DEEP STRUCTURE OF YAKUTIAN DIAMONDIFEROUS AREAS: EVIDENCE FROM GEOPHYSICAL DATA

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Nowadays, most primary diamond deposits in the world are known to occur within ancient cratons. This supports the tendency that was reported by Kennedy (1964) and Clifford (1966). The information on the deep structure of such areas is rather scarce. Hence, to assess the features of kimberlite spatial distributions is quite difficult. To date, deep structure of the Yakutian diamondiferous province has been studied with several geophysical methods. This allowed the conclusions about the spatial emplacement of kimberlites over the platform and some geophysical phenomenal regularities accompanying kimberlite magmatism.

Basing on geophysical data (Mokshantsev et al., 1975; Gusev et al., 1975), the Yakutian kimberlite province occupies an area within which the Early Archean Tunguss (west), Olenyok, and Tyung (east) cores surrounded by extended Late Archean-Early Proterozoic mobile belts are recognized. The latter are clearly traced by positive and negative linear magnetic anomalies.

The results of magneto-telluric sounding (Nikulin et al., 1988) show that the province is located within a thick (150-200 km) lithosphere block, likely representing a so-called "mantle root" (Gurney, 1984; Helmstedt, 1993). Asthenosphere beneath this block is almost completely thinned out and preserved as low-thick lenses. Weak-altered segments of the ancient Early Archean cores are noted by high transverse resistivity of the earth's crust, unlike ancient mobile belts, that are characterized by low up to 100 Om.m resistivity.

Extraordinary low earth crust resistivity (< 100 O m/m) was recorded also in the Daldyn-Alakit diamondiferous region (Poltoratskaya, 1995). This can be related to the processes of secondary metamorphic alterations. Such alterations of metamorphic rocks were reported by V. Serenko (1989) while studying the xenoliths from kimberlite pipes of the region. However, the Mirny, Muna and several northern kimberlite fields are accompanied by high resistivity areas.

The information about the structure of upper mantle and consolidated crust was obtained due to deep seismic sounding (Suvorov, 1993). The depth to the Moho's interface ranges from 30 to 50 and more km within the province. There was found a depression in the Moho's interface that is traced from the Mirny to Daldyn kimberlite fields. In the earth crust, this depression is balanced by a swell-like rise. Both structures tend to the eastern edge of ancient mobile belt. Their strike changes according to the position of Early Archean cores. The whole territory located within the ancient mobile belt is characterized by unusually high differentiation of border velocities along the Moho's interface (8.2-9.0 km/sec), whereas outside the belt velocities rarely exceed 8.2-8.4 km/sec. V. Suvorov assumed that the existence of such heterogeneities can be related to vigorous crust-mantle processes that could be responsible for the change of deep-seated rock properties. V. Suvorov also marked some abnormal features of the earth's crust in the areas of kimberlite magmatism manifestation:

- relative increase of Poisson's coefficient in the lower crust;
- increase of absorption coefficient in the upper crust;
- strong seismic foliation of the upper crust.

Some signs that were marked for kimberlite fields evidence of the crust features that are favourable to the intrusion of kimberlite pipes. According to magneto-telluric sounding data, over many kimberlite bodies there are distinct subvertical disturbances of geological section that are exhibited as the alteration of high and low resistivity zones. This can be explained by the occurrence of vertical convective currents which re-worked the crust (Poltoratskaya, 1995). Gravity studies, carried out in the northern part of the province, showed that kimberlites tend to the areas with decreased thickness of the upper crust (Manakov, 1995). The same tendency was noted for kimberlite fields of the Daldyn-Alakit region, as well. Thus, kimberlite field are characterized by gravitational lows that are recorded either in observed anomalies, or in transformed local values. Also, these minima can result from the change of densities due to crust-mantle processes.

As a rule, gravitation minima over kimberlite fields are accompanied by the reduction of magnetic anomaly intensities. The magnetic minima and the areas of reduced horizontal gradient of magnetic field can appear. Abnormally high values of the depths to the magnetic objects that are calculated for the area of kimberlite fields can relate to the same magnetic field features. If there are linear regional anomalies within the observed magnetic fields, the latter are characterized by a change of the shape of anomalies near kimberlite field. That is anomalies change their strike, split into separate finer elements, and so on. The aforesaid features of magnetic anomalies also can support the local change of crustal rock magnetic properties in the areas of kimberlite magmatism display.

Gravimetric and magnetic anomalies over kimberlite fields are very important for kimberlite search and prospecting. Only these materials are usually available for blank, not investigated areas. Nevertheless, the noted anomalies over kimberlite fields are usually complicated due to different geological factors. Thus, to get useful information certain transformations are required.