KEYWORDS: ***Chariot – Siberia – Tuva – Bronze Age – Eurasia***

NEW EVIDENCE FOR A BRONZE AGE DATE OF CHARIOT DEPICTIONS IN THE EURASIAN STEPPE

Gino Caspari, Timur Sadykov, Jegor Blochin, Matthias Bolliger and Sönke Szidat

Abstract. Two-wheeled horse-drawn chariot depictions in the Eurasian steppe have long been stylistically dated to the Bronze Age. Here we present an example of a petroglyph embedded in the architecture of an early Scythian royal tomb in the Tuva Republic, Siberia. The construction of the tomb is dated through wiggle-matching to between 833 and 800 BCE (95.4%) thus providing a rare terminus ante quem for chariot depictions in southern Siberia. The new evidence supports the current chronological range for this type of petroglyph in the Eurasian steppe belt.

1. Introduction

The earliest examples of light two-wheeled chariots can be traced back to a broad area around the Sintashta culture dating to around 2050–1700 BCE (Hanks et al. 2007; Epimakhov and Krause 2013) from where it quickly spread over the Eurasian continent. The strong similarities between chariots in different regions from Egypt and the Near East (Moorey 1986) to India (Kulakarni 1994) and China (Shaughnessy 1988; Wu 2013) have led to the assumption of a single origin for this innovation (Pinheiro 2010). Contradictory to this stands evidence of cart-like depictions from a gallery grave in Züschen, Germany, dating to the fourth millennium BCE (Loerper et al. 2008; Wefers et al. 2016). The emergence of chariots in the Bronze Age steppes fundamentally changed warfare (Moorey 1986) in Eurasia. Although there is some controversy considering the use of chariots in warfare on the steppes in terms of whether the rock art depictions of chariots are related to warfare or not (cf. Francfort and Jacobson 2004; Cheremisin 2006), these images take an important place in the iconographic world of the pre-Historic steppe.

Chariot depictions in rock art have a wide distribution in the eastern Eurasian steppes and are known from a large region including the Russian Altai (Kubarev 2004, 2006), the Sayan area (Dèvlet 1998: 182), western Mongolia (Jacobson-Tepfer 2012) and Xinjiang Province (e.g. Xinjiang Cultural Relics Bureau 2011: 160; Su 2013: 516). In Tuva Republic (Russian Federation), in particular, many examples are known including petroglyphs from the sites of Aldy-Mozaga, Ustu-Mozaga, Syyn-Chyurek, Dogee and Chaylag-Khem (Kilunovskaya 2017: 35). Petroglyphs are often found in early Scythian burial mounds in a secondary context, but the stratigraphy is rarely very clear. A broken depiction of a chariot was documented near the Arzhan 2 burial mound (Chugunov et al. 2010: 134). This type of petroglyph in the Eurasian steppes is usually dated to the Late Bronze Age, based on stylistics and cross-comparisons with independently dated contexts of material culture.

2. The Tunnug 1 Project

In 2017 a first preliminary survey was conducted with a small team investigating a large burial mound which was lying in an unexpected location in the Uyuk Valley in the Tuva Republic (Fig. 1). Iron Age burial mounds throughout southern Siberia are known to have been constructed mostly on river terraces; however, the burial mound Tunnug 1 is located in the river plain, in the middle of a swamp (Caspari et al. 2018). The royal burial mound was analysed through WorldView-2 data which showed palaeo-river channels on the western side of the monument and hinted towards erosional impact (Caspari et al. 2019). We generated a high-resolution 3D-model and recovered first samples of preserved wood through cleaning collapsed parts of the monument's eastern side. Based on aerial observations, satellite data and a high-resolution digital elevation model, the comparative analysis of Tunnug 1 with the burials Arzhan 1 (Gryaznov 1980) and Arzhan 5 (Rukavishnikova and Gladchenkov 2016) yielded a similar architectural composition. All three burial mounds encompass a relatively flat stone platform as opposed to later burial mounds which are often

