
Dolomitization and Reservoir Quality in the Arab and Asab Formations (Upper Jurassic, United Arab Emirates)

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Dolomitization is one major control on the reservoir quality of Arab-Asab carbonates. Overall, the dolomites have higher porosities and permeabilities than the limestones. Petrography and stable isotopic analysis reveal the presence of two types of replacive dolomite with different reservoir properties.

Type-I dolomite is finely crystalline, planar, and facies-controlled, occurring almost exclusively in sabkha, tidal flat and lagoonal sediments. Type-I dolomite occurs paragenetically early, and is interpreted as having precipitated from evaporitic brines generated within sabkhas and lagoons. $\delta^{18}\text{O}$ values for Type-I dolomite are consistent with precipitation from a fluid with $\delta^{18}\text{O}$ up to +4‰ SMOW (Jurassic seawater -1.2‰ SMOW) at temperatures between about 35° and 100°C.

Neomorphism of early-formed dolomite could have occurred in a meteoric or mixed marine-meteoric fluid $\delta^{18}\text{O} < -1.2\text{‰}$ SMOW. Type-II dolomite is coarsely crystalline, non-planar, not facies-controlled, but aerially restricted. "Ghost" textures indicate that Type-II dolomite post-dates significant compaction, is paragenetically late, and precipitated from evolved brines at high temperature. $\delta^{18}\text{O}$ values for Type-II dolomite are consistent with precipitation from a fluid with $\delta^{18}\text{O}$ as high as +3.8‰ SMOW, at temperatures up to 140°C (maximum burial temperature). Type-II dolomite is intimately associated with late-stage anhydrite. It is proposed that late-stage dolomitization and anhydritization were linked.

The permeability and total porosity of Arab-Asab dolomites are largely independent of primary (limestone) texture. In both dolomite types, permeability tends to increase with increasing porosity but, for a given porosity, Type-II dolomites tend to have the higher permeability.
