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Research Article

ROCKS REMOVAL IN THE NIVAL ZONE OF BARKRAKSAY (PSKEM RIDGE)

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ABSTRACT
The scheme of the geological and geomorphological structure of the Barkraksai valley is considered. The influence of zones of outpouring of interlayer groundwater and tectonic processes on landslide processes of rock removal is shown.

Keywords: *Alluvial Fan, Debris Cone, Moraine Deposits, Sedimentation, Solid Runoff, Glaciers*

INTRODUCTION

In the upper reaches of the Barkraksay (left tributary of the Oygaying River) there is the eponymous and largest glacier of the Barkrak group, which consists of three parts: the Eastern Barkrak, the Middle Barkrak and the Western Barkrak. The boundaries of the Middle Barkrak glacier have the following structure: on the Eastern side the is a square of outcrops of acidic intrusive rocks, on the south – hydrothermally altered, silicified rocks, on the Western part – carbonate rocks that are weakly resistant to erosion processes, contributing to the continuous flow of sedimentary moraine deposits from the glacier, creating a powerful load on the same deposits of this glacier (Fig. 1).

Eastern glacier (Barkrak right) is surrounded by intrusive rocks, it is a fairly compact basin, which communicates with the Middle glacier through a small bridge in the northern part of the square of intrusions (Fig. 1).

Further following along the right bank of the Barkraksai river, the intrusions continue to inhibit the development of all landslide and erosion processes in this part of the valley for 9 km. At the base of their outcrops, for about 1 km, sedimentary rocks of carbonate composition are exposed, accompanied by the outpouring of numerous small springs. Along these springs hollows are formed, with abundant herbaceous vegetation. Following the intrusions, along the same side of the valley, a thick (a few tens of meters) layer of metasomatically altered igneous and skarn carbonate rocks begins to develop. These rocks are characterized with niobium-tantalum mineralization, as well as amazonite, crystal-bearing quartz, optical fluorite, and other formations in pegmatites. Dumps of mine workings, scattered along the slope, are technogenic placers of these minerals.

The left bank of the river along almost its entire length down to the confluence of Barkraksay with the Oygaying river is composed of Devonian-Silurian carbonate rocks. And only a small part of metasomatites, skarn formations similar to the right bank, has outcrops along the left bank.

The section of the Barkraksai valley finishes in an alluvial fan composed by bed sediments of Early Quaternary age. The most complete section of which is exposed on the right bank directly from the river channel and composed (from bottom to top, thickness in meters) of bed sand and gravel sediments (5), sharply changing to medium conglomerate rocks (6) which are represented mainly by rounded or flattened fragments of carbonate composition (Fig. 2) (Akbarov *et al.,* 2018). The latter are partially flooded at the base of the layer and covered with crusts of light-colored leached carbonates. The increased tectonic activity in the area was accompanied by covering of the previous layer by well-rounded large-block rocks (8) of mainly acid intrusion kind (Koldaev *et al.,* 2015).

