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The Anomalous Structure and Discrete Potential Fields of the Earth's Consolidated Crust as Factors Governing the Position of the Giant Romashkino Oil Field

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The formation of large and giant ore and nonmetallic fields remains a major problem of petroleum geology that has yet to be solved. This mainly consists in the positioning of large oil accumulations under the influence of deep structures in the Earth's consolidated crust that are detected by geophysical techniques. It is known that 19 giant oil accumulations are located in only 24 sedimentary basins out of 520. The in-place reserves of these giant fields exceed ultimate reserves of 313 world's largest oil fields. This fact has to be logically explained and studied. Factors that affect the formation of large and giant oil fields include the fluid dynamic development of sedimentary basins and the formation history of their consolidated crusts. The question of how the formation of the largest oil accumulation is reflected in deep geophysical, geological and petrological data has to be answered. This paper aims to analyse these processes. The object of the study is the Romashkino oil field located in the South Tatarstan Arch of the East European Platform with initial in-place reserves of more than 4 billion tonnes. The field is crossed by deep latitudinal and meridional geophysical survey lines in its northeastern portion, which allowed the determination of the shapes, sizes, depths and character of geophysical anomalies in the Earth's crust. The output data of deep high frequency seismic sounding at 30-40 Hz on a section of the Granite line, crossing the northwestern portion of Romashkino, have been published. The seismic dynamic heterogeneity above a depth of 130 km reflects the complex hierarchical structure of the Earth's crystalline crust and upper mantle. A major seismic energy anomaly with three

branches in the lowermost portion of the consolidated crust is observed at a depth of 110-60 km. The gravity and magnetic fields have been analysed in this survey line section at 1:200 000 scale. Data inversion was performed by 3D wavelet decomposition. The apparent density section from the M surface to a depth of 18-25 km features two high-density zones of different orders with the most intensive one branching in the upper crust into a series of smaller sources. The magnetic section of the Earth's crust features heterogeneous zones with the boundaries between them. A vast area of magnetised rocks, in contrast to the more differentiated gravity field, is traced between depths of 40 km and 20-25 km in the central portion of this survey line section. The gravity, magnetic and seismic energy anomalies are generally consistent and reflect the structural and compositional heterogeneity of the Earth's crust below the Romashkino field. CDP data indicate that the lower and middle consolidated crust contains zones that produce intensive seismic reflections featuring a series of dome-like structures. These structures are reflected in strong magnetic fields and in strong but more differentiated gravity fields. The data on the cyclic geodynamic development and the evolution of the ancient structural and anomalous geochemical fields in the sedimentary cover allow the modelling of the giant Romashkino field in the Earth's anomalous consolidated crust.