Insights into the origin of a zone of slipped deformation bands from the Seiyal Fault, Western Desert, Egypt

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Abstract

This study, part of a larger project known as Desert Eyes, seeks to constrain the timing of deformation band formation on a NE-SW striking fault splay of the E-W striking Seiyal Fault. These faults cut a structural dome (500 m by 1,000 m) consisting of shallowly dipping Cretaceous sandstone. This research examines deformation bands and calcite veins within the Seiyal Fault splay damage zone in order to determine their relative timing and relationship to tectonic events affecting southern Egypt since the Late Cretaceous. Cataclastic deformation bands are associated with faulting in porous rocks, such as the field area's Taref Member of the Nubian Sandstone, and form between 1.5 and 2.5 km depth.

Field data on the abundance (per square meter) and orientation of deformation bands and calcite veins were collected 70 km SW of Aswan in January 2012. SEM images show a decrease in mean grain size within the deformation bands ranging from 37-75% relative to the host rock. Field data indicate that deformation band abundance decreases from 8.6 bands/m^2 of exposure at the center of the fault damage zone to 1.6 bands/m^2 exposure at its edge 30 m away. Over the same distance, the mean variance of deformation band orientation (the difference between the deformation band and fault plane orientation) increases slightly by 5.4^o, from 42.2^o to 47.6^o. While deformation band abundance and orientation change with increasing distance from the center of the fault damage zone, calcite veins do not show a similar pattern. They are not concentrated near the center of the fault damage zone and take on a greater range of orientations.

In thin section, calcite veins cut across deformation bands. Preliminary SEM/CL results show that an early cement generation of quartz is cut by deformation bands. Later post-deformation band cements include an initial generation of microcrystalline calcite inter-grown with kaolinite and a later blocky, pore-filling calcite coeval with the calcite veins. Known depth ranges for deformation band formation and cementation will be combined with a burial history model for the Taref Member.