SHEARED LHERZOLITES FROM KIMBERLITES OF YAKUTIA

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The problem of origin of sheared lherzolite xenoliths (SLX) in kimberlites is one of the most important and disputable problems in the Upper Mantle petrology.

We have studied SLX collections from Udachnaya and Dalnaya Yakutian kimberlite pipes (Sobolev et al., 1984; Kharkiv et al., 1983). The SLXs as a rule are of oval, smoothed form, their sizes being ranged from the first cm to 57 cm along the long axis. All the studied SLXs belong to lherzolite paragenesis, ilmenite-bearing varieties often occur among them, chromite-bearing ones are more seldom. The texture of SLX rocks varies from fluidal-mozaic up to regular granular with subordinate development of mozaic areas.

The analysis of microprobe study results allows the following conclusions to be made:

1. SLX from both pipes are represented by two types
   a) common sheared lherzolites with the range of equilibrium temperatures from 1150 to 1290 °C;
   b) ilmenite-bearing SLX with lower temperatures of equilibrium (1080-1210 °C); the minerals of ilmenite-bearing SLX are enriched in iron on an average and contain a lower chromium admixture compared with common SLX.
2. Xenoliths of common granular lherzolites from both pipes are characterized by lower temperatures of equilibrium (890-1160 °C).
3. Some xenoliths with transitional textures between SLX and common granular rocks are discovered in both studied pipes. Compositional features of the minerals of these rocks are close to the minerals of SLX. Temperatures of equilibrium range within 1140 to 1260 °C.

Calculations of equilibrium parameters for SLX from the Udachnaya and Dalnaya pipes show that equilibrium points in P-T coordinates for CLX are between geotherms for heat flows in 40 and 50 $mW/m^2/s$, being closer to the second geotherm, and refer to depths of 120-160 km, whereas equilibrium points of regular granular xenoliths from the same pipes occupy a position which is closer to or even lower sometimes than the geotherm for the flow in 40 $mW/m^2/s$ and are typical of depths of 70 to 170 km.

An important feature of SLX from Yakutian pipes is the presence of inhomogeneities of some types (Sobolev et al., 1984), the main ones being as follows:

1) zonality of garnets from the core to rim according to Cr_2O_3 content (maximum range of 8.5-1.1 wt% for common SLX and 6.4-0.9 wt% for ilmenite SLX); a conjugate increase in titanium content and iron content of garnet from the core to rim is noted;

2) a difference in compositions of clinopyroxenes from the ground mass of sheared lherzolites, the maximum range of variations being in magnitude of Ca/Ca+Mg ratios (43.7 - 41.3%, respectively) and Fe/Fe+Mg ratios (8.5 - 9.5%, respectively);

3) composition differences of minerals homogenous within a grain for different areas of SLX: a) garnets according to Cr_2O_3 contents (1.1 - 9.9 wt%), TiO_2 (1.12 - 1.61 wt%), FeO (8.47 - 10.6 wt%), a clear positive correlation being stated between chromium and titanium contents,

and negative one between iron and chromium contents; b) olivines according to iron contents from 9.1 to 12.4%.

When considering SXL genesis problems the main attention was paid to the specific character of their texture and especially to the depth nature of equilibrium. It permitted F.R.Boyd to connect their genesis with dynamic processes in the basement of moving platform plates. To our opinion, the mechanism of similar rock formation during intrusion of deep substance into upper levels in the form of diapirs is more real. It was shown that under conditions of upper mantle at temperatures more than 1100 °C coexisting minerals are reequilibrated rather quickly when changing P-T parameters. This feature strongly prevents from detection of traces of vertical displacement of deep rocks on the basis of mineralogical and petrological data. The data obtained can be related to changes of equilibrium P-T parameters resulted from vertical movements of mantle substance during the period immediately preceding to the kimberlite formation.

REFERENCES

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