The formation and decomposing processes of cryoconite granules on Urumqi Glacier No.1, in Tien Shan Mountains, China

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Cryoconite is the dark-colored surface dust called cryoconite covering the ablation ice of glaciers. Organic and inorganic particles in cryoconite often form spherical aggregations called cryoconite granules. Cryoconite granules can reduce surface albedo and accelerate the melting of glaciers. In addition, cryoconite granules washed out of glacier may contribute to forming organic soils downstream of the glacier. Thus, it is important to understand the forming and decomposing processes of cryoconite granules on and out of glaciers. In this study, we analyzed the size and organic matter content of cryoconite granules collected from various ice surfaces and from the bottom of discharge water stream in the glacial forefield of Urumqi Glacier No.1 in Tienshan Mountains in China, in order to study the forming, maintaining and decomposing processes of cryoconite granules.
Microscopic study revealed that cryoconite granules were observed in at all of the study sites on the glacier. The mean size of cryoconite granules were relatively smaller on the surface in the upper area, near the glacial margins and in the meltwater streams. The results suggest that the life span of granules was limited by low temperature in the upper area, by abundant supply of mineral particles from a rock cliff adjacent to the glacier, and by physical forces of water streams. Cryoconite collected from the discharge water stream in the glacial forefield revealed that cryoconite granules were deposited at the bottom of stream in the area from the terminus to the distance of 100 meters. However, the granules appeared to be the less microbial abundance on the surface of granules compared with that on the glacier. Moreover, the split granules were often observed in the samples away from the glacial terminus. These results suggest that cryoconite granules washed out of the glacier, were gradually decomposed as cryoconite granules were moved down to the downstream.

Keywords: cryoconite, organic matter, glacial forefield, soil

