Widespread intracrustal melting and the generation of charnockites in the Neoproterozoic Madurai Block, South India

J.K. TOMSON[1]*, Y.J. BHASKAR RAO[1], T. VIJAYA KUMAR[1] AND A.K. CHOUDHARY[2]

[1]National Geophysical Research Institute, Hyderabad, India (*correspondence: tomsonjk@ngri.res.in)
[2]Institute Instrumentation Centre, IIT-Roorkee, India

The Precambrian Southern Granulite Terrain (SGT) of South India is a collage of discrete crustal blocks that are divisible broadly into Archaean and Proterozoic terrains based on regional granulite facies metamorphism at ca. 2.5 Ga and ca. 0.5 Ga. The Madurai Block (MB) represents the largest Neoproterozoic terrain across the crustal-scale Palghat-Cauvery shear zone system (PCSZ) with widespread calc-alkaline felsic magmatism between ca.0.75 – 0.56 Ga. The crustal history of the MB region is directly relevant to the elucidation of the Neoproterozoic assembly of the Eastern Gondwana Supercontinent. Here, we present a large data set of major and trace element geochemical data for charnockite orthogneiss samples from across the MB, together with Sr-Nd isotopic compositions in an attempt to constrain the magma genesis and emplacement conditions.

The Neoproterozoic charnockites of the MB range from quartz monzonite to monzogranite with minor tonalite and granodiorite. The suites are calc-alkaline, metaluminous to weakly peraluminous and show a similar range of enrichment and fractionation of LREE and HREE. Fe-Ti oxide and apatite saturation temperatures at 7.5 kbar suggest high-melting temperatures (800-1080°C). Interestingly however, charnockites along an ~10 km-wide belt straddling the Karur-Oddanchattram-Kodaikanal Shear Zone (KOKSZ) yield Middle Archaean Nd-model ages (3.2–3.0 Ga) and show either negative or no Eu-anomaly, while elsewhere throughout the MB, the charnockites show prominent negative Eu anomaly and relatively younger model ages (2.8-1.8 Ga). The Sr and Nd isotopic correlations present consistent hyperbolic mixing trends between two end-members; a juvenile mantle material and ancient contiental crust characterised by low ε_{Nd} and highly radiogenic $^{87}Sr/^{86}Sr$. This supports tectonic processes invoving arc magmatism and intra-crustal melting that can be linked to the broad picture of the Neoproterozoic terrane accretion in Eastern Gondwana across the Pan-African Orogen. Thus, the MB could represent the deep-section of a collisional orogen, where the PCSZ as well as the *less known* KOKSZ could represent Palaeo sutures or manifestations thereof.

Boron isotope systematics in Central America Volcanoes

S. TONARINI[1], W.P. LEEMAN[2] AND S. AGOSTINI[1]

[1]Ist. Geoscienze e Georisorse, CNR Pisa, Italy (s.tonarini@igg.cnr.it, s.agostini@igg.cnr.it)
[2]National Science Foundation, Arlington, VA 22230, USA (wleeman@nsf.gov)

The Central American Volcanic Arc (CAVA) is characterized by pronounced geochemical zoning along its volcanic chain [1]. As an additional constraint on the nature of subduction contributions to arc magma sources, we report $\delta^{11}B$ data for Nicaragua (NI) and Costa Rica (CR) volcanoes together with previously published $\delta^{11}B$ for El Salvador (ES) volcanoes [2]. The samples show a wide variation in fluid-mobile/fluid-immobile element ratios such as B/Nb (0.2 to15) and B/La (<0.1 to 5.4), with the highest B enrichments occurring in ES and NI lavas and the lowest ratios (similar to normal mantle values) seen in CR samples. $\delta^{11}B$ is elevated (up to +6‰) in ES and NI lavas, and decreases (as low as -8.5‰) at the southern end of the arc. $\delta^{11}B$ is positively correlated with tracers of fluid mobile element enrichment (e.g., B/Nb, Pb/Ce, U/Th, Cs/La) implying a dominance of hydrous fluids derived from the subducting slab beneath ES and NI, and small slab fluid inputs beneath the CR sector. A weak correlation between $\delta^{11}B$ and ^{10}Be suggests that B and ^{10}Be are unlikely to be derived from the same reservoir.

Variations in $\delta^{11}B$ with respect to the radiogenic isotopes suggest that boron is added to a depleted mantle source beneath ES and NI, whereas an enriched mantle source with weak slab influence seems involved beneath CR. However, the dramatic decrease of $\delta^{11}B$ in CR lavas coupled with elevated $^{206}Pb/^{204}Pb$ (particularly for Platanar and Irazu volcanoes, which overlies the projected locus of a morphological boundary where the Cocos ridge is currently subducting) implies that B and Pb isotope signatures likely are controlled by the same reservoir. The low hydrous fluid signal indicated by fluid-mobile/fluid-immobile element ratios together with the Galapagos-type Pb isotopes suggest a dominant role of silicate melt transport of slab components.

[1] Carr *et al.* (2003) In : J.Eiler and G. Abers (eds): Inside the subduction factory. *AGU Geophsical Monograph* **138**, 153-179. [2] Tonarini *et al.* (2007) *Geochemistry, Geophysics, Geosystems* doi:10.1029/2006GC001508.