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Short communication

Tunnug 1 (Arzhan 0) – an early Scythian kurgan in Tuva Republic, Russia

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ABSTRACT

The burial mound Tunnug 1 (Arzhan 0) lies in a swamp of the Uyuk River Valley, Tuva Republic, Russia. The construction of this princely Scythian tomb is similar to the earliest identified Scythian kurgan Arzhan 1. Preserved wood from the burial mound was dated through AMS to the 9th century BCE. This confirms that Tunnug 1 (Arzhan 0) belongs to the oldest Scythian cultural horizon and potentially predates Arzhan 1. Due to its peculiar topographic location Tunnug 1 (Arzhan 0) appears to be a frozen tomb.

1. The earliest Scythian horizon in southern Siberia

Research on the earliest burial mounds of the so-called “Scythian” material culture began in the early 1970s with the excavation of Arzhan 1 led by M. Gryaznov and M. Mannay-ool (Gryaznov, 1980, 1984; Parzinger, 2006). Dated through *wiggle matching* to the 9th/8th century BCE (Zaitseva et al., 2007) Arzhan 1 constitutes the earliest known elite Scythian burial to date. With its singular internal structure of radially arranged wooden chambers and the good state of preservation including all elements of the Scythian triad (weapons, horse harness objects, and animal style), the discovery of Arzhan 1 defined the earliest Scythian horizon in Southern Siberia in particular and in the Eurasian steppe in general (Simpson and Pankova, 2017). The princely tomb of Arzhan 1 in some aspects was closer to the burials of the late Bronze Age (Mongun-Taiga culture, ca. 15th–9th century BCE) than to the hitherto early Scythian material culture in the area (Aldy-Bel culture, ca. 7th–6th century BCE).

However, in the Uyuk Valley there are other large princely tombs which belong into the context of the early Scythian period in Southern Siberia. On a regional level there are no other monuments of similar size and importance from this period and it can be assumed that the power of the rulers buried in the princely tombs of the Siberian “Valley of the Kings” radiated far beyond the borders of the Uyuk Valley.

Arzhan 1 lies in line with three other princely tombs of similar size (Fig. 1). From the outside Arzhan 1 to 4 all looked similar, consisting of a relatively flat stone platform. Arzhan 2 had a diameter of 80 m, Arzhan 3 measured roughly 90 m, Arzhan 4 had a diameter of > 100 m

(Chugunov et al., 2010).

From 2001 to 2004 K. Chugunov, H. Parzinger and A. Nagler excavated the burial mound Arzhan 2, the easternmost burial in the chain of princely tombs. The main burial was unlooted due to its off-centre position and yielded one of the richest assemblages of the Eurasian steppe belt ever discovered (Chugunov et al., 2010; Menghin et al., 2007). Arzhan 2 was dated to the 7th century BCE and stylistically associated with the Aldy-Bel culture.

Since 2008, the Central Asian expedition of the State Hermitage Museum is excavating the Chinge-Tei 1 burial mound (Chugunov, 2011). Chinge-Tei is the westernmost early princely tomb of the Uyuk Valley. It is surrounded by a deep moat with a diameter of 106 m at the outer boundary. Up until now seven accompanying burials have been excavated at the fringe of the mound. The objects discovered in the burials can also be associated with the Aldy-Bel period.

In 2014 I. Rukavishnikova started excavating the early Scythian burial mound Arzhan 5. Its first finds are stylistically close to Arzhan 1. With 55 m the burial is smaller than the largest early Scythian tombs in the Uyuk Valley, but preserved wood within the monument shows that a similar radial structure like in Arzhan 1 was erected before the mound was covered with stones (Rukavishnikova and Gladchenkov, 2016).

