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Paleofluid evolution of strike-slip compartmentalized extensional fault zones in the Jabal Qusaybah anticline, Salakh Arc, Oman

Fabrizio Balsamo (1), Luca Clemenzi (1), Fabrizio Storti (1), Mahtab Mozafari (2), John Solum (3), Rudy Swennen (2), Conxita Taberner (3), and Christian Tueckmantel (3)

(1) Università degli Studi di Parma, Dipartimento di Fisica e Scienze dela Terra, Parma, Italy (fabrizio.balsamo@unipr.it), (2) Geology Department of Earth and Environmental Sciences, KU Leuven, Belgium., (3) Carbonate Research Team, Shell Global Solutions International, Rijswijk, The Netherlands.

The E-W-trending Jabal Qusaybah anticline, developed in layered Cretaceous carbonates, is located at the western termination of the Salakh Arc, Oman Mountains. The anticline is 10 km long and is characterized by a complex fault pattern which mainly includes NE-SW left-lateral strike-slip and N-S extensional fault zones. The N-S striking extensional fault zones are best developed in the central sector of the anticlinal crest, likely due to along-strike outer-arc extension associated with positive fault inversion and salt migration. Extensional fault zones are perpendicular to the fold axis and geometrically confined within major NE-SW left-lateral strike-slip fault zones. They have trace lengths ranging from a few m up to ∼800 m, and displacements ranging from a few dm up to ∼60 m. Fault zones consist of cataclastic fault cores (∼1-15 cm thick) surrounded by vein-dominated damage zones. Overall, fault zones show significant volumes of dilation breccia texture, m-thick infillings of calcite crystals, and cm- to m-thick veins localized at fault tip zones, areas of fault overlap, and zones of interaction between strike-slip and extensional fault segments. By analyzing fault abutting geometries, detailed vein relative chronology, delta13C and delta18O signatures and fluid inclusion data from calcite veins and calcite fault infillings, we propose a model where a deep seated left-lateral strike-slip fault system, active during the growth of the anticline, inhibited the lateral propagation of late-stage transversal extensional fault zones. Our findings show that, in this geological setting, the structural position, rather than fault throw, is the parameter controlling the location of the more dilatant fault segments.