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THERMOBARIC DEPENDENCES OF PHYSICAL PROPERTIES OF ROCKS DISCAVERED BY THE KRIVOY ROG ULTRADEEP BOREHOLE

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ABSTRACT

Information about results of studies of thermobaric changes of physical properties of rocks discovered in drilling the Krivoy Rog ultradeep borehole (Ukraine) are summarized. Pethrophysical models of the Earth's crust of the area of its location are set up.

The main tasks of drilling this borehole located in an iron province which is one of the largest in the world were to elucidate the formation conditions, composition, properties and evolution of the Earth's crust of continental type within the area of the development of precambrian iron-silicon and granite-greenstone formations of the Central Ukrainian Shield. Also specified was the interpretation of anomalies of the observed geophysical fields and the nature of seismic boundaries in crust.

For this purpose and to set up a regional petrophysical model of the interior we have obtained a new unique information on PT-changes of physical characteristics of rocks discovered by the borehole. The drifted part of the section is mainly represented by metaconglomerates, various schists, quartzites, amphibolites, plagiogranites and some other lower-proterozoic and upper-archean mineral formations of different composition. Almost all rocks encountered in drilling show differently expressed banding, schistosity and linear arrangement of minerals.

The method worked out earlier in which specialized chambers are used was applied in a set of laboratory petrophysical PT-experiments on samples of a representative collection of cores. We carefully studied elastic, thermal, electrical and magnetic parameters of rocks in characteristic strictly oriented structural and textural with simulating respective deep thermobaric conditions in PT-experiments. We are founding the nature of the anisotropy of the distribution of the studied petrophysical parameters found within the section and which is most probably preserved even at greater depth (below the hole bottom).

The features of thermobaric changes of specific electrical resistance and dielectrical constant of the rocks studied are due to their saturation with fluids, mineralization of the latter, dissociation and dehydration of carbonates, micas and other minerals. With increasing pressure the thermal conductivity and thermal diffusivity coefficients of rocks are increased by almost one third. They evently decrease with increasing temperature. We have established a relatively early stage of metamorphism of mineral formations. At the simultaneous programmed PT-effect the remanent magnetization of the most samples containing ferromagnetics is featured by anomalous changes in respective directions. Based on experimental PT data obtained by the method proposed, changes of elastic anisotropy of core samples were studied and criteria-precursors of the destruction of the near-shaft space during borehole drifting were found. They are mainly due to violation of the elastic lithostatic balance of the geologic medium.

An analysis of the results of the whole set of petrophysical PT-experiments and the geologic-geophysical information enabled us to assume possible changes of properties, composition and state of rocks at depth so far not reached by drilling. We have also set up prognosed deep petrovelocity, geoelectrical and lithological models of the Earth's crust of the area of the Krivoy Rog over- and underthrust structure.

I sincerely thank all my researchers that participated in the investigations.