The Tunnug 1 (Arzhan 0) burial mound was first marked by M. Gryaznov (Gryaznov, 1980) on a map but remained unstudied up until 2013. The burial mound is very low and its location in the swamps of the river Uyuk makes it difficult to find and access. In 2013 D. Rukavishnikov conducted a geophysical survey and first aerial photographs were taken (Rukavishnikova et al., 2015). It was concluded that organic

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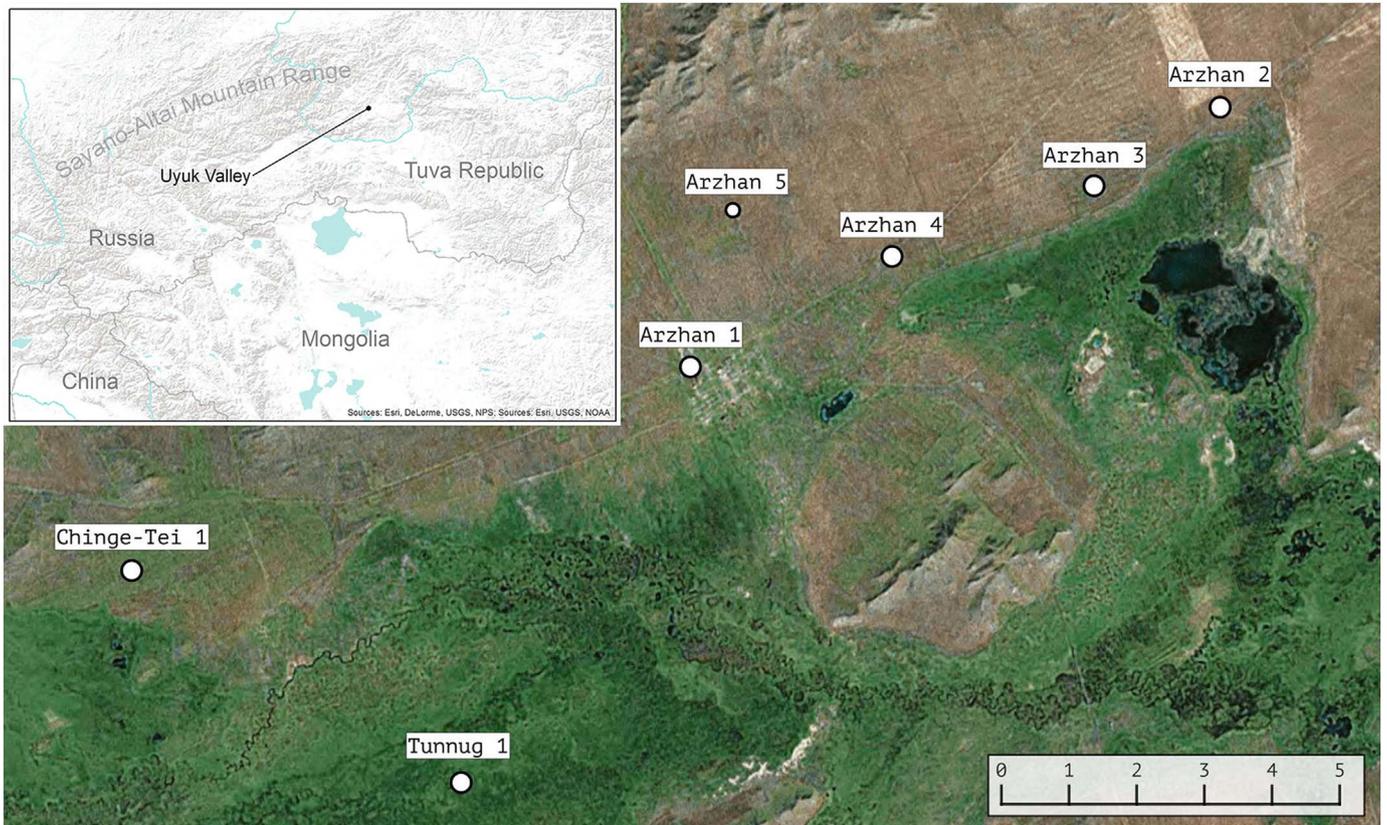


Fig. 1. Known early Scythian princely tombs in the Uyuk Valley, Tuva Republic, Russia.

