Thermal evolution of high-grade crust in the Acadian/Alleghenian orogens, central New England: Comparing numeric models with insights from monazite paragenesis in LPHT metamorphic rocks

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Monazite paragenesis across the central New England Acadian and Alleghenian orogens differs significantly between discrete structural levels. Pelitic migmatites (LM) from Gilsum, NH, spatially associated with the Kinsman Quartz Monzonite (KQM), contain 4 generations of monazite, the last formed during melt crystallization (~750°C, 355 Ma), post-dating KQM intrusion by ~45 m.y. Thus, the KQM was not a heat source for the melting of the LM pelites. Petrologic *T-t* paths from the LM samples were compared with *T-t* paths generated from 2-D numerical models for a variety of heating mechanisms. Our analyses indicate: 1) a period of cooling between monazite generations 1-2; 2) a deceleration of heating rate between monazite generations 2-3 (14.4±2.0°C/m.y., 1 sigma) and generations 3-4 (8.2±1.4°C/m.y.). The numeric best fit to the monazite *T-t* path involved simultaneous intrusion of a 900°C, 2-km thick sill 1 km below the modeled rock (325°C, Z =14 km) and asthenospheric underplating (1450°C, Z = 30 km). The numeric model generates a *T* maximum of 730-740°C at 35-40 m.y. after lithospheric delamination; a time interval similar to the KQM intrusion-LM melting time interval. Production of *T* max in this range is due to the persistence of the initial thermal perturbation caused by pluton intrusion, followed by the conductive heat transfer from underplated asthenosphere. Monazite age-intrusion age diachronicity is also found in pluton-proximal migmatized pelites from southwest ME, southern NH, and central MA. Central MA monazites contain both late Acadian (core: 354±11 Ma, 1 s.e.) and Alleghenian (rim: 310±12 Ma) components. We suggest that lithospheric delamination played a major role in supplying heat for Acadian (400-350 Ma) metamorphism in central New England; the role, if any, of delamination in Alleghenian metamorphism is unclear.

Lithogeochemical studies in terrains affected by overthrust of tectonic nappes (Variscan Belt-Northern Portugal)

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Introduction

The studied area corresponds to an upper Ordovician to lower Devonian metassedimentary sequence intruded by syn-orogenic granites, located in Northern Portugal (Chaves). This metassedimentary sequence belongs to the Galiza Média - Trás-os-Montes Zone (ZGMTM), a geotectonic zone of the Variscan Iberian Belt characterized by the overthrust of allochthonous nappes over parauthochthonous nappes, developed during D_2.

Two lithostratigraphic units (NE unit and SW unit), were individualized, both formed essentially by semi-pelitic and pelitc lithologies.

Lithogeochemical results

Lithogeochemically, NE unit has a quartz-ilitic and quartz albitic composition in the sedimentary and volcano-sedimentary domains with a distinct grade of geochemical maturity. These lithologies are rich in SiO_2, Na_2O, and in Rb, Zr (acid crustal source).

The SW unit has pelitic lithologies showing a sedimentary sorting, with a higher grade of geochemical maturity, with relatively high values of Al_2O_3, Fe_2O_3, MnO, MgO, CaO, Ti and Sc, V, Cr, Ni (basic source).

The Th/Sc versus V/La ratios and the Th/Sc versus Zr/Y ratios indicate, for the two units, a geotectonic environment ranging from an Active Continental Margin (ACM) to a Continental Insular Arc (CIA).