

New results of OSL dating of Quaternary sediments in the Upper Katun' valley (*Gorny Altai*) and adjacent area

I.D. Zolnikov^{a,b,d,*}, E.V. Deev^{c,d}, S.A. Kotler^{a,d}, G.G. Rusanov^e, D.V. Nazarov^{f,g}

^a V.S. Sobolev Institute of Geology and Mineralogy, Siberian Branch of the Russian Academy of Sciences,
pr. Akademika Koptyuga 3, Novosibirsk, 630090, Russia

^b Institute of Archeology and Ethnography, Siberian Branch of the Russian Academy of Sciences,
pr. Lavrentieva 17, Novosibirsk, 630090, Russia

^c A.A. Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of the Russian Academy of Sciences,
pr. Akademika Koptyuga 3, Novosibirsk, 630090, Russia

^d Novosibirsk State University, ul. Pirogova 2, Novosibirsk, 630090, Russia

^e Gorno-Altai Expedition JSC, ul. Sovetskaya 15, Maloeniseiskoe Village, Altai Territory, 659370, Russia

^f A.P. Karpinsky Russian Geological Research Institute, Srednii pr. 74, St. Petersburg, 199106, Russia

^g St. Petersburg State University, Universitetskaya nab. 7/9, St. Petersburg, 199034, Russia

Received 9 June 2015; accepted 24 September 2015

Abstract

Several sections have been studied to understand the distribution and interrelation of basic genetic types of Quaternary deposits in the Uimon basin and adjacent area. The OSL date of 101 ± 10 ka from the glaciolacustrine terrace on the northeastern rim of the basin corresponds to the cool substage of MIS 5. The glaciolacustrine sediments of the northern rim are covered with widespread diamictic flows of the outburst draining of the ice-dammed lake. The diamicts are overlain by a subaerial complex of loesses and three fossil soils. From the OSL loess dates in the range of 43 to 49 ka we infer that the complex formed from the early MIS 3 through the Holocene. This is also supported by radiocarbon dates from alluvial deposits incised into the glaciolacustrine terrace and into megaflood sediments of the final draining of the last paleolake. The OSL dates in the range of 77 to 89 ka from alluvial sediments indicate that postglacial downcutting of the present-day Katun' valley probably started just after MIS 5. The discrepancy between the beryllium dates from dropstones and Holocene TL-dates of the Katun' valley floods ranging from 23 to 6 ka can be explained if the younger floods are related to the draining of moraine- and rock slide dammed rather than ice-dammed lakes. The younger floods, though being less voluminous than the glacial megafloods, were capable of producing giant ripple marks.

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Keywords: Quaternary sediments; OSL dating; alluvial and lacustrine deposits; glacial megafloods; Gorny Altai

Introduction

The Upper Katun' valley is the area in which the river flows through the Uimon, Katanda, and Tyungur intermontane basins (Deev et al., 2012, 2013). The Tyuguryuk and Abai basins are localized west of the Uimon basin (Fig. 1). The Late Quaternary evolution of the above-mentioned basins should be considered together, because they were flooded by the same ice-dammed lake during glaciations. Also, paleoreconstructions require data on the Middle Katun' valley (Yaloman graben (Deev et al., 2015)) and the Chuya valley.

The local difference in elevations between the bottoms of the Uimon, Katanda, and Tyungur depressions (900–1150 m a.s.l.) and the spurs of the Terehta and Katun' Ranges (≤ 2800 m a.s.l.) reaches 2000 m. The river valleys in both ranges have trough profiles in the upper parts, with a set of well-developed terminal moraines. Most of the moraines in the trough valleys dam lakes, the largest of which are localized in the Katun' Range (Rudoy and Rusanov, 2010a). The depression bottoms are slightly inclined southward. The basins are filled with Cenozoic sediments. The depth of the basement in the Uimon basin reaches 550–870 m (Deev et al., 2012).

The study area is localized within three sheets of geological maps of scale 1:200,000 (old series M-45-XIII (Levitskii et al., 1961), M-45-XIV (Levitskii et al., 1964), and M-45-XV

* Corresponding author.

E-mail address: zol@igm.nsc.ru (I.D. Zolnikov)