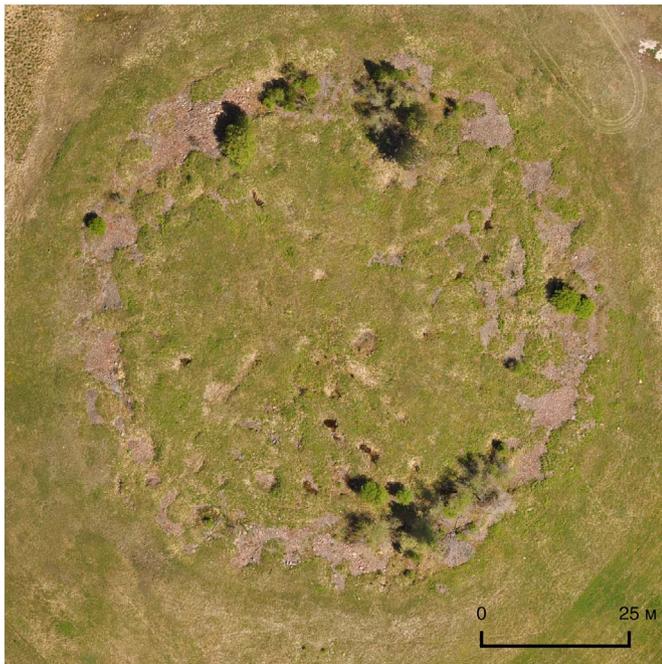


Fig. 2. High-resolution textured digital elevation model of the monument (ortho render, north-oriented, relative coordinates).

preservation was unlikely and the works were not continued due to the unfortunate sudden death of D. Rukavishnikov.

2. Survey preparation

First analyzed and identified through satellite imagery (WorldView-

2 data) the gigantic princely tomb Tunnug 1 in the swamp along the Uyuk River was the object of this expedition's interest. A Swiss-Russian scientific cooperation between the University of Bern, the Hermitage Museum and the Russian Academy of Sciences laid the foundation for the project. In order to gain a better understanding of the site and its surroundings as well as for planning of the logistics, high-resolution satellite imagery was ordered through a grant from the Digital Globe Foundation. Judging from the optical satellite data it appeared clear that there is a radial structure of wooden beams or logs underneath a thick package of stones. The parallels to the princely kurgans Arzhan 1 and Arzhan 5 were apparent, but it was unknown how old the monument is and why it was built in an area which is very untypical for early Scythian kurgans. Monuments of this period were usually erected on the river terraces. The unstable ground of the wetlands were unfavourable building grounds. Tunnug 1 lies in the middle of a swamp.

3. Mapping activities

A high-resolution 3D-model and ortho-photographs were generated through a structure from motion approach with the software *Agisoft*. The model has an accuracy of 4 cm and was used as the main decision making tool for the further steps of the project. Accurate mapping helped defining the best locations where we would be likely to answer our questions. The radial structure underlying the stone package is clearly visible in the rendered ortho-photograph (Fig. 2). Parts of the kurgan which show no vegetation are most likely collapsed wooden chambers which were covered with logs and a layer of stones. The logs broke and the stones fell into the chambers creating stone-filled pits. Plants are not growing on top of the pits because the stone package drains the water and no substrate is available.

The mound appears to be largely untouched apart from a somewhat disturbed periphery due to earlier attempts to source stones for a road through the swamp. It is possible that – because of its hidden position in

