



## Case report

## Landscape archaeology in the Chinese Altai Mountains – Survey of the Heiliutan Basin

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## A B S T R A C T

Due to difficult access, the Southern Chinese Altai has so far been understudied, despite being a key region for understanding cultural transfers and the spread of ideas between East and West during the Eurasian Bronze and Iron Age. The Dzungaria Landscape Project in its first campaigns has set out to document the variety of archaeological monuments in the southern Chinese Altai by means of remote sensing and GPS-based intensive survey. It can be shown that the region experienced a peak in anthropogenic activity during the early and middle Iron Age which culturally ties in with the northern Russian Altai (Pazyryk culture) and later shifts towards strong influences from the Semirechye.

## 1. Introduction

In 2014, a joint Swiss-Chinese project was set up between the University of Bern, the Xinjiang Branch of the Chinese Academy of Sciences (CAS) and the Laboratory for Information Engineering in Surveying, Mapping and Remote Sensing (LIESMARS) of Wuhan University. After 15 months of careful preparation, we were able to start with the first phase of our project and organized a survey in the Heiliutan basin near the Chinese-Russian-Kazakh border. This short preliminary paper will present the short and long term objectives of our project, the employed methodologies and the strategy used to develop a project responding to the needs of modern archaeological practice in a region characterized with strict and unpredictable rules concerning geographic data and access to sites. As such, this paper will serve as an introduction into the practicalities of landscape archaeology in Xinjiang and will be useful to those non-Chinese researchers interested in developing fieldwork-based projects in China.

For thousands of years, the Altai Mountains have been an important transitional region between the major ecological regions of Eurasia. As

a result of its specific setting and particular preservation conditions (i.e. discontinuous permafrost on certain high mountainous plateaus), the region is known as one of Central Asia's richest and most varied archaeological regions. Having some of Siberia's oldest sites, dating back up to 430,000 BP (Chlachula, 2001, Rybin, 2005: 79), and the highest concentration of cave and open air sites, the Altai Mountains presents itself as one of the regions key to understanding the prehistory of Eurasia. This mountainous region is, however, best known for its rich Bronze and Iron Age heritage. From the late Neolithic onwards (3200–2400 BCE), the different groups that once inhabited the Altai left their permanent mark on the Altaian landscape by means of an extraordinary number of monuments and petroglyphs. Almost every valley of the mountainous landscape comprises hundreds of archaeological monuments, ranging from 5000-year-old stone burial mounds to recent rock-art sites (Gheyle, 2009, Jacobson-Tepfer et al., 2010, Plets, 2013). Excavations predominantly focusing on the burial archaeology of the Iron Age<sup>1</sup> put the region on the archaeological world map.<sup>2,3</sup>

The Altai mountain range as a geographical feature play a very

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<sup>1</sup> In archaeological literature this period is often connected to so-called Scythian or Saka culture, however the use of cultures across Central Asia is not without pitfalls (see Frachetti, 2011).

<sup>2</sup> E.g. Rudenko (1970) excavated the frozen royal burial mounds of the so-called 'Pazyryk culture' (4th–3rd century BCE), yielding magnificent organic finds and uniquely preserved human remains.

<sup>3</sup> Recent explorations by archaeologists from the Russian Academy of Sciences refocused attention on the Altai Mountains when uniquely preserved mummies on the Ukok Plateau (Russian Altai) were discovered in the 1990s (Polosmak and Seifert, 1996).

