Late Paleozoic tectonic evolution in eastern Heillongjiang Province, NE China: Constraints from detrital zircons and volcanisms

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Geochronology of detrital and magmatic zircons and geochemistry of the volcanic rocks from the late Paleozoic strata in eastern Heilongjiang province of NE China, provide constraints on the Late Paleozoic tectonic evolution of the eastern segment of the Central Asian Orogenic Belt between the Siberian and the North China cratons [1].

LA-ICP-MS U-Pb dating results for detrital zircons from the Early Devonian sandstones show that the detrital zircons from the rocks in the Songnen-Zhangguangcai Range Massif (SZM) have age populations of 2503, 1833, 903~802, and 551~403 Ma, different from those from the coeval rocks in the Jiamusi Massif (JM) with ages of 569, 542, 509, and 484 Ma [2]. This finding indicates that (1) they deposited after 403 and 484 Ma, respectively; (2) ancient crustal remnants existed in the SZM in the Late Paleozoic; (3) the amalgamation of the SZM and JM could happen before 403 Ma.

Zircon U-Pb dating results for the magmatic zircons from the Late Paleozoic volcanic rocks in the region indicate that three volcanical events exist in the Late Paleozoic, i.e. the Middle Devonian (386 Ma), Early Permian (291 Ma), and Middle Permian (268 Ma). Their geochemical data and Sr-Nd-Hf isotopes reveal that: (1) the Middle Devonian volcanic rocks in eastern margin of the JM consist of basalt and rhyolite, a bimodal volcanism, suggesting an extensional environment, which is consistent with the existence of coeval A-type rhyolites in the SZM; (2) the Early Permian volcanic rcoks in the eastern margin of the JM are composed mainly of a calc-alkaline volcanic rocks such as basalt, basalt-andesite, and minor dacite, indicating an active continental margin setting, whereas the coeval bimodal volcanical rocks in the SZ suggests an extensional environment similar to a back-arc basin setting [3];. and (3) the Middle Permian syn-collisional rhyolites in the southeastern margin of the JM imply the amalgamation of the JM and the Khanka Massif.

[1] Sengör A.M.C. *et al*. (1993) *Nature* **364**, 299–307. [2] Meng *et al*. (2010) *Tectonophysics*. **485**, 42–51. [3] Meng *et al*. (2011) *J. Asian Earth Sci*. **41,** 119-132.

Hf-Nd isotope decoupling during partial melting of thickened eclogitic lower continental crust

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Worldwide granulites usually do not exhibit decoupled Hf-Nd systems expected for crustal melting at the presence of garnet. Here we present whole-rock Nd–Hf isotopic data for a rare suite of lower crustal eclogitic xenoliths and their host early Cretaceous high-Mg adakitic porphyries from the Xuhuai area from the eastern North China craton. The xenoliths and their host intrusions are considered to represent residues and melt formed by melting of eclogitic lower crust that foundered into the convecting mantle based on their complementary major and trace element compositions and similar zircon age patterns. Nine of the eleven analyzed xenoliths plot significantly above the terrestrial Hf-Nd array with ε_{Hf} up to +60, while the porphyries fall essentially along the array. Hf-Nd isotopic modelling shows that the eclogitic xenoliths can be interpreted by 30-50% extraction of melt, which after reaction with 10-30% depleted mantle can produce the observed porphyry. The retarded time-integrated Hf isotope ingrowth of the porphyries is due to its very low Lu/Hf ratio and a relatively short time span after its formation. Our results also indicate that garnet is the major factor controlling Lu/Hf ratio of the residue with accessory minerals rutile and titanite also playing a role. Granulite with <10% garnet will not evolve to show significant decoupled Hf-Nd isotopic signatures even after 500 Ma of melt extraction. The generally terrestrial Hf-Nd compositions of worldwide granulites may be because they have never experienced partial melting at presence of abundant garnet. Instead, the lower crustal granulite may transform into eclogite during crustal thickening. Such an eclogitic lower crust is short-lived, and will be recycled into the mantle. Decoupled Hf-Nd isotopic signatures are expected to be more pronounced in eclogite foundering-related basaltic magma than eclogite-derived TTG melt, as observed in some of Cenozoic basalts from the eastern North China craton.