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Geoarchaeological approach for palaeoenvironment and local climate reconstruction in Holocene

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The landscapes of Northern Germany have been subject to various anthropogenic factors that significantly influenced their development. For this reason past anthropogenic influence should never be ignored when analyzing the present situation and making prognosis for the future. Climate has been recognized as one of the most important factors affecting palaeohuman behavior and cultural landscape development. There have been plenty of attempts to reconstruct palaeoenvironmental situation by methods of different sciences, from history and archaeology to geology and soil science.

The properties of soil profile and colluvial deposits serve as a powerful tool for geoarchaeological reconstruction of palaeoenvironmental conditions. The sequence of colluvial layers, their properties, presence of structural disturbances in the profile carry important information on palaeoclimatic conditions and give a better understanding of ancient societies. This has been analyzed for an area in Northern Germany using four-dimensional approach of landscape analysis. The area has been abandoned from the agricultural land use some ten years ago.

Morphological and structural properties of the profiles allowed identifying presence of structural disturbances, while the specific properties of these structures indicated their origin. Inversion and vertical structure of the layers pointed out that these formations were windfalls that were formed during extreme weather events e.g. storms. Shape of windfall holes can indicate past wind directions. Fragments of relict horizons can be conserved in these structures, whereas this material cannot be found anywhere else in the area due to erosion processes. For example, traces of podzolic horizon were morphologically identified in the windfalls. Quantitative characteristics of the preserved material in combination with charcoal analysis and radiocarbon dating help making hypotheses on land cover of the region and palaeolandscape development.

Nowadays magnetic susceptibility is being used as an indirect indicator of environmental development in the past as well as in the present. Magnetic susceptibility helps to differentiate between the topsoil, subsoil and parent material facilitating the study of soil distribution on time scales from months to thousands of years. On the basis of magnetic susceptibility of buried soils, quantitative reconstruction of palaeoprecipitation is possible. The field data allowed establishing a connection between the values of magnetic susceptibility and the size of the catchment area along with hydrological regime.

Statistical properties of colluvial deposits distribution show at which stage of land surface development (accumulation/denudation) these deposits were conserved. Predictive maps of colluvial deposits distribution allow calculating volume of colluvium in landscape in total and in considered historical period. Based on this, the impacts of palaeohuman activity and natural extreme events on landscape can be assessed.