Petroleum Charge History in the Lunnan Low Uplift, Tarim Basin, China – Revealed from Fluid Inclusion Investigation

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The Lunnan Low Uplift area in the Tarim Basin has undergone several phases of hydrocarbon generation, accumulation and migration. Despite much work, oil source and charge history remain quite controversial. We attempt to understand the charge history through geochemical analyses on four palaeo-oils trapped in fluid inclusions (FI) and five production oils from the Ordovician and Triassic reservoirs.

Both FI and production oils contain abundant n-alkanes with low to medium carbon numbers, consistent with results from Quantitative Grain Fluorescence (QGF) and Total Scanning Fluorescence (TSF). However, the biomarker signatures of the Ordovician FI oils are significantly different from Triassic FI oils with higher abundances of C19 tricyclic and C24 tetracyclic terpanes, the C27 hopane Ts, C29Ts and the tetracyclic polyprenoids Ta and Tb, and lesser amounts of 1,2,3,4-tetramethylbenzene, and 2,3,6 methyl-substituted arylisoprenoids. Aromatic and aliphatic parameters indicate an early to mid oil window thermal maturity level for all FI oils.

The source-specific signature of the production oils indicates a higher maturity than the FI oils and appears to more closely resemble the Triassic FI oils than to the Ordovician FI oils. Production oils from Triassic reservoirs are slightly more mature than Ordovician oils. The presence of C29 25-norhopane is largely restricted to the production oils and to Triassic FI oils, indicating that a phase of biodegradation post-dated the trapping of FI oils in Ordovician reservoirs. The production oils in the Ordovician and Triassic reservoirs are probably a mixture of biodegraded oils from an early charging episode, and more mature oils from later charging episodes.