Deep roots of the fluid systems and oil-gas fields (isotope geochemical and geodynamic aspects)

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Up to now the results of many dozens of publications on the use of carbon-helium isotope-geochemical data have been accumulated. We performed a multi-regional summarization of carbon-helium isotope-geochemical data related to the deep fluid-gas systems of volcanoes and hydrotherms. The summary of the data related to carbon-helium isotope-geochemical system for methane of oil-gas fields of regions of Russia, USA, China, Japan, New Zealand and other countries was made.

The change in the ratio of the number of carbon atoms to the number of the atoms of light helium isotope (^{3}He) for methane of oil-gas fields (10^9-10^{13}) and for carbon dioxide in fluids of volcanoes, fumaroles and hydrotherms (10^9-10^{14}) was similar. Like the carbon dioxide, the genesis of methane is also associated with deep crust-mantle processes, i.e. the recycling of crustal material was involved not only in the generation of water-carbon dioxide, but also in hydrocarbon fluids. The change of the oxidation state of carbon (CO_2) recovered (CH_4 and higher molecular weight hydrocarbons), shows a decrease in the intensity of magmatic activity (the degree of partial melting of the matter).

A variety of isotope-geochemical spots (characteristics) in the summary diagram for methane reflects the diversity of regional and local environments of the generation and transformation of deep hydrocarbon fluids in the formation of oil-gas fields. Diversity is also manifested in the specific trends in the relationship $C_{CH4}/^3$He on carbon-helium diagrams for different regions (Japan, California, New Zealand, Eastern China). Carbon-helium isotope-geochemical indicators and trends can be used to solve practical problems in oil-gas geology, including basing modeling.

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