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Modelling metamorphism in the Hoosac Schist, Western Massachusetts: new approaches to a New England problem

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Along the western margin of the metamorphic Appalachians in New England, Taconic (Ordovician) tectonism and metamorphism are overprinted towards the east by Acadian (Devonian) structures and metamorphism. The Hoosac Schist, a probable correlate of the well-known Gassetts Schist of Vermont, lies in the region of overprinting. It forms a narrow N-S-trending tectonically-bound zone crossing several Barrovian mineral-assemblage zones from garnet to kyanite grade. Highly aluminous units containing cm-sized garnets (Cheney & Brady, 1992) are noted for the occurrence of textural unconformities within the garnets, separating inclusion-rich cores from inclusion-poor rims. Matrix domains contain both paragonite and muscovite. Muscovite is present in at least two compositionally distinct generations, with broad later laths cutting across a microfolded earlier fabric. Rutile is restricted to inclusions in garnet, whereas the matrix Ti- phase is ilmenite. These features suggest a polymetamorphic history, potentially recording the superimposition of Acadian metamorphism on Taconic, but it has not yet proved possible to demonstrate the presence of two metamorphic cycles.

This study aims to test and employ the new and revised activity models recently developed for metapelites in the full system MnNCKFMASHTO (White et al, 2014), for use with the Holland & Powell data-set 6. Features that can now be more explicitly modelled include garnet zonation in relation to its inclusion suites and microstructural features, the occurrence, texture and distribution of Ti-bearing accessory minerals, and the assemblages and compositional trends in white micas.

Preliminary modelling, correlated with microstructural observation, indicates (1) some confirmation of the concern expressed by White et al (2014) that the stability of margarite-bearing assemblages may be somewhat overestimated, (2) that apart from this, the early growth history of garnet is consistent with its suite of trapped inclusions at 8–9 kbar, 500–540°C, (3) that the progression from rutile to ilmenite via an interval of coexistence may be consistent with a single prograde process, and (4) that the marked transition from phengitic to low-Si, high-Na muscovite probably occurred during the growth of the cross-cutting mica generation, but after the growth of ilmenite micropoikiloblasts at the expense of rutile.

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White, RW, Powell, R & Johnson, TE (2014), The effect of Mn on mineral stability in metapelites revisited: new a–x relations for manganese-bearing minerals, Journal of Metamorphic Geology, 32, 809–828.