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Paleo-mesoarchean crustal and metamorphic evolution of the Southern Bundelkhand craton.

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The Bundelkhand Craton, India, constitutes two E-W trending greenstone belts and a layered ultramafic complex with a diverse assemblage of Archean lithologies. Within the southern Bundelkhand complex, the Girar Greenstone Belt and the Madawara Ultramafic Complex exhibit distinct lithological and geochemical characteristics. The Madawara Ultramafic Complex, located north of the greenstone belt, consists of layered talc-tremolite schist and overlying massive peridotites associated with gabbros. In contrast, the Girar Greenstone Belt is dominated by metabasalts, tonalite-trondhjemite-granodiorite (TTG) suites, and metasedimentary rocks, including banded iron formations (BIFs), banded magnetite quartzites (BMQs), quartz-pebble conglomerates (QPCs), fuchsite quartzites, and schists. Geochemical analyses indicate that the layered ultramafics and spinel peridotites were derived from distinct sources. The talc-tremolite schists exhibit deformation signatures and evidence of high-temperature seawater hydrothermal alteration, whereas the massive peridotites suggest moderate degrees of partial melting. Furthermore, the low Ni and Cr concentrations in metabasalts indicate a depletion relative to primitive mantle values. The geochemical variability in metabasalts suggests an evolved tholeiitic to basaltic-andesitic composition, consistent with its derivation from a heterogeneous mantle source. Previous studies propose that the metabasalts formed in a shallow subduction setting, while the layered ultramafic rocks crystallized from two distinct magma chambers at different depths within the subduction environment. This study presents new geochemical and petrographic data from the southern Bundelkhand Craton to elucidate further the genetic relationship between the Madawara Ultramafic Complex and the Girar Greenstone Belt. The findings contribute to a comprehensive understanding of the Archean evolutionary history of the Bundelkhand Craton and its geodynamic significance.