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Towards improved cirque glacier reconstructions: differentiating glacial- from non-glacial sediments by means of environmental magnetism.

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Skriufonnen, a small cirque glacier (0.4 km^2) in Southern Norway, has been monitored for the last 10 years, revealing a short response time to on-going climate change. This is the only remaining glacier in the central mountain massif known as Rondane where investigations of past climate variability are scarce. A series of short (HTH, n=8) and long (piston, n=6) cores from two lakes located downstream of Skriufonnen were retrieved and sediments were dated and analysed. In order to complement and validate lake sediment interpretations i.e., the potential connection to glacier variability, a number of soil samples was collected from the surrounding catchment.

The six 110 mm piston cores ($<$ 3.1 m length) and eight sediment surface cores were analysed for grain size distribution, geochemical elements (ITRAX XRF-scanning), organic matter content (LOI), magnetic parameters (magnetic susceptibility; surface and bulk), anhysteretic remanent magnetization (ARM) and Saturation Isothermal remanent magnetizations (sIRM). Consistent age-depth relationships were obtained by AMS-C14 and Pb210 dates showing that the cores cover at least the last 10 000 years.

High-resolution analysis (XRF and MS) reveals centennial trends, but also distinct changes in frequency and amplitude. A quiescent period during the Holocene Thermal Optimum (9-6 ka) is followed by a sudden onset of Neoglacial (3.8 ka) activity peaking at 2.4 ka. The Little Ice Age (LIA) peaked at 1800 AD. A weak magnetic signal is observed in all cores. This is explained by the fact that Rondane is made of Sparagmite, an arkosic sandstone partly consisting of metamorphosed sandstone and conglomerate with high content of quarts (SiO_2) (between 80 to 87 %) and Feldspar. The Sparagmite is resistant to chemical weathering, making the soils dry and sandy.

Catchment sediment samples, running in a transect all the way up from the lakes to the glacier snout were sieved into various size classes (250, 125, 63, 38, 20 μm) prior to measuring bulk susceptibility (χbulk) at 293K and 77K. The ratio between the two measurements indicates the relative amount of paramagnetic versus ferromagnetic minerals, and results indicate not only that the finest fractions increase in strength as one gets closer to the glacier front, but also that there are long periods in the cores which is dominated by paramagnetic minerals.

The approach employed here suggests that the combination of catchment samples with high-resolution analysis of lake sediment cores provide a more accurate reconstruction of past glacier variability, and has resulted in the first continuous cirque glacier reconstruction from this area.