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# Afontova Gora II archaeological site: geology and postdepositional deformation (*Krasnoyarsk, Siberia*)

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**Abstract**

The Afontova Gora II archaeological site located within two geologically and geomorphically different areas has been studied in terms of geology and Quaternary deposition history. Both areas lie upon alluvial terrace II of the Yensei River. At the time when terrace I alluvium was deposited, aeolian and slope-wash facies accumulated on the surface of terrace II and a slope-wash apron formed on the gently sloping surface of terrace III. It is at these different levels of the Yenisei River bank that the latest Paleolithic Afontov culture of Siberia has been found. At the Late Glacial–Holocene boundary, the slope-wash apron upon terrace III was involved in landsliding and thrust over terrace II, which deformed the subaerial deposits over both terraces II and III. As shown by detailed analysis, the landslide deposits are either strongly deformed to the degree of losing of their primary sedimentary textures and structures or form imbricated blocks with deformed margins but minor deformation in their interior. The preserved textures and structures of sediments inside the imbricated landslide blocks provide stratigraphic and genetic constraints and prove the *in situ* origin of anthropological, archaeological, and paleontological finds. This division also explains the archaeological sterility and abnormal thickness of the subaerial cover upon the landslide blocks.


*Keywords:* terrace; landslide; deformation; Paleolithic

## Introduction

An assemblage of archaeological sites jointly called Afontova Gora are among the key Paleolithic objects of Siberia which have been studied for more than 100 years (Fig. 1*A*) (Astakhov, 1999; Drozdov and Artemiev, 1997, 2007). The archaeological artefacts are dispersed over a large area and located in different geological and geomorphic settings, which lends special importance to study of geology. Note that the primary stratigraphy has been locally disturbed by deformation, possibly associated with landsliding in the Yenisei River terraces (Drozdov and Artemiev, 2007; Gromov, 1932) judging by surface topography (Fig. 1*B*). The deformation-induced disturbance questions the correlation between cultural layers and the *in situ* origin of archaeological and paleontological finds. The interest to these issues was rekindled in the course of recovery archaeological works in 2014 at the Afontova Gora II site which fell into the construction area of the fourth motorway bridge over the Yenisei. Earth stripping over a large construction area has revealed numerous archaeological artefacts (Derevyanko et al., 2014) and provided insights into the structure of the host Late Quaternary section. The main aspects discussed in the paper are: local geology; sedimentary structures and textures; and postdepositional deformations.

## Geological setting

The Afontova Gora area is located on the left bank of the Yenisei River in the western part of Krasnoyarsk city.

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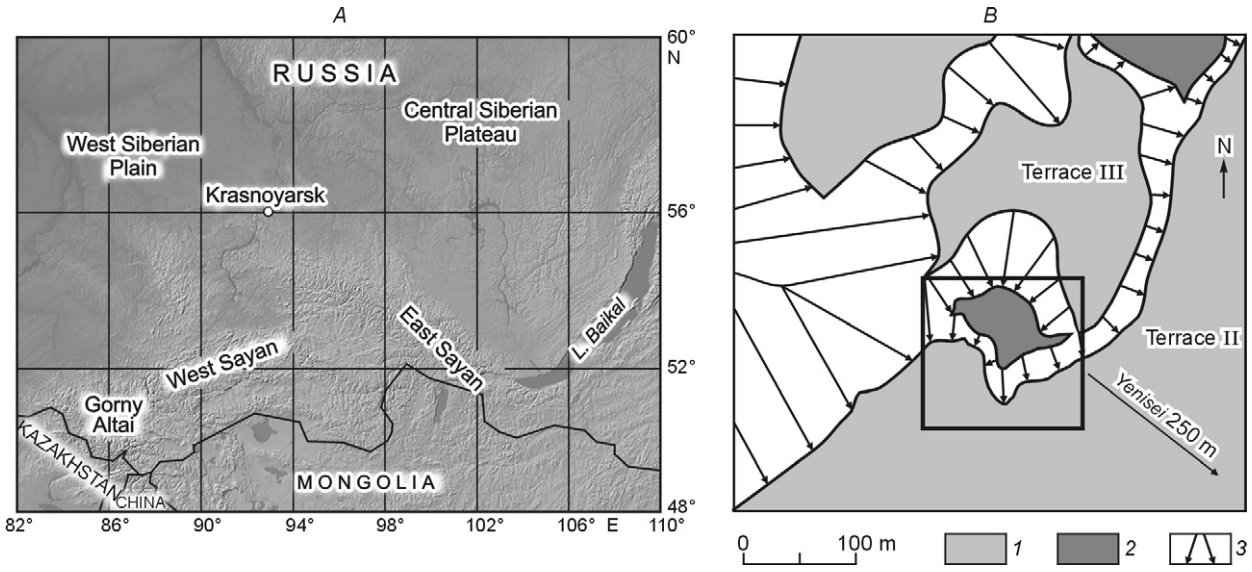


Fig. 1. *A*, location map of study area in the mountain framework of northern Central Asia. *B*, Geomorphological sketch of the Yenisei River left bank, at Afontova Gora Site. *1*, alluvial terraces; *2*, landslide terrace; *3*, slopes. Box frames study area at Afontova Gora II Site.