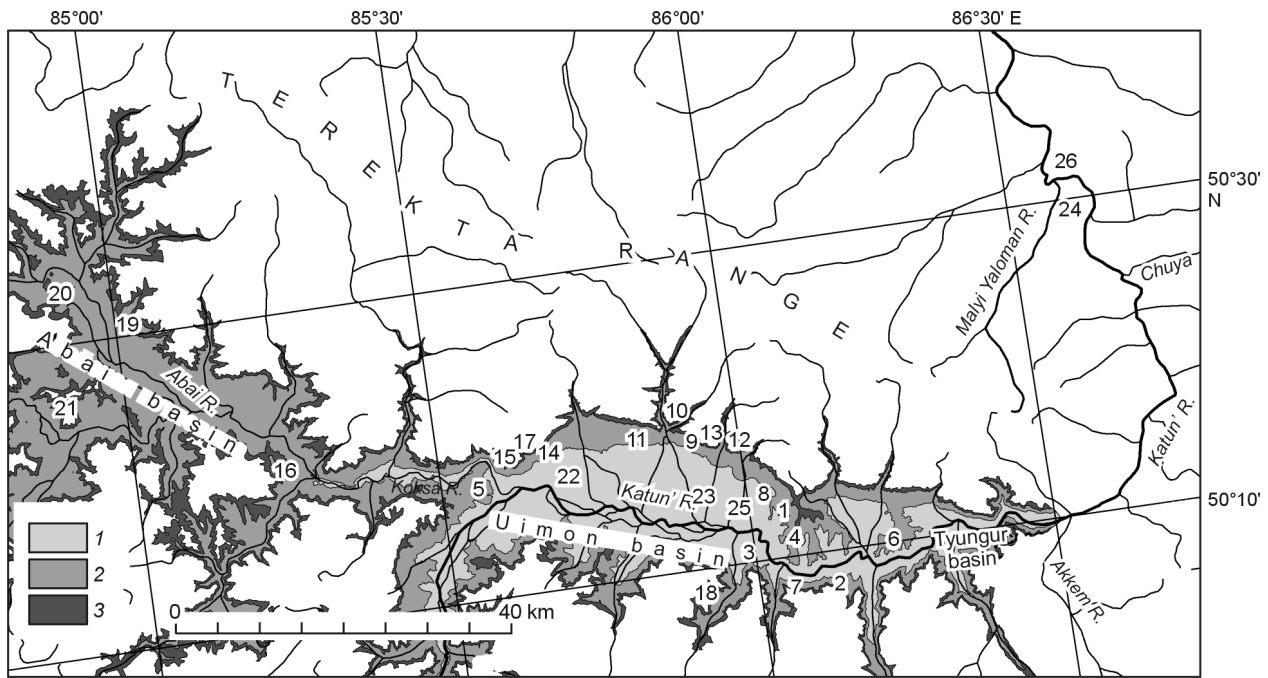


Fig. 1. Map of data obtained. 1–3, outlines of the ice-dammed paleolake in the upper reaches of the Katun' River: 1, altitude of 1040 m (Rudoy and Rusanov, 2010a); 2, altitude of 1276 m (Bailagasov and Bailagasova, 2008); 3, altitude of 1390 m (Butvilovskii and Prekhtel', 2000). Numbers show the sections considered in the paper.

(Volkov and Sergeev, 1961)). Also, a new-series geological map (Butenko, 2001) was issued for the area shown on sheet M-45-XV. The data in the present paper were obtained from the comprehensive studies which accompanied the geological mapping of the new series of sheet M-45-XIV.

The lacustrine deposits which confirm the existence of the large Late Pleistocene ice-dammed lake named Roerich Lake by V.V. Butvilovskii are described in outcrops near the mouth of the Akkem River, Tyungur Village, and Ognevka Village; besides that, they are stripped by four boreholes in the Uimon basin near Kastakhta and Zernovoe Villages and on the eastern margin of the Abai basin (Bailagasov and Bailagasova, 2008; Bogachkin, 1981; Butvilovskii and Prekhtel', 2000).

Traces of the ice dam of Roerich Lake in the form of moraines ("till") were observed as early as in (Obruchev, 1914) near the Kuragan River (right tributary of the Katun' River). According to (Rudoy and Rusanov, 2010a), the glacier which descended along the Akkem valley during the maximum glaciation reached the Katun' valley, absolutely blocking it with a thick dam, upstream of which an ice-dammed lake formed. For the waters of this lake to reach at least the mouth of the Tyuguryuk River, its depth near the ice dam must exceed 230 m. To ensure this, the lake level must be at an altitude of at least 1040 m. As presumed in (Rudoy and Rusanov, 2010b), the Uimon paleolake was 1200 km² in area, with 200 km³ water. In (Butvilovskii and Prekhtel', 2000), the paleolake depth is estimated at no less than 500 m. As hypothesized by V.V. Butvilovskii, the lake water plane was at an altitude of 1390 m and the lake discharged through the Karylyk Pass into the Charysh river basin. Traces of the shore zone of the Uimon paleolake as niches, funnels, and

even caves were found by L.V. Bailagasov and I.L. Bailagasova (2008) at average altitudes of 1273–1276 m. Butvilovskii and Prekhtel' (2000) state that they observed different relations between lacustrine sediments and other deposits at the bottom of the Uimon basin, in the littoral deposits of the Katun' River, and in quarries; this suggested the existence of at least three paleolakes of different ages. From their viewpoint, this testifies to the repeated filling and draining of the dammed water reservoir during the latest glaciation. The paleolake boundaries, based on data by different authors, are shown in Fig. 1.

As regards the age of the latest ice-dammed lake in the Uimon basin, the following view had become prevailing by the late 20th century: It existed during the last Pleistocene global glaciation (23.0–11.5 ka) (i.e., synchronously with MIS 2) (Butvilovskii and Prekhtel', 2000; Rudoy and Rusanov, 2012; Rusanov, 2008). The integrated studies made by members of Gorny Altai Expedition OJSC, Sobolev Institute of Geology and Mineralogy, Trofimuk Institute of Petroleum Geology and Geophysics, VSEGEI, St. Petersburg State University, and Novosibirsk State University permitted supplementing and specifying views on the regularities of formation of Quaternary sediments of the Upper Katun' River. This concerns mainly the age of the latest ice-dammed lake and of the sediments of the subsequent sedimentation cycle. During interdepartmental studies, >150 outcrops were described and new AMS and OSL ages were obtained. This permitted a new view on the genesis and age of Quaternary sediments in the Upper and Middle Katun' valleys in general.

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