J. Ind. Geophys. Union, 29(4) (2025), 282-292

Student Section

Possible extension of Proterozoic sediments beneath Eastern Ghats Belt: A case study of Bastar Craton

Ankita Roy[1], Swarnapriya Chowdari[2] and A. Vasanthi [2]*
[1]Department of Earth Sciences, Pondicherry University, Puducherry-605014, India
[2]CSIR-National Geophysical Research Institute, Hyderabad-500007, India
*Corresponding author: vasanthi99ngri@gmail.com

ABSTRACT

The eastern margin of the Indian shield presents a geologically and geotectonically intricate zone where Proterozoic sedimentary basins and the high-grade metamorphic Eastern Ghats Belt (EGB), are juxtaposed along a broad, shear-dominated contact stretching from Odisha in the north to northern Tamil Nadu in the south. The tectonic relationship between the Bastar craton and the Eastern Ghats Belt in eastern India, has been the subject of considerable geological interest due to its implications for Proterozoic crustal evolution, basin development, and the assembly of ancient continental blocks. In this study, satellite-derived gravity data over Bastar craton and adjoining regions have been analysed to explore the possible extension of Proterozoic sedimentary sequences of this craton beneath EGB. The presence of a prominent residual gravity low of the order of -50 mGal on the SE part of the study area has been delineated below the EGB terrain, indicating possible presence of Mesoproterozoic to early Neoproterozoic sedimentary sequences. Further, gravity modelling across the Bastar craton and EGB, reveals steep crustal-scale contacts and high-density zones that are consistent with a under-thrust geometry. The underthrusting of Bastar sediments beneath the EGB likely occurred during the Mesoproterozoic collisional events, linked to the Rodinia supercontinent assembly. These findings not only enhance our understanding of the tectono-thermal history of the Bastar craton and EGB interface, but also provide a framework for re-evaluating crustal accretion processes along the cratonic margins in the Indian shield.

Key Words: Proterozoic sediments, Eastern Ghats Belt (EGB), Satellite gravity, Finite Element Method, Bastar craton, Bastar-EGB interface

INTRODUCTION

The Indian peninsular shield predominantly comprises Precambrian crustal blocks that formed approximately 3.6 to 2.6 billion years ago during the Archean Eon, representing some of the earliest solidified portions of the Earth's lithosphere (Sarkar et al., 1990; Sharma, 2010). These stable crustal blocks, commonly known as cratons, form the foundational cores of continental plates and are the key to understanding early Earth processes (Smithies et al., 2009). The tectonic framework of the Indian shield is well characterized by five major cratons, the Aravalli, Bundelkhand, Singhbhum, Bastar, and Dharwar, each exhibiting distinct geological histories and tectono-thermal events (Naqvi and Rogers, 1987; Ramakrishnan and Vaidyanadhan, 2010) (Figure 1). These Archean cratonic blocks are bounded and separated by various Proterozoic mobile belts, rift zones, grabens, and the shear zones, reflecting a complex and prolonged tectonic evolution marked by episodic collisions, accretions, and crustal reworking (Meert, 2003).

This study principally focuses on the Bastar craton, a significant Archean cratonic block situated in central India, renowned for its preserved ancient crust and tectono-thermal history that provide invaluable insights into the geodynamic evolution of the Indian Shield (Asokan et al., 2020; Mohanty, 2021), which in turn has implications for global tectonics, including supercontinent cycles such as Columbia and Rodinia (Satpathi et al., 2022). However, the intricate and heterogeneous litho-tectonic configuration within the Bastar region, characterized by a mosaic of metavolcanic, metasedimentary and granitic units, renders lithological correlations speculative and complex.

Multiple geological and geophysical investigations have been conducted to unravel the crustal and lithospheric architecture of the Bastar craton. Seismic wave dispersion studies reveal a lithospheric thickness of approximately 140 km beneath this region (Mitra et al., 2006). Complementary seismological analyses estimate the crustal thickness of Bastar craton to be in the range of 35–40 km, consistent with the other ancient continental crusts worldwide (Jagadeesh and Rai, 2008). Heat flow measurements carried out by Gupta et al. (1993) have documented relatively high surface heat flow in Bastar craton compared to the Dharwar craton, which has been attributed to spatial variations in upper crustal radiogenic heat production and possibly localized tectono-thermal activity.

In addition, several studies were also carried out to understand the tectonic relationship between the Bastar craton and the Eastern Ghats Belt (EGB) in eastern India. The southeastern margin of the Bastar craton is structurally juxtaposed against the high-grade Proterozoic EGB, forming a tectonically complex and thermally contrasting boundary in eastern Peninsular India. Proterozoic sedimentary basins, such as the Chhattisgarh Supergroup (~1.4–1.0 Ga), Khariar, Indravati, Sabari, Abujhmar and Amphani groups, lie along the Bastar craton's fringe and are interpreted as rift-related intra-basinal sequences. Gravity studies highlight the presence of tectonically active contact between Bastar craton and the EGB (Subramanyam and Verma, 1986; Kumar et al., 2004; Valdiya, 2015). Moreover, thermal (Bhadra et al., 2004), geochemical and geochronological studies have identified successive mafic magmatic events that have profoundly reshaped the lithosphere of the Bastar craton, evidencing sustained crust-mantle interactions that may have influenced its present-day geodynamic character (Rao et al., 2023).

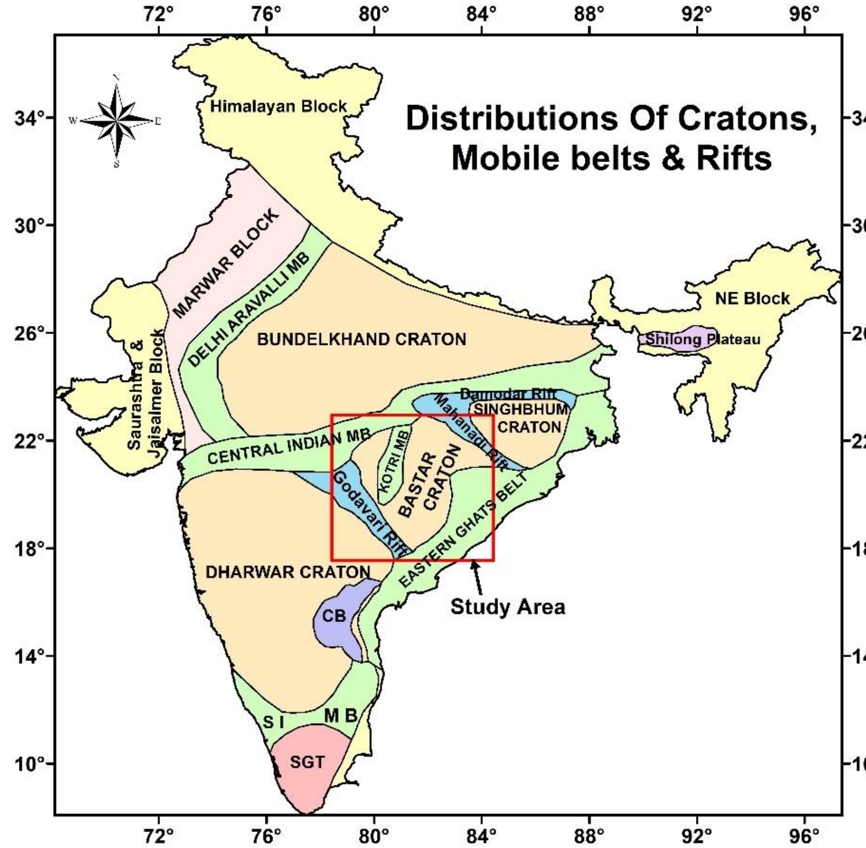

Figure 1. Distribution of cratons and mobile belts in India. Location of present study area is shown by red colour box (modified after Chowdari, 2019). CB: Cuddapah basin, SIMB: South India Mobile Belt, SGT: Southern Granulite Terrain.

