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New evidence for the complexity of river terrace formation in Northern Bavaria

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Fluvial terraces are widespread geomorphic features and their formation occurred dominantly during the Quaternary. Besides tectonic reasons, the formation of Quaternary fluvial terraces is related to paleoclimatic changes and their corresponding changes in fluvial discharge and sediment load. However, within the Pleistocene, the exact timing and the paleoenvironmental conditions for terrace formation are still under debate and traditional concepts are questioned.

To shed light on the question of Pleistocene environmental conditions for terrace formation, we investigate their timing by establishing a terrace chronostratigraphy based on numerical dating. The study is located in a dry valley north of the city of Bayreuth, Bavaria, Germany. Here, within a former interconnection between the Red Main/Steinach drainage system in the south and the White Main River in the north, five Pleistocene terrace levels are distinguished. The terraces are interpreted as the result of a very complex landscape evolution, which is characterized by at least twofold river deflection. Because of this river deflection, fluvial and periglacial slope sediments are still widely preserved and can now be used as sediment archives for reconstructing the timing of fluvial and therefore paleoenvironmental change.

In a first step, we focused the investigations on dating the youngest Pleistocene terrace (T2). Following the traditional explanations, this terrace level is interpreted as a Weichselian (Würmian) formation, developed during the last glacial maximum. First optically stimulated luminescence (OSL) dating results, however, indicate a significantly older age for the aggradation of the gravel and, thus, point to a much earlier deflection of the primary Steinach River. The correctness of the OSL ages is supported by radiocarbon AMS dating.

These results indicate a significant Weichselian (Würmian) fluvial geomorphodynamic during the Lower or Middle Pleniglacial rather than during the Upper Pleniglacial. Furthermore they show that the response of fluvial systems to environmental changes is complex and in addition strongly depends on local conditions. Our findings raise new questions concerning climatic conditions during the Middle and Lower Pleniglacial and their impacts on geomorphological processes relating to the forming of fluvial terraces.