MIGRABITUMENS – THE LINK BETWEEN THE PODHALE TROUGH AND THE CRYSTALLINE BASEMENT OF THE WESTERN TATRA MTS.

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The Tatra Mts. form one of the uplifted crystalline cores present in the Inner Western Carpathians. The allochtonous crystalline basement is overthrusted by folded Mesozoic unmetamorphosed sedimentary sequences. From the north block of the Tatra Mts. is bordered by the Podhale Trough. That structure is built up of Mesozoic basement (adequate to the Tatra Mesozic cover) and Tertiary filling: Podhale Flysch and nummulitic Eocene limestones (KĘPIŃSKA, 1997). Several boreholes drilled the structure of the Podhale Trough. Apart from gas and oil manifestations sulphide thermal waters were stated here, too. Both the Tatra Mts. block and Podhale Trough are cut by the NE-SW trending tectonic zones. Some of the boreholes, cutting Podhale Trough, are located roughly on/near the tectonic lineaments (Zakopane IG-1, Poronin PAN-1, Biały Dunajec PAN-1).

In the crystalline basement the presence of bitumens, entrapped in the quartz-sealed tectonic zones, were stated. Bitumens are at oil window stage of transformation (R_{CS} = 0.75–0.82) and contain biomarkers (steranes and hopanes), conventionally used for the oil-source rocks correlation. Possible source rocks for the bitumens were Upper Triassic – Lower Jurassic sedimentary rocks, deposited in the marine, oxic to suboxic environments (MARYNOWSKI *et al.*, 2001).

Rock-Eval analyses showed that rock samples from the Podhale Flysch have the total organic carbon (TOC) content in the range 0.6–1.4 wt% and T_{max} varying in the range from 430 °C to 445 °C. All investigated Tertiary samples represent the usually non-generative, III type of kerogen. Additionally, extractable bitumens from the Tertiary Podhale Flysch contain significant amounts of oleanes, which are absent in the migrabitumens as well as in the extractable organic matter from the Tatra Mesozoic cover and Podhale Mesozoic basement.

The Mesozoic basement rocks reached the transformation of dry gas window stage, with R_o changing from 1.1% (north of Podhale) to 1.51% and 2.3% (south of Podhale). Organic matter from the Mesozoic rocks of the Tatra block cover showed the mean R_o = 1.23%.

GC-MS investigations revealed that thermally stable isomers of phenantrenes, terphenyls and phenylonaftalenes as well as the aromatic sulphur compounds concentrations are the lowest in the bitumens from the crystalline rocks and much higher in the Mesozoic and Tertiary rocks. That fact, together with vitrinite reflectance measurements, point out the differences in maturity between bitumens and organic matter from the Podhale and Tatra sedimentary rocks. The high level of organic matter maturity in the Podhale Trough caused the decomposition of biomarkers, so it is not possible to compare the characteristics of source rocks for migrabitumens and Mesozoic and Tertiary rocks of Podhale. The presence of *n*-alk-1-enes was stated in both Mesozoic rocks and, in lower concentrations, in bitumens from the tectonic zones. The n-alk-1-enes are important markers of rock-oil migration and secondary expulsion, especially in the rocks which underwent the maturation processes to the level higher than R_o = 1.2 %. They are usually enriched during the last stages of crude oil expulsion.

Both Mesozoic basement rocks and Tertiary fill of the Podhale Trough underwent the intensive maturation (level of late catagenesis to early metagenesis) after the hydrocarbons expulsion. In this complex situation the correlation of the migrabitumen and source rocks was enabled only by the occurrence of *n*-alk-1-enes and $\delta^{13}C$ isotope data. The similarity of isotope data and consequent changes of *n*-alk-1-enes along the NE-SW-trending tectonic lineaments, together with the characteristics of Mesozoic sedimentary rocks led to the conclusion that Mesozoic (T, J) sedimentary rocks were the source of the investigated bitumens.

The migrabitumens from the tectonic zone of the crystalline basement of the Tatra Mts. are much less mature than the dispersed organic matter in the Mesozoic source rocks. The preservation of primary molecular constitution was possible due to quartz sealing of the tectonic fractures and/or due to the differences in heat flow in the western part of the Tatra and Podhale complex.

References

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