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Deformation and Fluid Flow in the Etendeka Plateau, NW Namibia

Eric Salomon (1), Daniel Koehn (2), Cees Passchier (1), Jennifer Davis (2), Aron Salvona (2), and Peter Chung (2)

(1) Institute of Geosciences, University of Mainz, Becherweg 21, Mainz, 55128, Germany (salomon@uni-mainz.de), (2) School of Geographical and Earth Sciences, University of Glasgow, Glasgow, G12 8QQ, United Kingdom

We studied deformation bands in sandstone and breccia veins in overlying basalts of the Etendeka Plateau, NW Namibia, regarding their development and history of fluid flow within.

The studied deformation bands can be divided into disaggregation bands and cataclastic bands. The former appear to develop in unsorted sandstone, whereas the latter form in well sorted sandstone. We estimated the porosity of the bands and host rock in thin sections using a simple image analysis software (ImageJ). Results show, that no or only a minor decrease in porosity occur in disaggregation bands, while the porosity in cataclastic bands is decreased by up to 82 % with respect to the host rock. These observations are in agreement with results of existing studies (e.g. Fossen et al., 2007).

Hence the cataclastic bands form a seal to fluid flow in the host rock, yet it is observed in outcrops that deformation bands can develop into open fractures which in turn increase the permeability of the rock.

Breccia veins in the overlying basalts show intense fracturing where the basalt is locally fractured into elongated chips. Mineral precipitation in these breccia veins indicates a hydrothermal origin of the fluids since the precipitates consist of extremely fine-grained quartz aggregates. Secondary mineralization with large crystals indicates that a long-lived fluid circulation through tubular networks was active at a later stage, which eventually sealed the veins completely.

We propose that the Etendeka basalts on top of the sandstone formation produced a localized deformation along deformation bands and heated up fluid below the lavas. At a later stage fluid pressures were either high enough to break through the basalt or fracturing due to ongoing extension produced fluid pathways.

References

Fossen, H., Schultz, R., Shipton, Z. and Mair, K. (2007). Deformation bands in sandstone: a review. J. Geol. Soc., 164, 755-769.