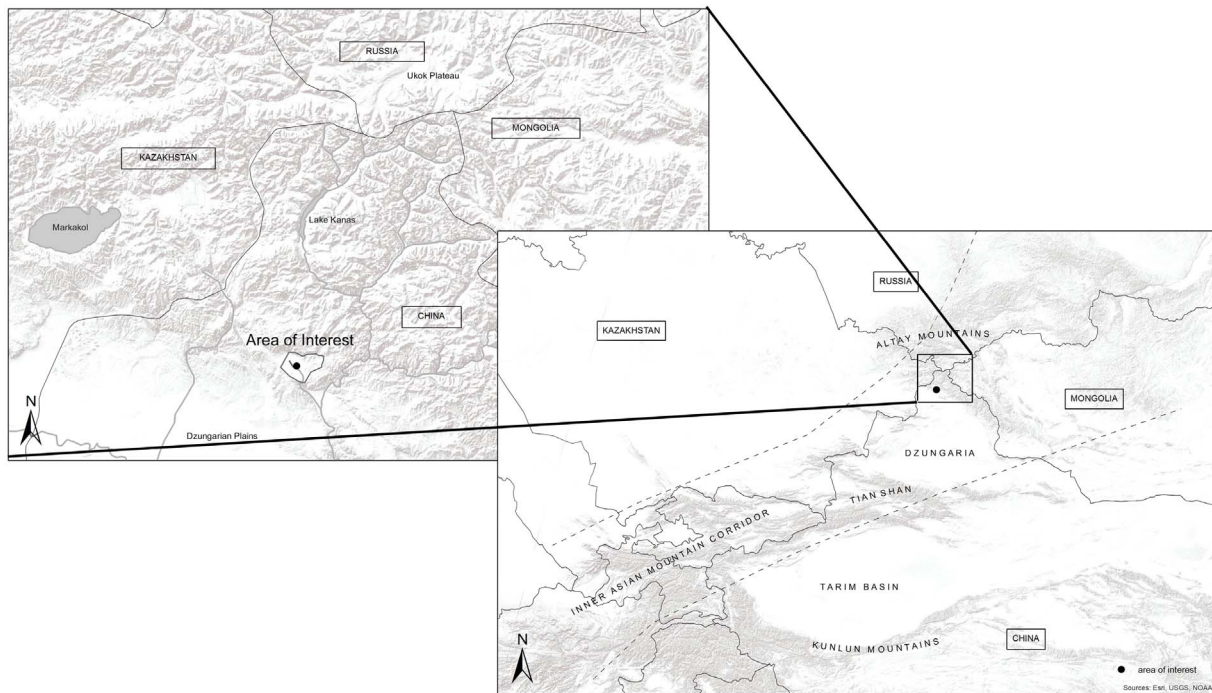


Fig. 1. The area of interest and the Inner Asian Mountain Corridor.

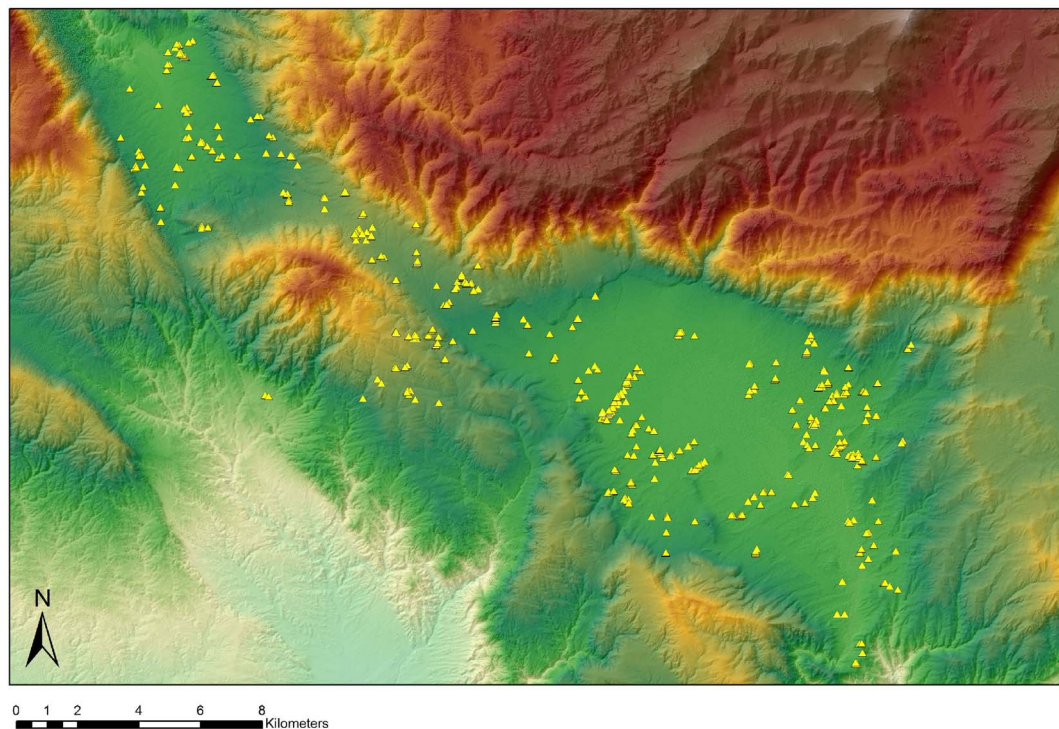


Fig. 2. Results of the remote sensing survey.

