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The Lithosphere Beneath the Indian Shield

A Geodynamic Perspective

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Abstract

The shield comprises cratons, both with steady-state and anomalous thermal structures. The WDC and Bundelkhand craton display thermal structure expressed by perturbed geotherms. The difference between the two is stark, whereas the WDC shows intra-craton variation in thermal structure and exhibits a Proterozoic geotherm overprinted by the Cenozoic thermal anomaly, the Bundelkhand craton has a Cenozoic thermal imprint with contributions from crustal accretion. These changes are the result of advective heat from magmas ponded at the crust-mantle boundary. The distribution of granulites and the eclogitic rocks provides an indication of the rate of thermal equilibration and its spatial distribution.

The thermal structure of the EDC and that of the adjoining Bastar Craton are different. They are characterised by cratonic geotherms distinct from the other two. The thermal thickness of the EDC lithosphere is similar to Archaean cratons elsewhere, but that of the WDC is analogous to the Mesozoic-Cenozoic terrains worldwide.

The heat flow picture is distinct from that of the geothermal structure. The WDC registers the lowest heat flow (29–32 mWm^{-2}) with 35–40 km crustal thickness whereas the EDC has a heat flow of 25–51 mWm^{-2} (crustal thickness 34–36 km), Bastar 51–64 mWm^{-2} and Bundelkhand the least, 32–41 mWm^{-2}. In the interior of the shield, the heat flow is 41–55 mWm^{-2} (31–18 km) whereas at the continental margin in the west, near Cambay basin it varies from 55–96 mWm^{-2} (crustal thickness 8–15 km). The high concentration of radioactive elements in the felsic granulites from the lower crust could contribute significantly to the surface heat flow.

In the SGT, the heat flow is 28–58 mWm^{-2} (crustal thickness 41–45 km). It is likely that this high heat flow is related to the metasomatic imprint. Both the western and eastern margins of the shield display gravity lows, negative magnetic anomalies, and are characterised by high geothermal gradients.