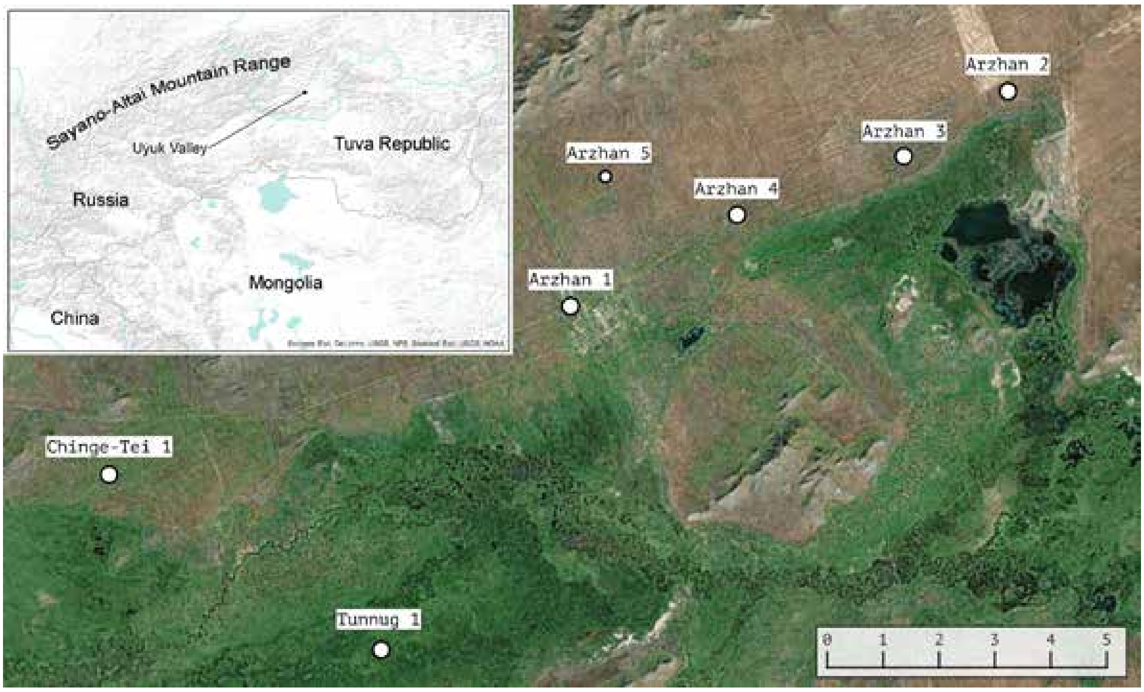

***Figure 1.** The Uyuk Valley in the Tuva Republic, Russian Federation. The map indicates the most important early Scythian burial mounds. Scale in km.*

composed of a soil-stone mixture and loom high over the river terraces. Satellite data, high-resolution digital elevation model and geomagnetic survey results all showed radial features underneath the stone platform (Caspari et al. 2019). These radial features appeared to be connected to an underlying construction made from logs covered by the stone package of the mound. These features led to the hypothesis that the burial mound Tunnug 1 belonged to the earliest monuments of the Early Iron Age in the steppes and made it necessary to obtain an accurate date to secure its chronological position. Thus a large excavation campaign was started which led to the documentation of a stone slab with the broken depiction of a 'two-wheeled chariot' in June 2019. The slab was found in the filling of a pit directly on the constructive clay architecture underlying the stone package of the burial mound Tunnug 1 (Fig. 2).

3. The petroglyph and its stratigraphic position

A wooden construction forms the base layer of the burial mound. This lattice made from complete larch trees was then covered in an irregular clay architecture, leaving gaps and depressions open. These compartments were later filled with stones and in some cases covered with wood (showing the undisturbed nature of the architecture). The petroglyph was found

