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SOURCE ROCK CHARACTERISATION OF THE PALMYRA FIELD, THE HAYAN BLOCK, SYRIA

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Exploratory wells of the Palmyra field (Palmyra-1, -2 & -3) are drilled in the Hayan contract area located in Palmyrides region in Central Syria. Gas and condensate discoveries were registered in the Permian sediments of Amanus Sand Formation and in the Carboniferous sediments of Markada Formation.

The Palmyrides are an inverted Mesozoic rift basin (Brew et al., 2001). The Palmyrides, as a one of the major tectonic zones of Syria, are an intracontinental mountain fold belt extending from the Dead Sea Fault Zone in the west, and joins the Euphrates fault system in the east. The Jihar fault separates the southwest from the northeast Palmyrides. Between the Jihar fault and the short-wavelength folds of the southern Palmyrides lies low-relief Al Daww Depression where the Hayan block is situated.

Detailed geochemical characterization of types and maturity of organic matter in a sense of source rocks and hydrocarbon potential determination as well as source rock-hydrocarbons genetic correlation were the objective of this study. For that purpose, conventional geochemical techniques and analytical procedures were performed on rock (cores and cuttings) and fluid samples.

Based on obtained results, Upper-Middle Triassic and Carboniferous sediments have source rock characteristics.

Carbonate/shale sequences of Upper-Middle Triassic Kurachine Dolomite Formation are very good source rocks, enriched in organic carbon content with fair to very good generative potential and amorphous-sapropelic, algal-bacterial organic matter which usually corresponds to type II kerogen. Maturity parameters exhibit diagenetic stage in thermal transformation e.g. thermal immaturity of organic matter. Bitumens are sulphur and asphalthene rich, typically of algal and/or bacterial origin and anoxic (reducing) deposition environment. Presence of free hydrocarbons can be attributed to high percentage of organic bonded sulphur (up to 13 % S) which enabled hydrocarbon generation (heavy, asphalthene rich bitumen), even in a late stage of diagenesis due to breaking of weak carbon-sulphur bonds (Baskin & Peters, 1992). Small quantities of H_2S were registered in the interval.

Bacterial sulphate reduction connected with carbonate-anhydrite environment under lower temperature regime is presumed as main driving mechanism for their formation.

Increased values of total organic carbon are also linked with a claystone/shale sequences of Carboniferous Markada Formation but with relatively poor source rock characteristics due to restricted genetic potential. Kerogen maceral composition is characterised by variable share of amorphous organic matter, vitrinite, liptinite (up to 15 %) and inertinite macerals (fusinite, semifusinite and reworked vitrinite) of terrigenous origin, usually attributed to type III kerogen (with some input of kerogen type II). Based on visual kerogen analysis organic matter is in early to mid catagenetic stage of thermal evolution.

Bitumens (EOM) of Markada Formation samples are highly thermally altered, of secondary, migrated origin probably from source rocks with mixed organic matter in a higher catagenetic stage (main gas generation) which are deposit in anoxic, marine environment.

Discovered gas is high thermogenic with minimum high hydrocarbon homologues. Carbon isotope ratio in methane is $\delta^{13}C$ -33.6 ‰ and deuterium ratio δD -126 ‰. Applying Schoell's genetic zone charts gas is thermogenetic, condensate associated. This indicates that the precursor maturity coupled with the reflectance higher than 1.3 %Ro (gas-condensate window). Condensates associated with gases are characterized by expressed loss of light gasoline components, affecting the considerable API gravity decrease. Within the gasoline fraction hydrocarbons are partially degraded with evaporative fractionation processes (Thompson, 1987) which most likely took places during migration and not within the reservoir, because gases contain minimum of higher hydrocarbon homologues. High light aromatic compound concentrations as well as benzene/toluene ratio indicate high terrestrial and humic input in their precursors. These types of rocks are determined in Markada Formation but in analysed wells they have not reached expected higher maturity stage as they have on other Hayan block field.

REFERENCES

Baskin, D.K. & Peters, K.E. (1992): Early Generation Characteristics of a Sulfur-Rich Monterey Kerogen. AAPG Bulletin, 76,1-13.

Brew, G., Barazangi, M., Al-Maleh, A.K. & Sawaf, T. (2001): Tectonic and geologic evolution of Syria. GeoArabia, 6/4, 573-616.

Schoell, M. (1983): Genetic characterization of natural gases. American Association of Petroleum Geologists Bulletin. 67, 2225-2238.

Thompson, K.F.M. (1987): Fractionated aromatic petroleums and the generation of gas-condensates. Org. Geochem., 11 (6), 573-590.