown	dark brown	
530234 5700484	C2	SUR	1	body	dec.	impression	0.9	6	sand	0.079	16		gray	gray-brown	dark brown	

UTM (zone 47)	Unit/Coll. #	Level	# Items	Part	Decoration	Type Decoration	Thick	Weight	Type Inclusion	Size Inclusion	Incl/cm^2	Rim diam.	Color Int	Color Ext	Core	Residue
52979 5700911	C2	SUR	1	body	no dec.		1.03	8	sand	0.045	19		red-brown	red-brown	black	
536729 5707256	I9	SUR	1	body	no dec.		0.8	5.8	sand	0.049	34		red-brown	gray-brown	black	
531065 5701856	D3	SUR	1	body	no dec.		0.94	3	sand	0.047	31		red-brown	buff	homogenous brown	
530080 5705514	C7	SUR	1	rim	dec.		1.05	13.9	sand	0.052	36	18	black	brown	sandwich	yes
529764 5706808	B8	SUR	1	rim	no dec.		0.71	3.1	sand	0.068	23		brown	brown	dark brown	
529156 570665	B8	SUR	2	body	no dec.		0.93	24.4	sand	0.05	15		brown	brown	dark brown	yes
535365 5704559	H6	SUR	2	body	dec.		0.4	11.4	porcelain ?				white	brown	white	
535365 5704559	H6	SUR	2	body	dec.		0.45	2.1	porcelain ?				brown	brown	white	
535365 5704559	H6	SUR	1	rim	no dec.		.7-1.3	7.4	porcelain				light blue	light blue	white	
538993 5703567	H5	SUR	1	body	no dec.		0.45	1.1	porcelain				brown	brown	white	
529729 5706817	B8	SUR	1	body	no dec.		1.3	10.2	sand	0.074	19		brown	red-brown	black	
529742 5706778	B8	SUR	1	body	dec.		0.7	5.2	sand	0.073	21		reddish-brown/gray	buff	black	
529742 5706778	B8	SUR	1	rim	no dec.		0.85	6.7	sand	0.074	13	36	gray-brown	gray-brown	homogenous gray	
529742 5706778	B8	SUR	1	rim	no dec.		0.65	2.1	sand	0.06	14		gray-brown	gray-brown	black	
529742 5706778	B8	SUR	1	body	no dec.		0.7	2.2	sand	0.056	4		red-brown	brown	homogenous red-brown	
529742 5706778	B8	SUR	1	body	no dec.		1.01	4.7	sand	0.082	28		black	red-brown	black	
529742 5706778	B8	SUR	1	body	no dec.		0.63	0.8	sand	0.061	12		black	red-brown	2-color	
529742 5706778	B8	SUR	1	body	no dec.		0.6	3	sand	0.11	19		gray	gray-brown	black	
529742 5706778	B8	SUR	1	body	no dec.		0.9	3.5	sand	0.093	13		red-brown	brown	homogenous red-brown	
529742 5706778	B8	SUR	1	body	no dec.		0.95	3.4	sand	0.074	25		red-brown	red-brown	sandwich	
529742 5706778	B8	SUR	1	body	no dec.		0.76	3	sand	0.064	7		red-brown	red-brown	homogenous gray	
529742 5706778	B8	SUR	1	rim	no dec.		0.86	7.2	sand	0.057	25		black	gray-brown	dark gray	
529748 5706802	B8	SUR	1	body	dec.		0.7	3.2	sand	0.087	15		red-brown	brown	black	
529748 5706802	B8	SUR	1	rim ?	no dec.		0.79	4.3	sand	0.058	17		gray	gray-brown	homogenous gray	
529748 5706802	B8	SUR	2	body	no dec.		1.04	8	sand	0.078	28		brown	red-brown	black	
530705 5700796	C3	SUR	1	body	dec.		1	4	sand	0.026	32		buff	red-brown	homogenous gray	
530705 5700796	C3	SUR	1	body	dec.		0.9	4.5	sand	0.026	32		buff	red-brown	homogenous gray	
530705 5700796	C3	SUR	17	body	no dec.		1.1	125	sand	0.026	32		buff	red-brown	homogenous gray	
52998 5701671	C3	SUR	1	body	no dec.		0.72	1.5	sand	0.04	20		red-brown	gray	homogenous red-brown	
52998 5701671	C3	SUR	1	rim	no dec.		0.61	2.1	sand	0.025	23		red-brown	brown	homogenous brown	
52998 5701671	C3	SUR	2	body	no dec.		1.07	9.7	sand	0.054	12		gray	brown	black	
52998 5701671	C3	SUR	2	body	no dec.		0.75	3.5	sand	0.067	11		brown	brown	2-color	
534058 5704945	G6	SUR	1	body	no dec.		1.05	10.5	sand	0.07	16		red-brown	brown	black	
534058 5704945	G6	SUR	1	body	no dec.		0.95	3.2	sand	0.036	28		brown	red-brown	black	
535982 5706868	I8	SUR	1	body	dec.		0.6	2	sand	0.05	28		brown	brown	black	
535982 5706868	I8	SUR	1	body	dec.		0.5	0.5	sand	0.061	20		black	black	black	
535982 5706868	I8	SUR	1	body	no dec.		0.83	6.8	sand	0.046	25		brown	brown	black	
535982 5706868	I8	SUR	1	body	no dec.		0.57	2.8	sand	0.034	34		gray	red-brown	black	
533017 5706929	F8	SUR	3	body	no dec.		0.72	11.3	sand	0.065	21		red-brown	red-brown	dark gray	
531967 5703446	D5	SUR	1	rim	no dec.		0.75	2.1	sand	0.08	16		gray	red-brown	black	
531967 5703446	D5	SUR	1	body	no dec.		1.1	14.3	sand	0.081	21		red-brown	red-brown	2-color	
529539 5699770	B1	SUR	1	stamped frag	dec.		1.36	2.9	sand	0.032	7		-	buff	buff	

UTM (zone 47)	Unit/Coll. #	Level	# Items	Part	Decoration	Type Decoration	Thick	Weight	Type Inclusion	Size Inclusion	Incl/cm^2	Rim diam.	Color Int	Color Ext	Core	Residue
529480 5701315	B3	SUR	1	body	no dec.		0.6	1.8	sand	0.055	15		buff	buff	homogenous reddish brown	
529586 5699804	B1	SUR	2	body	no dec.		1.15	14	sand	0.119	21		red-brown	gray	homogenous brown	
530074 5705556	C7	SUR	1	-	-	-	-	-	-	-	-	-	-	-	-	-
530074 5705556	C7	SUR	1	body	no dec.		0.4	0.4					-	red-brown		
529807 5699899	B1	SUR	1	rim	dec.	lip and diagonal incisions	1.2	10.6	sand	0.098	28	36	buff	red-brown	dark brown	yes
529807 5699899	B1	SUR	1	body	dec.		1.1	4.2	sand	0.11	25		red-brown	red-brown	dark brown	
529807 5699899	B1	SUR	1	body	no dec.		1.25	13.5	sand	0.08	24		gray	red-brown	sandwich	
529807 5699899	B1	SUR	2	body	no dec.		0.81	5	sand	0.074	21		black	gray-brown	black	
529807 5699899	B1	SUR	1	body	no dec.		0.9	5.8	sand	0.09	18		red-brown	gray-brown	black	
529807 5699899	B1	SUR	2	body	no dec.		0.79	3.6	sand	0.055	17		black	red-brown	2-color	
529807 5699899	B1	SUR	2	body	no dec.		0.82	3.6	sand	0.08	24		red-brown	red-brown	homogenous red-brown	
529632 5701611	B3	SUR	1	body	dec.		1	12	sand	0.065	16		brown	red-brown	2-color	
529632 5701611	B3	SUR	1	rim	dec.		0.85	5.3	sand	0.037	30		red-brown	red-brown	dark brown	
529632 5701611	B3	SUR	1	rim	dec.		0.9	4.3	sand	0.054	27		red-brown	gray-brown	2-color	
529632 5701611	B3	SUR	1	body	dec.	punctate	1.35	6.4	sand	0.103	23		red-brown	red-brown	homogenous gray	
529632 5701611	B3	SUR	2	body	no dec.		1.28	29.4	sand	0.13	11		brown	red-brown	black	
529632 5701611	B3	SUR	3	body	no dec.		0.75	7.6	sand	0.06	7		gray	gray	homogenous gray	
529632 5701611	B3	SUR	5	body	no dec.		0.9	23.1	sand	0.11	8		red-brown	red-brown	red-brown and gray	
529632 5701611	B3	SUR	3	body	no dec.		0.78	6.4	sand	0.088	5		red-brown	red-brown	homogenous brown	
529632 5701611	B3	SUR	1	body	no dec.		1.19	11.9	sand	0.067	31		brown	gray-brown	sandwich	
529632 5701611	B3	SUR	7	body	no dec.		1.04	52.3	sand	0.071	14		black and gray-brown	gray-brown	gray and black	
529632 5701611	B3	SUR	8	body	no dec.		0.85	19	sand	0.074	18		red and red-brown	red and red-brown	red and brown/black	
528355 5701098	A3	SUR	1	body	no dec.		1.2	11.8	sand	0.14	11		red-brown (lt.)	buff/brown	2-color	
530919 5702714	C4	SUR	1	body	dec.		0.8	4.7	sand	0.055	26		brown	red-brown	black	
534114 5703545	G5	SUR	1	body	no dec.		0.95	7.4	sand	0.102	20		gray-brown	red-brown	dark brown	maybe
530620 5710930	OUT	SUR	1	rim	dec.	slight bulge and vertical incisions	1	9.1	sand	0.047	35	-	red-brown	red-brown	red-brown	Yes (ext)
530620 5710930	OUT	SUR	1	rim	dec.		1.1	3.9	sand	0.056	29		red-brown	red-brown	black	
530620 5710930	OUT	SUR	1	body	no dec.		1	10.2	sand	0.061	37		black	red-brown	black	
530620 5710930	OUT	SUR	1	rim	no dec.		1	4.8	sand	0.067	34	20	red-brown	black	black	
530620 5710930	OUT	SUR	3	body	no dec.		0.5	3.7	porcelain	-	-	-	brown/black	brown/black	white	
530620 5710930	OUT	SUR	6	body	no dec.		0.88	24.9	sand	0.062	13		brown	red-brown	black/brown	
530620 5710930	OUT	SUR	4	body	no dec.		0.87	6.8	sand	4	15		red-brown	red-brown	sandwich - black/grey core	
530620 5710930	OUT	SUR	2	body	no dec.		0.83	6.6	sand	0.067	26		gray-grown	gray-brown	black	
530620 5710930	OUT	SUR	1	body	no dec.		0.75	4.6	sand	0.044	17		red-brown	brown	black	

UTM (zone 47)	Unit/Coll. #	Level	# Items	Part	Decoration	Type Decoration	Thick	Weight	Type Inclusion	Size Inclusion	Incl/cm^2	Rim diam.	Color Int	Color Ext	Core	Residue
530620 5710930	OUT	SUR	1	body	no dec.		0.86	6.8	sand	0.129	5		red-brown	gray-brown	2-color (red-black)	
530620 5710930	OUT	SUR	2	body	no dec.		0.58	4	sand	0.057	12		red-brown	red-brown	red-brown	
530620 5710930	OUT	SUR	1	body	no dec.		0.94	4.2	sand	0.055	36		black	red-brown	red-brown	
530620 5710930	OUT	SUR	1	body	no dec.		0.83	4.7	sand	0.069	15		black	-	2 color black/gray	
537972 5704034	J6	SUR	2	body	no dec.		1.2	17	sand	0.09	6		red-brown	red-brown	dark brown	
533096 5710398	OUT	SUR	1	body	no dec.		0.95	5.3	sand	0.073	24		black	gray-brown	2 color brown/black	
533640 5711020	OUT	SUR	2	body	no dec.		0.39	0.7	sand	0.048	7		red-brown	red-brown	red-brown	
536981 5704297	I6	SUR	1	body	no dec.		0.85	4.1	sand	0.034	31		red-brown	gray-brown	dark brown	
537987 5704050	J6	SUR	1	body	no dec.		1.05	22.8	sand	0.086	38		black/brown	red-brown	2-color	
537987 5704050	J6	SUR	1	body	no dec.		0.78	5.3	sand	0.035	33		red-brown	gray-brown	dark brown	
529702 5696938	OUT	SUR	3	body	dec.		0.8	14.2	sand	0.062	11		black/brown	gray-brown	dark brown	
529702 5696938	OUT	SUR	1	rim	no dec.		0.8	4.3	sand	0.062	11	20	black/brown	gray-brown	dark brown	
529702 5696938	OUT	SUR	1	rim	no dec.		0.8	4.6	sand	0.062	11	20	black/brown	gray-brown	dark brown	
529702 5696938	OUT	SUR	39	body	no dec.		0.57	72.8	sand	0.062	11		black/brown	gray-brown/red-brown	dark brown	
531045 5696070	OUT	SUR	1	rim	dec.	ridge and diag. incised lines	1	18.7	sand	0.072	13	-	brown	brown	dark brown	
531045 5696070	OUT	SUR	1	rim	dec.	diagonal incisions	0.75	3.4	sand	0.058	17	-	brown	brown	dark brown	
531045 5696070	OUT	SUR	1	body	dec.	incised parallel lines	0.65	3.4	sand	0.056	23		brown	brown	red-brown	
531045 5696070	OUT	SUR	1	body	dec.		0.65	1.9	sand	0.043	14		brown	red-brown	2-color/dark brown	
531045 5696070	OUT	SUR	1	rim	no dec.		0.75	7.8	sand	0.011	17	18	black	brown	black	
531045 5696070	OUT	SUR	1	rim	no dec.		0.45	0.3	sand	0.018	32		buff	buff	buff	
531045 5696070	OUT	SUR	124	body	no dec.		0.74	168	sand	0.078	39		red-brown	red-brown	red-brown	
531045 5696070	OUT	SUR	1	body	no dec.		0.39	2.1	sand	0.035	28		black	gray	black	
site 004/B8	TR1/A1	4	1	body	dec.	applique lug	1.4	123	sand	0.077	14		black-brown	black-brown	black	maybe
528210 5700998	A2	SUR	1	rim	dec.		0.9	6.1	sand	0.064	26	-	black	buff	black	maybe
528210 5700998	A2	SUR	2	body	no dec.		0.85	6.6	sand	0.085	12		red-brown	buff	black	
Site 003/C7	TR2/A1	2	2	body	no dec.		0.65	4.7	sand	0.06	12		black	brown (dark)	black	
Site 003/C7	TR1/A1	1	2	body	no dec.		0.85	1.1	sand	0.068	14		black	red-brown	red-brown	
Site 003/C7	TR3/A1	2	3	body	no dec.		0.6	17	sand	0.049	27		gray-brown	brown	red-brown	
Site 003/C7	TR3/A1	1	1	body	no dec.		0.6	1.1	sand	0.043	20		brown	brown	homogenous brown	
Site 003/C7	TR3/A1	1	1	body	no dec.		0.9	4.7	sand	0.06	22		black	brown (dark)	2-color	
Site 003/C7	TR3/A1	1	8	body	no dec.		0.8	11.7	sand	0.098	5		red-brown	brown-black	red-brown	
Site 003/C7	TR3/A1	1	3	body	no dec.		0.75	3.4	sand	0.069	11		red-brown	brown (dark)	red-brown	
Site 003/C7	TR3/A1	3	1	body	no dec.		0.5	1.7	sand	0.053	12		brown	brown	brown	
Site 003/C7	TR3/A1	2	1	body	no dec.		0.5	1	sand	0.095	14		brown	brown (dark)	brown	
536793 5702122	J4	SUR	1	body	no dec.		0.95	3.3	sand	0.045	31		gray	red-brown	2-color (brown-black)	
536617 5701952	J4	SUR	1	body	no dec.		0.75	1.5	sand	0.04	12		red-brown	gray	2-color (gray/red-brown)	
site 004/B8	TR1/A1	1	1	body	no dec.		0.7	0.6	sand	0.045	16		gray	red-brown	red-brown	
site 004/B8	TR3/A1	1	1	rim	dec.	diagonal incisions	0.9	3.6	sand	0.062	15	-	buff	brown	black	

