



Trace Elements of Oil of Tatarstan as Example of Interaction of Deep Process with the Sediment Fill

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The trace elements petroleum study, conducted in Tatarstan permits the recognition of three oil types: (1) of the Melekes trough, (2) of the central part of the South Tatarstan Arch and (3) of the Bavli oil fields, varying in amount of Mo, Se, Au, Ag and Hg. Some portions of the Minnibaevo oil area contain higher concentrations of Ba, Hf and W, and the Zelenogolsk oil area has a high tantalum content. Asphaltenes have been found to contain elements, greatly varying in their geochemical properties, which could have only been transferred by the abyssal reducing fluids that had made them neutral to matrix. At the same time, naphthoids can be differentiated on the basis of genetically sensitive lanthanoids (Gottikh & Pisotsky, 2000). It has been found that asphaltenes have a distinct, positive europium-produced anomaly and a ratio of Eu/Sm reaching 1.16 that is obviously not characteristic of the upper crust formations. Thus, the source of these microelements can only be found in the lower crust or upper mantle. Strontium isotopic ratios provide another piece of evidence that oil has no relation to the “producing” sedimentary material. Devonian aphanite limestone from the sea area is characterized by the $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of 0.7082, and oil from the Nurlat and Abdrakhmanovo areas - by 0.7102 and 0.7100, respectively. However, the biogenic concepts suppose that the oil should have inherited some sea-related matter (Gottikh & Pisotsky, 2000). Strontium isotopic systems and neodymium in petroleum and carbonic rocks were evolved in different ways, and naphthoids of the Melekes trough and the central part of the South Tatarstan Arch had different sources of microelements. Diagrams of $\text{eNd-}^{87}\text{Sr}/^{86}\text{Sr}$, used to identify the zones of magmatic accumulation in the crust, have shown that microelements found in petroleum might have their sources in magmas of varying composition, in active zones of the lower-crust substratum and

in the mantle. Geochemical features of the mantle fluid relics sealed in diamonds and those of the oil-producing systems have been found to be fully identical. The fluids that affect the lithosphere extract microelements out of the matrix and take part in oil formation must have themselves been formed at a great depth at low fO_2 . Geophysical data have also confirmed that gas systems reached the upper mantle and earth's crust to undergo polymerization and polycondensation.