Geophysical Research Abstracts
Vol. 17, EGU2015-6078, 2015
EGU General Assembly 2015

How mineralization and stylolitization record fault reactivation caused by stress changes ?

Laborde Marine (1), Homberg Catherine (1), Makhloufi Yasin (1,2), and Schnyder Johann (1)

(1) ISTeP, UMR CNRS 7193, UPMC Paris VI, 4 Place Jussieu, 75252 Paris, France, (2) Current adress: Biogéosciences, UMR CNRS 6282, Université de Bourgogne, 6 Bd Gabriel, 21000 Dijon, France.

In multi-phased tectonic basins, reactivation of faults is common and mineralization patterns are complex. The aim of this study is to understand how mineralization and stylolitization of rocks observed at microscopic scale record fault activity during basin-scale stress field variations. For this purpose, we analyzed mesoscale faults and small-scale brittle structures on eight sites in the Vocontian Basin in SE France, as an example of a complex multi-phased basin. The southeastern French Basin resulted from a WNW-ESE rifting which began at Liassic time, later followed by the opening of Tethyan Ocean to the East. This basin was affected by later extensional events during the Late Jurassic to Early Cretaceous period during which the Vocontian Basin developed with an E-W orientation. Then, it was affected by two major Pyrenean and Alpine compressions, interrupted by the Oligocene extension. Thin-sections were realized on samples collected along 13 normal faults with vertical offsets up to several meters on seven sites. These thin-sections were analyzed in transmitted light and in cathodoluminescence and the observed structures were consistently characterized in 3D. A microtectonic analysis was also conducted, consisting in the measurement of fault-slip data, veins, and stylolitic planes. The results of this analysis showed that during the Mesozoic and Cenozoic times, the Vocontian Basin has been affected by three major strike-slip regimes in relation with the Pyrenean and the Alpine compressional tectonic phases, and a third later event. The basin extension was poorly recorded on the various sites and did not allow the calculation of the stress tensors. Macroscopic and microscopic fault structures show that all analyzed normal faults contain evidences of reactivation. Microstructures analysis indicated that the history of the investigated faults was complex implying two states of stress driving their activity with (1) an opening episode that may be associated with normal slip and (2) a reactivation of the fault with a strike-slip movement. The strike slip reactivation can involve the brecciation of the previous opening mineralization and wall rock, like at the Villebois site. At Villeperdrix A and Sahune, the strike-slip movement produced either a stylolitization of the previous mineralization with a closing component or a calcite mineralization with an opening component. Some faults also Show dolomitization and dedolomitization stages after calcite cementation in the fault plane, but the origin and age of this event is still unclear. In two cases, clear reactivation was observed on outcrop scale, even though thin-section analysis only evidenced the earlier normal slip. This indicates that later stages of reactivation might not necessarily exhibit micro-structural mineralization. In conclusion, coupling of the macro- and micro-structural analysis is a powerful tool to document fault reactivation and the variety of mechanisms occurring during faulting.