
Petrography and Geochemistry of Solid Bitumen in the Intra-salt Carbonate Stringers of the South Oman Salt Basin

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Solid bitumen-plugged carbonate "stringers" in the South Oman Salt Basin (SOSB) are enclosed in large domal bodies of Ara Salt and are buried at depths of 3 to 5 km. The stringers represent an intra-salt petroleum system of Infracambrian age, known as the Ara carbonate stringer play. Several wells have successfully explored the stringers but some of these wells have failed to produce at significant rates. Detailed microstructural investigations by SEM imaging, transmitted and reflected light microscopy revealed that 80% of 75 investigated stringer cores of those wells are plugged by solid bitumen. Mostly, this solid bitumen is observed as intergranular cement, which covers the pore-walls and occurs in microfractures.

Microstructure-correlated maturity analysis shows that paleo-temperatures of the SOSB, obtained by reflectance measurement (BR %), are significantly higher than present-day well temperatures. In most stringers a very heterogeneous distribution of paleo-temperatures (BR (%)-values) is recorded and few samples clearly contain a low and a high reflective generation of solid bitumen. Geochemically, the solid bitumen-bearing rocks were analysed by Rock-Eval pyrolysis and biomarker analysis. Some of the solid bitumen shows features indicative of very high temperatures (> 200 °C), which acted in the stringers leading to the formation of impsonite and coke structures. These high temperatures are probably related to hot fluids, deriving from deeper strata, which infiltrated the stringers during times of tectonic movement. This observation has severe consequences with respect to our understanding of salt permeability.
