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Crustal Thermal Structure of Narmada-Son Lineament Region

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Central India is characterized by the presence of numerous hot springs, feeder dykes for Deccan Traps and seismicity all along the Narmada-Son Lineaments (NSL) which separates the Vindhyans (Meso Neoproterozoic) in the north from the Gondwanas (Permo-Carboniferous) in the south. The NSL is divided in two parts by Barwani-Sukta Fault (BSF). To the west of this fault a graben exist, whereas to the east basement is uplifted between Narmada North Fault (NNF) and Narmada South Fault (NSF). The present work deals with the 2-D thermal modeling to delineate the crustal thermal structure in the NSL region east of BSF. The 2-D modeling approach needs 2-D crustal structure upto the Moho and P-wave velocity distribution for construction of the model and for estimation of the heat production in the middle and lower crust, respectively by using an empirical relationship between heat production (A) and P-wave velocity (V_p). The heat production in the upper layer is estimated by using exponential model. 2-D crustal structure and P-wave velocity distribution in the central India are given by DSS studies along four profiles running across the Narmada-Son Lineament in almost north-south direction. These profiles are: (I) Hirapur – Mandla (II) Khajuriakalan-Pulgaon, (III) Ujjain – Mahan, and (IV) Thuadara – Sindad. The first three profiles falls in the region of basement uplift to the east of BSF. Crustal thermal structure along the first three DSS profiles has been computed. Numerical results reveal that the conductive surface heat flow value in the central India varies between 45 to 49 mW/m^2. Out of which 21-23 mW/m^2 is the contribution from the mantle heat flow and remaining from within the crust. The calculated heat flow values are found in close agreement with the heat flow values measured at Lonar (47 mW/m^2), Satephal (47 mW/m^2) and Singdad (49 mW/m^2) in Yawatmal area, Mandwa (48 mW/m^2) in Wardha area towards southern tips of Profile II and III, and Mohapani (49 mW/m^2) located in the northern tips of Satpura basin south of NSL. The Curie depth is found to vary between 36 to 43 km and is in close agreement with Curie depth estimated from MAGSAT data. The Moho temperature varies between 500 to 580^{0}C. It indicates that the central Indian region is characterized by low mantle heat flow which in turn makes the lower crust brittle and amenable to the occurrence of deep focused earthquakes such as Satpura (1938) and Jabalpur (1997) earthquakes.