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Mapping of Crustal Structure Using Potential Field Methods in Parts of Central Chhattisgarh, India

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Abstract

The article is the highlights of the mapping of crustal structures such as inferred fault/ lineament, tectonic contacts and basin boundaries using potential field method (Gravity and Magnetic methods) in parts of Raipur, Janjgiri-Champa, Mahasamund and Raigrah districts, Central Chhattisgarh, Central India. Geologically, the area of investigation is comprised by Tonidongar Bengpal, Bengpal Gneiss, Sukma, Sonakhan, Singhora, Chandarpur, and Raipur group. Several filtering and processing techniques are applied on potential field anomalies (Bouguer gravity and Magnetic) for outlining of crustal structures, which in turn correlated well with the geological features. The general trend of gravity and magnetic contour is in NW-SE direction which is in good correlation with NW-SE alignment of geological formations. The high gravity (H1) values (-26.5 to -8.9 mGal) recorded near Sonakhan and Deori villages which align in NW-SE direction is due to Meta Basalt (high density formation) in Sonakhan formation. The gravity 'high' (H2) values observed near Deori and Harda is due the cumulative effect of Meta basalt, Meta Gabbro, Phyllite and, Meta Rhyolite of Sonakhan formation. The gravity 'low' (L2) values (-62.4 to -50.1 mGal) is observed near Katgi and Pauni in western part which may be due to Hirri sub-basin within Chhattisgarh basin with deeper basement. The major gravity gradient (F3-F3') is trending in E-W and NW-SE direction near Katgi, Pauni and Sonakhan villages is demarcated as the boundary of Hirri Sub-basin within Chhattisgarh basin. The low intensity magnetic (T.F.) anomalies (-628.00 to 19.77 nT) are reflected near Sankara, eastern part of Pithora and southern part of Nanwapara due to the presence of Quartzite and Granite gneiss. The general regional trend of regional gravity contour is in NW-SE directions. Gravity highs (H1, H2 & H3) still exist in the regional gravity map indicating that causative sources of these anomalies are from deeper level. The Regional magnetic anomaly map provides integrated view of the study area with smooth trend. The prominent shallow features near Sonakhan - Deori and Deori - Harda villages are due to presence of Meta Basalt (high density formation) and cumulative effect of formation such as Meta basalt, Phyllite and Meta Rhyolite of the Sonakhan Formation. The Vertical derivative low near Katgi and Pauni, in the central part is observed over sub-basin (Hirri Sub-basin) of Chhattisgarh Formation due to the deeper basement. The Euler depth solutions are provided less than 1.5Km, 1.5 to 3.0Km, 3.0 to 5.0 Km and beyond 5.0 Km of gravity data. The solution of gravity data is falling at inferred lineament and contact between two litho-units varying depth from 1.5 to 5.0 Km.

Keywords: Mapping, Crustal Structure, Gravity and Magnetic Methods, Central Chhattisgarh

Introduction

Gravity and Magnetic methods known as potential field data are often used in the exploration geophysics. The sources are the variation in the physical properties of rocks, namely density and susceptibility. The measured data provide an excellent possibility to make a better image of structures beneath the Earth's surface. The data are usually collected at the earth surface (ground) or on-board airplane (airborne) (Mohammadi, 2014). The potential field method is employed effectively to map the crustal structure, such as faults/ fractures/ shear zones/ altered zones, which are significant loci for the occurrences of mineral resources/ emplacement of an intrusive suite of rocks (Dahanayake and Subasinghe, 1988; Gorle *et al.,* 2016; Subasinghe, 1998). The area chosen for the study of investigation is the parts of Raipur, Janjgiri-Champa, Mahasamund and Raigrah districts, Central Chhattisgarh, Central India. The study area comes under latitude 21º15'00" N to 21º 45' 00" N and longitude 82º 15' 00" E to 83º 00' 00" E and the Survey of India Toposheet Nos. 64K/07, 10, 11, 14 and 15. Gravity, Magnetic and Differential Global Positioning System (DGPS) data were collected by employing the CG-5 Autograv gravimeter, GSM-19T Magnetometer and DGPS 1200, respectively.

Geological Setting

The study area is represented by Tonidongar Bengpal, Bengpal Gneiss and Sukma group of Archean age, Sonakhan group