important role in forming a better understanding of Eurasian prehistory (Hank, 2010: 469–470). With the Mongolian steppe to its East, the pastures of Kazakhstan and Russia to its West, the forested taiga of Siberia in the North and the dry arid landscapes of Xinjiang in the South, the mountain range is situated between Central Asia's four major steppe zones (Gheyle, 2009, 39). The landscape of the mountains themselves, which is furthermore rich in metal ores (cf. Zhang, 2009), both separates and connects these four climatic areas, and is believed to have been a node of cultural interaction in Eurasia (Parzinger, 2006: 526–536, Kuzmina, 2008: 88–107).

So far international research campaigns have predominantly focused on the mountainous Russian and Kazakh parts of the Altai range (Bourgeois et al., 2001; Gheyle, 2009; Frachetti et al., 2010; Doumani et al., 2015), the steppe landscape of Mongolia (Jacobson-Tepfer et al., 2010; Bemmman et al., 2009; Wright, 2007; Allard and Erdenebaatar, 2005) and Inner Mongolia (Indrisano, 2006; Linduff et al., 2002). Although over the past two decades research by the Xinjiang Institute of Archaeology has been investigating the heritage of Chinese Altai (e.g. Xinjiang Institute of Archaeology, 2014), few international projects have been implemented (c.f. Jia et al., 2016, Jia et al., 2011). This

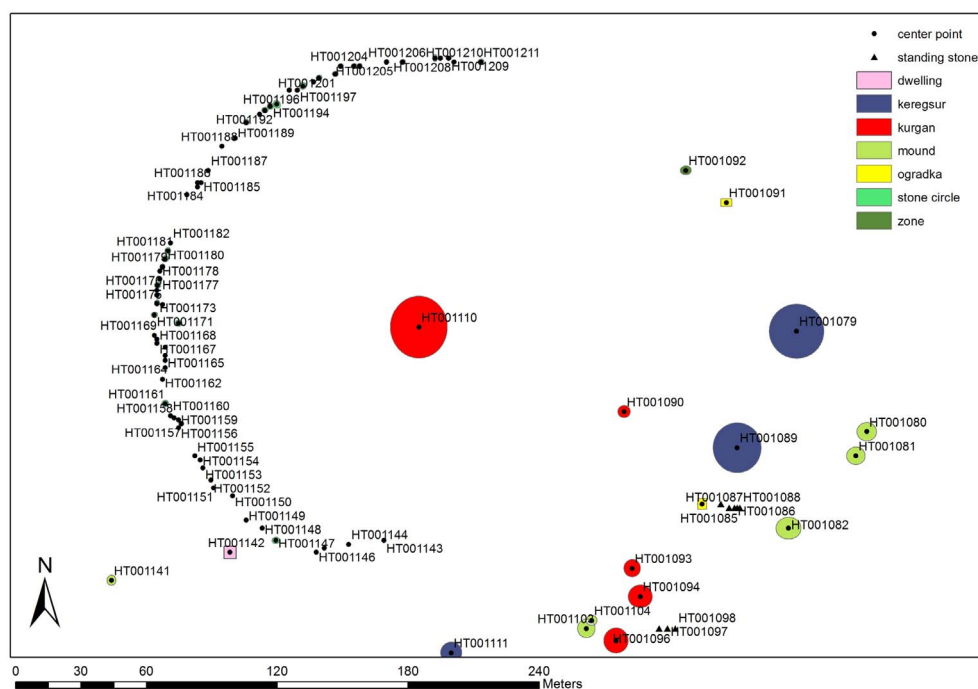


Fig. 3. Cluster of monuments in the center of the AOI with structures from the Bronze Age to the Turkic period.

stands in sharp contrast with the importance of concepts like the Inner Asian Mountain Corridor, of which the Southern reaches of Altai are a part, and the general archaeological literature on long distance exchange of technologies, ideas and domesticates in Central Asia (cf. Frachetti, 2013; Spengler et al., 2016; Zhang, 2009; Chen and Hiebert, 1995).

