Paleoseismoloy of the Seyring Fault in the Vienna Basin (Austria)

Oppenauer, Lisa[1]; Flores-Orozco, Adrian[2]; Weissl, Michael[1]; Decker, Kurt[1]

1 Department of Geodynamics and Sedimentology, University of Vienna, Josef-Holaubek-Platz 2, A-1090 Vienna, Austria; 2 Department of Geodesy and Geoinformation, Technical University of Vienna, Wiedner Hauptstraße 8, A-1040 Vienna, Austria.

Active tectonics along the Vienna Basin Transfer Fault (VBTF) has been studied thoroughly in the last decades by not only using subsurface seismic, borehole drillings, shallow geophysical methods or geomorphological observations but also by paleoseismological trenching. By studying prehistoric earthquakes, the location, recurrence and magnitude of future earthquakes can be estimated. The Vienna Basin is characterized by moderate historical and instrumental seismicity. Quaternary basin subsidence and active faulting in the Austrian part of the Vienna Basin is indicated by geomorphological features like fault scarps and the offset of Quaternary terraces of the Danube. Studies show, that faults in the Vienna Basin can produce earthquakes with a maximum magnitude of Mmax = 6.0–6.8 and geological data suggest slip rates of 1–2 mm/yr for the main strike-slip fault system. Studies on normal faults that formed at releasing bends of the strike-slip system like the Aderklaa-Bockfließ Fault (ABF) and the Markgrafneusiedl Fault (MF) also show Quaternary activity with a maximum slip rate for the ABF of 0,05 mm/a for the last 200 kyr and for the MF 0,02 to 0,05 mm/a. With this study, we present data from a segment of the Seyring Fault, which is one of the normal faults compensating extension at releasing fault bends of the VBTF. The Seyring Fault System is an approximately SW-NE striking normal fault, delimiting the Gänserndorf Terrace in the west, from the terrace west of Seyring. The Pleistocene Gänserndorf Terrace in the central Vienna Basin, formed by the fluvial plain of the Danube, is dissected into several parts by the Aderklaa-Bockfließ Fault and the Markgrafneusiedl Fault. The terrace deposits represent glacial- and interglacial periods. Seismic profiles, electrical resistivity tomography (ERT) data and borehole data were used to locate a segment of the Seyring Fault 3.4 km NNE of the city limits of Vienna. From the borehole data, ERT and seismic profiles an offset in the Quaternary sediments of about 15 m could be observed. Further evidence for Quaternary deformation was derived from trenching of the Seyring Fault segment. Here, several normal faults at a depth of approximately 2 meters below the surface could be observed terminating at three event horizons and off-setting a succession of gravel, sand and loess. A clear Quaternary offset, the maximum slip rate and the magnitude of the earthquakes could be derived from the observations in the trench. Furthermore, the deformation history for six events and a time stratigraphic framework could be constructed with ^{14}C ages derived from gastropod samples. These six events observed in the trench took place in a time period between 31.96 kyr and 14.99 kyr BP producing several displacements of the sand and loess layers and three colluvial wedges with a maximum offset by a single event of about 0.4 m which is indicative of an earthquake with a magnitude of M = 6.4. The smaller colluvial wedges and offsets are estimated to be produced by earthquakes with magnitudes between M = 4 and M = 5.5.