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Interplay of Quaternary tectonic activity and fluvial processes inferred from paleoseismology and geomorphology (northern Upper Rhine Graben, Germany)

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This study focuses on the paleoseismic activity of the northern Upper Rhine Graben, Germany. Low intra-plate seismicity and historical earthquakes that have not been large enough to produce surface rupturing characterize this part of the graben. Moreover, the records of Quaternary surface processes and human modifications are presumed to mask the record of the relatively slow tectonic deformation. In order to gain information on the paleoseismicity in this setting, an integration of techniques in paleoseismology, structural analysis, shallow geophysics and geomorphology is used. The study concentrates on a segment of the Western Border Fault (WBF), which follows a 20 km long and 50 – 100 m high scarp of unclear origin. The selection of trench sites at the southern end of the fault segment was determined mainly by the results of shallow geophysical surveys. A structural analysis performed on the complex fault structures, which have been excavated in several trenches, shows a consistent extensional style with a maximum vertical displacement of 0.5 m. In one trench, the deformation structures are dated between 19 and 8 ka. The fault structures and additional liquefaction features observed in the trenches are interpreted to be the result of tectonic deformation. It remains unclear though whether the deformation was related to continuous creep (fault creep rate of $\geq$ 0.04 mm/yr) or a single seismic event (M_w of 6.5).

The reconstruction of the trench site indicates that, in addition to tectonic activity, fluvial dynamics have played a major role in the evolution of the scarp as indicated by phases of fluvial sedimentation. Geomorphological investigations of the larger sur-

rounding area also support the interplay of tectonics and fluvial dynamics. Morphological terrace mapping reveals that the 50 – 100 m high scarp consists of a sequence of fluvial terraces. Both the scarp morphology and the alignment of terraces along the WBF lead to the interpretation that most of the scarp morphology is the result of fluvial incision. The activity of the border fault is considered minor in terms of vertical displacement, but its influence on the location of erosion and accumulation of fluvial deposits is considered significant.