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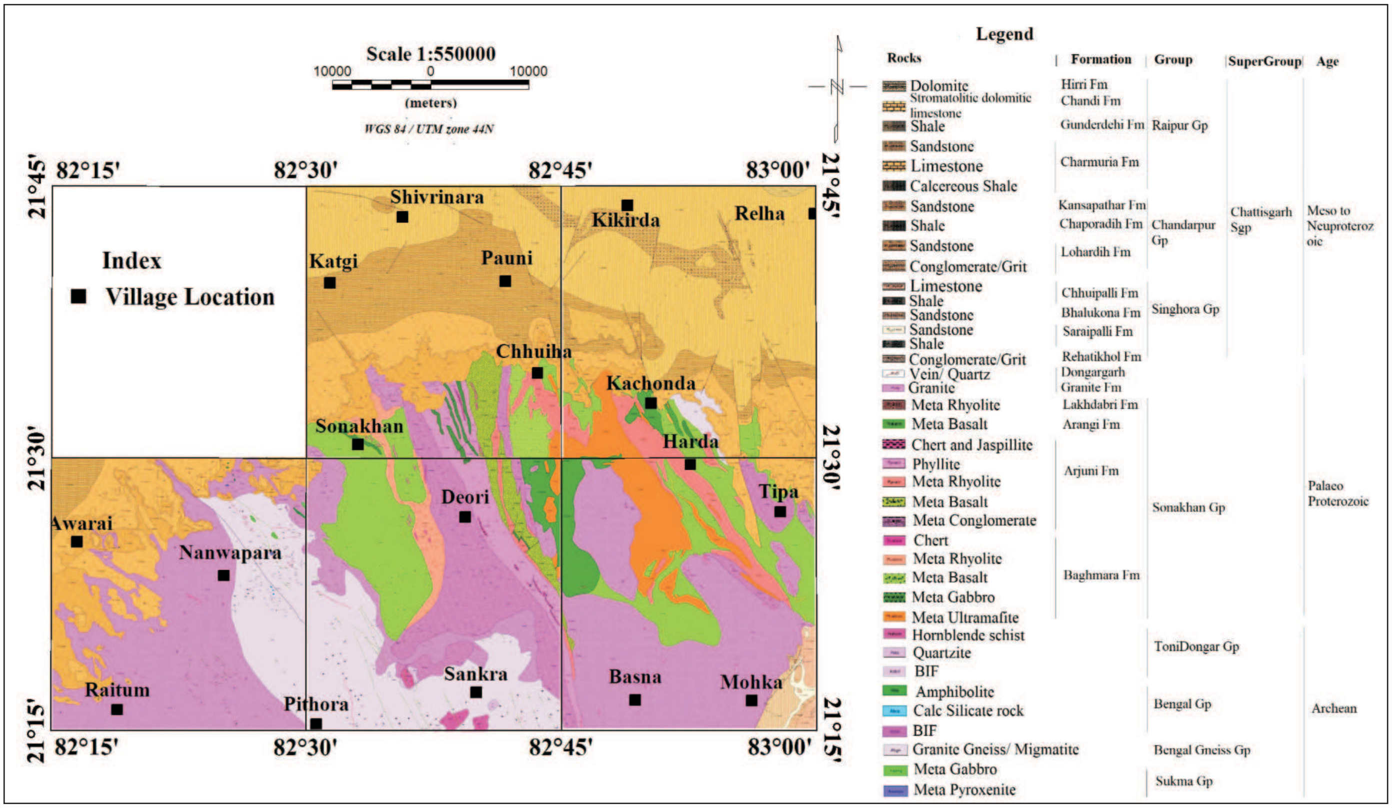

Fig.1. Local Geological Map of (Toposheet Nos. 64K/07, 10, 11, 14 and 15) parts of Raipur, Janjgiri-Champa, Mahasamund and Raigrah districts, Chhattisgarh (GSI, 2017)

of Palaeoproterozoic age and Singhora, Chandarpur and Raipur group of Meso to Neoproterozoic age (Fig. 1; Table 1). The oldest rock is the Basement Gneissic Complex (Baya Gneissic Complex) consists mainly of biotite-hornblende-plagioclase-orthoclase-quartz gneiss with amphibole-biotite schist and belongs to amphibolite facies of metamorphism. The greenstone belt which consists mainly of basic and acid volcanics with meta-sediments *viz.* conglomerate, schist and argillites etc and belong to low grade green schist to amphibolite facies (Bhowmik *et al.,* 2011; Mohanty, 2015). The Sonakhan Group is subdivided into Baghmara Subgroup, the middle Arjuni Subgroup and upper Billari Subgroup. The Baghmara Subgroup is subdivided into Jangla Pahar Formation and Golajhar Formation. Both of these are most important units of Sonakhan Group. Jangla Pahar formation is comprised of meta-basalt and meta-andesite with thin bands of meta-ultramafite and amphibolite. Golajhar acid volcanic comprises of rhyolite and rhyolitic tuffs. The middle Arjuni Subgroup comprises Jonk and Karmel Formations, comprising conglomerate-greywacke and argillite-phyllite-shale, respectively. The Jonk Formation is overlain by the Karmel Formation, comprising argillite, siltstone, mudstone *etc.* The Arangi Formation Forming lower part of Billari Subgroup and is composed of basic volcanic rocks. The rocks of Chhattisgarh Supergroup are comprised of shale, siltstone intercalation, glauconitic quartz arenite, cherty limestone and shelly limestone (Mondal and Raza, 2009).

Methodology

Gravity, Magnetic and Differential Global Positioning System (DGPS) data were collected by employing the Scintrex CG-5Autograv gravimeter (with resolution 0.001 mGal), GEM System GSM-19T Magnetometer (with resolution 0.01 nT) and Leica Geosystem DGPS 1200 (with resolution 5-10 mm), respectively.

Gravity Data

The gravity data were acquired at 1289 observation locations (Fig. 2) with a station density of one gravity station per 2.5 Sq Km covering 3500 Sq Km. Gravity observation points were observed along the available roads, forest tracks, cart tracks and foot tracks with a station spacing varying between 1.25 and 1.50 Km and away from the high-rise buildings, electric lines and bridges. The gravity observations are taken with reference to gravity field bases established during the field operations. These field bases are tied to a nearby base station the Circuit House at Raigarh, adjacent to reception (Gravity base IGSN1971) after employing drift correction. Free-air correction term was calculated by the standard free-air gradient of 0.3086 mGal/m (neglecting higher order terms). For Bouguer correction, mean crustal density of 2.67gm/cc was assumed. The theoretical gravity value at each location was calculated using Geodetic Reference System 1980 (GRS80). Thus, all the raw gravity data were subjected to instrument drift (based on repeat reading), Free-air and Bouguer corrections to calculate the Bouguer anomaly values at each location (Mandal *et al.,* 2020). The elevation from Mean Sea Level (MSL) of each gravity station was connected to triangulation point by DGPS. DGPS system is used for coordinates and height from the mean sea level of the observation points (Reduced Level (RL)). The optimum aerial distance between Base and Rover is maintained less than 10 km and observational time of 15-20 min was kept as per requisite. The DGPS system is kept in open sky to avoid multiple reflections of DGPS signal. The raw data of DGPS were processed to get the elevation from Mean

