P241-WE

OIL GEOCHEMISTRY: A CLUE TO THE UNDERSTANDING HYDROCARBON GENERATION AND MIGRATION IN POLISH FLYSCH CARPATHIANS

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The Silesian Unit occupies the largest area in the Polish Flysch Carpathians. The characteristic features of this Unit are: full development of the flysch succession from Lower Cretaceous to Oligocene and different lithology in comparison with other units. For this part of petroleum province was made an attempt to reconstruct petroleum system. A genetic analysis of oils and potential source rocks and their mutual correlation revises existing opinions on genesis, migration and accumulation of hydrocarbons in these parts of the Carpathians.

This study indicates that the oils accumulated in fields of this region were generated from the Menilite shales of the Dukla Nappe, which occurred in tectonic windows within the Magura Nappe.

In Silesian Unit occurs oils which differ mainly in their level of maturity. The oils characterized by lowest maturity are accumulated at shallower depth. It suggests that generation and trap filling was syntectonic. Identification and understanding all geological and geochemical facts provides to determine chart of events in petroleum

This study is a part of a „Petroleum System Analysis" project in which the understanding of hydrocarbon generation, migration, filling history is emphasized. In this paper are presented a geochemical study of crude oils from Silesian and Dukla Units fields in the flysch Carpathians- Poland region. The oils come from different production wells reservoirs horizons, and compartments, but probably, have a common source (Menilite Beds) with some organo-facies differences. The aim of this geochemical study is to understand the type and quality of crude oils, their correlation, degree of thermal maturity and subsequent alteration. A total of 84 oil samples were examined through whole-oil gas chromatography, gas chromatography of saturate and aromatic fractions. Detailed saturate and aromatic biomarker analysis were performed on GC-MS. Some of the analyzed crude oils have undergone post emplacement alteration in the reservoir, including water washing, and biodegradation. This has affected some of the geochemical parameters normally used to interpret organic matter type, depositional setting and maturity of the source rocks. We used a

1 – 10 scale proposed by Peters and Moldowan (1993) on which the extent of biodegradation of an oil can be ranked based on the oil geochemistry (the presence or absence of various biomarkers that have different susceptibilities to biodegradation). Biodegraded oils (extent of biodegradation minor to moderate) are found in relatively shallow reservoirs ranging from approximately 260m to 1000 m in depth. Biodegradation has not affected the distribution of biomarkers such as hopanes and steranes. However the more intriguing aspects of this analysis were: 1) the fact that many of these biodegraded oils also contained a relatively high concentration of lower molecular weight hydrocarbons in the $C_4 - C_{10}$ range 2) same of non-biodegraded oils have high F ratios, suggesting little loss of light ends due to evaporative fractionation 3) another group of four oils found in structurally deeper reservoirs are residual oils. The best explanation in each case seemed to be that moderate degraded oils were mixed with non-dergraded petroleum. The presence of 25-norhopanes in some non-biodegraded oils confirm this approach. It is widely accepted that petroleum containing n-alkanes, isoprenoid alkanes and 25-norhopanes is a mixture of heavily degraded oil containing 25-norhopanes and fresh oil containing n-alkanes. Such scenario indicates either two distinct periods of migration separated by a biodegradational event, or migration into the reservoir along more than one pathway.

All these processes may affect maturity assessment using geochemical parameters. Consequently, there were used many maturity indicators calculated from distribution of aromatic and saturate hydrocarbons (also presence of specific biomarkers) to evaluation maturity of oils. Several geochemical parameters indicate that some of examined oils are not fully mature whereas another are more mature and even “overmature”. Variation in level of maturity across the fields could supply useful information about filling directions. The ability to determine the migrated pathway by an oil from source rock to reservoir could greatly assist in the identification of new accumulations of petroleum.

REFERENCES

Peters K.E. and Moldowan J.M. (1993). The Biomarker Guide, Prentice Hall, Eaglewood Cliffs.