Geophysical Research Abstracts
Vol. 13, EGU2011-2897, 2011
EGU General Assembly 2011

Deformation bands in Pleistocene sediments related to basement tectonics

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We present an outcrop-based study on the geometry of deformation band faults, which developed in Middle Pleistocene glaciolacustrine delta deposits (Winsemann et al., 2007), and are exposed in a large open quarry to the north-west of the village of Freden in northern Germany. A shear wave reflection seismic profile and a set of wells in the study area provide a better understanding of how basement tectonics and the deformation bands are related. The study area is located above a NW-SE trending narrow salt-cored anticline. Basement faults in this area run NW-SE, parallel to the axis of a salt anticline. In large parts of the quarry, the deformation band faults trend NW-SE. This fits the trend of the basement faults. Therefore it is very likely that the deformation band faults are the expression of syn- or post-Saalian activity along basement faults. Within the quarry, wells detected the top of the Mesozoic basement is in a depth of 20 to 40 m below surface. To the north and south of the quarry, the top of the basement was detected in a depth of 3 to 5 m below surface. Thus, the Middle Pleistocene glaciogenic delta deposits are restricted to a 1 km wide zone, which might represent a NW-SE trending graben. The seismic profile visualizes steep normal faults within the basement rocks at an approximated depth of 60 to 80 m. We show that the observed deformation bands in the quarry reflect the basement tectonics and suggest that they might be related to salt movements and enhanced crestal collapse or to a reactivation of the basement faults due to ice loading during glaciations.

References:

Winsemann, J., Asprion, A., Meyer, T. and Schramm, C. (2007) Facies characteristics of Middle Pleistocene (Saalian) ice-margin subaqueous fan and delta deposits, glacial Lake Leine, NW Germany. Sedimentary Geology, 193, 105-129.