UTM (zone 47)	Unit/Coll. #	Level	# Items	Part	Decoration	Type Decoration	Thick	Weight	Type Inclusion	Size Inclusion	Incl/cm^2	Rim diam.	Color Int	Color Ext	Core	Residue
site 004/B8	TR3/A1	1	1	body	no dec.		0.83	2.2	sand	0.037	16		red-brown	red-brown	black	
site 004/B8	TR3/A1	1	2	body	no dec.		0.69	4.6	sand	0.039	29		black	gray-brown	black	
site 004/B8	TR3/A1	2	1	body	no dec.		0.65	0.8	sand	0.042	18		-	red-brown	2-color (brown-black)	
site 004/B8	TR3/A1	3	1	body	no dec.		0.9	2.6	sand	0.047	10		red-brown	brown	gray	
site 004/B8	TR3/A1	3	1	body	no dec.		1.5	6.5	sand	0.043	28		black	brown	black	
site 004/B8	TR3/A1	4	1	body	no dec.		0.75	2.3	sand	0.046	17		brown	red-brown	brown	
site 004/B8	TR3/A1	5	1	body	dec.	incised lines	0.6	6.1	sand	0.05	21		brown	brown	dark brown	
site 004/B8	TR3/A1	6	1	body	no dec.		1.1	4	sand	0.033	13		black	red-brown	black	
site 004/B8	TR3/A1	wall cleaning	1	body	dec.	incised lines	0.75	4.3	sand	0.072	27		black	brown	2-color (brown-black)	maybe
site 004/B8	TR4/A1	1	1	body	no dec.		0.99	5.2	sand	0.079	28		red-brown	brown	black	
site 004/B8	TR4/A1	1	1	body	no dec.		1.02	4.3	sand	0.067	23		brown	buff	brown	
site 004/B8	TR4/A1	1	1	body	no dec.		0.73	2.6	sand	0.077	16		brown	buff	brown	
site 004/B8	TR4/A1	4	1	body	no dec.		0.9	3.2	sand	0.065	17		black	brown	black	
site 004/B8	TR4/A1	4	2	rim	no dec.		-	0.5	sand	0.02	-		-	-	red-brown	
site 001/G6	TR4/A1	2	1	body	dec.		0.65	2.6	sand	0.058	18		gray-brown	red-brown	black	
site 001/G6	TR2/A1	2	2	body	no dec.		0.85	8.6	sand	0.031	23		black	brown	2 color (brown-black)	
site 001/G6	TR4/A1	2	1	body	no dec.		0.9	5.3	sand	0.056	25		brown	brown	brown	
site 002/C4	TR3/A1	2	2	body	no dec.		1.22	28.1	sand	0.127	9		brown	red-brown	dark brown	
site 002/C4	TR2/A1	3	1	body	no dec.		1.05	5	sand	0.048	13		black	buff	2 color (red-black)	yes - exterior
529760 5706800	B8	SHOV	1	body	dec.	incised lines (chevron)	0.65	2.4	sand	0.08	16		brown	brown	black	
529760 5706840	B8	SHOV	1	body	no dec.		1.1	8	sand?	0.032	31		brown	brown	buff	
529740 5706840	B8	SHOV	1	body	no dec.		0.85	2.8	sand	0.044	28		red-brown	brown	dark brown	
531000 5702780	C4	SHOV	1	body	no dec.		0.95	3.6	sand	0.046	19		gray	gray	gray	
529840 5706800	B8	SHOV	1	body	no dec.		0.4	<.1	sand	-	-		brown	-	red-brown	
529720 5706840	B8	SHOV	1	body	no dec.		1.4	3.8	sand	0.04	41		brown	red-brown	2-color (red-black)	
no gps wp	OUT	SUR	1	handle	no dec.		0.85	1.7	sand	0.05	27		red-brown	red-brown	black	
Nutsgen Tolgoi	Circle Grave		1	rim	no dec.		6.43	5.5	sand	0.06	11	-	black	gray-brown	black	
Nutsgen Tolgoi	Circle Grave		1	body	dec.	lines	7.01	11.2	sand	0.102	11		gray-brown	red-brown	dark gray	
Nutsgen Tolgoi	Circle Grave		1	body	dec.	lines	7.49	24.4	sand	0.09	13		black	red-brown	dark gray	
529764 5706808	B8	SUR	4	body	no dec.		0.68	4.7	sand	0.051	14		varies	varies	varies	

APPENDIX C

CERAMIC CHRONOLOGY

Sherds were labeled and sorted into groups based on their similar characteristics. These groups were then assigned to the chronological time period to which they likely belonged (Section 5.1). Examples of sherds from each period are presented in this appendix, followed by sketches, photographs and chronological group of each decorated and rim sherd. Approximate rim/base diameter is given when possible.

Figure 58: Early Bronze Age sherds

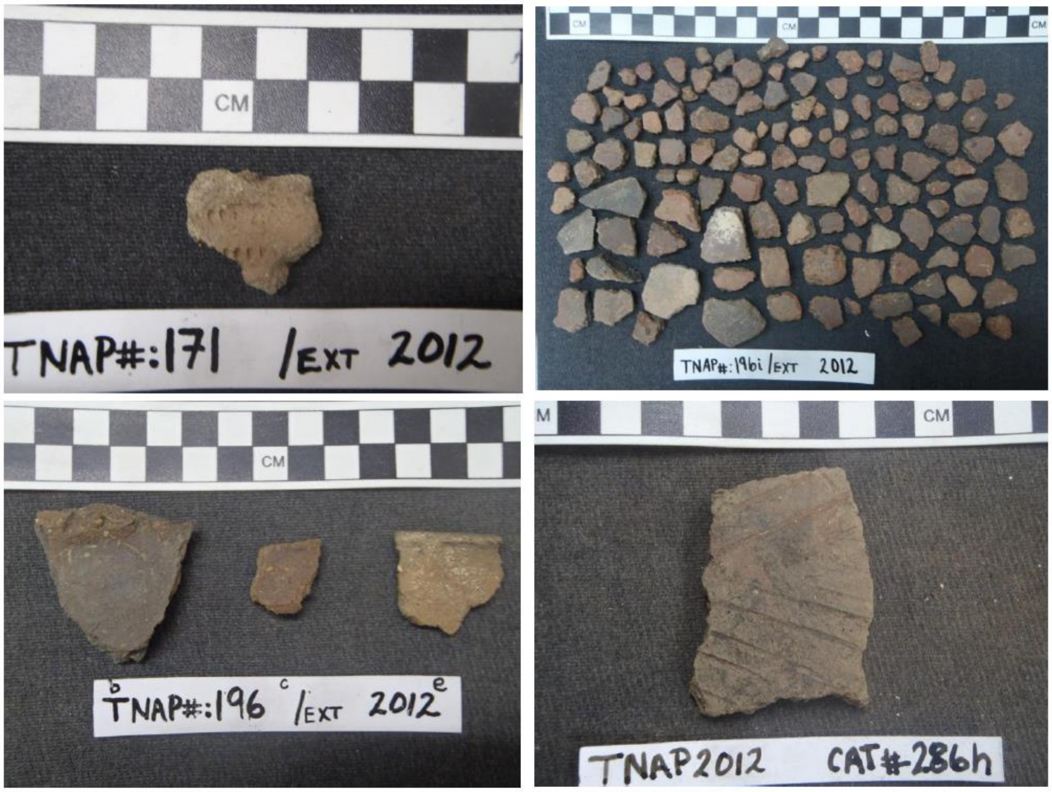


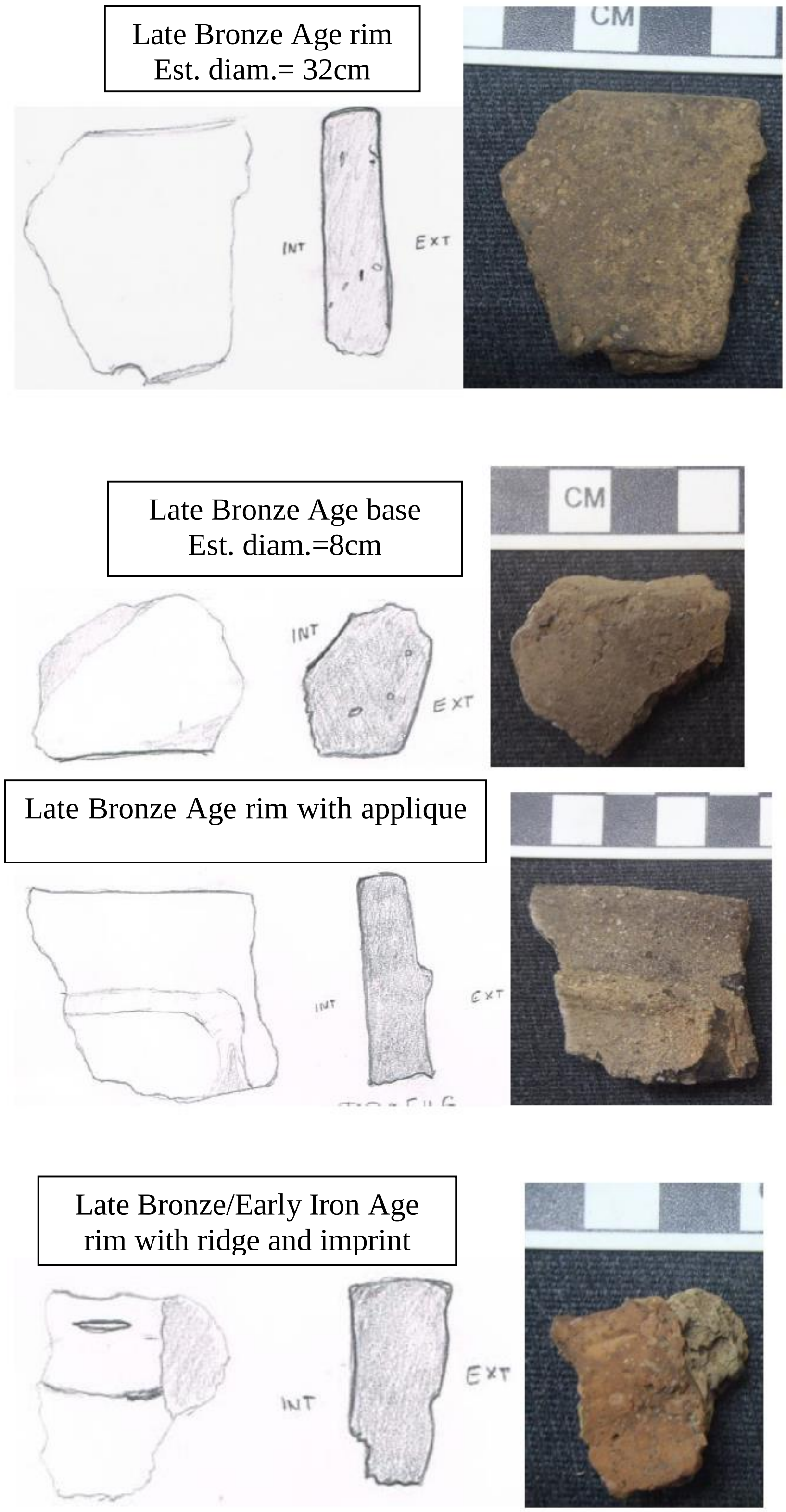
Figure 59: Late Bronze Age sherds

Figure 60: Late Bronze Age/Early Iron Age sherds

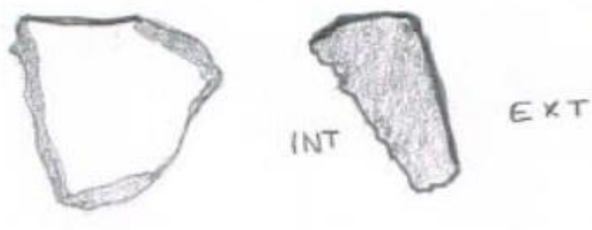
Figure 61: Iron Age (Xiongnu) sherds

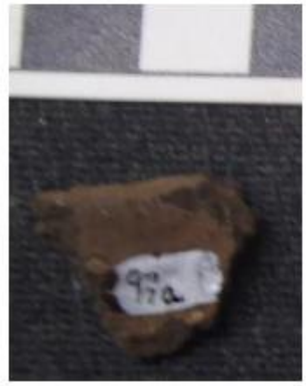
Figure 62: Turkic and later empires (pre-Mongol empire) sherds

Figure 63: Rim sherds from the Targan Nuur Archaeology Project



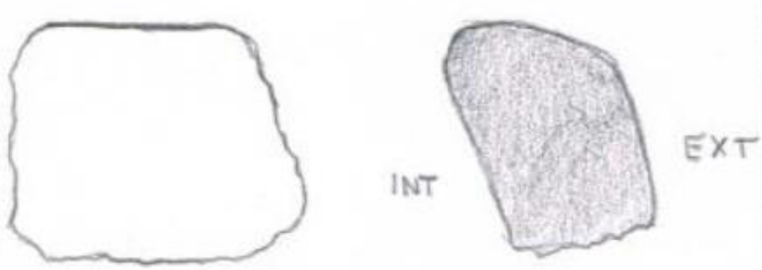
Turkic/Later Period rim



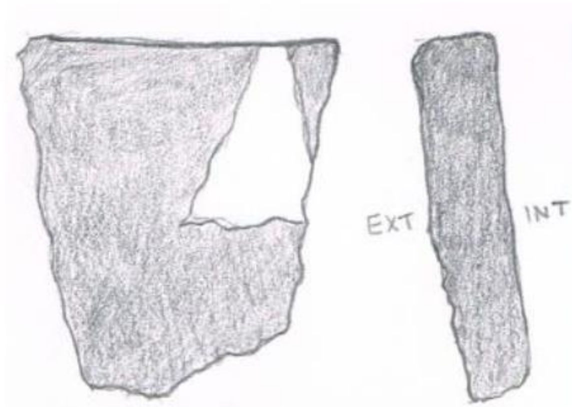


Late Bronze Age rim

Late Bronze Age rim
Est. diam.=28cm

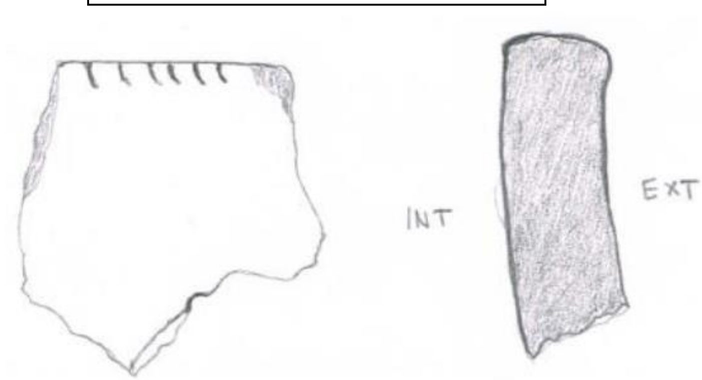


Late Bronze Age rim
Est. diam.=24cm

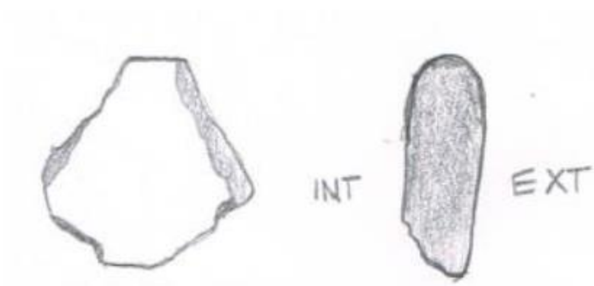


Late Bronze Age decorated
sherd with imprint

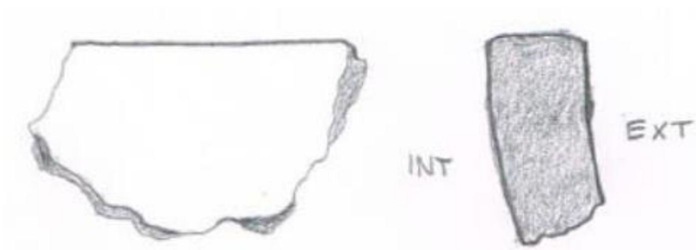
Late Bronze Age decorated rim
Est. diam.=18cm