Table 1: The Stratigraphy of litho-units (*Source:* Geology from 1:50,000 Geological map series, Central Region, Nagpur)

Litho units	Formation	Group	Supergroup	Age
Dolomite	Hirri	Raipur	Chattisgarh	Meso to Neoproterozoic
Stromatolitic Dolomitic Limestone	Chandi			
Shale	Gunderdehi			
Sandstone Limestone Calcareous Shale	Charmuria			
Sandstone	Kansapathar	Chandarpur		
Shale	Chaporadih			
Sandstone Conglomerate/ Grit	Lohardih			
Limestone Shale	Chhuipalli	Singhora		
Sandstone	Bhalukona			
Sandstone Shale	Saraipalli			
Conglomerate/ Grit	Rehatikhol			
Vein Quartz Granite	Dongargarh Granite	Sonakhan		Palaeoproterozoic
Diorite				
Meta Rhyolite Meta Basalt	Lakhdabri			
Meta Basalt Jaspillite Arjuni Chert Phyllite Meta Rhyolite Meta Basalt Meta Conglomerate	Arangi			
Chert Meta Rhyolite Meta Basalt Meta Gabbro Meta Ultramafite	Baghmara			
Hornblende Schist Quartzite BIF		Tonidongar		Archean
Amphibolite Calc Silicate BIF		Bengpal Group		
Granite Gneiss/ Migmatite Meta Gabbro Meta Pyroxenite	Bengpal Gneiss	Sukma		

Sea Level (MSL) using Leica Geo Office version 8.8 (Bharati *et al.,* 2016; Gorle *et al.,* 2016; Kumar and Punekar, 2018). For checking the accuracy of Gravity, the repeated measurement was taken of observation of stations. Bouguer gravity anomaly values are presented as contour maps using minimum curvature gridding technique in Geosoft software.

Magnetic Data

The magnetic survey was carried out at same stations of the gravity measurements (Fig. 2). The magnetic observations total field (T.F.) were taken by avoiding magnetic objects, power line and electricity pole etc. The magnetic (T.F.) observations were corrected for the diurnal variation using the magnetic data collected at magnetic base station. The International Geomagnetic Reference Field (IGRF) correction was applied to diurnal corrected magnetic data using IGRF coefficients for the 2015 epoch to get the total field magnetic anomaly values (Baranov, 1957a; Roest and Pilkington, 1993; Mandal *et al.,* 2020). The repeated measurement was taken of observation of stations for the accuracy of magnetic data. Magnetic (T.F.) anomalies values are presented as contour maps using minimum curvature gridding technique in Geosoft software.

Result and Discussion

Bouguer Gravity Anomaly Map

The general trend of gravity contour (Fig. 3) is in NW-SE

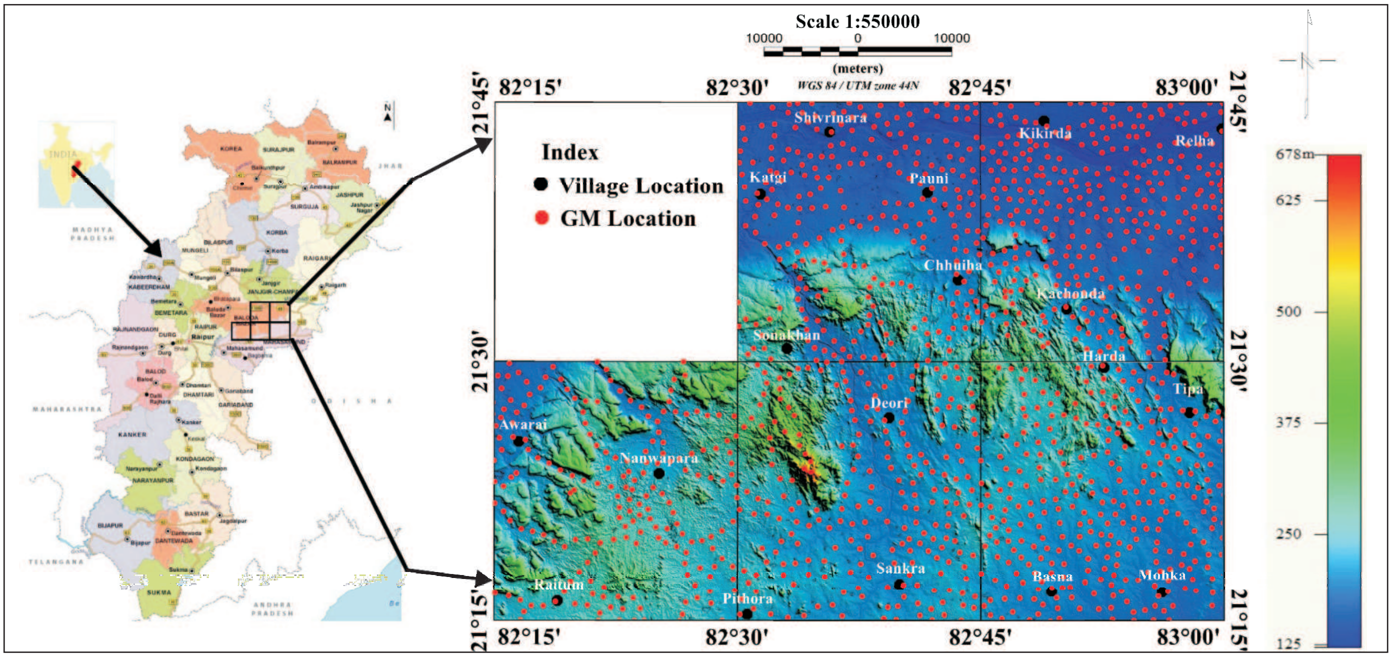

Fig.2. Gravity and Magnetic Stations Overlaid on Digital Elevation Map of (Toposheet Nos. 64K/07, 10, 11, 14 and 15) parts of Raipur, Janjgiri -Champa. Mahasamund and Raigrah districts, Chhattisgarh (*Source: bhuvan*.nrsc.gov.in).

