Geophysical and Geological investigations of a major Miocene fault system within the city of Vienna: evidence for active tectonics

Bernhard Salcher¹, Jan-Christoph Otto¹, Stephanie Neuhuber², Christopher Lüthgens², Sabine Grupe³, Thomas Payer³, and Markus Fiebig²

¹Salzburg University, Department of Geography and Geology, Salzburg, Austria (bernhard.salcher@sbg.ac.at)
²Institute of Applied Geology, University of Natural Resources and Life Sciences, Vienna, Austria
³Geological Engineering Company, Wiener Gewässer Management GmbH, Vienna, Austria

We present investigations of a major Miocene fault system crossing the city of Vienna by using sedimentological, geophysical, remote sensing and numerical age dating methods. The fault zone is located at the western edge of the Vienna Basin, a c. 55 km wide and c. 200 km long rhomb-shaped pull-apart basin, separating the mountain ranges of the Alps and Carpathians. At its western edge a major sidewall fault, the Leopoldsdorf Fault System vertically offsets alpine units by up to 5 km. In this study, we focus on Pleistocene fluvial sediments of the Danube deposited along this fault zone. Distribution and facies provide suitable conditions to speculate on Quaternary fault activity. Fluvial gravels rest on top of fine-grained, marine sediments of the Miocene. Quaternary uplift preserved these sediments in the form of terraces that were extensively covered by Pleistocene aeolian deposits (i.e. loess). Later, solifluction affected those fine-grained sediments and obliterated the terrace steps resulting in a relative homogenously inclined top as well as a flat accumulation zone at the toe of the slope. Age brackets of Quaternary deposits are provided from redeposited quartz gravels using cosmogenically produced $^{26}$Al and $^{10}$Be as well as luminescence ages of the loess-like cover sediments.

The high resistivity contrast of the coarse-grained sediments to the underlying fine-grained marine sediments and the overlying loess deposits provided excellent conditions to infer the geometry of the fluvial deposits. Accordingly, we used electrical resistivity tomography and data derived from driller’s lithologic logs to constrain possible vertical offset of terraces. Possible surface ruptures were discussed by utilizing data from LiDAR-based high-resolution digital elevation models.