Journal of Field Archaeology

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/yjfa20

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To cite this article: Timur Sadykov , Gino Caspari & Jegor Blochin (2020): Kurgan Tunnug 1—New Data on the Earliest Horizon of Scythian Material Culture, Journal of Field Archaeology, DOI: 10.1080/00934690.2020.1821152

To link to this article: https://doi.org/10.1080/00934690.2020.1821152

Published online: 30 Sep 2020.

JOURNAL OF FIELD ARCHAEOLOGY
https://doi.org/10.1080/00934690.2020.1821152

Routledge
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Kurgan Tunnug 1—New Data on the Earliest Horizon of Scythian Material Culture

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ABSTRACT

Questions surrounding the emergence of highly mobile nomadic pastoralism and the origins of the associated Scythian material culture have a long history in Eurasian steppe archaeology, but advances in knowledge have been hindered by a lack of data. Here we present new findings on the Early Iron Age royal burial mound Tunnug 1 in Tuva. While the site belongs to the same cultural tradition as Arzhan 1, the conceptual roots of the funerary ritual architecture can be traced to precursors in the Mongun Taiga culture and the Mongolian deer stone khirigsuur complex. The clay architecture uncovered at Tunnug 1 does not find any regional comparisons and possibly hints towards a western Central Asian contribution to the formation of the earliest Scythian horizon. Our research demonstrates the value of a multi-disciplinary approach to documenting monumental earthen architecture, including technical approaches (satellite imagery, aerial photographs, 3D models, digital elevation models, geophysics, and radiocarbon dating) with an analysis of construction material and associated finds.

KEYWORDS

Siberia; burial mound; Early Iron Age; Tuva; Eurasia; Arzhan; Russia

Introduction

For almost three centuries, burial mounds (kurgans) of the Early Iron Age steppes and their associated archaeology have captured the imagination of a broader audience and drawn attention to the late prehistoric peoples of Eurasia between Mongolia and the Danube Region. An emerging material culture associated with the highly mobile nomadic pastoralists of the Early Iron Age, which illustrates unusually close ties to Europe and Asia for the first time, became a focus of early archaeological research. Drawing on historical sources—in particular, Herodotus—these communities are most often associated with the Scythians, and, although this term historically only denoted tribes in the northern Black Sea region, its use has expanded to include a large material culture complex reaching far beyond its historical scope. More recent archaeological research has started to disentangle ethnonyms and material culture, and a number of Early Iron Age material cultures from the Eurasian steppes are now better understood. Including the Tagar culture in the Minusinsk Basin, the Pazyryk culture in the Altai Mountains, the Saka in eastern Kazakhstan, and the classic Scythians of the northern Black Sea region, there are strong similarities with regard to lifestyle, economic characteristics, and artistic expression across all of them. This is why "Scythian material culture" remains very much in use in Russian and German archaeological literature, referring to a supergroup of highly mobile nomadic pastoralists of the Early Iron Age Eurasian steppes (approximately from the 9th–2nd century B.C.), although the broad-brush nature of the term and its particular grounding in the history of research in these regions is also acknowledged.

Despite significant interest in these prehistoric steppe cultures, the origins of Scythian material culture have largely remained in the dark. The excavation of Arzhan 1 in the 1970s (Gryaznov 1980) documented what is widely recognized as one of the earliest royal burial mounds of Scythian culture. The unique architectural structure of this large burial mound in the Republic of Tuva and its associated finds supported the hypothesis for an initial Scythian homeland somewhere in the eastern Eurasian steppes in the 9th century B.C. Prior to this discovery, the Scythians were assumed to have roots in the Pontic steppes. For decades, Arzhan 1 remained one of the few reference points for the origins of the Scythians. It was not until 2018 that radiocarbon dates and 3D models from the site of Tunnug 1 suggested that a similar burial mound dating to the earliest Scythian horizon was located in the wetlands of the Uyuk Valley (Caspari et al. 2018). In this article, we present new data relevant to the discussion of the origins of Scythian material culture derived from surveys and excavations conducted in 2018 and 2019. The observations made during the first two field seasons at the early Scythian royal mound of Tunnug 1 in the Tuva Republic allow for a reanalysis of the cultural components associated with an early Scythian assemblage. Crucial structural features of this important archaeological site are, in some regards, unique in the corresponding cultural and chronological horizon, and differ both from the previous cultural traditions in the area and the subsequent and well-researched classical burial complexes of the Early Iron Age.

The structural components of the Tunnug 1 site and its periphery are not limited to research questions of local interest but provide a chance to analyze the confluence of architectural traditions that is key to understanding the formation of Scythian identity. The kurgan Tunnug 1 has been dated to the time of the emergence of this tradition in the 9th century B.C. (Caspari et al. 2020a, 56) and thus should theoretically allow us to decipher the initial cultural components. Importantly, these excavations reveal a period prior to subsequent traditions and cultural influences that often blur interpretations. Connections between an early Scythian horizon and regional cultures of the Late Bronze Age have long been suggested, in particular the traditions of the Mongun Taiga culture and the

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Mongolian deer stone khirigsuur complex (Honeychurch 2015, 174–175; Houle 2010, 11), but other cultural relations have also been proposed, most often ties to post-Andronovo cultures from the west (Kyzlasov 1979, 35; Savinov 2002, 31–32) or from the southeast (Chugunov 2020, 141). Some of the structural architectural elements of Tunnug 1 have obvious parallels in monuments of the deer stone khirigsuur complex and show apparent connections. However, there are also unique architectural elements lacking local precursors or parallels. These are in need of explanation, since tomb construction characteristics are one of the important elements of Scythian identity.

The Early Iron Age in Tuva and the Tunnug 1 Project

The scientific excavations of kurgans attached to Siberian scholarship focused on Scythian material culture began more than a hundred years ago with V.V. Radlov's expeditions to the Early Iron Age burial grounds of Katanda and Berel' in the Altai (Radlov 1884, 1895). Compared to the northern Black Sea region where the first royal kurgans, such as the Kul-Oba burial mound, had already been documented in archaeological excavations (Shcheglov, Katz, and Salmond 1991), these discoveries in the east were later, and this is, in part, a reason why the term "Scythians" acquired such a broad meaning. At the dawn of research into Early Iron Age steppe cultures, new finds emerging from the mountains and steppes of inner Asia were interpreted as a heavily-influenced offshoot from traditions found in the northern Black Sea region (Artamonov 1975). Scythian archeology, meanwhile, developed and identified separate archaeological cultures. In the eastern parts of the Eurasian steppe belt, these are, namely, the Tagar culture in Khakassia and southern Krasnoyarsk Territory (Bokovenko et al. 1995), the Pazyryk culture in Altai, including the Kazakh, Mongolian, and Chinese Altai (e.g. Hiebert 1992; Molodin et al. 2008; Caspari 2020a), and the Aldy-Bel and Uyuk-Sagly cultures (also called Uyuk culture) in Tuva (Chugunov 2020; Parzinger 2006, 606–608). In each of these areas, specific characteristic elements are distinguished, but the overall material culture adheres to the concept of the so-called Scythian triad encompassing specific weapons, horse gear, and items decorated with animals in Scythian style. In fact, Herodotus mentions that Scythians migrated to the northern Black Sea region from Asia, and, with new archaeological data, the Central Asian hypothesis of the origin of Scythian material culture became more popular (Terenozhkin 1971). The discovery of the Arzhan 1 kurgan in the Tuva Republic effectively ended the debate regarding the origins of this material culture, as the excavations and publication of this material hinted at a much earlier date for this site (Gryaznov 1980). The initial dating placed this royal burial mound in the 7th century B.C., and subsequent analyses, with the improvements of radiocarbon dating and dendrochronology, then situated it even earlier at the turn of the 9th–8th centuries B.C. (Zaitseva et al. 2007). Since then, the Central Asian hypothesis has been based mainly on the material from Arzhan 1, which still remains surprisingly unique.

Burial monuments of the Early Iron Age in the Tuva Republic have been extensively studied and thus provide a good overview of regional change. In the 7th–6th centuries B.C., the Aldy-Bel culture was widespread and shows features typical of the Scythian triad. The 6th century in Tuva saw changes in burial practices and has thus been assigned to another temporal subcategory, the so-called Sagly, Uyuk, or Uyuk-Sagly culture (in fact, there is much debate regarding terminology). This archeologically-defined lens existed until the 3rd or possibly even the 2nd century B.C. Late Uyuk-Sagly monuments display influences of Xiongnu material culture, which spread across the eastern steppes and is sometimes differentiated from the Uyuk-Sagly culture, defined as the Ozen-Ala-Belig stage (Semenov 2003; Chugunov 2020, 139). To be sure, the range in data regarding burial monuments required further clarification about chronology and the associated interpretations.

