Os isotope evidence for diachronous formation of lithospheric mantle beneath the Trans-North China Orogen, North China Craton

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The north-south trending Trans-North China Orogen (TNCO) formed as a result of the collision of the Eastern and Western blocks of the North China Craton ca. 1.85 Ga [1]. While the crust of the TNCO originally formed during the Archean, the age of the underlying lithospheric mantle is in dispute. Osmium model ages for xenolithic peridotites from localities in the northern TNCO are reported to be either ~1.9 Ga [2] or ~2.5 Ga [3, 4]. If the Proterozoic ages are correct, they may suggest that the mantle lithosphere was replaced during the orogeny. In the southern TNCO, limited Archean Os model ages for sulfides from peridotite xenoliths suggest the presence of Archean lithospheric mantle there [5]. It, thus, remains unclear whether or how the lithospheric mantle was influenced by the orogeny. To address these issues, we analyzed the Os isotopic compositions and HSE contents of 76 peridotite xenoliths from five localities within the TNCO: three in the north (Hannuoba, Yangyuan, and Fansi), two in the south (Fushan and Hebi), as well as one locality (Jining) in the Western block, which lies only ~100 km to the west of Hannuoba and Yangyuan. We also re-analyzed samples from previous investigations [3, 4] that yielded Early Proterozoic to Archean model ages. We find no evidence for Archean lithospheric mantle beneath Hannuoba, Yangyuan and Jining. Instead, ~2 Ga model ages dominate. In contrast, Early Proterozoic to Late Archean lithosphere is found in the more southerly localities (Hebi, Fushan, and Fansi). Proterozoic mantle lithosphere coincides with the extension of the nearly east-west trending ~1.95 Ga khondalite belt in the Western block (Jining is located in this belt). Thus, the khondalite belt may represent a collision zone that crosscuts the TNCO [6] and disrupted the lithosphere there. Elsewhere within the TNCO, we find no evidence for lithospheric replacement following its original formation in the Archean.

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Evolution of fluid chlorinity indicated by Cl-bearing minerals in the processes of subduction and exhumation of UHP eclogites of Yangkou from the Sulu ultrahigh pressure metamorphic terrane, China

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The apatites preserved in subduction process from coronal metagabbro, coronal eclogite and coesite-bearing eclogite at Yangkou have been studied in this paper. The apatites in coronal metagabbro and coronal eclogite show low Cl contents with the same compositions. However, some of apatites in coesite-bearing eclogite, with increasing Cl zoning from core to rim, show evident enrichment of Cl, which reflects a development of Cl enrichment in fluids along the prograde metamorphic process. During the exhumation process, Cl-rich amphibole and apatite occur in the quartz-phengite vein, and as coronas and in the symplectite after omphacite [1]. All types of amphiboles and apatites have large variations of chlorine contents, and are zoned with decreasing Cl contents from core to rim. It can be determined that the fluids were evolved along decreasing chlorine content from early to late stages.

The development of Cl enrichment in fluids along the prograde metamorphic process is inferred to be related to hydration reactions of phengite formation and more accommodation of water in the nominally anhydrous minerals in country gneisses. Oppositely, the water release by the decomposition of phengite and the nominally anhydrous minerals in country gneisses results in decreasing chlorinity of fluids during the exhumation process of UHP terrane.

[1] Liu *et al*. (2009) *Eur. J. Mineral*. **21**, 1265.