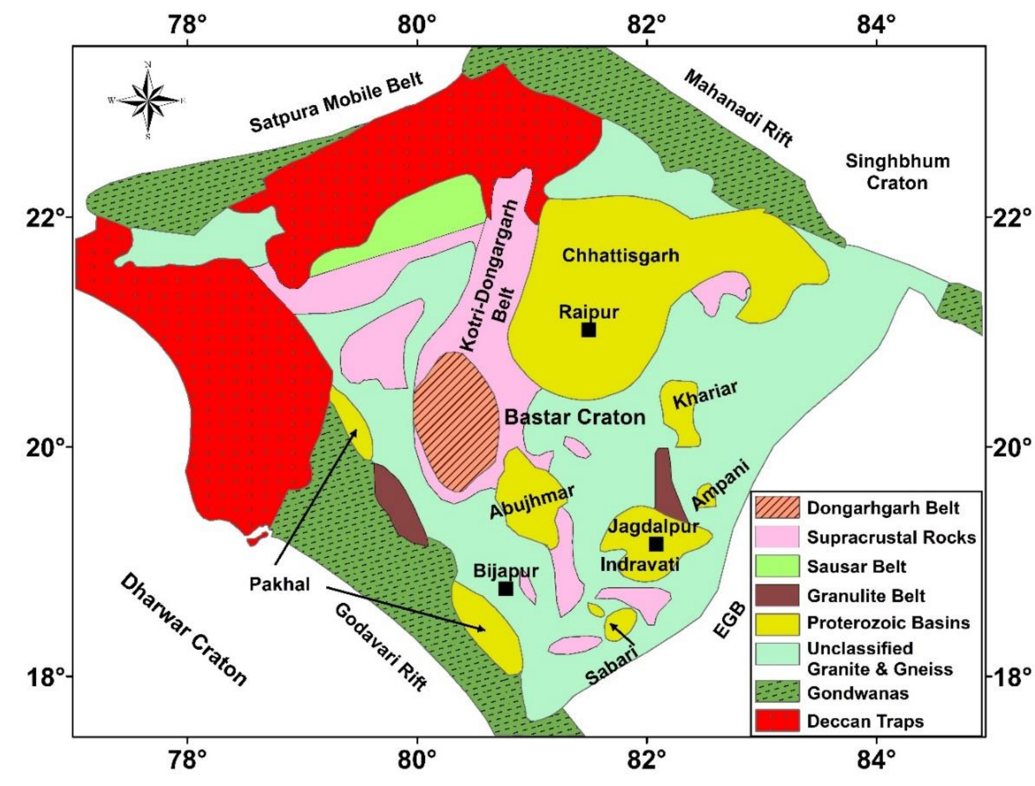

Figure 2. Generalized geology and tectonic boundaries of Bastar craton (modified after Santosh et al., 2020).

In the present study, gravity data derived from a Global Gravity Model (Zingerle et al., 2020) over the Bastar craton and its adjoining regions, are analyzed to delineate the subsurface tectonic framework, and to check the possibility of extension of Proterozoic sediments beneath the EGB. The application of edge enhancement techniques enables detailed delineation of faults, lineaments, and tectonic boundaries that are otherwise challenging to resolve. Additionally, 2.5D gravity modeling along a NW-SE profile, cutting across the Eastern Ghats Belt and Bastar craton, is employed to further constrain the crustal and lithospheric configuration.

GEOLOGY AND STRUCTURAL FRAMEWORK

Bastar craton, displaying a broadly trapezoidal configuration (Mohanty, 2021), lies within 17°30′ N - 23°30′ N and 77° 48′ E – 84°06′ E. This craton is confined by mobile belts and rift zones from all sides, Godavari rift zone in the south-western part and Mahanadi rift in north-east. The south-eastern part of this craton is marked by Eastern Ghats Belt (Biswal et al., 2001). The Central India Tectonic Zone, Son-Narmada lineament, and the Satpura Mobile belt, forms the boundary close to north-western part of the craton (Bandyopadhyay, 1995). The major geological formations in this region are tonalite- trondhjeamite- granodiorite (TTG)- rich gneissic basement complex, enclaves of high grade supracrustal rocks forming the granulitic belts, intra cratonic Kotri-Dongarhgarh mobile belt, and Proterozoic Purana basins (Ramakrishnan and Vaidyanadhan, 2010) (Figure 2). The initial crustal growth phase in the craton took place during Paleoarchean period (Sarkar et al.,1993).

This craton hosts several intra-cratonic Proterozoic sedimentary basins among which, Chhattisgarh Basin (Deb, 2004) is the largest. Other small basins include Indravati, Ampani, Abujhmar, Khariar, Sabari and Pakhal. The complex geology of Bastar craton reflects a long tectonic history which not only shapes the surface geology, but also influenced the underlying deep crustal processes. Among the major supracrustal/volcanic sequences, the Kotri-Dongargarh Supergroup is mainly composed of the Amagaon, Nandagon and Khairagarh groups of rocks. The Amagon group, composed of granites and gneisses with subordinate schists and quartzites, is considered to have been formed at around 2.3 Ga (Naqvi and Rogers, 1987). The Nandgaon Group incorporates the Bijli and Pitapani volcanic suites, which are dominated by rhyolites and subordinate dacites and andesites, with the rhyolite dated at 2503 to 2180 Ma (Sarkar et al., 1993). This terrain also hosts several deformed alkaline complexes along the suture with the Eastern Ghats Belt, including the Mesoproterozoic (1480 Ma) Khariar alkaline complex. The Southern portion of Bastar craton exhibits several episodes of mafic magmatism, as evidenced by the presence of several mafic dyke swarms (Srivastava et al., 2021; Rao et al., 2023).

