EGU24-1794, updated on 14 Aug 2024
https://doi.org/10.5194/egusphere-egu24-1794
EGU General Assembly 2024
© Author(s) 2024. This work is distributed under
the Creative Commons Attribution 4.0 License.

Disaggregation bands as indicator for active blind faults

Christian Brandes[1], David Tanner[2], Haakon Fossen[3], Matthias Halisch[2], and Katharina Müller[1]
[1]Leibniz Universität Hannover, Institut für Geologie, Callinstr. 30, 30167 Hannover, Germany (brandes@geowi.uni-hannover.de)
[2]Leibniz Institut für Angewandte Geophysik (LIAG), Stilleweg 2, 30655 Hannover, Germany
[3]Natural History Collections, University Museum of Bergen, University of Bergen, 5020 Bergen, Norway

The identification of active faults is an important step in the seismic hazard evaluation process. However, this task is often difficult because many faults are unknown, buried below younger sediments. Especially in slowly-deforming intraplate areas with long recurrence intervals between individual seismic events, the detection of hidden blind faults is a major challenge. Furthermore, active faults can undergo long episodes of aseismic creep and thus do not produce typical earthquake-related, soft-sediment deformation structures, which also hinders the detection of these faults. Consequently, there is the demand for a robust universal geological indicator for active blind faults. Based on outcrop studies, we are able to show that disaggregation bands (near-surface deformation bands that develop in unconsolidated sediments due to reorganization of the grain fabric) are such an indicator. Disaggregation bands are developed at several locations in Central Europe and Scandinavia, in near-surface sandy sediments above the tip lines of blind faults. The strike of these bands is parallel to the strike of the underlying faults, which indicates that the disaggregation bands formed as a consequence of fault movement. The disaggregation bands internally show a pore-space reduction and in some cases a clear alignment of elongated grains. The thickness of the disaggregation bands increases with the amount of offset along the bands. Based on these observations, we infer that the bands formed in the process zone of propagating faults due to a shear-related reorganization of the grain fabric that leads to strain-hardening and a growth of the bands into centimetre-thick tabular structures. With analogue shearing experiments we show that disaggregation bands can form at a wide range of deformation speeds, even down to speeds several orders of magnitudes lower than seismogenic fault-slip velocities. Thus, disaggregation bands are key structures that record large parts of the seismic cycle and represent a very suitable indicator for active blind faults, even if the related fault creeps without emitting seismic waves. Disaggregation bands can easily be recognized in outcrops and artificial trenches, and previous studies showed that it is possible to even image them with ground-penetrating radar.