The excavation of Arzhan 1 made it clear that drastic changes occurred at the beginning of the first millennium B.C. and that research into monuments of this time period would contribute not only to solving local chronological problems, but would also be important for broadscale research questions concerning nomadism in the Eurasian steppe. Closely related are the debates concerning the nature of the transition from the Late Bronze Age to the Early Iron Age, the emergence of Scythian material culture(s), the origin and spread of nomadism, and the corresponding emergence of strongly hierarchical societies in the Eurasian steppes.

In 1980, M. Gryaznov, a pioneer of research into the origins of the Scythians, noted that he considered three large burial mounds within the landscape of the Uyuk Valley in the Tuva Republic to provide the most promising insights into the earliest Scythian horizon (Gryaznov 1980, 5). The Uyuk Valley in the Tuva Republic, which he dubbed the "Valley of the Kings," boasts over 150 burial mounds, each with a diameter of over 25 m, as well as several extremely large monuments with diameters over 100 m (Caspari 2020b). What is more, there are a few monuments which take the form of relatively flat stone platforms, rather than conical hills; these are the subject of the current research regarding the earliest Scythian material culture.

One of the first kurgans to be explored was Arzhan 1, lying inside the small modern village of Arzhaan, excavated by Gryaznov himself. The second one—eventually named Arzhan 2—was excavated by a Russian-German expedition in the early 2000s and received worldwide attention: the main burial of the mound remained unlooted (Chugunov, Parzinger, and Nagler 2010), which is extremely rare. The vast majority of burial mounds on the Eurasian steppes are heavily damaged by looting (Caspari 2018), likely robbed relatively soon after their construction. Recent analysis has shown that in the Uyuk Valley, around 92% of burial mounds suffered from severe looting (Caspari 2020b). Despite the rich material remains recovered from Arzhan 2, the burial was not able to contribute data to questions concerning the inception of Scythian material culture, as the animal style is already fully developed. In light of this data, Arzhan 2 was securely dated to the middle of the 7th century B.C. (Chugunov, Parzinger, and Nagler 2010) and forms the prime example of a royal burial mound of the Aldy-Bel stage. The third mound noted to be of interest by M. Gryaznov was Tunnug 1, after a small rivulet in the south of the Uyuk Valley, as, following Russian conventions, sites are usually named after the closest known toponym.

A survey carried out by the authors in 2017 made it possible to clarify the kurgan's location and obtain preliminary radiocarbon dates (Caspari et al. 2018), which situated the site within the chronological context of Arzhan 1. Between the excavations at Arzhan 1 and Tunnug 1, only one other sizeable mound dated to the Arzhan period was studied—Arzhan 5, which also seems to belong to the Arzhan period, as corroborated by radiocarbon dates in the 9th–8th century B.C. (Rukavishnikova and Gladchenkov 2016, 55). This is a slightly smaller mound, only around 55 m in diameter. Its excavation has been halted, but preliminary results show similar architecture to Arzhan 1. During survey, the burial mounds which lie in between Arzhan 1 and Arzhan 2 were assigned the site names Arzhan 3 and Arzhan 4, but their exact chronology remains unclear (Figure 1).

The preliminary survey of the Tunnug 1 site in summer 2017 revealed its significance. An internal radial structure of the kurgan, reminiscent of Arzhan 1, was documented using a range of approaches: satellite imagery, aerial photographs, 3D models, and digital elevation models. The site's location in the floodplain of the Uyuk Valley gave rise to hypotheses about significant landscape changes in the upper reaches of the valley at the turn of the Late Bronze Age to the Early Iron Age. In fact, researchers posited that there would be no later archaeological material on the site. The first large excavation campaign, however, demonstrated the diachronic nature of material remains from the Bronze Age to the Turkic period, illustrating the rare multi-period occupation of Tunnug 1 over ca. 2500 years of human presence (Sadykov, Caspari, and Blochin 2019). Subsequent surveys utilizing optical and SAR data, furthermore, showed the burial mound to be an isolated occurrence in a wetland zone (Caspari et al. 2020b) when compared to the preference for tombs located on terraces along the northern areas of the river valley. The unique location within a swamp and the presence of ice around 1 m below the surface level in June 2017 (Caspari et al. 2018) suggested the possibility of well-preserved organic remains, and indeed, subsequent excavation campaigns revealed excellently preserved wood. A more precise date for the burial mound was obtained in 2019 by means of wiggle-matching, situating the Tunnug 1 site at around 833–800 B.C. (Caspari et al. 2020a). This makes the site effectively comparable to Arzhan 1 with regards to both the overall size—both sites belong to the largest category of burial mounds in the Uyuk Valley (Caspari 2020b)—and the chronological position at the beginning of the Early Iron Age in the Eurasian steppes (see Table 1 for current radiocarbon dates). Given that larch forests covered (and still cover) large stretches of the adjacent mountains and would have been available as an abundant resource, with little need to store felled trees over extended periods of time (i.e. more than a decade), the authors argue that construction materials are likely to be contemporary with timber harvesting. In addition to the excellent wood preservation, the site is in remarkably pristine condition, with a near complete absence of any visible damage. The above criteria made Tunnug 1 directly relevant to major scholarly debates in Eurasian archaeology and led to the establishment of a large interdisciplinary Russian-Swiss research project. The project has involved specialists in anthropology, genetics, geomorphology, paleozoology, palynology, and soil science, among others, but the remaining sections of this article focuses primarily on the preliminary field archaeological results and are restricted to the Early Iron Age aspects of the site.

Methods

The specific topographic conditions, with the site lying in a wetland zone with regular flooding seasons, the complex

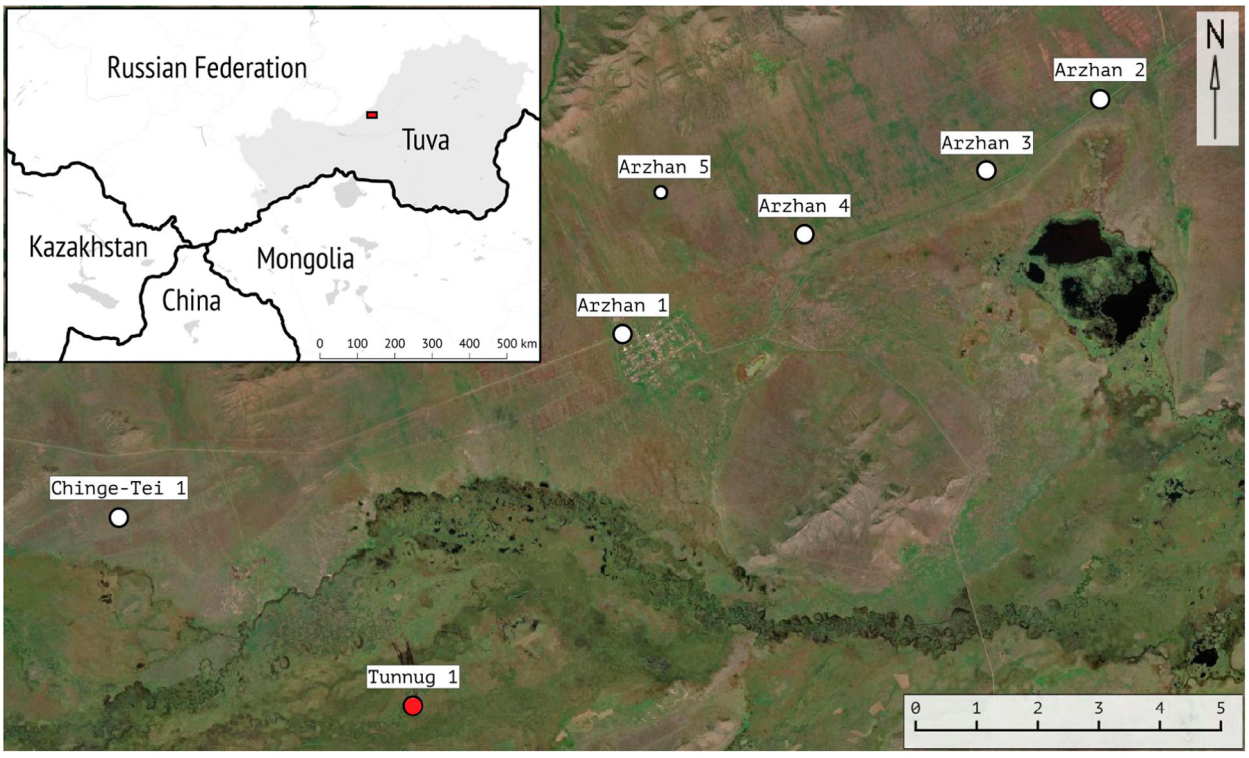

Figure 1. Map of the "Valley of the Kings." The most important early Scythian kurgans are noted. For a complete map of the royal burial mounds on the northern river terrace, see Caspari 2020b.

