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Occurrence of granulite facies metamorphosed Bastar cratonic rocks in the western margin of the Eastern Ghats Province: Implications from petrology and whole rock geochemistry of garnet-bearing charnockites

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Collisional orogeny is one the most important mechanisms of continental growth during the supercontinent cycle. The craton – orogenic belt contact zone are the hallmarks for understanding the evolution of collisional orogens, as these zones are more affected by the collisional events than the interiors. One such zone, connecting the Proterozoic Eastern Ghats Province (EGP; a part of the Eastern Ghats Belt) and the Archean Bastar Craton of Proto-India, is termed as the Terrane Boundary Shear Zone (TBSZ). The TBSZ contains a wide variety of rock types from the EGP as well as Bastar craton that are co-metamorphosed in granulite facies conditions. Such complex lithology and available discrete geochronological data render the determination of the age and mechanism of the collision difficult. We present here a petrochronologically-controlled geochemical data of the metaigneous rocks from the TBSZ and Bastar craton to understand the age and mechanism of collision of the two continental blocks. The garnet-bearing charnockites that show Archean Sm-Nd model ages possess petrological and geochemical characters that are distinct from that of the EGP. Published petrological data show that these rocks are metamorphosed in granulite facies conditions in the lower crust (~10kbar, 875°C). Geochemical data show that the charnockites plot in the field of granites and are meta- to peraluminous in composition. They show enriched LREEs and LILEs and strong depletions of elements such as Eu, Nb, Ta, Ti and Sr, indicating formation in an arc setting. The greenschist-facies metamorphosed biotite granites from the adjacent part of the Bastar craton, as well as interior of the craton, share same geochemical characteristics with the granulite-facies metamorphosed charnockites from the TBSZ. Therefore, the major and trace element characteristics, along with the available Sm-Nd model ages, suggests that the charnockites are high-grade metamorphosed equivalents of Bastar craton rocks. This interpretation further indicate burial of the Bastar craton rocks as a result of underthrusting beneath the Eastern Ghats Province, which is consistent with available seismic data, most likely during the Grenvillian orogeny.