## 2. Short and long term goals of the Dzungaria Landscape Project

The Dzungaria Landscape Project aims to gain a different and in many cases first-time view on the archaeological heritage of the southern Altai Mountains and the adjacent steppe and desert zones in Xinjiang. By systematically registering the vanishing archaeology of the region, this project specifically ambitions to connect the region to existing work on the Inner Asian Mountain Corridor. Drawing on the latest technological developments, the Chinese-European projects aims to chart the diachronic development of this geographical area and how it became and sustained its role as a major passageway and contact zone, not only between east and west, but also between the northern Siberian taiga and southern Dzungarian plains.

In an effort to establish a chronology of the range's heritage and study its spatial development, we will integrate the existing survey data from China, Russia, Kazakhstan, and Mongolia. By integrating old and new data, we will establish a chronology of the existing surface structures, which will be used for further large-scale landscape analysis. In order to secure dates and clarify functions of unknown structures, we will conduct small scale excavations and provide  $^{14}\text{C}$ -datings for a number of previously only poorly researched archaeological structures. An extensive database will be central to the effort and will be used for in-depth assessment of the different cultural influences across the region.

In the long term we aim to expand our efforts to the northern flank of the Tianshan Mountains, develop an ecological cross-section through Dzungaria and study the archaeological diversity. A detailed analysis of the cultural landscape of Dzungaria will further our understanding of the Inner Asian Mountain Corridor and its role throughout Central Asian prehistory (Fig. 1).

## 3. Mapping the archaeological landscapes of the Chinese Altai: from remote sensing to political maneuvering

Our main area of interest (AOI) was the relatively isolated Heiliutan basin in the southernmost part of the Chinese Altai Mountains, in Habahe County (Xinjiang Uyghur Autonomous Region). This broad open basin in which different mountain rivulets flow out is defined by an arid steppe vegetation and is surrounded by high mountain ranges in the north and south. Within the broader landscape of the southern Altai the basin occupies a central place and connects the lower plains around Bu'erjin with the heart of the Altai Mountains. In the east two mountain passes connect the lower fertile flatlands with the large Kanas lake whose headwaters are connected with the high mountainous and archaeologically rich Ukok Plateau (Russia), in the west another mountain pass connects the basin with a series of valleys going in the direction of present day Kazakhstan. This basin was selected because of its topographic position and its, based on a remote sensing evaluation, relatively rich archaeological heritage (c.f. Fig. 2).

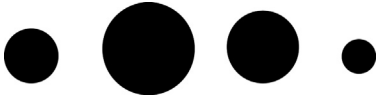
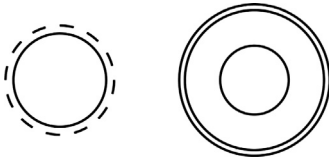
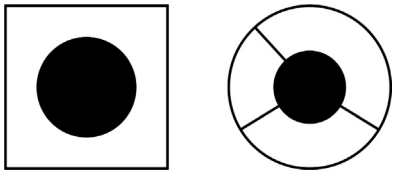
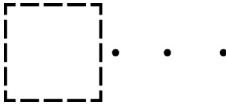
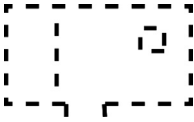
### a. Remote sensing survey

Conducting a large-scale automated survey of the southern foothills of the Altai by means of a computer vision based algorithm allowed us to narrow down the choice of potential areas of interest based on the relative density of monuments. By applying a Hough Forest based automatic detection algorithm on high-resolution satellite imagery, we were able to computationally address an immense area which would otherwise have taken months to be evaluated by visual interpretation (c.f. Caspari et al., 2014). Thus we were able to predefine an area with a rich and varied archaeological heritage.

