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Geochronology of initial soils in Late-Holocene polycyclic drift-sand deposits (Weerterbergen, S.E. Netherlands)

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Late glacial aeolian coversand dominates the surface geology of the eastern part of the province Noord-Brabant (Netherlands). During prehistoric and early historic time, forest grazing, wood cutting and shifting cultivation gradually transformed natural forest into heath land. During the 11th – 13th century, commercial clear cutting of forests caused sand drifting. Farmers protected the heath against drift sand and continued till 1750 AD with shallow stable management. In the course of the 18th century deep stable management was introduced and farmers started with sod digging on the heath to increase the total amount of manure. Sod digging resulted in a second period of extension of driftsand landscapes with characteristic 'cultural' landforms and soils. Polycyclic driftsand deposits are paleoecological records of alternating instable (sand drifting) and stable (soil formation) phases in landscape development.

Interpretation of paleoecological information, derived from these records, requires accurate knowledge of the geochronology. Radiocarbon dating, applied on extracted soil organic matter from humic buried AE horizons is not reliable. Calibrated 14C ages of seven selected buried 'micropodzols' range from 340 – 1950 AD.

To understand the geochronology of polycyclic sequences, we applied soil micromorphology to improve our knowledge about the organic matrix of micropodzols and OSL dating.

Micromorphological analysis of thin sections of micropodzols provide more information about the composition of SOM of the humic horizons. SOM consists of post sedimentary compounds, related to soil formation. We can identify soil fungi, fragmented litter and fecal pellets as the results of litter decomposition. But SOM contains also sin sedimentary compounds, related to sand drifting. We can identify transported and rounded organic aggregates, mineral grains with organic cutans and charcoal fragments, originating from eroded (older) soil horizons. Consequently, the 14C dates of extracted SOM are indeed not reliable.

OSL dating works excellent for aeolian sandy deposits with a high percentage of quartz grains. The OSL age is defined as the time after the last bleaching by solar radiation of mineral grains. In contrast to 14C dating, application of OSL dating provides accurate information over the age of top and bottom of deposited sand beds and consequently over the time, available for soil development. Based on OSL dates, the micropodzols developed between 1700 and 1950 AD and reflect relatively stable periods (soil formation) in the landscape development after the introduction of the deep stable management.