Halite and Solid Bitumen Plugging in the Intra-salt Carbonate Stringers of the South Oman Salt Basin

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Halite-plugged carbonate “stringers” in the South Oman Salt Basin (SOSB) are enclosed in large domal bodies of Ara Salt and are buried to a depth of 3 to 5 km. The stringers represent an intra-salt petroleum system of Infracambrian age, known as the Ara carbonate stringer play, which represents a six-cyclic carbonate to evaporite sequence. Transitions from carbonate facies to salt and from salt to carbonate facies are commonly characterized by the occurrence of a roof and a floor anhydrite.

The carbonate stringer play has been successfully explored in recent years. Some stringers revealed poor reservoir performance despite a favourable primary reservoir facies. Detailed thin section studies of these stringers revealed a widespread cementation by halite and solid bitumen. Early halite is interpreted to have cemented pores of the carbonates due to the infiltration of supersaturated seawater brine, as the deposition of a roof anhydrite didn't occur. The high minus (halite-) cement porosity is also consistent with an early origin for this halite. Geochemical and maturity analyses of the solid bitumen indicate a precipitation from oil by enhanced temperature in the basin. The fracture-plugging halite post-dates this solid bitumen and is therefore interpreted as diagenetically late. The most likely origin of the second halite is a phase of salt tectonics in the SOSB, where the increasing burial and stress changes led to the formation of fractures and advection of brines inside the intra-salt stringers. The spatial distribution of halite and the resulting reduction of flow properties can be heterogeneous, even at the scale of metres.