

# Regional gravity and magnetic surveys in parts of Belgaum, Bijapur, Dharwar and Raichur districts, Karnataka (India)

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## ABSTRACT

Regional geophysical survey, employing gravity and magnetic methods, have been carried out in 2160 sq km area of Western Dharwar Craton (WDC). The objective of the survey was to delineate subsurface structural features. The Bouguer anomaly (BA) map has brought out negative gravity anomaly with amplitude of 29 mGal in the range from -78 mGal in the eastern part to -107 mGal. The area surveyed is characterized by high gravity anomaly towards northern and east central part and low to medium gravity anomaly in the west central and southern part, except a small gravity high closure near Yankachi. The elongated residual high gravity nosing trending in nearly NW-SE direction in the central portion and flanked by residual gravity lows on either side, is inferred as basement high below Kaladgi Supergroup of sediments. Similarly, magnetic anomaly (TF) map shows bipolar magnetic anomalies in the northern and east central parts; magnitude of anomalies ranging between -81 nT to 488 nT. Presence of wide spread Kaladgi Supergroup of sediments in the central and southern part of the studied region, may have contributed for low to medium intensity magnetic anomaly except a major high south of Bagalkot in the southern part. High intensity magnetic anomaly closure around Yankachi, reflected as a zone of high analytic signal, may be attributed to Hungund schist belt towards east central part. The radially averaged power spectrum of gravity data has brought out two interfaces at depths of around 8.33 km and 3.12 km, and for magnetic data one interface at the depth of 2 km respectively. The interfaces brought out by both the gravity as well as magnetic data, may represent the range of basement depth (2-8.33 km) in the western part of Dharwar Craton. The linear clustering, trending in N-S direction of Euler depth solutions towards west central part, NE-SW trending linear cluster around Bilji-Kolhar towards central part and NW-SE trending towards northern part in Kolhar-Kakhandaki-Babaleshwar section, whereas curvilinear clustering around north of Girisagar in the central part and south of Katgeri in the southern part have been brought out. These linear and curvilinear clustering may be inferred as geologic/faulted contacts warrants for detailing the area.

**Keywords:** Gravity and magnetic studies, Dharwar Craton, Euler 3D solutions, Geologic structures, Indian shield

## INTRODUCTION

The South Indian Shield forms a coherent unit in which geological activity can be traced continuously over the entire Precambrian. It records more than a billion years of the early history of the Earth, involving several episodes of crustal development. The Dharwar Craton is located in the central part of the South Indian Shield, flanked by the high-grade granulitic terrain to the south and the younger cover of the Deccan flood basalts to the north. This craton can be divided into two distinct tectonic blocks: the Western Dharwar Craton (WDC) and Eastern Dharwar Craton (EDC) (Naqvi and Rogers, 1987; Swaminath and Ramakrishnan, 1981). Swaminath et al. (1976) marked an arbitrary boundary between both the blocks parallel to the western margin of Closepet granite, which was subsequently modified that coincide with the Chitradurga boundary fault and confirmed by Deep Seismic Sounding (DSS) (Kaila et al., 1979) and Landsat imagery (Drury and Holt, 1980). Manikyamba and Kerrich (2012) carried out geological study over eastern Dharwar Craton and reinterpreted it as composite tectonostratigraphic terranes of accreted plume-derived and convergent margin-derived magmatic sequences based on new high-precision elemental data. The Kushtagi greenstone belt (KGB) occurs in the central part of the EDC and is the northern continuation of the 400 km long Ramagiri-Hungund composite greenstone belt. A shear zone passes through the centre of the belt along which numerous gold occurrences are found (Manikyamba et al., 2004b). Matin (2006) studied the tectonic of Hungund-Kushtagi schist belt and opined that this relatively unknown schist belt is characterized by two major episodes of deformation. Qureshy et al. (1967) have

noted that the gravity highs in this region are located over the schist belts and the moderate gravity lows are associated with the exposures of the granites and gneisses. Subrahmanyam and Verma (1982) proposed that the crust on the western part of the Dharwar Craton might be thicker than to the east of the Chitradurga Boundary Fault. The teleseismic studies (Gupta et al. 2003) report much thicker crust (42-51 km) beneath the West Dharwar Craton. Srinagesh and Rai (1996) observe that the seismic velocities at a depth of 40–180 km, corresponding to the upper mantle, are higher in the western block than those in the eastern block by about 2-3 per cent. The geoelectric model is suggestive of a suture along the Chitradurga-Gadag schist belt, formed by the thrusting of the West Dharwar Craton beneath its eastern counterpart (Gokarn et al., 2004). From the borehole studies, Roy and Rao (2000) and Gupta et al. (1991) have observed that the surface heat flows are higher in the Eastern Dharwar Block than the West Dharwar Block. The thickness of the lithosphere estimated from these studies is more than 200 km. Magnetic susceptibility map of the Dharwar region is obtained using the aeromagnetic anomalies to characterize the rock formations (Harikumar et al., 2000).

The present work (Longitudes 75°30' - 75°45' E and Latitudes 16°00' - 16°45' N; 47 P/10, 11 and 12) is an effort towards delineating the variations in lithology and structure would give rise to density and susceptibility contrasts invoking gravity and magnetic (GM) studies to bring out subsurface geological architecture (Figure 1). Structurally weak zones in the belt are common exploration targets, which act as locales for possible mineral-charged hydrothermal deposits.