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## RADIOCARBON DATING OF ARCHAEOLOGICAL SITES OF THE OKA PLATEAU

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**Abstract.** The article presents the generalized data about the first results of radiocarbon dating carried out for the archaeological sites of the Oka Plateau in the Eastern Sayan Mountain Ridge. For the first time archaeological sites in the territory of the Oka Plateau have become known since the beginning of the second part of the 19<sup>th</sup> century, however at that time only assumption about the ancience of the sites was proposed without substantiations. Further, for a long time archeologists visited this territory occasionally with long time intervals and the investigations consisted of the collecting artifacts from daylight surface. All attempts of the archaeological site and materials dating was based on the comparing of the typology and morphology of the artifacts from the Oka Plateau and that from the neighboring territories. In 2017 chronological investigations of Oka Plateau ancient sites with using radiocarbon dating metho began. The first archaeological site, which was dated by radiocarbon method, was the stone construction in the form of the pathway that the local people called Strela Gesera. Further on ancient settlements were engaged in the chronological research. Basing on obtained data the fact about ancient people occupying Rivers Valleys of the Oka Plateau in the final Pleistocene was approved.

**Keywords:** archaeology, archaeological sites, radiocarbon dating, Pleistocene, Holocene, Eastern Siberia, Eastern Sayan Mountain, Oka Plateau

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## РАДИОУГЛЕРОДНОЕ ДАТИРОВАНИЕ АРХЕОЛОГИЧЕСКИХ МЕСТОНАХОЖДЕНИЙ ОКИНСКОГО ПЛОСКОГОРЬЯ

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**Резюме.** В статье приводятся обобщенные сведения о первых результатах радиоуглеродного датирования археологических местонахождений Окинского плоскогорья в Восточном Саяне. Впервые об археологических объектах на территории Окинского плоскогорья становится известно еще во второй половине XIX в., но на тот момент было сделано предположение о древности этих объектов. Долгое время эту территорию археологи посещали периодически, с большими временными интервалами, а сами исследования заключались в сборе подъемных материалов. Все попытки датирования археологических местонахождений и материалов были основаны на сравнении типологии и морфологии артефактов, полученных на плоскогорье, с материалами сопредельных территорий. В 2017 г. начинаются хронологические исследования древних местонахождений, основанные на радиоуглеродном методе датирования. Первым археологическим объектом, на котором было применено радиоуглеродное датирование, стала каменная конструкция в виде дорожки, которую местное население называет Стрела Гэсэра. В дальнейшем к хронологическим исследованиям были привлечены древние стоянки. На основании этих исследований впервые доказан факт освоения древним человеком речных долин плоскогорья в финале плейстоцена.

**Ключевые слова:** археология, археологические местонахождения, радиоуглеродное датирование, плейстоцен, голоцен, Восточная Сибирь, Восточный Саян, Окинское плоскогорье

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### **I**ntroduction

While only reconnaissance trips were conducted in 2017 to assess the potential for finding and examining archaeological sites, the Oka Plateau experienced the start of organized archaeological investigation that year. Since then, this kind of research has become more routine, numerous new archaeological sites have been found, the first Stone Age site excavations have been carried out, and the amount of archaeological materials discovered during pitting and excavation operations has increased. The development of an archaeological database has made it necessary to apply natural scientific research methods for the purpose to comprehend the ways in which humans and the environment interact in the unique

natural environment of the Oka Plateau at different times. Chronological research has become increasingly significant in this sense. Concerns over the Oka Plateau's archaeological sites' significance to human history have existed since the early days of archeological excavations in this area. Concurrently, solutions to these issues were proposed. P.A. Kropotkin disclosed the Oka Plateau's archeological sites for the first time, based on the findings of an expedition that looked into extinct volcanoes in the upper Zhombolok River (Zuun Bulak). The researcher described two different kinds of archeological sites: round stone mounds and rock paintings and indicated at their ancientry (Kropotkin, 1867, pp. 56, 57).

