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Nival moraine – unclassified dry-climate periglacial sediment. Example from Pamiro-Altay Mts.

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Forms related to nival accumulation are recorded worldwide, and the role of nivation in relief formation was studied by many scientists. In classifications used nowadays, adopted in the last two decades, protalus and sub-slope nivation and glacial forms are divided into four types: pronival ramparts, glacial moraines, rock-slope failures and protalus rock glaciers. The existence of terrain forms and sediments not corresponding to the classifications was found during geomorphological research in Tajikistan mountains.

The research, conducted in June 2019, included geomorphological mapping, GPS measurements and photographic documentation. The investigation was performed in the Fann Mountains in the Pamiro-Altay range. The research area elevation is approx. 2400 m a.m.s.l. It is a typical mountainous terrain, with steep slopes and active morphogenetic processes. The studied segment of the valley has a fluvial nature; the valley bed is filled with fluvial and fluvio-glacial sediments. Glaciation did not reach this level of valleys. The maximum range of glaciers, dated at approx. 55 ka, reached 2780 m a.m.s.l. and its distance from the studied area is 5.5 km.

Sediments of undoubted nival origin exist at the fluvial sections of the valley. The occurrence of two forms of nival moraines was recorded in the research area. Both forms of the nival moraine consist of sediments with various grain sizes, with a noticeable prevalence of sands and gravels. Stones, 5-20 cm in diameters, constitute (depending on the site) 5-50% of the sediment volume, with their percentage usually amounting to 10-20%. Larger rock blocks occur individually. The thickness of the sediments varies greatly. In some places the nival material is about a dozen cm thick, while in the place of its greatest thickness it reaches 21 metres. The sediment consists solely of local limestone forming the adjacent rock walls.

The grain size distribution of these sediments is similar to moraine deposits, but its location, relief and local material suggest its classification as a pronival rampart. According to the criteria proposed by Hedding and Sumner, these forms fulfil three criteria of rock glaciers and four criteria of pronival ramparts. The analysis of such forms encourage authors to conclude that these are not intermediate forms between specific types, but a separate type of form not defined so far.

We suggest defining a nivation moraine as a sediment (and at the same time terrain form) originated as a result of accumulation of local material delivered to the valley bottom from

surrounding rock slopes and accumulated on many-years old snow cover of small thickness. The distinguishing features of this deposit include: 1) diversified fraction of the material, typical of moraine sediments, 2) no erratics, the deposit of only local material, 3) no traces of glacial erosion, 4) close neighbourhood of talus slopes enabling nival transport of material, 5) the existence in a dry and cold climate, where the snow supply was small.