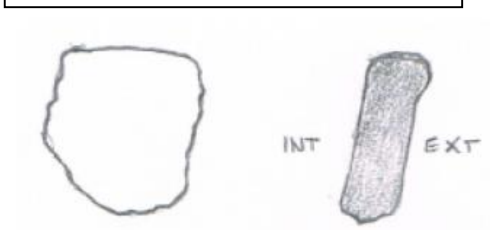
Late Bronze Age rim

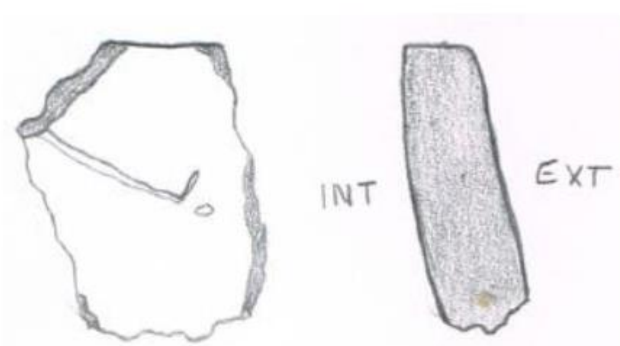


Xiongnu Period rim
Est. diam.=36cm



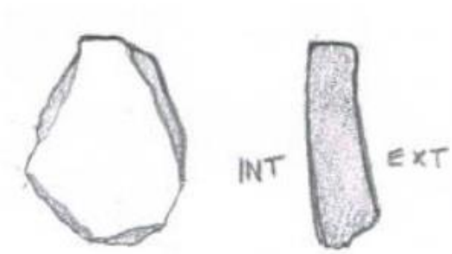
Late Bronze Age rim



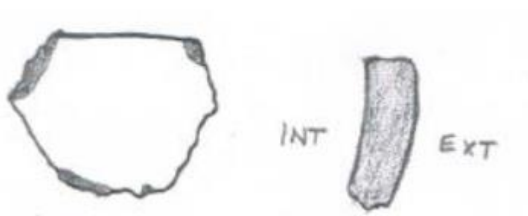


Late Bronze Age rim

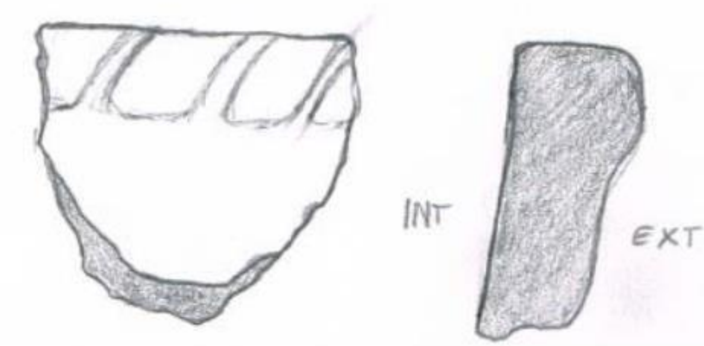
Late Bronze/Early Iron Age rim



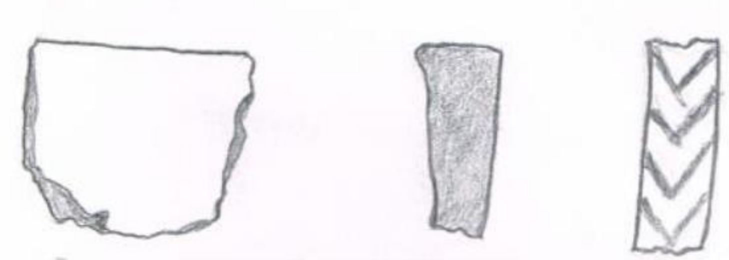
Late Bronze Age rim



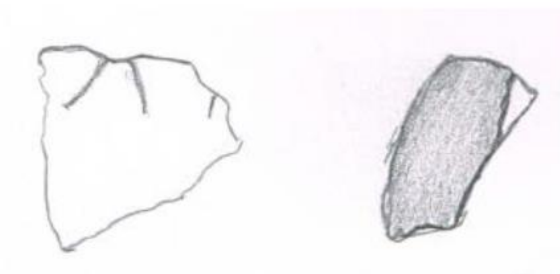
Late Bronze Age rim
Est. diam.=36cm

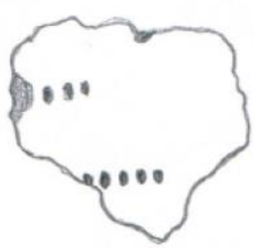


Xiongnu Period decorated rim



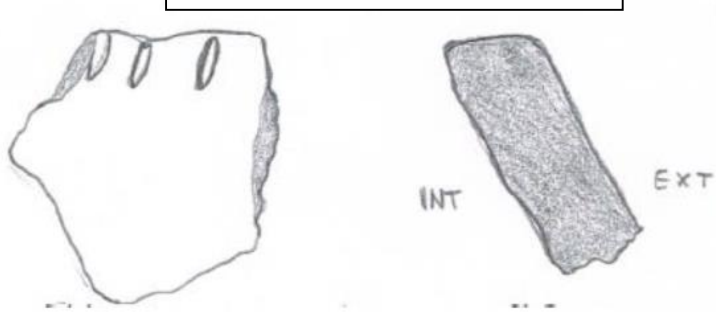
Late Bronze Age decorated rim



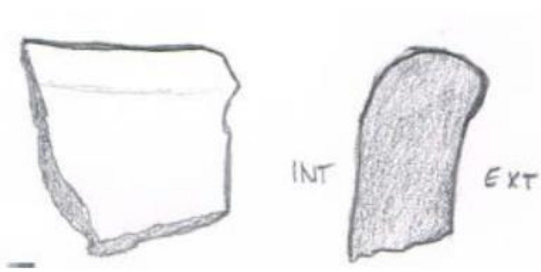


Early/Middle Bronze Age
decorated sherd

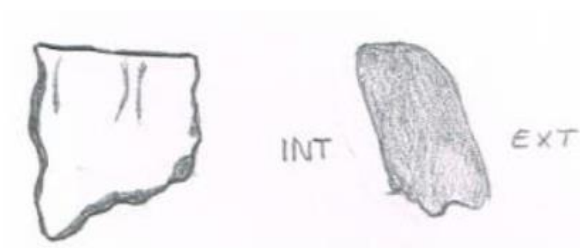
Late Bronze Age decorated rim



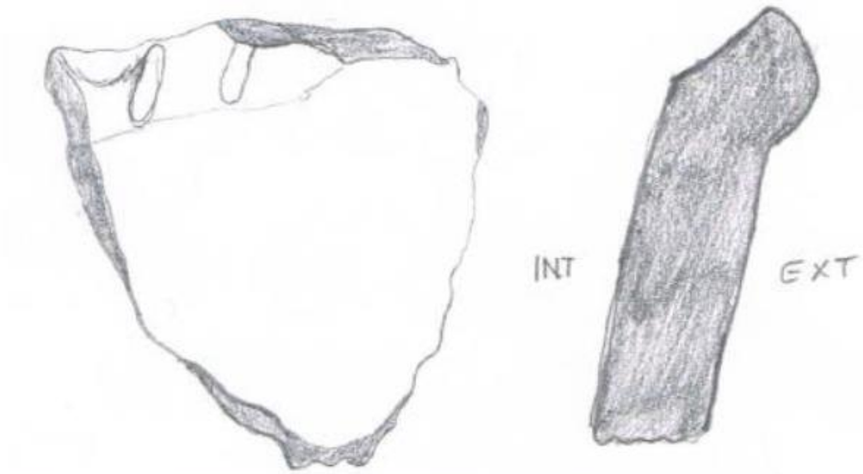
Late Bronze Age decorated rim
Est. diam.=20cm



Late Bronze Age decorated rim

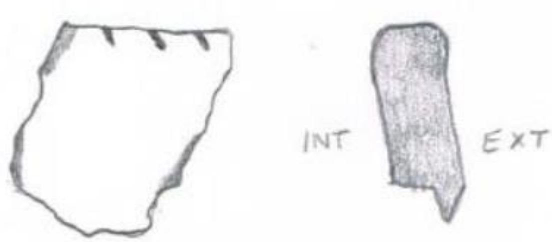


Turkic/Later Period decorated
rim (refit)
Est. diam.=20cm

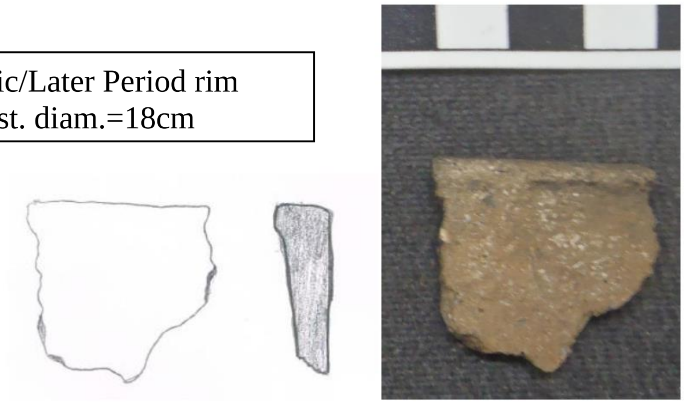


Late Bronze Age decorated rim

Early/Middle Bronze Age decorated rim



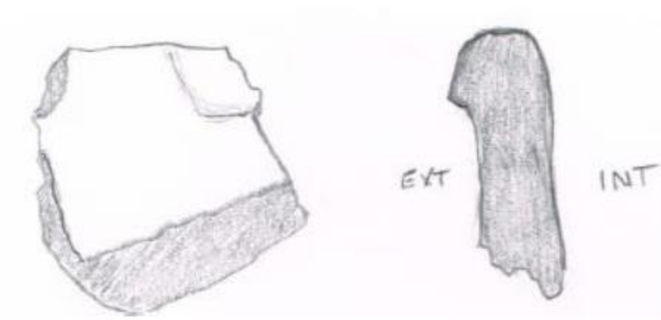
Turkic/Later Period rim
Est. diam.=18cm



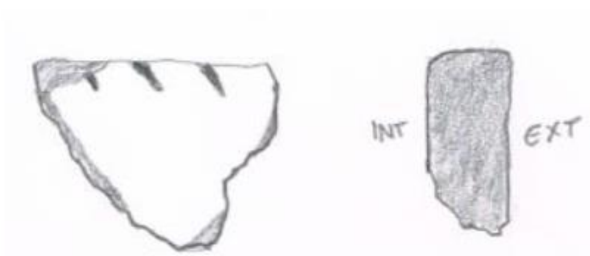
Early/Middle Bronze Age
decorated sherd

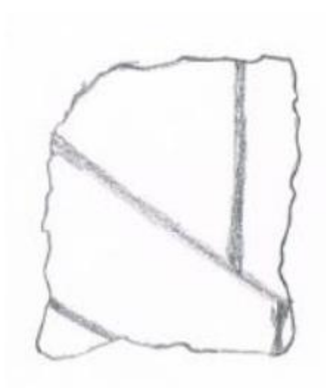
Late Bronze Age decorated
sherd

Late Bronze Age decorated rim



Xiongnu Period decorated rim

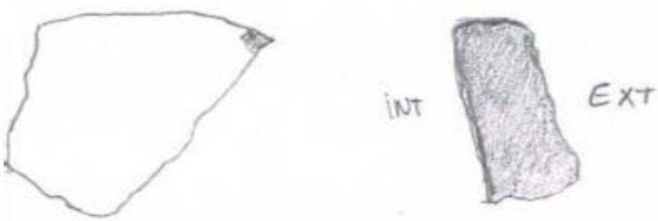


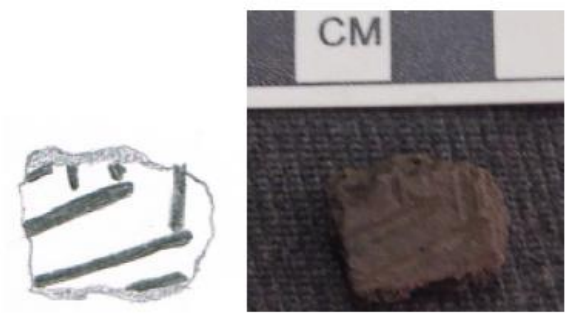


Turkic/Later Period
decorated sherd

Late Bronze/Early Iron Age decorated sherd

Late Bronze Age rim





Turkic/Later Period decorated sherd

Late Bronze Age token/handle?

Early/Middle Bronze Age
decorated sherd

APPENDIX D

TARGAN NUUR ARCHAEOLOGY PROJECT FAUNAL CODING SYSTEM

The following system was devised by Julia Clark (the author) and Megan Conger (Undergraduate assistant, University of Pittsburgh). It is based on coding systems used by the Khanuy Valley Archaeology Project in central Mongolia (Broderick 2011) and the Pavlinovo System (Hanks 2003).