Table 1. Radiocarbon dates obtained from Tunnug 1. Uncertainties of ^{14}C ages refer to 68% probabilities (1σ), whereas calibrated ranges represent 95% probabilities (2σ). ^{14}C ages were calibrated using the IntCal13 calibration curve (Reimer et al. 2013). All samples were wood obtained from the burial mound architecture. The modelled age based on wiggle matching as reported by Caspari and colleagues (2020a) lies between 833–800 B.C.

Lab Code	Conventional Radiocarbon Date B.P. (68.2% probability)	Calibrated Date Range B.C. (95.4% probability)	Citation
ETH-80046	2719 ± 16	904–824 B.C.	Caspari et al. 2018
ETH-80047	2678 ± 19	895–868 B.C.	Caspari et al. 2018
		859–802 B.C.	
BE-9513.1.1	2712 ± 23	903–814 B.C.	Caspari et al. 2020a
BE-9512.1.1	2728 ± 23	915–822 B.C.	Caspari et al. 2020a
BE-9516.1.1	2740 ± 23	926–828 B.C.	Caspari et al. 2020a
BE-9515.1.1	2708 ± 23	902–813 B.C.	Caspari et al. 2020a
BE-9514.1.1	2644 ± 23	832–795 B.C.	Caspari et al. 2020a

structure of the site, and the enormous amount of simultaneous work (at times more than a hundred archaeologists and volunteers were working on the site and had to be organized across a large excavation area), as well as the very strict requirements of the Russian cultural heritage authorities, required the development of a specific excavation methodology guided by these significant constraints. From preliminary surveys and test trenches in 2017, we were able to separate the site into the main royal kurgan and its periphery, consisting of a conglomerate of burial and ritual stone structures both contemporary with and later than the main mound.

The fieldwork methodology had to respond to these challenges and encompassed a dual set of excavation units. The kurgan itself was divided into 16 sectors, the edges of which were drawn through the conventional center of the stone platform. Each edge was denoted by Latin letters from A–P, each excavation sector being denoted by its border lines (AB, BC, CD, etc.). The periphery was sectioned into quadrants of 8 × 8 m using a box grid. The conventional zero was located in the southwestern corner of the excavation. Lines of squares were numbered from 1–25 on the horizontal axis (X) and from 1–24 on the vertical axis (Y). The quadrants were defined by a combination of two numbers—X-numbers first, Y-numbers second (1-1, 9-5, 25-24, etc.). This enabled effective organization of the fieldwork on the periphery of the kurgan, while being able to work simultaneously on the main burial mound (Figure 2). In accordance with the requirements of Russian archaeological authorities, each individual "object" (объект)—which essentially denotes an entire separable archaeological structure—must receive its own stratigraphic profile and plans of each archaeological layer. The established rules of the Russian cultural heritage administration, as well as established local traditions, do not allow for a strict execution of a stratigraphic excavation. In most cases, the approach is comparable to the excavation of individual stratigraphic units, but differences can occur. During excavation, most of the archaeological objects were cut with a real profile (as opposed to a virtual profile reconstructed during post-processing). However, in cases where it was not possible to obtain a real profile in the field, the objects were excavated while documenting plans of thin horizons. The stratigraphic profile was then drawn during post-processing. The reason for this approach lies in the instability of features such as pit fills, which may consist of a very unstable mixture of small and large stones with loose, sandy loam. When high groundwater appears, the original stratigraphic profiles do not hold up and thus collapse before the documentation can be completed. The detailed documentation of each layer of stones by means of photogrammetry and 3D modeling allowed us to reconstruct the exact 3D location of each stone in the filling and get an adequate picture of the stratigraphy.

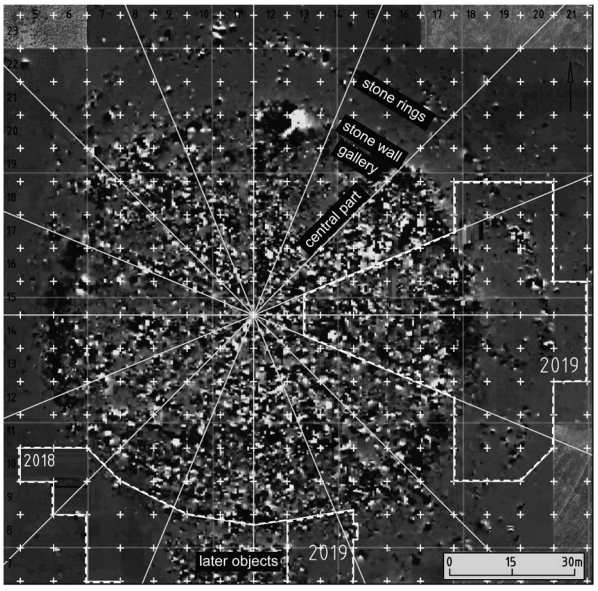

Figure 2. Magnetometric plan with excavated areas and main structural elements marked.

The excavation of the main kurgan was organized as a series of cleaning/documentation steps. First, the removal of the vegetation and topsoil layer was carried out, cleaning the stone surface and documenting it. In a second step, all small stones (generally below 5–6 cm) were removed, which led to a clean surface of larger stones. The third step consisted of the removal of all stones and the cleaning of the underlying clay level. In this level, there were the first traces of poorly preserved wood. Additionally, on this level, pits or compartments ("chambers") of the kurgan were often identified, guiding further steps. We then removed a thick layer of clay, cutting additional profiles into the clay architecture and cleaning the underlying wooden structure, the logs of which lay on the natural, underlying geological layer, though they had sometimes become submerged into the natural clay layer, due to the presence of water. Finally, the separate compartments, delineated by the wooden remains, were excavated, and each was documented with additional profiles. General stratigraphic profiles were documented following the sector lines (the main profile for 2019 being Profile E), and contextual profiles were drawn in cases where clarification of a context's morphology was needed.

Every cleaned layer was documented using 3D modelling of the excavated areas by means of a structure from motion approach. All documentation was referenced in the coordinate system created for the site during the 2017 survey.

After each stage of excavation, every excavation unit (a quadrant, a part of a sector, or an object) was documented with UAVs (DJI Phantom 4 Advanced/Mavic 2 Professional) and with digital photography. From these sets of photographs, 3D models, elevation models, and orthophotographs of every unit were generated using Agisoft Metashape software. Object drawings were created in Autodesk AutoCAD using data from the 3D models.

All artifacts found during excavations (animal bones, ceramic fragments, iron, bronze, bone, and stone items), as well as wood, soil, or bone samples taken for analysis, were recorded using a total station in the coordinate system adopted for the excavation. The decision to document every artifact with its exact coordinates, although not often used on large Iron Age sites and time-consuming while on site, proved to be very helpful at the post-processing stage, for example while reconstructing vessels or analyzing archaeozoological data.

The Internal Structure of Tunnug 1

Tunnug 1 is much more complex than a simple soil or stone mound over a burial, as is often the case with smaller Early Iron Age sites. The archaeological complex consists of several architectural features dating to the Early Iron Age and a number of structures that belong to later time periods (see Figure 2). Structurally, we distinguish: the central part of the main mound built from wood, clay, and stone; the surrounding gallery with clay structures and pits; a wall surrounding the gallery that is constructed from stone slabs; stone rings and other structures surrounding the complex as a whole; a large amorphous mound and several smaller contemporary funerary and ritual structures that date to the first centuries A.D., which also partially destroyed the stone rings and the edge of the stone wall in the southern periphery of the site; medieval burial objects in the southern periphery; and, finally, stray finds dating to the Middle Bronze Age.

Around ten percent of the Early Iron Age component of the site has been excavated, including parts of the main mound, gallery, and wall, as well as stone structures and rings in the immediate periphery. In the following, we elaborate on individual stratigraphic complexes which allow for comparisons to other archaeological sites on a larger scale or concern previous hypotheses from other scholars, where our findings add to the academic discourse concerning Early Iron Age architecture of the Eurasian steppes.

Peripheral stone rings—signs of long-term ritual practice?

