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Field observations and interpretation of remote sensing data from an exhumed high pressure carbonate reservoir, Jebel Shams, Oman Mountains

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Geological mapping and interpretation is often limited to a few adjacent scales of observation. In this work we attempt to (1) integrate detailed fieldwork with (2) the analysis of a high resolution QuickBird satellite image. In exceptional outcrops of our working area in an exhumed high-pressure cell in Cretaceous Shuaiba carbonate reservoir on the southern flank of Jebel Shams/ Oman, several generations of pervasive regional fault and fracture sets are exposed. These were healed by calcite cement before the next set faults or fractures were formed. Detailed logging of the stratigraphy allowed correlation of units across faults and accurate measurement of fault off-sets. Fieldwork included measurements of structural data (orientation of joints, faults, striations, fracture hierarchy), ground truthing and visual estimates of fault throw magnitudes. Veins in the study area are filled with bright calcite in grey host rock, allowing 0.5 m- resolution mapping based on interpretation of satellite images using QuickBird and Landsat. Joints and fractures were interpreted using a GIS system with a 0.7 m spatial resolution QuickBird image.

Ground truthing by detailed field observation in selected areas shows four generations of veins, generally a few 10's of meters long without signs of mechanical interactions such as curving or abutting. However, many of the linear features which can be interpreted on the satellite images turn out to consist of complex mixtures of healed and late stage open fractures, partly filled with very fine and bright alluvium.

Burial extension within a high fluid-pressure environment led to the formation of four to five fracture generations by an anti-clockwise rotating stress field. This was followed by bedding parallel shear under lithostatic fluid pressure conditions. The high-pressure cell was drained along dilatant normal faults, which were also repeatedly cemented and reactivated.