direction which is in good correlation with NW-SE alignment of geological formations (Fig. 1). Gravity values vary from a minimum of -62.4 mGal to a maximum of -8.9mGal, with an overall variation of 53.5 mGal. Bouguer gravity anomaly contour map is characterized by broad gravity variations as we can see, gravity 'high' in central portion of the area (Southern part of Toposheet No. 64K/10 and northern part of Toposheet No. 64K/11 and covering the entire Toposheet No. 64K/14 and 15), whereas gravity low is seen around Katgi and Pauni (Toposheet No. 65K/10) Awarai, Nanwapara and Raitum (Toposheet No. 64K/07). The high gravity (H1) values (-26.5 to -8.9 mGal) recorded near Sonakhan and Deori villages which align in NW-SE direction is due to Meta Basalt (high density formation) in Sonakhan Formation. The gravity 'high' (H2) values observed near Deori and Harda is due the cumulative effect of Meta basalt, Meta Gabbro, Phyllite and, Meta Rhyolite of Sonakhan Formation. The gravity 'high' (H3) values observed near Kikirda and Kachonda villages which may be due to occurrence of basement (Sonakhan Formation) at shallow depth underling the Chhattisgarh Formation. Moderate gravity values (-48.1 to -27.8 mGal) are observed near Awarai, Sankra and Basna in Western and Northeastern portion (Toposheet No. 64K/07), central portion (Toposheet No. 64K/11) and South western portion (Toposheet No 64K/15), respectively which is due to Dongargarh granite. The gravity 'low' (L2) values (-62.4 to -50.1 mGal) is observed near Katgi and Pauni (western part of Toposheet No. 64K/10) which may be due to Hirri Sub-basin within Chhattisgarh Basin (Ram *et al.,* 2007) with deeper basement, whereas, gravity low (L1) is recorded near Pithora and Nanwapara villages (Toposheet No. 64K/07) due to low density formation (Granite Gneiss of Bengpal Gneiss group) compared to adjacent Dongargarh Granite Formation. A gravity gradient (F1-F1' and F2-F2') aligning in NW-SE direction is observed around Awarai and Pithora villages (southwestern part of Toposheet No. 65K/07). It is inferred as a contact in between Dongargarh Granite, Sonakhan Group and Bengal Gneiss Group which corroborates with geological map (Fig. 1). The major gravity gradient (F3-F3') is trending in E-W and NW-SE direction near Katgi, Pauni and Sonakhan villages is demarcated as the boundary of Hirri Sub-basin within Chhattisgarh Basin. The major gravity gradient (F4-F4') trending in NNW-SSE direction near Harda and Tipa villages which is inferred as the fault which is also reflected on geological map (Fig. 1). The gravity gradient (F5-F5') along the nosing aligned approximately NW-SE direction (Toposheet No. 64K/15) is observed near Shivrinarayan, Pauni and Chhuiha (Toposheet No. 64K/10), Kachonda village (Toposheet No. 64K/14) and Harda (Toposheet No. 64K/15) which may be demarcated as inferred lineament (Faults/Shears/Contacts).

Magnetic (T.F.) Anomaly Map

Total variation 1233.5 nT has been recorded (Fig. 4) in

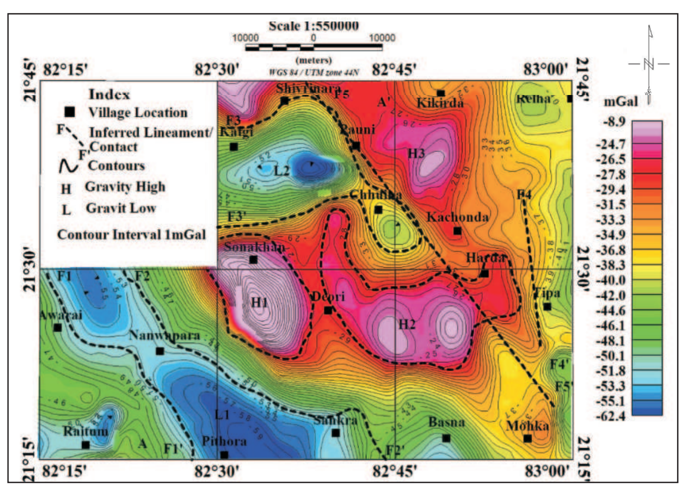

Fig. 3. Bouguer Gravity Anomaly Contour Map of (Toposheet Nos. 64K/07, 10, 11, 14 and 15) parts of Raipur, Janjgiri-Champa, Mahasamund and Raigarh districts, Chhattisgarh

contour map of magnetic (T.F.) anomaly (-628.0 to 605.5 nT). The general trend of magnetic contour is in NW-SE direction, which is correlating with alignment of geological formations (Fig. 1) and the Bouguer gravity map (Fig. 3). The high intensity/ positive dominant anomalies (100.49 nT to 605.57 nT) are recorded near Shivrinarayan, Pauni, Chhuiha (northern and northeastern part of Toposheet No. 64K/10), Kachonda and Harda (western and south western part of Toposheet No. 64K/14) and Kikirda, Relha, Mohka and Tipa (central part of Toposheet No. 64K/15) is due to presence of Metagabbro and Metabasalts. The moderate anomalies (19.77 nT to 100.49 nT) with few low amplitude positive dominant are observed near Sonakhan (Toposheet No. 64K/10) and near Deori (northern part of Toposheet No. 64K/11) may be due to some basic intrusive bodies within Chhattisgarh Formation and basement. The low intensity magnetic (T.F.) anomalies (-628.00 to 19.77 nT) are reflected near Sankara, eastern part of Pithora and southern part of Nanwapara (Toposheet No. 64K/11) due to the presence of Quartzite and Granite gneiss. The above observation from Bouguer gravity and magnetic anomaly contour map are further analyzed using derivative maps to confirm the inference drawn.