Stone rings surrounding a central mound are a frequent element of Early Iron Age kurgan sites in Central Asia (cf. Chugunov, Parzinger, and Nagler 2010, 15; Gheyle 2009, 181; Caspari et al. 2017, fig. 3; Bourgeois et al. 2007, 14), and this architectural characteristic finds clear parallels in the deer stones and khirigsuurs complex of Mongolia (cf. Allard and Erdenebaatar 2005; Fitzhugh 2009). A long-standing question is whether they reflect ritual practices contemporary with the construction of the burial or a gradual build-up reflective of a longer period where the burial mound served as a place of post-funerary ritual practices. A recent study analyzing the stone circles around several Late Bronze Age khirigsuur in Tsatsyn Ereg (Mongolia) found that the stone circles around the monuments were built over a period of approximately 50 years (Zazzo et al. 2019). The stratigraphic configuration of the stone circles at Tunnug 1 also supports a longer period of construction of these peripheral features.

Before the start of the 2019 excavations, a geophysical survey of the periphery of the site was conducted (Caspari et al. 2019). Due to the characteristics of soil formation in the area of the site and the vegetation, the peripheral structures surrounding the main kurgan are mostly invisible on the surface. Out of the three applied geophysical prospection methods (ground-penetrating radar, geoelectric resistivity, and geomagnetometry), only the geomagnetometry yielded good results. The peripheral structures appeared very clearly in the geomagnetic data. The eastern periphery of the main burial mound showed these features to be largely undisturbed by later anthropogenic activity and was therefore chosen for excavation (Figure 3). The stone rings, as far as can be judged from the excavated area and the geomagnetic survey, are arranged around the mound in a single row. The number of rows is variable for different sites, and a row of stone circles can surround only part of an Early Iron Age mound. At Arzhan 1, for example, from 1–3 lines of rings have been identified (Gryaznov 1980, 11), and at Arzhan 2, a disorderly circular arrangement has been documented, with up to 4 short rows of stone circles closely aligned (Chugunov, Parzinger, and Nagler 2010, 15).

Among the assessed rings from Tunnug 1, at least 3 types can be distinguished, based on the type of stone, the location, and general orderliness (Figure 4A–C). The rings of type A are constructed from large fragments of worked, gray flagstone. This type of stone is quite rare among the stones of the wall and the main structure. In cases where it does occur, they are always found on top of the stone surface of the main mound. We hypothesize that these stones pertain to disassembled rings. In addition to being of the same type, they also display the same artificially rounded contours on one side.

Rings of type B are made of flagstone, but the color and texture of these slabs are quite arbitrary. These rings may contain fragments of stones from the first type of rings, but the rounded edges of these reused stones are not used as the outer edge. In one case (the rings DE-R2 and DE-R3, see Figure 3A), the stratigraphic correspondence is directly visible—under the ring of the second type, a layer of soil with small fragments of stone typical for the rings of the first type is documented (see Figure 4). The rings of the third type are made of a disorderly assemblage of unworked, reddish rock.

All five documented rings were in a row in one area (see Figure 3B). To cover the mound and to build the rings, at least ten types of stone were used (a separate study based on sourcing analyses will be devoted to this). On the mound, no obvious system concerning their distribution has so far been noted. Within sight of the kurgan, only one possible quarry was identified, but the type of stone found there is not the most common at the site. At this time, we do not know much about the types of stone in Arzhan 1, nor their procurement locations. For this reason, detailed comparisons are currently not possible. In the case of Arzhan 2, however, we know that it was built almost exclusively with Devonian sandstone, and the quarry was found 2 km away from the site (Chugunov 2011, 264).

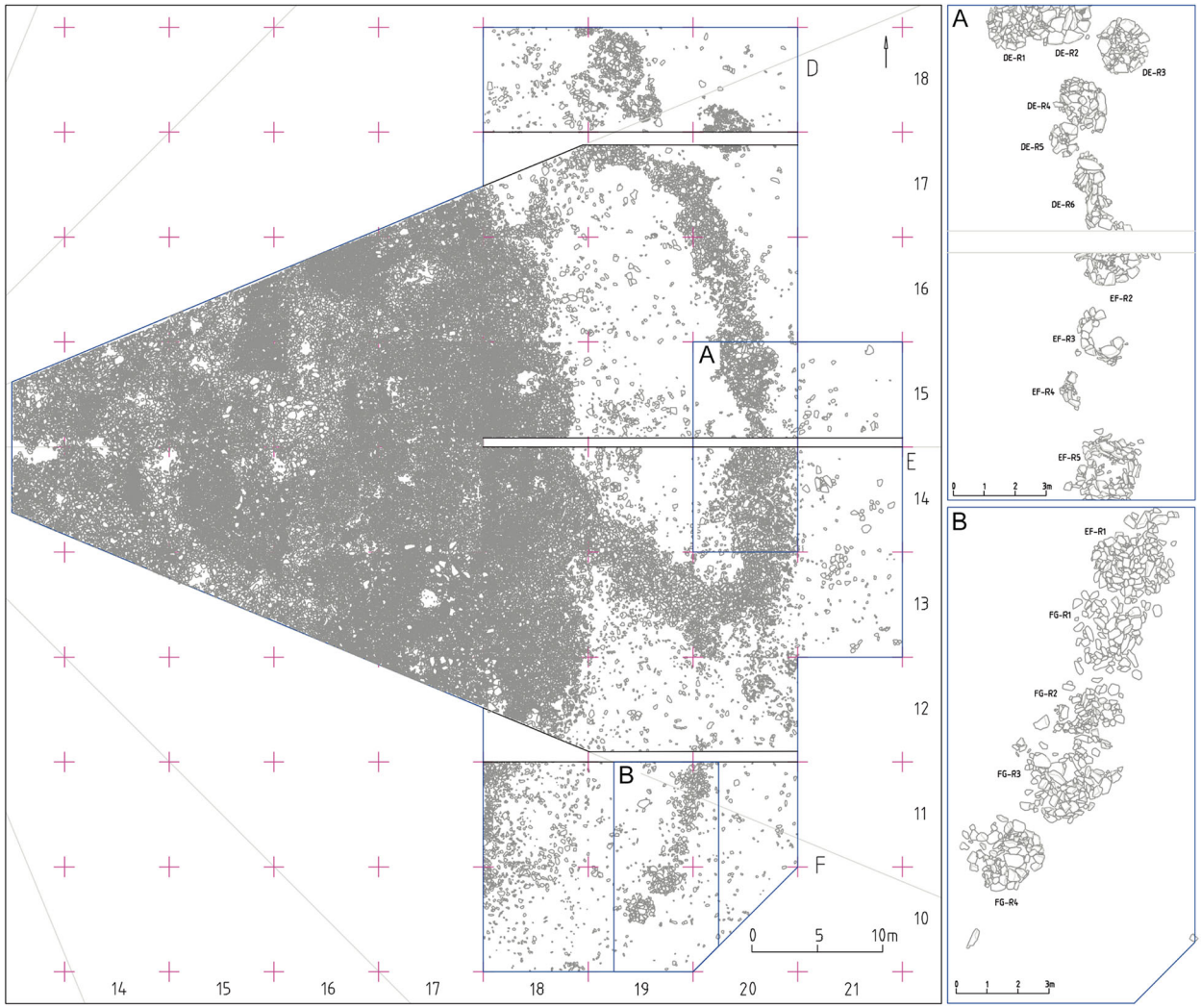

Figure 3. Eastern area after topsoil removal. Insets show details of the stone rings—a common peripheral monument with Early Iron Age burial mounds, but also Late Bronze Age khirigsuurs.

The situation from our assessment of Tunnug 1 thus presents a new body of data. The main conclusion is that the rings are not all contemporary with the initial construction phase of the royal kurgan. They are, at least in part, remains of later ritual actions, and the stones may have been reused or destroyed during subsequent activities. At the same time, the

Figure 4. Types of stone rings in the periphery of the burial mound and their stratigraphic relationship.

diversity of the rings may also hint towards the heterogeneity of communities that used the kurgan as a place of worship. Different sources of stones, different construction techniques (shaped slabs in the rings of type A, simple piled stones in the rings of type C), and different planigraphic positions of the rings of different types could be interpreted as reflecting chronological or possibly cultural differences.

Finds among these structures were rare and could not be assigned unequivocally to a particular structure. Among the stones of the rings, only individual small animal bones were documented. A bronze knife, a socketed axe, and some fragments of ceramics were found, which can be interpreted as Early Iron Age based on their typology.

An interesting planigraphic detail is the broad stone pavements connecting the stone wall with the line of stone rings surrounding the mound. Similar stone structures have been documented in some cases in the khirigsuurs of Mongolia, for example Ulaan Uushig I, Kh-1 (Hayashi 2013, fig. 7), or Tubshin Nuur, Kh-3 (Liu 2014, fig. 9). Another distant, but nonetheless interesting parallel in this case are the so-called kurgans with mustaches (*kurgan s usami*) from Kazakhstan and the southern Urals (Beisenov 2017). The dating of these "mustache" additions is still debatable, and they may not belong to the original construction phase of the burial mounds. In fact, Grudochko (2018) argues that they may represent a cultural tradition separate from Scythian correlates. Also important is the directionality of these architectural features: they are consistently located in the eastern areas of the burial mounds. Considering the geomagnetic survey data from the yet-unexcavated parts of the site, which gives no indication of their presence, we do not expect to find such additional structures at Tunnug 1.