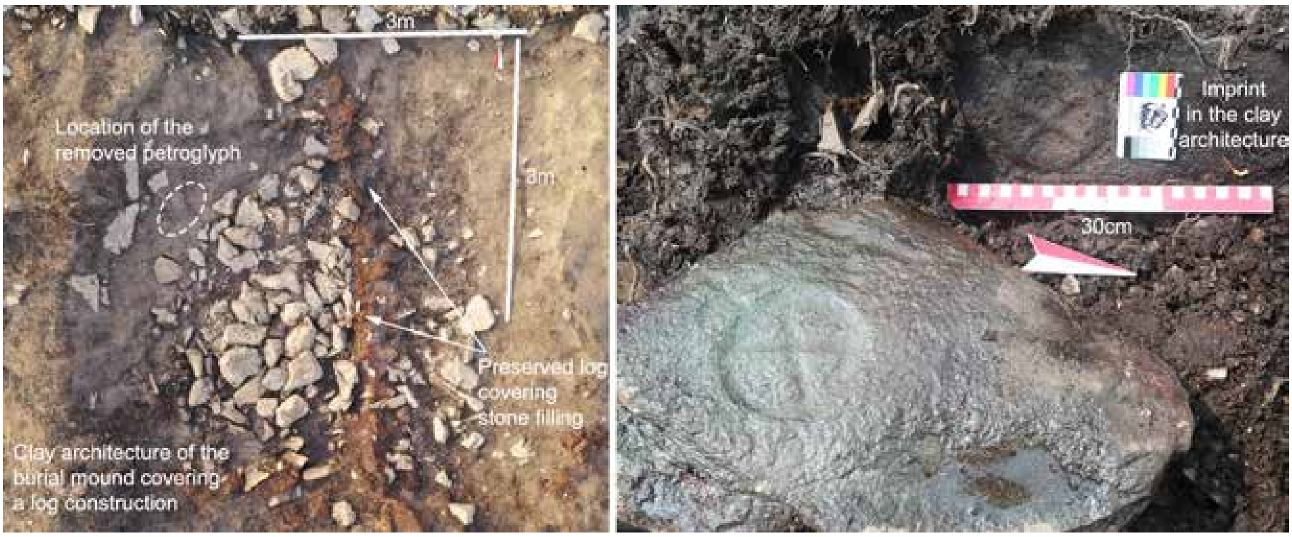

***Figure 2.** (Left) Aerial view of the pit marking the chamber indicating the findspot of the stone slab with the 'chariot' petroglyph. (Right) Lying face down on the constructive clay layer in the filling of a pit of the burial mound, the petroglyph was only recognised after turning the slab. The imprint in the clay is still in situ.*

in the stone filling of one of the compartments. The filling of the pit was not disturbed, since also in this case, a preserved wooden log is leading over the stone filling which could be traced without any interruption. The petroglyph was lying upside down on the constructive clay layer. While turning the slab over, the depiction was recognised and photographed with the imprint in the clay still in situ (Fig. 2). Its face-down position and broken state seem to indicate a secondary use.

Figure 3 shows a rendering of a three-dimensional model of the petroglyph which was created through a structure from motion approach with the software Agisoft (cf. Plets et al. 2012). The petroglyph is between 2 mm and 4 mm deep and preserved to a length of 24 cm and a width of 16 cm. The larger half including a wheel and the axis has been preserved, but the second wheel is lacking since the stone was broken. The original width of the chariot depiction would have been around 30 cm. Despite scrutiny, the second half of the petroglyph could not be found in the filling of the pit. It is thus unclear if the chariot featured draught animals and a charioteer or not.

Figure 3. *Rendering of a 3D model created through structure from motion. The deeper surface area of the petroglyph has been highlighted for better visibility with a white overlay with 40% opacity.*

4. Dating the burial mound

Under a protective stone package inside the trench D, a clear clay layer covered a wooden structure (Fig. 4). The covered wooden construction consists of several logs which form part of a segment of a circle, comparable to the log walls in Arzhan 1 (Gryaznov 1980) running parallel to the ray-like arranged logs coming from the centre. This is also the case here. The wood was surrounded by a thick clay layer which preserved the organic material; only the outermost tree rings had started to decay.

The dendrochronological measurement of the tree ring sequence serves as the basis for taking samples for radiocarbon dating. By combining the results of the radiocarbon data at precisely defined intervals, the felling date of the tree can be established accurately (Galimberti et al. 2004). Bark was not preserved on the sample; the outer parts were partially degraded or had fallen off in many places. In the area of a branch, however, we determined the preserved wane edge, i.e. the last built ring under the bark. The observations in the field confirm that despite traces of degradation, the round trunk was originally completely preserved and that an intact sample could be recovered.

