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Microfabrics of Buried Soils in Loess Sediments of the Lower Volga Basin

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Soils develop under the direct influence of climatic parameters, and they retain environmental information in their features (soil memory: Targulian and Goryachkin, 2008). Micromorphological features have their own soil memory, which makes it possible to distinguish between the results of pedogenetic processes under different environmental conditions and to specify the genesis of sedimentation processes. Buried soils provide an excellent opportunity to reconstruct paleoenvironments preceding their burying. The Lower Volga basin experienced considerable changes due to fluctuations in the Caspian Sea level together with other responses to glacial-interglacial cycles in the Quaternary. Numerous horizons of buried soils have been recorded in sedimentary sequences, and they have been used for stratigraphic correlations and paleogeomorphic reconstructions in the area (Konstantinov et al., 2016). However, the study of paleosols as a paleoenvironmental proxy has not been performed until now.
Micromorphological studies of a section of soil–sedimentary sequence were performed for the natural escarpment 1 km from Volgograd (48.7005277 N, 44.89330709 E, 16 m asl). It was found that the buried soil had been formed under subaerial conditions with loess sedimentation alternating with the periods of fluvial and marine sedimentation. The soil–loess sequence (MIS1–MIS5) includes six paleosol layers separated by sediments of different compositions and geneses. Longer periods of interruption of sedimentation processes predetermined the formation of better developed soils.
All the soils are polygenetic and contain contrasting sets of macro- and microfeatures reflecting different stages of pedogenesis: (1) steppe pedogenesis marked by well-shaped humus horizons with biogenic aggregation, diverse carbonate pedofeatures, and mole tunnels; (2) hydromorphic pedogenesis marked by gleyed mottles and Fe–Mn nodules that could be formed under conditions of long floods; (3) cryogenic pedogenesis under the influence of syngenetic (MIS3) and epigenetic (MIS5) cryogenesis marked by frost cracks, ring-shaped arrangement of coarse fractions, fissuring of quartz grains, and specific aggregation.
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