According to national geological surveys (Chairkin and Zalyaleev, 1962), the Late Cenozoic section is composed of watershed subaerial deposits and alluvium of nine terraces above the Yenisei River floodplain. Terraces I–III are Upper Pleistocene low terraces formed in the Early–Middle Karginian ($Q^3_{III}$) (terrace III), Late Karginian–Middle Sartanian ($Q^3_{III}$–$Q^4_{III}$) (terrace II), and Late Sartanian–Early Holocene ($Q^4_{III}$–$Q_H$) (terrace I) times, while the floodplain consists of Holocene ($Q_H$) sediments (Volkova et al., 2010).

According to previous published evidence (Astakhov, 1999; Drozdov and Artemiev, 1997, 2007; Gromov, 1932) and to results of recovery archaeological works in 2014 (Derevyanko et al., 2014), the archaeological artefacs were found within two main landforms: terrace II, 10–12 m (up to 16 m) high above the Yenisei level with quite a flat surface, and terrace III reaching a height of 30 m above the Yenisei, which is deformed by landslides. In terms of geology, both terraces consist of alluvial pebble and sand below and subaerial sand, loamy sand, and loam above, but the upper subaerial unit is thicker in terrace III.

The stratigraphy of the terraces can be illustrated by example sections of two trench walls in terrace II. One at 55.99398° N; 92.80524° E (Fig. 2) consists of two units.

**Unit 1.** Alluvium, up to 1.4 m of visible thickness, three layers.

*Layer 1.1*: floodplain alluvium, visible thickness from 0.6 to 0.7 m; gray and olive greenish subhorizontal plane-parallel laminated fine silty sand alternated with 1–2 mm to 2–3 cm thick dark gray loam making about 10% of the layer thickness;

*layer 1.2*: alluvial sand bar (levee), up to 0.6 m thick; light gray coarse sand with wavy and lenticular lamination;

*layer 1.3*: alluvium of a small shallow channel, up to 0.8 m thick; gray, light gray fine plane-parallel laminated sand, with dark gray loam near the top.

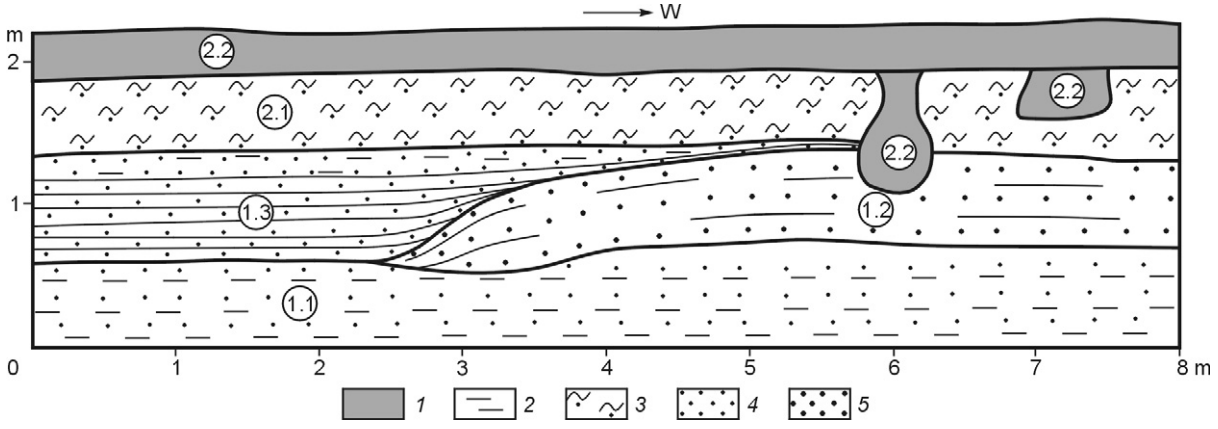


Fig. 2. Cross section of terrace II above Yenisei floodplain, trench 18, southern wall. *1*, man-made deposits; *2*, loam; *3*, loamy sand; *4*, fine sand; *5*, medium and coarse sand.