The annual ring was measured under the binocular on a measuring table. The annual rings were measured with a resolution of 1/100th mm with the program Dendroplus. Due to the fragmentation, only individual segments of the wood could be measured. However, they could be synchronised to a mean curve of the tree. The larch has 62 annual rings. The wane edge

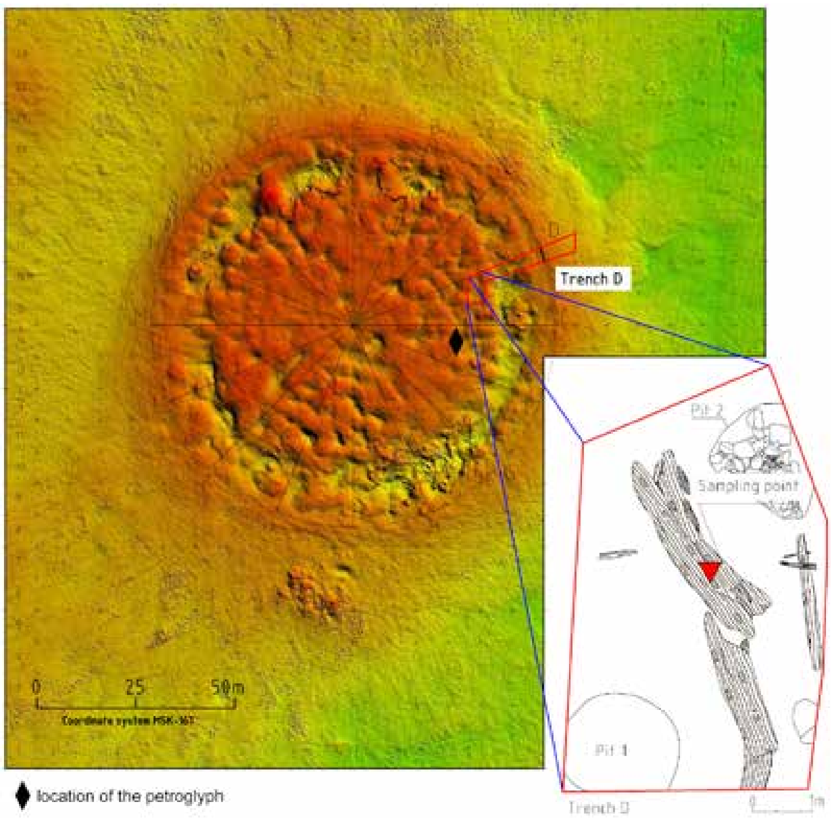

Figure 4. *The burial architecture with underlying radial features. Excavation trench D with well-preserved wood and sampling spot. The black diamond marks the findspot of the petroglyph in the filling of the chamber.*

^{14}C sample code	Annual ring	^{14}C age (BP)	Calibrated age	Modelled age
BE-9513.1.1	1–3	2712 ± 23	903–814 BCE	893–860 BCE
BE-9512.1.1	2–3	2728 ± 23	915–822 BCE	892–859 BCE
BE-9516.1.1	27–29	2740 ± 23	926–828 BCE	867–834 BCE
BE-9515.1.1	48–55	2708 ± 23	902–813 BCE	843–810 BCE
BE-9514.1.1	58–62	2644 ± 23	832–795 BCE	835–802 BCE
Wane edge	62–64	n.d.	n.d.	833–800 BCE

n.d.: not determined

Table 1. *Radiocarbon dating of the sample at the Laboratory for the Analysis of Radiocarbon with AMS (LARA) at the University of Bern (Szidat et al. 2014). Uncertainties of ^{14}C ages refer to 68% probabilities (1σ), whereas ranges of calibrated and modelled ages represent 95% probabilities (2σ).*

is indicated as 'unsafe', as the sample could only be prepared close to the point mentioned above of the branch with the preserved wane edge due to its fragile condition. Up to this point, only one or two rings may be missing, which would result in a marginally younger date for the felling of the tree.

For radiocarbon dating, five samples were taken from precisely defined annual ring ranges (Table 1). The samples were taken at freshly prepared parts with clean blades to avoid contamination. ^{14}C dating was performed at the Laboratory for the Analysis of Radiocarbon with AMS (LARA) at the University of Bern (Szidat et al. 2014). Cellulose was extracted with the BABAB method at 75°C for all steps (Němec et al. 2010). The sample was treated in 4% NaOH overnight, followed by three repeated sequential treatments in 4% HCl and 4% NaOH of 1 hr each and several bleaching steps of 30 min each using 5% NaClO2 and two drops of 4% HCl. ^{14}C was measured with the accelerator mass spectrometry (AMS) system MICADAS (Synal et al. 2007). ^{14}C-free sodium acetate (Sigma-Aldrich, No. 71180) and the primary NIST standard oxalic acid II (SRM 4990C) were used for blank subtraction, standard normalisation and correction for isotope fractionations. ^{14}C ages were calibrated using the IntCal13 calibration curve (Reimer et al. 2013). Wiggle matching of the individual tree ring samples was done with the D-sequence model in the program OxCal 4.3.2 (Ramsey 2009; Ramsey et al. 2001). Through this process, the age of the wane edge of the tree was determined as 833–800 BCE (95% probability). Details are shown in Figure 5 and Table 1.