The mound as a quarry—destruction by Soviet machinery

Previously, Gryaznov (1980, 5) had pointed out that stone was sourced at the Tunnug 1 mound for the construction of a nearby winter road during Soviet times. This was a major concern before the start of excavation, because heavy machinery might have destroyed a large part of the site. The geomagnetic data showed the periphery of the structure quite clearly, yet the central part of the site was characterized by a large amount of noise, likely a result of the dense coverage of stone on the surface. During the survey campaign in 2017, we produced a digital elevation model (DEM) of the kurgan (Caspari et al. 2018), and this method proved to be in many ways more effective in revealing the structure of the main burial mound. In 2019, before the start of excavation, all major vegetation was removed from the mound and the grass cut short, and a new, more accurate DEM of the mound with a resolution of up to 3 cm/pixel was generated through photogrammetry. This revealed the architectural outline of the mound in detail (Figure 5).

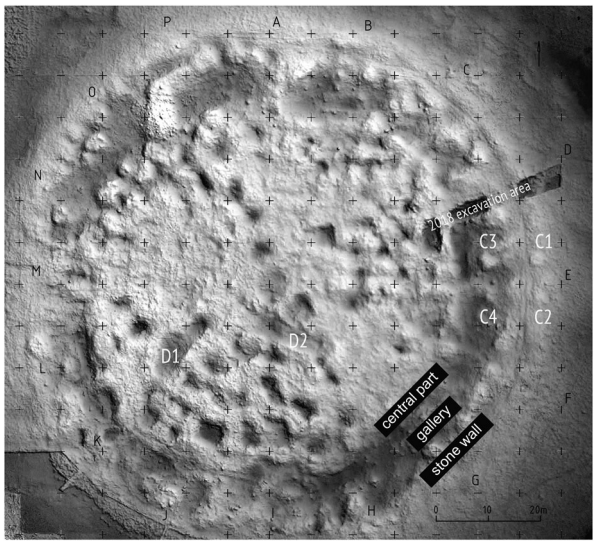

Figure 5. 3 cm/pixel DEM before excavation in summer 2019.

With the vegetation removed, the wheel-like structure of the site, with radial spokes coming from the center and going to the periphery, is even more evident. Some small areas where this pattern is not visible are interpreted as traces of destruction. However, it seems that if stone was sourced at all in the recent past, this has only led to minor signs of destruction. We assume that the main impacts of attempts to use the central part of the burial mound as a quarry can be seen in Figure 5 (D1 and D2). Generally, stones would have been taken from the gallery surrounding the central mound, where stones are free of vegetation and easily accessible. But here as well, we can only see slight alterations of the original form of the mound. We investigated the remains of a nearby defunct winter road, but the stones were not indicative of those from the kurgan. In summer, the area is frequently flooded and impassable; in winter, the ground is deeply frozen and does not necessarily require a road for passage. Perhaps Gryaznov interpreted the open parts of the gallery which remain free from vegetation (due to all water being drained quickly into the ground) as damage caused by sourcing stones for a road. From the aerial photographs and the DEM, these depressions are clearly a structural part of the site, yet this would have been hard to grasp from the ground in the 1970s.

In addition to evaluating the general structure and preservation conditions of the mound in the DEM, we now turn to specific areas of interest. The western and southeastern sectors of the central mound have almost no depressions on the modern surface. One potential interpretation is that the underlying construction in these areas has not yet collapsed. Future excavations of the upper levels will provide needed information with which to assess the relationships of wooden structures and clay layers. We do note that in the westernmost part of the gallery there is an interruption in the depression, bridging the wall with the central part of the mound. This may indicate architectural elements, which may be the focus of future campaigns.

Stone wall and gallery—a contribution to the reconstruction of Arzhan 1

Knowing the structure of Tunnug 1 allows us to make cross-comparisons with other Early Iron Age burial mounds of the earliest Scythian horizon in the Uyuk Valley. The first architectural reconstructions of Arzhan 1 suggested a continuous flat stone platform over the entire site. Early descriptions of the kurgan Arzhan 1 mention that the stone cover of the mound was still intact, but there are no references to a wall, a gallery, or anything similar (Kyzlasov 1979, 34). Given the brevity of these descriptions, which were not intended to be comprehensive architectural records, the lack of detail is not particularly surprising. At the beginning of the excavation

of Arzhan 1 in 1971, the stones at the site had been almost entirely removed. Given the proximity of the large burial mound to the village of Arzhaan, most of the stones were incorporated into the construction of the roads and the village school. Only the central part of the kurgan (with a diameter of 75–80 m) remained intact and thus an option for excavation. In the surrounding area, some test trenches and additional profiles were recorded, but the wider area and periphery of the burial mound remained largely undocumented. A more recent reconstruction of the architecture of Arzhan 1 (Figure 6) was proposed by D. G. Savinov (Savinov 2002, 179), who derived the primary data from 1970s excavation field reports. This reconstruction differentiates a central part, a stone wall, and a gallery between the central mound and the surrounding stone wall. The same features were firmly documented in the construction of Tunnug 1, and thus indirectly confirm the validity of Savinov's reconstruction of Arzhan 1.

The central part of Tunnug 1 is surrounded by a stone wall framing a gallery (Figure 7). The stone wall—up to 1 m high and 12 m wide—is mostly composed of stone slabs piled up in relatively regular dry masonry. The internal facade of the wall is clearly defined, while the external facade on the studied area shows signs of collapse (Figure 8). Two clay hillocks 3–4 m in diameter were built before or during the construction of the stone wall. These clay humps in the body of the wall are clearly visible on the DEM made prior to excavation (see Figure 5: C1, C2). Similar elevated areas can be seen in other parts of the wall. It is possible that the external facade

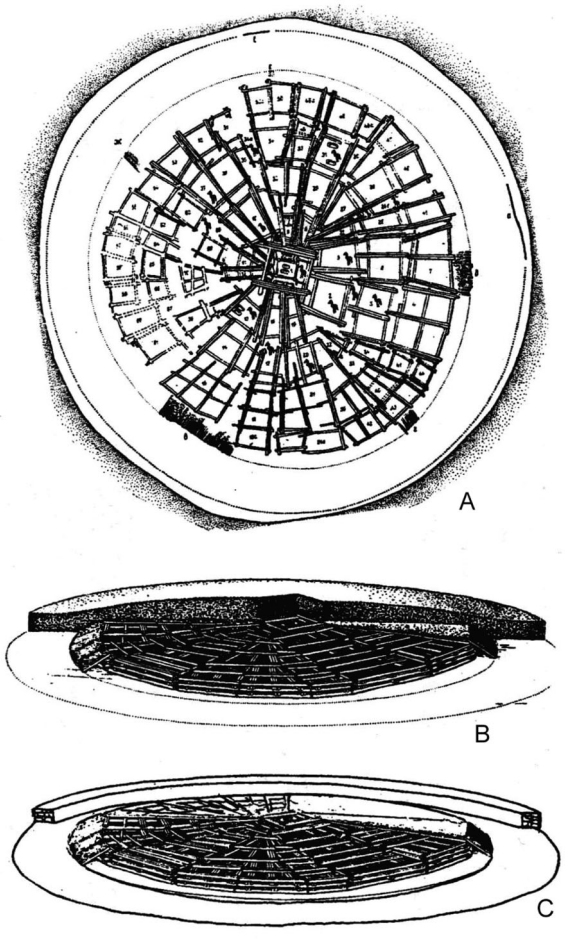

Figure 6. Reconstruction of Arzhan 1 (A), according to M. P. Gryaznov (B) and D. G. Savinov (C) (after Savinov 2002, fig. 5).

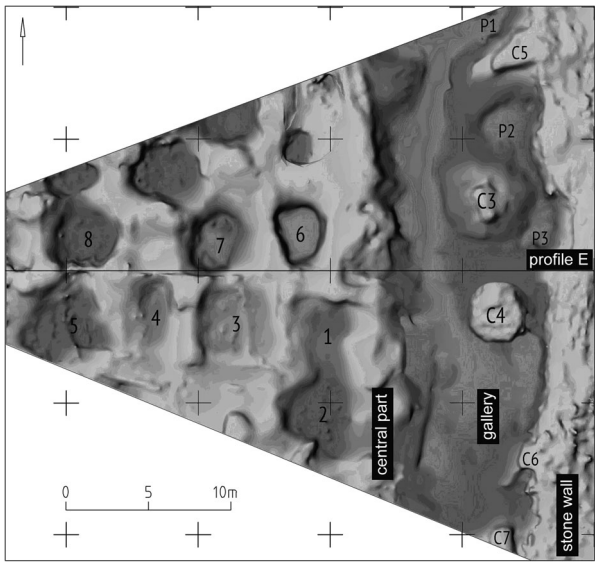

Figure 7. DEM of the clay surface, gallery, and stone wall.

of the wall was also formed with clay, but this requires additional confirmation.