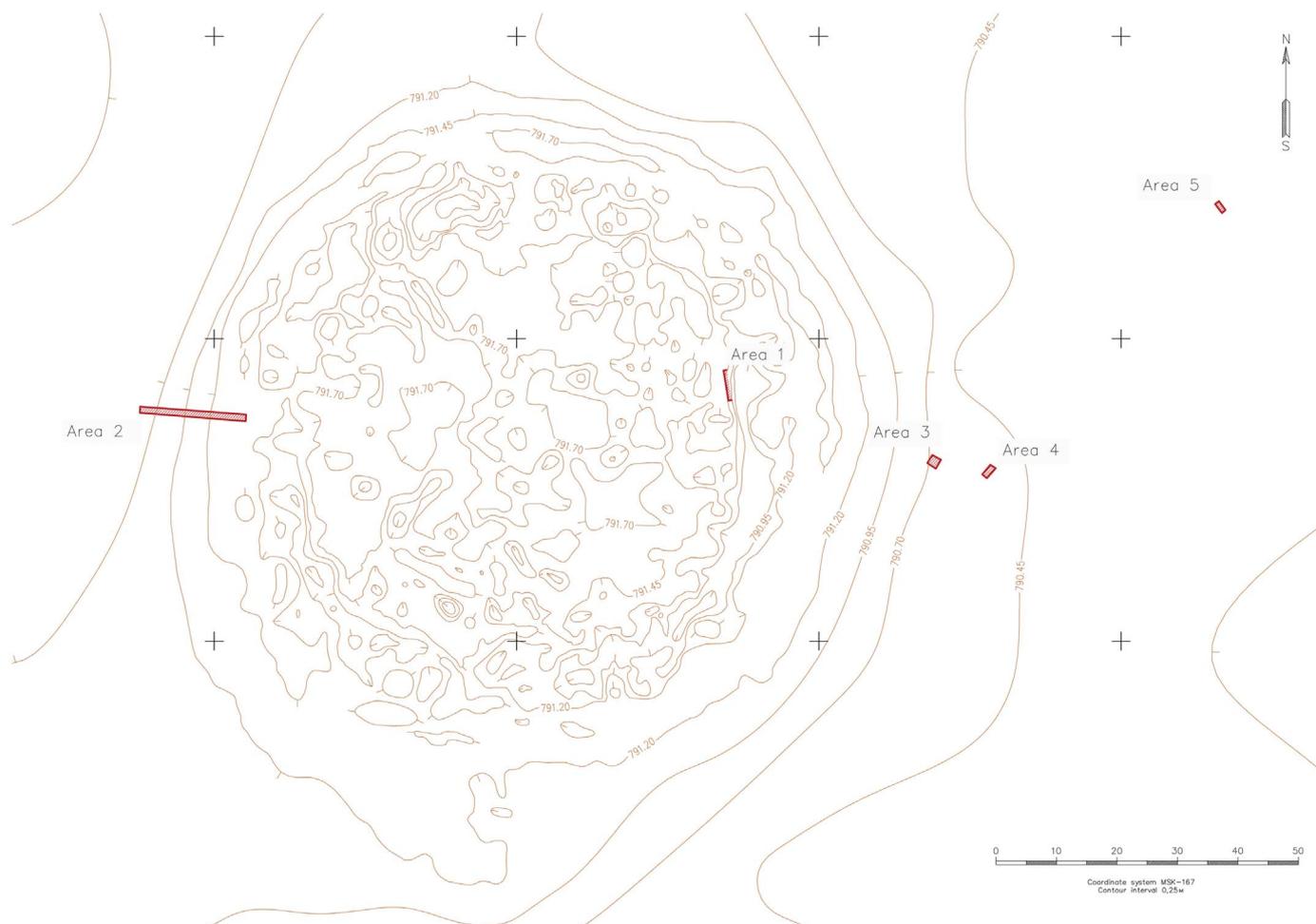


Fig. 3. Selected areas for surface cleaning on detailed elevation model (relative coordinates).

the swamp – it might be unrobbed.

4. Surface cleaning

The rules established by the Russian Cultural Heritage Administration do not allow to dig test trenches inside the object, but surfaces of destroyed and covered parts of the monument can be cleaned. Fig. 3 shows the areas we decided to work on.

4.1. Area 1

Area 1 was chosen through the analysis of the 3D-model by looking at pits that seemed to be impacted/destroyed. We cleaned the eroded stones first and created a clear profile. Only a few centimetres under the surface remains of wood were found (Fig. 4).

At the bottom of the profile the first wooden beams showed up as predicted from the satellite imagery. All wood pieces were sampled for further analysis in the laboratory. The lower wooden logs were placed in a layer of grey yellow clay. Underneath it the soil was frozen. Cleaning the side profile of area 1 it became apparent that the ice was a regular occurrence at around 1 m depth.

