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PERIDOTITE XENOLITHS ENTRAINED IN MESOZOIC BASALTS AND DIORITES IN NORTH CHINA: COMPARISON TO CENOZOIC PERIDOTITE XENOLITHS

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ABSTRACT

The numerous peridotite xenoliths entrained in Paleozoic kimberlites and Cenozoic alkali basalts in North China have made the direct study of in situ lithosphere mantle available (Liu et al., 1981; Zhou and O'Nions, 1986, Song et al., 1989; Menzies et al., 1993; Chen, 1996; Chi et al., 1996; Xu et al., 1996; Zhou et al., 1996, Zheng et al., 1999). Two apparent differences between Paleozoic and Cenozoic lithosphere mantle beneath North China have been concluded by many scientists: 1) The lithosphere mantle was as thick as 200 km in Paleozoic while it was reduced to 60~80 km in Cenozoic; 2) Hydrous phases, such as phlogopite and serpentine, are common in the Paleozoic kimberlite-borne xenoliths while they are rarely found in the Cenozoic basalt-borne xenoliths. To answer how the lithosphere mantle beneath North China evolved from Paleozoic to Cenozoic, it becomes the top priority to obtain the information about the Mesozoic lithosphere mantle. Unfortunately, only two Mesozoic xenolith localities have been reported so far, distinct from the numerous Paleozoic and Cenozoic xenolith localities.

The deep-seated xenoliths entrained by the alkali basalts (ca. 84 Ma, K-Ar) in Fuxin area include spinel lherzolites, lherzolites, pyroxenites and two-pyroxene granulites (Zheng et al., 1999). Amphibole is found in both spinel lherzolite and pyroxenite xenoliths, indicating the hydrous feature of the Mesozoic lithosphere mantle. Olivines have similar Fo content (89~91%) to that from the Cenozoic xenoliths. Diopsides are enriched in Al and depleted in Ca. $MgAl_2O_4$ dominates in the composition of spinel. The Cr/(Cr+Al) ratio of spinel (<0.100) is much lower than that in the Cenozoic peridotite xenoliths. The existence of phlogopite and the Al-rich feature in both diopside and spinel indicate that the Mesozoic peridotite xenolith, hence the lithosphere mantle is more fertile than that in Paleozoic. The equilibrium temperature of the spinel lherzolites is in the range of 940~1050°C, similar to those of the Cenozoic xenoliths.

The peridotite xenoliths entrained in the diorites (ca. 120 Ma, K-Ar) in Shangdong area include lherzolites, harzburgites and wehrlites. They are typically in two kinds of structure: cumulative and metamorphic. The cumulative peridotite xenoliths show similar mineral composition to those Cenozoic basalt-borne xenoliths except for the common occurrence of chrompicotite instead of spinel. The metamorphic peridotite xenoliths show extremely high Fo content in olivine (97%), much higher than that in the olivines from most peridotite xenoliths (86~90%, highest 95%). Diopside from the metamorphic xenoliths is enriched in Al_2O_3 (>6.0 wt%) and CaO contents (>25 wt%) and depleted in Na_2O content (<0.01 wt%). The composition of the spinels from the metamorphic xenoliths is dominated by $MgAl_2O_4$. The mineralogical Mg# number in the metamorphic xenoliths is characterized by olivine > spinel > diopside, distinct from the normal sequence of diopside > enstatite > olivine > spinel in the Cenozoic peridotite xenoliths. The origin of the peridotite xenoliths and their implications for the in situ lithosphere mantle are not clear yet; however, it is a hot debate and a two-stage cumulate model has been proposed.

The comparison between Mesozoic and Cenozoic basalt-borne xenoliths indicates a dehydration process coupled with the thinning of the lithosphere mantle beneath North China. More information about the lithosphere mantle will be supplied from further study of these diorite-borne xenoliths. Detailed geochemical and comparative study over the Mesozoic basalt- and diorite-borne peridotite xenoliths is being conducted, which should be stressed as their key role in the study of lithosphere mantle evolution and the rarity of the Mesozoic xenolith localities in North China.

REFERENCES

Chen S.H., 1996. Xenolith Information on the Lower Crust and Upper Mantle Stratigraphy and Crust-Mantle Interaction Beneath Hannuoba, Northern North China Craton. Ph. D. dissertation, Institute of Geology, Chinese Academy of Sciences, Beijing, China.

Chi J.S. and Lu F.X., 1996. The Characteristics of the Kimberlites and Paleozoic Lithospheric Mantle in North China. Science Press, Beijing, China.

Liu R.X., Yang M.E., Xu H.J., Guo J.D. and Wang W.H., 1981. Preliminary study on the ultramfic xenoliths from Cenozoic alkali basalts in North China. Seismology and Geology, 3 (3): 39-48.

Menzies M.A., Fan W.M. and Zhang M., 1993. Paleozoic and Cenozoic lithoprobes and the loss of >120 km of Archean lithosphere, Sino-korean craton, China. Geol. Soc. London, Spec. Publ., 76: 71-81.

Song Y. and Frey F.A., 1989. Geochemistry of peridotite xenoliths in basalt from Hannuoba, eastern China: implications for subcontinental mantle heterogeneity. Geochim. Cosmochim. Acta, 55: 3697-3708.

Xu Y.G., Menzies M.A., Mattey D.P., Lowry D., Harte B. and Hinton R.W., 1996. The nature of the lithospheric mantle near the Tancheng-Lujiang fault, China: an integration of texture, chemistry and O-isotopes. Chem. Geol., 134: 67-81.

Zheng C.Q., Xu W.L. and Wang D.Y., 1999. Preliminary study on the deep-seated xenoliths entrained by Mesozoic alkali basalts in FuXin, western Liaoning province, China. Submitted to Chinese Science Bulletin.

Zheng J.P. and Lu F.X., 1999. Mantle xenoliths from kimberlites, Shangdong and Liaoning: Paleozoic mantle character and its

heterogeneity. Acta Petrologica Sinica, 15: 65-74.
Zhou X.H. and O'Nions R.K., 1986, Sr-Nd-Pb isotope systematics of mantle-derived xenoliths from E. China, Terra Cognita, 6 (2): 244.
Zhou X.H., Sun, M, Chen S.H. and Zhang G.H., 1996, Granulite xenoliths vs. Terrains in an Archearn craton: a case study of lower crust beneath North China, Sixth Goldschmidt Conf., Heidelberg, Germany, J. Conference Abstracts, 1: 697.