Five years after the P.A. Kropotkin's expedition P.A. Rovinskii reported about two excavated by himself mounds, which Kropotkin had characterized as dwellings, and concluded that they were cenotaphs, or markers of sacrificial places. P.A. Rovinskii confirmed the mounds' antiquity in his report; however, he did not provide any details (Rovinskii, 1871, pp. 38, 39). Since there were no artifacts from the Oka Plateau documented in scientific circles at the time of P.A. Rovinskii's work, the current Oka district of the Republic of Buryatia was not taken into account in the primary chronological constructions that P.A. Rovinskii created using materials from the Tunka valley (Rovinskii, 1871, pp. 39, 40).

N.I. Vitkovskii published a report in 1889, which contained a small note about the Stone Age in the Oka river valley. In 1887, priest Chistokhin provided the Irkutsk Museum of the East Siberian Department of the Imperial Russian Geographical Society with stone artifacts "(nuclei)" that he had gathered along the banks of the Oka River (Vitkovskii, 1889, pp. 29–31). In his report N.I. Vitkovskii gave a brief description of the materials and indicated that some of the artifacts could be considered as Paleolithic, but based on the entirety of the data he defined them as Neolithic (Ibid.). Judging by the available data, this is the first mention of stone artifacts from the Oka valley and the first determination of their place in the chronology of the ancient past and in the periodization of the Stone Age.

In the course of ethnographic expeditions in Eastern Sayan in the 1920s, B.E. Petri also gathered archaeological artifacts from the surface along the banks of the Oka near the Oka Guard (the location of the contemporary settlement of Sayany). These artifacts, referred to The Neolithic-era, were moved to the Irkutsk Museum of Local Lore, but they were never published (Savelyev, 1991, p. 85). The Oka Plateau archeological research in the latter part of the 20<sup>th</sup> century involve only visiting a few archaeological sites and the occasional collecting of archeological materials from surfaces, but at this time the reporting documentation contained the suggestion of the classifying some sites as Paleolithic based on the definition of "flake of the Paleolithic appearance". Results of 2004 field works conducted in the Sentsa river valley, Shasnur locality, allowed suggesting a more precise temporal distribution of archaeological material according to the typology of artifacts (Arzhannikov et al., 2010). Therefore, up until 2017, all efforts to arrange archaeological materials chronologically based only on the features of items' morphology and typology. After the works in 2017, a number of chronological studies using the radiocarbon dating method were carried out directly on archaeological sites. Earlier a few radiocarbon dates were obtained from locations closed to archeological sites as a part of geological study. This paper offers generalized data from the first radiocarbon dating of archaeological objects of the Oka Plateau.

### ***Objects and methods of research***

The first archaeological site from the Oka Plateau to be dated by radiocarbon dating was a stone construction known locally as Strela Gesera. It is located 400 meters northwest from the northwest outskirts of the Sayany village, near the foot of the cliff (Fig. 1.-A, B). A specific location known as Shamkhag-Baisan contains both the rock with the drawings on it and the stone construction beneath it (Antonova, Miyagashev, 2013; Tashak, Kharinskii, Portnyagin, 2021). The stone construction is arranged in a walkway that is approximately 9 meters long and 1.7 meters wide, using rock pieces of different sizes. The trail is aligned in a southeasterly direction. Buried soil was taken from beneath a sizable piece of platy rock in order to determine the age of the stone structure. A pit was dug for this purpose next to the stone path, and soil was pulled out for study from the pit's profile. (Fig. 2.-1).

