A QUALITATIVE APPRAISAL OF THE REGIONAL MAGNETIC INVESTIGATIONS OVER THE NORTH CUDDAPAH BASIN

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ABSTRACT

The Cuddapah basin of Andhra Pradesh has been of considerable geophysical interest since the observation of high negative Bouguer gravity anomalies over it, despite zero or positive density contrast of the basin sedimentaries with the surrounding Archaean country. The results of the magnetic investigations conducted over an area of about 20,000 square kilometres over and around Cuddapah basin north of 16° parallel are presented and discussed qualitatively. The basin is brought out as a separate and distinct unit in contrast with the surroundings in the magnetic anomaly map. A probable mid-basin upliftment is suggested. A huge deep seated body with a possible causative connection with the mineralisation at the eastern margin of the Cuddapah basin is proposed.

INTRODUCTION

THE Cuddapah basin, which is typically sedimentary, occupies a crescent shaped tract of about 13,500 square miles in area in the east-central part of Peninsular India. It is an epicontinental basin formed after a considerable lapse of time since the deposition, upliftment and metamorphism of Dharwars. It is believed that the basin originally extended beyond its present boundaries, to the west and possibly also to the north (Krishnan[6]).

The special geophysical interest in the basin is the observation of high negative Bouguer gravity anomalies over the basin sedimentaries of nearly equal or slightly greater densities compared to the surrounding country. Glennie[2-4], had attributed these gravity anomalies to a down-warping of the crust. Glennie's explanations, however, did produce neither clinching evidence for the crustal down-warp nor for an overthrust in the east.

The geophysics department of Andhra University has already conducted large-scale geophysical investigations, with a close network of gravity and magnetic observations, over Godavari Valley, Gondwana basin, Cuddapah basin and parts of Eastern ghats. In this paper, results of the magnetic investigations conducted over the North Cuddapah basin and the adjoining area are presented and discussed qualitatively.

GEOLOGY OF THE AREA

Major part of the North Cuddapah basin consists of the older Cuddapah series, while the Kurnools are exposed in the southern and south-western sides, of the area. Srisailam quartzites of Kistna series are found in the western part of the basin extending from the western boundary right upto the centre of the basin and as a rim enclosing it round the northern tip, and the eastern part, upto Nekarikallu. Outliers of Srisailam Quartzites are well recognised on the eastern as well as the western sides of the basin. Achempet dome is one of such outliers in the east. Limestones are extensively developed in the area. Cumbum Shales, are developed in the north and also in the south of the basin, along the eastern margin. All along the eastern margin, they are highly folded, contorted and overturned.

The other formations occurring in the area are a patch of Kurnools, consisting of Paniam Quartzites, Kundair Limestones, Bangannapalle Quartzites in the central area. Unclassified quartzites are exposed at different places in the basin. In the south western side, Vempalle Limestones and Culcheru Quartzites, Pulivendla/ Nagari Quartzites, Tadpatri/Pullampet Shales are exposed.

MAGNETIC SURVEYS

The present investigations cover an area of about 20,000 square km., between 16° and 17° N latitudes and 78° and 81° 15′ E longitudes. Nearly 900 magnetic stations were set up at 3 to 6 km intervals in the area. Every attempt has been made to see that the station distribution is even, as far as possible, in the area. An Askanai Torsion Magnetometer of type GfZ was used for making the magnetic observations.

Reduction of the Magnetic Data.—The magnetic anomalies presented here are computed with reference to the primary base station at Vijayawada. The base is established after an exhaustive study of the area and its vicinity and after continuous magnetic observations on a number of days at the beginning of the surveys. Number of auxiliary bases have also been set up during the course of the survey for operational convenience and for the computation of the correction for the diurnal variation of the earth's vertical magnetic intensity. These auxiliary bases are duly tied magnetically with the primary base by the standard method (Nettleton[8]).

For the computation of diurnal correction, a typical diurnal variation pattern is obtained on a day at each of the auxiliary bases by making observations at quarter-hourly intervals. The variations obtained were then compared with the Magnetic Observatory data of the National Geophysical Research Institute, Hyderabad, on the corresponding days and suitable adjustments in the magnitude of the variations for the auxiliary bases, the type of variation remaining same, were made. During the remaining days, observations at the beginning and end of the day's work were only made at the base and diurnal variations curves for these days are obtained as outlined and used for the computation of the diurnal correction.

