Element mobility in mafic and felsic ultrahigh-pressure metamorphic rocks during continental collision

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In order to decipher element mobility in ultrahigh-pressure (UHP) eclogite-facies metamorphic rocks during subduction and exhumation of continental crust, major-trace elements and Sr-Nd isotopes were systematically investigated for two continuous core segments of about 3 m length from the Chinese Continental Scientific Drilling (CCSD) project in the Sulu orogen. The segments are composed of lithological transitions between UHP eclogite and granitic gneiss. The eclogite exhibits a large variation in major and some trace elements such as LILE (e.g. Rb, Ba and K) and LREE, but a relatively limited range in HFSE and HREE. This suggests high mobility of LILE and LREE but immobility of HFSE and HREE during continental collision-zone metamorphism. Some eclogites have andesitic compositions with high SiO_2, alkalis, LREE, and LILE but low CaO, MgO and FeO contents. On the other hand, some eclogites appear to have geochemical affinity to refractory rocks formed by melt extraction as evidenced by strong LREE and LILE depletion and the absence of hydrous minerals. These results provide evidence of melt-induced element mobility in the UHP metamorphic rocks. In particular, large variations in the abundance of such elements as SiO_2, LREE and LILE occur at the contact between eclogite and granitic gneiss, indicating their mobility between different slab components. Petrographic observations also show the presence of felsic veins on small scales in the UHP metamorphic rocks, demonstrating the occurrence of hydrous melt in local open-systems during the continental collision. As a whole, nevertheless, the protolith nature dictates the geochemical differences in both eclogite and granitic gneiss between the two core segments because mass transport during the subduction-zone metamorphism is principally dictated by the lithological differences at contact. The eclogite and granitic gneiss from the first core segment have high $\varepsilon Nd(t)$ values, whereas those from the second core segment show relatively low $\varepsilon Nd(t)$ values in concordance with majority of UHP metaigneous rocks outcropped along the Dabie-Sulu orogenic belt. Thus contrasting origins of bimodal igneous rocks were involved in the continental collision, demonstrating that the subducted continental crust is the magmatic product of active rifting margin during supercontinental breakup in the middle Neoproterozoic.

Occurrence of Rare Earth Elements in Huaibei coals, Anhui Province

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Our previous research indicated that rare earth elements (REEs) enriched in the Permian coals from the Huaibei Coalfield, Anhui Province, China, and the average $\sum$REE is high up to 141μg/g. Especially in No.5 and 7 coals that influenced by igneous intrusion, REE contents are obviously higher than other coals.

Method

The six-step sequential extraction procedure was used in this study, and these tests measured the fractional amount of REEs in various density fractions that was soluble in a series of increasingly aggressive solvents and acids. According to the procedures, modes of occurrence of REEs in the Huaibei coals were classified as water-leachable, ion-exchangeable, organic-bound, carbonate-bound, silicate-bound, and sulfide-bound.

Discussion and Results

The results indicated that: (1) water-leachable and ion-exchangeable REEs is not abundant in Huaibei coals, and these REEs fractios show a near 1:1 abundance suggesting a common origin; (2) silicate-bound REEs dominated coal seams 3, 4, 5, 7, and 10, respectively accounting 84%, 71%, 94%, 89%, and 77% of the REEs in these seams; (3)a part amount of REE may be in the organic matter of coal, and average organic-bound REEs accounted 7% of the REEs in these coals; (4)carbonate-bound REEs contributed 17% of REEs in coal seam 4, which shown more abundant carbonte minerals.

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