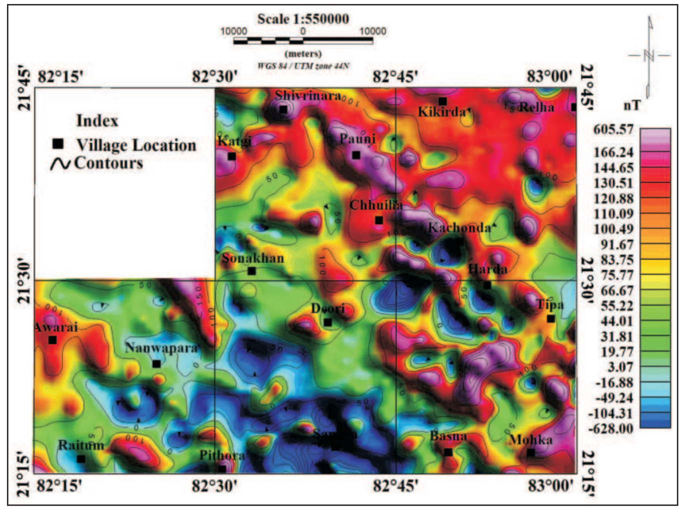

Fig.4. Magnetic (T.F.) Anomaly Contour Map of (Toposheet Nos. 64K/07, 10, 11, 14 and 15) parts of Raipur, Janjgiri-Champa, Mahasamund and Raigrah districts, Chhattisgarh

Regional Gravity and Magnetic Anomaly Maps

Regional and residual separation technique is carried out for better understanding of the sub-surface responses from deeper and shallower causative sources, respectively. Various techniques are available to prepare regional gravity anomaly *viz.* visual analysis, trend analysis, upward continuation and wave number analysis (Mandal *et al.*, 2020). Regional anomaly map is prepared using upward continuation technique which is utilized the enhancement technique smoothens out shorter wavelength anomalies after the determination of the potential field at an elevation higher than that at which the potential field is measured. Upward continuation filter is used in smoothing and suppressing the effect of shallow anomalies, in order to acquire information on deeper anomalies. The most important effects of this filter on the data are basically to infer the effects of depth of continuation on potential sources which are associated with the basement rocks and geological structures, as well as to reveal the regional basement anomaly trends (Hakim *et al.,* 2006; Ganiyu *et al.,* 2013, Pacino and Introcaso, 1987; Blakely, 1995). After analyzing the results of different depth of upward continuation, finally a depth of 6.0 Km has been selected with reference of Radial average power spectrum (RAPS) of gravity and magnetic anomaly maps (Fig. 5-6) for generating the regional gravity and magnetic anomaly maps which has produced better results (Fig. 7-8). The general regional trend of regional gravity contour (Fig. 7) is in NW-SE directions. Gravity highs (H1, H2 and H3) still exist in the regional gravity map indicating that causative sources of these anomalies are from deeper level. The Regional magnetic anomaly map (Fig. 8) provides integrated view of the study area with smooth trend of magnetic (T.F.) anomaly near Shivrinarayan and Pauni (northern and northeastern part of Toposheet No. 64K/10, over complete Toposheet No. 64K/14) and central part and near Mohka (southeastern part of Toposheet No. 64K/15) may be due to presence of high magnetic susceptibility rocks at deeper level.

Residual Gravity and Magnetic Anomaly Maps

The residual field which is the local field of interest arising from shorter-wavelength gravity anomalies was derived by removing the regional field caused by gentle trend long-wavelength associated deep-seated basement features (Ganiyu *et al.,* 2013). The Residual anomaly map has brought out some additional features, which are either masked/merged in comparatively larger anomalies or not clearly reflected in Bouguer anomaly contour map. The residual gravity map amplitude provides the information of shallow

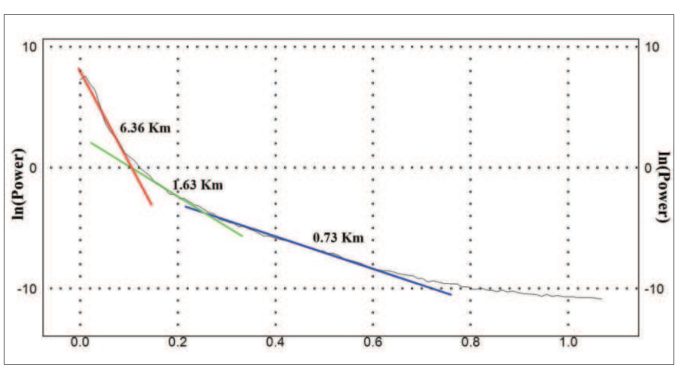

Fig. 5. Radially Averaged Power Spectrum (RAPS) of Bouguer Gravity Anomaly of (Toposheet Nos. 64K/07, 10, 11, 14 and 15) parts of Raipur, Janjgiri-Champa, Mahasamund and Raigrah districts, Chhattisgarh

