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Observing and simulating soil development using a chronosequence of cold raised marine terraces on Spitsbergen

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The coasts of Spitsbergen are covered with raised marine beaches, developed under the isostatic rebound after the Last Glacial Maximum. This chronosequence of beaches provides a unique chance to study the speed of soil forming processes in cold and dry Arctic regions. Fieldwork was performed on gravelly marine beaches in the Ebba valley, central Spitsbergen, with ages ranging from 3.000 up to 14.000 years. The soils on 30 random selected locations were described and sampled. Results indicate several soil forming processes, which have a strong dependence on time, but also on landscape setting and vegetation presence. These processes include the accumulation of organic matter, aeolian deposition of sand and weathering and dissolution of the limestone gravel that dominates the parent material. This last process results in translocation of silt through the profile, creating silt caps on remaining limestone gravel, and when enough silt is accumulated, a Bl horizon. The carbonates from the limestone form precipitates under the gravel grains. Results support the notion that even under cold, permafrost conditions, soil formation and particularly weathering can still happen reasonably fast if some water is available. Using an early version of soilscape model LORICA, some of the pedogenic processes are simulated in order to get better insight in their dynamics and distribution in the study area. The model links geomorphic processes such as aeolian deposition, isostatic rebound and erosion to the vertical development of the soil profiles in the area.