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Origin and Occurrence of Natural Gases in the Miocene Strata of the Eastern Part of the Polish Carpathian Foredeep: Isotopic and Geological Approach

Maciej J Kotarba
AGH University of Science and Technology, Faculty of Geology, Geophysics and Environmental Protection, Poland

In the autochthonous Miocene strata of the Carpathian Foredeep between Sedziszow and Polish-Ukrainian border over 70 gas deposits were discovered since the 1960s. In this study area, fourteen natural gas samples were collected from the Miocene sandstone reservoirs. Molecular and isotopic ($\delta^{13}C$ in CH_4, C_2H_6, C_3H_8, iC_4H_{10}, nC_4H_{10}, iC_5H_{12}, nC_5H_{12} and CO_2, δ^2H in CH_4, C_2H_6 and C_3H_8, and $\delta^{15}N$ in N_2) compositions of natural gases were analysed. Additional 65 results of molecular and an incomplete, previously published set of isotopic analyses of gases from the study area were used for genetic interpretation. Methane concentrations in natural gas usually exceed 95 vol%. Isotopic studies reveal that methane and partly ethane and even propane accumulated within the autochthonous Miocene strata were generated by microbial reduction of carbon dioxide in marine depositional environments, mainly during sedimentation of the Miocene clays and muds. Generation and accumulation of microbial methane, ethane and propane, formation and loading of multiply stacked Miocene sandstone reservoirs and claystone source rocks were facilitated by rhythmic and cyclic deposition of clays, muds and sands at very high sedimentation rates. The higher light hydrocarbons (butanes and pentanes, and partly ethane and propane) were originated during diagenesis and at the initial stage of the low-temperature thermogenic processes. Carbon dioxide and molecular nitrogen were generated by both microbial and early thermogenic processes. Thermogenic gas which migrated from the Upper Jurassic strata of the Palaeozoic-Mesozoic basement occurs only in the lowest Miocene horizon of the Gora Ropczycka deposit.

Biography:

Maciej J. Kotarba is professor of petroleum geology and geochemistry at the Faculty of Geology, Geophysics and Environmental Protection, AGH University of Science and Technology. He earned his M.Sc. degree in 1971 and Ph.D. in 1979 from AGH University of Science and Technology. His research interests include petroleum geochemistry, coal methane, isotope geochemistry and origin, kinetics and simulation of petroleum generation and expulsion processes. He has graduated 11 PhDs and published 12 monographs and books, and over 180 scientific articles.