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The added value of biomarker analysis in paleopedology

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Paleosols are important soil archives in landscape evolution studies. The impact of (pre)historical land use systems on landforms and soils in Dutch cultural sandy landscapes can be reconstructed by pollen analysis, in combination with 14C and OSL dating, of humic horizons in polycyclic driftsand deposits and plaggic antrosols.

A polycyclic driftsand sequence is the result of several cycles in landscape evolution, each consisting of an instable period with sand deposition followed by a stable period with soil formation (initial podzols). Pollen grains of relevant species as Pinus, Calluna and Poaceae can be deposited onsite or transported from the surroundings. As a result, pollen diagrams show regional environmental change, but do not allow for a reliable determination of the local onsite vegetation during geomorphological stable periods when soil formation took place. The application of biomarker analysis provides relevant onsite information about the vegetation development.
Biomarkers in the form of plant-specific concentrations ratios of C20-C36 n-alkenes and n-alcohols, extracted from the same soil samples as used for pollen extractions, are associated with onsite produced soil organic matter and our preliminary results show they provide reliable information about the vegetation present during the development of the initial podzols in polycyclic driftsand sequences.

The interpretation of pollen spectra of plaggic horizons is complicated by the mix of pollen, produced by the onsite vegetation, aeolian transported pollen from the surroundings and pollen, present in the plaggic manure. An important factor in the interpretation of the environmental impact of plaggen agriculture on landscape evolution is related with the source areas of the plaggic manure such as forests, grasslands and heath. Also in this setting, our tentative results show that the application of biomarkers to determine source areas of the sods may be more reliable than palynological interpretations.

Altogether, biomarker analysis improves the interpretation of paleoecological records to landscape evolution and as such is of significant added value in paleopedological research where determination of onsite vegetation is of great importance.