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Deep-seated xenoliths and xenocrysts from Sytykanskaya pipe: evidence for the evolution of the mantle beneath Alakit, Yakutia.

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The concentrate from two phases of the kimberlite (breccia and porphyritic kimberlite) and about 130 xenoliths from the Sytykanskaya pipe of the Alakit field (Yakutia) were studied by EPMA and LAM ICP methods. Reconstructions of the PTXfO_2 mantle sections were made separately for the two phases. The porphyritic kimberlites and breccia show differences in the minerals although the layering and pressure interval remains the same. For the porphyritic kimberlite the trends P- Fe# - CaO in garnet, fO_2 are sub-vertical while the xenocrysts from the breccia show stepped and curved trends possibly due to interaction with fluids. Minerals within xenoliths show the widest variation in all pressure intervals. PT points for the ilmenites which trace the magmatic system show splitting of the magmatic source into two levels at the pyroxenite lens (4GPa) accompanied by peridotite contamination and an increase in Cr in ilmenites. Two groups of metasomatites with Fe#Ol $\sim$ 10-12% and 13-15% were created by the melts derived from protokimberlites and trace the mantle columns from the lithosphere base (Ilm - Gar - Cr diopside) to Moho becoming essentially pyroxenitic (Cr-diopside with Phl).
The first Opx-Gar-based mantle geotherm from the Alakit field has been constructed from15 associations and is close to 35 mw/m2 in the lower part of mantle section but deviates to high temperatures in the upper part of the mantle section.
The oxidation state for the protokimberlite melts determined from ilmenites is higher than for the other pipes in the Yakutian kimberlite province which probably accounts for the decrease in the diamond grade of this pipe.
The geochemistry of the minerals (garnets and clinopyroxenes) from breccias, metasomatic peridotite xenoliths and pyroxenites systematically differ. Xenocrysts from the breccia were produced by the most differentiated melts and enriched protokimberlite or carbonatite; they show highly inclined nearly linear REE patterns and deep troughs of HFSE. Minerals of the metasomatic xenoliths are less inclined with lower La/Cen ratios and without troughs in spider diagrams. The garnets often show S-shaped patterns. Garnets from the Cr websterites show round REE patterns and deep troughs in Ba-Sr but enrichment in Nb-Ta-U. The clinopyroxenes reveal the inclined and inflected on Gd spectrums with variations in LREE due to AFC differentiation.
The 40Ar-39Ar ages for micas from the Alakit field reveal three intervals for the metasomatism. The first (1154 Ma) relates to dispersed phlogopites found throughout the mantle column, and probably corresponds to the continental arc stage in the early stage of Rodinia. Veined highly alkaline and Ti-rich veins with richterite $\sim$1015 Ma corresponds to the plume event within the Rodinia mantle. The $\sim$600-550 Ma stage marks the final Rodinia break-up. The last one near 385 Ma is protokimberlite related. supported by RBRF 11-05-00060; 11-05-91060-PICS