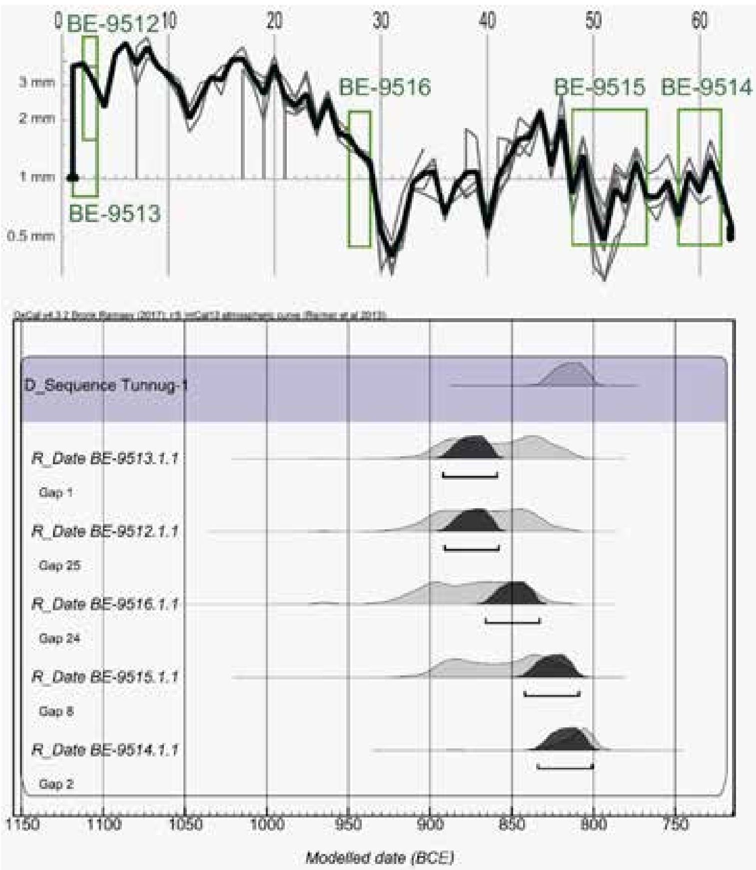

Figure 5. *Measured segments and synchronised mean dendrochronological curve of the sample, including the sampled ring sections for radiocarbon dating (top). Radiocarbon date distributions of tree ring packages (bottom).*

A *terminus ante quem* for chariot depictions in the Eurasian steppes

To our knowledge, the case reported above is the first one in which a chariot petroglyph is directly stratigraphically associated with an archaeological complex encompassing wood architecture, and we can thus provide a *terminus ante quem* through wiggle matching. The creation of the petroglyph predates the construction of the burial mound since it was used in an undisturbed filling of a pit. This is a lucky case, considering Early Iron Age burial mounds are more often than not heavily impacted by looting (Caspari 2018). The wiggle matching of preserved constructive wood of the tomb yielded a date of 833–800 BCE (95% probability). This range constitutes a *terminus ante quem* for the creation of the petroglyph. The 'chariot' depiction, however, might be considerably older since its context within the Early Iron Age burial mound does suggest no conscious placement. Considering the slab's broken state and inverted position, it might have been placed there by accident as a simple part of the filling of the pit.

Acknowledgments

The project was made possible through generous donations of Dr F. Paulsen, the Society for the Exploration of EurAsia, conducted with the financial and logistical help of the Russian Ministry of Culture (project No. 656-01-1-41/12-18); Institute for the History of Material Culture of the Russian Academy of Sciences (Saint-Petersburg); and with logistic and volunteer help of the Russian Geographical Society. We especially thank the anonymous *RAR* referees for their constructive comments on this paper.

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RAR 37-1316