A Major City of the Kazakh Steppe?

Investigating Semiyarka's Bronze Age Legacy

Miljana Radivojević[1], Dan Lawrence[2], Victor K. Mertz[3], Ilya V. Mertz[3], Elena Demidkova[3], Mark Woolston-Houshold[2], Richie Villis[2] and Peter J. Brown[2]

[1]UCL Institute of Archaeology, London, UK,

[2] Department of Archaeology, Durham University, UK,

[3]Joint Research Center for Archaeological Studies named after A.Kh. Margulan, Toraighyrov University, Pavlodar, Kazakhstan

Corresponding author: Dan Lawrence, dan.lawrence@durham.ac.uk

Abstract

Semiyarka is a newly identified 140-hectare Late Bronze Age settlement in northeastern Kazakhstan, featuring rectilinear earthworks, a central monumental structure, and zones for domestic life and tin bronze production. Occupied from around 1600 BC and linked to Alekseevka-Sargary and Cherkaskul cultures, it represents a unique settlement with planned architecture, low density pottery scatter and evidence for organised tin bronze production.

Introduction

The site of Semiyarka is located in the Beskaragay district of Abai Oblast, Kazakhstan, 180 km southeast of the city of Pavlodar. It is situated on a promontory overlooking the Irtysh River, above the dynamic floodplain. Identified in the early 2000s, preliminary studies (Мерц 2006; Mertz 2017) suggested the site covered 40 hectares. Rectilinear earthworks stretching over a kilometre are clearly visible in both satellite imagery (Figure 1) and confirmed through on-site investigations (Figure 2). Surface finds included pottery from Late Bronze Age cultures, specifically Cherkaskul (1600–1250 BC) and Alekseevka-Sargary (1500–1100 cal BC). Evidence of metallurgical activity was identified, with discoveries of ores, slag, crucibles, and finished metal artefacts.

Alekseevka-Sargary material culture is found across the eastern Eurasian Steppe, associated with the emergence of more permanent dwellings and settlements up to 30 hectares (Agapov *et al*. 2013; Varfolomeev *et al*. 2017). Emerging alongside it in Western Siberia, the Andronoid Cherkaskul culture blended Andronovo and local groups, practicing agropastoralism, hunting, gathering, and fishing (Korochkova 2010). Material at Semiyarka predominantly relates to the Alekseevka-Sargary Culture, with some finds linked to the Cherkaskul Culture. The site's size, the presence of rectilinear earthworks, and metallurgical evidence highlight its importance in understanding regional settlement patterns, social organization, and technology.

In 2018, a UK–Kazakh team initiated investigations at Semiyarka to examine the extent, structure, and metallurgical potential of the site. Surface collection recovered abundant Late Bronze Age ceramics alongside metallurgical debris, including crucibles, ores, and slag. Unlike majority of steppe metallurgical sites, Semiyarka provides substantial evidence for tin bronze production.

This indicates a highly organised centre capable of controlled, high-yield production, potentially serving broader exchange networks. The discovery challenges dominant assumptions about the absence of structured metal economies among semi-nomadic communities. Geophysical survey within earthworks revealed architectural traces, indicating a structured layout. These results underpin ongoing excavation and absolute dating, now integrated into the ERC/UKRI-funded DREAM project at UCL.

Topography and Geophysical Prospection Results

Semiyarka was located where the Irtysh valley narrows, enabling control over movement along the river itself and the valley bottom. (Figure 3). There are several sites of similar date surveyed within the region, including two burial mounds to the north of the site and several small and highly ephemeral occupations along the river (e.g. Semiyarka 4–5, Altybai, Lesnoe, Nurbai, Chemaar) have been surveyed. Though ephemeral, they offer promising targets for future excavation. At Semiyarka, earthworks are clearly visible, rising approximately a meter above the ground surface. These features consist of two rows of structures with internal divisions, suggesting a degree of architectural planning (Figures 1-2). A central structure is oriented almost exactly east-west, and set just behind the meeting point of the two lines of earthworks. Its orientation and larger size suggest it may have held a ritual or communal function (Mertz 2017).

Geophysical surveys focused on these earthworks and an area associated with metallurgical activities (Figures 4 and 5). The results showed that substantial walls, likely of mud brick, were built along the inside edges of the earthworks, with internal divisions also visible. We interpret these as structures, likely domestic houses given their scale and ubiquity. The central structure was approximately double the size of these units and may have had a central chamber or courtyard. This could represent a centralised institution, or a richer household. The scale of the earthworks is unusual, with their size and arrangement deviating from more conventional settlement patterns observed in the region.

The second area targeted by the geophysical survey was selected due to surface evidence of metallurgical activities, including slags, crucibles and ores. However, this area revealed few features, suggesting that metallurgical production may have been dispersed or occurred in less architecturally formalized spaces.

Material Culture Distribution

Surface collection used 10m^2 units spaced 50m apart. Finds were sparse due to compacted soils. Artefacts were often associated with modern disturbances from roadworks, water management and tree planting. The low density surface scatter extended much further east than the earthworks, suggesting more ephemeral, perhaps seasonal, occupation. Finished metal artifacts were primarily located in the western half of the site, while a concentration of metallurgical remains, including ore, slag and crucible fragments, was identified to the southeast, suggesting a distinct production zone (Figure 5).