REGIONAL TOPOGRAPHY

The overall topography of this region (Figure 3) is rugged as it is integrally linked with mobile belts, rift zones and low-lying Proterozoic basinal structures. The elevation varies from as low as 150 m for low lying areas to more than 900 m for upland regions. For example, Eastern Ghats Belt along the south eastern part of the craton, is a structurally upland region, with high elevation of around 900 meter (Valdiya, 2015). In contrast, the intra-cratonic depressions, including Chhattisgarh, Indravati, Sabari, Ampani, Abujhmar, Khariar, collectively form the significant low relief topographic feature. The regions uneven topography is further emphasized by the presence of localized tectonic belt. Kotri-Dongargarh mobile belt is one such tectonic feature, extending ~ 250 km in length, with 50 km wide range from north-south to NNE-SSW direction (Chakraborty and Debnath, 2023). The structurally uplifted nature of the belt, resulted into localized topography high (Ramakrishnan and Vaidyanadhan, 2010).

GRAVITY STUDY

For the present study, the gravity data of the Bastar craton and its adjoining regions have been derived from XGM2019e_2159 global gravity field model, which offers a harmonized and high resolution representation of Earth's gravity field (Zingerle et al., 2020). Figure 4 depicts the Bouguer anomaly map of the studied region, where the anomalies range from -95 mGal to +75 mGal. All the basins of the craton are clearly brought-out with prominent gravity lows, while different high-grade rocks are well reflected by gravity highs.

In general, the observed Bouguer gravity anomaly reflects contribution from both deeper (regional) and shallower (residual) sources, and it is thus important to remove the broader regional trend, which in turn brings out various geological structural features very clearly. In this study, Finite Element Method (FEM) (Mallick et al., 2012; Vasanthi and Santosh, 2021a, b) has been used to compute the regional gravity component, which has been subsequently removed from observed Bouguer gravity anomaly to obtain the residual gravity anomaly map.

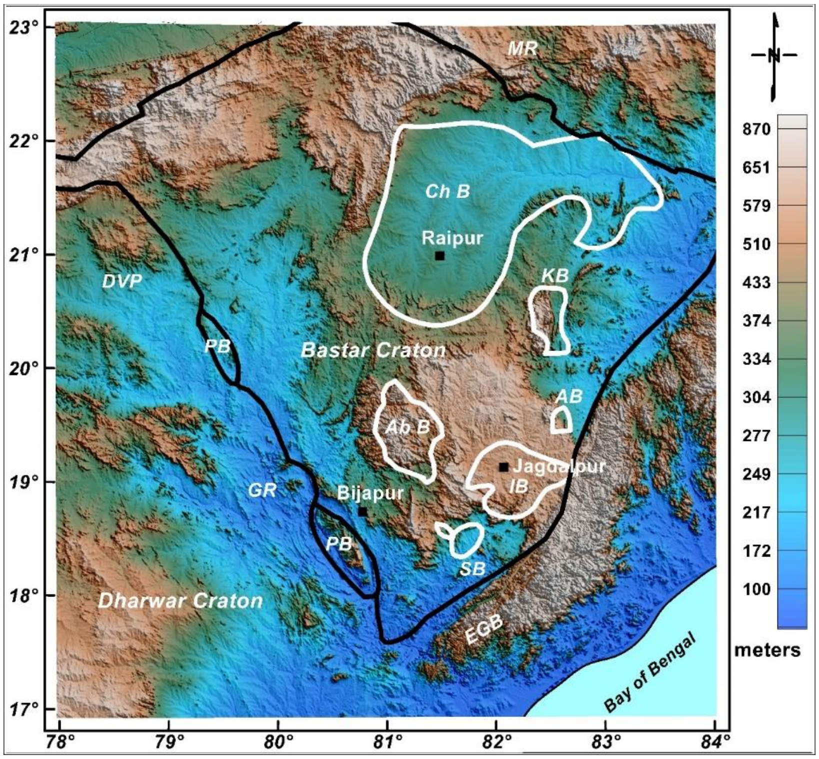

Figure 3. Topographic map of the study region obtained from the Shuttle Radar Topography Mission (SRTM) (ftp://edcsgs9.cr.usgs.gov/pub/data/srtm). Bold black line denotes the boundary of the Bastar craton, and white solid line represents the basin boundaries. Ch B: Chhattisgarh Basin, KB: Khariar Basin, AB: Ampani Basin, IB: Indravati Basin, SB: Sabari Basin, PB: Pakhal Basin, MR: Mahanadi Rift, GR: Godavari Rift, EGB: Eastern Ghats Belt.

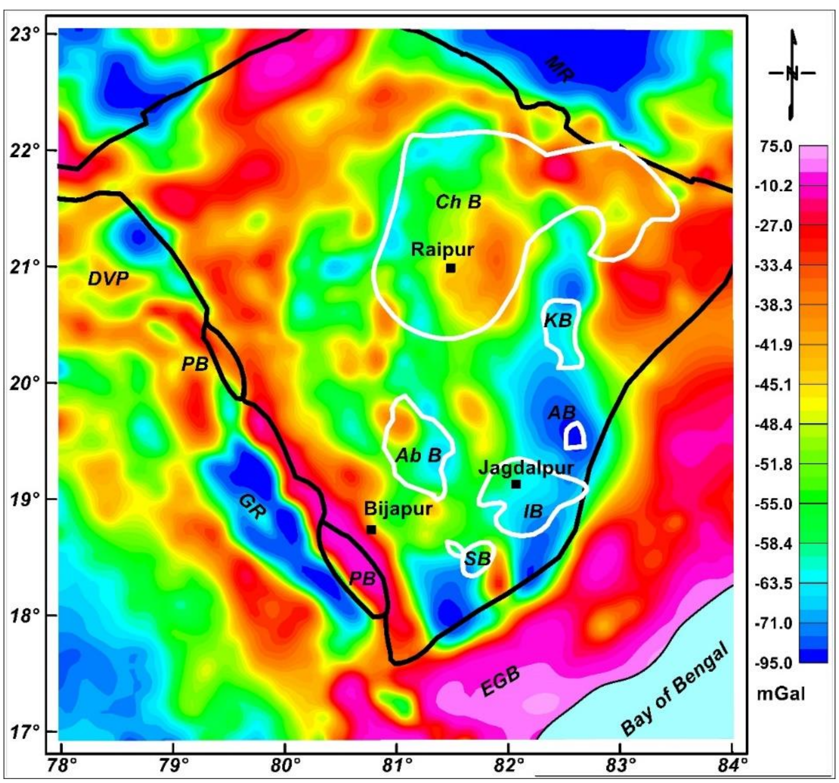

Figure 4. Bouguer gravity anomaly map of the Bastar craton and its surrounding regions. Bold black line denotes the boundary of the Bastar craton, and white solid line represents the basinal boundaries. Ch B: Chhattisgarh Basin, KB: Khariar Basin, AB: Ampani Basin, IB: Indravati Basin, SB: Sabari Basin, PB: Pakhal Basin, MR: Mahanadi Rift, GR: Godavari Rift, EGB: Eastern Ghats Belt.