The following two dates were determined on animal bone pieces found in the cultural horizons of Stone Age sites: Tropa Kropotkina-3 in the Zhombolok valley (see Fig. 1.-A, B); and Shasnur-8 in the Sentsa River valley (see Fig. 1.-A). Tropa-Kropotkina-3 is the Neolithic site which archaeological materials concentrate in the 2d lithological layer, i.e. right under the greensward. In the upper level of this layer the most archaeological finds are the ceramic fragments: corded and ust'-belaya type characteristic for the Neolithic of the Angara region. At the site Tropa-Kropotkina-3, bone fragments were obtained from the contact zone between the first and the second lithological layers (Fig. 2.-2), that means from the surface of the second lithological layer with a thickness of roughly 30 cm, which contains material remnants of prehistoric human activity (Tashak, 2022a). The site Shasnur-8 is situated on the Sentsa River left bank. Here several test pits were positioned; three pits showed a lithological layer similar to the 2d lithological layer of Tropa Kropotkina-3 exactly as archaeological materials from this layer are analogous to Tropa Kropotkina-3 materials: microblades, arrow heads, small scrapers and etc.

During the investigation of Shasnur-8 bone pieces for dating were taken from the humus level between lithological layers 4 and 5, revealed only in one test pit (Fig. 2.-3). In addition to the bones more than dozen of small flakes were found here. Furthermore, the uppermost portion of the deposits here mostly match to the upper part of the deposits at Tropa Kropotkina-3 (Tashak, 2022a).

A soil sample from the second lithological layer was used to date the cultural horizon of the Zun Nomto-Gol-2 site, which is situated on the left bank of the Oka River (Fig. 2.-4) (Tashak, 2022b). Archaeological materials of the site are represented by the net-impressed pottery typical for the early Neolithic of the Angara region, microblades, micro scrapers.

Radiocarbon dates from organic samples collected during the investigation of the age of the Zhombolok lava field (Arzhannikov et al., 2017, pp. 32–36) from locations close to the Zun Nomto-Gol sites provided additional information to determine the time frame for the existence of ancient sites in the Zun Nomto-Gol area. Another date, derived from charcoal found on the right bank of the Oka River's coastal outcrops located opposite the sites of Zun Nomto-Gol (see Fig. 1.-A, B), indicates the late stage of the development of paleolake, which bank were the place for the occupying by ancient sites under the common name Zun Nomto-Gol (Tashak, 2022b).



Fig. 1. A – General map of the locations of the sites under radiocarbon research:

1 – Tropa Kropotkina-3; 2 – Strela Gesera; 3 – Zun Nomto-Gol-2; 4 – Nomto-Gol; 5 – Sharza-3-1 (burial ground); 6 – Shasnur-8; 7, 8 – left bank of the Oka River, pits 3 and 4. B – The view toward the sites with radiocarbon dates from the east, from right bank of the Oka River

Рис. 1. А – общая схема расположения объектов, на которых проводились радиоуглеродные исследования:  
1 – Тропа Кропоткина-3; 2 – Стрела Гэсэра; 3 – Зун Номто-Гол-2; 4 – Номто-Гол; 5 – Шарза-3-1 (могильник);  
6 – Шаснур-8; 7, 8 – левый берег Оки, разрезы 3 и 4. Б – вид на расположение объектов, на которых проводились радиоуглеродные исследования, с востока, с правобережья р. Ока



Fig. 2. Stratigraphy of the archaeological sites under radiocarbon research:

1 – Strela Gesera; 2 – Тропа Кропоткина-3; 3 – Shasnur-8; 4 – Zun Nomto-Gol-2. Arrows indicate the levels of the specimen sampling

Рис. 2. Стратиграфия археологических местонахождений, на которых проводились радиоуглеродные исследования:

1 – Стрела Гэсэра; 2 – Тропа Кропоткина-3; 3 – Шаснур-8; 4 – Зун Номто-Гол-2. Стрелками показаны уровни отбора образцов

One of the most recent investigations on the archaeology of the Oka region presents the results of dating the ancient grave Sharza-3-1, which is situated on the left bank of the Zhombolok River, opposite the Tropa Kropotkina sites. The bones of a person buried under a stone mound served as the material for dating (Kharinskii, Kichigin, 2024). In the Oka Plateau, this is the only stone mound from the excavated where a burial has been found.

