Incipient charnockite formation in Kerala (S.India) - constraints from geochronology and REE in zircon

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Incipient charnockite in S. India have been intensively studied over the last three decades, resulting in a number of petrogenetic models based on the whole-rock and mineral chemical and isotopic data as well as fluid inclusion studies. The aim of our study is to date dehydration process and to detect phase transition effects on U-Th-Pb and REE systematic in zircon by comparing zircons separated from closely paired samples on either side of phase transition.

We sampled incipient charnockites from number of localities from Kerala Khondalite Belt (KKB). Leptynitic gneisses and khondalite, two major lithologies of the KKB, are common hosts for the incipient charnockite. Three types of incipient charnockite were observed: (1) charnockite patches related to the leucosome formation in leptinitic gneisses, (2) elongated charnockitic patches cross cutting gneissic fabric in khondalite and (3) charnockite as margins to a pegmatitic dyke in porphyritic granite.

Early results of examination of the zircons from incipient charnockite and hosting leptynitic gneiss in the Manali quarry (type 1) showed that oscillatory zoning in zircons are generaly blurred and broad indicating recrystallisation of protolith zircon. Recrystallisation caused partial resetting of U-Th-Pb isotopic system resulting in large discordance of the obtained ages. Cl-dark metamorphic zircon rims majority of the grains. Zircons in charnockite have nearly identical internal structure however, CL-dark rims are much thicker with weak sector zoning. In addition some grains have two generations of identical rims. Two groups of CL-dark rims in leptynitic gneiss gave concordant ages of 520±10 Ma and 582±22Ma. Zircon rims from charnockite split in two age groups as well: 503±13 Ma and 555±11 Ma. Younger and older generations of zircon rims from each lithology are coeval within age errors. Older generation of the zircon rims shows a HREE depleted pattern indicating closed system fractionation of the REE between zircon and garnet. Younger generation of zircon rims are most probably related to partial melting and leucosome formation therefore they date charnockite formation. However, depleted HREE pattern in these zircons are not consistent with open system partitioning.