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A multi-millenial record of rock glacier ice chemistry at Lazaun (Northern Italy)

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Studies on the internal structure of rock glaciers are still confined to a few sites and hardly any data exist on the chemical composition of rock glacier ice. A vertical core of 40 m length was extracted from the active rock glacier at Lazaun (LZRG) in the southern Ötztal Alps (Italy). The ice containing part of the core extends from about 2.8 m down to 24 m depth and consists of two lobes - both a mix of ice and debris, separated by a 2 m thick ice free layer. Radiocarbon dating of embedded plant macrofossil remains indicates that the ice at the base of the frozen rock glacier core dates back to the early Holocene (Krainer et al. 2015).
The two lobes of LZRG show layers of high solute content and peak values of electrical conductivity exceeding 1000 μS/cm, but they differ in acidity and metal concentration - high acidity (minimum pH of 4.15) and high levels of like nickel, cobalt, zinc, manganese, iron and aluminum characterize the upper lobe, while in the bottom lobe neutral to alkaline pH and metal values close to the limit of detection prevail. Solutes accumulated in the ice are attributed to intense weathering of bedrock minerals. Oxidation of pyrite and the production of acidity enhance the solution of metals in the upper lobe. The chemical composition of the LZRG ice core also reveals signals of prehistoric atmospheric deposition from different sources including wood combustion, metal ore mining, and the Minoan volcanic eruption at Santorini.