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Editorial

STUDY OF THERMODYNAMIC PROCESSES OF THE EARTH FROM THE POSITION OF THE GENESIS OF HYDROCARBONS AT GREAT DEPTHS

In the context of significant depletion of traditional proven oil reserves in the Russian Federation and the inevitability of searching for new directions of study and expansion of the raw material base of hydrocarbon raw materials in hard-to-reach regions and on the Arctic shelf, a scientific search is underway for accumulations in complex geological conditions and in manifestations that differ significantly from traditional ones, which include the processes of oil and gas formation and preservation of oil and gas in low-permeability "shale" strata and in heterogeneous reservoirs at great and super-great depths. Within the oil and gas provinces of the world, drilling of a number of deep and super-deep wells has revealed deposits at great depths, established connections between hydrocarbon deposits and "traces" of hydrocarbon migration left in the core of deep wells, which has made it possible to significantly re-evaluate theoretical ideas on the issue of oil and gas formation conditions and the search for technologies aimed at solving applied problems. Modern geochemical, chromatographic, bituminological, coal petrographic and pyrolytic methods of studying oil and bitumoids extracted from the host rocks of deep well cores give a hope for identifying correlations in the oil-source system, revealing processes that determine the possibility of hydrocarbon formation and accumulation, and defining predictive criteria for oil and gas potential at great depths.

This vector of development determines two key tasks. The first task is to expand the base of accessible sources of petroleum products in the conditions of high growth rates of demand for energy resources from domestic industry, due to the peculiarities of the modern technical and economic development of the economy. The second task is to create a reserve of alternative sources of strategic metals associated with deposits of carbon-containing raw materials to implement the strategy of reproduction of mineral resources in the context of import substitution.

The thematic volume of the "Journal of Mining Institute" offered to readers contains articles examining the problems of domestic and world science in the field of naphthogenesis processes, the relationship between the oil-bearing potential of hydrocarbon deposits and the elemental composition of the inorganic part of oils and their reservoir rocks, the features of mineral forms of noble and rare metals associated with carbon-containing raw materials and methods for their extraction and concentration.

One of the approaches aimed at solving the problems of determining the prospects of great depths is modeling of oil and gas generation and accumulation systems of sedimentary basins, the identification of potentially productive deposits and the assessment of their generation characteristics, which, along with the enrichment of rocks with organic matter, include the degree of transformation and the kinetics of thermal transformation, which affect the manifestation of intensive periods of oil and gas formation. A number of articles in the issue considers this topic. The article by *Mariya A. Bolshakova* and co-authors is devoted to the study of ancient Precambrian oil and gas source rocks, the specific composition of ancient organic matter and the identified patterns of the implementation of generation potential in the process of catagenetic transformation.

The article by *Aleksandr V. Kozlov* and co-authors examines a geological-genetic model of diamond deposit formation based on original material on the study of ontogenetic features of diamond crystals. The possibility of hydrocarbon generation at mantle levels corresponding to diamond formation areas is shown based on the presence of methane and heavy hydrocarbons in inclusions in diamond crystals.

The article by *Aleksei E. Kontorovich, Lev M. Burshtein* and co-authors is devoted to the problem of deeply buried oil and gas systems of the Lena-Vilyui sedimentary basin in the east of the Siberian platform. Analysis of black shale strata and overlying deposits made it possible to substantiate the possibility of identifying large hydrocarbon deposits in the Kuonamka complex and clinoform-structured deposits of the Mayan stage. A probabilistic assessment of geological hydrocarbon resources of the Cambrian and younger Paleozoic complexes of the Lena-Vilyui sedimentary basin is presented. The authors emphasize the need for a deep and ultra-deep parametric drilling program in the study area.

The article by *Svetlana V. Mozhegova* and co-authors presents the results of determining the kinetic parameters of two high-carbon source strata, distributed in the territory of three oil and gas basins. Differences for different types of organic matter, influencing the time of the onset of generation, are shown.

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The article by *Irina N. Plotnikova* and co-authors examines the influence of anoxia (oxygen deficiency) of the paleobasin on the formation of high-carbon strata. A new methodological approach to the geochemical study of domanikites and domanikoids is proposed, based on the use of diaryl isoprenoids and tetramethylbenzenes as indicators of anoxic formation conditions. The influence of tetramethylbenzene isomers on the thermodynamic state of the hydrocarbon environment is established.

The study by *Oleg M. Prishchepa* and co-authors examines the main geological prerequisites and mechanisms that determine the possibility of hydrocarbons existing at depths greater than 5 and 6 km, as well as the preservation of the liquid phase under extreme thermodynamic conditions. The possibility of using thermodynamic modeling as a basis for predicting phase states is demonstrated using the example of studying fluids from two areas with identified hydrocarbon deposits.

The features of physical characteristics of reservoir rocks of oil fields in the refraction of geological exploration are considered in the article by *Vladimir L. Trushko* and co-authors, in order to research the mechanism of formation of fractured reservoirs at great depths, acoustic emission studies were conducted. A classification of the geometry of destruction and strength and seismic criteria was obtained. A significant zone of micro-fractures for igneous rocks was revealed, which determines a large contribution of the dilatancy process in the preparation of their destruction.

A comprehensive study of the unique features of various phases of rocks that have the potential to accumulate hydrocarbons or are geologically close to possible oil formation zones allows us to increase the accuracy of forecasting oil deposits and possible routes of its migration and accumulation. In the article by *Tatyana N. Aleksandrova* and co-authors, using molecular modeling methods, the potential structures of organic compounds of transition metal carriers in heavy oil fractions are substantiated. Based on the established ratios of transition metal contents in reservoir rocks and oil samples, the mechanisms of possible hydrocarbon accumulation processes on sorption-active rocks after contact with mantle fluids are suggested.

A number of articles have more extensively investigated the features of the correlation of the platinum group element contents with possible mechanisms of polygenesis of oils and associated ore deposits. In the article by *Elena G. Panova* and co-authors, based on the assessment of the geochemical resource of noble and transition metals and associated elements for black shales as a whole and separately for the submicron fraction, the potential for complex processing has been confirmed. The article by *Nadezhda A. Krivolutskaya* presents extensive studies of the processes of genesis of platinum-copper-nickel deposits and notes the special role of the evolution of the Enisei-Khatanga trough. The article by *Irina V. Talovina* and co-authors is devoted to the study of potential geological causes of the formation of abnormally high concentrations of platinum metals in oils, the totality of which can be considered as positive search indicators for identifying oil deposits.

The article by *Tamara N. Matveeva* and co-authors is devoted to the problem of increasing the complexity of extracting strategic metals from proposed alternative sources associated with carbon-containing raw materials using flotation methods for concentrating useful components with fundamentally new reagents. Alternative carbon-containing sources of strategic metals can be metamorphosed technogenic wastes of production, which can act as nature-like raw material models. Extrapolation of the developed principles and methods of their processing to natural raw materials will allow to significantly expand the understanding of the ongoing deep processes and properties of carbon-containing raw materials on such material. The work of *Natalya N. Orekhova* and co-authors is devoted to the study and assessment of the enrichment of metallurgical dusts by size using magnetic and flotation methods, and the impact of dust disintegration processes on the enrichment indicators.

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