European Mineralogical Conference
Vol. 1, EMC2012-311, 2012
European Mineralogical Conference 2012

The granulite facies Ongole domain of the Eastern Ghats Belt, India – A Proterozoic island arc?

T. Sarkar and V. Schenk
Institüt für Geowissenschaften, Christian-Albrechts-Universität, Kiel, Germany (ts@min.uni-kiel.de)

The Eastern Ghats Belt (EGB) is an assembly of several granulite terrains with different metamorphic ages on the eastern coast of India. It is bounded by the Singhbhum Craton in the north and the Bhandara Craton and Eastern Dharwar Craton in the west. Shear zones along which the granulites are thrusted over the cratonic units, mark the western margin of the EGB.

Recent work has established four major crustal units separated by tectonic boundaries (Dobmeier and Raith, 2003): the Late Archean Jeypore and Rengali province (northwest and north), the Mesoproterozoic Eastern Ghats Province (east), and the late Palaeoproterozoic Ongole domain (southwest). The Ongole domain is mainly composed of a suite of felsic granulites (charnockites and enderbites) within which migmatitic metapelitic granulites and basic granulites occur as enclaves and rafts. The charnockites and the enderbites are of different generations showing complex cross cutting relationship in outcrop, indicating that the later Ongole domain grew through many felsic to mafic intrusions. The metapelitic granulites are Fe-Al rich hercynite-quartz bearing rocks showing beautiful reaction textures. In some hercynite-cordierite bearing metapelitic layers cordierite is being replaced by symplectitic intergrowths of orthopyroxene with andalusite and/or kyanite and/or sillimanite. Spinel-quartz and biotite-garnet may also form parts of the replacement assemblages. The orthopyroxene + aluminosilicate symplectite replacing cordierite possibly occurred under low water activity during the late stage cooling of the rock before final exhumation. The textures in metapelites are helpful in deducing prograde and retrograde mineral reactions. Geothermobarometric data and the considerations from the deduced mineral reactions in the petrogenetic grid show that the hercynite-quartz bearing granulites evolved through an anticlockwise P-T trajectory and the last stage of the P-T evolution passed near the aluminosilicate triple point.

The best tectonic model (Waters, 1991) that supports UHT metamorphism of a hercynite-quartz bearing granulite, evolving through an anticlockwise P-T trajectory is a magmatic arc at a continental margin, where voluminous mantle derived magmas were transferred to higher levels causing medium P, ultrahigh T metamorphism, accompanied and followed by crustal thickening and then slow cooling at mid crustal levels.

Major element geochemistry of the intrusive rocks indicates a calc-alkaline evolution trend. The rocks in general are meta to peraluminous, calcic to calc-alkaline, magnesian granitoids. The highly differentiated ones are slightly ferroan and tend to be peraluminous. The signatures are very similar to the signatures shown by the exposed parts of magmatic arcs, like the Cordilleran batholiths of USA.

In the Ongole domain the monazite apparent age population shows that the history of the high temperature metamorphism ended between 1600-1550 Ma. Though monazite does not record pre-intrusion tectonothermal events, the apparent ages indicate that the tectonothermal events in the Ongole domain are older than the formation of Rodinia, but younger than Columbia formation. Thus, the accretion of the possible Ongole island arc took place in between the two supercontinent forming events.

References

Dobmeier, C. and Raith, M.M. (2003). Geol. Soc. London. Spec. Publ. 206, 145-168.
Waters, D.J. (1991). European Journal of Mineralogy 3, 367-386