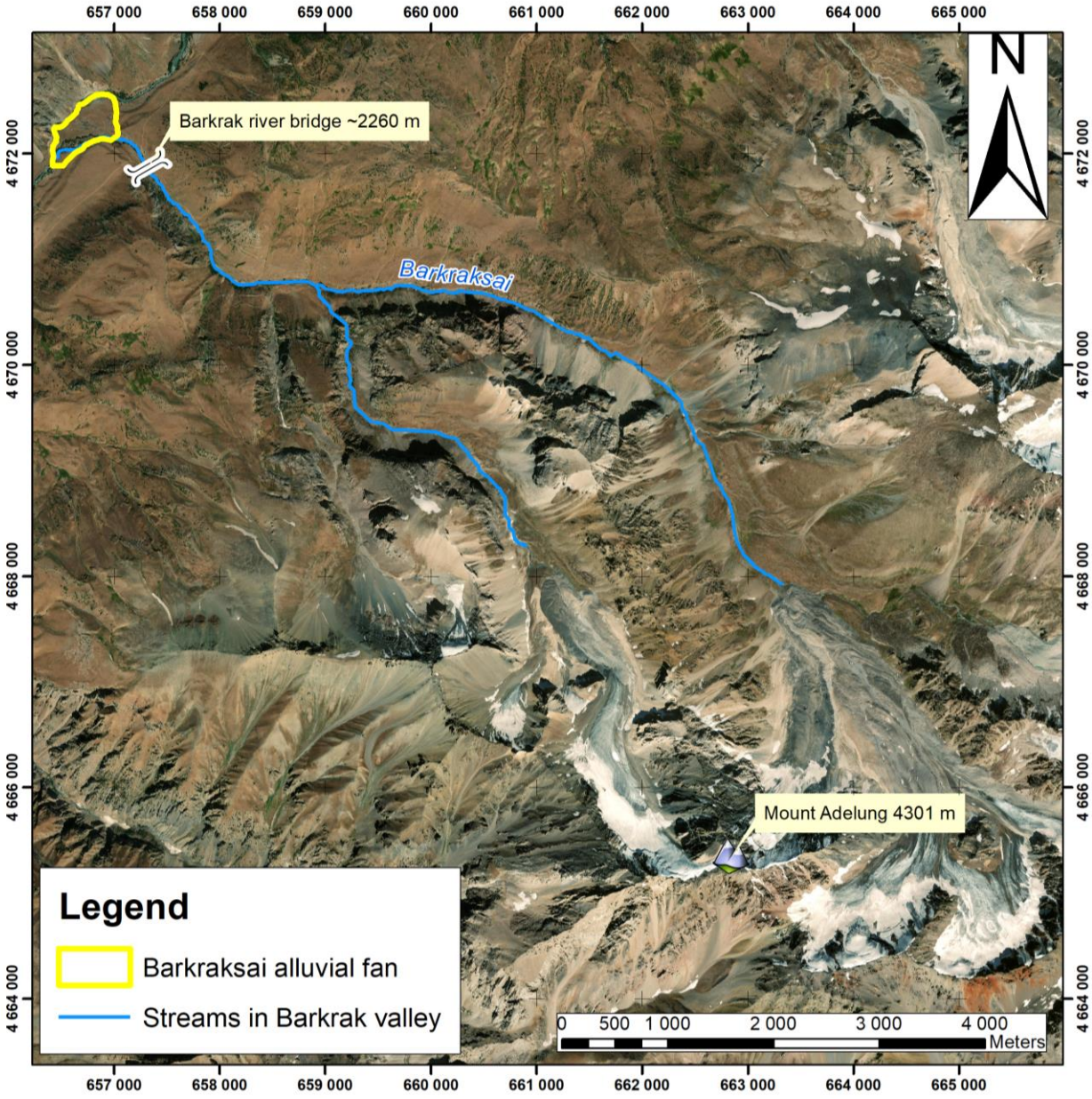

Figure 1: Map of the Barkraksai valley with satellite image base layer

On the left bank, there are no conglomerate rocks of the sand/gravel fraction, which indicates an elevated character of the right bank with a displacement amplitude of 11 m. Cone outcrops with partially eroded large-block deposits are exposed on the right (and least eroded) bank in an area of about 30,000 m^2 (150x200 m). All these sediments compose an ancient alluvial fan, cut at its northern end by the bed of the Oygaing River. The total apparent thickness of the rock outcrops of the cone is approximately 20-25 m. Up to 40 g/t of tantalum is estimated in its sand and gravel deposits on the right bank (data from neutron activation analysis).

