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PALEOENVIRONMENT. THE STONE AGE

I.D. Zolnikov[1], A.V. Postnov[2], V.A. Lyamina[1], V.S. Slavinski[2], and D.A. Chupina[1]

[1]Institute of Geology and Mineralogy, Siberian Branch, Russian Academy of Sciences, Pr. Akademika Koptyuga 3, Novosibirsk, 630090, Russia
E-mail: zol@igm.nsc.ru; vbalandis@yandex.ru; Dasha.chupina@gmail.com
[2]Institute of Archaeology and Ethnography, Siberian Branch, Russian Academy of Sciences, Pr. Akademika Lavrentieva 17, Novosibirsk, 630090, Russia
E-mail: po@archaeology.nsc.ru; slavinski@yandex.ru

GEOINFORMATION MODELING OF ENVIRONMENTS FAVORABLE FOR PREHISTORIC HUMANS OF THE ALTAI MOUNTAINS

Geoinformation technologies are applied to an analysis of the living environments of Paleolithic people, using a territory along the route of a future gas pipeline planned for construction in the Altai Mountains as an example. GIS modeling of a paleoenvironment is based on the notion of a paleolandscape's geological and morphological framework. The SRTM digital model of terrain, and geological maps of scale 1: 200,000 were used. The main factors that control localization of sites have been selected: the presence of flat, even grounds suitable for settlement; proximity to sources of raw materials; good conditions for sun exposure; and water availability across the territory. Verification of known Paleolithic sites showed the adequacy of GIS-modeling and its suitability in the optimal search for new sites.

Keywords: *Paleolithic, paleoenvironment, Gorny Altai, Geoinformation System, digital terrain models.*

Introduction

Geoinformation technologies have been actively used in archaeological research for solving issues associated with analyzing spatial distribution patterns of archaeological sites in accordance with the conditions of a paleoenvironment. One pioneering Geoinformation System (GIS) projects in Siberia included the creation of a geodata bank (with Internet access) for radiocarbon-dated Paleolithic sites, including those with the remains of large mammals (in particular, mammoths). GIS analysis of the inhabited world of Paleolithic humans and of the habitat of large mammals at various chronological intervals (Kuzmin et al., 2004; Orlova, Kuzmin, Zolnikov, 2000) made it possible to use archaeological and paleontological data in support of the hypothesis that the Mansi sea-lake in the south of the Western Siberian Plain was absent during the period between 23,000–11,000 BP. For a number of years, staff of the Institute of Archaeology and Ethnography of SB RAS and the GIS Center of the Institute of Geology and Mineralogy of SB RAS have been conducting joint research projects aimed at clarifying the associative patterns of archaeological sites in Western Siberia with various paleogeographic conditions for specific chrono-stratigraphic intervals.

This article presents the results of geoinformation modeling of the living conditions of Paleolithic humans in the area along the route of a future gas pipeline planned for construction in the Altai Mountains (Slavinski et al., 2011). Since the adaptive mechanism for interacting with an environment was typically used by ancient humans, terrain is therefore the key element when assessing

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favorable environments for ancient habitation sites as it is a structural framework of landscapes and paleolandscapes. The open access SRTM digital model of terrain with the original cell size of 90 × 60 m for these latitudes, reduced to the spatial resolution of 60 × 60 m was used for geomorphological analysis. In contrast to previous studies, the purpose of this work was not to reconstruct paleoenvironments on the basis of archaeological and paleontological data of paleogeographic significance, but instead to identify those sites which might have been most favorable for the habitation of Paleolithic humans. The solution for doing so is based on the patterns of localizing Stone Age sites in accordance with the geological and geomorphological framework of the paleolandscape. The practical application of such a research issue is the possible optimization of the search for new Paleolithic sites.

