Suprastructure-infrastructure boundaries in polydeformed metamorphic rocks as moving targets: a case study in the Thor-Odin – Pinnacles area of south-eastern British Columbia, with future applications on Cape Breton Island.

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The Thor-Odin dome in SE BC is a tectonothermal culmination, structurally overlain by an ~12 km thick south-southwest dipping panel of rocks, and together, these high grade polydeformed metamorphic rocks are exposed in the footwall of the Columbia River and Okanagan Valley-Eagle River extensional fault systems. The panel that overlies the Thor-Odin dome is often interpreted as a single mid-crustal zone representing orogenic infrastructure or a mid-crustal channel during the Late Cretaceous to Eocene. We question this interpretation based on new analyses of the metamorphic and deformation history within this panel.

The rocks in the footwalls of the CRF experienced protracted, but not necessarily continuous metamorphism throughout the Cretaceous to Paleocene, with the ages of metamorphism younging downwards, and increasing in grade downwards throughout the structural section into the dome. This downward younging progression of metamorphism and deformation is best explained by a migrating suprastructure-infrastructure boundary that is located at different structural levels at different times. Cooling paths constructed for different structural levels within the section using U-Pb zircon, monazite and titanite geochronology data in conjunction with new hornblende, biotite and muscovite $^{40}Ar/^{39}Ar$ data show that the panel has a complex cooling/reheating history. Exhumation in the upper part of the section was ongoing during the last stages of transposition and folding in the dome during northeast-directed transport over a basement ramp in the Eocene at ~56–54 Ma. By ~51Ma, retrograde metamorphic processes were active at all structural levels reflecting crustal scale extension.

We propose that the approach of looking for suprastructure-infrastructure boundaries within packages of apparently undivided metamorphic rocks would be instructive in areas where metamorphic history and linkages to deformation are broadly known, but the details remain elusive. The gneissic units of the Boisdale Hills area on Cape Breton Island offer a possibility to test this prediction.

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