Sediment deposition, regional uplift and local normal faulting recorded in the Danube terrace staircase of Vienna

Neuhuber, Stephanie[1]; Salcher, Bernhard[2]; Otto, Jan-Christoph[2]; Payer, Thomas[3]; Lüthgens, Christopher[1]; Grupe, Sabine[3]; Flores-Orozco, Adrian[4]; Fiebig, Markus[1]

1 Department of Civil Engineering and Natural Hazards, Institute of Applied Geology, University of Natural Resources and Life Sciences Vienna, Peter-Jordan-Straße 82, A-1190 Vienna, Austria; 2 University of Salzburg; 3 Wiener Gewässer Management Gesellschaft mbH; 4 TU Wien.

Quaternary landscape evolution in the Vienna Basin is controlled the climate related sediment aggradation/erosion of the Danube, local normal faulting, and regional uplift. Glacial-interglacial climate dynamics highly influence the mode and amount of sediment transport. Within the extensional structure of the Vienna Basin the highest vertical subsidence focuses narrow Middle-Pleistocene sub-basins. Outside the major Miocene Vienna Basin sidewall faults, normal faults are slow or inactive during the Quaternary. In these areas regional uplift is high enough to form terraces. In case regional uplift compensates local subsidence, complex terrace levels develop caused by rate change over time (i.e. phases of tectonic activity vs. quiescence). Local normal faulting imposed by regional uplift is apparent within the city of Vienna. Vienna is crosscut by prominent normal faults, the Leopoldsdorfer Fault System (LFS), with highest subsidence during the Miocene when it offset the alpine basement by around 4,500 m. At the surface, the western side of the LFS is characterized by a well-developed terrace staircase that is missing at the eastern side. Quaternary faulting along the LFS has been previously proposed. Here we analyze the dynamics of landscape evolution and include stream behaviour, normal faulting, and uplift into a consistent picture covering the time interval between the Late Pliocene and Early Pleistocene. In a multi-methodological approach, involving terrestrial cosmogenic nuclide dating, geophysical (ERT) prospection, multiple drill-log and sedimentological analyses, we investigate how regional uplift and local subsidence along the Vienna terrace staircase affect the geomorphology over the last ca. 2.5 Ma resulting in today's landscape. We propose that the vertical movement and different slip rates over time, first result in sediment preservation trough local subsidence and later in preservation through uplift and inversion.