The dating of soil samples was carried out at the Scientific Laboratory of Geomorphological and Paleogeographic Research of Polar Regions and the World Ocean at St. Petersburg State University using the method of liquid scintillation counting (LSC). All other dates were obtained in various laboratories using the method of accelerator mass spectrometry (AMS).

### **Radiocarbon dating results**

For the stone structure Strela Gesera, the initial radiocarbon dating was determined to be  $1570 \pm 100$  cal. yr BP<sup>5</sup> (see table). Taking into account the facts that the soil sample collected for analysis was located near the surface and did not instantly transfer into the state of an “obsolete organism” we may presume the older age of the stone construction. The obtained result, however, indicates that the so called Strela Gesera was constructed no later than between 253 and 654, AD<sup>6</sup>.

### **Radiocarbon dating of the archaeological sites and geological trenches of the Oka Plateau**

#### **Радиоуглеродное датирование археологических местонахождений и геологических разрезов Окинского плоскогорья**

Lab number	Measurement method	Archaeological site / geological trench	Material	<sup>14</sup> C Age BP	CAL*** 95,4%	Reference
LU-8931	LSC*	Strela Gesera	Soil	$1570 \pm 100$	1698–1296	(Tashak, Antonova, Kobylkin., 2019)
LU-10601	LSC	Zun Nomto-Gol-2	Soil	$6300 \pm 90$	7423–6995	This Study
LU-10601	LSC	Nomto-Gol / Oka River right bank / geological trench	Soil	$1950 \pm 70$	2052–1710	This Study
GV-3550	AMS**	Shasnur-8	Bone	$12135 \pm 40$	14126–13814	(Tashak, 2023)
GV-3549	AMS	Tropa Kropotkina-3	Bone	$5111 \pm 31$	5929–5749	(Tashak, Antonova, 2023)
OxA-42021	AMS	Sharza-3-1 (burial ground)	Bone	$2564 \pm 19$	2750–2544	(Kharinskii, Kichigin, 2024)
AEON- 1465	AMS	Oka River left bank / geological trench № 4	charcoal	$11460 \pm 45$	13453–13192	(Arzhannikov et al., 2017, pp. 32–36)
AEON-1327	AMS	Oka River left bank / geological trench № 3	shell	$11550 \pm 45$	13496–13317	(Arzhannikov et al., 2017, pp. 32–36)

\* LSC — liquid scintillation counting (метод жидкостной сцинтилляции).

\*\* AMS — accelerator mass spectrometry (метод ускорительной масс-спектрометрии).

\*\*\* Calibration was made with using OxCal 4.4 (Bronk Ramsey, 2021; Reimer et al., 2020).

<sup>5</sup> Hereinafter, dates were calibrated using the OxCal 4.4 calibration program (Bronk Ramsey, 2021; Reimer et al., 2020).

<sup>6</sup> Ibid.

