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Variations of soil profile characteristics due to varying time spans since ice retreat in the inner Nordfjord, western Norway

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In the Erdalen and Bødalen drainage basins located in the inner Nordfjord in western Norway the soils have been formed after deglaciation. The climate in the upper valley part is sub-arctic oceanic with an annual areal precipitation of ca 1500 mm. The lithology in Erdalen and Bødalen consists of Precambrian granitic orthogneisses on which Leptosols and Regosols are the most common soils. Parts of the valleys were affected by the Little Ice Age glacier advance with the maximum glacier extent around 1750 BP.

In this study five sites on moraine and colluvium materials were selected to examine the main soil properties of the most representative soils found in the region. The objective was to assess if soil profile characteristics and pattern of fallout radionuclides (FRN's) and environmental radionuclides (ERN's) are affected by different stages of ice retreat. Soil profiles were sampled at 5 cm depth interval increments until 20 cm depth. The Leptosols on the moraines are shallow, poorly developed and vegetated with moss and small birches. The two selected profiles show different radionuclide activities and grain size distribution. At P2 profile where ice retreated earlier (ca., 1767) depth profile activities of FRN´s are more homogenous than in P1 that became ice-free since ca. 1930. The sampled soils on the colluviums outside the LIA glacier limit became ice free during the Preboral. The Regosols present better developed profiles, thicker organic horizons and are fully covered by grasses. Activity of ^{137}Cs and ^{210}Pb$_{ex}$ concentrate at the topsoil and decrease sharply with depth. The grain size distribution of these soils also reflects the difference in geomorphic processes that have affected the colluvium sites. Lower activities of FRN´s in soils on the moraines are related to the predominant sand material that has less capacity to fix the radionuclides. Lower ^{40}K activities in Erdalen as compared to Bødalen are likely related to soil mineralogical composition. All profiles show disequilibrium in the uranium and thorium series. These results indicate differences in soil development that are consistent with the age of ice retreat. In addition, the pattern distribution of ^{137}Cs and ^{210}Pb$_{ex}$activities differs in the soils related to the LIA glacier limits in the drainage basins.