Figure 64: Faunal Coding System

Field 1
Site

Field 2
Date (dd-mon-yyyy)

Field 3
Collection Method
01 Survey
02 Excavation
999 Unknown

Field 4
Screen size
01 1 mm
05 5 mm
999 Unknown
(etc…)

Field 5
Transect/Unit

Field 6
Level

Field 7
Bag Number

Field 8
Bone Identification number

Field 9
Length (= greatest linear dimension) (mm)

Field 10
Other measurements taken?
1 No
2 Yes, see Metric Form

Field 11
Weight (g)

Field 12
Certainty Index
1--more than 50% of some identifiable landmark/articular/occlusal surface present
2--Between 50% and 25 % of some some identifiable landmark/articular/occlusal surface present
3--Between 25% and 1 % of some identifiable landmark/articular/occlusal surface present
4--No (0%) identifiable landmark/articular/occlusal surface present

Field 13
Element Identification
** Unless otherwise noted…
  No decimal = whole element OR too small/fragmented to tell
  .01 Proximal
  .02 Shaft
  .03 Distal
01 Cranium
02 Hyoid
03 General vertebra (codes below for all vertebrae, 03-09)
  .04 Body
  .05 Neural Arch
  .06 Transverse Process

.07 Spinous Process
04 Atlas
05 Axis
06 Cervical vertebra
07 Thoracic vertebra
08 Lumbar vertebra
09 Caudal vertebra
10 Sacrum
11 Rib
.08 Vertebral End
.09 Shaft
.10 Sternal End
12 Sternum
13 Scapula
.11 Glenoid Fossa + Neck
.12 Spine
.13 Vertebral Border
14 Clavicle**
15 Humerus**
16 Radius**
17 Ulna**
18 Radius + Ulna fused**
19 Carpal
20 Metacarpal**
21 Sesamoid (excl. Patella)
22 Phalanx**
23 First Phalanx
24 Second Phalanx
25 Third Phalanx
26 Pelvis
.14 Acetabulum
.15 Ilium
.16 Ischium
.17 Pubis
27 Femur**
28 Patella
29 Tibia**
30 Fibula**
31 Tibia + Fibula fused**
32 Astragalus
33 Calcaneus
34 Tarsal
35 Metatarsal**
36 Metapodial**
37 Loose Tooth Upper
38 Loose Tooth Lower
39 Loose Tooth General
40 Loose Molar (codes below for all ID'ed loose teeth 40-43)
.1 First
.2 Second
.3 Third
.4 Fourth
41 Loose Premolar
42 Loose Canine
43 Loose Incisor
44 Loose Cheek Tooth (Molar or Premolar)
45 Mandible
46 Unidentified Epiphysis
47 Long Bone Fragment
48 Horn Core
49 Flat Bone Fragment
50 Ear Bones
51 Antler/Horn
999 Indeterminate

Field 14

Animal Type Identification
01 Equidae
02 Bovinae
03 Ovis
04 Capra
05 Caprine (sheep/goat)
06 Suidae
07 Camelida
08 Canidae
09 Felidae
10 Rodentia/Lagomorpha
.01 Large (rabbit-sized or larger)
.02 Small (smaller than rabbit-sized)
11 Cervidae
.01 Large (Elk/Caribou sized)
.02 Small (deer-sized)
12 General Mammal
.01 Large (Deer-sized or larger)
.02 Medium (Sheep-sized)
.03Small (Cat-sized or smaller)
13 Aves (Bird)
.01 Large (Duck-sized or larger)
.02 Small (Smaller than Duck-sized)
14 Reptilia/Amphibia
15 Osteichthyes (Bony Fish)
999 Indeterminate

Field 15

Side
1 Left
2 Right
3 N/A (non-sideable element)
999 Indeterminate

Field 16
Sex
1 Female
2 Male
999 Indeterminate

Field 17
Age
1 Subadult/Deciduous(Teeth)
2 Adult/Permanent(Teeth)
3 Old Adult
999 Indeterminate

Field 18
Percent Complete
Of total bone
In increments of 5%
999 indeterminate
(if element is 999, this must also be 999)

Field 19
Breaks
1 Absent
2 Present

Field 20
Recent Breaks
1 Absent
2 Present
999 Indeterminate

Field 21
Modifications
1 Absent
2 Cut mark
3 Conchoidal Flaking
4 Chop Mark
5 Scrape Mark
6 Saw Mark
7 Pitting
8 Puncture
999 Present but Indeterminate

Field 22
Burning
1 Absent (unburned)
2 Burned
3 Calcined
999 Indeterminate

Field 23
Weathering
1 Absent
2 Spalling
3 Fine Line Fractures
4 Erosion of Edges
5 Articular Surface Cracking
6 Bone Surface Cracking
7 Bone Surface Abrasion
999 Present but Indeterminate

Field 24
Gnawing
1 Absent
2 Present
999 Indeterminate

Field 25
Staining
1 Discoloration absent (same color throughout)
2 Discoloration localized
.[Munsell] (indicate color)
3 Discoloration throughout (ie, mottling)
.[Munsell] (indicate color)

Field 26
Overall Preservation
1- Excellent
2- Okay
3- Poor
4- Terrible

Field 27
Comment
Include: Wear Stage for teeth, noteable associations, etc…

ON A SEPARATE FORM…
Metric data, include:

Fields 1-8
Name of Measurement
Value

-Measurements will follow guidelines in Von den Driesch manual
-All possible measurements will be taken for all elements where designated points are present

Figure 65: Faunal Remains from the Targan Nuur Archaeology Project

1: SITE	2: DATE	3: COLLECTION METHOD	4: SCREEN SIZE (MM)	5: TRANSECT/UNIT	6: CONTEXT	7: CATALOGUE #	8: LENGTH (MM)	9: OTHER MEA1EMENTS?	10: WEIGHT (G)	11: CERTAINTY INDEX	12: ELEMENT	13: SPECIES	14: SIDE	15: SEX	16: AGE	17: % COMPLETE	18: BREAKS	19: RECENT BREAKS	20: MODIFICATIONS	21: BURNING	22: WEATHERING	23: GNAWING	24: STAINING	25: PRESERVATION	26: COMMENTS
1	29/07/2012	2	6	TR2/A1	1	111	31.3		0.8	3	39	12	999	999	999	999	2	2	1	1	1	1	1	2	"refit" 2 frags.; ???
1	30/07/2012	2	6	TR1/A1	4	123	13		0.3	1	45	10.02	1	999	999	15	2	1	1	1	1	1	1	2	5 teeth present; likely intrusive
1	29/07/2012	2	6	TR2/A1	2	245b	45.76		1.7	4	47	12.02	999	999	999	999	2	2	2	1	4	1	1	2	
1	30/07/2012	2	6	TR4/A1	2	246b	17.26		1.2	4	999	999	999	999	999	999	2	1	1	1	4	1	1	2	
2	31/07/2012	2	6	TR3/A1	2	247b	7.99		0.5	3	39	999	999	999	999	999	2	2	1	1	6	1	1	3	
2	31/07/2012	2	6	TR3/A1	1	100	17.7		0.4	4	999	999	999	999	999	999	2	2	1	1	6	1	1	3	
2	1/8/2012	2	6	TR3/A1	2	262b	-		<.1	4	999	999	999	999	999	999	2	2	2	3	999	999	999	3	fragments so small - impractical
3	5/8/2012	2	6	TR3/A1	2	212c	70.6		20.1	1	1	1	2	999	999	5	2	1	2	1	4	1	1	2	large skull frag
3	3/8/2012	2	6	TR3/A1	1	206c	37.98		8.5	1	4	1	999	999	999	10	2	1	1	2	3,4,8	1	1	2	
3	3/8/2012	2	6	TR3/A1	1	206c	57.25		13.5	1	4	1	999	999	999	10	2	2	1	2	4,8	1	1	2	
3	5/8/2012	2	6	TR3/A1	3	211	15.89		0.5	3	11	999					2	1	1	2	6	1	1	2	rib?
3	3/8/2012	2	6	TR3/A1	1	206c	57.16		5.1	1	11.09	12.01	999	999	999	20	2	2	1	1	2,3,4,7	1	1	3	
3	5/8/2012	2	6	TR3/A1	2	212c	89.55		10.7	3	11.09	12.01					2	2	2	1	6	1	1	2	large rib?; 2 frags
3	5/8/2012	2	6	TR3/A1	2	212c	52.03		1.8	3	11.09	12.02					2	1	1	1	6,7	1	1	2	rib?
3	5/8/2012	2	6	TR3/A1	2	212c	18.5		0.4	3	11.09	12.02					2	1	1	1	4	1	1	2	rib frag
3	3/8/2012	2	6	TR2/A1	2	200b	101.6		34.9	1	16	12.01	2	999	2	15	2	2	1	1	4,7,8	1	1	2	cow sized
3	5/8/2012	2	6	TR3/A1	2	212c	92.79		30.1	1	20	2	999	999	999	30	2	2	1	2	6,7,8	1	1	2	refit - 4 frags
3	3/8/2012	2	6	TR3/A1	1	206c	51.43		23.3	1	24	1	999	999	1	85	2	1	2	1	3,4,5	1	1	2	prox. Epiph. Missing
3	6/8/2012	2	6	TR3/A1	3	210b	18.21		0.6	3	26	999					2	1	1	3	1	1	1	2	pelvis leading up to acetab.?
3	6/8/2012	2	6	TR3/A1	3	210b	14.87		0.5	3	26.14	999					2	1	1	3	8	1	1	2	acetab.?
3	3/8/2012	2	6	TR2/A1	2	200b	79.23		12.1	2	29.02	12.01	1	999	999	20	2	2	1	1	4,7,8	1	1	2	
3	3/8/2012	2	6	TR2/A1	2	200b	203.8		39.5	1	29.02	12.02	2	999	999	80	2	2	1	1	2,4,7,8	1	1	2	
3	3/8/2012	2	6	TR3/A1	1	206c	139.48		10	2	29.02	12.02	999	999	999	40	2	2	1	1	4	1	1	2	sheep/goat size
3	3/8/2012	2	6	TR1/A1	1	202b	119.06	2	38	2	29.03	1	2	999	2	40	2	1	4	1	3,4,6,7,8	1	1	2	2 chopmarks on distal end
3	7/8/2012	2	6	TR4/A1	2	201a	53.95		7.2	1	36	12.02					2	1	1	1	3,4,8	1	1	2	sheep/goat size
3	5/8/2012	2	6	TR3/A1	2	212c	32.51		6.6	1	37	12	999	999	999	999	2	2	1	1	6	1	1	2	>sheep, <cow
3	3/8/2012	2	6	TR3/A1	1	206c	36.49		13.1	1	39	1	1	999		95	1	2	1	1	6	1	1	2	left forward most bottom
3	5/8/2012	2	6	TR1/A1	2	205d	17.41		0.4	3	39	12	999	999	999	999	2	1	1	1	1	1	1	2	
3	6/8/2012	2	6	TR3/A1	3	210b	17.59		0.1	3	39	999					2	1	2	1	1	1	1	2	tooth frag
3	6/8/2012	2	6	TR3/A1	3	210b	21.31		0.5	3	39	999					2	1	1	1	1	1	1	2	tooth frag
3	5/8/2012	2	6	TR3/A1	3	211	37.5		3.2	3	39	999					2	1	1	1	8	1	1	2	tooth frag
3	3/8/2012	2	6	TR2/A1	1	203a	37.51		2.8	1	46	12.02	999	999	1	85	1	1	1	1	3,4,	1	1	2	unfused epiphysis
3	6/8/2012	2	6	TR3/A1	3	210b	15.36		1.1	3	46	999					2	1	1	3	1	1	1	2	ball epiph.
3	3/8/2012	2	6	TR2/A1	2	200b	48.7		2.4	4	47	12	999	999	999	999	2	1	1	1	4,7,8	1	1	3	lot:2
3	3/8/2012	2	6	TR2/A1	2	200b	28.1		1.3	4	47	12	999	999	999	999	2	1	1	2	8	1	1	2	partially burnt
3	7/8/2012	2	6	TR4/A1	2	201a	34.92		14.1	4	47	12	999	999	999	999	2	2	1	1	3,4,7,8		1	3	lot:11
3	7/8/2012	2	6	TR4/A1	2	201a	22.5		1.3	4	47	12	999	999	999	999	2	1	1	2	3,4	1	1	2	
3	3/8/2012	2	6	TR2/A1	1	203a	44.96		13.8	4	47	12	999	999	999	999	2	2	1	1	3,7,8	1	1	2	lot:8
3	5/9/2012	2	6	TR1/A1	2	205d	21.77		1.7	4	47	12	999	999	999	999	2	1	1	1	2,6	1	1	2	lot:3
3	5/10/2012	2	6	TR1/A1	2	205d	14.57		4	4	47	12	999	999	999	999	2	1	1	2	3,8	1	1	2	lot:8
3	3/8/2012	2	6	TR3/A1	1	206c	15.68		0.8	4	47	12	999	999	999	999	2	1	1	2	1	1	1	1	lot:2
3	3/8/2012	2	6	TR3/A1	1	206c	33.75		20.7	4	47	12	999	999	999	999	2	2	4	1	3,4,7,8	1	1	2	lot:11
3	7/8/2012	2	6	TR3/A1	3	207b	21		1	4	47	12	999	999	999	999	2	1	1	3	1	1	1	2	
3	6/8/2012	2	6	TR3/A1	3	210b	20.7		2.2	4	47	12	999	999	999	999	2	1	1	1	6	1	1	2	lot:3