A gallery 8–10 m in width separates the stone wall and the central part of the mound. On the modern surface, this looks like a ditch mostly covered with stones and lacking vegetation. This layer of stones lies on top of the natural geology. No stone structures can be identified inside the gallery; all stones inside the gallery are the result of a filling process. In part, erosion might have had an additional impact on smoothing out the borders of the main mound and the wall, with stones gradually sliding into the gallery (see Figure 8). Two clay elevations with a diameter of 4–5 m each are located in the excavated area (see Figures 5, 7: C3, C4), close to the wall. Three more clay humps in the gallery are not yet clearly defined, but they seem to be associated with the wall (Figure 7: C5–7). At least three pits in the gallery seem to be partially covered by the stone wall (Figure 7: P1–3). Although there are no wooden structures in the gallery, these, along with clay structures, generally lie lower than the stones. The entire structure of the monument looks unified and planned, despite the different construction techniques that were used in its make-up. The DEM (see Figure 5) clearly shows that there are additional clay humps and pits in the gallery and in the stone wall in areas that have not yet been excavated.

A find in association with the wall (Figure 9) serves as a terminus ante quem and indirectly confirms the Early Iron Age date of this part of the architecture. This tear-shaped stone vessel has widespread analogies: it is well-known in the Aral Sea area from the sites of Uigarak and southern Tagisken (Itina and Yablonsky 1997), and examples have been found in northern Kazakhstan (Tairov 2017, fig. 6) and Arzhan 2 in Tuva (Chugunov, Parzinger, and Nagler 2010, Tafel 83, 5). Stone vessels of this type are, in most cases, found in kurgans dating to the 7th century B.C. Here we can present a possible earlier example that is also associated with the Early Iron Age, supporting the hypothesis that the wall is part of the main burial mound construction. The stratigraphic relationship of the stone vessel with the wall, however, leaves room for interpretation.

The analysis of the spatial construction principles provides an additional opportunity for cross-comparisons with related

Figure 8. Profile of the stone wall (profile E).

architectural traditions. The separation of a central mound from the surroundings by a wall is a tradition that is reminiscent of local Late Bronze Age monuments, and, in Tuva, can be found in the Mongun Taiga kurgans (Chugunov 1994), some of which may continue without interruption into the Early Iron Age (Chugunov 2018). The concept is also similar to the tradition of deer stone khirigsuur complexes in Mongolia, where khirigsuurs are surrounded by a rectangular or circular fence (Wright 2007). This tradition, however, gradually disappears in the construction of kurgans of the Early Scythian Aldy-Bel culture, where the stone fence (*krepida*) becomes a part of the main mound.

Clay—a surprising component in Early Iron Age steppe architecture

In the Late Bronze Age Mongun Taiga architectural tradition, all kurgans are exclusively built from stone. Similarly, in khirigsuur monuments, we find almost an exclusive use of stones as a construction material. One of the few exceptions is the Huahaizi (Sandaohaizi) site in northern Xinjiang, which contained remains of wooden logs and "earthen heaps" (Guo et al. 2017, 154).

The vast majority of Early Iron Age burial mounds in Tuva are stone constructions; exceptions are very rare. During the Aldy-Bel stage, most of the known mounds were built from stone. The kurgans Arzhan 1 and Arzhan 5 are essentially wooden structures covered with stone: no other materials are mentioned by the respective excavators (Gryaznov 1980; Rukavishnikova and Gladchenkov 2016). Before starting the excavations on the Tunnug kurgan, we therefore expected to find wooden structures at the base level but assumed that the main body of the mound consisted exclusively of stone.

After excavating two sectors, it became clear that the central part of the Tunnug burial mound is made up of clay and covered with a relatively thin layer of stone (Figure 10). This stone layer does not appear to contain any additional architectural components. Before the start of the excavation, we mapped all vertically placed stones visible on the surface of the mound. It seemed important to identify all possible indications of consciously arranged stone structures. With the progression of the excavation, however, it became clear that these vertical stones on the surface are connected with the edges of depressions ("chambers" or compartments), rather than being originally placed deliberately.

Figure 9. Stone vessel and its in situ position between the stones of the wall.

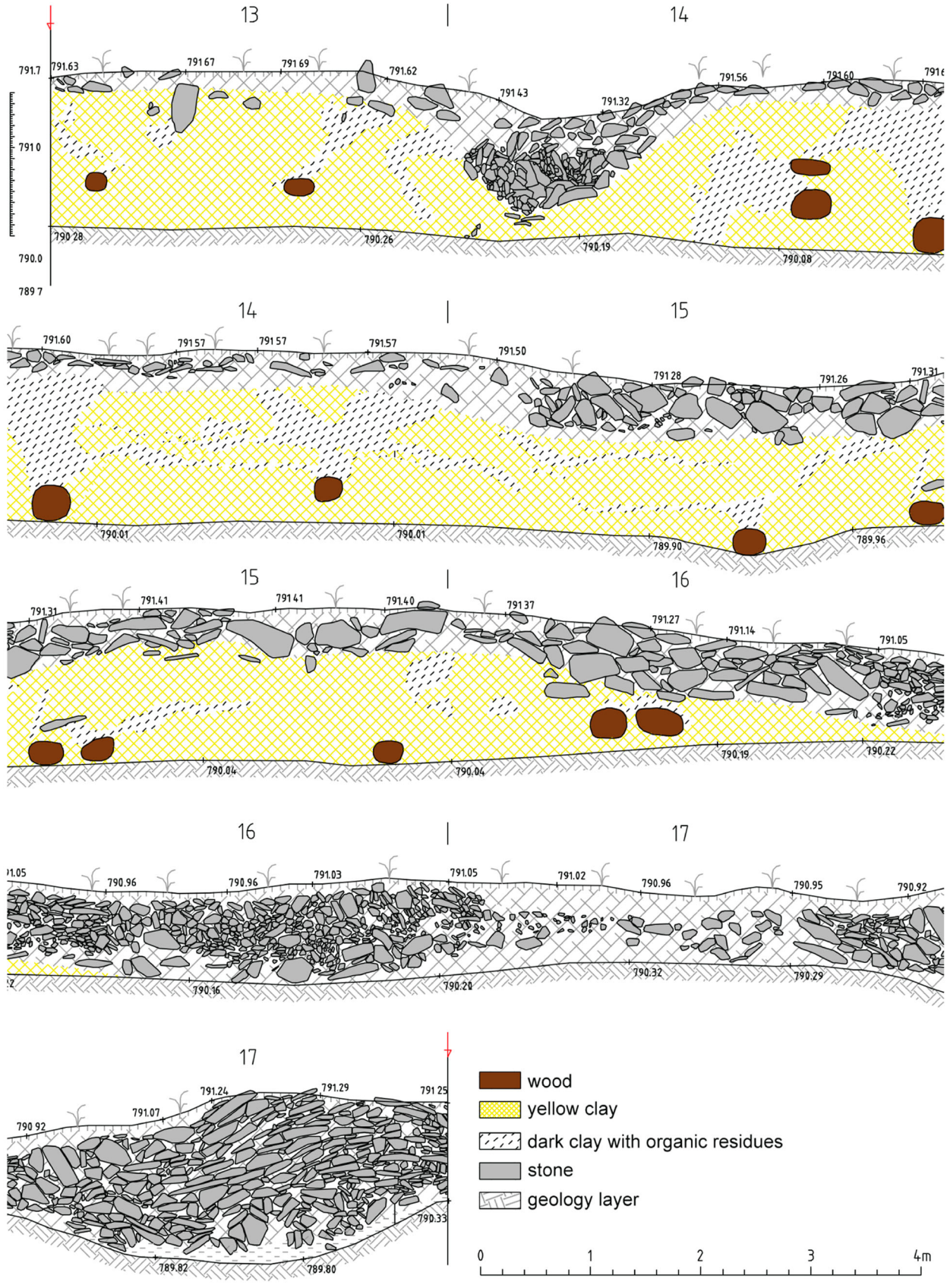

Figure 10. Profile E showing the clay and wood composition of the main burial mound with a thin layer of stones on top.

