Geophysical Research Abstracts,
Vol. 11, EGU2009-8654, 2009
EGU General Assembly 2009

Characterization of shallow normal fault systems in unconsolidated sediments using 3-D ground penetrating radar (SE Vienna Basin, Austria)

D. Spahic (1), U. Exner (1), M. Behm (2), B. Grasemann (1), and A. Haring (3)

(1) University of Vienna, Geodynamics & Sedimentology, Vienna, Austria (darko.spahic@univie.ac.at), (2) Institute of Geodesy and Geophysics, Vienna University of Technology, Austria (mbehm@mail.tuwien.ac.at), (3) Christian Doppler Laboratory for "Spatial Data from Laser Scanning and Remote Sensing", Vienna University of Technology, Austria. (ah@ipf.tuwien.ac.at)

In a gravel pit at the eastern margin of the Eisenstadt Basin, a subbasin of Vienna Basin (Austria), a set of normal faults crosscuts a Middle Miocene succession consisting of gravel layers, sandy gravels, fine-grained sands and silts with variable thicknesses between 1 and 4 m. These mainly friable sediments are cut by a numerous N-S striking high angle normal faults of ca. 0.5 – 10m length, offsetting, dragging and tilting the sedimentary layering. Normal faults occur either as isolated planes, or as parallel sets of high-angle faults dipping to the West. The outcrop is situated in the hanging wall of a major normal fault with a vertical displacement of at least 40m, which was interpreted as listric fault associated with a rollover anticline (Decker & Peresson, 1996).

The displacement magnitude varies significantly along individual faults from cm to a few meters. The strong displacement gradients along these short faults result in the formation of perturbation fields around them, which deflect the initially planar sedimentary marker beds in the vicinity of the faults producing a pronounced reverse fault drag. None of these short faults display listric geometries or are associated with low angle detachment horizons. The spatial orientation and distribution of the faults and the associated fault drag was mapped in detail on a 3D laser scan of the outcrop wall.

In order to assess the 3D distribution and geometry of this fault system, a series of parallel GPR (ground penetrating radar) profiles were recorded with a low frequency antenna behind the well-studied outcrop wall. The profile data were interpolated into a 3D GPR cube. Faults with normal offset of ca. 0.5-1,5 m can be mapped by detailed correlation of conspicuous marker horizons. Additionally, the deflection of markers around the fault planes can be documented from the GPR dataset.

Both outcrop and GPR data were compiled in a 3D structural model using Gocad (Paradigm). The detailed geometry of the sedimentary horizons, the normal fault system and the associated fault drag is used to infer the subsurface continuation of the major normal fault below. Kinematic reconstruction of the fault plane using the Coulomb Collapse Theory predicts a bending of the fault plane into a subhorizontal orientation at $\tilde{7}0$ m below the outcrop level. It is important to note, that these kind of reconstruction techniques inherently assume a listric fault geometry and therefore will always result in extensional fault, which flatten at a certain depth. However, correlation of reconstructed detachment this level with outcrop observation in the same gravel pit strongly question the interpretation as a listric fault. Instead, we suggest that in analogy to the smaller sized structures in the hanging wall, the observed deflection of stratigraphic horizons could be caused by displacement gradients along the fault, and that the deflection of markers should be interpreted as large scale fault drag instead of a rollover anticline.

Decker, K. & Peresson, H. 1996. Rollover and hanging-wall collapse during Sarmatian/Pannonian synsedimentary extension in the Eisenstadt Basin. Mitt. Ges. Geol. Bergbaustud. Österr. 41, 45-52.