1: SITE	2: DATE	3: COLLECTION METHOD	4: SCREEN SIZE (MM)	5: TRANSECT/UNIT	6: CONTEXT	7: CATALOGUE #	8: LENGTH (MM)	9: OTHER MEA1EMENTS?	10: WEIGHT (G)	11: CERTAINTY INDEX	12: ELEMENT	13: SPECIES	14: SIDE	15: SEX	16: AGE	17: % COMPLETE	18: BREAKS	19: RECENT BREAKS	20: MODIFICATIONS	21: BURNING	22: WEATHERING	23: GNAWING	24: STAINING	25: PRESERVATION	26: COMMENTS
3	6/9/2012	2	6	TR3/A1	3	210b	18.17		7	4	47	12	999	999	999	999	2	1	1	3	8	1	1	2	lot:8
3	5/8/2012	2	6	TR3/A1	3	211	27.1		6	4	47	12	999	999	999	999	2	1	1	2	8	1	1	2	lot:2
3	5/8/2012	2	6	TR3/A1	2	212c	38.4		35.1	4	47	12	999	999	999	999	2	2	1	1	3,4,6,8	1	1	2	lot:11
3	6/8/2012	2	6	TR3/A1	3	213	14.06		0.5	4	47	12	999	999	999	999	2	1	1	3	1	1	1	2	
3	5/8/2012	2	6	TR4/A1	2	214a	37.09		2.3	4	47	12	999	999	999	999	2	2	1	1	3,4,6	1	1	3	3 frags - same bone?
3	5/8/2012	2	6	TR4/A1	1	215	15.12		2.2	4	47	12	999	999	999	999	2	2	1	1	3,8	1	1	2	lot:6
3	5/8/2012	2	6	TR2/A1	2	217a	35.87		4.2	4	47	12	999	999	999	999	2	1	1	1	6,8	1	1	2	"shiny"/smooth luster
3	5/8/2012	2	6	TR3/A1	2	212c	17.388		4.7	4	47	12.02	999	999	999	999	2	1	1	3	8	1	1	2	lot:5
3	5/8/2012	2	6	TR3/A1	2	212c	26.1		0.8	4	47	12.02	999	999	999	999	2	1	1	2	2,8	1	1	2	lot:3
3	5/8/2012	2	6	TR1/A1	1	219a	16.77		3.7	4	47	12.02	999	999	999	999	2	1	1	2	8	1	1	2	"shiny"/smooth luster
3	3/8/2012	2	6	TR3/A1	1	206c	66.57		2.5	2	47	999	999	999	1	95	2	2	1	1	2,3,4,6,7	1	1	4	"refit" 2 frags.
3	3/8/2012	2	6	TR3/A1	1	206c	21.17		1.8	3	49	12	999	999	999	999	2	1	1	1	6,7,8	1	1	2	lot:2
3	3/8/2012	2	6	TR3/A1	1	206c	25.92		1.1	4	50	12	999	999	999	999	2	1	1	1	8	1	1	2	
3	5/8/2012	2	6	TR3/A1	2	212c	31.66		5.2	3	50	999	999	999	999	999	2	1	1	1	4	1	1	2	lot:3; skull frags
3	3/8/2012	2	6	TR3/A1	1	206c	11.61		1.4	4	999	12	999	999	999	999	2	1	1	3	1	1	1	1	lot:4
3	3/8/2012	2	6	TR1/A1	1	202b	25.08		0.6	4	999	999	999	999	999	999	2	1	1	1	3,4	1	1	3	
3	3/8/2012	2	6	TR1/A1	1	202b	5.22		0.1	4	999	999	999	999	999	999	2	1	1	3	1	1	1	2	
3	3/8/2012	2	6	TR2/A1	1	203a	5.59		0.5	4	999	999	999	999	999	999	2	1	1	3	1	1	1	2	lot:11
3	5/8/2012	2	6	TR3/A1	2	204b	12.79		0.9	4	999	999	999	999	999	999	2	1	1	3	1	1	1	2	
3	3/8/2012	2	6	TR3/A1	1	206c	15.6		1.3	4	999	999	999	999	999	999	2	2	1	1	7	1	1	3	lot:3
3	7/8/2012	2	6	TR3/A1	3	207b	15.63		0.4	4	999	999	999	999	999	999	2	1	1	2	1	1	1	2	
3	2/8/2012	2	6	TR3/A1	1	209d	12.65		0.2	4	999	999	999	999	999	999	2	1	1	3	1	1	1	2	
3	6/8/2012	2	6	TR3/A1	3	210b	20.35		0.9	4	999	999	999	999	999	999	2	1	1	1	6	1	1	2	lot:3
3	6/8/2012	2	6	TR3/A1	3	210b	25.38		3.2	4	999	999	999	999	999	999	2	1	1	3	8	1	1	2	lot:2; partially calcined (?)
3	6/8/2012	2	6	TR3/A1	3	210b	11.5		5.1	4	999	999	999	999	999	999	2	1	1	3	8	1	1	2	lot:29; calcined
3	5/8/2012	2	6	TR3/A1	3	211	25.3		6	4	999	999	999	999	999	999	2	2	1	1	3,4,6,7,8	1	1	3	lot:9
3	5/8/2012	2	6	TR3/A1	3	211	12.26		3.8	4	999	999	999	999	999	999	2	1	1	3	8	1	1	2	lot:13
3	5/8/2012	2	6	TR3/A1	2	212c	23.2		14	4	999	999	999	999	999	999	2	2	1	1	2,3,4,6,7,8	1	1	3	lot:24
3	5/8/2012	2	6	TR3/A1	2	212c	17.67		8.9	4	999	999	999	999	999	999	2	1	1	3	8	1	1	2	lot:19
3	5/8/2012	2	6	TR4/A1	1	215	6.2		0.2	4	999	999	999	999	999	999	2	1	1	2	8	1	1	2	lot:2
3	6/8/2012	2	6	TR3/A1	3	216b	18.43		0.1	3	999	999	999	999	999	999	2	1	1	2	8	1	1	2	from flotation
3	6/8/2012	2	6	TR3/A1	2	220	13.12		1.3	3	999	999	999	999	999	999	2	1	1	3	1	1	1	2	lot:3; from flotation
3	7/8/2012	2	6	TR4/A1	2	201a	160		43.1	3	999	999	999	999	999	999	2	2	1	1	4,7,8	1	1	3	
3	3/8/2012	2	6	TR1/A1	1	202b	39.37	1	3.4	3	999	999	999	999	999	999	2	1	1	2	8	1	1	2	
3	3/8/2012	2	6	TR3/A1	1	206c	13.28		0.7	3	999	999	999	999	999	999	2	1	1	1	1	1	1	2	
3	3/8/2012	2	6	TR3/A1	1	206c	12.14		0.2	3	999	999	999	999	999	999	2	1	1	1	1	1	1	2	
3	3/8/2012	2	6	TR3/A1	1	206c	28.01		3.2	3	999	999	999	999	999	999	2	1	1	2	3,4	1	1	3	
3	3/8/2012	2	6	TR3/A1	1	206c	18.01		0.6	3	999	999	999	999	999	999	2	1	1	1	4	1	1	3	
3	3/8/2012	2	6	TR3/A1	1	206c	24.65		1.2	3	999	999	999	999	999	999	2	1	2	1	3,4	1	1	2	
3	3/8/2012	2	6	TR3/A1	1	206c	16.09		0.8	2	999	999	999	999	999	999	2	1	1	1	3	1	1	2	
3	3/8/2012	2	6	TR3/A1	1	206c	39.08		0.3	3	999	999	999	999	999	999	2	1	1	1	6	1	1	3	
3	6/10/2012	2	6	TR3/A1	3	210b	25.98		1.5	3	999	999	999	999	999	999	2	1	1	3	8	1	1	2	partially calcined?
3	5/8/2012	2	6	TR3/A1	2	212c	59.06		3.2	2	999	999	999	999	999	999	2	1	1	1	6,7,8	1	1	2	
3	5/8/2012	2	6	TR3/A1	3	211	12.95		0.3	2	19/34	999	999	999	999	999	1	1	1	1	1	1	1	2	carpal/tarsal?

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3	5/8/2012	2	6	TR3/A1	2	212c	18.7		1.4	1	19/34	999	999	999	999	999	2	1	1	1	4	1	1	3	carpal/tarsal?
4	9/8/2012	2	6	TR1/A1	1	224b	93.99		20.8	3	1	1	1	999	999	5	2	1	1	1	7	1	1	2	skull frag
4	10/8/2012	2	6	TR1/A1	2	225b	83.9		16	1	1	5	1	999	999	10	2	1	2	1	4	1	1	2	2 skull frags - refit along suture
4	11/8/2012	2	6	TR4/A1	4	241c	12.68		0.3	2	3	10.02	999	999	999	999	2	1	1	1	1	1	1	2	
4	10/8/2012	2	6	TR1/A1	3	226a	15.95		0.9	3	3	999	999	999	999	999	2	1	1	2	4	1	1	3	vert. edge
4	11/8/2012	2	6	TR4/A1	4	241c	53.29		25.5	1	4	999	999	999	1	95	1	1	1	1	3,4,7	1	1	3	sheep goat sized
4	10/8/2012	2	6	TR1/A1	3	226a	14.09		0.4	3	11	999	999	999	999	999	2	1	1	1	4	1	1	3	concave - rib end
4	11/8/2012	2	6	TR1/A1	5	237	56.37		3.2	3	11.09	1	999	999	999	5	2	1	2	1	6	1	1	2	
4	10/8/2012	2	6	TR1/A1	3	226a	62.72		6.6	1	15	12.02	2	999	999	15	2	1	1	1	1	1	1	2	sheep sized - more gracile?
4	11/8/2012	2	6	TR4/A1	4	241c	46.62		24.2	1	24	1	999	999	1	95	1	1	1	1	3,4,6,7	1	1	3	unfused epiphysis + main bone
4	10/8/2012	2	6	TR2/A1	1	235	44.79		10.2	1	25	2	999	999	999	90	2	1	1	1	3,4,6,7	1	1	2	
4	11/8/2012	2	6	TR4/A1	4	241c	15.45		0.5	2	27.03	10.02	999	999	999	999	2	1	1	1	1	1	1	2	
4	11/8/2012	2	6	TR4/A1	2	240	19.98		2.1	3	28	5	1	999	1	95	2	1	1	1	4	1	1	3	1face mostly eroded away
4	11/8/2012	2	6	TR3/A1	5	232b	102.31		62.9	1	33	1	2	999	2	90	2	1	1	1	3,4	2	1	2	
4	10/8/2012	2	6	TR1/A1	2	225b	94.03		8.1	2	36	1	999	999	999	999	2	1	1	1	4	1	1	2	horse side of metapodial
4	9/8/2012	2	6	TR1/A1	1	224b	17.19		1.9	2	39	1	999	999	999	999	2	1	1	1	6	1	1	2	tooth frag
4	10/8/2012	2	6	TR4/A1	1	238b	12.72		3.6	3	39	1	999	999	999	999	2	1	1	1	6	1	1	2	5 tooth frags.
4	11/8/2012	2	6	TR4/A1	4	241c	34.13		9.1	3	39	1	999	999	999	999	2	1	1	1	6	1	1	2	tooth frag; very broken up.
4	10/8/2012	2	6	TR3/A1	1	227c	18.79		1.9	3	39	12	999	999	999	999	2	1	1	1	1	1	1	2	lot:3; tooth frags
4	9/8/2012	2	6	TR1/A1	1	224b	11.73		0.4	2	39	999	999	999	999	999	2	1	1	1	1	1	1	2	smaller tooth frag
4	10/8/2012	2	6	TR1/A1	2	225b	13.9		3.4	3	39	999	999	999	999	999	2	2	1	1	1	1	1	2	lot:7; tooth frags
4	10/8/2012	2	6	TR1/A1	3	226a	18.44		0.6	1	39	999	999	999	999	999	2	1	1	1	1	1	1	2	tooth - two frags re-fit
4	10/8/2012	2	6	TR1/A1	3	226a	12.63		0.8	3	39	999	999	999	999	999	2	1	1	1	1	1	1	2	2 tooth frags
4	10/8/2012	2	6	TR2/A1	1	235	20.66		3	3	39	999	999	999	999	999	2	1	1	1	6	1	1	2	2 tooth frags
4	11/8/2012	2	6	TR4/A1	5	242	115.24		46.6	4	45	5	2	999	1	40	2	2	2	1	3,6	1	1	2	age based on tooth eruption
4	11/8/2012	2	6	TR4/A1	4	241c	19.35		0.5	1	45	10.02	1	999	999	85	2	1	1	1	1	1	1	2	lot:7; likely intrusive
4	13/08/2012	2	6	TR4/A1	5	243	13.72		0.1	1	45	10.02	1	999	999	35	2	1	1	1	1	1	1	2	
4	13/08/2012	2	6	TR4/A1	5	243	13.19		0.1	1	45	10.02	1	999	999	70	2	1	1	1	1	1	1	2	
4	9/8/2012	2	6	TR1/A1	1	224b	30.59		1.3	1	46	999	999	999	999	999	1	1	1	1	4	1	1	2	unfused epiphysis
4	10/8/2012	2	6	TR3/A1	2	228b	24.56		1	3	46	999	999	999	999	999	2	1	1	1	3,6	1	1	2	piece of articular 1face
4	14/08/2012	2	6	TR3/A1	2	229	16.83		0.8	3	46	999	999	999	999	999	2	2	1	1	3,4,6	1	1	3	piece of articular 1face
4	5/9/2012	2	6	TR3/A2	3	211	39.99		5.1	4	47	12	999	999	999	999	2	2	1	1	4,6,8	1	1	2	lot:2
4	9/8/2012	2	6	TR1/A1	1	224b	33.57		1.4	4	47	12	999	999	999	999	2	1	1	1	4,6	2	1	2	
4	10/8/2012	2	6	TR1/A1	2	225b	31.87		39	4	47	12	999	999	999	999	2	2	2	1	2,3,4,6	1	1	2	lot:19
4	10/8/2012	2	6	TR1/A1	3	226a	27.7		8.2	4	47	12	999	999	999	999	2	2	1	1	3,4,6	1	1	2	lot:9
4	10/8/2012	2	6	TR3/A1	1	227c	30.62		6.1	4	47	12	999	999	999	999	2	2	1	1	3	1	1	2	lot:4
4	10/8/2012	2	6	TR3/A1	2	228b	41.78		2.8	4	47	12	999	999	999	999	2	1	2	1	1	1	1	2	long bone frag
4	11/8/2012	2	6	TR3/A1	4	231b	42.43		6.5	4	47	12	999	999	999	999	2	1	1	1	2,3,6,73	1	1	2	
4	11/8/2012	2	6	TR3/A1	5	232b	72.84		3.7	3	47	12	999	999	999	999	2	1	1	1	8	1	1	2	
4	11/8/2012	2	6	TR3/A1	6	233b	33.68		1.1	4	47	12	999	999	999	999	2	1	1	1	8	1	1	2	
4	10/8/2012	2	6	TR2/A1	1	235	24		5.1	4	47	12	999	999	999	999	2	2	1	1	3,4,	1	1	2	lot:6
4	10/8/2012	2	6	TR2/A1	5	236	22.87		0.6	4	47	12	999	999	999	999	2	1	1	1	6	1	1	1	coloring/condition sugest recent/intrusive
4	11/8/2012	2	6	TR4/A1	2	240	30.19		3.4	4	47	12	999	999	999	999	2	1	1	1	4,6	1	1	2	lot6
4	11/8/2012	2	6	TR4/A1	2	240	17.97		1.9	4	47	12	999	999	999	999	2	1	1	2	2,8	1	1	2	lot:2