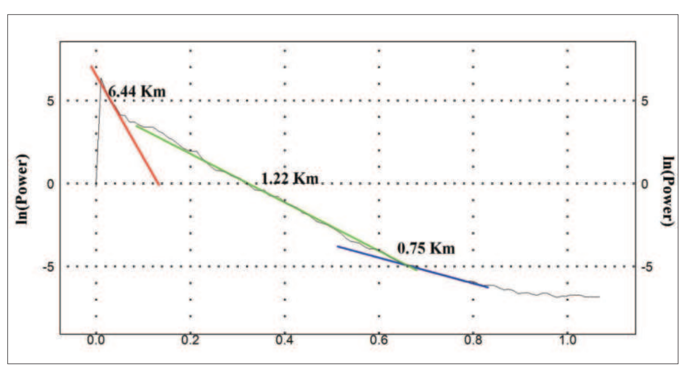

Fig. 6. Radially Averaged Power Spectrum (RAPS) of Magnetic (T.F.) Anomaly of (Toposheet Nos. 64K/07, 10, 11, 14 and 15) parts of Raipur, Janjgiri-Champa, Mahasamund and Raigrah districs, Chhattisgarh

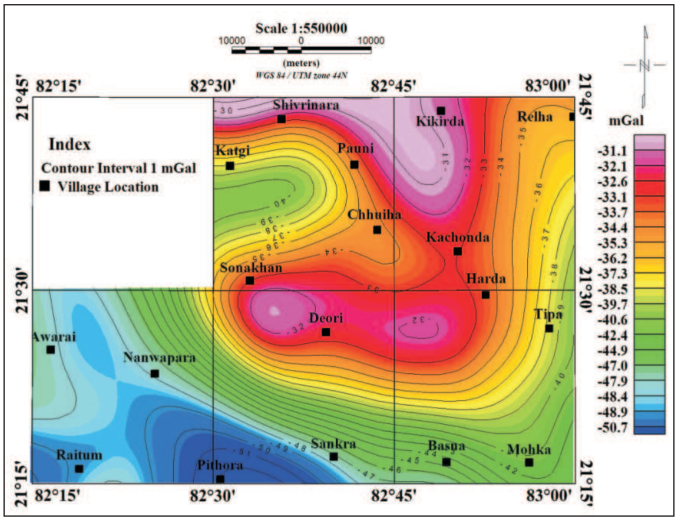

Fig. 7. Regional Bouguer Gravity Anomaly Contour Map of (Toposheet Nos. 64K/07, 10, 11, 14 and 15) parts of Raipur, Janjgiri-Champa, Mahasamund and Raigrah districts, Chhattisgarh

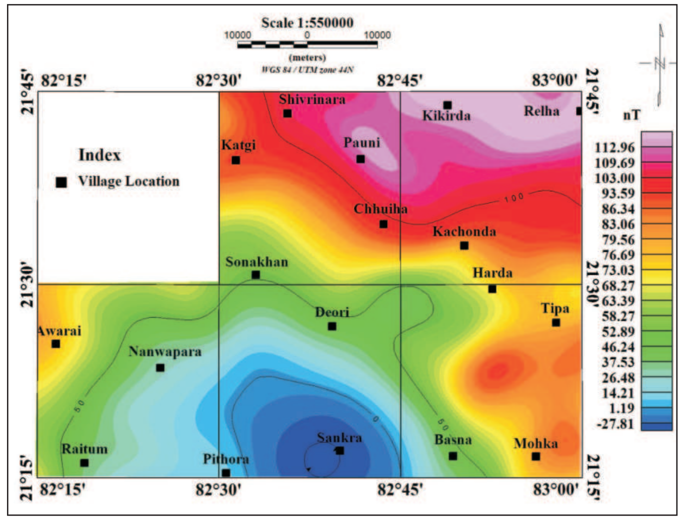

Fig. 8. Regional Magnetic Anomaly Contour Map of (Toposheet Nos. 64K/07, 10, 11, 14 and 15) parts of Raipur, Janjgiri-Champa, Mahasamund and Raigrah districts, Chhattisgarh

level structures with increased resolution (Mandal *et al.*, 2020, Hakim *et al.,* 2006). Residual gravity and magnetic anomaly maps are prepared using regional-residual separations technique (Fig. 9-10). The Residual gravity map (Fig. 9) has brought out multiple residual gravity 'high' (RH) and 'low' (RL) anomaly zones. The residual gravity high near Sonakhan and Deori and Deori and Harda villages (RH-1) and (RH-2) is due to presence of Meta Basalt (high-density formation) and cumulative effect of formation such as lateral extension of basalt part of Meta basalt in Sonakhan formation which exists at shallow depth. The residual gravity high is near Mohka (Toposheet No. 64K/15) (RH-3) and Kikirda and Relha villages (RH-4) (Toposheet No. 64K/14) aligned in NW-SE direction may be demarcated as inferred lineaments (Faults/Shears/Contacts). The residual gravity low near Katgi and Pauni (RL-2), in the western part (Toposheet No. 64K/10) is over sub-basin (Hirri Sub-basin) of Chhattisgarh Formation whereas, residual gravity low (RL-1) near Pithora and Nanwapara villages (Toposheet No. 64K/07) is over Granite Gneiss formation of Bengpal Gneiss Group which is due to its low density shows a deepest part of basin. The residual magnetic anomaly map clearly reflected the number of local magnetic anomalies along with various polarities, shapes extensions and orientations (Fig. 10). Several NE–SW magnetic anomalies are clearly shown in the northwestern part while NE-SW, NW-SE and E–W trending local anomalies have been enhanced over the rest of the area. Several, approximately NW-SE local magnetic anomalies are clearly shown in the northeastern part and also exist over the western part map.

