CARBONATITES AND THEIR PATTERNS OF REE DISTRIBUTION IN ERDAOBIAN AND BOSHAN AREAS, CHINA.

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Carbonatite has been found in Erdaobian area of Zhangbei county, Hebei province. The carbonatite occurs in the form of a pipe with its long axis trending to N60-70°W, 200 m in width, and 300 m in length. It emplaced in the Tertiary Hannuoba basalt.

The Hannuoba basalt is distributed on the northern side of deep Chicheng-Shangyi fault zone. This deep fault zone extends in NW-NWW direction. Thus, the long axis of this carbonatite body is orientated principally in consistance with the Chicheng-Shangyi deep fault zone. To southwest of this deep fault zone, some ultrabasic rock bodies may be seen, they have been emplaced in the Archean metamorphic rocks.

Fress carbonatite rock is grey-brown, and white, loose after weathering. Major minerals of this carbonatite body are calcite, has grained or radial texture; its accessory minerals are enstatite, chrom diopsite, garnet, zircon, picotite, ilmenite and magnetite; but no apatite is found. Study of this carbonatite body indicates that it belongs to a calcite carbonatite type.

At the same time, in this carbonatite body some xenoliths are found, there are basalt and augite-peridotite. These xenoliths are oval or rounded, some xenoliths have 10-15 cm diameter or more.

Carbonatite has also been found in the vicinty of Boshan city, Shandong province, such as in Badao village, Dongshima and Xiahima areas. Among them, one carbonatite pipe is found in Badao village, its long axis extends in N15°W direction 80 m in width, and 200 m in length. It has been emplaced in cambrian periodic limestone. In the eastern part of the pipe, carbonatite shows linear flow structure EW trend and dipping south at 65-80°. This carbonatite body is of a biotite-carbonatite type, locally contains hornblende rich biotite-granite, basalt and andesite breccia (xenoliths). Major minerals of this carbonatite pipe are calcite; and their accessory minerals are biotite (vermiculated), feldspar and quartz (xenocryst), enstenite, diopsite, zircon (or baddeleyite), magnetite and olivine.

The clusters of carbonatite veins occur in Dongshima and Xishima areas southwest of Boshan city. These veins trend to N55°E, dip to NW at 8-20°, each vein is 10-40 cm wide. They have been emplaced in cambrian periodic limestone. They also contain many xenoliths, such as horblend-biotite

garnet xenoliths. Major minerals of these carbonatite bodies are calcite, biotite, apatite, augite, zircon and magnetite.

The age of Boshan carbonatite bodies is determined to be 123-135 m.y. and Erdaobian carbonatite body is nearly late Tertiary.

Chemical composition of carbonatite in Boshan area, as we analysed, is as follows: TiO_2=0.62-0.67 %, MgO=2.21-8.16 %, Na_2O=0.45-1.45 %, K_2O=1.75-4.85 %, P_2O_5=2.9-6.4 % and F^-=0.2-0.3 %.

Stable isotope analysis of Erdaobian shows: for two samples of fresh carbonatite, $\delta^{13}C$= -7.3 ‰, $\delta^{18}O$= +8.5 ‰; $\delta^{13}C$= -5.7 ‰, $\delta^{18}O$= +10.1 ‰; The data fall in a range of mantle carbonatitic magma. For other nine samples of carbonatite, $\delta^{13}C$= -9.4— -11.8 ‰, $\delta^{18}O$=+22.3— +23.1 ‰; these values are close tostable isotope value ($\delta^{13}C$= -7.5— -11.1 ‰, $\delta^{18}O$= +19.6— +22 ‰) incalcite from basalts (wall rock). It indicates that some carbonatitic magma came from mantle, but their major components (calcite) may be come from basaltic magma, in form of its product of late differentiation. otherwise, stable isotope analysis shows $\delta^{18}O$= +5.6 ‰ in enstatite, $\delta^{18}O$= +5.6‰ in chrom diopsite, $\delta^{18}O$= +4.1 ‰ in picotite; These facts show that the carbonatitic magma in Erdaobian area came from mantle.

In Boshan area, the stable isotope analysis of carbonatites show $\delta^{13}C$= +0.1 ‰, $\delta^{18}O$= +11.2 ‰; $\delta^{13}C$= -1.9 ‰, $\delta^{18}O$= +14.16 ‰; $\delta^{13}C$= -5.64 ‰, $\delta^{18}O$= +9.64 ‰. These values indicate: $\delta^{13}C$= -5.64 ‰ is fitted to mantle carbonatite, but the rest values indicte that the carbonatite has been contaminated by the crustal materials on its way up to the surface.