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4	11/8/2012	2	6	TR4/A1	4	241c	15		11.5	4	47	12	999	999	999	999	2	1	1	3	8	1	1	2	lot:41
4	13/08/2012	2	6	TR4/A1	5	243	24.65		3.4	4	47	12	999	999	999	999	2	1	1	1	3,4,7	1	1	3	lot:4
4	10/8/2012	2	6	TR1/A1	3	226a	103.7		10.2	2	47	999	999	999	999	999	2	1	1	1	2,4,7	1	1	2	long bone
4	10/8/2012	2	6	TR1/A1	3	226a	34.06		1.5	3	47	999	999	999	999	999	2	1	1	1	1	1	1	2	smaller long bone
4	10/8/2012	2	6	TR1/A1	2	225b	15.16		0.1	4	49	12	999	999	999	999	2	1	2	1	1	1	1	2	single frag.
4	10/8/2012	2	6	TR1/A1	2	225b	24.41		4.3	3	50	12	999	999	999	999	2	2	1	1	1	1	1	2	lot:4; skull frags
4	11/8/2012	2	6	TR4/A1	2	240	20.64		7.4	3,4	50	12	999	999	999	999	2	2	1	1	3,4,6	1	1	2	lot:4
4	11/8/2012	2	6	TR1/A1	4	198	4.27		0.8	4	999	999	999	999	999	999	2	1	1	1	6	1	1	3	lot: 4 frags.
4	9/8/2012	2	6	TR1/A1	1	224b	14.28		3.1	4	999	999	999	999	999	999	2	2	1	1	3,4,6	1	1	3	lot:6
4	10/8/2012	2	6	TR1/A1	2	225b	12.65		0.2	4	999	999	999	999	999	999	2	1	1	3	1	1	1	2	
4	10/8/2012	2	6	TR1/A1	3	226a	11.26		1.3	3	999	999	999	999	999	999	2	1	1	1	1	1	1	2	lot: 3; very hard - tooth or skull frags
4	10/8/2012	2	6	TR1/A1	3	226a	11.83		1.5	4	999	999	999	999	999	999	2	2	1	1	3,4,6	1	1	2	lot:6
4	14/08/2012	2	6	TR3/A1	2	229	18.07		0.2	4	999	999	999	999	999	999	2	1	1	1	3,4	1	1	2	
4	11/8/2012	2	6	TR1/A1	5	237	27.33		0.5	4	999	999	999	999	999	999	2	1	1	1	3,4	1	1	3	
4	10/8/2012	2	6	TR4/A1	1	238b	19.74		1	3	999	999	999	999	999	999	2	2	1	1	3,4,5	1	1	3	artic. 1? Or sawed off edge?
4	10/8/2012	2	6	TR4/A1	1	238b	13.36		0.2	4	999	999	999	999	999	999	2	1	1	1	1	1	1	2	
4	11/8/2012	2	6	TR4/A1	2	240	10.14		1.4	4	999	999	999	999	999	999	2	1	1	3	8	1	1	2	lot:8
4	11/8/2012	2	6	TR4/A1	4	241c	9.33		2.6	3,4	999	999	999	999	999	999	2	1	1	1	1	1	1	2	lot:13; 1 frag weathered; others not
4	10/8/2012	2	6	TR1/A1	2	225b	9.19		15.9	3	999	999	999	999	999	999	2	1	1	1	4	2	1	2	
4	10/8/2012	2	6	TR3/A1	2	228b	11.44		0.1	3	999	999	999	999	999	999	2	2	1	1	1	1	1	2	rodent bone?; possibly intrusive
4	11/8/2012	2	6	TR3/A1	4	231b	15.07		0.4	3	999	999	999	999	999	999	2	2	1	1	4	1	1	2	
4	10/8/2012	2	6	TR4/A1	2	239	18.31		0.9	3	999	999	999	999	999	999	2	1	1	1	6	1	1	2	
4	11/8/2012	2	6	TR4/A1	2	240	71.15		4	3	999	999	999	999	999	999	2	1	1	1	4,6	2	1	3	
4	11/8/2012	2	6	TR4/A1	2	240	13.56		0.4	3	999	999	999	999	999	999	2	2	1	1	1	1	1	2	
4	13/08/2012	2	6	TR4/A1	5	243	56.37		27.2	1	999	999	999	999	999	999	2	1	1	1	2,7,8	1	1	3	severe root-etching
529720/5706840	9/8/2012	1	6	B8	shovel probe	269b	14.71		0.1	2	26.15	10.02	999	999	999	999	2	1	1	1	1	1	1	1	likely intrusive
529720/5706840	9/8/2012	1	6	B8	shovel probe	269b	28.58		0.7	4	47	12.02	999	999	999	999	2	1	1	1	1	1	1	1	intrusive based on context and condition
530080, 5705520	31/07/2012	1	6	C7	shovel probe	66b	22.2		1.4	3	0	5	1	999	2	5	2	1	1	1	4	1	1	2	
531040/5702777	9/8/2012	1	6	D4	shovel probe	263	10.59		0.5	1	22.01	999	999	999	999	999	2	1	2	3	3,8	1	1	2	proximal epiph of phalanx
531040/5702777	9/8/2012	1	6	D4	shovel probe	263	12.23		9.9	4	999	999	999	999	999	999	2	1	2	3	3,8	1	1	2	lot:29
531040/5702777	9/8/2012	1	6	D4	shovel probe	263	16.36		1.2	2	999	999	999	999	999	999	2	2	2	3	3	1	1	2	2 frags refit
531110, 5702660	5702660	2	6	D4	1face	98c	13.4		0.2	3	39	999	999	999	999	999	2	1	1	1	1	1	1	2	out of rodent hole, but possibly modern
534240, 5704201	27/07/2012	1	6	G6	shovel probe	78b	13.8, 9.2		0.6	3	999	999	999	999	999	999	2	1	1	1	1	1	1	2	
534460, 5704220	27/07/2012	1	6	G6	shovel probe	107	15.2		8	4	47	12.02	999	999	999	999	2	1	1	3	8	1	1	2	lot:13 frags.
534460, 5704220	27/07/2012	1	6	G6	shovel probe	107	15.11		0.6	4	49	12.02	999	999	999	999	2	1	1	3	8	1	1	2	
534501, 5704237	27/07/2012	1	6	G6	shovel probe	124	18.8		0.7	3	47	12.02	999	999	999	999	2	1	1	3	1	1	1	2	"refit" 3 frags.
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	East Side	275b	13.96		0.5	3	1	999	999	999	999	999	2	2	1	3	3	1	1	2	skull frag
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	16.83		0.4	3	3	12.03	999	999	999	999	2	1	1	1	4	1	1	2	vert frag
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	8.64		0.2	1	3	10.02	999	999	999	999	1	1	1	1	4	1	1	2	rodent vert.
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	20.93		1.8	3	3	999	999	999	999	999	2	1	1	1	7	1	1	3	verteb. Frags: 3
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	East Side	275b	26.3		6.4	1	15	5	1	999	999	10	2	1	1	2	4	1	1	2	conchoidal process?
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		280	61.3		2.7	1	16	5	2	999	1	90	1	1	1	1	3,4,7	1	1	3	epiphysis missing - juvenile
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	20.48		1.3	1	17	10.01	1	999	999	10	2	1	1	1	3,7	1	1	2	bigger than marmot
Circle Grave	?	2	6	Nutsgen Tolgoi		281	21.16		0.9	1	23	5	999	999	1	100	1	1	1	1	3,4	1	1	2	prox epiph. Missing

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Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #6	286d	21.02		0.6	1	23	5	999	999	1	70	2	1	1	3	7	1	1	2	phalanx
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi	Bayaraa's #18	274	12.62		0.4	1	24	5	999	999	1	100	1	1	1	1	7	1	1	2	proximal epiph missing
Circle Grave	?	2	6	Nutsgen Tolgoi		281	23.08		2.3	1	24	5	999	999	2	100	1	1	1	2	7	1	1	2	
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	19.49		1	1	24	5	999	999	1	90	1	1	1	1	4,7	1	1	2	
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	13.82		0.4	1	24	5	999	999	1	100	1	1	1	1	4	1	1	2	proximal phalanx epiphysis
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	East Side	275b	20.87		1.1	2	26.14	5	1	999	999	5	2	1	1	1	4	1	1	2	
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	14.17		0.2	2	26.14	10.02	1	999	999	5	2	2	1	3	7	1	1	2	smaller than marmot
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi	Bayaraa's #16	274	21.08		1.7	2	28	5	1	999	2	95	2	1	1	3	7	1	1	2	
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	16.4		3.4	2	39	12	999	999	999	999	2	1	1	1	7	1	1	2	tooth frags: 10
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi		279	13.18		0.3	3	39	999	999	999	999	999	2	1	1	1	6	1	1	3	
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #11	286i	41.8		0.9	3	39	999	999	999	999	999	2	2	1	1	7	1	1	2	2 tooth frags - refit
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	18.42		1.7	2	39	999	999	999	999	999	2	1	1	1	8	1	1	2	tooth frags 5/leaf/shovel shape
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	East Side	275b	24.5		1.3	3	39	999	999	999	999	999	2	1	1	2	6	1	1	2	2 tooth frags
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #8	286e	57.88		25.3	1	44	2	2	999	2?	85	2	1	1	1	2,7	1	1	2	tooth frags. 2: refit
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	12.99		0.4	1	46	13	999	999	999	999	2	1	1	1	7	1	1	2	epiphysis
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi	Bayaraa's #15	274	20.33		1.6	1	46	999	999	999	999	999	2	1	1	3	5,7	1	1	2	articular 1face
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	17.61		1.4	3	46	999	999	999	999	999	2	1	1	1	5,7	1	1	2	calcined socket
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	18.79		0.6	3	46	999	999	999	999	999	2	1	1	2	4	1	1	2	ball joint frag
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	30.92		0.8	2	47	13	999	999	999	999	2	1	1	1	6,7	1	1	2	bird long bone
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi	Bayaraa's #15	274	16.58		2.4	4	47	12	999	999	999	999	2	1	1	3	7	1	1	2	lot:6
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #11	286i	44.98		3	4	47	12	999	999	999	999	2	1	1	2	7	1	1	2	
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		273	46.4		2.5	4	47	12.02	999	999	999	999	2	1	1	1	3,7,8	1	1	2	
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		273	17.7		1.3	4	47	12.02	999	999	999	999	2	1	1	2	8	1	1	2	lot:2
Circle Grave	?	2	6	Nutsgen Tolgoi		281	21		2.3	4	47	999	999	999	999	999	2	1	1	1	3	1	1	2	lot:2
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	39.77		2.3	3	47	999	999	999	999	999	2	1	1	3	3	1	1	2	calcined long bone with bulge
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	42.94		2.1	2	47	999	999	999	999	999	2	1	1	1	7	1	1	2	long bone missing epiphysis
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	32.89		2.1	3	47	999	999	999	999	999	2	1	1	1	7	1	1	2	long bone with bulge
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi	Bayaraa's #20	274	33.6		0.5	1	50	15	999	999	999	999	2	1	1	1	4	1	1	2	dark lines around edges
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	34.83		1.4	1	50	10.02	999	999	999	999	2	1	1	1	1	1	1	1	rodent skull, pelvis, and other frags: 9
Circle Grave	?	2	6	Nutsgen Tolgoi		281	22.9		1.6	3	50	999	999	999	999	999	2	1	1	1	2	1	1	2	lot:2
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	27.78		1.2	3	50	999	999	999	999	999	2	1	1	1	7	1	1	3	skull frag
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #9	286f	30		7	3	51	11	999	2	2	999	2	1	1	1	3,4,7	1	1	3	antler frags: 4
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi	Bayaraa's #19	278	102.8		59.7	2	51	11.01	999	999	999	999	2	1	1	1	3,4,6,7	1	1	3	
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	17.1		3.1	4	51	12	999	999	999	999	2	1	1	1	3,4,7	1	1	3	antler/horn frags: 7
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	32.27		5.1	3	51	12.01		999	999	999	2	1	1	1	3,4,7	1	1	2	antler proximal
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi	Bayaraa's #17	274	11.5		0.4	4	999	12	999	999	999	999	2	1	1	3	3,4	1	1	2	lot:2
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi		278	66.27		2.8	3	999	12	999	999	999	999	2	1	1	1	7	1	1	2	
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	11.5		16.6	4	999	12	999	999	999	999	2	1	1	3	3,7	1	1	2	calcined frags: 43
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	6.1		4.2	4	999	12	999	999	999	999	2	1	1	2	4,7	1	1	3	mostly cancelous bone:6
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	21.49		2.6	4	999	12	999	999	999	999	2	2	1	1	3,7,8	1	1	2	long bone frags: 9
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	20.45		2.9	4	999	12	999	999	999	999	2	1	1	1	3,7	1	1	2	skull frags:15
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	22.7		2.9	4	999	12	999	999	999	999	2	1	1	2	7	1	1	2	burned long bone frags:5
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	9		2.8	4	999	12	999	999	999	999	2	1	1	1	7	1	1	3	lot:18
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	10		22	4	999	12	999	999	999	999	2	1	1	3	6,7	1	1	2	calcined bone frags: 53

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Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	47.8		44.6	4	999	12	999	999	999	999	2	1	1	1	2,3,6,7	1	1	2	big mammal frags: 3
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	18.05		6.6	4	999	12	999	999	999	999	2	1	1	1	3,7	1	1	2	med/sml mammal long bone frags: 13
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	19.6		4.9	4	999	12	999	999	999	999	2	1	1	2	2,3,7	1	1	2	med/sml mammal long bone burnt frags:10
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	20		2.8	3	999	12	999	999	999	999	2	1	1	3	4,7	1	1	2	
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	22.36		7.4	3	999	12.01	999	999	999	999	2	1	1	1	4	1	1	2	skull fags. Large mammal?:4
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #14	286j	18.92		0.6	4	999	12.01	999	999	999	999	2	1	1	3	7	1	1	2	
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	15.5		1.2	3	999	12.03	999	999	999	999	2	1	1	1	4	1	1	2	
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi	Bayaraa's #15	274	19.9		0.7	3	999	999	999	999	999	999	2	1	1	1	4,7	1	1	3	
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi	Bayaraa's #21	274	19.02		0.8	4	999	999	999	999	999	999	2	1	1	3	7	1	1	2	
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi	Bayaraa's #16	274	15.43		3.7	4	999	999	999	999	999	999	2	1	1	3	7	1	1	2	lot:20
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	East Side	275b	19.16		21.9	3/4	999	999	999	999	999	999	2	1	1	1	2,3,7	1	1	2	lot:45
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	East Side	275b	14		16.5	4	999	999	999	999	999	999	2	2	1	3	3,7	1	1	2	lot:52
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	from flotation	276	11.77		1	4	999	999	999	999	999	999	2	2	1	3	6,7	1	1	2	lot:2
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		277	15.04		1.4	4	999	999	999	999	999	999	2	1	1	1	3,4,7	1	1	2	lot:3
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		277	13.92		0.7	4	999	999	999	999	999	999	2	1	1	3	4	1	1	2	lot:2
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi		279	10.22		0.3	4	999	999	999	999	999	999	2	1	1	3	8	1	1	2	
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi		279	14.4		0.9	4	999	999	999	999	999	999	2	1	1	1	4	1	1	2	lot:2
Circle Grave	?	2	6	Nutsgen Tolgoi		281	8.45		0.6	4	999	999	999	999	999	999	2	1	1	3	7	1	1	2	lot:2
Circle Grave	?	2	6	Nutsgen Tolgoi		282	12.29		1.4	4	999	999	999	999	999	999	2	1	1	3	7	1	1	2	lot: 4
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #7	286b	16.2		3.5	4	999	999	999	999	999	999	2	1	1	1&3	7	1	1	2	lot:5
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #6	286d	8.7		5.8	4	999	999	999	999	999	999	2	1	1	3	7	1	1	2	lot:29
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's#9	286f	24.6		3.3	4	999	999	999	999	999	999	2	1	1	2	7	1	1	2	long bone frags:5
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #9	286f	11.7		1.6	4	999	999	999	999	999	999	2	1	1	3	7	1	1	2	calcined frags: 4
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #10	286g	12.6		4.2	4	999	999	999	999	999	999	2	1	1	3	7	1	1	2	calcined frags:14
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #10	286g	16.1		1.2	4	999	999	999	999	999	999	2	1	1	1	3,7	1	1	2	frags: 3
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #10	286g	13.1		0.8	4	999	999	999	999	999	999	2	1	1	2	7	1	1	2	burnt frags:2
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #11	286i	12.76		1.7	4	999	999	999	999	999	999	2	1	1	3	7	1	1	2	frags:7
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #14	286j	55.65		6	3	999	999	999	999	999	999	2	1	1	1	7,8	1	1	2	
Circle Grave	1/8/2012	2	6	Nutsgen Tolgoi	Bayaraa's #16	274	15.49		2	3	999	999	999	999	999	999	2	2	1	2	7,8	1	1	2	lot:4
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	East Side	275b	19.45		1.1	2	999	999	999	999	999	999	2	1	1	1	4	1	1	2	
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	16.65		0.2	3	999	999	999	999	999	999	2	1	1	1	4,7	1	1	2	90 angle
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	15.63		0.6	1	19/34	5	999	999	999	999	1	2	1	3	4	1	1	2	comparable to that in collection
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	west side	284	16.29		1.3	1	19/34	5	999	999	999	100	1	1	1	3	4,5	1	1	2	smaller than that in collection
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		283	13.03		0.5	3	19/34?	999	999	999	999	999	2	1	1	3	3	1	1	2	
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi	Bayaraa's #13	286a	27.15		71.9	1	45&39	5	1&2	999	999	25	2	2	1	1	3,7	1	1	2	lot:36
Circle Grave	31/07/2012	2	6	Nutsgen Tolgoi		285	27.3		50.5	3	50 & 51?	12.01	999	999	999	999	2	2	1	1	3,4,7	1	1	3	lot:17

APPENDIX E

TARGAN NUUR ARCHAEOLOGY PROJECT LITHICS CODING SYSTEM

The following coding system was designed for use by the Targan Nuur Archaeology Project by Julia Clark (the author) and Katie Harris (Phd Student, Washington State University). It is based upon a coding system developed by Dr. William Andrefsky (2005).