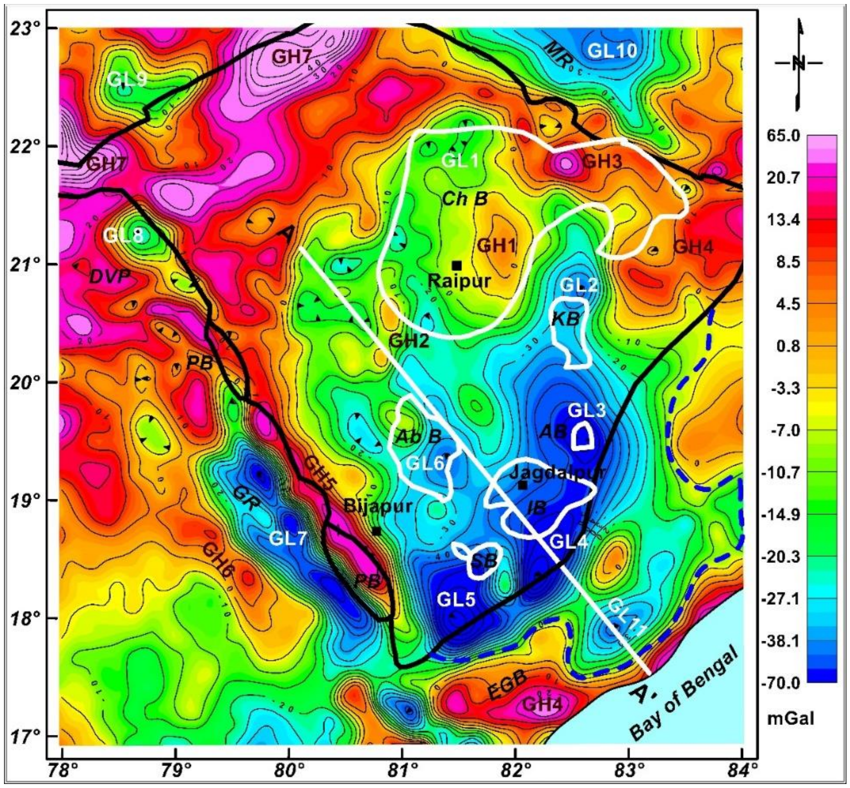

Figure 5. Residual gravity anomaly map, derived by Finite Element Method, covering Bastar craton and adjacent region highlighting key structural features. GL1-GL11 represent the prominent gravity lows, while GH1-GH7 gravity high zones. Bold black line denotes the boundary of the Bastar craton, and white solid line represents the basin boundaries. NW-SE profile AA', is marked, along which 2.5D gravity modelling has been carried out. MR: Mahanadi Rift, GR: Godavari Rift, EGB: Eastern Ghats Belt.

The resultant residual gravity anomaly map is shown in Figure 5. It is interesting to observe that the boundaries of various litho-tectonic units are brought out very clearly. The central and northern parts of the Bastar craton are mostly associated with isoloated gravity highs (GH1, GH2 and GH3) corresponding to un-classified metamorphic rocks (Figure 2) concealed below the sedimentary succession. A notable gravity high (GH4) in south-eastern and eastern part of the study area aligns with the Eastern Ghats Belt (EGB). The Bhoopalapatnam and Karimnagar granulitic belts, which are situated on either side of the Godavari Rift (GR) basin, are characterized by conspicuous gravity highs (GH5 and GH6 respectively). Similarly, the high-order gravity anomaly (GH7) on the NW part of the study region reflects the Deccan Trap cover.

The basins of the craton, such as Chhattisghar (Ch B), Khariar (KB), Indravati (IB), Ampani (AB), Sabari (SB) and Abujhmar (Ab B), correspond to gravity low anomalies (GL1, GL2, GL3, GL4, GL5 and GL6 respectively). However, over the Pakhal Basin (PB), we observe a gravity high anomaly, as the high-density Bhopalpatnam granulitic rocks are in contact with the sedimentary succession. A prominent gravity low (GL7) located in south-western part of study area is sandwiched between the conspicuous gravity high GH5 and GH6 . This prominent gravity low zone corresponds to the Gondwana sedimentary rock accumulation in the Godavari Rift Basin (Vasanthi, 2025). Similarly, Gondwana sediments of Wardha sub-basin and Satpura sequence are associated with gravity lows GL8 and GL9 respectively. Similarly, a notable gravity low (GL10) corresponds to Mahanadi Gondwana sediments.

An interesting finding of the present study has been the delineation of gravity highs (GH1 and GH3) in Chhattisgarh Basin, which contrasts with the usual gravity low association with sedimentary basins. This positive bias might be explained by the geological influence of adjacent Kotri-Dongarhgarh mobile belt. Geological mapping of the craton (Figure 2) shows that the Kotri-Dongarhgarh orogenic supracrustal rocks occurs along the Chhattisgarh basins eastern edge, even though the orogen trends north to south. Therefore, the present study reveals the continuation of the Kotri-Dongarhgarh belt beneath the Chhattisghar Basin.

As discussed earlier, the cluster of gravity lows (GL2 to GL6) characterizing the SE portion of the craton due to the presence of number of basins like Khariar (KB), Ampani (AB), Indravati (IB), Sabari (SB) and Abujhmar (Ab B). It is important to note that this low anomaly stretches beyond the mapped boundary of the craton, towards EGB. Despite the high grade metamorphic nature of this terrain, the persistence of this gravity low (as marked by blue dotted line; GL11) raises the possibility of under-thrusting of Bastar sediments beneath EGB.

EDGE ENHANCEMENT TECHNIQUES

Precise imaging of crustal architecture plays important role in tectonic reconstruction and resource exploration. The Bouguer anomaly map or residual map without edge constraints, often struggle to delineate sharp crustal boundaries. It has often been used to resolve lateral heterogeneities and sharp crustal boundaries (Blakely and Simpson, 1986; Hsu et al., 1996). The different edge enhancement methods used in this study are Horizontal Gradient, First Vertical Derivative and Analytical Signal.

Horizontal Gradient Method

This technique works on the principle of identifying local maxima in the gravity data (Cordell and Grauch, 1985). The local maxima do not mean the gravity high or low, rather it indicates the abrupt transition in gravity as we move along surface.

$$HG = \sqrt{\left(\frac{\partial g}{\partial x}\right)^2 + \left(\frac{\partial g}{\partial y}\right)^2}$$

The mathematical formula of horizontal gradient method suggests that the method is more concern about the spatial gradient than the absolute values. Which means this method focuses on increasing and decreasing value of gravity in both x and y direction, and mark the area as local maxima where the transition is strongest, which represents the possible edge or boundary of the associated feature (Chowdari et al., 2017, 2022). The aim of using the method for this study is to highlight structural edges such as fault, lineament and rift boundaries.

