Geophysical Research Abstracts
Vol. 20, EGU2018-14608, 2018
EGU General Assembly 2018

Evolution of fluid circulation along a major basin-bounding fault: the Gediz detachment fault, Menderes Massif, western Turkey

Eric Salomon (1), Atle Rotevatn (1,2), Talip Güngör (3), Kerem Kadir Oguz (4), and Edoseghe Edwin Osagiede (1)

(1) University of Bergen, Department of Earth Science, Norway (eric.salomon@uib.no), (2) Department of Geology, University of Otago, New Zealand, (3) Department of Geological Engineering, Dokuz Eylül University, Izmir, Turkey, (4) Salihli Municipality, Salihli, Turkey

Basin-bounding fault zones play a major role in affecting fluid circulation along and within sedimentary basins. A prominent example is the Gediz detachment fault of the Menderes Massif in western Turkey. This E-W striking low-angle normal fault displaces medium- to high-grade metamorphic rocks against lower Miocene to Pleistocene syn-rift sedimentary rocks that were deposited in a hanging wall depocenter. At present, numerous active hot springs and fumaroles in the vicinity of the detachment fault clearly indicate that this structure provides pathways for upward fluid flow. This circumstance was utilized already during the Roman times, when the hot water supplied the Sardes bathing complex. Today, it is also increasingly used to deliver geothermal heating and power production to surrounding communities of the Gediz graben.

The occurrence of hot springs is not equally distributed along the detachment fault, and the controls on their distribution along-strike is as of yet poorly understood. Along-strike variation of basement lithology, ranging from mica schist, syn-tectonic granite, and marble has led to a variation of damage zone extent. This circumstance makes footwall marble a preferential reservoirfor geothermal exploitation, however it has not lead to a confinement of hot spring occurrence. Therefore, it is hypothesized that the intersections of the detachment fault with younger N-S striking faults are potential pathways, although their presence is difficult to confirm in the field.

Here, we present the first results of an ongoing study on the evolution of fluid circulation along the Gediz detachment fault. Among determining characteristics of fluid circulation patterns, we want to elucidate structural controls on along strike variations of fluid flow. Based on field observations, microstructural and geochemical analyses, we will show that the detachment fault zone was affected by fluid flow of varying composition throughout its evolution. In the hanging wall, hematite cement precipitated intensively at a very early diagenetic phase of the sedimentary rock, followed by silica-rich fluid circulation forming quartz veins in pre-existing fractures and normal faults. The footwall damage zone comprises vein networks crosscutting and joining each other and consisting of quartz, chert, calcite and iron oxides, indicating a highly variable fluid circulation. In the field, we located a prominent N-S trending strike-slip fault surface, cutting through marble ultra cataclasite, which is also the site of decimeter-thick veins. We interpret the veins to filling extensional fractures that formed in direct relation to the strike slip movement. With a hot spring nearby this locality, this observation suggests that movement along N-S striking faults produced significant pathways through the detachment fault. Further geochemical, petrological, and direct chronological analyses of the veins will allow drawing comparison of past fluid circulation to active thermal outpour along the Gediz detachment. This setting highlights that comprehending structural controls on fluid flow within basin bounding fault zones is vital for understanding fluid migration in and along sedimentary basins.