Figure 66: Lithic Coding System

TNAP 2012 CODING SYSTEM FOR LITHIC MATERIAL

Debitage Type
1. Proximal Flake
2. Broken Flake
3. Angular Shatter

Flake Condition

0. Angular Shatter
1. Proximal Flake
2. Medial Flake
3. Distal Flake

Flake Termination
1. Feathered
2. Stepped
3. Hinged
4. Plunging

Platform Type
1. Cortical
2. Complex
3. Flat
4. Abraded

Dorsal Cortex Amount
1. 0%
2. >0% and <50%
3. >50% and <100%
4. 100%

Flake Tool Modification
1. Unimarginal on dorsal
2. Unimarginal on ventral
3. Unimarginal on dorsal and ventral
4. Bimarginal
5. Unimarginal and Bimarginal

Core Type
1. Unidirectional
2. Multidirectional

Biface Stage
1. Blank
2. Edged Biface
3. Thinned Biface
4. Preform
5. Finished Biface

Figure 67: Proximal Debitage and Flake Tools from the Targan Nuur Archaeology Project

Unit	Level	Material Type	Debitage Type	Flake Condition	Termination Type	Platform Type	Platform Width (mm)	Platform Thickness (mm	Weight(g)	Length (mm)	Width (mm)	Thickness (mm)	Dorsal Cortex	Flake Tool Modification	Comments
surface		black chert	1	1	1	4	26.6	8.7	13.5	29.2	39.45	11.8	1	5	
surface		black chert	3	0	-	-	-	-	5.1	18.2	25.4	12.3	1	0	
surface		black chert	3	0	-	-	-	-	1.3	13.9	12.1	7.9	1	0	
surface		black chert	1	1	2	3	6.1	2.5	2.7	22.9	17.5	6.3	1	0	
surface		black chert	1	1	1	4	21.4	10.3	6.4	22.2	29.9	8.2	2	0	water worn
surface		black chert	2	3	1	-	0	0.0	1.6	17..3	20.4	5	1	0	
surface		black chert	1	1	3	4	9.74	3.8	0.8	16.5	11	3.6	1	0	
surface		black chert	2	3	3	-	-	-	1.3	13	17	5.17	1	0	
surface		black chert	3	0	-	-	-	-	0.9	21.14	8.76	3.58	1	0	
surface		black chert	1	1	2	2	23.2	6.1	3.9	19.4	26.1	6.1	2	0	
surface		black chert	2	1	2	4	21.7	8.6	3.6	16.7	23.6	7.9	1	0	
surface		black chert	2	1	2	2&4	3	1.8	1.6	22.4	18.9	3.8	1	0	
surface		black chert	2	3	1	-	-	-	3.4	24.5	19.2	6.2	2	0	
surface		black chert	3	0	-	-	-	-	1.0	15	10.7	6.3	1	0	
surface		black chert	2	3	1	-	-	-	1.3	19	19.4	3.5	1	0	
surface		black chert	1	1	3	2	14.2	6.5	2.0	23.4	20.5	5	1	0	
surface		black chert	3	0	-	-	-	-	3.5	25.1	15.7	9.9	1	0	
shovel		black chert	2	2	2	-	-	-	0.1	11.4	5.8	1.8	1	0	microblade
shovel		black chert	1	1	1	3	3	1.7	0.1	8.1	7.8	1.5	1	0	
surface		black chert	1	1	2	4	7.6	2.3	3.7	21.19	22.46	6.9	1	0	heat spall
surface		gray chert	2	3	2	-	-	-	3.4	21.18	26.96	6.35	1	0	
surface		gray chert	2	2	2	-	-	-	2.6	21.56	17.1	6.94	1	0	
surface		black chert	1	1	3	4	24.18	10.0	9.6	28.3	37.7	11	2	0	water worn
surface		black chert	1	1	1	4	19.24	4.5	3.3	20.3	23.44	7.2	1	0	
surface		black chert	1	1	4	2	17.9	10.6	7.9	32.19	29.7	9.1	1	2	
surface		black chert	1	1	3	3	9.1	2.8	7.8	30.3	31.7	9.83	1	0	
surface		black chert	2	3	1	-	-	-	0.6	7.21	18.8	3.28	1	0	microblade
surface		black chert	1	1	2	2&4	23.7	6.6	4.2	26.6	23.7	7.6	1	4	
surface		pink chert	1	1	3	3	8.2	3.1	0.8	23.2	9.1	3	1	2	pink microblade
surface		black chert	2	1	2	4	6.3	1.3	0.2	9.5	10.1	1.6	1	0	
surface		black chert	2	3	1	-	-	-	1.3	15.6	15.5	6.7	1	0	
surface		black chert	1	1	2	2	13.4	3.5	0.8	16.9	18.4	3	1	0	
surface		black chert	1	1	1	4	4.9	2.0	0.2	13.2	6.3	3.4	1	0	
surface		black chert	1	1	2	4	25.4	8.4	11.7	32	42.3	9.8	2	0	
surface		black chert	1	1	1	2	7	2.8	3.1	25.8	22.4	5.46	1	0	
surface		black chert	1	1	4	3	3.8	1.6	2.5	28.1	19.4	8.1	1	0	
surface		black chert	2	3	1	-	-	-	1.6	20.4	21.3	3.3	1	0	
surface		black chert	1	1	2	3	4.5	1.4	1.1	18.9	15.7	3.7	1	0	microblade dorsal scars
surface		black chert	2	3	1	-	0	0.0	0.4	10.8	14.3	3.2	1	0	
surface		black chert	2	1	2	3	4	2.0	0.2	10.7	9.1	2.2	1	0	microblade
surface		black chert	2	3	1	-	-	-	1.2	19.3	13.5	4.4	2	4	
surface		black chert	2	3	1	-	-	-	0.4	13.1	13.2	3	1	0	
surface		black chert	1	1	2	2	3.4	1.4	0.1	9.3	12	1.8	1	0	
surface		black chert	1	1	1	4	22	8.1	8.4	32.7	27.8	7.5	1	4	end scraper on flake
surface		gray chert	1	1	1	4	6.5	0.6	3.4	42.8	22.1	7.7	1	0	
surface		black chert	1	1	3	2	14.1	5.2	4.0	28.3	18.6	9.2	1	0	
surface		black chert	2	3	1	-	-	-	1.8	27.6	17	4.3	1	0	
surface		black chert	1	1	2	4	6	2.1	0.7	12.8	18.4	4.3	1	0	
surface		black chert	1	1	2	3	8.3	1.7	0.4	14.5	13.8	2.2	1	0	
surface		black chert	1	1	3	4	4.5	1.0	0.1	10.3	6.9	1.3	1	0	microblade
surface		black chert	1	1	2	4	14.6	4.9	1.0	12.2	16.1	5	1	0	
surface		black chert	2	1	2	2	12.2	5.4	6.3	24.4	25.5	8.1	1	0	water worn

Unit	Level	Material Type	Debitage Type	Flake Condition	Termination Type	Platform Type	Platform Width (mm)	Platform Thickness (mm	Weight(g)	Length (mm)	Width (mm)	Thickness (mm)	Dorsal Cortex	Flake Tool Modification	Comments
shovel		black chert	2	3	1	-	-	-	3.6	17.3	30.14	7..8	2	0	
shovel		black chert	2	2	2	-	-	-	8.7	42.3	30.4	10.1	1	0	
surface		black chert	1	1	1	2	13.3	7.0	1.4	16.4	13.3	7	1	0	
surface		black chert	3	0	-	-	-	-	0.9	16.6	13.2	4.7	1	0	
surface		black chert	1	1	1	4	7.6	3.7	2.7	18.5	21.46	11.54	1	0	
surface		black chert	1	1	1	3	13.1	4.6	2.7	21.8	18.3	6.2	1	0	
shovel		black chert	2	3	1	-	-	-	0.2	13.7	9.9	2.4	1	0	
surface		black chert	1	1	2	4	15.3	16.7	9.6	35.5	28.13	8.46	1	3	
2011 TP2	3	gray chert	2	3	1	-	-	-	2.8	32.6	17.9	5.9	1	0	
surface		gray chert	2	1	0	3	16.1	4.1	1.8	15.7	27.6	3.9	1	0	
surface		black chert	3	0	-	-	-	-	33.8	44.5	37.9	23	2	0	
surface		black chert	3	0	-	-	-	-	3.6	17.7	17.1	7.4	1	0	
surface		black chert	1	1	2	3	6.5	2.3	0.3	10.8	8.3	3.6	1	0	
surface		black chert	1	1	2	4	4.6	1.9	5.9	27.7	22.4	9.3	1	0	
surface		black chert	1	1	2	3	11.6	4.7	2.1	16.1	17.7	6	1	0	
surface		black chert	1	1	1	4	8.1	1.6	1.1	22.7	12.8	3.3	1	0	
surface		black chert	1	1	1	2	5.1	3.5	2.1	20.1	14.1	7.2	1	0	
surface		red-brown chert	3	0	-	-	-	-	2.0	19.9	17.9	5.9	1	0	
surface		black chert	1	1	1	3	19.8	13.9	11.3	30.2	20.6	13.1	2	0	
surface		black chert	1	1	2	3	19.8	11.4	7.5	23.3	21.43	13.2	2	0	
surface		black chert	1	1	1	3	20.6	12.7	9.6	27	23.6	13.5	1	0	
surface		black chert	1	1	1	4	9.3	3.3	19.7	46.2	21.6	19.4	1	1	
surface		black chert	1	1	2	2	7	4.5	7.8	29.9	29.1	6.55	1	0	
surface		black chert	2	2	2	-	-	-	7.0	28.6	24.5	15	1	0	
surface		black chert	2	3	3	-	-	-	1.1	10.3	13.5	6.6	1	0	
surface		olive gray chert	1	1	3	4	6	2.3	4.2	29.3	22.7	5.3	1	0	
surface		olive gray chert	2	2	2	-	-	-	2.8	21.3	23.8	6.8	2	0	
surface		black chert	1	1	1	3	8.1	5.5	3.7	14.4	20.6	7.8	3	0	
surface		black chert	1	1	3	4	14.2	6.3	4.6	22.9	25.6	7.5	1	0	
surface		black chert	2	2	2	-	-	-	0.2	8.6	14.7	2.7	1	0	
surface		black chert	1	1	3	2	12.8	4.6	0.8	15.4	14.8	4.5	1	0	water worn
surface		black chert	1	1	1	1	24.6	7.6	1.9	11	25.6	5.7	2	0	
surface		black chert	1	1	1	2	22.9	7.9	7.4	20.4	31.9	9.1	1	0	
surface		black chert	2	1	2	3	36.4	15.4	35.0	27.2	45.8	21.1	4	0	
surface		black chert	1	1	4	2	6.7	3.2	4.2	30.2	11.9	8.1	1	0	
surface		black chert	2	3	1	-	-	-	2.8	22.6	20.4	5	1	0	
surface		black chert	2	2	2	-	-	-	1.8	12.1	17.7	6.5	1	0	
surface		yellowish brown	1	1	1	1	19	6.5	4.7	20.2	26.8	7.4	2	0	
surface		black chert	1	1	2	4	12.7	6.4	6.0	31.1	22.1	8.8	1	0	
surface		black chert	1	1	2	3	15.5	7.3	1.7	15.4	17	6.9	1	0	
surface		black chert	2	3	1	-	-	-	0.6	12.4	13.3	4.6	1	0	
surface		gray chert	1	1	1	4	32.1	6.6	9.6	22.5	43.1	7.8	2	0	
site 3/TR1	2	black chert	1	1	2	2	14.9	3.2	8.8	28.3	23.3	14.9	2	0	
site 3/TR1	2	black chert	2	3	1	-	-	-	0.8	13.8	15	3.5	1	0	
site 3/TR1	2	dark gray quartzite	1	1	1	4	6	1.8	0.9	19.9	10.3	4.5	1	0	
site 3/TR1	2	white quartz	1	1	1	3	13.5	4.6	0.9	10.5	15.6	4.5	1	0	
site 3/TR1	1	red chert	2	2	2	-	-	-	0.4	9.9	9.9	2.7	1	0	
site 3/TR3	3	black chert	1	1	2	4	6.9	1.5	0.1	6.1	4.5	1.9	1	0	
site 3/TR3	1	red-brown chert	2	3	1	-	-	-	1.3	22.4	9.8	5	1	0	
site 3/TR3	1	black chert	1	1	2	4	11.7	4.2	1.0	18.7	11.6	4.4	1	0	
site 3/TR3	2	red-brown chert	2	3	1	-	-	-	0.9	12.1	20.4	5.2	4	0	
site 3/TR3	3	black chert	1	1	1	3	8.3	8.9	2.5	20.6	12.6	8.7	1	0	

Unit	Level	Material Type	Debitage Type	Flake Condition	Termination Type	Platform Type	Platform Width (mm)	Platform Thickness (mm)	Weight(g)	Length (mm)	Width (mm)	Thickness (mm)	Dorsal Cortex	Flake Tool Modification	Comments
site 3/TR3	1	black chert	2	2	2	-	-	-	0.2	8	9.6	1.9	1	0	
site 2/TR4		black chert	1	1	1	2	21.3	10.8	5.6	22	24.2	12.2	1	0	water worn
surface		black chert	2	2	2	-	-	-	0.1	6.5	4.6	1.3	1	0	microblade
surface		black chert	1	1	2	1	8.2	3.0	1.2	13	8.5	3.8	2	0	blade?
surface		gray quartzite	2	3	1	-	-	-	5.4	34.9	21.8	6.3	1	0	
surface		black chert	1	1	1	4	8.6	8.2	6.2	31	24.4	7.2	3	0	
surface		black chert	1	1	1	4	12.9	6.7	3.2	22.8	19.2	5.7	1	0	
surface		black chert	1	1	1	1	32.8	11.9	4.1	9.4	32.9	4.9	2	0	
surface		black chert	1	1	1	1	6.2	3.8	7.4	36.3	20.2	8.8	2	0	
surface		gray chert	1	1	2	1	11.5	6.7	1.4	12.8	18	6.4	2	0	
surface		black chert	1	1	1	3	3.7	7.1	3.4	25.9	23.9	5.7	1	0	
surface		black chert	1	1	1	2	12.4	3.7	5.7	35.4	15.3	11.3	1	0	
surface		black chert	1	1	2	2	6	2.0	3.4	27	26.9	4.7	1	0	
surface		striped chert	2	2	2	-	-	-	2.8	20.7	23	5.9	1	0	black and white
surface		black chert	2	3	1	-	-	-	0.9	20	16.4	4	1	0	
surface		black chert	1	1	1	4	15	2.6	4.2	33	20.6	6.6	1	0	
surface		black chert	1	1	2	3	1.9	1.8	0.8	21.14	13.13	3.6	1	0	pressure flake?
surface		black chert	1	1	1	2	3.8	4.1	3.1	23.8	23.6	6.5	1	0	
surface		black chert	1	1	2	4	7.8	3.1	2.1	17.1	27.1	5	1	0	
surface		black chert	1	1	2	1	17.1	5.6	17.8	36.3	25.8	18.1	2	0	
surface		black chert	1	1	2	4	2.6	1.6	1.1	21.1	16.8	3.5	1	0	
surface		black chert	1	1	2	1	16.9	3.8	0.6	10.1	17.4	2.4	2	0	
surface		black chert	2	3	1	-	-	-	1.5	18.7	18.7	3.2	1	0	
surface		gray chert	1	1	1	3	10.8	5.3	1.7	16.3	12.7	5.9	1	0	
surface		black chert	2	3	3	-	-	-	1.9	16.13	20.3	5.9	1	0	
surface		black chert	1	1	1	2	6	1.9	1.9	19	14.7	4.9	1	0	
surface		black chert	1	1	1	3	7.1	4.2	1.9	24	14.6	6.1	1	0	
surface		black chert	1	1	2	3	10.7	3.9	1.3	15.3	15.5	5.2	1	0	
surface		black chert	1	1	1	3	2.6	0.6	0.1	11.8	12.5	1.9	1	0	
surface		black chert	1	1	2	4	5.3	1.8	0.5	13.3	14.1	2.4	1	0	
surface		black chert	1	1	1	2	4.2	3.5	3.0	22.7	25.4	4.4	1	0	
surface		black chert	1	1	1	2	7.1	2.2	2.6	14.9	29.2	6.7	1	0	
surface		black chert	1	1	2	2	6.3	2.5	0.6	10.7	14.3	3.4	1	0	
surface		black chert	1	1	1	1	12.9	5.6	0.6	4.6	18.8	3.2	1	0	
surface		black chert	2	2	2	-	-	-	2.5	10.7	27.8	7.2	1	0	
surface		black chert	2	3	1	-	-	-	3.4	29.7	20.5	6.2	1	0	
surface		black chert	1	1	1	2	2.6	2.1	2.0	22.4	19.7	6.8	1	0	
surface		black chert	1	1	2	4	12.5	3.0	0.8	12.26	17.1	2.7	1	0	
surface		black chert	1	1	3	4	7.8	4.4	2.6	29.5	19.3	4.6	1	0	
surface		black chert	1	1	2	2	6	3.5	1	17.3	13.2	4.4	1	0	
surface		black chert	1	1	2	4	8.2	3.3	1	16.8	13.1	6.1	1	0	
surface		black chert	2	3	1	-	-	-	1.6	21	20	4.4	2	0	
surface		black chert	2	3	1	-	-	-	0.8	14.7	13.8	4.4	2	0	
surface		black chert	1	1	1	4	4.5	2.6	1	15.1	20.1	4.2	1	0	
surface		black chert	2	3	1	-	-	-	1.5	17.4	26.1	3.2	1	0	
surface		black chert	1	1	1	2	10.8	3.4	1.4	19.6	21.5	4.4	1	0	
surface		black chert	1	1	2	3	9	4.2	1.4	17.6	16.9	4.7	1	0	
surface		black chert	1	1	3	4	6.5	2.8	4.1	27.4	19.6	8.4	1	0	
surface		black chert	1	1	1	3	7.5	2.7	0.3	7.9	13.8	2.5	1	0	
surface		black chert	1	1	2	3	2.3	1.4	0.3	11.2	10.9	1.7	1	0	
surface		black chert	1	1	1	3	10	5.2	1.4	22.9	15	4.8	1	0	
surface		black chert	1	1	1	3	5.4	2.6	0.9	11.4	19.6	5.7	1	0	