4.2. Area 2

Area 2 was set on the western side of the kurgan in the hope of defining the border of the architectural structure. In the upper part, the constructive stones were clearly visible on the surface. Unfortunately, the edge seems to be destroyed, therefore the actual size of the object

could not be determined by this area. The satellite image provided an explanation: since an ancient riverbed used to flow close to the burial, the shore line might have eroded large parts of the north-western edge of the kurgan. On top of the stones a number of non-ornamented ceramic fragments were found (Fig. 5, 1). They might belong to the Kokel culture. It is a common occurrence to find some Kokel ceramics or even secondary burials in Scythian tombs. Underneath the stone package a number of undistinctive shards were found that might date to the Bronze Age (Fig. 5, 2).¹

4.3. Area 3

With area 3 we tried to determine the outer border of the kurgan by selecting a stone circle (usually a peripheral monument) and cleaning it thoroughly. After the first 20 cm it became clear that what we had thought of as stone circles or other peripheral structures were in fact parts of the main structure of the kurgan which had been shifted through taphonomic processes. Area 3 is close to the border of the monument but possibly still the original stone construction (it could also be an eroded part, but unlikely so). Using the easternmost edge of area 3 and the centre point of the kurgan we can now estimate the original size of the object to about 140 m in diameter. This is 30 m wider than Arzhan 1 and would make Tunnug 1 the largest kurgan of its kind in southern Siberia, but only further excavation of a larger area can bring clarity here. Four bone fragments were found between the stones (one of them likely from a horse).

¹ Oral communication with M. Kilunovskaya.

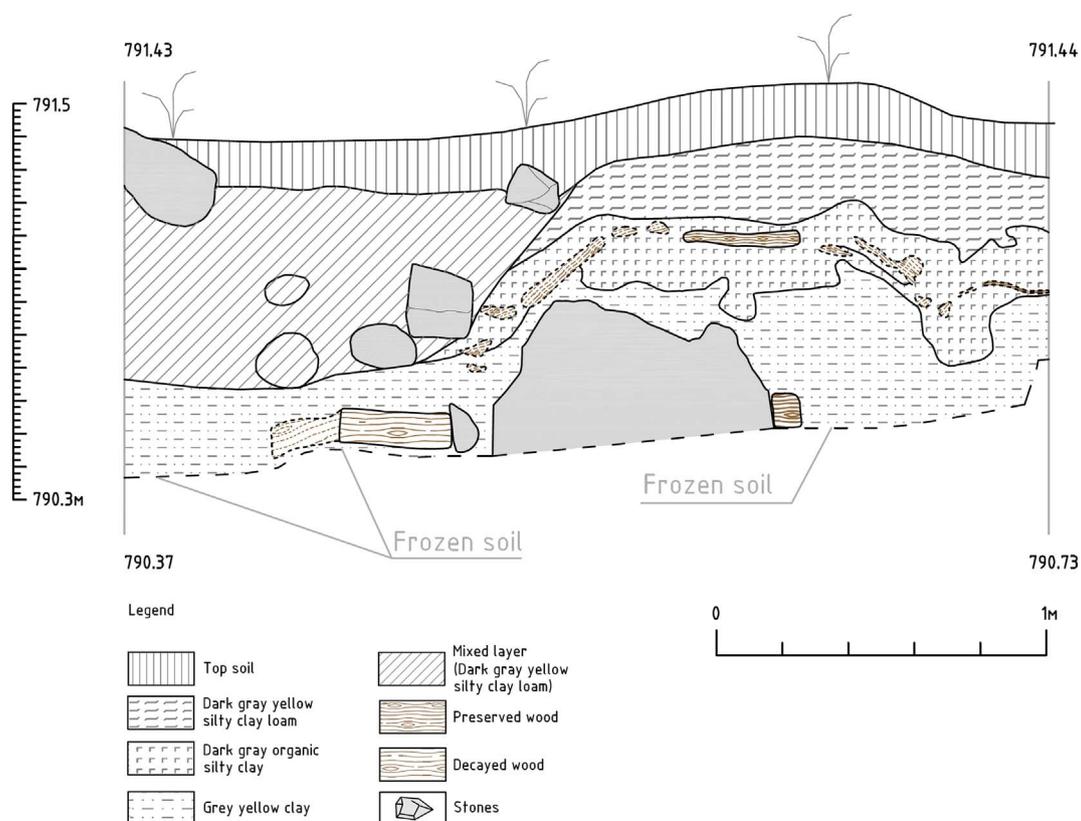


Fig. 4. Profile of area 1 with remains of wood.

