PbSL dating of garnet and staurolite: Constrains the age of peak metamorphism for Liaohe Group in the Eastern Block of the North China Craton

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The North China Craton is the largest and oldest known cratonic block in China. As a major lithostratigraphic unit of the Palaeoproterozoic Jiao-Liao-Ji Belt, the Liaohe Group occurs along a long, linear, North-east-trending belt in the eastern North China Craton. Many isotopic data for Liaohe Group are reported to constrain its volcanic components and some to its sedimentary components. However, the age of the peak metamorphism of Liaohe Group has not been well limited.

The isotope systematics of metamorphic minerals can be used to date parts of prograde thermal histories of metamorphic belts. Dating of a petrologically relevant mineral, such as garnet and staurolite, has the distinct advantage that time information ideally can be related directly to the pressure-temperature-deformation history recorded by the same mineral. In this paper we present the precise $^{207}Pb/^{206}Pb$ stepwise-leaching (PbSL) isochron dating of garnet and staurolite from the metasedimentary rocks of the Liaohe Group.

The primitive Pb and radiogenic Pb are selectively extracted from garnet and straurolite by leach steps and determined by Multiple collector (MC-) ICP-MS. The data give $^{207}Pb/^{206}Pb$ isochron ages of 1883 ± 25 Ma (±2σ, MSWD = 0.53) for garnet and 1876 ± 21 Ma (±2σ, MSWD = 1.5) for staurolite, respectively. They are identical to U-Pb age of metamorphic zircons from the Liaohe group (1955 ± 130 Ma) [1] and older than that of post-tectonic syenites (1843-1876 Ma) [2-3]. Therefore, the age of peak metamorphism of Liaohe Group is ~1880 Ma.

[1] Luo Y., Sun M. & Zhao G.C. *et al.* (2004) *Precambrian Research* **134**, 349-371. [2] Lu X.P., Wu F.Y. & Lin J.Q. *et al.* (2004) *Chin. J. Geol.* **39**, 123-138. [3] Yang J.H., Wu F.Y., Xie L.W. & Liu X.M. (2007) *Acta Petrologica Sinica* **23**, 263-276.

The ages and geochemical characteristics of the Cretaceous basalts from Eastern Zhejiang, China

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The Early Cretaceous basalts occurring in eastern Zhejiang and Fujian provinces were stratigraphically divided into upper series (US) and lower series (LS), respectively. They have significant differences in the formation time and isotopic compositions.

Most zircons grains from the basalts in LS (BLS) show simple internal structure. They give $t_{^{206}Pb/^{238}U}$ = 118 – 120 Ma (SHRIMP date), and Th/U = 0.6 – 2.4, suggesting a magmatic origin. A few zircons show core–rim structure with the core of about 132 Ma and rim 115 Ma old. Zircons from the basalts in US (BUS) with simple structure give uniform ages of about 103 Ma, which is interpreted as the formation age. Relict zircons are identified in BUS, suggesting that the magma was contaminated by crustal rocks. BLS and BUS have similar REE pattern showing LREE enrichment but different trace elements and isotopes. The Cr and Ni concentrations of the both < 160 and 70 ppm, and Ni/MgO < 15, lower than those of peridotite-derived melt. However, the BUS show higher Cr, Ni and lower Nb/Ta ratios than that of the BLS, and no HFSEs negative anomaly. BLS show $I_{Sr}(T)$ = 0.7076 ~ 0.7096, $\varepsilon_{Nd}(T)$ = -2 ~ -7, while BUS show $I_{Sr}(T)$ = 0.7055 ~ 0.7062, $\varepsilon_{Nd}(T)$ = +2 ~ -2. Because the Cenozoic basalts from eastern China have isotopic compositions similar to that of the MORB, we suggest that the geochemical characteristics of the lithospheric mantle in the area were transformed from enriched to depleted from 118 Ma to 103 Ma until the Cenozoic.

We conclude that the BLS were formed by the partial melting of the lithospheric mantle in 118 Ma and assimilated by small amount of the underplated 132 Ma old rock. After that, the extension was enhanced and the asthenosphere upwelled, the mixture of lithosphere- and asthenosphere-derived magma formed the BUS, which assimilated by small amount of crustal rock.

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