Unit	Level	Material Type	Debitage Type	Flake Condition	Termination Type	Platform Type	Platform Width (mm)	Platform Thickness (mm	Weight(g)	Length (mm)	Width (mm)	Thickness (mm)	Dorsal Cortex	Flake Tool Modification	Comments
surface		black chert	2	2	2	-	-	-	0.8	12.2	18.1	3.5	1	0	
surface		black chert	2	3	1	-	-	-	0.6	12.6	15.31	2.8	1	0	
surface		black chert	1	1	3	2	11.4	2.1	0.9	11.5	18.1	4.2	1	0	
surface		black chert	1	1	2	4	8.3	2.4	0.3	11.5	8.5	2.6	1	0	microblade
surface		black chert	2	3	1	-	-	-	0.2	13.3	8	2.9	1	0	microblade
surface		black chert	1	1	1	4	7.6	2.1	0.6	10.1	14.2	3.2	1	0	
surface		black chert	2	3	1	-	-	-	1.3	16.18	18.9	5.2	1	0	
surface		black chert	2	3	1	-	-	-	1.8	18.1	18.8	4.4	3	0	
surface		black chert	2	3	3	-	-	-	0.8	15.3	17.5	4.2	1	0	
surface		black chert	2	2	2	-	-	-	1.8	14.9	18.8	5.5	1	0	
surface		black chert	2	2	2	-	-	-	1.5	12.4	18.2	6.8	1	0	
surface		black chert	1	1	2	2	5.52	2.3	0.7	13.4	16.9	5	1	0	
surface		black chert	2	2	2	-	-	-	0.9	10	17.7	6.1	1	0	
surface		black chert	2	3	3	-	-	-	0.8	11.1	17.8	7	1	0	
surface		black chert	2	3	1	-	-	-	0.5	9.9	17.2	3.1	1	0	
surface		black chert	2	2	2	-	-	-	0.5	14	13.2	3.3	1	0	
surface		black chert	1	1	2	2	5.4	2.0	0.5	12.9	14	2.9	1	0	
surface		black chert	3	0	-	-	-	-	0.8	16.4	7.4	4.8	1	0	
surface		gray chert	2	3	1	-	-	-	0.4	7.9	11.5	4.9	1	0	
surface		black chert	1	1	1	3	13.7	3.9	0.5	11.3	13.9	3.8	1	0	
surface		black chert	1	1	2	4	3.6	1.4	0.5	16.2	11.7	3.6	1	0	
surface		black chert	3	0	-	-	-	-	1.0	13.3	14.6	5.7	1	0	
surface		black chert	1	1	3	3	8.8	2.7	0.4	13.5	14.5	2.5	1	0	
surface		black chert	1	1	2	4	4.4	3.8	0.6	13.2	15.9	4.1	1	0	
surface		black chert	2	3	2	-	-	-	0.3	14	12.5	1.7	1	0	
surface		black chert	2	3	2	-	-	-	0.3	9.2	15.2	2.8	1	0	
surface		black chert	2	2	2	-	-	-	0.2	10.3	12	2.2	1	0	
surface		black chert	2	2	2	-	-	-	0.4	10.8	12.4	3.3	1	0	
surface		black chert	1	1	2	2	5.1	3.1	0.3	9.6	13.2	3.5	1	0	
surface		gray chert	2	3	1	-	-	-	0.4	10.2	11.4	4.3	1	0	
surface		black chert	2	2	2	-	-	-	0.3	13.1	11	2.3	1	0	
surface		black chert	1	1	2	3	4.2	1.4	0.5	11.7	13.1	3.5	1	0	
surface		black chert	1	1	3	3	9.3	5.3	0.4	8.7	11.1	4.9	1	0	
surface		black chert	1	1	2	3	7.6	4.1	0.9	13.7	13.1	4.1	1	0	
surface		black chert	1	1	1	4	3.8	0.9	0.2	13.1	11.7	2.3	1	0	pressure flake?
surface		black chert	1	1	4	4	4.9	2.9	0.6	12.9	9	4.5	1	0	
surface		black chert	1	1	2	4	10.6	3.0	0.3	11.2	11.3	2.7	1	0	
surface		black chert	2	2	2	-	-	-	0.3	9.3	10.5	2.2	1	0	
surface		black chert	2	3	1	-	-	-	0.4	8.2	14.2	3.2	1	0	
surface		black chert	1	1	2	4	4.6	2.8	0.3	7.8	10.5	3.4	1	0	
surface		black chert	2	3	1	-	-	-	0.4	11.5	14.3	4.4	1	0	
surface		black chert	1	1	2	3	1	0.9	0.3	12.1	9.8	1.8	1	0	
surface		black chert	1	1	2	4	2.3	0.9	0.2	10.5	9.2	1.7	1	0	
surface		black chert	2	2	2	-	-	-	0.2	8.4	10.5	1.7	1	0	
surface		black chert	2	3	1	-	-	-	0.3	7.8	13.6	4.1	1	0	
surface		black chert	1	1	1	4	6.7	2.7	0.2	11.8	7.2	2.7	1	0	
surface		black chert	2	3	1	-	-	-	0.3	11.7	13.7	2.3	1	0	
surface		black chert	2	2	2	-	-	-	0.2	9.4	12.2	2.2	1	0	
surface		black chert	1	1	2	3	3.8	1.7	0.2	10.7	9.1	2.9	1	0	
surface		black chert	2	3	1	-	-	-	0.3	12.1	9.6	3	1	0	
surface		black chert	3	0	-	-	-	-	0.3	12	6.2	3.9	1	0	
surface		black chert	2	3	1	-	-	-	0.2	10.9	11.5	1.7	1	0	

Unit	Level	Material Type	Debitage Type	Flake Condition	Termination Type	Platform Type	Platform Width (mm)	Platform Thickness (mm	Weight(g)	Length (mm)	Width (mm)	Thickness (mm)	Dorsal Cortex	Flake Tool Modification	Comments
surface		black chert	3	0	-	-	-	-	0.2	11.7	7.2	4.1	1	0	
surface		black chert	1	1	1	3	3.1	1.8	0.2	8.6	11.2	4.5	1	0	
surface		black chert	1	1	2	4	3.5	1.3	0.2	7.9	14	2	1	0	
surface		gray quartzite	1	1	1	4	5.2	1.6	0.1	10.3	7.5	1.5	1	0	
surface		black chert	1	1	2	4	7.3	1.4	0.3	8.8	9.8	2.8	1	0	
surface		black chert	3	0	-	-	-	-	0.1	10.8	6.5	3.1	1	0	
surface		black chert	1	1	1	3	4.4	2.5	0.4	10.2	13.4	3.6	1	0	
surface		black chert	1	1	2	4	4.8	0.9	0.2	8.9	9.9	2.8	1	0	
surface		black chert	1	1	2	4	3	1.5	0.2	8	10.3	2.2	1	0	
surface		black chert	1	1	3	2	10.2	3.7	0.2	8	13	3.3	1	0	
surface		black chert	2	3	1	-	-	-	0.1	7.9	14	1.9	1	0	
surface		black chert	1	1	2	3	10.5	3.1	0.2	6.1	12.4	3.2	1	0	
surface		black chert	2	2	2	-	-	-	0.2	6.9	12.1	2.4	1	0	
surface		black chert	2	3	1	-	-	-	0.2	5.3	11.5	2.9	1	0	
surface		black chert	2	2	2	-	-	-	0.1	6.8	9.8	1.4	1	0	
surface		black chert	1	1	2	4	6.8	2.0	0.1	9.1	9.8	1.9	1	0	
surface		black chert	2	2	2	-	-	-	0.1	7.4	12.1	2.1	1	0	
surface		black chert	1	1	2	3	3.5	1.1	0.2	11.7	10.2	2.3	1	0	
surface		black chert	2	2	2	-	-	-	0.1	7.8	11.7	1.8	1	0	
surface		black chert	2	3	1	-	-	-	0.2	6.6	13.4	2.1	1	0	
surface		black chert	3	0	-	-	-	-	0.1	6.2	7.2	3.3	1	0	
surface		black chert	2	2	2	-	-	-	0.1	4.6	9.7	0.9	1	0	
surface		black chert	2	3	1	-	-	-	0.1	8.2	8.4	2.2	1	0	
surface		black chert	1	1	3	3	3.8	0.4	0.1	9	7.5	0.9	1	0	
surface		black chert	2	2	2	-	-	-	0.1	0.8	4.9	2.1	1	0	
surface		black chert	2	3	1	-	-	-	0.1	0.3	6.3	1.8	1	0	
surface		black chert	2	3	1	-	-	-	0.1	6.4	10.3	1.8	1	0	
surface		black chert	1	1	2	3	4.7	2.7	0.1	7.4	5.9	2.1	1	0	
surface		black chert	2	3	3	-	-	-	0.1	7.7	8.7	1.9	1	0	
surface		black chert	2	2	2	-	-	-	0.1	4.5	9.8	1.6	1	0	
surface		black chert	3	0	-	-	-	-	0.1	0.5	1.4	1.21	1	0	
surface		black chert	2	2	2	-	-	-	0.1	4.7	7.9	1.2	1	0	
surface		black chert	1	1	2	4	3.2	1.5	0.1	6	8.9	1.7	1	0	
surface		black chert	2	3	3	-	-	-	0.1	3.8	7.5	1.7	1	0	
surface		black chert	2	3	3	-	-	-	0.1	5.5	8.8	2.1	1	0	
surface		black chert	2	3	1	-	-	-	9.0	29.3	39.4	9.4	1	0	

Figure 68: Core Tools from the Targan Nuur Archaeology Project

Core Tools

Unit	Material	Core Type	Weight	MLD	Comments
surface	black chert	1	7.8	25.27	microblade core
surface	black chert	2	33.9	44.08	
surface	black chert	1	10.4	31.5	microblade core
surface	black chert	1	16.1	35.66	microblade core

Figure 69: Bifaces from the Targan Nuur Archaeology Project

Bifaces

Unit	Hafted/Non	Material Type	Weight (g)	Length (mm)	Width (mm)	Thick (mm)	Stage	Comments
Surface	non	black chert	21.1	57.89	31.16	11.77	4	
Surface	non	black chert	32.4	55.8	34	13.9	3	made on flake
Surface	non	black chert	22	41.6	31.8	13.5	2	~30% cortex still present
Surface	non	black chert	31.3	75.1	33.5	12.5	4	
Surface	hafted	black chert	0.5	12.79	14.29	3.5	5	proximal end of projectile point

APPENDIX F

EXPERIMENTAL ARCHAEOLOGY CLAY AND TILE ANALYSIS

The tables that follow provide a more detailed look at the performance of the clay samples collected and the clay tiles created during the experimental archaeology program of the Targan Nuur Archaeology Project (Section 4.6 and Section 5.4). The first table describes the characteristics of the clay before firing during preparation and vessel/tile formation. The second table describes the characteristics of the tiles during and after firing.

Table 15: Characteristic of Clay Samples

Sample Number	Munsell (Wet)	Depth (cmbs)	Coil Test	Ball Test	Loop Test	Standardized 'Usability' Score
01	2.5Y 3/2	1.15	1	36	1	.7
02	GLEY 4/10Y	1.1	3	80	1	5.9
03	GLEY I 5/10Y	.1	2	47	3	4.6
04	GLEY I 5/10Y	.1	3	51	2	4.9
05	2.5Y 4/3	.2	2	57	3	5.3
06	5Y 4.5/2	.2	3	57	1	4.3
07	10YR 3/2	.05	1	38	3	2.9
08	10YR 3/2	.23	1	54	3	4.0
09	7.5YR 3/2	.15	-	-	-	--
10	5Y 3/2	.14	3	35	2	3.8
11	5Y 5/2	.1	3	60	1	4.5
12	10YR 4/3	.26	1	29	3	2.3
13	5Y 3/1.5	.05	2	53	3	5.0
14	2.5Y 4/2	0.06	-	-	-	--
15	GLEY I 2.5/N	0	1	47	3	3.5
16	5Y 4/1	.11	3	74	1	5.5

Table 16: Characteristics of Fired Clay Tiles

Sample Number	Munsell (Dry)	Firing Method	Hardness (Fired)*	% Shrinkage	˚C Change	% Water Absorbed
01	2.5 Y 3/2	Wood Pit	Medium	4.8%	3.5	24.3%
02	GLEY 4/10 Y	Dung Surface	Hard	7.6%	3.8	21.9%
03	GLEY 1 5/10 Y	Dung Pit	Hard	_	_	_
04	GLEY 1 5/10 Y	Wood Surface	Medium	15.0%	3.25	18.3%
05	2.5 Y 4/3	Wood Pit	Soft	6.4%	4.4	22.1%
06	5 Y 4.5/2	Wood Pit	Hard	13.0%	2.85	23.8%
07	10 YR 3/2	Wood Surface	Soft	7.6%	2.55	_
08	10 YR 3/2	Wood Pit	Soft	7.6%	3.35	22.8%
09	_	_	_	_	_	_
10	5 Y 3.2	Dung Surface	Medium	12.6%	3.2	21.8%
11	5 Y 5/2	Dung Pit	Hard	11.6%	3.9	22.0%
12	10 YR 4/3	Dung Surface	Hard	8.2%	3.8	17.6%
13	5 Y 3/1.5	Dung Surface	Soft	8.2%	3.25	_
14	_	_	_	_	_	_
15	GLEY 1 2.5/N	Dung Pit	Soft	_	_	_
16	5 Y 4/1	Dung Pit	Hard	8.4%	4.05	21.8%

**Hard = not scratched by copper wire; Medium = scratched by wire, but not by fingernail; Soft = scratched by fingernail.*

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