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Tectono-metamorphic history of the granulite facies terrain of the Balaram-Abu Road area, North Gujarat, West India: Implications for the India–Madagascar connection in Gondwana

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The Balaram–Abu Road area is located at the southwestern extreme of the Proterozoic Aravalli Delhi Fold Belt [1]. It is the only one of three granulite facies occurrences in the Rajasthan–Gujarat Precambrian shield in northwestern India to exhibit sapphirine-bearing Mg-Al granulites. In the Balaram–Abu Road area of north Gujarat, these orthopyroxene–sillimanite–sapphirine–spinel bearing rocks represent high-grade (UHT) metapelites with peak temperature of 950–1040 °C and 8.3–8.5 kbar pressure. They occur as part of an obducted tectonic sliver, which is bound to the northwest by the Kutch-Chitrasani Fault (KCF) along which they abut against the Erinpura (Abu) granite. To the east, these granulites are juxtaposed with an amphibolite terrain along the Surpagla Tectonic Junction. These sapphirine-bearing granulites in the Balaram–Abu Road area may have an important bearing in evaluating the possibility of a Western India–Madagascar connection during the Proterozoic or even earlier time, since similar assemblages have also been reported from central and northern Madagascar [2,3].

Gravity, magnetic and DSS data for the Precambrian shield of Rajasthan and North Gujarat are correlated with the high-grade metamorphic terrains of the region [4,5,6]. The tectono-metamorphic history, as deduced from the petrography, mineral phase equilibria and P–T trajectory, is strongly supported by the DSS and gravity data. Lack of correlation between gravity anomalies and magnetic data has helped in ruling out the possibility that granulite facies metamorphism could be due to magmatic under-plating. Instead, a collisional tectonic model is strongly supported by metamorphic history of the sapphirine-bearing granulites, which record a distinct clockwise P–T trajectory, DSS data, gravity and the metamorphic facies map. The geophysical data suggest that the KCF represents a former trench. The geophysical data and tectonic setting suggest that the Balaram–Abu Road granulite terrain experienced rapid obduction, as evidenced by various symplectites and an isothermal decompression (ITD) path during 690–700 Ma, after prolonged westward subduction. Subduction to sufficient depth resulted in partial melting and generation of granitic magma, which was emplaced in the supra-subduction zone northwest of the KCF as the Mount Abu granite around 740 Ma. Geophysical data are also found to be useful for correlating the granulite province of south-central Rajasthan with that of north Gujarat.

References:

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