PLUTONIC CHARNOCKITES FROM A PROTEROZOIC MOBILE BELT IN ANTARCTICA — EVIDENCE FOR FRACTIONATION OF THOLEIITIC PARENT MAGMA IN THICKENED, OROGENIC CRUST

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At around 1000 Ma ago an intense orogenic event, possibly associated with continental collision, produced high-grade gneiss terranes in the East Antarctic Shield, the Eastern Ghats of India, Sri Lanka and elsewhere in Australia and Africa. A feature of this orogeny in the Proterozoic mobile belt of the Mawson Coast, Antarctica, was the intrusion of vast amounts of charnockite (present outcrop 5,000 km)^{2}into a transitional amphibolite-granulite supracrustal gneiss sequence, following two isoclinal folding episodes and prior to a less intense third deformation. An age of 960 Ma probably records D3 when a foliation and retrograde biotite-garnet (much less commonly hornblende) were developed in the charnockites.

High temperatures for the magma are inferred from field evidence that many xenoliths and some remnant country-rock gneiss outcrops have been partly melted in contact with the charnockite producing migmatites, felsic dykes and pegmatites (boundins and dykes). There is an absence of hydrate-bearing, felsic gneiss xenoliths in equlibrium with the host charnockite and mafic amphibolite xenoliths are also partly melted.

Geochemically the Mawson Coast charnockites define two main groups. A low Ti, high Mg gropup ranges from 53 to 70% $SioO_2$ and has heavy rare-earth element (HREE) contents which vary significantly from strong ly depleted to strongly enriched, and can be modelled only by fractionation of magmatic garnet. A low Mg, h igh Ti group has a similarly broad range in composition but shows no HREE depletion and has high P_2O_5 contents (up to 1.1% in the most mafic rocks).

A possible petrogenetic model features a tholeiitic parent magma for both types but with the low Ti charnockites retaining evidence for garnet frcactionation at deep levels (> 14 kbar) and the high Ti rocks representing precipitates and cumulates from a more evolved tholeiite at higher crustal levels (closer to the ca 7 kbar level of emplacement). Isotopic analyses by P. A. Arriens require assimilation of rediogenic gneiss to explain high $^{87}Sr/^{86}Sr$ of some high Ti samples. An important tectonic implication of this study is that fractionation of garnet requires elevated pressures and hence thickened crust, suggesting that an Andean or Himalayan plate margin existed at 1000 Ma.