Protolith nature and element mobility of eclogite-facies metabasite and metagranite in a continental subduction-zone.

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It is commonly accepted that subducting oceanic crust undergoes extensive dehydration during eclogite-facies metamorphism, with significant removal of fluid-mobile elements like LILEs and LREEs relative to fluid-immobile elements like HFSEs. However, recent studies show that mafic rocks do not lose significant amounts of trace elements during HP metamorphism up to eclogite-facies, indicating a decoupling of dehydration and loss of trace elements during prograde subduction-zone metamorphism.

While oceanic subduction-zone metamorphism is associated with coupling or decoupling between dehydration and loss of fluid-mobile elements, it is of great interest whether element mobility is also influenced by continental subduction-zone metamorphism. For this purpose, major and trace elements, Sr-Nd and O isotopes were systematically studied for two continuous core segments composed of ultrahigh-pressure metabasite and metagranite from the main hole of Chinese Continental Scientific Drilling Project at depths of 734.21 to 737.16 m and 929.67 to 932.86 m, respectively. The results show significant differences in both eclogite and gneiss between the two core segments. The eclogite from the first core segment has high $\delta^{18}O$ values and $\varepsilon_{Nd}(t)$ values with young Nd model ages close to those of the gneiss. On the other hand, the eclogite and gneiss from the second core segment have negative $\delta^{18}O$ values and relatively low $\varepsilon_{Nd}(t)$ values with old Nd model ages. These indicate that their protoliths are the different origins of bimodal igneous rocks that were derived from rifting anatexis of old crusts with consistently high-T meteoric-hydrothermal alteration but contrasting mantle inputs. Furthermore, the eclogites from the second core segment are divided into two groups with respect to their trace element behavior. The first group resembles all the gneisses, both are consistently enriched in fluid-mobile elements (K, Ba, Rb, U, Th) but depleted in fluid-immobile elements (Nb and Ta). In contrast, the second group shows remarkable depletion in K, Ba and Rb and positive anomalies in Nb and Ta relative to the adjacent elements U and K. With regardless of fluid-mobile or immobile elements, nevertheless, they have fully inherited their protolith compositions without significant modification by the continental subduction-zone metamorphism.