One of the main outcomes of our research is that we now have evidence that the main body of the kurgan consisted of clay. The clay was not a simple fill layer, but rather was shaped to form architectural elements such as walls, ramparts, humps, pillars, and platforms. From the DEM of the clay level (see Figure 7), all these elements are clearly visible. They continue into the structure of the gallery and, to some extent, into the structure of the stone wall, as discussed above. Clay walls divide the mound into separate sections with individual compartments. We prefer to use the term "compartment" rather than "chamber" as a more descriptive term, yet we note that many use the terms interchangeably.

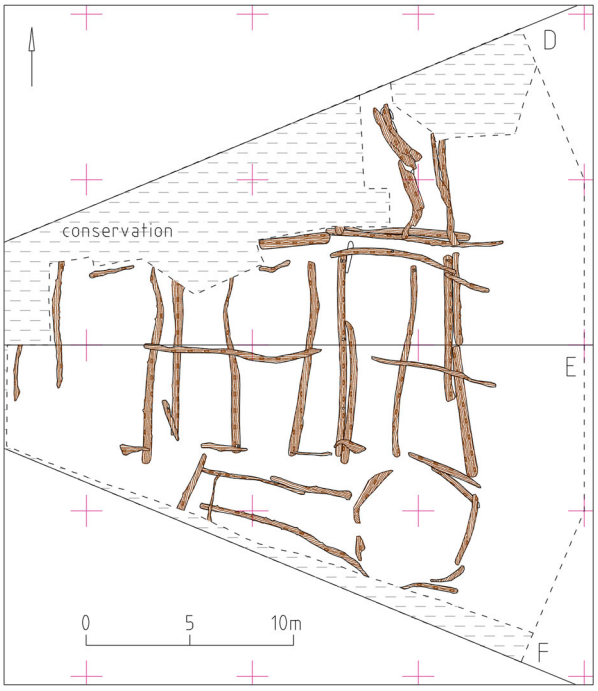

Figure 11. The wooden architecture of the main burial mound.

A radial structure of larch logs (Figure 11) at the base layer of the Tunnug 1 burial mound seemingly played only an auxiliary role. The wood was covered in clay, forming compartments with clay walls. These compartments were most likely closed with a wooden ceiling made up of additional wooden beams and, finally, covered with layers of stones. This is merely a tentative, although likely, reconstruction, which requires further analysis. Poorly preserved wood was often found under the layers of stone lying directly on the clay. In most cases, it was not possible to trace its direction or estimate its quantity, due to poor preservation. The western and southeastern parts of the mound, where the compartments may not have collapsed yet, based on the DEM, may be the most promising areas to investigate these features in the future.

On this basis, we can make a cautious assumption that there may be about 4–5 rows of compartments between the outer border of the main mound and the center of the mound. We estimate around 32 compartments in the outermost ring, with their size and number decreasing towards the center. Based on this, the total number of compartments in the central part of the kurgan will be about 100. This is comparable to Arzhan 1 (see Figure 6).

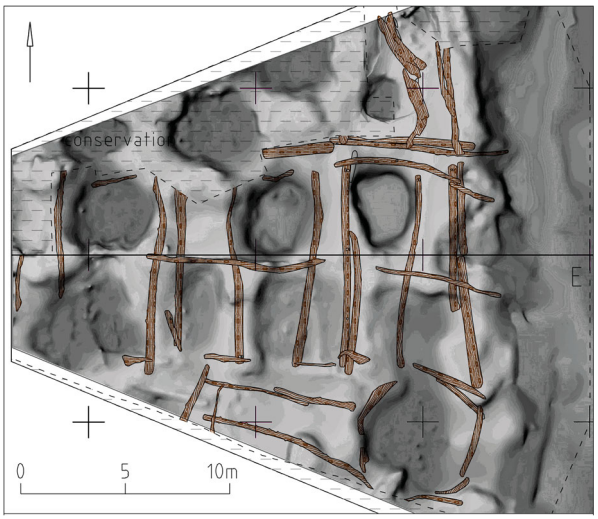

Figure 12. Clay and wooden architecture of the main burial mound.

At the base of the clay walls lie one, two, or even three wooden logs (Figures 10, 12). Clay for the walls was sourced somewhere close to the kurgan—in some cases, the clay of the structure is almost indistinguishable from the natural, underlying geological layer. The use of clay as a construction material is completely unknown in the previous Mongun Taiga tradition in Tuva and does not find parallels in the deer stone khirigsuur complex. Clay is sometimes used in sites associated with Scythian material culture (Chugunov 2011), but all examples postdate Tunnug 1. In the few cases where clay is used, it never serves as the main construction material. Confirming the use of clay as a construction material in one of the earliest burial mounds with Scythian material culture has been an unexpected result of our research and raises the question of whether the origins of Scythian material culture contain a component beyond regional Late Bronze Age precursors. Could there be another influence, perhaps from a community familiar with the traditions of clay as a construction material in monumental architecture? If so, however, no such community is currently known from the surrounding region.

A radial wooden structure—parallels and differences between Tunnug 1 and Arzhan 1

The radial wooden structure with internal "chambers" at Arzhan 1 is often referred to in the scientific literature as unique (cf. Parzinger 2017; Honeychurch 2015, 173). Excavations during summer 2019 at Tunnug 1 revealed a comparable structure of larch logs underneath the burial mound: from this new datapoint, there is at least one more "royal" kurgan with this clay-timber architectural tradition. This result will have implications for our perception of the Arzhan horizon in the Uyuk Valley and possibly lead to a clearer idea of the time span associated with these large-scale constructions.

The base layer of the central mound of Tunnug 1 is formed by a wheel-like wooden structure with spokes coming from the center, separated by crossbeams. Larch logs were used for this construction, likely after their bark was removed. The logs were placed on top of one another without any cuts or log cabin-like constructions that we see in later Aldy-Bel and Uyuk-Sagly burial chambers (cf. Chugunov, Parzinger, and Nagler 2010). In most cases, logs going around the kurgan's circumference were placed first, with the radial ones being generally placed over them. Numerous grooves documented in the logs were cut for transportation by dragging. The lower logs are almost perfectly preserved, and samples have been taken for dendrochronology from each excavated trunk. This gives us the possibility to establish whether the wheel-like structure was built in one season or if it was gradually assembled over several years. With some logs showing over 280 years of rings, there is likely an overlap with Arzhan 1, and we will be able to determine the chronological relationship between these two important sites. The structure of the log pattern (see Figure 11) is clearly very similar to Arzhan 1, but there are noteworthy differences. All the logs were placed in one layer and do not form walls of "chambers" as reconstructed by Gryaznov (1980) for Arzhan

Figure 13. Compartments in sector EF. View towards the west.

1. At the same time, the arrangement of the logs correlates with the clay structures placed above it, and the walls of the chambers are built with clay. The wood in Tunnug 1 seems not to be the main building material but rather had a reinforcing or marking function for the clay architecture.

Compartments and pits—parallels and differences between Tunnug 1 and Arzhan 1

Within the compartments (or "chambers," as used in the literature for Arzhan) in the mound, several pits were documented. Those in compartments 1–4 were excavated. The pits precisely match the general wood-clay planigraphy of the mound and seem to be contemporary to its construction (Figure 13). Since the surroundings of the site are regularly flooded, it is only possible to excavate these pits during a few weeks of the year (usually in May and early June). Towards the end of June, the rapid rise of groundwater levels makes work in the lower strata very difficult, despite the use of heavy pumps. The remaining pits will likely be excavated in 2021, since the best time for excavation was missed due to the COVID-19 pandemic. In compartments 1 and 4, the pits are only slightly below the ancient ground level and can be interpreted as stones from the mound that were pressed into the natural geology. In compartment 3, the stone filling of the pit was covered with a wooden beam (Figure 14); its depth was around 0.5 m (from the level of the wooden log). The pit in compartment 2 was also likely covered with a wooden log. The depth of the pit reached 1.3 m, but only a fox jaw was found in its fill. The excavated pits were not burial pits and did not contain any archaeological material at all. We were unable to identify traces of later intrusions that might hint at looting and destruction. The function of these pits is currently not understood. Flotation samples were taken from the filling and the lower edge of all pits and await future analyses. In fact, the presence of pits is another important difference between Tunnug 1 and Arzhan 1, where no pits were documented, and all burials and depositions were on the level of the ancient surface, not below it. It should be noted here that only a few of the Arzhan 1 chambers contained archaeological material. What is more, patterns behind the placement of horse burials and other deposits within the wooden structure of Arzhan 1 are also a topic of ongoing research. No material was found in the chambers of the outer ring at Arzhan 1, which seems to find an echo at Tunnug 1.

