Intra-Delta Versus Sub-Delta Sourcing of Petroleum – a Global Review

Samuel, O. J.[1], G.D. Abbott[1], C. Cornford[2] (1) University of Newcastle upon Tyne, Newcastle upon Tyne, United Kingdom (2) Integrated Geochemical Interpretation Ltd (IGI), Bideford, United Kingdom

Deltas have seen active petroleum exploration in the last three decades, but whether 'deltaic oils' are sourced within (intra-delta) or from below the delta (sub-delta) remains unclear. For sub-delta sourcing, the role of the delta is primarily one of burial and maturation of a pre-existing source rock. As a group, deltaic oils are characterised by being sourced from a kerogen mix comprising terrigenous plants of the hinterland and delta top, and marine phytoplankton whose bioproductivity may be enhanced by fluvial nutrients. Nearly all the Petroleum Systems identified in Tertiary deltas (e.g. Beaufort-Mackenzie, Niger, Assam, and Mahakam,) have been designated 'hypothetical' with respect to oil-source correlations.

We have harvested the literature for high resolution geochemical analyses, databasing analyses from 229 oils reservoired within Tertiary deltas worldwide. Molecular and isotopic data suggest intra-delta and sub-delta sourcing operates within most deltas. The sub-delta groups show molecular affinity with marine organofacies (e.g. %C27 and occurrence of C30 Steranes) and higher maturity (C29 Sterane20S/S+R). The intra-delta oils have waxier n-alkane distributions, terrigenous biomarkers and lower expulsion maturities.

Our evidence fits a model where the intra-delta source rocks are either coals, or large volumes of lean shales either containing a mix of land plant and aquatic kerogens, while the sub-delta source rocks tend to be thinner discrete units, rich in TOC and contain marine kerogen. Where sub-delta oils migrate into deltaic reservoirs, molecules may be picked up by leaching (migrational contamination). These conclusions from published data will be augmented by new analyses in the coming months.