First HGS/EAGE Conference on Latin America (November 2019)

Greater Caribbean Petroleum Systems

by Craig Schiefelbein and William Dickson

Integrated Petroleum Systems Studies will illuminate multiple aspects of the geologic development and exploration potential of a region. We consider the Greater Caribbean and its several petroleum systems using a dual approach and offer illustrations of progress towards understanding this complicated area. Study aims included geochemical objectives (evaluation of source facies, thermal maturity, and degree of alteration from biodegradation, migration/fractionation and/or mixing) and geologic assessment of the hydrocarbon containers (location, burial, structural framework).

We began with a state-of-art analysis of some 1000 crude oils and condensates from Surinam – Guyana, Trinidad (onshore and Columbus Basin), Barbados, Central America, Cuba, Colombia and Venezuela. Crude oil samples were characterized via gas chromatography, stable carbon isotope analysis, and quantitative biomarker analysis of saturate and aromatic fractions by gas chromatography/mass spectrometry (GC/MS). The oils data were augmented by analysis of seafloor seepage recovered by piston cores at deep-water sites off Barbados and in the Columbus Basin. The latter can be correlated to production on the shelf, helping to assess petroleum systems extents in this frontier area.

A geochemical framework was established by determining the distinct oil families using source inferences for age and paleo-environment and making source-to-oil correlations through comparisons with published source rock information. Because oil quality has strong implications for exploration commerciality, attention was paid to chemistries that identify complex underlying contributions from processes including source facies variations, relative maturity, biodegradation, water washing, evaporative fractionation, gas stripping, remigration and mixing of hydrocarbons.

The definition of containers is a function of matching general outlines and thicknesses from the literature against our compilations of basement depth, sediment thickness and gravity-bathymetry-magnetics data. Features are first adjusted to a best match for the tectono-structural interpretation. Oil family distributions are then compared for spatial coherence with container and sub-container consistency.

Our work provides a snapshot of an ongoing study showing the distribution of key oil families, their containers, and gaps where we speculate on yet-to-find indications of hydrocarbons.