

Organic matter research from the Pieniny Klippen Belt (Central Western Carpathians)

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Jurassic-Cretaceous shales of the flysch and pelagic formations from the Pieniny Klippen Belt, being a constituent of the Central Western Carpathians, were analyzed to evaluate the type of organic matter, the origin and the depositional environment. The Pieniny Klippen Belt formations were deposited 120 million years in the northern sector of the Tethys Ocean. Results from the 24 samples established the organic geochemical characteristics and identified the kerogen type and thermal maturity of organic matter based on their petrographic approach as observed under incident white light and blue light excitation.

Both petrographic microscopy and biomarker parameters showed that the shales contain organic matter of terrigenous and marine origin preserved in the sediments under various depositional conditions at different depths beneath the shelf. The organic matter represented by three maceral groups, is typical for flysch sediments of the Szlachtowa Formations. It signifies mixed organic matter origin, proved by the presence of yellow fluorescing liptinite macerals with the addition of vitrinite and inertinite particles. The organic petrography of pelagic sediments represented by the Opaleniec and Skrzypny Formations revealed a low abundance of organic matter represented mainly by the inertinite group with the addition of vitrinite and liptinite remains. Bimodal distribution at $n\text{-C}_{16}$ – $n\text{-C}_{18}$ and $n\text{-C}_{23}$ – $n\text{-C}_{28}$ with the predominance of long-chain over short-chain n -alkanes in the flysch sediments also confirmed various sources for the organic matter within the epicontinental basin. The lack of homologues from $n\text{-C}_{11}$ to $n\text{-C}_{14}$ indicates the biodegradation of organic matter. The marine origin of the pelagic deposits of the Opaleniec and Skrzypny Formations was testified in the distribution of n -alkanes as the dominance of short-chains with a low contribution of middle- and long-chain n -alkanes, which may suggest their mainly planktonic/bacterial origin. The steranes were uncommon in the samples; only single sterane peaks were observed. Aromatic hydrocarbons such as dimethyl- and trimethylnaphthalenes, usually show low concentrations, but only in the flysch samples. The Pr/Ph ratio values range from 1.00 to 3.72 (av. of 2.27), indicating that organic matter was deposited in a marine environment and preserved under suboxic and oxic conditions.

The kerogen type-III identification obtained using the cross-plot of Pr/ $n\text{-C}_{17}$ versus Ph/ $n\text{-C}_{18}$, corresponds to the thermally mature organic matter being at early/middle catagenesis of the oil window. These results are consistent with vitrinite reflectance values in the range of 0.60% to 1.03% measured on indigenous vitrinite particles.

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