THE MIDDLE CAMBRIAN SUCCESSION IN THE CENTRAL BALTIC BASIN: GEOCHEMISTRY OF OILS AND SANDSTONE RESERVOIR CHARACTERISTICS

O. Zdanaviciute, J. Lazauskiene, A.I. Khoubldikov, M.V. Dakhnova and T. P. Zheglova

Some 36 oilfields, all producing from Middle Cambrian (Deimena Group) sandstones, are located in the central Baltic Basin in an area covering onshore Lithuania and Kaliningrad (Russia) and the adjacent offshore. This paper presents new data on the composition of crude oils from fields in this area and reviews the reservoir properties of the Deimena Group sandstones.

Twenty-one crude oil samples from fields in Lithuania and Kaliningrad were analysed by standard techniques including GC and GC-MS. The oils had densities of 790.5 to 870.0 kg/m³, and had low asphaltenes (<2.2%) and sulphur (<0.44%) contents. The gasoline fraction (b.p. >200°C) ranged from 12–34%. The saturated hydrocarbon content was 35.3 to 77.8%, and the ratio of saturate to aromatic hydrocarbons was 2.1–5.2, indicating long-distance migration or high thermal maturities. GC analyses of saturate fractions indicated a composition dominated by n-alkanes with a maximum at C₁₃–C₁₅ and reduced abundance in the C₂₀–C₃₅ range. The analysed crude oil samples are characterized by relatively low concentrations of steranes and triterpanes.

Biomarker data indicated an algal origin for the precursor organic matter and a clastic-dominated source rock. Sterane isomerization ratios imply that the oils are in general relatively mature. Exceptions are samples from the Juzno Olempijskoye and Deiminskoye fields, Kaliningrad, which were early mature. Oil from well Gondinga-1 (Lithuania) was lightly fractionally evaporated and has a relatively higher density, higher viscosity, higher asphaltene content and lower content of saturated fractions.

Stable carbon isotope ratios of crude oils and saturated and aromatic fractions were analysed. Whole oils showed little carbon isotope variation, but there were significant differences in δ¹³C ratios for saturated and aromatic fractions. The geochemical data show differences in oil sourcing and indicate the possible existence of different kitchen areas in the Kaliningrad region.

Vertical and lateral variations in Deimena Group reservoir properties are controlled by variations in quartz cementation. In fields in western Lithuania, sandstone porosity ranges from 0.7 to 20% and permeability from 20 mD to 300 mD; in fields onshore Kaliningrad, porosity is up to 34% and gas permeability up to 4.8 D. Wide variations in porosity and permeability occur at a field scale.

Key words: Baltic Basin, Lithuania, Kaliningrad, Cambrian sandstones, Deimena Group, reservoir properties, oil composition.