Materials and methods

Our geoinformation model is based on the results of research in Paleolithic sites as well as their geological and geomorphological environment in the Altai Republic along the route of a future gas pipeline (Fig. 1). The length of the research area was 677 km; the width of the buffer zone where the surveys were conducted was 50 km; the total area was 32,690 sq. km. Our research focused on the valleys of the rivers of Peschanaya, Ursul, Katun, Chuya, and their tributaries. Thirty-five Paleolithic sites are known in this territory, and a separate layer of archaeological sites was created for them in GIS. Twenty-seven sites were discovered in the autumn of 2011 (Slavinski et al., 2011); other sites had been discovered earlier (Derevianko, Markin, 1987; Derevianko et al., 2003; Postnov et al., 2007). The Paleolithic sites can be characterized as follows.

The site of Ust-Kazanda is located at the spit of the rivers Peschanaya and Kazanda, on the right banks of the streams. Surface finds were discovered on the southern outcrop of an altiplanation terrace; a flattened platform at a height of 15–20 m above the present waterline of the Peschanaya River. Three large flake cores as well as some flakes and a blade were found. The finds are associated with loose soil from terrace cover deposits. The site was tentatively dated to the Upper Paleolithic.

The site of Verkhny Tourachek-1 is located at the spit of the rivers Peschanaya and Verkhny Tourachek, on the left bank of the Tourachek River, at a flattened 20-meter projecting extremity of the platform of an altiplanation terrace. Four flakes were discovered, presumably from the Upper Paleolithic. The sites of Verkhny Tourachek-2 and -3 are located on the left bank of an unnamed creek which is a left tributary of the Verkhny Tourachek River, 2 km from its confluence with the Peschanaya River, on a flattened 40-meter platform of an altiplanation terrace. Two flakes were found at the first site, and a blade fragment at the second site; all of them were tentatively dated to the Upper Paleolithic.

The site of the Mariinsky Pass is located on the pass of the same name, 10 km east of the Cherny Anui River, on the border of Shebalinsky and Ust-Kansky Regions. Surface finds include a scraper on a flake and a fragment of a bifacial tool tentatively dated to the Upper Paleolithic.

The site of Ust-Karasu is located on the right bank of the Karasu River, 200 m from its confluence with the Verkhny Etagol River, on a promontory-like eminence of a 15-meter flattened altiplanation terrace. Artifacts were collected from a slope outcrop; these include a flake core with a single platform and one flake removal surface, a retouched blade of the Karakol type, and two flakes. The site was tentatively attributed to the Early Upper Paleolithic.

The sites of Bolshoi Ulush, Urala-1 and -4, Toldushka, Arbaitushka, Ust-Kuila, and Ust-Arbaita are located in the vicinity of the village of Iliinka on the right tributaries of the Peschanaya River, on a 10 km stretch. They were discovered on the slopes of altiplanation terraces with flattened platforms at heights of 20, 40, and 60 m above the present day waterline of the Peschanaya River. A fragment of a microblade, six flakes, and a piece of indeterminate implement were found at Bolshoi Ulush; they were tentatively dated to the Upper Paleolithic period. The finds from Urala-1 comprise a core trimming element, a scraper on a flake, and an undecorated fragment of pottery. The site is preliminary attributed to the Upper Paleolithic–Bronze Age. Urala-2, where two core trimming elements and a flake were found, was tentatively dated to the Upper Paleolithic. The artifact assemblage from Urala-3 includes eight fragments of undecorated pottery vessels and a flake. The site was tentatively attributed to the Bronze Age. The site of Urala-4, where a fragment of a large blade of the Kara-Bom type was discovered, was tentatively dated to the Early Upper Paleolithic. The artifact assemblage from Toldushka includes two flakes presumably attributable to the Upper Paleolithic and an undecorated fragment of a thick-walled ceramic vessel representing a later period. A core at the initial stage of reduction and a carinated endscraper on a blade were discovered at Arbaitushka; the finds were tentatively dated to the Early Upper Paleolithic. Ust-Kuila, where three flakes were found, presumably dates back to the Upper Paleolithic period.

The site of Ust-Arbaita is located on the spit of the rivers of Peschanaya and Arbaita on the right banks of the streams. Surface finds were collected from a slope outcrop which emerged during the construction of a road. The lithic assemblage includes a core-like fragment, three large blades of the Kara-Bom type (an intact blade and two proximal fragments), a retouched fragment, and two flakes. These artifacts can be tentatively dated to the Early