More than a year of working with remote sensing data not only enabled us to define the AOI, but also helped us immensely in planning and executing the on-ground intensive survey. The high-resolution IKONOS-2 (0.82 m panchromatic, 3.28 m multispectral) and WorldView-2 (0.46 m panchromatic, 1.85 m multispectral) data was provided by the Digital Globe Foundation and allowed us to map and classify more than 500 potential mound structures. Because of the large number of detected monuments and the high resolution of the imagery, we were already able to develop a typology for certain types of



**Table 1**  
Monument categories and their specific amounts mapped during the survey.

Category	Amount
“Scythian”kurgan: a burial mound built of stones with a light central depression, often lining up in approximate north-south direction with others of its kind, dating to the Iron Age, more specifically to the early and middle Iron Age period which is in other regions referred to as the Scythian period (Gheyle, 2009, 176–178). Usually between 5 and 15 m, large monuments up to 30 m.	149
	
“Saka” kurgan: a burial mound built of rounded stones, gravel and earth with a flat top and a surrounding circular structure consisting of either a ditch or a stone circle (Gass, 2014, 95). Diameter of the central mound usually between 15 and 30 m, large monuments up to 55 m. Diameters of the circular ditch or stone circle range up to 90 m.	59
	
Kirigsuur: A central stone accumulation surrounded by a circular or rectangular structure of stones, sometimes with rays connecting the outer ring to the central mound (Gheyle, 2009, 194). Usually between 10 and 25 m, large monuments up to 30 m.	11
	
Ogradka: a mound-like accumulation of stones with a rectangular enclosure of big stone slabs inside and often (but not necessarily) a single or array of standing stones, dating to the Turkic period (Gheyle, 2009, 209–211). Usually between 2 and 5 m edge length.	32
	
Dwelling: a rectangular stone setting with architectural features. Between 6 and 15 m edge length.	6
	
Mound: largely unspecific accumulations of stones, rocks, pebbles, earth, or a combination of the latter materials which cannot be attributed to a specific time period.	182
Oval mound: a – generally small up to 4 m – mound of stones with a clear oval shape.	172
Stone circle: a circular setting of larger stones or rocks.	108
Standing stone: any kind of upright standing or formerly standing stele, encompassing more than two meter high standing stones as	125

**Table 1 (continued)**

Category	Amount
well as smaller, sometimes only 30 cm high so-called balbal.	
Stone concentration: an unspecific accumulation of sedimented stones which could for example encompass ploughed mounds which are scattered over a larger area.	76
Other: an accumulation of unidentifiable monuments like stone boxes, stone platforms, zones of several monuments destroyed beyond recognition, depressions, etc.	53
	973

monuments that had a consistent appearance throughout the data. In few cases this even allowed us to suggest a tentative date. Detailed digital elevation models derived from TanDEM-X data (12.0 m resolution) helped us to define the areas, which would be covered during the field walking in advance. Fixing our prospection region well beforehand was imperative for our permit and border documents.

#### b. On-ground intensive survey

In an effort to facilitate the integration of our data with existing projects in the Russian Altai, we followed the methodology of the Belgian ‘Altai Project’ (Bourgeois et al., 2007). Our survey centered on field walking with the aim of mapping all visible funerary monuments in the area with a high precision (differential) GPS while documenting the central characteristics of the structures (preservation, tentative date, and dimensions). The anticipated outcome was a detailed database linked with a Geographic Information System. As soon as we arrived we were forced to adapt our approach. Only handheld GPS operated by Chinese researchers were allowed and we were prohibited to access the extreme western part of the basin, despite having the right documents. The AOI was curtailed by the military border police through an arbitrarily drawn line, which was supposed to represent the border between the counties Habahe and Bu'erjin. The actual border between the counties, however, lies much further towards the west.

We worked with small and very mobile teams usually consisting of 3–4 people. Due to great visibility we were able to walk in lines with approximately 50 m spacing. Depending on terrain characteristics the spacing could be expanded to up to 100 m in flat and sparsely vegetated parts of the basin. The remote sensing survey proved to be a very reliable indicator since few monuments were discovered in areas where we had no previous indication in the high-resolution satellite data. In such manner the whole area interest was completely covered. Once the line walking had led to the discovery of a site, one person scouted the surroundings and produced a detailed site sketch (c.f. Fig. 3). The other two to three people documented the individual structures by means of photography, descriptions, and measurements. Finally, one of our Chinese project partners mapped them with a hand-held Garmin GPS. The survey's main focus was burial structures and even though we aimed to document chance finds of material in the vicinity of the sites, there was an apparent lack of such remains. The basin has been used for agricultural purposes in the 50s and 60s of the last century, however, since then the steppe vegetation has regrown, hence effectively covering potential small finds.

