Cenozoic volcanism of kamafugite and carbonatite in Western Qinling, China: Evidence of DUPAL-like asthenospheric mantle flow

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Dispersed Cenozoic potassic volcanism apperared over much of Tibet plateau and adjacent area during late stages of India-Eurasia plate collision and post-collision. Although widespread this volcanic activity appears to be distinct from that producing Large Igneous Provinces being characterized by greater compositional diversity and a lack of evidence for deep-mantle plumes. However, an additional feature is the dominance of DUPAL-like Pb isotopic compositions and ε_{Nd} in asthenosphere-derived melts, attributed variously to the influx of Indian Ocean mantle, endogenous mantle plumes or delaminated cratonic substrate. "Dispersed" volcanism may therefore pose fundamental questions concerning the dynamic behavior of sub-continental mantle in relation to continental plate collision. Is the asthenosphere mobilized during such plate collision? and to what extent and by which mechanisms are plate kinematics coupled to mantle flow? May be, the studies of Cenozoic Carbonatite and kamafugite in Western Qinling, China can answer the questions.

The kamafugite and carbonatite in Western Qinling, China located to the northeastern boundary of Tibet plateau. The volcanic rocks have the characteristics rich in LILE, LREE and HFSE (such as Nb,Zr,Th and U *et al*.) especially. The distribution patterns of REE chondrite-normalized is very like to OIB. Initial $^{87}Sr/^{86}Sr$ are lower (in the range of 0.70381-0.7094 for kamafugites, of 0.70529-0.71332 for carbonatites), initial $^{144}Nd/^{143}Nd$ (in the range of 0.512924-0.512404 for kamafugites, of 0.512928-0.512221 for carbonatites) are higher but homogeneous comparing to Sr isotopes of the volcanic rocks. A lot of volcanic rocks have the$\varepsilon_{(Nd)}$ a range of -3.4– -5.58 and plot in the area of OIB`s $\varepsilon_{(Nd)}$ and have Dupal-like the Pb isotope composition. The major element chemical and Sr, Nd, Pb isotopic geochemical composition of the volcanic rocks also fall in OIB compositional area in the diagrams of $^{208}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$, MgO (wt%) vs Ni (ppm) and $\varepsilon_{(Nd)}$ vs ($^{87}Sr/^{86}Sr$).

All of these mentioned above show that WQL Cenozoic kamafugites and carbonatites are a ultra-potassic volcanism related to mantle plumes and contained EM1 and EM11 end members in their mantle sources. Despite the apparent lack of plumes in the Western Qinling, the studies of Western Qinling Cenozoic volnacic rocks of kamafugite and carbonatite, and seismic tomography suggests the Cenozoic volcanism in Western Qinling is matched by swell-like low-velocity anomalies in the upper mantle or shallow-level perturbations of the asthenosphere. Spatial and temporal associations of the volcanism further suggest that discrete asthenosphere, i.e.so-called "crust-mantle transitional belt" were generated during late stages of the Idia- Eurasia continental collision.

Study of Lu-Hf geochronology - A case study of eclogite from Dabie UHP Belt

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We developed Lu-Hf isotope geochronology with isotope dilution multiple collector inductively coupled plasma mass spectrometry (MC-ICP-MS). Chemical separation of Lu and Hf from bulk rock is set up while the Lu cut of the chromatography contains Yb and $^{176}Lu/^{176}Yb$ is always larger than 30. The correction of Lu and Yb interference on Hf adopted in this work is based upon an exponential law although Lu and Yb concentration in the Hf cut is very low ($^{176}Lu/^{176}Hf$ and $^{176}Yb/^{176}Hf$ are less than 2×10^{-6} and 2×10^{-4}, respectively). Internal precision of $^{176}Hf/^{177}Hf$ measurements for natural samples is better than 0.0015% while the external precision is better than 0.0010%.

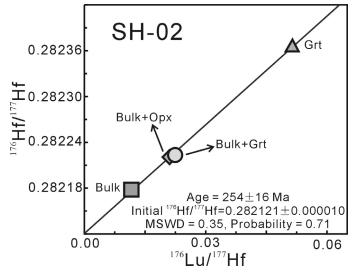

Fig 1 $^{176}Lu/^{177}Hf$-$^{176}Hf/^{177}Hf$ isochron of eclogite sample SH02. The middle two points are isotopic compositions of the mixture of garnet and bulk rock. The mixing proportion of garnet with whole rock and omphacite are 0.5 and 0.3 respectively.

We obtained a garnet-whole rock isochron age of 254 ± 16 Ma (2σ) for a Shanghe ecologite from the Dabie ultrahigh pressure metamorphic belt(see fig 1). The relative larger error is due to the low Lu concentration in garnet (1.1 μg/g) and close $^{176}Lu/^{177}Hf$ ratios in both garnet and bulk rocks (0.05 vs 0.01).

The result of Lu-Hf isotchron represents the garnet formation age during continental subduction and late peak- and post- ultrahigh pressure(UHP) metamorphism didn't disturb the Lu-Hf isotopic system in garnet.

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