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Powerful processes of hydrocarbon migration and generation on great depths

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The scheme of geodynamic and fluid dynamic processes in the zones of collision of lithospheric plates on great depths is based on the concepts of plate tectonics. This scheme covers the major stages starting with the break and drift of the ancient continents up to the transformation of the passive margins into the subduction zones. It also includes the description of the fluid dynamic regime in sedimentary basins at each stage of their evolution.

The hot waters, moving along the layering of the sedimentary rocks, should result in a very effective washing away of hydrocarbons and their migration from beneath the subduction zone towards depressions. The overthrusting process in depressions was accompanied by intensive pressing out of the interstitial waters and hydrocarbons from the major part of the sedimentary wedge, which by this time has been driven into the subduction zone. This process was also enhanced by the water supply from the deeper parts of the subduction zone of «crustal waveguide».

We suppose that these ancient infiltration flows considerably concede to the pressure of waters driven from depressions. Firstly, the migration of the thermal waters from the zone of subduction of lithospheric plates is provided by excess overcritical pressure of «crustal waveguide» in fractured zones on depths 15-20 km. Secondly, the reason may be found in the enormous volumes of the water of the ancient oceanic crust, which is a kind of a factory for their generation (at the expense of dehydration). Further, the pelagic deposits occurring in a subduction zone and accumulated at the edge of a

continent under the shelf conditions

The fluid dynamics is described in terms of a geomechanical model. A class of fluid dynamic models is considered. It includes a model of consolidation of the sedimentary basins, free oscillation model of «crustal waveguide»s, model of slow fluid motions in the zone of collision of lithospheric plates (in a compaction mode), as well as a model of quick fluid dynamic processes at the final stage of evolution of a sedimentary basin, that is in the subduction zone.

For the first time it was calculated that in reversal mode the hydrocarbon deposit exists in stratified fluid resistant environment in cycle of self-oscillations bound with different scale of dynamic inertia of fluids during their gravitational substitution. The period of such oscillations is commensurable with time of maintenance of a deposit. The classification pattern has allowed defining hydrodynamic behavior of fluids in sedimentary basins. The fulfilled exploratory calculations, which were made for the first time, have allowed to explain the most weak point in representations, existing for today, about the mechanism of migration and concentration of hydrocarbon fluids existing in great depths of sedimentary basins.

The results of numerical simulation within the framework of this model are presented together with the diagrams displaying consecutive stages of propagation of the gas–fluid dynamic front by the example of the Pre-Caspian, Cis-Verkhoyansk depression and Timan-Pechora basin.