Re-Os isotope geochemistry of mantle peridotite and pyroxenite xenoliths from North China craton

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Hannuoba, located in the North China Craton, is famous as a mantle xenolith-rich locality from which large and fresh samples are easily collected. Re-Os isotope data for 13 spinel peridotite xenoliths and 7 pyroxenite xenoliths entrained in the Cenozoic alkali basalts were obtained in this study.

The Re and Os concentration ranges of the peridotite xenoliths are 0.023-0.209 ppb and 2.015-4.307 ppb respectively. Their $^{187}Os/^{188}Os$ ratios vary from 0.1198 to 0.1261 and do not correlate with $^{187}Re/^{188}Os$, which may reflect mobility of Re and/or Os after mantle melting. In contrast, $^{187}Os/^{188}Os$ ratios of xenoliths correlate well with indices of basaltic melt extraction, such as Yb and Lu. As shown in Fig. 1, the formation age of the SCLM via melting in this area is deduced to be middle Proterozoic, at least 1500Ma ago. The negative correlations between Al_2O_3, CaO, TiO_2 and MgO contents and the depleted primitive mantle-normalized whole rock REE patterns indicate the removal of basaltic melts from fertile mantle. Therefore the present upper mantle, consisting of spinel lherzolites, in the area is probably the residue of the Middle Proterozoic SCLM after lithosphere delamination.

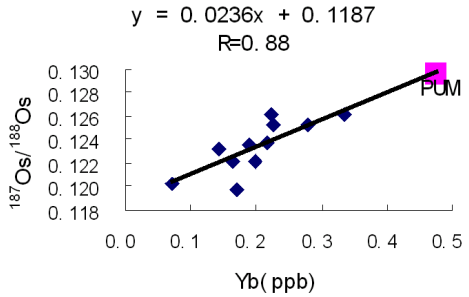

Fig. 1 The $^{187}Os/^{188}Os$ vs. Yb for Hannuoba peridotite xenoliths

The Re and Os concentration ranges of the Al-pyroxenite xenoliths are 0.053-0.215 ppb and 0.144-6.443 ppb respectively. Their $^{187}Os/^{188}Os$ ratios vary from 0.1419 to 0.2922. The diagram of $^{187}Os/^{188}Os$ vs 1/Os suggests the possible involvement of lower crustal components in the source via underplating at the CMB, where the pyroxenite xenoliths formed.

References

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Oxygen isotope and fluid inclusion data from the Chinese Continental Scientific Drilling Program: Different scales and possible depth of meteoric water/rock interactions

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Drillcores from the Chinese Continental Scientific Drilling Program have been studied by combined investigations of fluid inclusion and oxygen isotopes, aiming to construct a three-dimensional model for the fluid evolution during ultrahigh-pressure (UHP) metamorphism in the Dabie-Sulu UHP terrain.

A total of about 400 analyses have been carried out on mineral phases, mainly from eclogites, using an UV laser oxygen isotope probe. Investigated samples from depths above 1100m, including various eclogites and gneisses, have bulk $\delta^{18}O$ values of -5.3 to +4.5 per mil, obviously lower than normal metamorphic rocks, indicating meteoric water/rock interactions. By contrast, investigated samples from depths of 1690 to 1993m, have $\delta^{18}O$ values around 6 per mil, which do not show any indication for meteoric water/rock interactions.

Different types of fluid inclusions were identified in the investigated samples. The most abundant inclusions are secondary low salinity or almost pure water inclusions. However, primary high-salinity inclusions in omphacite, kyanite and quartz, and primary very high density CO_2 inclusions are also common. Primary fluid inclusions in samples with depleted oxygen isotope compositions are dominated by NaCl brines, whereas those in samples with $\delta^{18}O$ values higher than 5.8 per mil are related to very high density CO_2 fluids.

As it is well known, the UHP metamorphic rocks from the Dabie-Sulu area have been subjected to regional-scale meteoric water/rock interactions before subduction. Our data suggest that the meteoric water/rock interactions were heterogeneous in both horizontal- and vertical sequence on a scale of meters, however were homogeneous on grain- to centimeter- scale. The maximum depth of the meteoric water/rock interactions is possibly less than 2000m.