As pointed out by Gheyle (2009, 168–169), the terminology for monuments in the Altai is complicated because of transliterations and translations of Russian, Mongolian, and Kazakh terms into other languages and we are far from a unified typology. For a working typology, we tried to stay as close to descriptive terms as possible, with the exception of the terms kurgan, kirigsuur, and ogradka which are defined below and represent fairly well-established archaeological categories in the academic literature. We thus distinguished the following types of monuments:

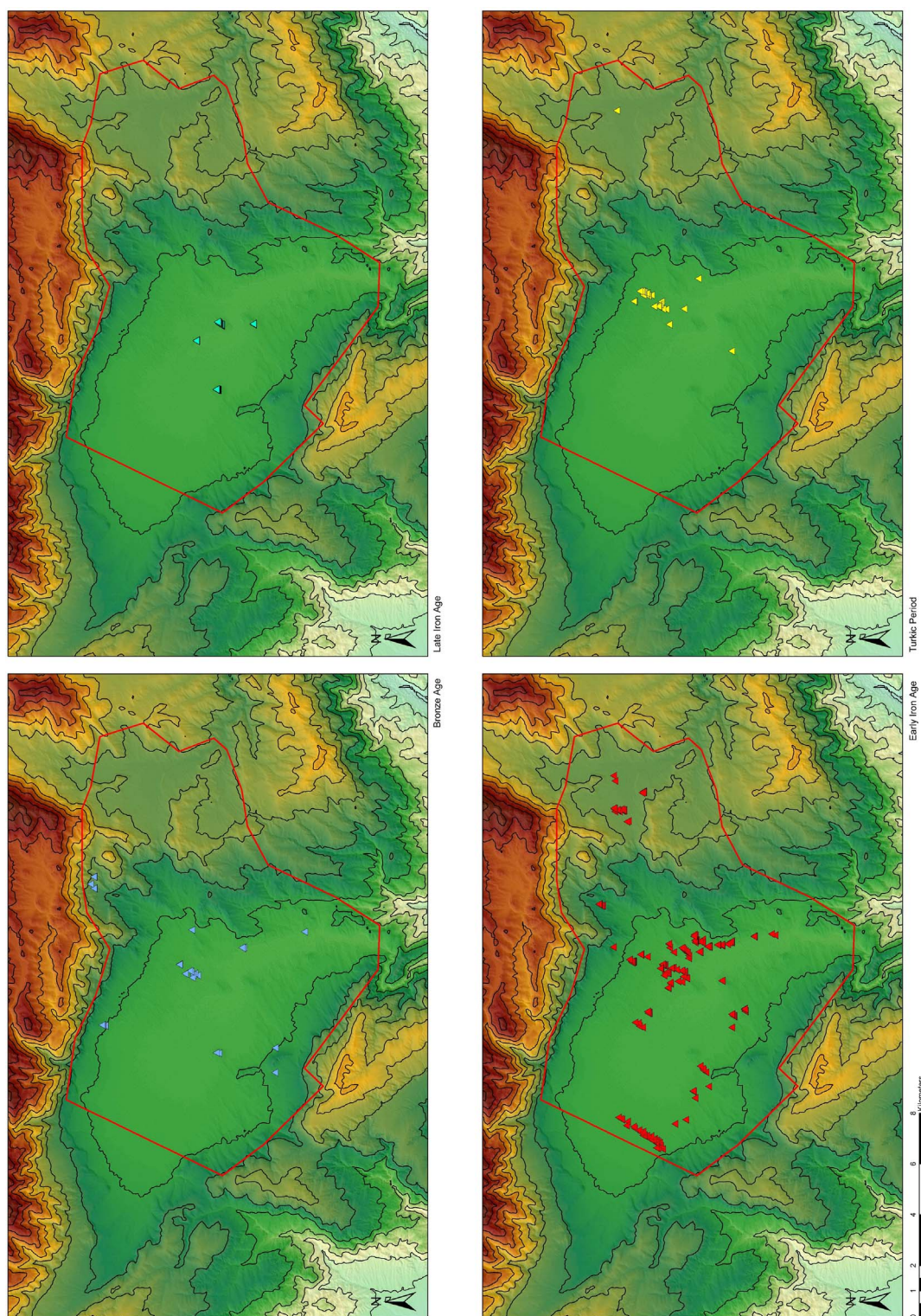


Fig. 4. Distributions of monuments throughout the main periods of analysis.

