POSTGLACIAL MANTLE LOAMS FORMATION OVER LATE PLEISTOCENE ENVIRONMENTAL CHANGE

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INTRODUCTION

Loamy sedimentary sequences are widespread in interfluvial landscapes of the Moscow (Saalian) glaciation marginal zone of the Russian Plain. Loamy mantle is considered polygenetic sediment in catenae and monogenetic in a local approach. Recent research reveals strong complexity in stratigraphic and morphological organization causing genetic and chronostratigraphic interpretation problems. Nevertheless, detailed geographic and lithological research allows for catenary chronostratigraphic correlation of mantle loams.

METHODS

The study was based on specific methodology of hierarchical morphogenetic approach. The approach allows considering complex mantle loams subsequently on different hierarchical scales – from macro- to submicroscale. The Mid-Protva River Basin and the Borisoglebsk Upland interfluves are case study sites.

RESULTS AND DISCUSSION

Postglacial interfluve deposits at the Middle Protva River Basin have an average thickness of 2-3m and is usually characterized as a binomial stratum. Complexly arranged sandy silty loams with clastic inclusions are covered by homogenous clayey-silty loams. Plastic type cryogenic deformations (cryoturbations) are common in lower part of the sequence within glaciofluvial and glacial contact zones. Ice-wedge casts occasionally penetrate both postglacial and glacial units. In places, the entire sedimentary cover of hilltops and slopes is unstratified and does not correlate with relict cryogenic topography of the last periglacial.

Thick postglacial sedimentary sequence of up to 13m covers the NE Borisoglebsk Upland. At hilltops, Moscow till is overlain by a contrastingly stratified glaciolacustrine unit 1-6m deep represented

by interbedding silty-sandy loams and sands. Upward, it is gradually replaced by a 1-1.5m layer of finely laminated silts. They most likely deposited in shallow residual lakes with significant aeolian input at the final stage of the Moscow ice cover degradation. Contact zone of the latter two is cryoturbated. Overlying complexly arranged non-laminated silty-loamy deposits 0.9-2.2m thick possess prominent traces of complex cryogenic, pedogenic and slope reworking. They are organized in large (up to 2m deep) cryostructures. Curvy boundaries indicate plastic cryodeformations supposedly in frost mound landscapes. Homogeneous clayey-silty mantle loams 0.8-1.2m thick cover the disturbed sedimentary complex.

From actual surface, the entire post-glacial sedimentary sequence is fractured by polygonal desiccation and ice wedge cracks of the latest cryogenic horizon. It is reworked by Holocene pedogenic processes causing formation of a polygenetic, texturally differentiated soil profile. Distinct signs of relict pedogenesis were found inside the deep soil horizon. Fragments of clay cutans and elements of pedogenic structures are shattered by plastic cryogenic deformations.

CONCLUSIONS

Considering the investigated arrangements of postglacial deposits at the case study interfluves at the Moscow glaciation marginal zone, regardless of their allocation, topography and geological structure, the cover distribution pattern attributes only to the upper pack of homogeneous clayey-silty loams. Underlying heterogenous stratum of postglacial (glaciofluvial, lacustrine and aeolian) sediments generally is not continual due to polygenetic nature and superimposed pedolithogenesis and cryogenesis since the Late Pleistocene. Although the traditional paleogeographic indicators are lacking in the interfluve sedimentary sequences, the set of lithologic, cryogenic and paleosol features allows reconstructing at least four environmental shifts. Plastic epi-cryogenic deformations in the two underlying glaciolacustrine and subaerial horizons suggest high water content in deposits. The former period is associated with intensive freezing under shallow water conditions. The latter excess of moisture was due to a contrasting continental climate providing a significant (more than 2m) depth of active layer against a background of severe winters and high temperature amplitudes. However, an event of texturally differentiated soil formation developed in a warmer climate between two cryogenic epochs. Dominant polygonal cryostructures showing from the actual surface attest to more severe cryoarid conditions in the Late Valdai period, contrary to the highly moistened or subaqueous environments, respectively, of the Early or Mid-Valdai and the end of the Mid-Pleistocene.