An experimental study on dehydration melting of UHP metagranite at high pressure

QIONG-XIA XIA*[1] JAMES A VAN ORMAN[2] JIAN HAN[2] YONG-FEI ZHENG [1]WAN-CAI LI[1] MENG YU[1] XU LUO[1]

[1] School of Earth and Space Sciences, University of Science and Technology of China, Hefei 230026, China

[2] Department of Earth, Environmental and Planetary Sciences, Case Western Reserve University, 10900 Euclid Avenue, Cleveland OH 44106, USA

Partial melting experiments of UHP metagranite were carried out at 1.0-2.0 GPa and 750 to 900ºC. The results show significant variations in melting degrees and melt compositions, providing insights into the behaviour of dehydration melting during the exhumation of deeply subducted continental crust. At 2.0 GPa and 750ºC, the metagranite starts to melt. However, the melting degree is as low as 1%, and the melt scatters sporadically intergranular or intragranular. With rising temperature, the melting degree increases to 5% at 900ºC, and the melt develops as large pocket. At 1.5 GPa, the melting degree rises to 3-10% at 750-850ºC and ~25% at 900ºC. At 1.0 GPa, the melting degree is higher than 25% at all temperatures. Melts occur pervasively, and idiomorphic quartz, feldspar and biotite start to crystalize from the melts.

The melts produced by the dehydration melting are granitic, and rich in silica and total alkali but poor in calcic and mafic compositions. The higher the temperature and the lower the pressure, the more silica, the higher the K_2O/Na_2O ratios and the less Na_2O are the melts. This indicates the incongruent breakdown of plagioclase and micas during the partial melting. With rising pressure, the anorthite component of plagioclase breaks down to grossular for crystallization of garnet, and the albite component of plagioclase partitions into the melt. Nevertheless, at 1.0 GPa, the melt compositions are almost homogenous at all temperatures at the high degrees of partial melting.