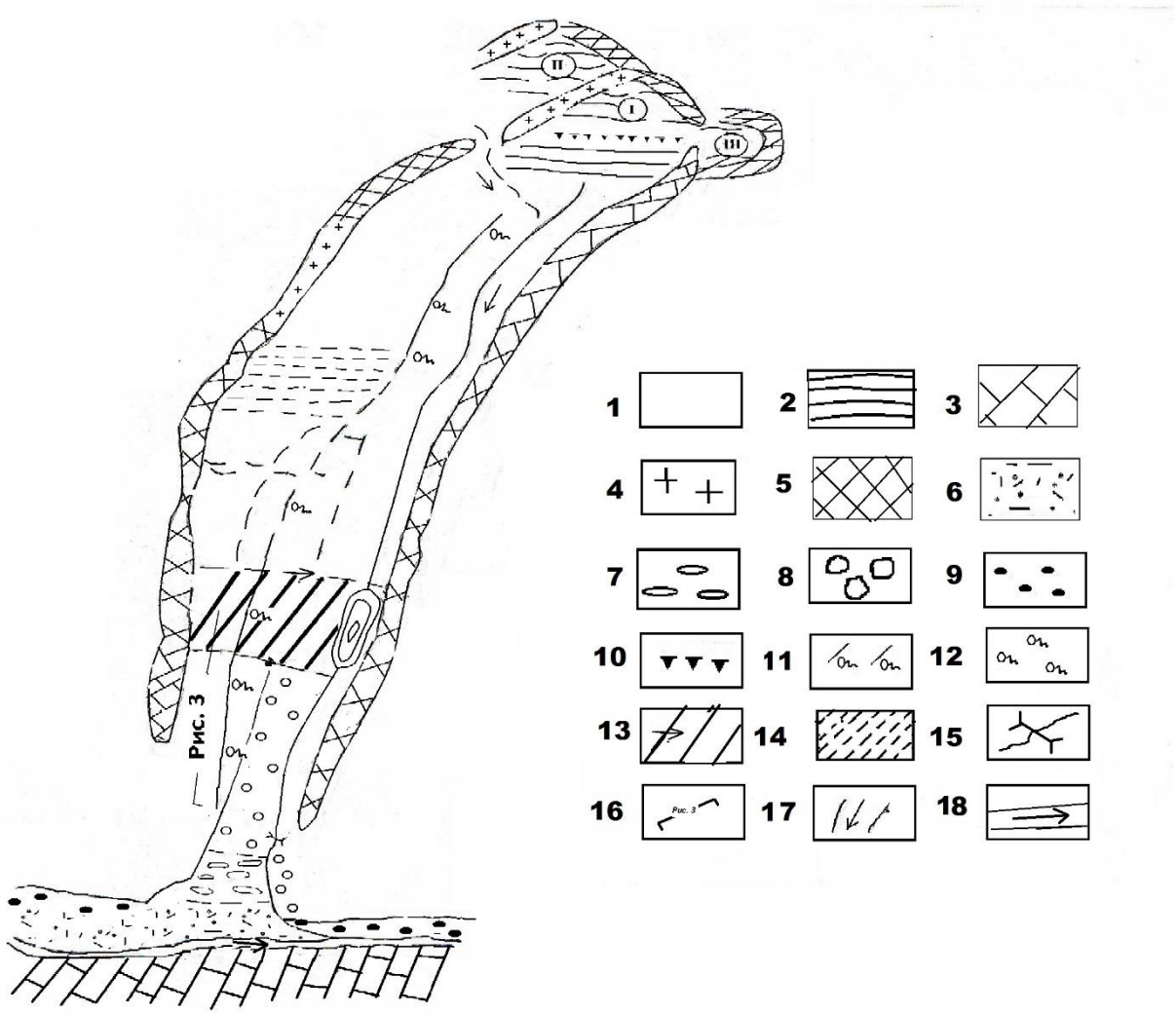

Figure 2: Scheme of the geological structure of the Barkraksai valley with glaciers:
I – Barkark Middle; II – Eastern Barkrak; III – Western Barkrak.
1 – modern deluvial-proluvial deposits; 2 – Early Quaternary and modern formations (moraines). Paleozoic: 3 – carbonates; 4 – acidic intrusions; 5 – metasomatites, skarnoids7.
Alluvial fan deposits (from bottom to top): 6 – sand-gravel containing up to 40 g/t of tantalum; 7 – medium pebble conglomerates of carbonate composition; 8 – large block conglomerates composed of acid intrusive rocks; 9 – different pebble conglomerates with carbonate lenses making up the left bank of the Oygaing River; 10 – inferred coastline of the Paleogene sea; 11 – line of springs on the outcrop of the interstratal waters; 12 – the same, but alleged; 13 – borders of the sliding block; 14 – surface of the dome (tunnel); 14 – technogenic placers; 15 – bridge across the Barkraksay; 16 – location of Fig. 3; 17 – Barkraksay; 18 – river Oygaing.