Vertical Derivative of Bouguer Gravity and Magnetic Anomaly Maps

The vertical derivative technique is one of several methods of removing the regional trend. The application of the vertical derivative in gravity interpretation to enhance localized small and weak near-surface features (*i.e.* improving the resolving power of the gravity map) has long been established (Baranov, 1957a-b;

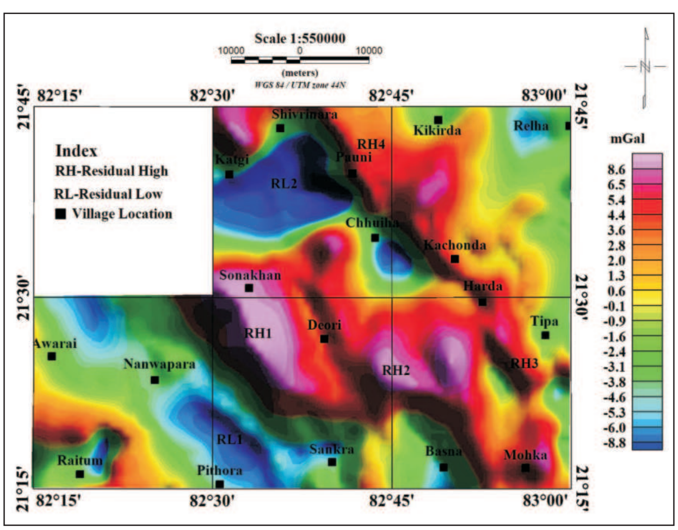

Fig. 9. Residual Bouguer Gravity Anomaly Map of (Toposheet Nos. 64K/07, 10, 11, 14 and 15 parts) of Raipur, Janjgiri-Champa, Mahasamund and Raigrah districts, Chhattisgarh

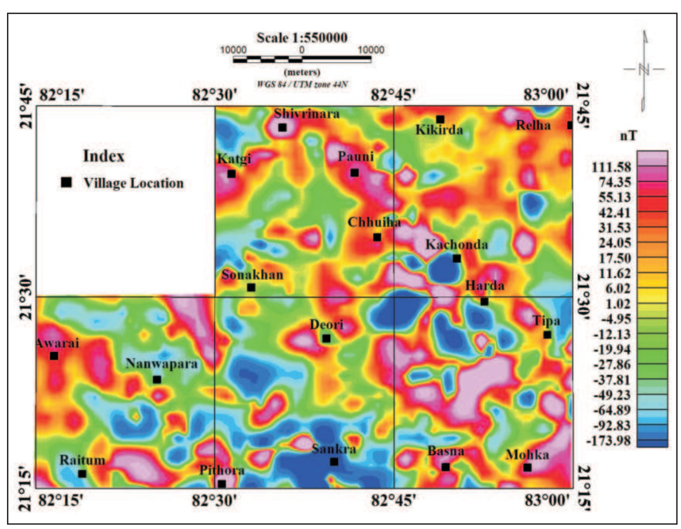

Fig. 10. Residual Magnetic Anomaly Map of (Toposheet Nos. 64K/07, 10, 11, 14 and 15) parts of Raipur, Janjgiri-Champa, Mahasamund and Raigrah districts, Chhattisgarh

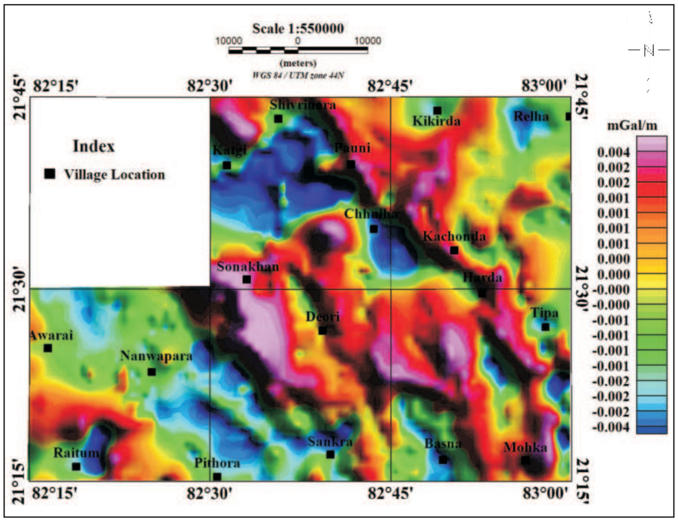

Fig. 11. Vertical Derivative (Z1) Map of Bouguer Gravity Anomaly of (Toposheet Nos. 64K/07, 10, 11, 14 and 15) parts of Raipur, Janjgiri-Champa, Mahasamund and Raigrah districts, Chhattisgarh

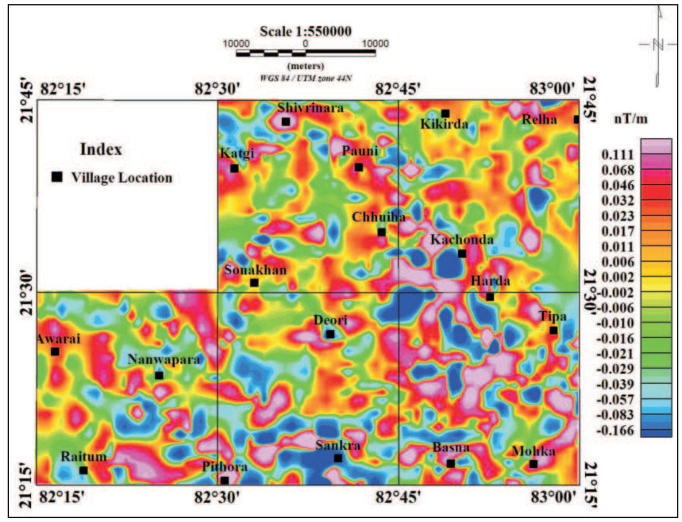

Fig. 12. Vertical Derivative (Z1) Map of Magnetic Anomaly of (Toposheet Nos. 64K/07, 10, 11, 14 and 15) parts of Raipur, Janjgiri-Champa, Mahasamund and Raigrah districts, Chhattisgarh

Gupta and Ramani, 1982; Evjen, 1936; Hood, 1989; Thurston and Smit, 1997).

