GEOCHEMISTRY OF PORPHYRITIC KIMBERLITES IN MENGYIN COUNTY, SHANDONG PROVINCE, AND IN FUXIAN COUNTY, LIAONING PROVINCE, CHINA.

HE GUANZHI[1] AND ZHAO YUHLONG[2]

[1]Institute of Geology, State Seismolocal Bureau, Beijing, China.
[2]Beijing Institute of Uranium Geology, Beijing, China.

Recently, the facts of open pit mining of kimberlite pipes suggest that for the kimberlite pipes in Mengyin county, Shandong province, four phenomenons are found in depth of 45-50 meters in open pit:

1. The kimberlite pipes are in irregular form;

2. The veins extending from the intruded into the wall rocks (the Archean hornblende-biotite gneisses are 2216-2545 m. y.). These kimberlite veins are connected with other veins on the surface.

3. The thickness of kimberlite-breccia on the margin of kimberlite pipes decreases;

4. In these kimberlite pipes, content of diamond and pyrope increases with depth.

Kimberlite pipe in Fuxian county, Liaoning province, exhibits following phenomena:

1. The wall rock (quartzite) of kimberlite has been baked evidently;

2. The kimberlite pipe dips at north;

3. On the excavated surface of kimberlite pipe, some veins intruded also the wall rock,

Thus, these kimberlite pipes are normal intrusive not the products of explosion.

In Mengyin and Fuxian areas, Porphyritic kimberlites contain the less exotic materials (include xenocrysts of wall rock and that from the deep crust), there chemical composition, as we analysed, is as follows: SiO_2= 30.07-37.54 %, Al_2O_3=1.47-5.05 %, MgO=23.77-35.1 %, MnO=0.21-0.1 %, P_2O_5= 0.14-1.94 %, K_2O (0.09-2.85)% > Na_2O (0.04-0.32) %; CO_2=1.26-6.5 %, H_2O^+= 6.8-12.8 %; P_2O_5, H_2O^+ and CO_2 higher than those in ultrabasic rocks, but different in relatively low TiO_2content, and $K_2O > Na_2O$.

The chemical analysis indicates:the porphyritic kimberlites in Mengyin have REEs value of 0.044-0.15 %, but the porphyritic kimberlites in Fuxian have their REEs value of 0.084-0.1 %.

The neutron activation analysis of rare-earth and trace elements of porphyritic kimberlites in Mengyin and Fuxian counties shows: Ce=107-267 ppm, Th=15.5-38.4 ppm, Tb=0.037-0.38 ppm, Eu=2.6-4.04 ppm, Sc=8.17-17.5 ppm, Co=15.2-92 ppm, Sm=8.9-13 ppm, Lu=0.07-0.13 ppm, U=0.9-2.3 ppm, Yb= 0.88-2.5 ppm, Nd=36.5-104 ppm, La=92.6-155 ppm.

This fact suggests: Sc, Co, Th is close to that of kimberlites in other parts of the world. The REEs are higher than those in ultramafic rocks and chondrites. The studied porphyritic kimberlites are relatively rich in light REEs, La/Yb=91-171. Therefore, the results of neutron activation and X-fluorescence analysis indicate that for the porphyritic kimberlites in Fuxian county, the light REEs are lower than that in Mengyin county.

According to the published data (Laul, J. C., et al., 1973, 1975), Sm/Nd ratio is 0.305 in chondrite. But the Sm/Nd ratio detected in most samples of porphyritic kimberlites is higher than that in chondrites. The Sm/Nd ratio (0.277-0.303) detected in several samples is close to that in chondrites.

All this indicates that the original kimberlitic magma chamber was located in the depth of 150-250 km and deeper in the upper mantle, and most intruded magma has been contaminated by crustal materials on its way up to the surface.

REE distribution in these porphyritic kimberlite is of a normal pattern (Fig. 1). Many samples of porphyritic kimberlites show no depletion in Eu. This fact is also found in the kimberlites from South Afica (Fieremans, M., et al., 1982). It suggests that there is no evidence of fractionation.

