



Electromagnetic imaging of lithosphere permeable zones

Tamara Litvinova (1), Alevtina Petrova Petrova (2), and Maxim Petrishchev Petrishchev (3)

(1) Russia Geological research Institute, regional geophysics, St. Petersburg, Russian Federation (tamara_litvinova@vsegei.ru), (2) SPbF IZMIRAN, Russian Academy of Sciences, St. Petersburg, Russian Federation, (aa_petrova@inbox.ru), (3) SPbF IZMIRAN, Russian Academy of Sciences, St. Petersburg, Russian Federation, (ms_petr@mail.ru)

By way of strong minima of magnetic anomalies studies we are investigated the features of the lithosphere structure by magnetic and gravity data. Exploration methods included the application of existing and open source near-surface aeromagnetic (WDMAM) with satellite data both at 100 km and 400 km in altitude (CHAMP) and gravity satellite data (GRACE). Aeromagnetic data have been used for the 2D geomagnetic model for a depth range from 3 to 50 km plotting. Gravity data has allowed to study the 2D density model for a depth range from 5 to 200 km plotting. At the heart of the geomagnetic and density model plotting lies the technique of the spectral-spatial representation of a geomagnetic field converted in a deep geomagnetic model. The technique of the spectral-spatial analysis (SPAN) is used to differentiate the weakly magnetic heterogeneities within the basement.

In this paper we have studied the structure of the lithosphere in the area of deep magnetic minima in the vicinity of the eastern part of the Fennoscandian Shield, Central Europe and the northern part of South America. We have found powerful (more than 10 km) permeable feeble magnetic zones in the middle crust (20-30 km in depth) that are detected as feebly magnetic layer using the geomagnetic data. The magnetic minimum at 100 and 400 km in altitude corresponds to this feeble magnetic layer. It stands out as the low density layer at depth 20-35 km and, after the break, at depth 60-100 km. Ground-based magnetotelluric survey has allowed to allocate the high-conductivity layer at depth 15-30 and 60-110 km. It suggests that the detected layers can be rheological weak.

The same is for the regions of Central Europe and South America. The powerful feebly magnetic layers have been detected in the middle and bottom crust (30-50 km for the Central Europe and 30-40 km for South America). The low density layers have been found for 20-35 km and 50-80 km in depth. The ground based measurement has confirmed the presence of conductive layer in 60-90 km in depth for the region of South America.

Thus, these low-magnetic zones detected at 100 and 400 km in altitude correspond to the presence of permeable zones at depths of the middle and lower crust (20-35 km) and lithosphere (50-100 km).