Tunnug 1

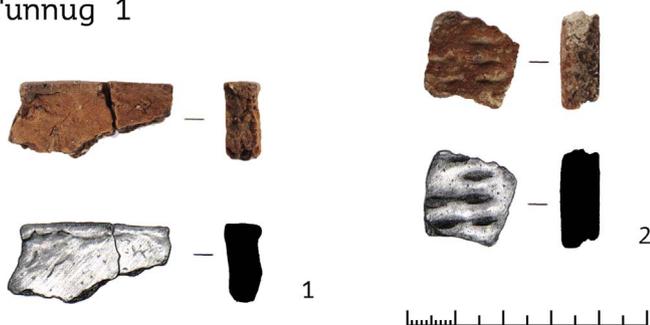


Fig. 5. Recovered shards from area 2. On the left side a rim shard which might belong to a vessel from the Kokel culture, on the right side a shard which might date back to the Bronze Age (V. Makarova).

4.4. Area 4

Area 4 was opened up along a row of stones in the periphery of the kurgan. The stones proved to have rolled down from the mound and were loosely placed in the soil. Around them only top soil was found under which a light alluvium starts that is void of finds.

4.5. Area 5

Area 5 was a clean area dug outside the periphery of the kurgan with the aim of understanding the geology of the site. Under an upper layer of black top soil a thick layer of light alluvium was found. In about 1.2 m depth a compressed ancient surface was identified. Samples were taken for ^{14}C -analysis.

5. AMS dating

Samples were taken from the two wooden logs in area 1 (Fig. 4). The upper parts of the preserved wood were also sampled, however, they were so contaminated with modern roots that they could not be reliably dated. Furthermore, soil samples from an ancient soil in area 5 were taken in order to establish a *terminus post quem* for the kurgan.

Samples of wood were treated using a standard AAA (acid-alkali-acid) which is designed to remove potential contamination with allochthonous carbon (Hajdas, 2008). The wood was soaked in hot acid (0.5 M HCl, 60 °C 6 h) to remove carbonates and in base (0.1 M NaOH, 60 °C 6 h) to remove humic acids. In a final acid step a potential contamination with atmospheric CO_2 dissolved in base step was removed. The sample of soil was also treated using the same AAA protocol after the fine fraction (< 150 μm) was obtained by wet sieving. In this step rootlets were removed to avoid contamination with modern carbon. The dry and clean samples were then weighed into the tin cups for

Table 1
Results of radiocarbon dating.

Lab nr.	Sample	Code-nr.	Material	C14 age $\pm 1\sigma$ (BP)	$\delta\text{C}13$	Calendar age (95.4% conf. level)
ETH-80046	WBA1_NL, northern part	Wooden beam sample, area 1	Wood	2719 \pm 16	-25.7	904 BCE – 824 BCE
ETH-80047	WBA1_SL, southern part	Wooden beam sample, area 1	Wood	2678 \pm 19	-27.1	895 BCE – 868 BCE
ETH-80048	ASA5_NP, ancient soil	Soil sample, area 5	Soil (< 150 μm)	4642 \pm 25	-27.3	859 BCE – 802 BCE 3515 BCE – 3361 BCE

