The Patomsky crater is located in east part of the Irkutsk region (Russia). This geological object has anomaly appearance and is discordant placed relative to hosting geological structure. The crater has been discovered in 1949 during routine geological survey of the territory by geologist V.V. Kolpakov. The drastic investigations of Patomsky crater by modern technology have began only since 2006. The first electromagnetic survey investigations by AMT method have been carried out in 2008 by «Irkutsk Electrospeectroprospecting Enterprise».

By now there is no agreement about crater origin. Two possible versions are considered: impact and endogenous, but neither of them have proper confirmation. The new attempt to shed the light on origin of this wonderful geological object has been making in August 2010 by joint geological and geophysical expedition. The field AMT crew includes 2 geophysicists (expert in EM methods) from Saint Petersburg Mining University.

The Patomsky crater is the ring structure of central type with piled up cone. The cone size is 160x130 m. The age of the crater tuffs is very young (200-500 years) and the crater breaks metamorphic sediments of Proterozoic age. The crater is located at the topographical feature which long axis is oriented in northwestern direction. Numerous faults of northwestern direction are found in the area of investigation. The spatial or genetic connections of the crater location with structural features have not been established.

The location of investigation area (a) and the photo of the Patomsky crater from the helicopter.

The preliminary geological model of the Patomsky crater. 1 - the Patomsky crater, 2 - the AMT profile, 3 - coastal shale, 4 - faults, 5 - hosting terrigenous and carbonate rocks.

The geological and geophysical model constructed on the base of previous investigations is shown. The hosting rocks for Patomsky structure are metamorphic and folded terrigenous and carbonate layers on Proterozoic age, which have high resistivity (1 000 - 100 000 Ohm-m). Also several conductive thin layers (with less than 150 m thickness) represented by coastal shale and coastal sandstone are observed. Resistivity of this layers could as low as 1-10 Ohm-m. So hosting medium could be approximated as 2-D structure with strike angle 45 degrees.

Typical (A) AMT curves and dipper frequency responses, The impedance tensor is rotated on 45 degrees. A - apparent resistivity (XY - solid line, YX - dotted line), B - induction vector (red - vertical, green - horizontal, blue - diagonal).

The scheme of AMT/MT station setting, a - scheme of setting for measurements, b - view of magnetic sensors installed on precision tripod, c - one of way of tripod and magnetic sensors transportation, 1 - MT-5u station, 2 - magnetic sensors, 3 - GPS receiver, 4 - magnetized electrode, 5 - azimuths of setting.

Five components AMT sounding were situated on the profile oriented in orthogonal direction to the strike of hosting rocks. Total length of the profile was 4.3 km. Average spacing between AMT stations was 200 m. Seven sets 5th generation of Multifunctional equipment MTU-5A (Phoenix Geophysics, Toronto,) as well as the same number of precision tripods for magnetic sensors (AGCOS, Toronto) were deployed at four days survey. Due to mountain terrain with heavy forest all equipment transportation in the area survey was done by foots.

Data processing and data editing was provided in field camp to control data quality. More processing and data editing were done in Saint Petersburg. Phoenix software SSMT-2000 was used to obtain AMT/MT (impedance tensor) as well as MVP function (tipper, induction vectors).

Conclusions

According to AMT interpretation results Patomsky crater shows up as the high resistive body which dipping in south-west direction breaking folded metamorphic sediments of Proterozoic age. Tipper and induction arrows using allowed us to create reliable model for this area with complicated geological structure. Some more 2-D modeling and inversion of AMT data has to be done to test different geological ideas. As the high resistivity of Patomsky crater body is the fact more geologists take side inogenous hypothesis of Patomsky crater origin, but in section there is not sing of magma channel. The obtain 3-D model of Patomsky crater looks reasonable to do 2 AMT profiles with same field techniques situated from first one. As well as some MT sites have to be done to investigate idea of magma body presence.

References


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