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# Geochemistry of a buried paleosol of Eemian age at Asklev, Denmark

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Buried soil surfaces are rich sources of information about past fauna, vegetation development, glacier dynamics, and climate variations However, in Denmark such former surfaces are very rare, as they rarely have escaped the intensive erosion below and in front of the Scandinavian ice sheets during the previous cold stages. Here we present a well-drained paleosol found extensively in a large gravel pit in the central part of Jutland, Denmark. The paleosol is suggested denoted the “Asklev paleosol”.

The Asklev paleosol is a well developed Podzol in sandy till of late Saalian age – the Asklev Till. The Asklev podsol is covered by fluvial sand in which another weaker podsol is present. Thermo-luminescense dating of the sand layer revealed an age of c. 100 ka BP, i.e. that the soil surface was buried in the early Weichelian. The surface was thus stable during the entire Eemain interglacial and subject to pedogenesis for >15.000 years. Discordantly resting on the fluvial sand is about 1.5 m of sandy till with an undisturbed grey lower part and a brown cryoturbated upper part. Fabric analyses from the lower grey part of the till reveal an ice movement from the SSE. This till is deposited during MIS 4 in middle Weichselian

Thin sections from the Podzol’ show that the buried A-horizons micromorphology is not fully comparable to present-day Podzols in the region as it has a well developed argillic horizon below despite the parent material low in clay (< 3%). In contrast to modern Danish Podzols it also retain ample evidence of burning (charcoal) and frost features (capping).

The Asklev paleosol classify as a Placic Podzol, but is a typical bi-sequum with a Bt-horizon at depth. Its content of organic C is up to 38 mg C/g soil in the A-horizon, 8.4 mg C/g soil in the Bhs-horizon, which decreases to <1 mg C/g soil in the C-horizon. Carbon-to-nitrogen ratios range from 80 in the E-horizon to 25 in the C-horizon. Concentrations of heavy metals is low with maximums of 3.7 mg Ni/kg soil, 16.4 mg Cr/kg soil, <0.05 mg Cd/kg soil, 6.7 mg Pb/kg soil and 33 mg Cu/kg soil. Arsenic concentrations vary from <0.1 mg/kg soil in the E-horizon to 4.7 mg/kg soil in the Bt-horizon.

Comparing the geochemistry of the Asklev paleosol with a modern analogue Podzol in a nearby natural, ancient woodland reveal a general higher content of heavy metals in the paleosol. These differences reflect a combination of different parent materials, modern-day pollution rates, losses/additions during the c. 90 ka where the soil has experienced permafrost, and the c. 10 ka with moist conditions during the present interglacial.

The combined methods together reflect a soil surface from the previous interglacial which may act as an important reference for modern-day soil chemical status and e.g. pollution rates, especially if enough sites with the Asklev paleosol is analysed.

Keywords
Soil, Paleosol, heavy metal, Geochemical background concentration, Glacial stratigraphy