Geophysical Research Abstracts
Vol. 15, EGU2013-12755, 2013
EGU General Assembly 2013

Fault linkage model of strike-slip and normal faults in the Vienna Basin based on paleoseismological constraints

Esther Hintersberger (1), Kurt Decker (1), Johanna Lomax (2,3), Markus Fiebig (3), and Christopher Lüthgens (3)

(1) Universität Wien, Department for Geodynamic and Sedimentology, Austria (esther.hintersberger@univie.ac.at), (2) Justus-Liebig-University Giessen, Department of Geography, Germany, (3) BOKU Vienna, Department of Applied Geology, Austria

The interaction and kinematic linkage of single faults within a fault system is an important issue for estimating the seismic potential of the fault system. Faults can be either linked directly by merging in greater depths or by lateral growth or indirectly by influencing each other by stress loading and unloading due to earthquakes.

The Vienna Basin in Central Europe between the Alps and the Carpathians is formed by a transtentional fault system consisting of a main strike-slip fault, which delimits the basin towards the east, and from which six secondary splay normal faults branch out and cross the entire basin. They seem to be geometrically linked with the main NNE-SSW striking left-lateral strike-slip Vienna Basin Transfer Fault (VBTF) via a E-dipping detachment, the Alpine thrust fault. Moderate seismicity (Imax/Mmax = 8-9/5.7) is focused along the southern and northern tips of the VBTF, whereas there are almost no earthquake records for the central Lassee segment and the splay normal faults during the last $\sim$ 500 years. Geological and morphological data, however, document Quaternary movement at very slow vertical velocities of $<$ 0.1 mm/a for the normal faults and at horizontal velocity of 1-2 mm/a for the VBTF.

The question therefore is if and how strongly the normal faults within the Vienna Basin are linked kinematically to the VBFT. Is there any kinematic and geometric triggering or is the linkage based on mere stress transfer? In order to address this question, the number of large earthquakes along each fault, the amount of displacement during single earthquakes as well as the recurrence intervals for each fault are key parameters. Therefore, we did paleoseismological investigations at the Lassee segment of the VBFT as well as along one of the splay normal faults (Markgrafneusiedl Fault, MF).

Correlation between three paleoseismological trenches across the MF revealed evidence for 5-6 major surface-breaking events during the last $\sim$ 120 ka that cut and offset gravels of a Pleistocene terrace of the Danube ($\sim$ 290–230 ka) in the footwall of the fault. Displacement estimates based on colluvial wedges and displaced layers lead to magnitude estimates ranging between Mw = 6.3 and Mw = 7.0. In sum, the recurrence interval of severe earthquakes with magnitudes $>$ 6 at the MF is determined to 20-30 ka. First trenching results along the VBTF show the fault within the trench dissecting the same Pleistocene Danube terrace. Based on displaced layers, tension cracks and colluvial wedges, at least 3 major earthquakes since $\sim$ 20 ka can be determined, with the most recent one occurring after $\sim$ 2500 years BP.

We then combine the paleoseismological results with Quaternary slip rates derived from geomorphic and geological constraints and geometrical calculations of slip transfer from the strike-slip movement of the VBTF to the splay normal faults. Thus, we can show that our data supports the hypothesis of a strongly linked fault system with the VBTF as the main driving force.