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Late Pleistocene–Early Holocene climatic shift recorded by the paleomorphology of the Lower Tisza fluvial system, Hungary

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Palaeohydrological record coupled with geochronology can serve as key tools for reconstructing past environmental and climatic change. The alluvial plains of the Carpathian Basin are hosting numerous generations of paleochannels which developed in response to highly varying water and sediment discharges. Our investigations focused on the Lower Tisza Basin where palaeomenaders remained recognisable only in a relatively narrow N-S belt along the Tisza river. The width and wavelength of these channels significantly exceed contemporary values even if compared to that of the Danube. Two major channel generations were investigated: one located on a higher level of the floodplain, having larger but more blurred pointbars and main channel, and another in the level of the present floodplain, having smaller but much fresher forms.

The primary aim of the research is create the chronological framework of fluvial activity in the region and to determine palaeodischarges, thus to evaluate the trend and magnitude of climatic change. On the other hand the rate of morphological evolution is also assessed, which provides a more detailed insight to the environment in which the meanders were developing.

The age and development rate of meanders were determined by the means of luminescence dating (OSL). 16 drillings were made to sample pointbar and channel sediments of two megameanders. Fluvial stratigraphy and sedimentological correlations were set up by laser grainsize analyis. Discharges were calculated on the basis of plaeohydrological equations, however by estimating palaeo cross-sectional area and slope more reasonable results were received. In all more than 30 sediment samples were measured by OSL. In numerous cases both their polymineral fine grain and quartz coarse grain fractions were also dated in order to assess the adequacy of bleaching during deposition, and the applicability of the more abundant fine grain sediments for dating purposes.

Luminescence measurements show that coarse grain minimum ages are in a relatively good coincidence with fine grain ages, thus both types of sediments can be applied for OSL in this meandering system. The formation of the more elevated, larger meander was dated to the Bölling-Alleröd Interstadial (12-14 ka). The smaller meander started to evolve approx. 10 ka ago, suggesting that incision and the development of the present floodplain level took place during the shift from the Younger Dryas to the more moderate Holocene climate. Based on calculations, channel forming discharges were around 10 000 and 5 000 m3/s, respectively. The rate of lateral accretion was also very different. The older meander developed at a rate of 1 m/y, while this value could be three four times higher in case of the younger one. This refers either to much higher energies or less stabilised boundaries acting within the fluvial system in the Early Holocene.