PETROCHEMICAL AND GEOCHEMICAL FEATURES OF KIMBERLITES OF NORTH-RUSSIAN PROVINCE.

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The North-Russian province (NRP) (Arkhangelsk region) consists of the diatrem groups: Zolotitskaya, Verkhotinskaya, Kepinskaya, Izhmo-Ozerskaya. There are also dikes and sills. The sill named Mela is located separately from the clusters. The pipes are composed of breccias, autolithic breccias and xenotuff breccias. The massive porphyrite kimberlites are rare. The hypabyssal bodies are filled with the fine-porphyrite massive kimberlites.

The North-Russian province is characterized by the wide variations of a rock mineralogical composition. Only the Zolotitskii group bodies consist of the typical kimberlites. The picrites and alnoites having the clinopyroxene, melilite and nepheline in the composition are present together with kimberlites in other groups. The kimberlites are completely altered by the metasomatic processes and mostly represented by a carbonate-serpentine-saponite aggregate.

The petrochemical and isotope-geochemical investigations of the Zolotitskaya kimberlites as well as kimberlites and picrites of the Izhma-Ozerskaya and Verkhotinskaya groups have been made. The samples were analyzed by the quantitative spectral, XRF and flame photometry methods. REE were determed by the spectral analysis, using the preliminary enrichment.

The NRP diatrem kimberlites have higher contents of SiO_2, Al_2O_3, Na_2O and lower concentrations of the carbonate component than Yakutian and S. African ones. This fact is partially explained by the contamination of the host Vendian quartzitic sandstones. The high contents of SiO_2, Na_2O (sometimes $Na_2O/K_2O>1$) from the autolithic and porphyric kimberlites indicate that these composition features were common to kimberlites at the melting stage. The chemical composition of NRP hypabyssal kimberlites is similar to that of Yakutian and S. African kimberlites. The space proximity of kimberlites, picrites and alnoites, the wide variation of Fe, Ti, Na_2O/K_2O composition suggest high differentiation of the NRP kimberlites.

The trace element contents in the kimberlite of NRP, Yakutian and S. African are closely allied (fig. 1) In fact the curves of the normalized to the hondrite average trace element contents coincide. The REE distribution is typical of the kimberlites (La/Yb>50) but the REE distribution curve of the diatrem kimberlites has clearly marked Eu minimum (fig. 2). It may be explaned by the host rock contamination. The hypabyssal

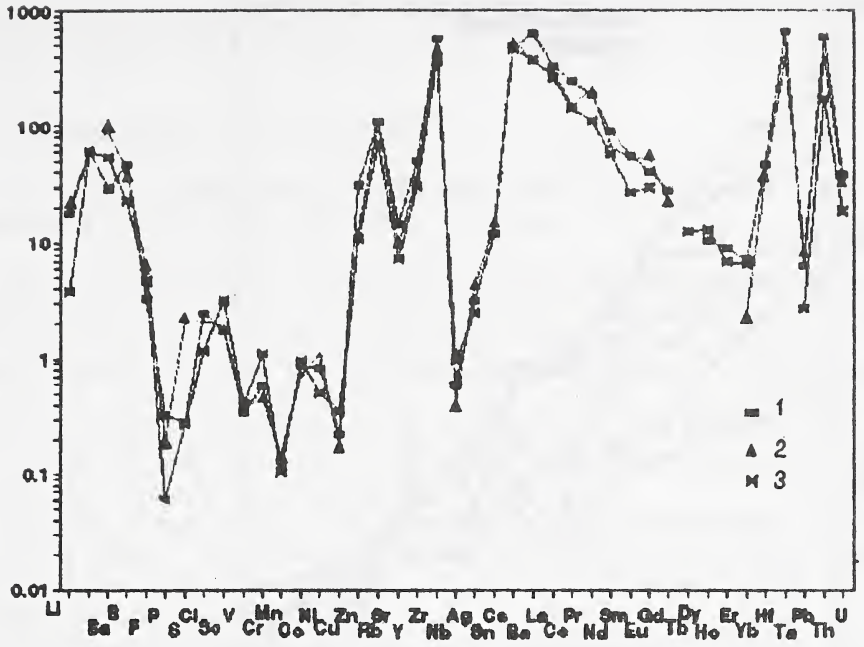

Fig. 1. The curves of the normalized to the hondrite average trace element contents of the kimberlites: 1 - South Africa, 2 - Yakutian province, 3 - North-Russian province.

kimberlites are distinctly enriched in the incompatible elements including REE having distribution similar to that of REE of Yakutian and S. African ones.

