The behaviour of boron during LP/HT metamorphism of metapelites, Mt. Stafford, central Australia.

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Metapelites at Mount Stafford underwent LP/HT metamorphism. At upper amphibolite and granulite grades, partial melting typically involved limited water-saturated fusion in the andalusite stability field and biotite+sillimanite fluid-absent melting, respectively. Sub-solidus metapelites and their upper amphibolite-facies, partially-melted equivalents generally contain 50-100 ppm B. The latter show evidence for multiple generations of tourmaline: early Ca-Ti-bearing schorl-dravite, growth-zoned Ca-Ti-poor schorl-dravite, and late Ca-Ti-poor schorl. The Ca-Ti-poor schorl occurs in textures consistent with precipitation from a B-bearing crystallizing partial melt and consequent replacement of peritectic cordierite by retrograde biotite, garnet, and andalusite/sillimanite. Evidence for B conservation is consistent with petrographic evidence of extensive replacement of peak-metamorphic minerals and hence that little melt has escaped from these rocks. Granulite-facies metapelites typically contain much lower B contents (<10 ppm), suggesting that some melt loss has occurred. At all grades metapelites are locally B-rich (~1300-6500 ppm B), leading to the development of tourmaline-rich assemblages. In agreement with this, LP melting experiments using B-rich Mt. Stafford medium-grade metasediments suggests that in these unusual bulk compositions tourmaline will persist to at least 800 ˚C (at 3.2 kbar). In the highest-grade natural example, the B-enriched bulk composition resulted in the development of mineral assemblages characterised by rare B-rich minerals such as Fe-werdingite and ominelite; the former recorded for the first time in cordierite-bearing rocks. The B-enrichment appears to be a pre-metamorphic feature that may be related to early hydrothermal alteration.