Geochemical characteristics of the Early-Creatceous mafic rocks from eastern China

Z. XIE, Q.-Z. LI AND J.-F. CHEN

CAS Key Laboratory of Crust-Mantle Materials and Envoirments, School of Earth and Space Sciences, University of Science and Technology of China, China (zxie@ustc.edu.cn, liqzhong@mail.ustc.edu.cn, cjf@ustc.edu.cn)

Sr-Nd-Pb isotopic compositions of the Early Cretaceous mafic rocks from different tectonic units of the eastern China, including western Shandong province in North China, Dabie orogenic belt and northeast margin of the lower Yangtze region are studied to deduce the characteristics of the Early Cretaceous subcontinental lithospheric mantle (SCLM) of eastern China.

The results suggest that the sources of these mafic rocks from different units have significant different Sr-Nd-Pb characteristics. The mafic intrusions from Jinan and Zouping, west Shandong province, have lower intial Sr compositions of 0.7041 ~ 0.7055, $\varepsilon_{Nd}(t)$ = -6 ~ -18.7, and $^{206}Pb/^{204}Pb(t)$ = 16.55 ~ 17.00, $^{207}Pb/^{204}Pb(t)$ = 15.22 ~ 15.35, $^{208}Pb/^{204}Pb(t)$ = 36.29 ~ 36.95. Those from North Dabie have $^{87}Sr/^{86}Sr(t)$ = 0.7067 ~ 0.7085, $\varepsilon_{Nd}(t)$ = -6.5 ~ -19.1, $^{206}Pb/^{204}Pb(t)$ = 16.37 ~ 17.40, $^{207}Pb/^{204}Pb(t)$ = 15.31 ~ 15.45, $^{208}Pb/^{204}Pb(t)$ = 37.11~37.98. Compared with the mafic rocks from North China craton, those from Dabie have higher μ data and Th/U ratios, much closer to EM I in the $^{206}Pb/^{204}Pb$-$^{207}Pb/^{204}Pb$ diagram. However, the basaltic rocks from Luzhong, east Yangtze block have $^{87}Sr/^{86}Sr(t)$ = 0.7057~0.7065, higher $\varepsilon_{Nd}(t)$ data (-3.9 ~ -6.2), and also higher Pb isotopic ratios: $^{206}Pb/^{204}Pb(t)$ = 17.88 ~ 18.08, $^{207}Pb/^{204}Pb(t)$ = 15.50 ~ 15.55 and $^{208}Pb/^{204}Pb(t)$ = 37.93 ~ 38.18, close to EM II. In I_{Sr}-$\varepsilon_{Nd}(t)$ and Pb evolution diagrams, the samples from each unit are well coupled with the area of lower crust , respectively.

The enriched isotopic characteristics of the mafic rocks from all units suggest the contribution of the lower crustal materials into the mantle source. Based on geochemical, isotopic and geochronological data, crustal contamination during magma ascending can be eliminated. Thus, it can be concluded that the involvement of different lower crustal material is one of the main processes which resulted in different isotopic characteristics in the mantle sources of different tectonic units in Eastern China at the Late Mesozoic by source mixing. The lithosphere delamination may be a possible dynamic model for explaining the incooperation of the lower crustal materials into the mantle source, but metasomatism model cannot be ruled out.

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Why carbonatites in the Lesser Qinling have high HREE compositions?

CHENG XU

Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550002, China (xucheng1999@hotmail.com)

Carbonatites are typically characterized by very high concentrations of LREE. They have very high LREE/HREE ratios. However, the carbonatite dykes in the Lesser Qinling, China, shows flat to weakly LREE enriched chondrite-normalized patterns (La/Ybn=1.0-5.5), which is in marked contrast with all other published carbonatite data. The calcite crystals analyzed by LA-ICPMS also show similar geochemical feature to their whole rocks. Xu *et al*. (2006) suggested that the carbonatites represent calcite-rich cumulate that had crystallized from a carbonatite melt. However, it cannot explain that why they contain higher HREE (e.g. Yb>30 ppm) than all other published carbonatite data. Calcite-rich cumulate is common in carbonatites (Woolley and Church, 2005). But the process cannot produce that other carbonatites have high HREE. Xu *et al*. (2006) considered that strong enrichment of HREE in the carbonatites may require their derivation by small degree of melting from a garnet-poor source. The explanation is not ideal, because other carbonatites may also derive from a garnet-poor source, and do not show high HREE contents. In addition, these carbonatite dykes is rarely intergrowth with pegmatitic quartz vein. Field observation indicates that their ages are close. Thus the high HREE abundances in the carbonatites may indicate that they underwent complex genesis processes. Regrettably, we cannot get unambiguous answer.

References

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