The normal correction is evaluated by bringing forward the gradients of vertical field intensity in the north-south and east-west directions for the whole area under survey from the maps and tables published by the Carnegie Institute of Washington (Vestine *et al.*[9]). For the area under survey, the average values of gradients in the north–south and east–west directions adopted respectively are 16 and 0·6 gammas per km. The magnetic anomalies thus computed are contoured and presented in Fig. 1.

observed across the boundary on all sides of the basin. An elongated + 200 gamma anomaly contour in the Palnad area roughly corresponds with the margins of the basin. To the south and south-west of the area also a number of + 200 gamma contours could be seen. It, thus, appears that a positive anomaly of 200 gammas seems to be a characteristic anomaly associated with the basin. On the other hand, at some places especially north of Piduguralla, and coming down further to the south, quite a few anomalies of the order of + 300 gammas are observed indicating a broad magnetic high in the middle of the basin. These anomalies are supposed to be associated with the basement configuration, in the form of a possible mid-basin upliftment.

In the western part of the basin, the distribution of the magnetic anomalies seems to be somewhat different from that on the eastern part. Between Amrabad and Wanaparti, the magnetic anomalies are positive on the crystallines west of the basin and negative within the basin, while a zero anomaly contour seems to correspond roughly with the boundary of the basin. The magnetic contours in this area are widely spaced indicating gentle gradients. It is also observed that the magnetic anomalies on the crystallines

