Geophysical Research Abstracts
Vol. 20, EGU2018-1439, 2018
EGU General Assembly 2018

Postobductional extension at the Frontal Range Fault (Eastern Oman Mountains)

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The Oman Mountains consist mainly of Permo-Mesozoic platform carbonates and the Tethys-derived Semail Ophiolite which was obducted onto the Arabian Platform during the late Cretaceous. After obduction, two major domes formed, the Saih Hatat and Jabal Akhdar domes. Our study concerns postobductional extension on the northern flanks of these domes and the area in between. These flanks are marked by a system of major interconnected, extensional faults, the "Frontal Range Fault System". While the vertical displacements along the Saih Hatat and westerly located eastern Jabal Akhdar domes measure 2.25-6.25km, 0.5-4.5km and 4-7km, respectively, the displacement amounts to 1-5km along the central and eastern Jabal Akhdar Dome. Extension started towards the end of ophiolite emplacement. Two phases of extension along similar striking parts the Frontal Range Fault can be deduced (late Cretaceous to early Eocene and probably Oligocene) for the Saih Hatat area. Along the differently striking fault segments at Sad and Sunub, the same two stages of deformation are ascertained. The first stage is characterized by extension but the second stage is marked by dextral motion, including local transtension. Post-late Eocene extension affected the Batinah Coast Fault (north and west of the Jabal Akhdar Dome) while it also affected outcrops at the Saih Hatat Dome. However, it is unclear whether the western segment of the Frontal Range Fault also had two stages of deformation. Bedding-parallel deformation (ductile and brittle) is a common phenomenon. Hot springs, listwaenite and a basalt intrusion are associated with dextral releasing bends within the fault system. In the Jabal Akhdar Dome, extension affected the Frontal Range at least 2.5km south of the Frontal Range Fault in its footwall. Also here, bedding-parallel shearing is important, but it is not exclusive. We observed the extensional reactivation of a late Cretaceous thrust by a branch fault of the Frontal Range Fault. Extension is ductile (limestone mylonites), ductile and brittle (ooid deformation, boudinaged belemnite rostra, shear bands) or brittle. We relate extension mainly to orogenic/gravitational collapse of the Oman Mountains. Collapse may have been associated with isostatic rebound and initial rise of the two domes. In the western part of the study area, the Frontal Range Fault has a listric character, where it probably becomes horizontal at depth of 15km below the Batinah coastal area. The fault likely use the clay- bearing Aruma Group as shear horizon. The depth of 15km coincides with the brittle-ductile transition of quartz-rich rocks. At this depth, the listric Batinah Coast Fault merges into the Frontal Range Fault. We propose that extension along the Frontal Range Fault and possibly the Batinah Coast Fault reactivated preexisting late Cretaceous thrust faults. The latter fault is probably mechanically linked with the extensional faults along the Saih Hatat Dome. Listwaenite and serpentinite cluster preferably near the extensional faults.