#### 4. Results

Within three weeks of fieldwork we were able to cover an area of well over 140 km<sup>2</sup>. The remote sensing data and automatic detection algorithm helped us immensely to consistently plan our survey. In total, we mapped close to 1000 structures (c.f. Table 1), ranging from Early Bronze Age burials to Turkic ritual structures.

The distribution of sites in the valley offers insights into prehistoric occupation and movement over roughly four millennia. Fig. 4 shows the

distribution of sites in the AOI for the Bronze Age, early Iron Age, late Iron Age, and the Turkic period. Later structures have been mapped but were not analyzed in detail.

Generally, structures are built on river terraces and alluvial fans with a slope factor of 10° or below. One major cluster lies in the east of the basin, in an area connecting two strategically important mountain masses (connecting the lower plains with the high mountain plateaus of the Altai Mountains). This spot was first occupied in the Bronze Age and henceforth formed a nucleus for activity over more than three



millennia. Especially funerary sites of the Iron Age seem to have been built also for representative purposes along the main transport axes within the basin.

The center of the basin is relatively empty and it seems it was not favored for the construction of funerary monuments. The absence is not due to taphonomic processes but can be related to the geomorphological setting. The central part of the basin is rife with rivulets, the soil has a high moisture content and can therefore be unstable. This area is bordered in the west by an almost 2 km long cluster of Iron Age “Saka” kurgans. The monuments are up to 6.5 m high and measure up to 90 m in diameter and are clearly the most central and obvious architectural feature of this cultural landscape. Strangely, apart from very few undateable peripheral structures, these monuments do never occur in conjunction with monuments of other time periods. Whereas the majority of structures is built on alluvial terraces, the three major late Iron Age<sup>4</sup> cemeteries constitute exceptions: the accumulations of small oval graves are all built on top of rocky hills overseeing major entryways to the basin as viewshed analyses suggest. Remote sensing data indicate that there are further smaller clusters towards the West near the pass.

## 5. Conclusion

Even though the Chinese Altai Mountains are a place where archaeological projects are not easily established and international researchers have to deal with a high entry barriers, it is also a place which is incredibly rewarding to work in because of the great preservation conditions and the lack of previous research (Jia et al., 2016). Despite the manifold hindrances we were able to produce precise maps relying on both high-resolution optical data and elevation data. Remote sensing is an ideal starting base and planning tool for the on-ground GPS-based survey. The combination of methods does yield considerable benefits during the planning and implementation stage of a field project and helps develop a preliminary image of the archaeological landscape, which is then detailed during the field research.

A first preliminary analysis of the data showed that the occupation of the basin started during the Bronze Age.<sup>5</sup> Funerary construction activity peaked during the Iron Age when both “Scythian” and “Saka” burials were erected in high numbers. During the late Iron Age burials were primarily built on higher places, removed from the sacred loci of previous periods. With the beginning of the Turkic period we see a return of structures onto the alluvial terraces in connection with earlier monuments. The variety of monuments suggests influences from the Russian Altai, the Mongolian regions of the mountain range, as well as the Semirechye.

Starting in summer 2017, we hope to substantiate many of the preliminary dating hypotheses with small scale excavations. In order to transgress the boundaries modern nation states impose on archaeological research in the area, we will first incorporate results from the Russian Altai working with a large-scale comparative approach across regions.

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<sup>4</sup> Also referred to as Hunno-Sarmation or Xiongnu period (3rd/2nd cent. BCE – 4th/5th cent. BCE).

<sup>5</sup> The few Bronze Age monuments do show more similarities to funerary structures from the Russian and Mongolian Altai than to the geographically closer Chemurchek/Qiemo'erqieke cemeteries (c.f. Jia and Betts, 2010).