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PALEOSOLS AND MODERN SOILS AS STAGES OF CONTINUOUS SOIL FORMATION

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A scientific base was developed for paleosol mapping. Maps of soils dated to various Pleistocene stages were compiled for the Ukrainian territory (M.F. Veklich, N.A. Sirenko, Zh.N. Matviishina). A.A. Velichko and T.D. Morozova (Laboratory of Evolutionary Geography, Institute of Geography RAS) compiled soil maps of Europe and later – of Northern Eurasia for the Mikulino (Eemian) Interglacial (125 ka BP), the Bryansk interval (32-24 ka BP), and others.

The team of the Laboratory of Evolutionary Geography headed by A.A. Velichko uses spatial paleosol reconstructions as models in order to assess modern soil response to changes in hydrothermal regime under the man-induced climatic warming; in particular such modes are applied to forecast of the moisture content in soils (A.A. Velichko, L.O. Karpachevsky, T.D. Morozova).

Data obtained by M.A.Glazovskaya suggest a great importance of paleosols as "carbon depots". According to the data, "the fossilized carbon exceeds that of modern soils by an order of magnitude". Based on those results, M.A. Glazovskaya estimated the carbon budget in the past. A.A. Velichko and T.D. Morozova considered the humus resources dynamics at the extrema of the Late Pleistocene macrocycle (the interglacial optimum 125 ka BP, LGM 18 ka BP, and the Atlantic optimum 6-5.5 ka BP).

Those are some of essential results of the paleopedology by the turn of the millenium. One may hope that the results would be elaborated in the course of further research due to new research techniques, new dating methods and expanding of investigations over new regions.

A paleopedological approach to discover the nature of ancient Maya fertiliser

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The Yucatecan Maya developed an advanced civilisation based on poorly known systems of intensive agriculture in a region with a seasonally dry tropical climate. The shallow Lithosols and Rendzinas of this region would have constrained agriculture because they contain little organic matter, fix phosphorus and lose other nutrients by rapid leaching. How could these people provide enough food to sustain for several centuries a greater population density than today's in both rural areas and urban centres? Some present-day Mayan communities still practice complex agriculture and agroforestry systems using various organic materials as fertilisers, and the ancient Mayan civilisations may have done the same rather than practice slash and burn agriculture. The soil cover of an ancient rural Mayan settlement (a complex series of rock alignments) in a wetland area of El Eden Ecological Reserve (northeast of the Yucatan Peninsula in the State of Quintana Roo, Mexico) was the subject of an interdisciplinary study. The reserve has two distinct ecological areas: swamps in temporarily flooded depressions, and dry tropical forest in higher areas. The dry forest areas have shallow soils poor in humus and nutrients. However, in the swamps there is a periphyton composed of filamentous and other algae, fungi, protozoa, bacteria and other micro-organisms, which is rich in phosphorus and nitrogen and could have been used by the ancient Mayans as a fertiliser. In a glasshouse experiment the periphyton had a positive effect on plant growth. We are currently looking for phytoliths or other residues of the periphyton in ancient agricultural

soils of the area to confirm its use as a natural organic fertiliser by the ancient Mayan people.

Micromorphological studies of a younger Pleistocene loess-palaeosoil-sequence (site Mainz-Weisenau, Rhineland, Germany)

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In the Mainz Basin, at the northern edge of the Upper Rhine Lowland, a loess-palaeosoil-sequence of the last (Wisconsinan or Würm) glaciation is found at the site of Mainz-Weisenau.

Three palaeosoils of early Würm interstadials, the so-called Moosbacher Humic Zones, are found, each separated by loess strata. We refer to them as Lower, Middle, and Upper Humic Zone, respectively.

The lower part of the **Lower Humic Zone**, the so-called mottled zone, features an irregular pattern of darker and more brightly couloured structural elements, ranging in size from a few millimeters to some centimeters. The dark elements are more densely packed than the brighter ones and have an slightly higher clay content. The clay of which they consist shows a dark color, probably due to extremely fine and evenly distributed organic matter. The brighter elements have a lower clay content, the clay lacks the dark color and the porosity of the matrix is higher.

The **loess** overlying the Lower Humic Zone is rich in carbonate with 20–25% approximately (estimation from thin-section observations). Many of the carbonates distributed in the matrix show characteristic forms which proof that they derive from destroyed root-tube fillings and carbonatic hypocoatings. These were destroyed and mixed into the soil matrix due to loess redeposition and, partially, vertical turbation.

The **Middle Humic Zone** has a moderate carbonate content only (estimated to be about 4–7%). Clay-sized and fine silt-sized Calcites, having been dissolved, are nearly absent. Calcites of bigger size show marks of corrosion.

This humic zone is the most distinctive one, showing dark-brown, humic components with high clay content, which surround the coarse particles and as well form small aggregates. The clay does not show any microscopically visible humus particles, though. To the contrary, humus particles are visible in the coarser part of the matrix, where occasionally even opaque coarse-silt-sized humus particles are found.

The **Upper Humic Zone** is characterized mainly by its high content in calcitic earthworm biospheroliths (about 25 biospheroliths in a 20 cm^2 thin-section). This, together with earthworm tubes and feacal aggregates, proves a high biologic activity during this interstadial.

This study proves the distinctive character of the Humic Zones within the younger pleistocene palaeosoils in the study area.

Growth rates of pedogenic carbonate cutans on clasts

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Pedogenic carbonate pendants, or cutans, on coarse rock fragments are common in stony soils of arid, semi-arid and semi-humid regions and can occur in humid areas in