POSTGLACIAL INCISION-WIDENING-INFILL CYCLES AT THE BORISOGLEBSK UPLAND: CORRELATIONS BETWEEN INTERFLUVE HEADWATERS AND FLUVIAL NETWORK

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INTRODUCTION

Postglacial fluvial network history of the central Russian Plain is complex and heterogeneous regarding both temporal framework and leading development agents. Modern valley systems inherit many relic features including excessively large width inconsistent with present runoff conditions, highly elevated terraces (both depositional and erosional), thick bottom sedimentary infills partly incised by modern gullies, inactive headwaters almost infilled and disconnected from the presently active fluvial network, etc. Such distinct footprints can be related to much higher intensities of fluvial and other associated processes in the past. For the Upper Volga region located within the last Middle Pleistocene (Moscow – Saalian) glaciation marginal zone, the phase of uninterrupted fluvial network evolution is limited to the later glacial-interglacial climatic cycle. More than 20 sections of Quaternary deposits have been thoroughly described in the area forming the stratigraphic framework for reconstructing postglacial landscape evolution. Geomorphological events with prominent stratigraphic representations are concentrated largely within the fluvial network. Hence, most of the landscape development reconstructions were strongly biased towards understanding fluvial sediment sequences, landforms and network evolution, and corresponding incision-widening-infill cycles. Unfortunately, until present such reconstructions remained controversial and unsupported by reliable absolute dating and chronological correlations with simultaneous processes in the upper reaches and headwaters through the major landscape shifts.

METHODS

The Borisoglebsk Upland case study area belongs to the long-existing Nero Lake basin. The latter remained local base level since the Moscow ice cover decay. Local fluvial network evolution was largely controlled by the Late Plestocene – Holocene lake level fluctuations. In attempt to reconstruct the past extent, density and distribution of fluvial systems and to correlate the incision-widening-infill cycles between their presently dynamic and inactive parts, an interdisciplinary research of the present and buried topography, lithology and pedogenic properties of surface deposits has been carried out. Several independent approaches were combined: detailed geomorphic descriptions and DGPS profiling, remote sensing data interpretation, description of geological sections and cores followed by comprehensive analysis of grainsize, chemical and organic contents, pedogenic features on macro, meso- and micromorphological levels, and absolute ^{14}C dating of organic-rich layers.

RESULTS AND DISCUSSION

Integrating the available results, we propose a scenario of the landscape evolution for the Moscow glaciation marginal zone over the last ca. 150 ka. First stage involved ice cover degradation and series of successive glaciofluvial incisions strongly controlled by local supraglacial and moraine-dammed proglacial lakes dynamics. Those were interrupted several times by the continuing glaciolacustrine accumulation at lower levels. The following stage during most of the Mikulino interglacial was associated with general landscape stabilization and pedogenesis. During the Late Pleistocene periglacial, upper parts of glaciofluvial depressions were gradually infilled and smoothened by heterogeneous deposition followed by one more distinctive incision period. Deposition in the middle reaches was interrupted by at least three distinctive incision episodes marked by erosive contacts and stratigraphic hiatuses.

CONCLUSIONS

Late Moscow glaciofluvial and Valdai fluvial systems were much denser and had greater extents than the present-day fluvial network. The latter often inherits their lower parts. However, it does not penetrate as far into the most elevated parts of interfluves and infilled headwaters where no signs of modern fluvial activity are observed (except for small steep gullies on hillslopes disconnected from the main network). That suggests much higher surface runoff discharges during the late glacial and some postglacial stages. It can be explained, respectively, by the excess glacial meltwater discharges and widespread permafrost causing substantial increase of surface runoff coefficient.

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