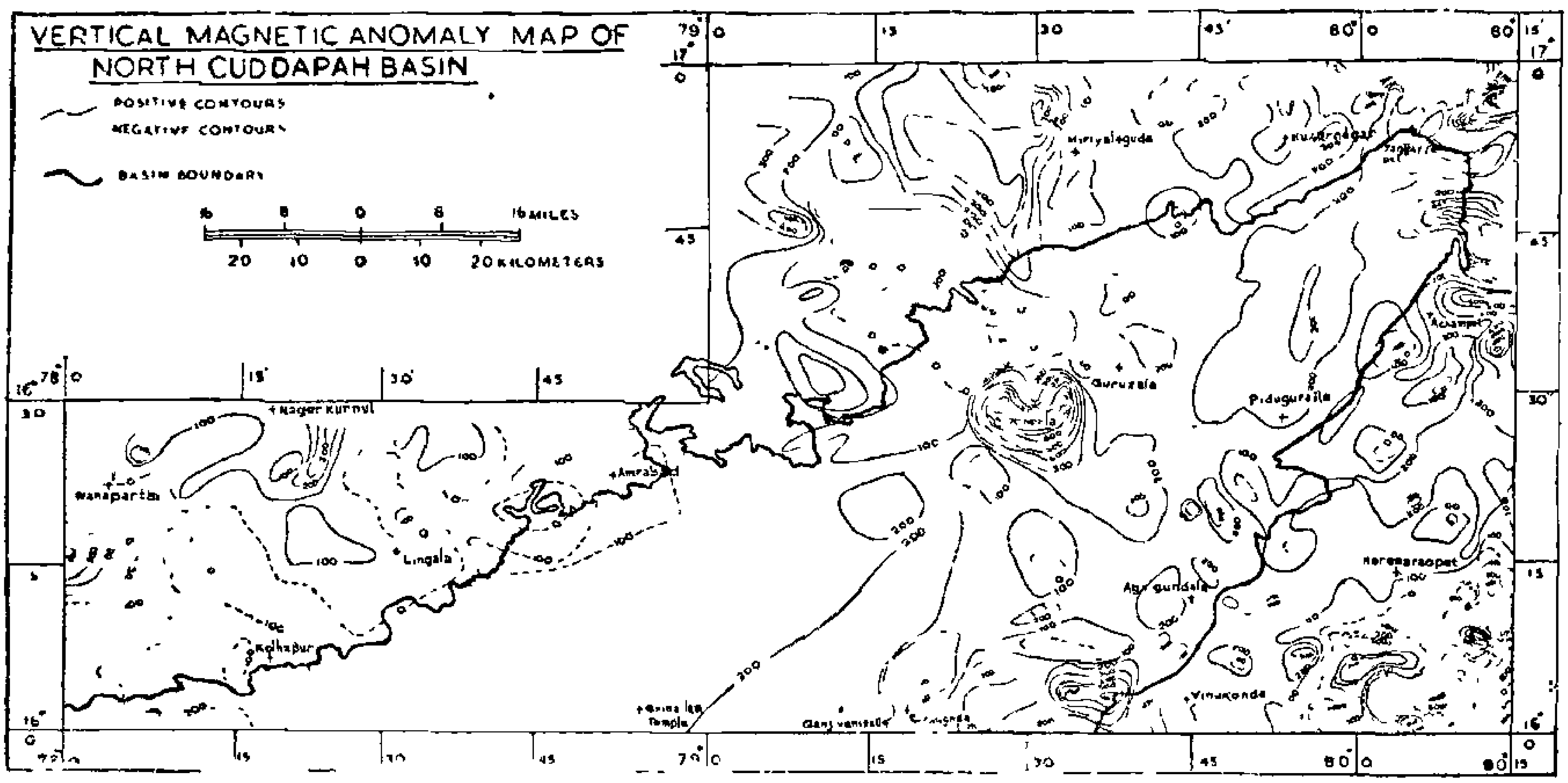

Fig. 1. Vertical Magnetic Anomaly map of North Cuddapah Basin.

Discussion of the Anomalies

The regional magnetic picture shows that the area covered by sedimentaries is quite well represented with very few magnetic anomalies. In contrast with the area outside, the basin is magnetically flat and magnetic gradient could be

west of the basin in this area do not exhibit, in general, the intense magnetic fluctuations observed on the crystallines east of the eastern margin of the basin.

While discussing the numerous outliers of the Cuddapahs, Foote[1], and others have suggested possible extension of the basin to the east of the present eastern margins. The distribution of the magnetic anomalies in the eastern part of the basin and on the crystallines east of the eastern margin seems to suggest that the magnetically flat area of the basin extends to east, beyond the eastern margin before intense magnetic fluctuations are encountered. The magnetically flat zone corresponds roughly to the area enclosed by the eastern margin of the basin and a line passing through Vinukonda, Narasaraopet and Achampet. Considerably less pronounced feature is noticed west of the western margin of the basin.

Intense positive and negative anomalies of the order of + 1400 gammas and — 1200 gammas in the area around Macherla have been observed. These anomalies could not be considered as due to some local cause because of the consistency of their range and their distribution over a large area around Macherla. The disposition of the observations is also fairly satisfactory there, to rule out the possibility of any local cause. Hence, this anomaly feature has to be explained not as due to any superficial cause but as related to the structures near or underlying the basement. This area has been studied in some detail and a possible relationship between the mineralisation occurring near the eastern margin of the basin and the high magnetic anomalies, observed here, has been worked out (Narasimhaswamy[7]).

Foote[1] had observed a singular series of elliptical anticlinal domes, six in number along the eastern boundary of the basin extending from Vinukonda nearly upto the Krishna river. It is difficult to say, with the present data, whether or not these domes have found any representation in the isoanomaly map. But the Vinukonda dome composed of post-syntectonic granites seems to have some relationship with the high positive anomalies of the order of + 1300 gammas south of it, whereas the Ipuru dome of the same composition as that of the Vinukonda dome has not found any significant mark in contour map. The apparent effect of the Nekarikallu dome composed of slates and phyllites, and the Biravallipaya outlier still to the north, both of them occurring near Piduguralla, seems to be + 300 gamma anomaly, west of the actual domes. The Achampet faulted dome, a true outlier of the sedimentaries into the gneissic country, is marked by a zero anomaly contour in the south-west and + 600 gamma contour in the north-east. The inability to get exact correlation of the anomalies with the domes, and their wide displacement in relation to the domes might perhaps be due to the effect of numerous basic dykes in the surrounding country rock adjacent to the basin.

