



Coarse-crystalline fracture-filling calcite and dolomite in Tertiary carbonate rocks from the United Arab Emirates: record of fluid flow history in sedimentary basins

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Field studies combined with Petrographic, geochemical (bulk chemical, electron microprobe and stable isotopes), and fluid inclusion microthermometry of coarse-crystalline fracture filling calcite and dolomite in outcropped limestones and dolostones from SW United Arab Emirates provided useful insight into the fluid flow history during tectonic deformation of the basin. Tectonic deformation resulted in fracturing and brecciation of the host carbonate rocks, which enhanced fluid flow. Two main tectonic events have led to the formation and reactivation/openness of these fractures, namely the E-W compressional event related to the Omani ophiolite obduction (Late Cretaceous-Late Eocene-Miocene), and the N-S to NNE-SSW compressional event associated with the Zagros-Alpine Orogeny (Late Eocene to present). Brecciation was accompanied by the formation of caverns and vugs, which have hence resulted in enhancement of reservoir quality. The complex, fine-scale zonation revealed by cathodoluminescence imaging together with the temperatures (80-160°C) and salinity (3-12 NaCl% equivalent) obtained from fluid inclusions and variations in $\delta^{13}\text{C}$ V-PDB (-13‰ to -2‰) and $\delta^{18}\text{O}$ V-PDB (-18‰ to -4‰) values of the various calcite generations within the fractures suggest precipitation from hot basinal brines, which were influenced by hydrocarbon oxidation. The latter is deciphered from the enrichment of calcite in ^{12}C with successive decrease in temperature and increase in $\delta^{18}\text{O}$ values. Accordingly, the Petrographic and geochemical analyses of fracture filling calcite

can be used as a tool to aid hydrocarbon exploration. Key words: fracture mineralization, carbonate reservoirs, calcite, dolomite, UAE