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Relic Late Pleistocene fluvial forms as geomorphic archives indicating periods of high climatic runoff over the East European Plain

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In water balance estimations within palaeoenvironmental studies river runoff is estimated as the difference between precipitation and evapotranspiration. The other technique is numerical modeling using general circulation models. Both approaches fail to recognize epochs of extremely high surface runoff characteristic for the Pleistocene cold epochs and recorded in geomorphic outcomes of this runoff. We have studied two kinds of such archives that have wide spatial coverage over the East European Plain (EEP).

1. Post-LGM large palaeochannels (macromeanders) in river valleys with channel width and meander wavelength 5-15 times as great as that of modern rivers. Massive measurements of their parameters and application of specially constructed transfer function provided estimations of palaeo-runoff from large river basins: in the Black Sea and Caspian Sea catchments it carried from 2.2 (Kama River) to 3.1 (Don, Dnieper Rivers) times as great as modern runoff. High runoff lasted long enough to provide formation of 2-3 generations of macromeanders characteristic for many valleys. Macromeanders were radiocarbon dated at 6 sites over EEP in the range 13-19 cal ka BP, but it is not clear whether high runoff was characteristic for the entire period or it performed during short isolated epochs within this interval. Therefore, it is not clear to what exact time palaeohydrological estimations should be attributed.

2. Dendritic and parallel systems of gentle hollows clearly designated in vegetation-free areas south from 55-57ºN. Distinctive spatial patterns and full integration into water transportation through modern fluvial landscapes provides interpretation of these hollow systems as partially or totally buried networks of small dry valleys (balkas). It is supported by revelation of buried incisions up to 10 m deep by coring and trenching across hollows. Ancient erosion network demonstrates erosion density much higher and Horton's "belt of no erosion" much narrower and therefore exhibits much abundant surface runoff than those at present. Dating of buried balkas has until recent times been based either on pollen spectra from peat deposits (in central EEP), or on stratigraphy of paleosoils found in the bottom of paleoforms (in southern EEP). Both markers point at Eemian (MIS 5e) age of their stabilization and therefore pre-Eemian (late MIS 6?) age of incision. However first attempt of OSL dating gave the contradictory result of filling of a 6-m deep balka by slopewash sediments during 80-70 ka BP. Questionable is the >30-ka delay between the soil formation in the balka bottom and start of its filling. It may mean either post-Eemian age of the soil, which would be unfortunate for the regional soil stratigraphy, or insufficient sensitivity of local quartz at ages close to Eemian.

The conclusion is that geomorphic evidences make unique palaeohydrological archives that document changes not recorded in other types of palaeoenvironmental data, but they suffer from uncertainties and low resolution of dating.

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