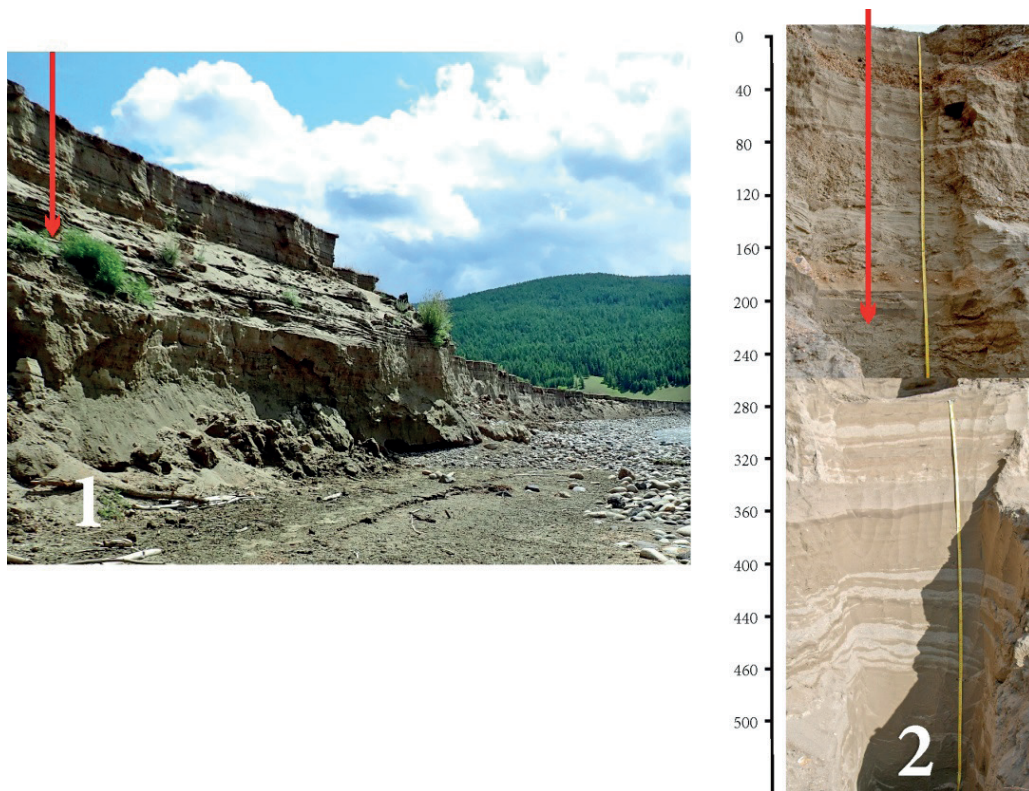


Fig. 3. Nomto-Gol locality, the right bank of the Oka River: 1 – the general view toward the bank cliff; 2 – the arrow indicates the place of the specimen sampling

Рис. 3. Местность Номто-Гол, правый берег Оки: 1 – общий вид на береговой обрыв; 2 – участок отбора образца, указан стрелкой

Buried soil was also utilized to determine the age of the cultural horizon at the Zun Nomto Gol-2 site. A sample of the buried soil was extracted straight from the lithological layer containing the artifacts. The result is a date of  $6300 \pm 90$  years ago, or 7423–6995 cal. yr BP, which corresponds to the Neolithic era of the Angara region. As demonstrated by the investigation of ancient sites in the Zun Nomto-Gol location, all of them were situated in the ancient times along the edge of a lake that had been dammed, but currently does not exist (Tashak, 2022b). There are two floodplain levels (up to 2–4 m) and five terraces above the floodplain with heights of 7–13–14.5, 18–19.5, 24–26.5, and 33–35 m along the banks of the Oka (Vyrkin, 2018). The artifacts from the Zun Nomto-Gol location are 30–35 meters higher the level of the current river. A series of dates were identified while examining the age of the Zhombolok lava field. Two of them have a direct relation to the phases involved in the formation of a dammed reservoir. In the first example, found in section 4, the date of  $11460 \pm 45$  years ago, or 13453–13192 cal. yr BP, was determined from charred plants under solidified lava (Arzhannikov et al., 2017, p. 35). The second date was obtained for the cover deposits that formed during the maximum



rise of the water level in ancient lake that covered part of the lava field in the coastal zone:  $11550 \pm 45$  or  $13496\text{--}13317$  cal. yr BP. Shells from the “amber” family served as the date material (Ibid.). The dates indicate the origin of the dammed lake practically coincided in time with the blocking of the ancient Oka riverbed by the lava flow. The date for the cultural horizon of the site Zun Nomto-Gol-2 marks a period when the lake level decreased, exposing a coastal strip at the foot of the upper lava level. Afterwards the people inhabited this coastal strip and originated lake’s coastline islands (Tashak, 2022b).