Figure 6 shows horizontal gradient map of residual gravity data over Bastar craton. The most significant features on the map are: NW-SE trending gradient maxima HZ1 near Raipur area, likely representing a buried fault zone in Chhattisgarh basin margin. The strong gravity gradient seen along HZ2, within the eastern part of the Bastar craton, trending towards N-S direction, marks a faulted boundary between Proterozoic sediment cover and adjoining granitic basement. E-W oriented lineament in SE part of craton (HZ3), could possibly be a tectonic contact between Bastar and EGB. Another gradient maxima HZ4 orienting towards NNE-SSW, corresponds to the contact between the Bastar craton and the Godavari rift basin. A notable fault marked by HZ6 is possibly a structural discontinuity between Deccan Province and the supracrustal basement rocks. Similarly, HZ7, a NW-SE trending maximum gradient, corresponds to a lineament near Mahanadi graben.

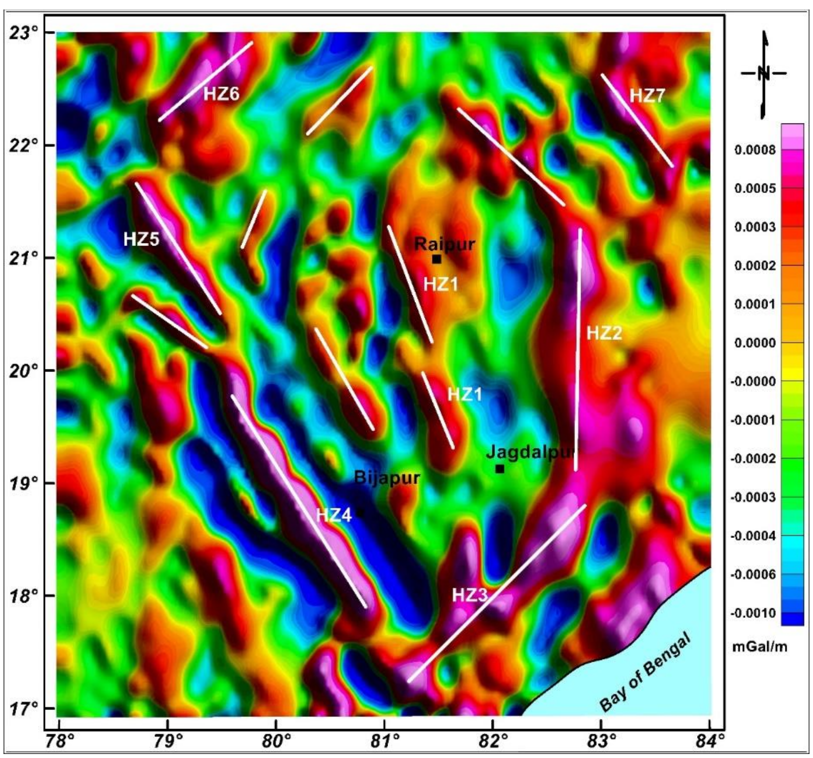

Figure 6. Horizontal gradient map of the residual gravity anomaly field with marked gravity interpreted faults (HZ1 to HZ7), as shown in white colour.

First Vertical Derivative Method

The horizontal gradient method outlines the structural edges by detecting lateral density contrast, however, it does not explain the extensional depth of the structure. First vertical derivative (Milligan and Gunn, 1997; Gönenç, 2014) fills that gap by pointing out rapid vertical changes in gravity.

$$\mathrm{FVD} = \frac{\partial \mathrm{g(x, y, z)}}{\partial \mathrm{z}}$$

This method acts as a high pass filter by calculating rate of change of gravity field in vertical direction, which reduces the contribution from deeper anomalies and enhance short wavelength features, associated with shallow crustal structures. Figure 7 shows First vertical derivative map, which reveals a more detailed picture of the subsurface, with multiple significant lineaments which were not prominent in the horizontal gradient map. The lineaments which were mentioned earlier are visible in vertical derivative map, with additional features trending towards NW-SE direction in NE part of Raipur, NNW-SSE oriented lineament in SE part and NNE-SSW oriented linear trend, all of which indicate a complicated subsurface geology.

Analytical signal Method

This method enhances gravity anomaly interpretation by combining both horizontal gradient and vertical derivative into a single measure (Klingele et al.,1991).

$$AS = \sqrt{\left(\frac{\partial g}{\partial x}\right)^2 + \left(\frac{\partial g}{\partial y}\right)^2 + \left(\frac{\partial g}{\partial z}\right)^2}$$

This fusion allows the method to capture the change in all directions, and produce a maximum directly above the boundary of subsurface density contrasts (Hakim et al., 2006). Unlike other edge enhancement techniques which are sensitive only in one aspect of anomaly, analytical signal balances both lateral and vertical information. This makes it particularly useful for outlining geological boundaries in complex crustal settings more precisely. Analytical signal map for the present study area (Figure 8), reveals some lineaments structures mainly in NE and central part of the craton, which were masked in previous maps. The boundaries of the entire Bastar craton are very well reflected here.

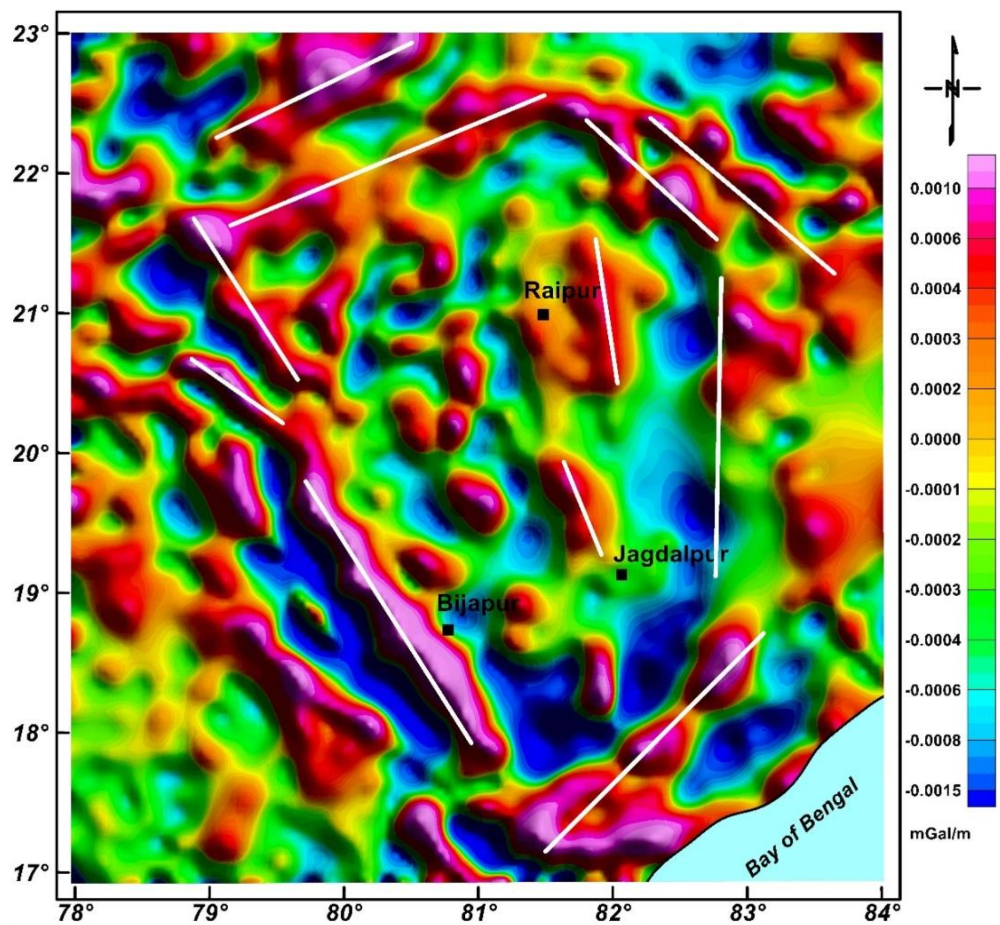

Figure 7. First-order vertical derivative map of residual gravity anomaly with marked gravity interpreted faults in white color.