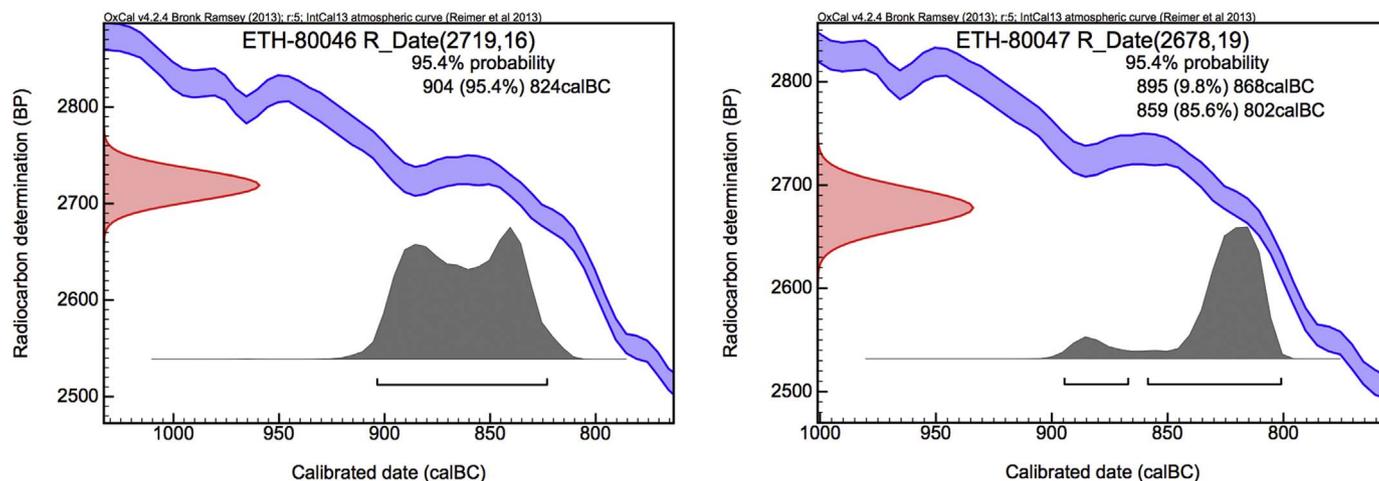


Fig. 6. Results of the calibration of the wood samples from the two wooden beams. Both dates lie outside the so-called Hallstatt plateau, a flat part of the calibration curve, which usually makes it difficult to precisely date Scythian burials.

combustion in the elemental analyser and subsequent graphitization (Wacker et al., 2010).

The wood samples were analyzed twice i.e., two targets each containing 1 mg of carbon were prepared for AMS analysis, which were performed at MICADAS instrument at ETH Zurich (Synal et al., 2007). The radiocarbon ages were calculated following Stuiver and Polach (1977).

The radiocarbon ages were calibrated using the OxCal v4.2.4 Bronk Ramsey and Lee (2013); and IntCal13 atmospheric curve (Reimer et al., 2013). The resulting calendar ages correspond to 2 sigma ranges (Table 1). Fig. 6 shows the calibrated ages plotted on the calibration curve. The age of constructive wood falls into the 9th century and suggests that Tunnug 1 is at least as old as Arzhan 1. It has to be taken into account that the wood samples stem from decaying wood and could belong to the inner tree rings. This would lead to a date slightly older than the construction date of the kurgan. Depending on how old the trees were, when they were cut for the construction of the tomb, this would mean that the tomb could be considerably younger than the radiocarbon dates presented in this paper. Additional analyses of materials from upcoming campaigns will clarify this.

6. Conclusion

The 2017 expedition to Tuva showed that what was hypothesized via a remote sensing survey can largely be confirmed. Tunnug 1 is a princely tomb with a structure similar to the earliest Scythian kurgan Arzhan 1. Contrary to what was believed before, Tunnug 1 might be a lot bigger than Arzhan 1. It is also quite possibly one of the largest frozen kurgans in existence. Similar to frozen kurgans in the Altai region the permafrost is directly below the stone package forming an ice lens (discontinuous permafrost) (e.g. Polosmak and Seifert, 1996; Rudenko, 1970; Molodin, 1996), for the surrounding areas the layer of frozen soil lies a lot deeper. The preservation conditions, age, setting, and size make this monument unique and give it a very high scientific value. No other frozen kurgans of this size are known in Eurasia. It is, however, also a danger because with the global rise in temperature these treasures are in immediate risk of being lost (Bourgeois et al., 2007). Large excavation campaigns need to be carried out throughout the next years to excavate the complete object and preserve the knowledge we can gain from it.

Conflicts of interest

The research which led to the compilation of the short communication on the Scythian burial mound Tunnug has been funded by Dr.

F. Paulsen and the Society for the Exploration of Eurasia. The Digital Globe Foundation provided us with the necessary high-resolution satellite imagery for our preliminary remote sensing survey through one of their imagery grants. There are no conflicts of interest.

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