THE SOURCE OF CO_2 INVOLVED IN CHARNOCKITE FORMATION IN SOUTH INDIA

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Carbon isotopic measurements have been obtained on CO_2 preserved in fluid inclusions in quartz grains in South Indian charnockites. A stepped thermal decrepitation procedure has been adopted for liberating the contents of fluid inclusions. Increase in fluid abundance and heavier isotopic compositions in incipient charnockites relative to precursor gneisses argue for fluid entrapment during charnockite formation. Carbon isotope data can be diagnostic of the source of carbon; organic carbon has 13C $<-25\ ^{o}/_{oo}$ mantle derived carbon has $-7\ ^{o}/_{oo} <$ 13C $<-5\ ^{o}/_{oo}$ and carbonates have $^{13}C<0\ ^{o}/_{oo}$. Results obtained in South India have been divided into two groups on the basis of radiometric evidence of two periods of charnockite formation. The earlier period (1.5 Ga), on the southern margin of the Archaean craton in Karnataka, is characterised by a wide range of isotopic compositions for inclusion - CO_2 ($-4\ ^{o}/_{oo}$ to $-\ 13\ ^{o}/_{oo}$). These compositions may be related to local crustal sources of modification of mantle CO_2, but the model preferred here involves charnockite formation above a subduction zone. In such an environment the carbon isotopic composition will be variable when released from subducted sediments or magmas. The younger charnockite formation episode, identified to the south of Moyar shear zone, probably occurred at around 500 Ma and is thought to be part of the same event that caused charnockite formation in Sri Lanka. The carbon isotope data ($-5\ ^{o}/_{oo}$ to $-7\ ^{o}/_{oo}$) argue strongly for a sub-continental mantle origin of the CO_2, although locally where incipient charnockites are formed in graphitic sediments the isotopic composition is buffered to lighter values. Isotopic data argue against an internal graphite oxidation process. CO_2 derived from the mantle was probably transported by basic magmas during a continental rifting and crustal thinning event, during the break up of Gondwanaland.