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TESTING THE APPLICABILITY OF THE CHANNEL FLOW MODEL IN THE SOUTHERN APPALACHIAN INNER PIEDMONT USING INTEGRATED ISOCHEMICAL PSUEDOSECTION MODELING AND GEOCHRONOLOGY

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The concept of long-wavelength ductile flow of lower crustal material, or channel flow, has emerged to explain the evolution of large hot orogens. In this model, growth of heat producing crust during collision leads to melt-weakening and flow of lower crust in response to tectonic forcing or long-wavelength gradients in gravitational potential energy. In the Himalayan-Tibetan (HT) orogen where the model was originally proposed, it has been hypothesized that a Miocene orogen-normal channel was active and that there was a more recent switch to orogen-parallel “escape” flow as the front of the orogen began to deform as a thrust wedge. However, because this hypothesized HT orogenic channel is largely subsurface it cannot be directly examined, making it difficult to test these hypotheses.

The Inner Piedmont (IP), southern Appalachians has been proposed to be an exhumed orogenic channel based on inverted metamorphic isograds, extensive migmatization, and a large-scale curved mineral lineation pattern that is consistent with a shift from orogen-normal to orogen-parallel flow. To test the viability of the channel flow model in the IP, we construct pressure-temperature-time (P-T-t) paths and compare these to existing models which indicate that peak temperatures and residence times will differ between thrust wedge and channel flow models. The P-T-t paths are constructed using isochemical phase diagram sections (pseudosections), garnet compositions, monazite geochronology, and $^{40}Ar/^{39}Ar$ thermochronology to define prograde to retrograde conditions and residence times. The channel flow models require temperatures above 700-750°C to initiate and maintain flow. Preliminary pseudosections from the northern IP Brindle Creek fault zone indicate prograde to peak conditions of 815–820 °C and 7.9–9.3 kbar, and retrograde conditions of 720–730 °C and 5.3–5.4 kbar based on observed garnet compositions and sample mineralogy (Qtz + Pl + Bt + Sil + Grt ± Ms ± Ep ± Ilm ± Rt). Pseudosections are still being revised, however if confirmed, the P-T conditions are compatible with channel flow in the IP. Future model revisions and age data from samples forming a transect across the IP and into the adjacent Carolina superterrane and eastern Blue Ridge will be used to compare the P-T-t histories between the prdoposed channel and surrounding units.

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