The prominent shallow features (Fig. 11) near Sonakhan-Deori and Deori-Harda villages is due to presence of Meta Basalt (high density formation) and cumulative effect of formation such as Meta Basalt, Phyllite and Meta Rhyolite of the Sonakhan formation. The shallow anomalies aligned approximately NW-SE direction is observed near Shivrinarayan, Pauni and Chhuiha (Toposheet No. 64K/10), Kachonda village (Toposheet No. 64K/14) and Harda (Toposheet No. 64K/15) which may be demarcated as inferred lineaments (Faults/Shears/Contacts) from Bouguer gravity anomaly map (Fig. 3). The Vertical derivative low near Katgi and Pauni, in the central part (Toposheet No. 64K/10) is observed over Hirri sub-basin of Chhattisgarh formation due to the deeper basement, while the vertical derivative of magnetic anomaly map is not represented properly (Fig. 12).

Euler 3D Depth Solutions of Gravity Data

Euler deconvolution can be used to estimate the depth for wide geological features such as faults, contact sand dykes. The method is best suited for anomalies caused by isolated and multiple anomalous sources (El Dawi et al., 2004).The standard Euler 3D deconvolution method is based on Euler's homogeneity equation that helps to estimate the depth of causative sources obtained from potential field data. The structural index (SI) is based on the geometry of the potential field data and is a measure of the rate of change of the anomaly with distance from the source. The cluster of Euler solutions around the perimeter of the bodies in a horizontal plane provides estimates of the depth of causative sources (Thompson, 1982). The Euler deconvolution, based on Euler's homogeneity equation (Thompson, 1982) is another popular tool to estimate the source depth locations from the observed anomalous potential field data.

The size of the window has to be chosen in such a way that it should not include effects of multiple sources but at the same time should cover substantial field variations. The quality of the depth estimation also depends on the choice of SI (Mandal *et al.,* 2020). The Euler 3D depth solutions were estimated using a window size of 10 grid cells, depth tolerance of 15% and with SI = 0 in Geosoft Software to further confirming the results of RAPS analysis and emphasize the contacts and faults for gravity data. The Euler depth solutions are provided less than 1.5Km, 1.5 to 3.0Km, 3.0 to 5.0 Km and beyond 5.0 Km of gravity data (Fig. 13). The majority of solutions are falling varying depth from 1.5 to 5.0 Km. The solution of gravity data is falling at inferred lineament and contact between two litho-units varying depth from 1.5 to 5.0 Km.

Conclusions

The structural features (Inferred fault/ Lineament/ Contact) revealed in results from potential field methods (Gravity and magnetic methods) are in consonance with the output of geological map. The high gravity recorded near Sonakhan and Deori villages

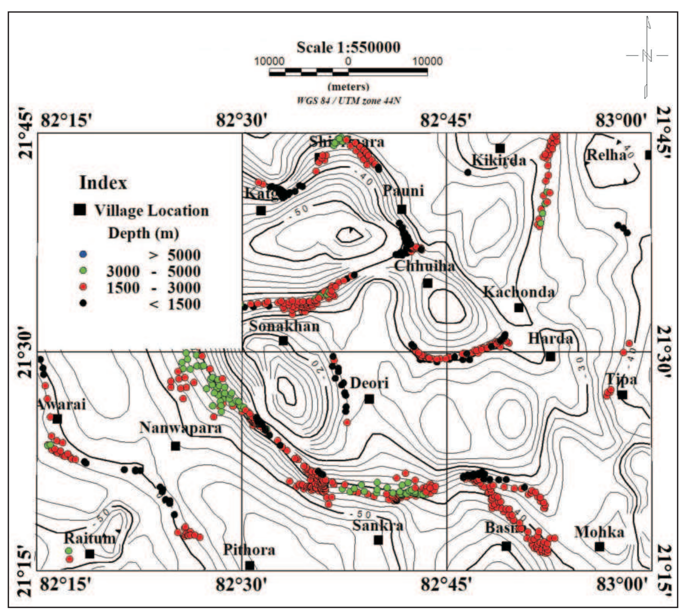

Fig. 13. Eluer 3D Depth Solutions (SI-0) of Bouguer Gravity Anomaly Map of (Toposheet Nos. 64K/07, 10, 11, 14 and 15) parts of Raipur, Janjgiri-Champa, Mahasamund and Raigrah districts, Chhattisgarh

which align in NW-SE direction is due to Meta Basalt (high density formation) in Sonakhan Formation. The major gravity gradient (F3-F3') is trending in E-W and NW-SE direction near Katgi, Pauni and Sonakhan villages is demarcated as the boundary of Hirri Sub-basin within Chhattisgarh basin. The low intensity magnetic (T.F.) anomalies are reflected near Sankara, eastern part of Pithora and southern part of Nanwapara (Toposheet No. 64K/11) due to the presence of Quartzite and Granite gneiss. The prominent shallow features near Sonakhan - Deori and Deori-Harda villages is due to the presence of Meta Basalt (high density formation) and cumulative effect of formation such as Meta Basalt, Phyllite and Meta Rhyolite of the Sonakhan Formation. The Vertical derivative low near Katgi and Pauni, in the central part (Toposheet No. 64K/10) is observed over sub-basin (Hirri Sub-basin) of Chhattisgarh Formation due to the deeper basement. The Euler depth solutions are provided less than 1.5Km, 1.5 to 3.0Km, 3.0 to 5.0 Km and beyond 5.0 Km of gravity data. The solution of gravity data is falling at inferred lineament and contact between two litho-units varying depth from 1.5 to 5.0 Km.

Authors' Contributions

RK: Writing-Original Draft. **BP: S**upervision, Reviewing and Editing. **N:** Data Acquisition. **VKT:** Data Acquisition

Conflict of Interest

Authors declare no conflict of interests.

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