Another date, obtained from a layer in a contemporary coastal outcrop on the Oka River’s right bank, is associated with a considerably later period of time:  $1950 \pm 70$  years ago, or  $2052\text{--}1710$  cal. yr BP. The layer containing the date materials is laid in alluvial deposits (Fig. 3.-1), which were formed in the shallow coastal zone. The layer is saturated with charcoal over a large area and presumably demonstrates the consequences of a large fire (Fig. 3.-2), may have been driven by a subsequent volcanic eruption in Zhombolok’s higher reaches. This date indicates that, although the surface area and level of the ancient lake declined dramatically, these did not take place immediately since the Stone Age sites at Zun Nomto-Gol began to function. In other words, the dam was destroyed gradually, thereby leading to a gradual decrease in the lake level. Around 2000 years ago, the lake level dropped and the locations of the ancient sites, which remained at a height of more than 20 m above the water surface, became unsuitable for habitation and sites were not renewed here.

The date obtained for the Tropa Kropotkina-3 location is  $5111 \pm 31$  years ago or  $5929\text{--}5749$  cal. yr BP, marks the final stage of the development of the second lithological layer of yellowish-reddish color, which is recorded at many archaeological sites in the valleys of the Oka tributaries — the Tissa, Sentsa, Zhombolok Rivers and in the valley of the Oka itself. Taking into account the date from the location of Zun Nomto-Gol-2, the minimum accumulation time of the yellowish-reddish layer is established — from 7500 to 6000 cal. yr BP.

On the territory of the Oka Plateau, one excavated burial is known today, for which a radiocarbon date was obtained:  $2564 \pm 19$  years ago. (Kharinskii, Kichigin, 2024) or  $2750\text{--}2544$  cal. BP. By the calendar indicated burial can be dated to the first half of the first millennium BC.

### **Conclusion**

From 2017 to 2024 the database on the archaeology of the Oka Plateau has been significantly expanded. The latest research into the ancient past of this area has not only led to new archaeological finds, but has also been significantly supplemented by natural scientific data. New data made it possible to solve important issues of interaction between humans and the natural environment over 15 thousand years under conditions of active neotectonic processes: glacier retreat; volcanic activity; catastrophic formation and discharge of retaining reservoirs, as well as a number of other processes. Among such data are the results of chronological studies, on the basis of which the active settlement of the Oka Plateau during the Holocene optimum is clearly visible. For the first time, we obtained dates confirming the archaeological data about the beginning of the occupying of the river valleys of the plateau at the end of the Pleistocene. The presence of the settlements indicates significant degradation of glaciers at least about 14 k.y.a. The first data on the time of installing of funeral and cult stone constructions in the Oka basin have been obtained.

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### CONTRIBUTION OF THE AUTHORS/ ВКЛАД АВТОРОВ

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V.I. Tashak: organizing and leading archaeological expeditions during which materials were collected for radiocarbon analysis, archaeological survey of sites, processing of archaeological materials, article writing, illustration design.

Ташак В.И.: организация и руководство археологических экспедиций, в ходе которых осуществлялся сбор материалов для радиоуглеродных анализов, археологическое исследование памятников, обработка археологических материалов, написание статьи, оформление рисунков.

D.V. Kobylkin: organizing and conducting research in the Nomto-Gol area, where materials were collected for radiocarbon dating, collection of soil samples for radiocarbon dating at the archaeological sites of Zun Nomto-Gol-2 and the Strela of Geser, illustration design, natural science data processing.

Кобылкин Д.В.: организация и проведение исследований в местности Номто-Гол, где отобраны материалы для радиоуглеродного датирования, сбор образцов почвы на ра-

диоуглеродное датирование на археологических объектах Зун Номто-Гол-2 и Стрела Гэсэра, оформление рисунков, обработка естественно-научных данных.

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