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Influence of Deep Gas Systems on Geochemical Formation of Sedimentary Basin (on Example of Volgo-Ural Region)

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Elastic properties of the earth's crust below the known hydrocarbon pools in radial and lateral directions are quite different. Moreover, large hydrocarbon fields spatially correspond to certain lateral domains of the crystalline crust and/or upper mantle (Bulin & Egorkin, 2000). Although the structure of the crystalline crust and upper mantle can only be studied in the course of a long-term seismic surveying, the interpretation of the acquired data is problematic because such processes as basic volcanism in Middle Devonian times, geochemical formation of the Upper Devonian, Lower Carboniferous and Upper Permian by the deep, reducing gas systems, oil and bitumen accumulation, - all took place in different times (Gottikh & Pisotsky, 2000). Moreover, the crystalline crust was also largely restructured by purely tectonic processes, not related to the fluid flows. Even in our times, formation of gas and condensate pools still takes place. Hydrocarbon migration was accompanied by the basement block movements and seismic activity, and a methane content in the troposphere can be correlated with the magnitudes of the recorded earthquakes. It has been found that earthquakes with magnitudes of 4 to 4.5 stimulate a methane discharge, and those with magnitudes of up to 5 inhibit it (Goryachev et al., 2000). Recent degassing processes have been detected by the repeated leveling data (Kuznetsov, 2000) and periodical seismic events, e.g. by the analyses of isotopic composition of carbon from oil of the Novo-Elkhovo field before and after earthquakes. Analyses of the basement gases extracted from the superdeep 20009 well have shown that their isotopes and other components are unstable in time. Isotopic composition of carbon in methane changed from -10 to -90%. This behavior is peculiar to the products of reaction between carbon monoxide and

hydrogen. Basement methane composition explains why that of associated gases from the Devonian is lighter than that of the Carboniferous. Geochemical studies can also substantially contribute to deep petroleum exploration. For example, radiogeochemical fields in hydrocarbon areas were produced by a wide range of microelements from great depths. These anomalous fields are directly correlated with oil-bearing areas (irrespective of the presence of structural traps), trending along the fracturing strike of ancient platforms. It is especially noteworthy that all productive wells of the Verkhne-Chon condensate field (Nepsko-Botuob anteclise), Novo-Elkhovo and Minnibaevo oil areas proved to be limited to hot zones. Thus, the integrated studies including chemical, structural and radiological analyses can effectively help to more precisely locate areas for further detailed geochemical and geophysical surveys to reveal hydrocarbon potentials of great depths.