Metallurgy

The survey yielded over 40 metallurgical samples, including ores, crucibles, slags, production debris and artifacts, with 37 selected for analysis (Amirova 2019). Ores were mainly copper carbonates (malachite and azurite), with evidence for both copper and tin bronze production (co-smelting and cementation, up to 12 wt% tin). No evidence of arsenic, leaded, or antimonial bronzes have been found. Technological analysis suggests the copper ores likely originated from local deposits, likely the Altai Mountains in East Kazakhstan. Semiyarka was a significant centre for metallurgical processing. The site's strategic location near abundant copper and tin ores, and transportation routes, suggests it was a hub in the Late Bronze Age metallurgical exchange network (Chernikov 1960).

Ceramics

The survey documented ceramic fragments representing at least 114 vessels. Alekseevka-Sargary types made up 85% of the assemblage, suggesting this was the primary cultural affiliation, with other types associated with the Cherkaskul Culture (Figure 5 bottom right). The presence of Andronoid pottery from the Cherkaskul Culture evidences interactions with groups from Western Siberia. The absence of Begazy-Dandybaev ceramicssuggests that the settlement was established this distinct tradition, likely during theduring the 16th century BC.

Outlook

Based on a settlement size of 40 hectares and the presence of earthworks, Mertz (2017) proposed Semiyarka as the largest 'proto-city' in the northern Kazakh steppes. Our work has shown that the site was even larger, perhaps 140 hectares, and was likely a significant centre of metallurgical production. Production centres in this region are rare and almost exclusively located in upland areas in close proximity to the mines (Stöllner *et al.* 2011). Semiyarka is the first large steppe centre to have on-site documented tin bronze production.

The site has few comparanda. Sites up to 30 hectares with substantial earthworks and domestic architecture are known, such as Čiča (Schneeweiss 2007). The artefact scatter at Semiyarka is much larger than these, although the absence of structures in the geophysical prospection away from the earthworks might suggest artefact density does not directly correspond to built-up areas. In contrast to other sites, the earthworks at Semiyarka surround individual structures rather than the entire settlement. Excavations are needed to assess the architectural layout, provide further evidence for metallurgical processes, and help contextualize Semiyarka's role within regional networks.

Bibliography

AGAPOV, S.A., A.D. DEGTYAREVA & S.V. KUZMINYKH. 2013. Die Metallverarbeitung Kasachstans am Ende der Bronzezeit, in: T. Stöllner & Z. Samašev (ed.) *Unbekanntes Kasachstan. Archäologie im Herzen Asiens. Band 1*: 455-70. Bochum: Deutsches Bergbau-Museum.

AMIROVA, S. 2019. *Copper and Tin Bronze Metallurgy on the Late Bronze Age Site Semiyarka (Kazakhstan). Unpublished MSc thesis.* UCL Institute of Archaeology.

CHERNIKOV, S.S. 1960. *East Kazakhstan in the Bronze Age (in Russian).* Moscow, Leningrad: Academy of Sciences USSR.

KOROCHKOVA, O.N. 2010. *Interaction of Cultures in the Late Bronze Age (Andronoid Antiquities of the Tobol-Irtysh Region) (in Russian).* Ekaterinburg: Ural UrIzdat.

MERTZ, V.K. 2017. Semiyar settlement of the Bronze age in the context of the problem of formation of protocity culture in the Upper Irtysh region. *World of the Great Altai* 3**:** 494-509.

SCHNEEWEISS, J. 2007. *Die Siedlung Čiča in der westsibirischen Waldsteppe I. Untersuchungen zur Keramik, Chronologie und kulturellen Stellung in der Spätbronzezeit und der Übergangsperiode zur frühen Eisenzeit. Archäologie in Eurasien 22.* Mainz: Verlag Philipp von Zabern.

STÖLLNER, T., Z. SAMASCHEV, S. BERDENOV, J. CIERNY, M. DOLL, J. GARNER, A. GONTSCHAROV, A. GORELIK, A. HAUPTMANN, H. RAINER, G.A. KUSCH, V. MERZ, T. RIESE, B. SIKORSKI & B. ZICKGRAF. 2011. Tin from Kazakhstan - Steppe tin for the West?, in*:* Ü. Yalçın (ed.) *Anatolian Metal V***:** 231-51. Bochum: Deutsches Bergbau-Museum.

VARFOLOMEEV, V., V. LOMAN & V. EVDOKIMOV 2017. *Kent-gorod bronzovogo veka v tsentre kazakhskikh stepei (Kent-the Bronze Age city in the center of Kazakh steppes, in Russian).* Astana: Kazakhskii Nauchno-Issledovatel'skii Institut Kul'tury, Astana.

МЕРЦ, В.К. 2006. Археологические исследования в Бескарагае *Алтай в Системе Металлургических Провинций Бронзового Века***:** 73-82. Барнаул: Издательство Алтайского Университета.

Figures

Figure 1 - Corona spy photograph of Semiyarka (KH4B Mission 1116, April 1972). Red boxes indicate geophysical prospection areas in Figure 4

Figure 2 – Drone photograph of the archaeological site of Semiyarka, looking from the Southeast to the Northwest. Photograph Peter J. Brown

Figure 3: Semiyarka location, with background Digital Elevation Model (SRTM) showing topography and Corona spy photograph showing landscape in the early 1970s (KH4B Mission 1116, April 1972). Red dots indicate collection units in Figure 5.

Figure 4 - Map of features recovered through geophysical prospection by Archaeological Services, Durham University.

Figure 5: Material culture distributions at Semiyarka. Top left: Distribution of all material culture, Top Right: Distribution of ceramics, Bottom Left: Distribution of metals. Bottom Right: Pottery of Alekseevka-Sargary (upper four sherds) and Cherkaskul (lower four sherds) cultures. The boundaries of the site can be identified by the absence of material culture from multiple rows of collection units at the edges of the map images