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F-rich phlogopite stability in ultra-high-temperature metapelites from the Napier Complex, East Antarctica

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ABSTRACT

Fluorine-rich phlogopite [F content up to ~8 wt%; F/(F + OH) ~0.9] in ultra-high-temperature metapelitic granulites from the Napier Complex, East Antarctica is associated with aluminous orthopyroxene, osumilite, sapphirine, garnet, and quartz. Textural relationships imply that some of the phlogopite is of primary origin and stable under ultra-high-temperature conditions. This is in accord with recent experimental evidence on the stability of F-rich phlogopite. Because the F-rich phlogopite also occurs as rounded inclusions in aluminous orthopyroxene (Al_2O_3 up to 12.8 wt%), sapphirine, osumilite, and garnet, it is inferred that the ultra-high-temperature mineral assemblages, which includes these minerals formed during prograde partial melting reactions at the expense of phlogopite, at a depth of less than 30 km. Thus the coarse-grained peak metamorphic assemblages formed below 9 kbar, and there is no evidence the rocks underwent any significant degree of decompression during or soon after peak metamorphic conditions. The phlogopite breakdown reactions we suggest on the basis of textural arguments differ from those postulated from experiments on F-free systems.