Figure 14. Pit in compartment 3 before the start of excavation. View from the south.

New data on the earliest horizon of Scythian material culture

Due to the very rare occurrence of sites from the earliest horizon of Scythian material culture, almost all known materials stem from the excavation of Arzhan 1. Like in the earlier Mongun Taiga culture and the later Aldy-Bel culture, there was a complete absence of ceramics in Arzhan 1. There are no doubts that ceramics were in use in daily life, yet they do not seem to have played a role as grave goods. The first, rare, ceramics finds from the central part of Tunnug 1 reveal a thus far unknown ceramic tradition. As expected for the early stage of Scythian material culture, the main finds to date belong to the category of horse gear, and clear stylistic parallels can be drawn to the bridles found at Arzhan 1.

In the central part of the mound, no complete funerary or ritual complexes have been discovered, yet; however, there are several finds made during the excavation of the clay construction which are unequivocally contemporaneous to the construction. These are bronze bridles without end pieces (Figure 15A), a simple bronze plate (Figure 15B), two fragments of ceramics that so far do not find any parallels in other cultures or time periods in the Tuva Republic (Figure 15C–D), and, most interestingly, a bronze buckle (Figure 15E) which has direct comparanda both at Arzhan 1 and in some sites of pre-Scythian times in Central Asia, including northern Tagisken (Chugunov 2015, fig. 4). S.V. Khavrin, of the scientific and technical expertise laboratory of the Hermitage Museum (Saint Petersburg, Russia), analyzed the metal composition by means of X-ray fluorescence on an ArtTAX spectrometer (Table 2). This method has its limitations: its accuracy does not exceed 0.1% for most elements and 0.4% for zinc (Tishkin and Khavrin 2006, 145), but as a non-destructive preliminary analysis, it was sufficient to compare the compositions of items from Arzhan 1 and Tunnug 1. The metal composition of the artifacts from Tunnug 1 is consistent with the metal alloys of the Arzhan horizon, featuring alloys including arsenic and antimony. The composition is substantially different from the alloys with tin of the subsequent Aldy-Bel culture (Khavrin 2003, 171).

Conclusion

The excavations at Tunnug 1 have started to provide additional insights into the earliest horizon of Scythian material culture, importantly focused on architectural approaches to monumental earthen architecture. The site belongs to the same architectural tradition as Arzhan 1 and

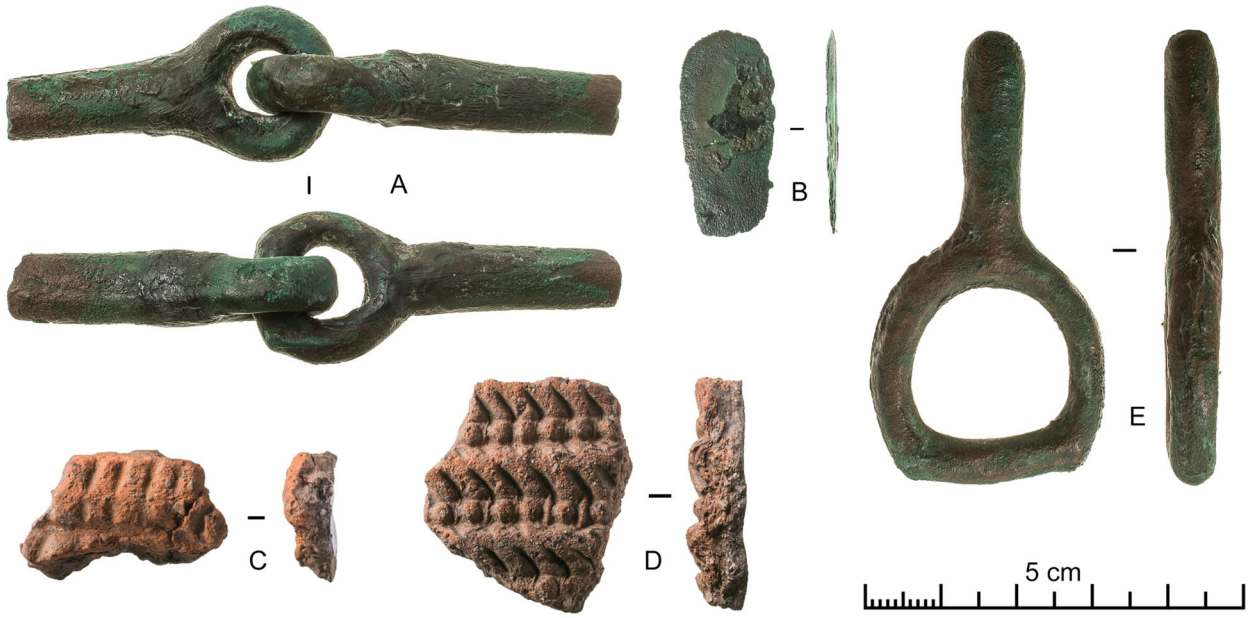

Figure 15. Finds from the central part of the kurgan. A) Bridles without end pieces; B) unspecified copper alloy item; C–D) ceramic sherds; and, E) bronze buckle.

Table 2. Composition of metal artifacts from Tunnug 1 (in percent).

№	Item	Cu	As	Sn	Pb	Sb	Ag	Zn	Fe	Ni	Bi
Figure 15A	bridle	main	4–5	< 0.2	-	2–4	trace	-	< 0.2	trace	ca. 1
	bridle	main	3–4	< 0.3	-	2–4	trace	-	< 0.2	trace	ca. 1
Figure 15B	?	main	< 0.3	< 0.5	< 0.9	-	trace		< 0.2	-	-
Figure 15E	buckle	main	2–4	< 0.2	-	3–5	trace	-	trace	trace	ca. 1

is clearly distinct from both earlier and later sites in Tuva, as well as in the wider region. The site may be seen as a monument with transitional characteristics showing traits of Late Bronze Age and Early Iron Age traditions. Its preliminary date in the latter half of the 9th century B.C. coincides with the emergence of Scythian material culture—a time period of major economic and social transitions on the Eurasian steppes—with elements of the Mongun Taiga culture and the deer stone khirigsuur complex in its architecture. Constructed stone rings around the mound and its spatial separation from the surrounding area by a wall or fence are clearly traceable to a local Late Bronze Age blueprint. The site, however, exhibits traits of another cultural influence through its heavy reliance on clay as a construction material—a tradition otherwise unattested in the area. Previous publications suggested that a potential contributing source of Scythian material culture might be found to the west with the mausoleums of northern Tagisken (Itina and Yablonsky 2001), as already indicated for Arzhan 1 by Savinov (1992, 109). Of a much more modest size, the mausoleums of northern Tagisken nevertheless contain similar architectural elements to Tunnug 1. Although this is a distant and indirect analogy, it can be carefully supported by the few finds that come directly from the central part of the kurgan. In the vast space between the Aral Sea and eastern Kazakhstan, we also find the so-called post-Andronovo cultures that are related to northern Tagisken, although their mausoleums are, with a few exceptions (Merz 2013), built of stone, not clay. The dating of the northern Tagisken mausoleums is also a matter of debate (Bonora 2018). Further evidence is thus needed to show the western, post-Andronovo contribution to the formation of Early Scythian material culture and might provide a different explanation of the innovations of the Arzhan period. Whatever this second, contributing source of the Arzhan horizon may be, the architecture of the kurgan Tunnug 1 has no direct parallels in earlier traditions, and it can be confidently stated that this site documents the appearance of a cultural complex closer to Scythian traditions than to early Bronze Age archaeological cultures in the area. We suggest considering Tunnug 1 as a transitional complex, bearing marks of influences from different traditions, merging them into something new. Excavations at the site will continue for several years and allow for the future support or rebuttal of the hypotheses presented here.

Acknowledgements

Field research was conducted as a joint expedition of the Institute of the History of Material Culture of the Russian Academy of Sciences, the Russian Geographical Society (project Expedition Tunnug), and the Swiss ArchaeoExploration. The excavation project is conducted with the financial and logistical help of the Russian Geographical Society (N 53/04/2019) and financial help of Dr. F. Paulsen, the Society for the Exploration of EurAsia, and the Russian Ministry of Culture (project No. 656-01-1-41/12-18). Post-excavation work by T. Sadykov and J. Blochin was carried out within the framework of the Program of Fundamental Scientific Research of the Russian Academy of Sciences, State Assignment No. 0184-2019-0011. G. Caspari was funded by the Swiss National Science Foundation, grant number P400PG_190982. We wish to thank S. Khavrin (Hermitage Museum, Saint-Petersburg) for the copper alloy definitions and K. Chugunov (Hermitage Museum, Saint-Petersburg) for consultations.

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