At the same time, the result of neutron activation analysis shows: In porphyritic kimberlites, the REEs content is highest in perovskite, and the light REEs especially concentrate in it; La, Nd, Tb and Lu are of positive value in the magnochromits, but Ce, Eu and Yb are depleted; the Nd, Tb and Lu are of positive value in the pyropes, the La, Sm and Yb are depleted; the La, Nd, Tb and Lu are of positive value in the phlogipites, and Ce, Sm and Yb are depleted. These results are determined in these minerals for REE distribution patterns.

Of course, REEs depletion is related with the mineral crystal lattice and crystal defect in these minerals, and related with the fractionation of REE. But, the possibility of REEs heterogeneity in mantle minerals can not be excluded.

A pattern of REE distribution of kimberlite-carbonatite in shown Fig. 2. It is seen that the REEs in kimberlite-carbonatite are lowest than that in porphyritic kimberlites.

Study of the porphyritic kimberlites by fission track method suggests that element uranium occurs mainly in perovskite, reaching 30-50 ppm; less in iron colloid minerals and serpophites, reaching 15ppm; and little in ferrocalcites, apatites and on cleavage face of phylogopites, reaching <10 ppm. But uranium is not found in pyropes, no altered olivines, antigorites and enstenites (xenoliths).

The fact indicates that the kimberlitic magma in the process of its upwelling and intrusion has absorbed uranium by the above minerals. Of course, the possibility of existence of uranium in small amount in the upper mantle is not excluded.

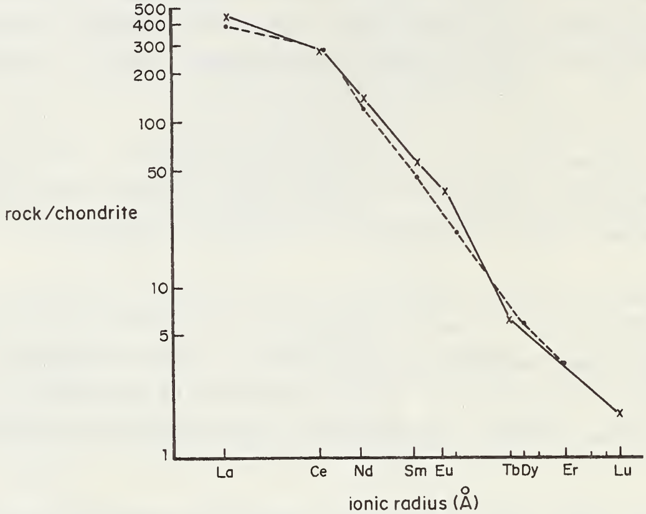

Fig. 1 A pattern of REE distribution in porphyritic kimberlite.
x—neutron activation analysis; •—X-fluorescence analysis.

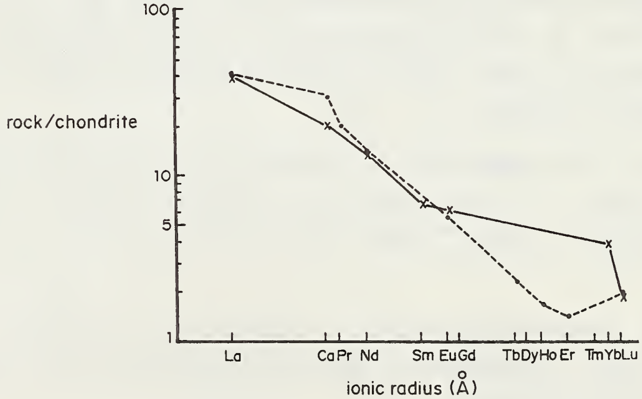

Fig.2 A pattern of REE distribution in kimberlite-carbonatite.
x—neutron activation analysis; •—X-fluorescence analysis.