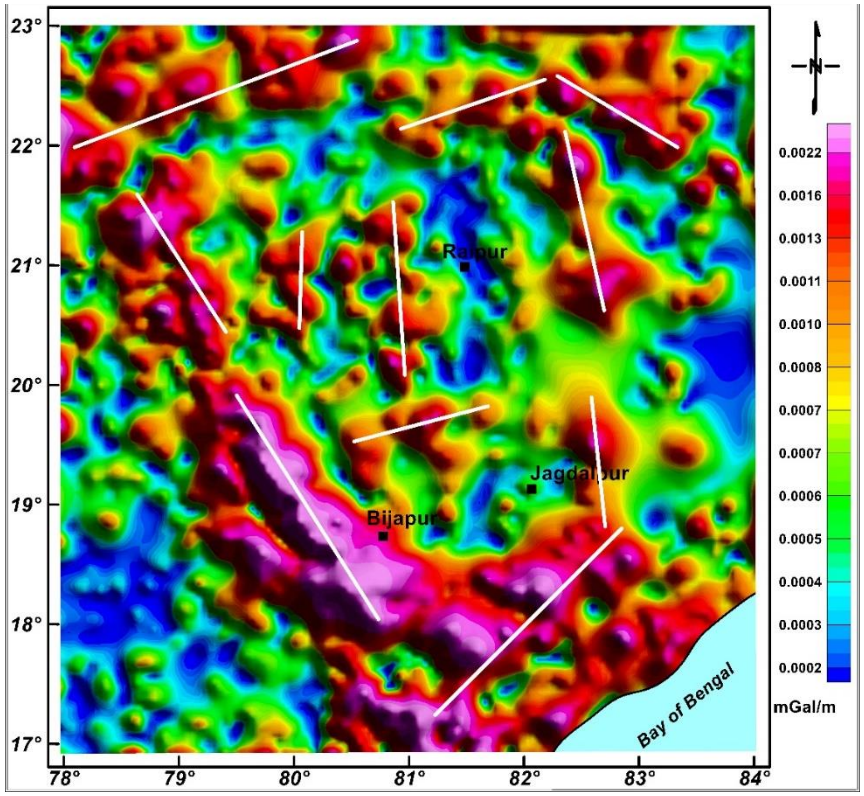

Figure 8. Analytical signal map of residual gravity anomaly with marked gravity Interpreted faults in white colour.

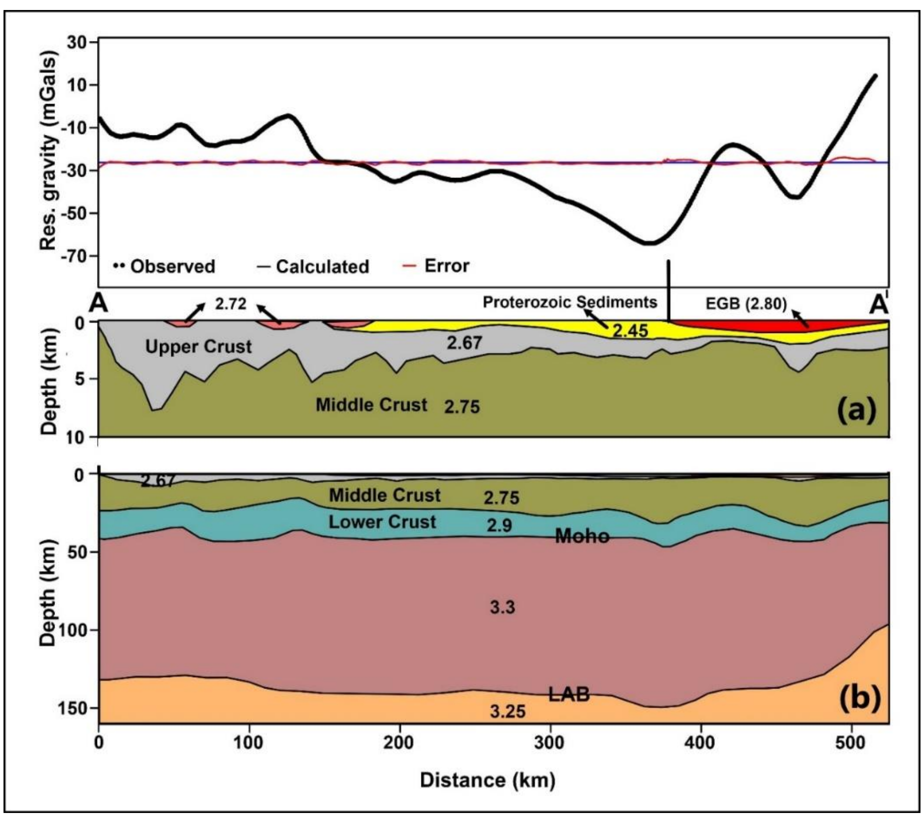

Figure 9. Density model along Profile AA' (location shown in Figure 5). **(a)** shallow crustal structure, and **(b)** lithospheric structure.

2.5D GRAVITY MODELLING

In order to understand the underlying crustal architecture, 2.5D modelling has been carried out along a NW-SE profile AA' cutting across the entire craton and adjacent EGB region (Figure 5). As the precise interpretation of gravity anomalies is non-unique, and often depends on direct inputs like the nature of the underlying rocks and their in-situ densities, we have used the available geophysical constraints in this region for different crustal layers in terms of their thicknesses and densities (Chalapathi Rao et al., 2011; Mandal et al., 2013).

The resultant best-fit density model (with an error of 0.7) along the profile AA' is shown in Figure 9. The top layer, corresponding to Proterozoic sediments, is assigned a density of 2.45 g/cm^3. This layer is followed by a thin upper crustal layer with density 2.67 g/cm^3, and mid-crustal layer, 2.75 g/cm^3. This layer is further underlain by a relatively high density lower-crustal layer which is assigned a density of 2.9 g/cm^3. Similarly, lithospheric mantle is assigned a density of 3.3 g/cm^3. Moho depth along this profile is taken as ~35 km below EGB to ~46 km beneath the sedimentary basins. Lithosphere-Asthenosphere Boundary (LAB) has been delineated between 100 to 144 km. This study delineated the sedimentary formation of the craton beneath the high-grade Eastern Ghats Belt (EGB) (Figure 9).

