

EGU21-5347

<https://doi.org/10.5194/egusphere-egu21-5347>

EGU General Assembly 2021

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Tephra layers in Perunika Glacier, Livingston Island, Antarctica

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Perunika Glacier is an 8 km long and 3 km wide roughly crescent-shaped glacier in Livingston Island, South Shetland Islands, Antarctica. The glacier is heavily crevassed in its lower half receiving ice influx from snowfields and from part of the islands ice cap.

Tephra layers recorded in the ice caps are very common in Antarctica, and Perunika Glacier is not an exception. The glacier contains several dark layers of unconsolidated ash (tephra), resulting the most probably from volcanic activities at Deception Island, a large active volcano in Bransfield Strait situated 40 km south of the tephra outcrops on Livingston Island (Pallas et al., 2001). Three eruptions have been documented in recent history – 1967, 1969 and 1970. The most powerful and intensive of which was in 1970.

The ice and tephra stratigraphy seen in the ice cliffs is the result of deposition within the accumulation zone in the interior of the island. The distortion of tephra layers during glacial transport and ablation may result in different local tephra stratigraphies. The distinctive grouping and spacing of the multiple tephra layers is repeated at many localities.

In the cliff of Perunika Glacier there are 10 tephra layers. During the 26th Bulgarian Antarctic Expedition 7 of them were observed, the other were inaccessible. The lower six levels are located at relatively equal intervals and have thicknesses between 3 cm and 5 cm. The layer 7 is situated about 10 m above the others and is 10–12 cm thick. All tephra layers consist predominantly of black and subordinately of red components. In this research is shown data about phase composition of the tephra layers, based on X-ray diffraction analysis.

The obtained phase composition by Powder X-ray diffraction corresponds with basalt and basaltic andesite from the published data on chemical content of the tephroid levels by Pallas et al. (2001). As main phases of samples at 7 assayed levels were determined plagioclase (34–47%) and pyroxene (7–10%). Diffraction lines analysis defines two types of plagioclase – anorthite and sodic anorthite. Comparison between registered diffraction lines and different pyroxene types from the reference database identifies pyroxene from all samples as ferrian diopside. In three of the levels was discovered andalusite (2–6%) and mica (5–7%). Due to low mica content in the samples, it is difficult to define its type by powder analysis. However, in samples from levels 1, 2, 3, 5, and 7 the mica is probably sericite type and in levels 4 and 6 – biotite type. The presence of xenocrystals of andalusite and micas (biotite and sericite) is interesting. Considering their metamorphic genesis, the most reasonable source is the metamorphic fundament of this Antarctic area. The lithotypes it

is built are represented by phyllites, schists, Ca-silicate rock types, marbles, rare amphibolites and fine layers of volcanic metaconglomerates (Marsh, Thompson, 1985).