Geomagnetic view of Illintsy structure: impact or volcano?

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Abstract: Illintsy structure is located in 15 kilometres to the west of district center Illintsy (Vinnitsa region of the Ukraine). It has been singled out by the results of gravimagnetic surveys were being carried in the sixties of XXth century. At the present time this structure is considered as phenomenon object [Yentin, 2010] that is characterized by intensive negative gravitational (-6 mGal) and magnetic (-500 ÷ -1000 nT) anomalies of isometric shape. Field minimum related to epicentral part of the structure is observed against relatively quiet negative background with intensity of -400 ÷ -600 nT (Fig.1).

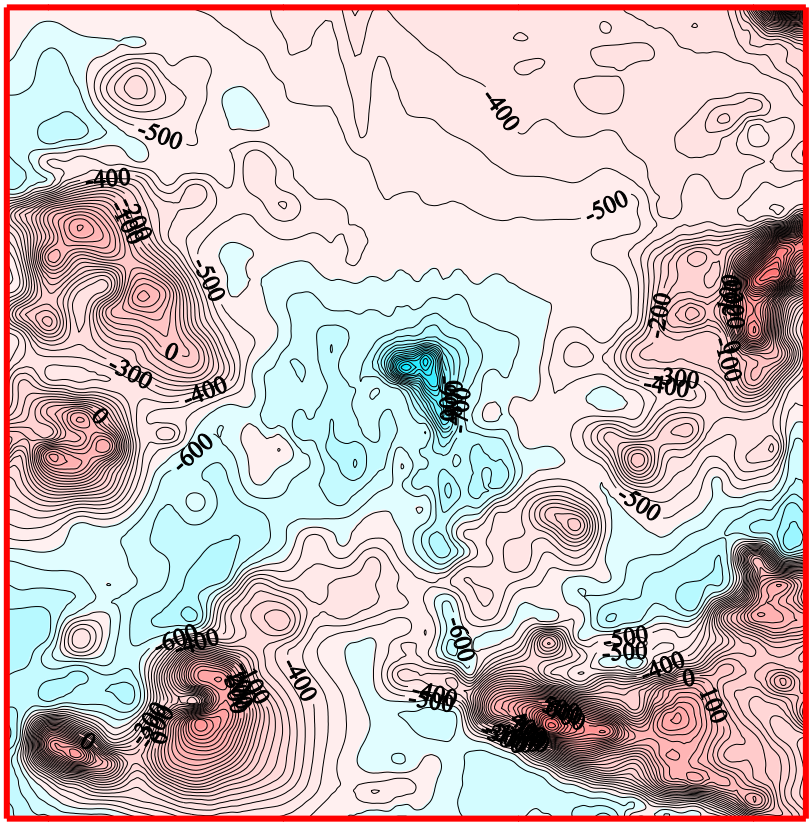

Figure 1: Magnetic anomaly map, nT

To study the nature of this minimum two short boreholes N 8-d, N 9-d have been drilled that taped generally heterogeneous formations of allogenic breccia. 22 pieces

have been sampled from them. For all samples the values of magnetic susceptibility and remanent magnetization were defined as well as zenith angles of remanent magnetization vector (Ir) relative to the position "top bottom" of a sample. As a result of researches it is established very high, as for this type formations, general magnetization of rocks (Ir=23.6 A/m, Ii=0, 3 A/m for the borehole 8D and Ir=3.0 A/m, Ii=0, 3 A/m for the borehole 9D). It is due as a rule to remanent component which absolute value is 10 times (Q=9.8) more than of inductive one. This is inverse (compairing with up-to-date magnetic field of the Earth) orientation of residual magnetization vector (negative values of zenith angle in limits 40°÷ -60°) for the samples of middle cross-section part of both boreholes (mainly thickness of argillites) that is serving as a defining factor which explains negative sign of observed magnetic anomaly. Negatively magnetized rocks are characterized by high values of remanent and inductive components magnetization (Ir = 55 A/m, Ii = 0.28 A/m for borehole 8 and Ir = 4 A/m, Ii = 0.37 A/m for borehole 9**)**. Tuff breccias containing these rocks are characterized by inclination angles of residual magnetization vector closer to the vector of up-to-date field of the Earth. According to magneto-mineralogical researches, it is ferromagnetic minerals that are magnetic properties carriers: magnetite, maghemite, magnetic pyrites, that are plentifully, but not evenly distributed by all this part of the section. Constant component of inverse magnetization is associated with fine-dispersed magnetite. Pyrite mineralization modification of top and bottom parts of boreholes cross-section and mixed one of its middle part (except pyrites there is here more fine-dispersed magnetite, maghemite or marcasite, with sizes of grains less than 5 μm) is an important data. It is to notice that magnetization vector of the rocks of top and bottom parts of boreholes cross-section is close to the vector of up-to-date magnetic field of the Earth.

New impact-volcanic concept of Illintsy structure formation and becoming has been proposed owing to the analysis of gravity and magnetic fields, experimental studies of core density and magnetization from two boreholes as well as of geochronology (Pesonen et al., 2004), its gravity and magnetic models (Yentin et.al., 2013). By the results of complex geological and geophysical studies it is known that impact-meteoritic effect had occurred in the Late Ordovician having formed classical impact structure, which provoked in the Early Devonian in the epicenter of cosmic body the development of eruptive volcanic apparatus.

Keywords: Illintsy structure, impact, volcanic structure