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PALAEOPEDOLOGY AND ROCK MAGNETISM OF THE UPPER PLEISTOCENE LOESS-PALAEOSOL SEQUENCE AT SMYKIV (NW UKRAINE)

The Upper Pleistocene sequence at Smykiv is one of the best developed loess-palaeosol sections of north-western Ukraine. The section is situated in the central part of the Volyn Upland (50°28.18' N, 25°08.22' E), on the slope of the deep road cut near Smykiv village (Rivne region). The section is on the right slope of the Dezha River (middle stream), a small left tributary (only 10 km long) of the Styr River.

The loess-palaeosol sequence comprises 13 stratigraphic units: 6 palaeosols and 7 non-soil beds. The section was studied by palaeopedological, micromorphological, grain-size and rock magnetic methods. The palaeosols were classified according to the World Reference Base for soil resources [1], and micromorphological features of palaeosols were described according to the terminology of [3, 4]. Grain size has been measured according to the pipetting technique [2].

The lowermost unit in the section, Dnipro, is represented by thick (over 5 m) laminated loamy sands with several levels affected by cryoturbation that enabled to interpret these sediments as periglacial alluvium.

The Kaydaky unit (MIS 5e) is represented by a soil with distinct textural differences: AEb@ and EBtb@ horizons are loamy sands, whereas Btgb@ horizon is a silt loam. Albeluvic glossae here penetrates the argic horizon, which, along with an abrupt textural difference, meet criteria of Retisol [1]. Micromorphology of the soil is characterized by numerous clay coatings with humus impurities in the Btgb@ horizon, platy microstructure with bleached micromass in the EBtb@ horizon and by an expressed microzonality in the AEb@ horizon.

The Pryluky unit (MIS 5c-a) includes three relatively thin soils separated by cryogenic levels (namely solifluction and soil veins). The lower soil (pl_{1b}) is the darkest in the section and is leached from carbonates, therefore the soil is classified as Haplic Phaeozem. This soil is characterized by a weak granular microstructure, and thin Fe-Mn hypocoatings, and has no signs of b-fabric. The middle soil (pl_{3b1}) is a thin humified soil, not affected by solifluction, which consists only of the Ab horizon. Thus, the soil is classified as Brunic Solimovic Regosol. This soil has a platy microstructure with pronounced brown humus punctuations. Here, the roundness of the sand grains increases, indicating intense sedimentation. The upper soil (pl_{3b2}) comprises the Akb@ and Bwkb@ horizons. The soil is disturbed by cryogenic features (solifluction, soil veins and reticulate post-cryogenic texture). The soil is characterized by many carbonate pedofeatures, particularly calcite hypocoatings and needle-fiber calcite. Thus, the soil is classified as Calcaric Solimovic Regosol.

The Uday unit (MIS 4) comprises loess and solifluction beds, both calcareous and silty. Carbonates are both secondary and primary with an explicit predominance of calcified root cells and soft nodules. The micromass is micritic and microstructure is rather platy with occasional granular peds.

The Vytachiv unit (MIS 3) is represented by Gleyic Cambisol with Agb and Bwb horizons. The soil is silty and calcareous (thin carbonate hypocoatings and typic nodules). The microstructure is weak blocky and granular with the silt concentrations on the walls of granule. The Cambisol is overlain by thin tundra gley.

The Bug unit (MIS 2) consists of loess and solifluction beds. The latter is dominated by brown soil material. Soft carbonate nodules and calcified root cells dominate the solifluction bed, whereas disperse powdery lime and pseudomicellia dominate the loess bed.

The Dofinivka unit is represented by a weak calcareous soil with pronounced redoximorphic features in the Bgkb horizon. Moreover, in the Bgkb horizon there are many carbonate rhizoliths and Fe-oxide depletion hypocoatings, whereas Awkb horizon is characterized by weak platy, granular and crumby microstructure. Therefore, soil is classified as Calcaric Gleyic Brunic Regosol.

The Prychornomorya unit is represented by a genuine calcareous loess, where carbonates are represented exclusively by disperse micrite.

The Holocene soil is truncated, including relatively shallow chernic horizon and calcareous Bk horizon that enables to interpret Holocene soil as Calcic Chernozem. Recent soil is characterized by darn brown humus and spongy microstructure with soil fauna excrements.

The grain-size data of the Smykiv section reveals two periods with principally different depositional environment. The first period includes late Dnipro, Kaydaky and Plyluky times showing high sedimentation rates of sands presumably of aeolian origin. In the late Pryluky times (pl_{3b2}), drastic changes in depositional

environment occurred, and a period of silt sedimentation began, which was probably caused by the rebuilding of the Styr river valley.

Mass specific magnetic susceptibility shows low values in all loess, palaeosol and aeolian sand samples (7−20 × 10^{-8} m^3kg^{-1}), with the exception of the Holocene soil (up to × 10^{-8} m^3kg^{-1}). This suggests very low concentration of ferrimagnets, in particular, lower content of soft magnetic minerals was revealed by magnetic-mineralogical parameters (IRM, S ratio, HIRM). This is typical for other loess-palaeosol sequence of the Volyn-Podillia Upland (Boyanychi, Korshiv, Medzhybizh).

At Smykiv, the Pryluky–Kaydaky palaeosol series demonstrate a higher degree of pedogenesis (indicated by mean $\chi_{fd\%}$ values in the section up to 12–13%) compared to that in the younger interstadial palaeosol units (only 3–3.5%). Relatively high $\chi_{fd\%}$ values (6%) are also observed in the Prychornomorya loess and pseudomorphs (due to reworking by soils).

Rock magnetic data from the Smykiv section supports the hypothesis of the transitional type (between “Chinese” and “Alaskan” types) of palaeoclimate record in north-western Ukraine.

Thus, the high stratigraphic variability of palaeosols at the Smykiv site and nearby sites indicates their high sensitivity to global and regional palaeoenvironmental changes, emphasizing the potential of the sequence for the further interdisciplinary studies.

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