Analysing landforms, borehole logs, and geophysics, for localization and assessment of active faults in the central Vienna Basin (Austria)

Michael Weissl¹, Decker Kurt¹, Adrian Flores-Orozco², and Matthias Steiner²

¹University of Vienna, Department of Geodynamics and Sedimentology, Althanstr. 14, A-1090 Vienna, Austria
(michael.weissl@univie.ac.at)
²TU Wien, Department of Geodesy and Geoinformation, Research Division Geophysics, Wiedner Hauptstr. 8, A-1040 Vienna, Austria

The formation of pull apart basins and normal faulting at splays along the Vienna Basin strike-slip fault system resulted in the dissection of the Pleistocene river terraces of the Danube. Displacements of terrace segments are visible on the surface as fault scarps or dells what allows mapping the system of active faults. Furthermore, displacement rates can be estimated from the elevation of the basis and the thickness of Quaternary fluvial sediments.

With regard to the prospective utilization of geothermal resources in the area of Vienna a research group was built (Geotief Explore 3D, funded by Wien Energie and FFG) with the objective to identify, map, and assess, Quaternary faults, because such rupture zones are not suitable for the reinjection of thermal water in view of the hazard of triggered earthquakes.

Normal splay faults define the eastern and western margins of Pleistocene Danube terraces north of Vienna. The bodies of these terraces are built up of coarse sandy gravel and sand whereas their surfaces are covered with aeolian and alluvial sediments of the last glacial. Tectonic displacements during the Pleistocene left distinct marks in the late glacial landform configuration of the terraces. Therefore many fault scarps and fault related valleys are clearly cognizable in high resolution LiDAR and satellite images.

During the last decade three distinct fault scarps of the Vienna Basin Transform Fault situated at the terrace edges could be investigated by trenching and transect analysis. Actual research has the objective to model the 3D geometry of the base of the Quaternary strata (horizon Base Quaternary) from a compilation of shallow drillings and the construction of a regional isopach map showing the thickness of Quaternary (growth-) strata.

In the course of research it becomes apparent that within the tectonically subsided areas evidence of neotectonics is overprinted by fluvial sediments and alluvium what hinders accurate localization of faults. However, the sinuosity of palaeochannels in the Danube floodplain seems to be related to tectonics and therefore the pattern of former river channels can be used as sign for tectonic activity during the Pleistocene. In places where signs for active faulting are completely overprinted by fluvial sedimentation and cryoturbation the approved methods for the localization and the
assessment of active faults are electrical resistivity tomography and near-surface seismics.