

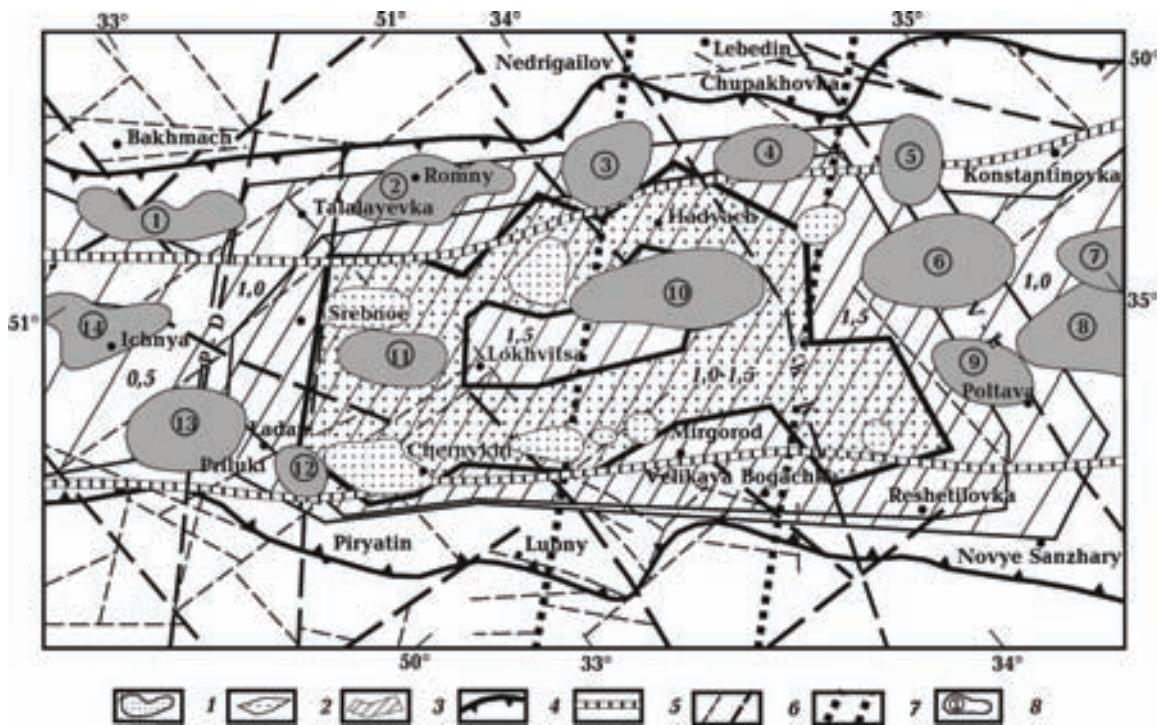
Nature of sources of the magnetic anomalies in the Central Depression of the Dnieper-Donets Aulacogen

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The nature of sources of the local and regional magnetic anomalies is an important element of the fundamental and applied studies aimed at elucidating the deep structure, composition and evolution of the Earth's crust. The present paper investigates the nature of the magnetization of different crustal layers of the Central Depression (CD) of the Dnieper-Donets Aulacogen (DDA) with special emphasis on elaboration of regional and local geomagnet-

ic criteria for prognosing the oil and gas potential of the Earth's crust of the study area [Orliuk, 1994; Orliuk, Pashkevich, 1996; Orliuk et al., 1998; 2000]. The CD is situated between the cities Ichnya and Poltava [Chirvinskaya, Sollogub, 1980]. The crystalline basement surface is situated at depths from 2 km in the Aulacogen boundary areas and at 5–12 km in the central part. A regular basement depth increases from N to SE is observed [Ilchenko, 1997;



Sources of the magnetic anomalies in the consolidated crust of the Central Depression: 1 — local magnetic bodies with magnetization of 1.5–2.5 A/m; 2 — contours of the magnetic inhomogeneities of the upper crust, magnetization in A/m; 3 — contours of the magnetic inhomogeneities of the lower crust; 4 — marginal fault of the aulacogen; 5 — boundary of the Central Graben of the DDA (compacted part of the aulacogen) and faults of the rank; 6 — fault of the second and third rank by gravimagnetic data; 7 — projection of the exposure of the lithospheric lineament G at the day surface the former separating the lithosphere with different thickness; 8 — contours of local depression.

Kozlenko, 1982]. Against the background of the regional change of the crystalline basement surface depth some local basins are distinguished. The Dimitrovskaya (1), Romenskaya (2), Sinevskaya (3), Kachanovskaya (4) and Sidoriachskaya (5) basins are located in the northern edge of the Aulacogen. The Solokhovskaya (6), Chutovskaya (7), Landoriskaya (8) and the Reshetilovskaya (9) basins are placed in the Aulacogen centre (at the Poltava and Akhtyrka longitude) (Figure). The Lutenskaya (10), Srebnenskaya (11) and Ichnianskaya (14) basins are situated in the central part of the Aulacogen, while the Ladanskaya (12) and Prylukskaya (13) basins are close to the southern boundary. The basins situated near the northern aulacogen (with the 6.0—7.5 km basement depths) are separated from the Aulacogen centre basins (7.0—12.0 km depth) by a peculiar swell with depths of 4.5—6.0 km to the crystalline basement surface. According to seismic data, the basement surface is disturbed by numerous faults of different strike.

The M uplift to 35 km is observed in the central part of the DDA [Sollogub, 1986]. The maximal gradient is recognized in the northern and southern aulacogen. The marginal aulacogen is featured by M depths >40 km, the gradient of the M for the northern boundary being steeper than that for the southern one. The magnetic model of the CD of DDA reflects the three-stage distribution of the magnetic sources in the Earth's crust. The upper stage consists of effusive-pyroclastic rocks of the Frasnian and the Famennian stages and lies in the lowermost sedimentary cover. Its mean weighted magnetization is 1.0—3.0 A/m. An analysis of the MS of a sedimentary cover enabled us to establish some regularities. 1) The increase in the magnetic susceptibility (MS) values of rocks from north to south is expected. Such a MS distribution corresponds to the consolidated crust magnetization, which kind of "contamination" with magnetic minerals of the whole crust in the area of the Lokhvytsya regional magnetic anomaly. 2) The increase of MS of the same type rocks with depth. This regularity is often masked by a certain periodicity in the distribution of the χ values associated with the structure of the sedimentary cover and perhaps with the character of the oxidation-reduction regime. 3) A clear differentiation of the MS values for the rocks of the bore-

holes with oil and gas fields. The magnetic sources in the upper consolidated crust (the upper edges at 3.0—15.0 km and the lower ones at 10.0—18.0 km depths respectively) have the magnetization of 1.0—2.5 A/m. The magnetic bodies of the lower crust are characterized by the magnetization of 1.0—1.5 A/m. The magnetic sources of the consolidated Earth's crust of the Central Depression have been formed at the stage of the Earth's crust extension during the aulacogen formation. This regime was favourable for the deposition of thick sedimentary masses and the accumulation of the organic substance from which the oil and gas accumulations were generated later. The MS values of different litho-logic types of rocks obtained by studying the core samples show that the hydrocarbon formation and migration were accompanied by the change in the magnetization of the sediments.

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