ORIGIN AND EVOLUTION OF GNEISS-CHARNOCKITE ROCKS OF DHARMAPURI DISTRICT, TAMIL NADU, INDIA; **D. Rameshwar Rao and B.L. Narayana,** National Geophysical Research Institute, Hyderabad, India - 500 007

A low- to high-grade transition area in Dharmapuri district has been investigated petrologically and geochemically. The investigation has confirmed the continuous section through a former lower crust, with felsic charnockites predominating the lower part and felsic gneisses the upper part.

The structure of original gneisses is preserved in charnockites and the latter show petrographic evidence for prograde metamorphism. The prograde metamorphism is of isochemical nature as revealed by the similarity of compositions of tonalitic gneisses and tonalitic charnockites. However, the depletion of LIL elements particularly Rb, caused variation in K/Rb ratios from low values (345) in the gneisses in upper part to higher values (1775) in the charnockites in the lower crust. This variation in K/Rb ratio in a north to south traverse is related to the progressive break-down of hydrous minerals under decreasing H_2O and increasing CO_2 fluid conditions. Metasomatism and partial melting has also taken place to a limited extent along shear planes and weak zones. During cooling the H_2O circulation affected substantial **auto-regression**[1] in the transition zone resulting in the formation of second generation biotite.

Geothermometry and geobarometry of orthogneisses also show a progade metamorphism from about 5-6 Kbars and $725 \pm 25^{o}C$ near the orthopyroxene isograd at the top of the section in the north, to about 7 to 8.5 Kbars and $775 \pm 25^{o}C$ towards south. The progressive increase in metamorphic grade is demonstrated by the systematic change in the mineral composition from felsic gneisses in the north to felsic charnockites in the south (eg. hornblende composition varying from hornblende-edenite to pargasite composition, and increase in contents of An in plagioclase, Ti in biotite and hornblende). The mineral chemistry in such rocks can record a depth of equilibration of minerals at 18 to 21 km and 25 to 29 km, and indicate steep geothermal gradients ranging from 35 to $38^{o}C/km$ and 26 to $30^{o}C/km$ in the upper and lower parts of the crust respectively[2]. The presence of such rocks now at the surface of the continental crust (ca. 35 km) could be cited as an evidence for this part of the Archaean crust to have been atleast 53 to 64 km thick. The differences in recorded pressure conditions might be related to the differences in erosional rates, rather than to tectonism.

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The petrochemical studies do not support the formation of the precursors (rocks of tonalitic and mafic composition) through primary fractionation of andesitic-dacitic magma[3] or intra-crustal partial melting[4]. The origin of precursors may be explained by the fractional crystallization of basaltic magma[5] or partial melting of amphibolite, leaving a mafic restite containing hornblende.

REFERENCES

1. Janardhan, A.S., Newton, R.C. and Hanson, E.C. (1982) Contrib. Mineral. Petrol., 79 : 130-149.

2. Rameshwar Rao, D. (1987) "Geochemistry and mineralogy of high-grade rocks of the transition zone in Dharmapuri district, Tamil Nadu, India. Ph.D Thesis (unpubl.), Osmania University, Hyderabad, India, 158 p.

3. Field, D., Drury, S.A. and Cooper, D.C. (1980) Lithos, 13 : 281-289

4. Fyfe, W.S. (1973) Phil. Trans. Roy. Soc. Lond., 273-A : 457-461.

5. Arth, J.G., Barker, F., Peterman, I.E. and Friedman, I. (1978) Jour. Petrol., 19 : 289-316.