Petrological and geochemical evidence for the "hot" exhumation of UHP metamorphic rocks in continental subduction zones

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Variable temperatures of 400 to 900°C have been frequently obtained from Fe-Mg partition thermometry for coexisting garnet and omphacite from UHP eclogites in the Dabie-Sulu orogenic belt. This is inconsistent with petrological, geochronological and geochemical constraints on P-T paths of UHP slabs during subduction and exhumation of continental crust. A potential problem with the Fe-Mg partition thermometry is retrograde reset of element partition after peak UHP metamorphism that is defined at the climax of metamorphic pressures. However, continental subduction-zone metamorphism is characterized by a peak pressure at lower temperatures and a peak temperature at lower pressures, corresponding to the 'hot' exhumation at HP eclogite facies. This is indicated by compositional gradients across garnet from UHP granitic gneiss in the Dabie-Sulu orogenic belt, with the highest Ca content in cores for the maximum pressure but the lowest Fe/Mg ratios in rims for the maximum temperatures. This generalization holds regardless of the differences in P-T paths between different UHP slabs (i.e. low-T/UHP, mid-T/UHP and high-T/UHP units)

The realization of 'hot' exhumation in the continental subduction zone has important implications for metamorphic dehydration, partial melting and element mobility of UHP rocks. Many hydrous minerals were metastable at the peak pressures but became decomposed with increasing temperature during the 'hot' exhumation. The pressure decrease also causes exsolution of structural hydroxyl and molecular water from nominally anhydrous minerals. This is capable of forming local sinks of aqueous fluid within the UHP slabs, and eventually leads to partial melting at appropriate P-T conditions. Dehydration melting has been found to occur in low-T/UHP granitic gneiss, mid-T/UHP eclogite and eclogite-gneiss contact, and high-T/UHP gneiss and gneiss-eclogite contact. Local sinks of hydrous melts form felsic veins at different scales, from veinlets on thin sections via microveins in hand specimen to veins on field outcrops. LA-ICPMS U-Pb dating on melt-grown zircons (having steep HREE patterns) from the UHP rocks and enclosed veins gave concordant ages that are consistently 10-20 Myr younger than the UHP metamorphic event. Therefore, the 'hot' exhumation is a characteristic feature of continental subduction-zone metamorphism.

LA-ICPMS zircon *in situ* analysis of magmatism and mineralization in the Jinchang gold ore-field, Heilongjiang Province, China

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There has been a growing recognition that the various mineral deposit types have a heterogeneous temporal distribution, with characteristic peaks in their abundance at specific times in Earth history [1]. It has been proved that ore-systems can serve as an ideal geodynamic probe as well [2]. To bracket the mineralization time and to understand tectonic setting of the Jinchang gold deposit, which is a large intrusion-related hydrothermal ore-system developed in the eastern end of the huge Central Asia Orogenic Belt, precise U-Pb ages, REE concentrations and Lu-Hf isotopes of ore-hosting granite and ore-forming diorite intrusions are obtained on single zircon grain using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICPMS).

All zircon grains have natural growth-zoning texture, with the Th/U ratio ranging mainly from 0.5 to 1.5, showing the nature of zircon grains of magmatic origin. The weighted average $^{206}Pb/^{238}U$ ages of zircon grains from granite and diorite are 202.1±3.0 Ma and 111.5±1.2 Ma, respectively, representing the times of two magmatic-hydrothermal mineralization events. The age of 198.0±3.9 Ma for the altered ore-hosting granite in northern Banjiegou circular structure system possibly reflects a late hydrothermal modification event which causes the 202-Ma granite yields younger age. Hence it is the overprinting and combination of two magmatic-hydrothermal mineralization events in the same position resulted in formation of the Jinchang large gold deposit. The earlier event at about 202 Ma originated from granite magmatism occurred in continental collision regime after the closure of Paleo-Asia Ocean. The later magmatic-hydrothermal event at about 111 Ma occurred in magmatic arc or back-arc extensional setting related to northwestward subduction of paleo-Pacific oceanic plate. The characteristics of host magma are shown by REE and Lu-Hf analysis, which indicates the mantle material addition.

[1] Goldfarb *et al*. (2001) *Ore Geology Reviews* **18**, 1–75. [2] Chen *et al*. (2008) *Geology in China* **35**(6) 1059–1073 (in Chinese with English abstract)