

Hydrocarbon potential of the Early Oligocene Menilite shales in the Eastern Outer Carpathians (Tarcău and Vrancea Nappes, Romania)

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During Oligocene to early Miocene time an extensive accumulation of organic-rich sedimentary rocks occurred in entire Paratethyan Basin, including its central part, i.e. the Carpathian Foredeep basin. Rocks of so-called Menilite facies formed there, burying significant amounts of organic matter (OM). These Menilite shales are now widely considered as a source of hydrocarbons throughout the Carpathian region.

For the purpose of presented study, rock samples of the Menilite facies (mainly of the Lower Menilite and Bituminous Marl Members) were collected from two sections located in the different tectonic units (the Tarcău and Vrancea Nappes, Romania) of the Outer Carpathians. The main goal of the study was to assess and compare their hydrocarbon potential by examination of bulk geochemistry (total organic carbon content, pyrolysis Rock-Eval), vitrinite reflectance (Ro) and application of lipid biomarker parameters.

The data show high variability in OM quantity and quality. Total organic carbon (TOC) content reaches peak values in the siliceous facies of the Lower Menilite Member (up to 8.6 wt% TOC), which contains type II kerogen represented by mainly marine OM type. Such results are confirmed by the presence of short-chain n-alkanes and hopanes. Mixed type II/III kerogen gains importance together with increasing contribution of turbiditic sedimentation. Terrigenous input is marked by occurrence of conifer aromatic biomarkers (such as simonellite, retene and 1,2,3,4-tetrahydrotetene) and odd over even long chain n-alkanes predominance, characteristic for epicuticular leaf waxes. The analysed source rocks can be classified as oil-prone and subordinately mixed oil/gas-prone. OM in the inner tectonic unit (Tarcău Nappe; $T_{max} \sim 430^{\circ} \text{C}$, $R_o \sim 0.5\%$) reaches onset of hydrocarbon generation, while in the outer unit (Vrancea Nappe) OM is immature ($T_{max} \sim 425^{\circ} \text{C}$, $R_o \sim 0.4\%$). This maturity trend may be an effect of different burial histories of these units, as well as variation in subsequent erosion and exhumation levels resulting from the more inner position of the Tarcău Nappe within the orogen relative to the Vrancea Nappe (Wendorff et al., 2017).

Based on the TOC content, S1 and S2 peak values the investigated rocks from the Vrancea Nappe reveal good to even excellent petroleum potential (especially for the siliceous facies of the Lower Menilite Mb.), although they did not attain the oil-window stage. The Tarcău Nappe source rocks have fair to good hydrocarbon potential. Hydrocarbons have been locally generated due to sufficient maturity, as also confirmed by high extractable bitumen yields and field observation of solid bitumen veins. However, hydrocarbon potential has not been exhausted as revealed by still high hydrocarbon index values. In the studied area the rocks of the Menilite facies have been suggested as a source for small gas/oil deposits, i.e. the Cujești and Moinești/Comănești field.

References

Wendorff, M., Rospondek, M., Kluska, B., Marynowski, L., 2017. Organic matter maturity and hydrocarbon potential of the Lower Oligocene Menilite facies in the Eastern Flysch Carpathians (Tarcău and Vrancea Nappes), Romania. *Applied Geochemistry* (in press).