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Modeling of the crossection layering and internal mantel structures beneath the regions of the kimberlite magmatism with the monomineral thermobarometry for five phases

Igor Ashchepkov (1), Valentin Afanasiev (1), Lyudmila Pokhilenko (1), Sergey Kuligin (1), Nikolai Vladykin (2), Elena Malygina (1), Alla Logvinova (1), Olga Khemelnikova (1), Sergei Mityukhin (3), and Anatoly Rotman (3)

(1) Institute of Geology and Mineralogy, Geodynamics, Novosibirsk, Russian Federation (igor.ashchepkov@uiggm.nsc.ru, +7 83832 332792), (2) Institute of Geochemistry SD RAS, Irkutsk, (3) ALROSA company, Mirny, Russia

Monomineral thermobarometry for the garnets, chromites, pyroxenes and ilmenites (Ashchepkov et al., 2009) using analyses of the heavy mineral concentrates allowed to construct the cross-sections of the mantle beneath the regions of the kimberlite magmatism of Yakutia (Daldyn, Alakite, Malo-Botuobinsky and others) and Archangelsk region. The pressures determined for the garnets was compared with those for the other minerals. The approximation of the isoconcentration of the Fe#Ol using and separate components of the minerals using Surfer 8 software showed the contrast layering extending in some cases through all the mantle section. Comparison of the combined diagrams using Fe#Ol for all the minerals in concentrate and those for separate minerals allowed to compile approximately the lithology of the mantle sections. The most contrast layering was determined using isolines of Ca content in garnets which reflects the primary layering showing the distribution of the dunites and harzburgites. Isolines of the Ti of the chromite, garnets and ilmenites detect the kevels of the protokimberlite metasomatism. For Fe# enrichment demonstrates the levels regeneration which are commonly close to the levels of the of the Ti-enrichment by the protokimberlite interaction related but sometimes coincide with the levels of phlogopite metasomatism which usually is more ancient.
The determined diagrams are quite different from those produced using previous versions of garnet thermobarometry (Griffin ea, 1989-Ryan ea, 1996) which shows for the Yakutia (Griffin ea, 1996; 1999) rather smooth layering. General depletion was detected for the lower part of the mantle sections compiled from 5-8 levels with the HFSE metasomatism in the lower part in Worldwide kimberlites. Our methods demonstrate more sharp layering represented by 16 -7 levels which is closer in structure to the diagrams produced by the seismic methods (Olson ea, 2006; Bostock ea, 2008 and references their in).
Mantle cross-section from the fields of Udachnaya to Zarnitsa field reconstructed by concentrate from 12 pipes shows the complex structure with at least 12 (16) layers and the inclination of the major units to the east form Udachnaya 30-40o. Three evident chromite –rich revel traces this structure in the lower part of the mantle with the maximum enrichment between 50- 60 kbars. The same horizons are enriched by the eclogites (Jacob ea., 2004; Snyder ea, 1996) judging from the mantle section beneath Udachnaya. Ilmenites repeat in general but more locally the general structure of the mantle but shows the dense concentration beneath the large pipes near 60 kbars. But for the (later?) satellite pipes they show the elevation probably related to the melt migration and metasomatism. In Alakite region mantle reveals the more detail layering (to 17 units) and gentle inclination toward the south. The enrichment in the chromite concentration was detected also in the lower part as well as for ilmenites. Enrichment in
CPx are more evident near 50 and 30 kbar levels. The maximum of the perturbations were reconstructed near the Yubileynaya pipe which possibly represents the break in the structure of mantle sequences in Alkite region from NNE to SSW from which the mantle layers reveal more sharp inclination. But three separate phases from Yubileyanaya: Ozernaya and Ottorzhenets demonstrate the elevation of the same structure upward to several kbar in the lower part of mantle columns probably due to the mantle diapirism.
Arkhangelsk region reveal the concentric structure with the melt enrichment in central part near Griba pipe (group 1 kimberlites) then (group 2 o low-Ti kimberlites) toward the periphery (Zolotitskoe field) and the alnoites in the margins. Beneath the Arkhangelsk kimberlite region the less general layering to >12 unites is reconstructed by

garnet and chromite grains and the inclination from Zolotitskoe to Kepinskoe field. But more general structure of the the local decreasing of alculated Fe#Ol beneath some pipes possibly is formed by the exhausting of mantle rocks in permeable zones which are more rich in dunite –harzburgites (Chr). The pronounced increase of Fe#Ol is found beneath the Grib pip and possibly adjacent areas reconstructed from concentrate from placers as suggested bu the higher melt concentration. But general depletion from 70 to 45 kbar is pronounced beneath the Kepinskoe field while mantle beneath Zolotitskoe is more fertile at these level.

More general transects from North (Anabar) to the South of and from West to East of Siberian craton will b also discussed.

Some reconstructions using the data from the literature for other world regions will be shown and compared with the reconstruction made by W.Griffin and colleagues (1996-2009) using garnet method.