The sediments of the cone cut older deposits, which are represented by mixed-pebble conglomerates with a total thickness of about 25 m, clearly traced to the west alongside the left bank of the river Oygaing for 1.5 km. A feature of these deposits is the presence of carbonate lenses of cemented conglomerates in their top.
The more interesting feature to us is the end zone of metasomatites on the right bank due to the fact that this area, partially undercut by the alluvial fan, has experienced or is experiencing sliding toward the left bank

(Fig. 2). Approximately 100 m north of this place, on the right bank, along the places where groundwater is cropping out to surface, plane trees (*Platanus orientalis*) are stretched in a line (Fig. 3). They point to the karst processes occurring here, along the contact of carbonate sediments and Paleozoic outcrops, contributing to the displacement of individual blocks of rocks along this line and its continuation in a southerly direction on the right bank.

a  b 

Figure 3: Thickets of the Chinar (Platanus orientalis) along the outcropping of interstratal waters on the right bank of the Barkaraksay (a – southern part of the thickets, b – continuation of the thickets in the northern direction opposite the bridge across the river).

The sliding led to creation of a tunnel (dome) that connected both banks of the Barkraksai and completely blocked its channel for about 150 m. If you stand at the downstream exit of the tunnel, you can hear a continuous loud rumble, the sound of stones falling into the water, which may indicate the presence of a waterfall here, under the vault. Small splashes rising up from the channel do not allow us to see the details of the tunnel roof structure. The overhanging of the vault at the entrance and exit of the tunnel doesn't allow to specify its height, which is probably at least 1.5-2 m.

The existence of an unusual dome in a state of an unstable equilibrium over Barkraksay for a long time allows to consider its origins. Which are landslide processes, according to the following observations. First, the right bank was raised 11 m in relation to the left bank. Second, the sediments of the alluvial fan undercut the right bank, and interstratal waters are pouring out through them. All this contributes to the continuous, not marked visually, sliding of the block of sediments on the right bank towards the left bank. Due to such shift this tunnel-like domed structure is preserved.

The total mass of the dome vault can be around 18 000 metric tons. This evaluation is calculated in accordance to the following parameters of the dome: width 30 m, length 150 m, vault height at least 2 m, with an average volumetric weight of rocks as 2 t/m^3. This doesn't include the rocks of the bank slopes, which will also be involved in the movement. All of the above makes it necessary to conduct hazard monitoring in this part of the Barkraksay basin (Fig. 2). Another solution is also possible, namely, the gradual elimination of this dome by conducting a series of directed low-power explosions in it.

CONCLUSIONS

a) Landslide processes in the right-bank part of the Barkraksai are a combination of the development of interstratal waters along the contact zone of carbonate bed sediments that undercut metasomatites, with their 11 m rising due to tectonic block movement.

b) The phenomenon of coalescence of the river banks under the influence of landslide processes is unparalleled in the glacial valleys of the SouthWestern Gissar and the Western Tien Shan (the right bank of the upper reaches of the Akhangaran River).

c) The tunnel (dome) formed over the channel of the Barkraksai is a real threat in the event of its collapse and sliding of the mass of sediments from the banks, the total volume of which can reach more than 36,000 tons.

It is assumed that landslide processes in the Barkraksay valley can proceed: on the right bank – in the junction zones of intrusive and metasomatic altered rocks and in the area with a constant inflow of interstratal

waters (upper reaches of the valley); on the left bank – in the junction zones of carbonate and metasomatic altered rocks.

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