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Holocene climate and environment variations from a multi-proxy lake sediment study in Rondane mountain massif, central Norway, and description of a new mid-Holocene basaltic tephra

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Rondane mountain massif in east-central Norway was the first area in Norway to be protected as a National Natural Reserve area in 1962. As a continuation of a recent update to the Quaternary geology map, the Geological Survey of Norway (NGU) has initiated detailed stratigraphical analysis of lake sediments and terrestrial deposits in central Rondane. The aim is to facilitate a deeper understanding of the regional deglaciation pattern, and Holocene climate and environmental evolution. Climate variations have controlled the evolution of flora and fauna, which in turn has influenced at least 4000 years of human activity in this relatively continental, high-alpine mountain region.
The first cores from Lake Rondvatnet, an elongated (3 x 0,4 km) tectonically controlled lake in a valley which cuts through the central Rondane massif, have been analyzed for density, magnetic susceptibility, x-ray radiography, XRF multi-element analysis , TOC and pollen content. Ground penetrating radar together with surficial soil mapping was used to visualize sub-bottom sediments in the lake and surfical deposits south of the lake, which is connected to the lake deglaciation history.

The results show a 10 000 year Holocene stratigraphy (radiocarbon dates of organic production onset) characterized by high variability in organic primary production and varying activity of slope processes in the catchment. These variables are closely linked to post-glacial climate evolution with high primary production and little slope process activity in the first half of the Holocene and a different pattern of biologic activity and higher frequency of minerogenic turbidity layers, connected to gravitational processes, after 5000 cal. yr. BP. In the lowermost core sections, glaciofluvial sediments from the last regional deglaciation display a complex pattern with three units; two fine-grained laminated units separated by a sand-layer. Magnetic susceptibility and statistical analysis of the XRF element data shows that these units differ in mineralogical composition and hence provenance, possibly indicating a complex glacial retreat and re-advance pattern. Moreover, a previously undescribed mid Holocene (∼6000 BP) basaltic tephra layer were found and analyzed. This tephra layer may form a future important time marker for similar studies in the region.