Simultaneous mantle metasomatism, diamond growth and crustal events in the Archean and Proterozoic of South Africa

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Subcalcic garnets from harzburgites are proxies of the chemical and isotope composition of their bulk rock. The present study and previous work [1,2] on the Sm-Nd and Lu-Hf isotope systematics show that they can be excellent recorders of multiple mantle events. Subcalcic garnets with sinusoidal REE patterns are the results of high degrees of partial melting of their protolith at shallow pressures followed by subduction and reenrichment by (silico-)carbonatitic melts. Metasomatism in a previously depleted mantle (εHf = +16) occurred underneath the crust the East Kaapvaal craton at around 3.2 Ga. Simoultaneously, the crust was affected by widespread activity around that time and Sm-Nd model dates of similar age from pooled peridotitic garnet inclusions in diamonds were interpreted as oldest diamond growth ages. Oceanic lithosphere was created between the West- and East-Kaapvaal around 2.95 Ga [2] and subducted underneath the West-block before the collision around 2.88 Ga. This also caused enrichment process in an overlying, highly depleted mantle wedge 2.9 Ga ago [2] and apparently triggered a major growth period of diamonds as demonstrated by similar Re-Os ages from sulfide inclusions in diamonds from Kimberley and Botswana. Further enrichment in the West-Kaapvaal mantle at 2.62 Ga [1] coincides with the 2.6-2.8 Ga Ventersdoorp magmatism and with a 2.6 Ga Re-Os isochron from E-type sulfide inclusions from Koffiefontein. The attachment of the Kheis-Magondi belt to the Kaapvaal craton caused further metasomatism around 1.90 Ga [2] in the mantle along the Western margin of the Kaapvaal craton. The latest stages of mantle metasomatism lie between 0.9-1.3 Ga, coincident with the Namaqua-Natal belt orogeny. Periods of diamond growth younger than 2.6 Ga cannot be related directly to any mantle or crustal event. Major geotectonic events and plume activity episodically remobilized low melting portions in the mantle keel which lead to episodic (auto) metasomatism of the depleted mantle, episodic diamond growth and destruction of the lithospheric keel.

[1] Lazarov *et al.*, 2009, Earth Planet. Sci. Lett. **27**, 1–10.
[2] Shu *et al.*, 2013, Geochim. Cosmochim. Acta, in press

The differentiation mechanism of W and Sn of Qitianling granite in Hunan province, south China

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Both large-scale tungsten and tin mineralization took place mostly in Nanling Mountains, South China. The two elements are usually related and accompanied with granitic rocks. Hua et al (2010) proposed that the eastern sector of the Nanling Mountains is characterized by strong and dense W mineralization, while Sn mineralization becomes stronger westwards. This study attempts to discuss reasons that cause the two elements differentiation, in the light of the study on the fluid inclusions of Furong Sn deposit and Xintianling W deposit, of which both have genetic relations to the Qitianling granitic rocks in Nanling Mountains, South China.

According to the study on the fluid inclusions of the two deposits, aqueous two-phase inclusions and daughter mineral-bearing inclusions are found in Furong Sn deposit, located in the south of Qitianling granites. The ore forming fluids have the composition of $CaCl_2$-NaCl-H_2O system with high salinity (36.99-42.45 wt% NaCl eq.) and temperature (462-494°C). While in the Xintianling W deposit, the CO_2-riched inclusion has been observed as the major inclusion. The ore forming fluids are characterised with low salinity (below 6%) and high temperature (367-392°C). The first melt temperatures of CO_2 range between -66.6~61.1°C.

These findings suggest that CO_2-enriched hydrothermal fluid differentiated from the Qitianling granites is conducive to the separation of W from the granitic magma system. In the later evolutional tertiary of the magma, the hydrothermal fluid is characterized with high level of Cl^-, which favor Sn enrichment in the ore-forming fluids. Accordingly, the difference of the ore-forming fluids of the two deposit maybe is the major factors responsible for the differentiation of W and Sn.

This research project was financially supported by the National Natural Science Foundation of China (41003024) and the Open Foundation of the State Key Laboratory of Ore Deposit Geochemistry (201103)

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DOI:10.1180/minmag.2013.077.5.19