The three groups of the oxides and trace elements have been recognized on the basis of the correlation

1. SiO_2 (?), MgO, H_2O, Ni, Co, Ag.
2. TiO_2, FeO, Al_2O_3, K_2O, P_2O_5, Cr, Sc, V, Li, Rb, Zn, Pb, Sn, Zr, Nb, F.
3. CaO, CO_2, MnO, P_2O_5, Sr, Ba, Be.

The positive correlation in the groups and negative correlation among the groups suggests that the differentiation processes had the great importance in the kimberlite formation.

The isotope data of NRP kimberlites (Kostrovitsky et al., 1991) evidences MORB close mantle source. The C and O stable isotope composition indicates the more considerable hydrothermal-metasomatic kimberlite alteration as compared with Yakutian kimberlites. The isotope-geochemical characteristic of picrites associated with kimberlites conforms with the conclusion about the common rock mantle source.

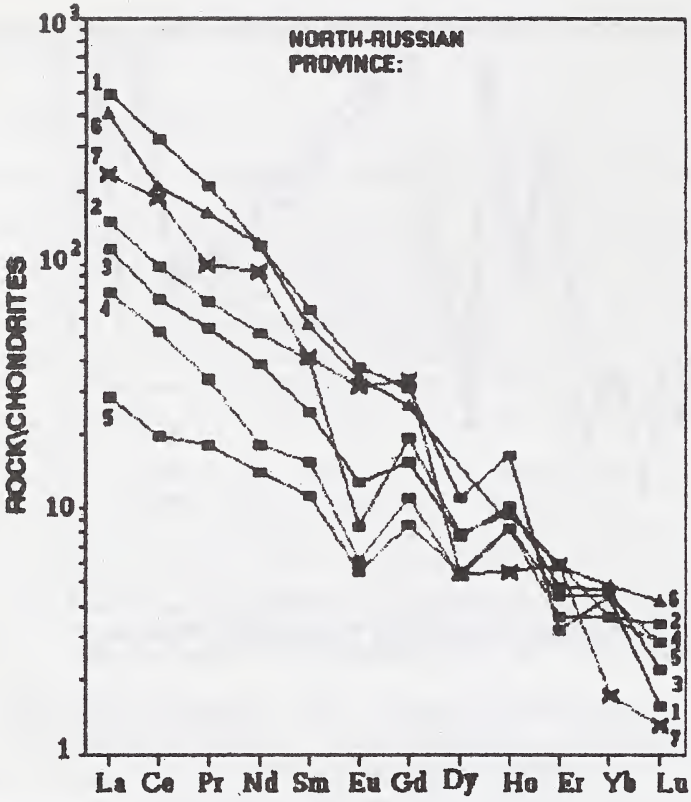

Fig.2. REE distribution patterns for kimberlites from different-provinces: 1-5 NRP: 1-sill's kimberlite, 2-pipe Lomonosov,massive kimberlite, 3-pipe Pioneerskya,kimberlite breccia, 4-pipe Lomonosov,breccia,5-Izhma-Ozerskaya group,picrite, 6-S. Africa(Muramatsu,1983), 7-Yakutiya (Ilupin et al,1978)

Ilupin, I. P., Kaminskii, F. V., Frantsesson, E. V. 1978. Geochemistry of kimberlites. Nauka Press, Moskow, 352 pp.(Russian).

Kostrovitsky, S. I., Skripnichenko, V. A., Plusnin, G. S. and Bobrov, V. A. 1991. In: Extended abstracts of 5 Intern. kimb. confer. Brasilia, pp.557-559.

Muramatsu, Y. 1983. Geochem. J., 17, pp.71-86.