

**IDENTIFICATION OF KEROGEN TYPE IN THE MENILITE SHALES OF THE SKOLE AND SILESIAN UNITS OF THE POLISH AND UKRAINIAN CARPATHIANS**

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The Polish and Ukrainian Carpathians belong to the largest petroleum provinces of Central Europe and constitute one of the oldest petroleum-producing regions in the world. Oligocene Menilite shales are considered as the main source rock in this area (Kotarba, Koltun, 2006). Curtis et al. (2004) based on 28 samples collected from 10 outcrops identified three different organic facies of these strata in the Polish part of Skole and Silesian units. They confirmed the presence of high-sulphur kerogen (Type-IIS) only in the western part of the Skole unit in the vicinity of Rzeszów.

The principal aim of this paper is to verify 328 samples collected from 39 outcrops if the high-reactive, high-sulphur kerogen is present in the Skole and Silesian units in the Polish and Ukrainian Carpathians. Determination of organic sulphur content in kerogen is a necessary element for precise assaying its genetic type and for modelling time position of an "oil-window" and other hydrocarbon generation phases for individual source rocks during the geological development of a petroleum basin. It also enables calculation of the kinetic parameters of kerogen by indirect method (Lewan and Ruble, 2002).

Organic sulphur determination was made for a total of 46 samples from 26 outcrops selected from the above mentioned amount of samples based on the results of Rock-Eval analyses. For elemental analyses only immature or low-mature samples were selected. The results of geochemical analyses (Rock-Eval as well biomarkers and stable carbon isotopes) samples from the Polish and Ukrainian part of Skole (in Ukraine: Skiba) unit show the presence of immature organic matter. Oil-prone Type-II kerogen with local admixtures of Type-II/III kerogen dominates. According to the range of a standard "oil-window" this kerogen was considered incapable of generating liquid hydrocarbons (Fig. 1A). There were selected 34 samples from 19 outcrops (22 samples from 12 outcrops in Polish part and 12 samples from 7 outcrops in Ukrainian part, respectively) for organic sulphur determination from this unit. The presence of high-sulphur (Type-IIS) kerogen was confirmed not only in the area reported by Curtis et al. (2004), but also in local folds at the Polish-Ukrainian border. The presence of Type-IIS kerogen in Menilite strata of the Skole unit indicates that the

generation process probably started (Fig. 1B) and that oil generation might have taken place during the sedimentation stage of development of basin of this tectonic unit as suggested by Lewan et al. (2006).

Organic sulphur content in Menilite shales from the Silesian (in Ukraine: Krosno) unit was determined in 11 samples from 6 outcrops (Polish part) and only one sample from the Ukrainian part. This is caused by the maturity of oil-prone Type-II kerogen, prevailing in these strata change from immature in western portion of Polish part to overmature in Ukrainian part. The investigations indicate the presence of low-sulphur Type-II kerogen in both the Polish and Ukrainian parts.

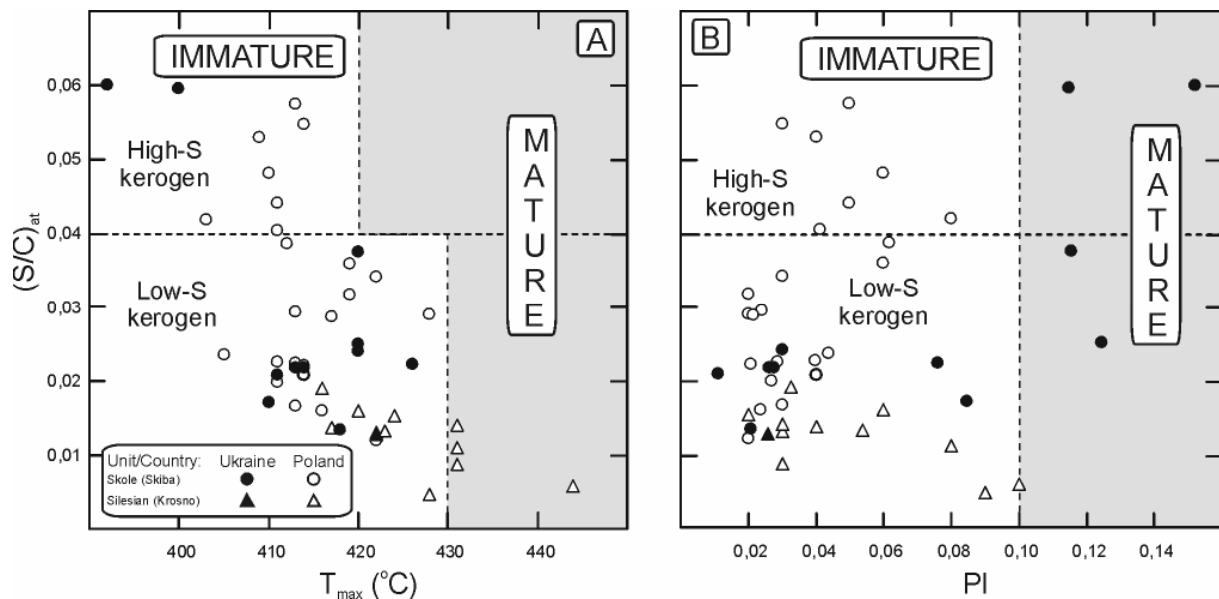


Figure 1. S/C atomic ratio vs. (A)  $T_{max}$  temperature and (B) production index of Menilite shales from the Polish and Ukrainian part of Skole (Skiba) and Silesian (Krosno) units.

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## REFERENCES

- Curtis, J.B., Kotarba, M.J., Lewan, M.D., Więclaw, D., 2004. Oil/source rock correlations in the Polish Flysch Carpathians and Mesozoic basement and organic facies of the Oligocene Menilite Shales: insights from hydrous pyrolysis experiments. *Organic Geochemistry* 35, 1573-1596.
- Kotarba, M.J., Koltun, Y.V., 2006. Origin and habitat of hydrocarbons of the Polish and Ukrainian parts of the Carpathian Province. In: Golonka, J., Picha, F. (Eds.), *The Carpathians: Geology and Hydrocarbon Resources*. American Association of Petroleum Geologists Memoir 84, pp. 395-443.
- Lewan M.D., Ruble T.E., 2002. Comparison of petroleum generation kinetics by isothermal hydrous and nonisothermal open-system pyrolysis. *Organic Geochemistry* 33, 1457-1475.
- Lewan M.D., Kotarba M.J., Curtis J.B., Więclaw D., Kosakowski P., 2006. Oil-generation kinetics for organic facies with Type-II and -IIS kerogen in the Menilite Shales of the Polish Carpathians. *Geochimica et Cosmochimica Acta* 70, 3351-3368.