The neutron activation analysis shows: the Erdaobian carbonatite is relatively poor in REE, the average value of four samples is as follows: La=1.05 ppm, Ce=2.3 ppm, Nd=1.33 ppm, Sm=0.38 ppm, Eu=0.12 ppm, Tb=0.07ppm, Yb0.27 ppm, Lu=0.05 ppm. But the Boshan carbonatite is relatively rich in REE, especially in LREE. The range of REE is: La=336-1184 ppm, Ce=694-2240 ppm, Nd=254-1186 ppm, Sm=13.5-51.7 ppm, Eu=12.3-22.1 ppm, Tb=1.66-60.4ppm, Yb=3.74-6 ppm, Lu=0.18-0.68 ppm. Sm/Nd=0.286 and La/Yb=3.89 are in Erdaobian; the Sm/Nd=0.11-0.204 and La/Yb=56-316.58 are in Boshan. These Sm/Nd ratio shows: Sm/Nd ratio in Erdaobian carbonatite is about the same as chondrites Sm/Nd ratio (0.305), therefore, the carbonatite might come from mantle; Sm/Nd ratio in Boshan carbonatite is more lower than that in chondrites, therefore, the carbonatite might come from deep crust; because it is very rich in LREE. Thus, it may be related to alkaline rock (such as aegirinite).

REE distribution in Boshan carbonatite is of a normal pattern(Fig.1), it is not depleted in Eu, there is no evidence for fractionation. But REE

distribution in Erdaobian carbonatite is of a abnormal pattern, Ce and Yb are positive value, the La and Tb are depletied (Fig.2).

Therefore, Erdaobian carbonatite is REE-poor carbonatite; and Boshan carbonatite is a REE-rich carbonatite.

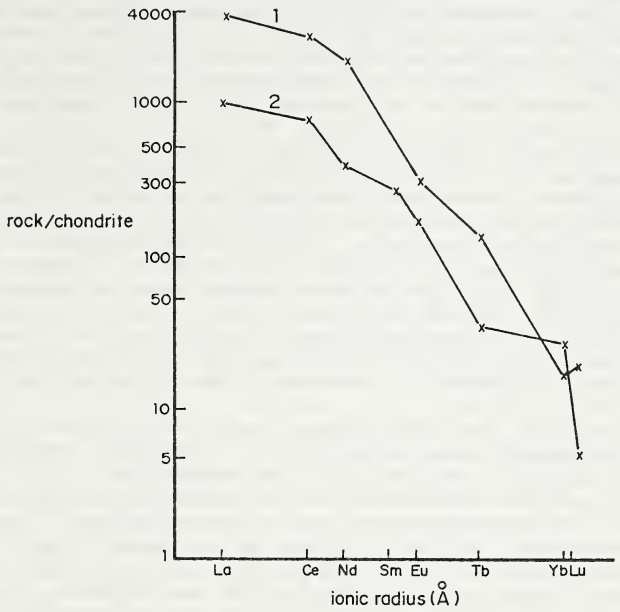

Fig. 1 A pattern of REE distribution in carbonatite from Boshan area, Shandong province. x--neutron activation analysis

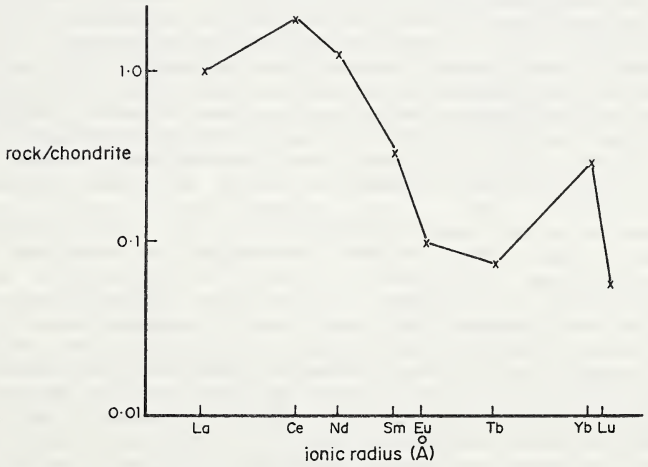

Fig. 2 A pattern of REE distribution in carbonatite from Erdaobian area, Hebei province.
x--neutron activation analysis.