Water-fluxed melting of orogenic crust: evidence from amphibole-bearing migmatite in the Dabie orogen, E China

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Amphibole-bearing migmatites from North Dabie in the Dabie orogen were investigated in order to constrain partial melting process. The migmatites are characterized by large euhedral poikilitic amphibole with abundant inclusions of plagioclase, biotite, and quartz in leucosome and melasome. Amphiboles show large variations in REE composition, interpreted as the result of equilibration with different melts during melting and crystallization.

Hornblende-plagiocase thermobarometry indicates that migmatites formed at P-T conditions of ~700-750 °C and 5 kbar, suggesting partial melting of a biotite + plagioclase + quartz-bearing protolith under water-fluxed conditions. Leucosomes range from tonalitic to granitic in composition with higher SiO2, Na_2O, Sr, and Ba contents than mesosomes, but lower contents of CaO, FeO, MgO, TiO_2, and MnO_2. The leucosomes have variable REE patterns, attributed to different degrees of amphibole entrainment into the leucosome and feldspar fractionation during partial melting. Zircons give U-Pb ages of 150 Ma to 137 Ma, indicating initial partial melting prior to 150 Ma. Inherited zircons yield U-Pb ages of 2.0-2.6 Ga and 730-720 Ma suggest that migmatites formed by partial melting of ancient basement of the Yangtze block. Low $\delta^{18}O$ values of zircons with Neoproterozoic ages and positively ε_{Nd} values suggest incorporation of juvenile crust that experienced high-T meteoric-hydrothermal alteration in response to the breakup of supercontinent Rodinia, while high $\delta^{18}O$ values of zircons with old Nd model ages indicate reworking of mature ancient crust.