New insights on metamorphism in the Central Metasedimentary Belt of Quebec, Grenville Province

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Evidence suggestive of a clockwise *P-T-t* trajectory for the Central Metasedimentary Belt (CMB) within Quebec is demonstrated by geothermobarometers, compositionally zoned garnets and relic inclusions within porphyroblasts. Compositional zonation of garnets suggests tectonic denudation after the initial phase of thrusting of the Grenville Orogeny. Peak metamorphic conditions measured from the geothermobarometers, in accordance with the observed mineral assemblages, are 790°C, 8 kbar (granulitic conditions). Growth of metamorphic zircon and monazite occurred *c.* 1185 Ma. Re-equilibration of monazite is coeval with extensive monzonitic plutonism and ductile shearing along the Nominingue-Cheneville Shear Zone at *c.* 1165 Ma.

Regional Geology

The CMB (Wynne-Edwards, 1972) is a juvenile Grenvillian crust with boundaries more or less parallel to the province. The field area is located 100km north of the Ottawa River between Ottawa and Montreal (Fig. 1). It surrounds the largest granulite terrane within the CMB. A possible terrane boundary between a marble-rich and a quartzite-rich domain cuts through the northwest margin of the field area (Fig. 2). A granulitic dome consisting mostly of orthogneisses with metapelites, quartzites and a tonalitic pluton dominates the western two thirds. The (north-south trending) Nominingue-Cheneville Shear Zone cuts through the structural trend of this granulitic dome (Fig. 2). Mineral assemblages within this shear zone provide evidence for a retrogressive event down to

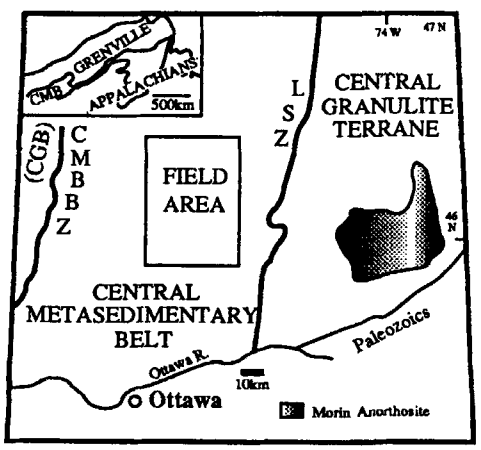

FIG. 1. Location for field area (LSZ - Labelle Shear Zone; CMBBZ - CMB Boundary Zone; CGB Cemtral Gneiiss Belt).

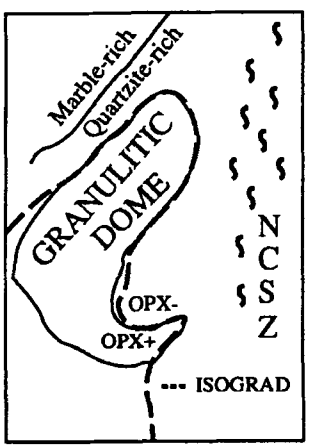

FIG. 2. Geological characteristics (NCSZ Nominigue-Cheneville Shear Zone).

amphibolite, muscovite-stable, conditions. Monzonite-diorite sheet complexes (1167–1164 Ma) were syntectonically emplaced along this shear zone (Corriveau *et al.*, 1994).

Methods/Results

The highest grade metamorphic assemblages are: Spr?-Qtz-Bt-Grt-Crd (P > 8 kbar) and Krn-Tur-Opx-Pl-Crd-Qtz (T > 735°C; abbreviations after Kretz 1983). The occurrence of Krn in contact with Opx provides further constraints on the P-T estimates of Indares and Martignole (1990) along a traverse through the CMB of Quebec. Assemblages such as Bt-Grt, Ilm-Mag, Grt-Sil-Spl-Qtz, Bt-Grt-Pl-Sil-Qtz and Pl-Grt-Opx-Qtz were used as geothermobarometers.

The prograde portions of the *P-T-t* trajectories were obtained from a detailed study of relic mineral inclusions such as Hc within Grt and Sil (suggesting the reaction Spl + Qtz = Grt + Sil), the cores or garnets and relic mineral assemblages. Information for the retrograde portions was obtained from the Nominingue-Cheneville Shear Zone and the rims of garnets.

Transects were completed across all minerals to test for zoning (only observed in garnets). Garnets larger than 3mm in diameter display consistent zonation patterns where X_{Fe} increases from the core to the rim, corresponding to a decrease in X_{Mg} (similar to the zonation pattern of Indares and Martignole 1990).

Geochronology

U–Pb analyses were done on zircons from one metapelite, monazites from 5 metapelites and titanites from 5 marbles and calc-silicates. Metamorphic zircons revealed a date of 1185 Ma in agreement with the oldest monazite ages. Younger monazite ages range between 1173 and 1140 Ma. Titanite ages from this region range from 1165 to 1133 Ma. A monazite from a late pegmatite within the Nominingue-Cheneville Shear Zone gave an age of 1155Ma.

Discussion\Conclusions

The CMB of Quebec shows a clockwise *P-T-t* trajectory with maximum pressures of 8 kbar followed by maximum temperatures of 790°C at *c.* 1185 Ma. Krn in contact with Opx was stable at these conditions, along with Sil, however Sil was not observed in contact with Opx. Monazite U-Pb systems have been reset by monzonite emplacement and regional cooling through 700°C (Heaman and Parrish, 1991). Upper titanite ages (1165 Ma) are attribute to monzonite plutonism whereas the younger ages constrain regional cooling through 600°C (Heaman and Parrish, 1991).

References

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