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Geomorphology and Ice Content of Glacier - Rock Glacier – Moraine Complexes in Ak-Shiirak Range (Inner Tien Shan, Kyrgyzstan)

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Meltwater originating from the Tien Shan is of high importance for the runoff to the arid and semi-arid region of Central Asia. Previous studies estimate a glaciers' contribution of about 40% for the Aksu-Tarim Catchment, a transboundary watershed between Kyrgyzstan and China. Large parts of the Ak-Shiirak Range drain into this watershed. Glaciers in Central and Inner Tien Shan are typically polythermal or even cold and surrounded by permafrost. Several glaciers terminate into large moraine complexes which show geomorphological indicators of ice content such as thermo-karst like depressions, and further downvalley signs of creep such as ridges and furrows and a fresh, steep rock front which are typical indicators for permafrost creep ("rock glacier"). Hence, glaciers and permafrost co-exist in this region and their interactions are important to consider, e.g. for the understanding of glacial and periglacial processes. It can also be assumed that the ice stored in these relatively large dead-ice/moraine-complexes is a significant amount of the total ice storage. However, no detailed investigations exist so far.

In an initial study, we investigated the structure and ice content of two typical glacier-moraine complexes in the Ak-Shiirak-Range using different ground penetrating radar (GPR) devices. In addition, the geomorphology was mapped using high resolution satellite imagery. The structure of the moraine-rock glacier complex is in general heterogeneous. Several dead ice bodies with different thicknesses and moraine-derived rock glaciers with different stages of activities could be identified. Few parts of these "rock glaciers" contain also massive ice but the largest parts are likely characterised by rock-ice layers of different thickness and ice contents. In one glacier forefield, the thickness of the rock-ice mixture is partly more than 300 m. This is only slightly lower than the maximum thickness of the glacier ice. Our measurements revealed that up to 20% of the total ice of the entire glacier-rock glacier-moraine-complex could be stored in the moraine-rock glacier parts.