DISCUSSION AND CONCLUSIONS

The tectonic framework of the eastern Indian shield, particularly along the Bastar craton–Eastern Ghats Belt (EGB) interface, provides critical insights into Proterozoic crustal dynamics and the structural architecture of ancient continental margins. The satellite-derived gravity data analyzed in this study brings out clearly the continuation of Proterozoic sedimentary sequences of the Bastar craton beneath the high-grade EGB terrain. The identification of a prominent residual gravity low (around –50 mGal) in the south-eastern part of the study area, where EGB lithologies dominate the surface geology, is a compelling geophysical signature suggestive of the presence of low-density crustal materials, which appears representing buried Mesoproterozoic sediments such as those of the Indravati and Khariar Groups underneath the granulitic terrain. These gravity anomalies are consistent with the crustal configurations elsewhere in orogenic belts where older sedimentary sequences are tectonically buried beneath younger or higher-grade metamorphic complexes (Pandey et al., 2014; Vasanthi and Singh, 2019; Vasanthi and Santosh, 2023). The gravity modeling results strengthen this interpretation by revealing steep, east-dipping crustal-scale density boundaries, which are indicative of large-scale underthrusting (Figure 9). Such configurations are typical of continental collision zones, where rigid cratonic blocks are partially underthrusted beneath mobile belts, resulting in crustal thickening and complex metamorphic overprinting. This tectonic episode is closely linked with the evolution of Rodinia supercontinent assembly, which involved widespread craton amalgamation and crustal reworking across several continental margins (Pandey et al., 2018; Singh et al., 2025). The development of ductile shear zones such as the Terrane Boundary Shear Zone, facilitated this crustal stacking, enabling the high-grade EGB rocks to thrust over relatively low-grade or un-metamorphosed Proterozoic sequences derived from the Bastar craton. Importantly, this study contributes to a growing body of evidence that redefines the EGB not as an entirely exotic terrane but as a mobile belt with genetic and structural ties with the adjacent Indian cratons. This re-interpretation has broad implications for models of crustal accretion, basin evolution, and tectonothermal reworking in the Indian shield, and encourages a re-evaluation of similar craton–mobile belt interfaces globally.

Acknowledgements

We sincerely thank Dr. Prakash Kumar, Director, CSIR-National Geophysical Research Institute, Hyderabad, for the permission to publish this work. Ankita Roy expresses her sincere thanks to Dr. Abhey Ram Bansal, project Leader ,Gravity and Magnetic Group, CSIR- NGRI, for his constant encouragement and support during Internship at NGRI. We profoundly thank Dr. O. P. Pandey, Editor-in-Chief, for his valuable comments and suggestions to improve the quality of the manuscript. The work has been approved by CSIR-NGRI for publication as contribution number NGRI/LIB/2025/Pub-81.

Author Credit Statement

Ankita Roy: Original manuscript writing, data analysis and figure preparation. Ch. Swarnapriya: Data analysis and figure preparation. A. Vasanthi: Conceptualization, original manuscript writing, editing and reviewing.

Data Availability

The satellite gravity data is available in http:// icgem.gfz-potsdam.de/calcgrid (Zingerle et al., 2020).

Compliance with ethical standards

The authors does not have any competing interest and adhere to copyright norms.

REFERENCES

Asokan, A. D., Elangovan, R., Vishwakarma, N., Hari, K. R. and Ram Mohan, M., 2020. Petrogenesis of the Kanker granites from the Bastar Craton: implications for crustal growth and evolution during the Archean-Proterozoic transition. Front. Earth Sci., 8, 212.

Bandyopadhyay, B. K., 1995. Structure and tectonics of a part of Central Indian shield. Mem. Geol. Soc. India., 31, 433-467.

Bhadra, S., Gupta, S. and Banerjee, M., 2004. Structural evolution across the Eastern Ghats Mobile Belt–Bastar craton boundary, India: hot over cold thrusting in an ancient collision zone. J. Struct. Geol., 26(2), 233-245.

Biswal, T. K., Seward, D. and Jena, S. K., 2001. Eastern Ghats Mobile Belt is an epitome of mesoproterozoic fold thrust belt: a study from its NW margin. Gondwana Res., 4(4), 579-581.

Blakely, R. J. and Simpson, R. W., 1986. Approximating edges of source bodies from magnetic or gravity anomalies. Geophys., 51(7), 1494-1498.

Chakraborty, M. and Debnath, S., 2023. Mapping Facies Classification of Volcanic and Associated Succession in the Dongargarh Province. J. Geol. Soc. India, 99 (6), 886–887.

Chalapathi Rao, N.V., Lehmann, B., Mainkar, D. and Belyatsky, B., 2011. Petrogenesis of the end-Cretaceous Behradih kimberlite (orangeite): implication for mantle plume–lithosphere interaction in the Bastar craton, Central India. Contrib. Miner. Petrol., 161, 721-742.

Chowdari, S., 2019. Gravity studies of Gondwana Rift basins of India with special emphasis on Son-Mahanadi Basin. Ph.D. Thesis. Osmania University, Hyderabad.

Chowdari, S., Singh, B., Rao, B. N., Kumar, N., Singh, A. P. and Chandrasekhar, D. V., 2017. Structural mapping based on potential field and remote sensing data, South Rewa Gondwana Basin, India. J. Earth Syst. Sci., 126, 1-27.

Chowdari, S., Singh, B. and Singh, A. P., 2022. Anatomy of an intracratonic Son-Mahanadi Gondwana rift basin in Peninsular India: An integrated gravity, magnetic and remote sensing approach. Phys. Earth Planet. Inter., 328, 106888.

Cordell, L. and Grauch, V. J. S., 1985. Mapping basement magnetization zones from aeromagnetic data in the San Juan Basin, New Mexico. In The utility of regional gravity and magnetic anomaly maps. SPG., 181-197.

Deb, S. P., 2004. Lithostratigraphy of the Neoproterozoic Chattisgarh Sequence, its bearing on the tectonics and palaeogeography. Gondwana Res., 7(2), 323-337.

Gönenç, T., 2014. Investigation of distribution of embedded shallow structures using the first order vertical derivative of gravity data. J. Appl. Geophys., 104, 44-57.

Gupta, M. L., Sundar, A., Sharma, S. R. and Singh, S. B., 1993. Heat flow in the Bastar craton, central Indian shield: implications for thermal characteristics of Proterozoic cratons. Phys. Earth Planet. Inter., 78(1-2), 23-31.

Hakim, S., H., Nishijima, J., Ehara, S. and Aboud, E., 2006. Integrated gradient interpretation techniques for 2D and 3D gravity data interpretation. EPSL., 58, 815-821.

Hsu, S. K., Sibuet, J. C. and Shyu, C. T., 1996. High-resolution detection of geologic boundaries from potential-field anomalies: An enhanced analytic signal technique. Geophysics, 61(2), 373-386.

Jagadeesh, S. and Rai, S. S., 2008. Thickness, composition, and evolution of the Indian Precambrian crust inferred from broadband seismological measurements. Precambrian Res., 162(1-2), 4-15.

Klingele, E. E., Marson, I. and Kahle, H. G., 1991. Automatic interpretation of gravity gradiometric data in two dimensions: vertical gradient 1. Geophys. Prospect., 39(3), 407-434.

Kumar, N., Singh, A. P., Gupta, S. B. and Mishra, D. C., 2004. Gravity signature, crustal architecture and collision tectonics of the Eastern Ghats Mobile Belt. J. Indian Geophys. Union., 8, 97-106.

Mallick, K., Vasanthi, A. and Sharma, K. K., 2012. Bouguer gravity regional and residual separation: Application to geology and environment. Springer-Verlag.

Mandal, B., Sen, M. K. and Vijaya Rao, V., 2013. New seismic images of the Central Indian Suture Zone and their tectonic implications. Tectonics, 32(4), 908-921.

Meert, J. G., 2003. A synopsis of events related to the assembly of eastern Gondwana. Tectonophysics, 362(1-4), 1-40.

Milligan, P. R. and Gunn, P. J., 1997. Enhancement and presentation of airborne geophysical data. AGSO J. Aust. Geol. Geophys., 17(2), 63-75.

Mitra, S., Priestley, K., Gaur, V. K., Rai, S. S. and Haines, J., 2006. Variation of Rayleigh wave group velocity dispersion and seismic heterogeneity of the Indian crust and uppermost mantle. Geophys. J. Int., 164(1), 88-98.

Mohanty, S. P., 2021. The Bastar Craton of Central India: Tectonostratigraphic evolution and implications in global correlations. Earth-Sci. Rev., 221, 103770.

Naqvi, S. M. and Rogers, J. J. W., 1987. Pre. Geo. of India. Oxford University Press. New York, 223.

Pandey, O. P., Tripathi, P., Parthasarathy, G., Rajagopalan, V. and Sreedhar, B., 2014. Geochemical and mineralogical studies of chlorine-rich amphibole and biotite from the 2.5 Ga mid-crustal basement beneath the 1993 Killari earthquake region, Maharashtra: evidence for mantle metasomatism beneath the Deccan trap. J. Geol. Soc. India, 83(6), 599-612.

Pandey, O. P., Chandrakala, K., Vasanthi, A. and Kumar, K. S., 2018. Seismically imaged shallow and deep crustal structure and potential field anomalies across the Eastern Dharwar Craton, south Indian shield: Possible geodynamical implications. J. Asian Earth Sci., 157, 302-316.

Ramakrishnan, M. and Vaidyanadhan, R., 2010. Geology of India: GSI., Bangalore, 994p.

Rao, B. N., Singh, B. and Ravikumar, M., 2023. Lithospheric density structure beneath the dyke swarm region of the southern Bastar craton reveals a possible Proterozoic mantle plume: Inference from gravity and geoid study. J. Asian Earth Sci., 256, 105820.

Santosh, M., Tsunogae, T., Yang, C. X., Han, Y. S., Hari, K. R., Prasanth, M. M. and Uthup, S., 2020. The Bastar craton, central India: A window to Archean–Paleoproterozoic crustal evolution. Gondwana Res., 79, 157-184.

Sarkar, A., Sarkar, G., Paul, D. K. and Mitra, N. D., 1990. Precambrian geochronology of the central Indian shield: a review. Geol. Surv. India, Spec. Publ. (28), 453-482.

Sarkar, G., Corfu, F., Paul, D. K., McNaughton, N. J., Gupta, S. N. and Bishui, P. K., 1993. Early Archean crust in Bastar Craton, Central India—a geochemical and isotopic study. Precambrian Res., 62(1-2), 127-137.

Satpathi, K., Hifzurrahman, H., Xie, H. Q., Misra, S., Nasipuri, P. Ao, S., 2022. A2-type granites from the Bastar Craton, South-Central India, and their implication in Archean-Paleoproterozoic tectonics in Indian Peninsula. Lithosphere, Special 8, 7938481.

Sharma Ram, S., 2010. Cratons and fold belts of India. Lecture Notes in Earth Sciences,127, 61-61.

Singh, S., Chandrakala, K. and Pandey, O. P., 2025. 3-D Crustal Structure Modelling of the Proterozoic Cuddapah Basin, Its Regional Geodynamic Evolution and Columbia–Rodinia Connection. Geol. J., 1-24.

Smithies, R. H., Champion, D. C. and Van Kranendonk, M. J., 2009. Formation of Paleoarchean continental crust through infracrustal melting of enriched basalt. Earth Planet. Sci. Lett., 281(3-4), 298-306.

Srivastava, R. K., Söderlund, U., Ernst, R. E. and Gautam, G. C., 2021. A Ca. 2.25 Ga mafic dyke swarm discovered in the Bastar craton, Central India: Implications for a widespread plume-generated large Igneous Province (LIP) in the Indian shield. Precambrian Res., 360, 106232.

Subrahmanyam, C. and Verma, R. K., 1986. Gravity field, structure and tectonics of the Eastern Ghats. Tectonophysics., 126(2-4), 195-212.

Valdiya, K. S., 2015. Mesoproterozoic Eastern Ghat Mobile Belt. The Making of India: Geod. Evol., 185-204.

Vasanthi, A., 2025. Mulugu Earthquake: Reactivation of a deep-seated crustal fault in Godavari Graben (India). J. Indian Geophys. Union., 29,124-131.

Vasanthi, A. and Santosh, M., 2021a. Overview of regional gravity field computation models and application of a novel method in imaging the lithospheric architecture and destruction of the North China Craton. Earth-Sci. Rev., 215, 103548.

Vasanthi, A. and Santosh, M., 2021b. Lithospheric architecture and geodynamics of the Archean Dharwar craton and surrounding terranes: New insights from satellite gravity investigation. Gondwana. Res., 95, 14-28.

Vasanthi, A. and Santosh, M., 2023. Post-deformation effects of Indo-Eurasia convergence on major geological features of north-central India: New insights from satellite gravity observations. Phys. Earth Planet. Inter, 340, 107030.

Vasanthi, A. and Singh, A. P., 2019. Bouguer gravity field over Bundelkhand craton and its adjoining regions. J. Indian Geophys. Union., 23, 575-579.

Zingerle, P., Pail, R., Gruber, T. and Oikonomidou, X., 2020. The combined global gravity field model XGM2019e. J. Geod., 94(7), 66.

Received on: 10-07-2025 Revised on: 02-04-2025 ; Accepted on: 16-04-2025