In the southern part of the area, in the middle of the basin near Erragondapalem and in the east, beyond Vinukonda, roughly along and above the 16° parallel, across the basin, magnetic disturbance could be observed with negative centre near Erragondapalem followed by positive anomalies and then intense negative anomalies in the east near Chilakaluripet. Heron (1947) has suggested the existence of two basins of subsidence, the larger one including the main area of Cuddapahs and the Kurnools, and the smaller one, the Palnad group. He advocated that in the Palnad basin, subsidence may have commenced later, not long before the deposition of Cuddapahs had finished in the main basin, and continued with far greater regularity and in deeper water as is shown by the immense accumulation (?) of the uniform limestones and shales interrupted only by the diamondiferous grits. His ideas, according to many succeeding investigators, are questionable and impracticable. However, a probable correlation between the above-mentioned feature in the observed anomaly map and the suggested boundary separating the two basins is apparent.

There is a marked contrast in the magnetic anomalies of the areas east and west of the basin. The area east of the basin right from Jaggayyapet in the north up to Chilakaluripet in the south is characterised by intense magnetic fluctuations. The anomalies north-east of Jaggayyapet are of local nature caused by the float iron ore deposits. Anomalies south of Jaggayyapet and up to Chilakaluripet indicate partly the intense tectonic disturbance in the form of folding, crushing, overturning, and faulting along the eastern boundary of the basin. The igneous activity in this area resulting in numerous basic dykes such as dolerites, may account for these anomalies to a greater extent.

Comparatively, the area west of the basin is not as disturbed magnetically as the eastern area. But in the area, west of Mirialguda and north of Macherla, occupied by crystallines, the magnetic anomalies exhibit fairly high gradients and magnitudes.

Conclusions

Distribution of observations was not satisfactory at some places, especially around Srisailam, because of dense forest and highly irregular terrain resulting in very scarce habitation and lack of any development of roads, etc. Despite these limitations in the data, the magnetic anomaly map has been able, to a large extent, to represent the various features observed by the geologists, and to bring out a picture of the basement relief. The basin has been shown as a separate and distinct unit from the rest of the area indicating the extended boundaries. The major eastern boundary fault propounded by King[5] has found its representation on the anomaly map. Results of further analysis of the data and the quantitative studies made, have also broadly conformed to the general qualitative interpretation obtained herein.

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SOME PHYSICOCHEMICAL PROPERTIES OF N-BENZENESULPHONYL L(−) HISTIDINE AND RELATED LIGANDS

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ABSTRACT

The syntheses of N-benzenesulphonyl L(−) histidine ($R^h H_2$), α-benzenesulphonamido β-2-benzimidazolyl L(−) *n* propionic acid ($R^p H_2$) have been reported and the uv and ir spectral data recorded. Preparation of α-benzenesulphonamido γ-2-benzimidazolyl L(+) *n*-butyric acid ($R^b H_2$) has also been described. Ir data show that these compounds exist as zwitterions.

COMPLEX compounds of various metal ions with histidine and related ligands exhibit very interesting properties[1-6]. However no attempt has yet been made to study the complexing behaviour of benzenesulphonyl derivative of histidine. The present paper describes the synthesis of N-benzenesulphonyl L(−) histidine ($R^h H_2$) and α-benzenesulphonamino β-2-benzimidazolyl L(−) *n*-propionic acid ($R^p H_2$). Their electronic spectra in ethanol and ir spectra in KBr matrices are also recorded. The corresponding data of α-benzenesulphonamide γ-2-benzimidazolyl L(+) *n*-butyric acid ($R^b H_2$) are included for comparison[7]. All these compounds exist as zwitterions and are found to form complexes with Cu(II), Ni(II) and Co(II) and may function as monoprotic or biprotic tridentate ligands. Details of complexation is under investigation.

EXPERIMENTAL

N-Benzenesulphonyl L(−) histidine ($R^h H_2$).—L(−) Histidine was allowed to react with benzenesulphonyl chloride in the presence of warm alkali. The reaction product was treated with norit, filtered and acidified with warm acetic acid (pH ∼ 3), when shining crystals of $R^h H_2$ separated. It was recrystallized from hot water, m.p. 267° d, slightly soluble in water, ethanol; soluble in DMF, DMSO, etc. (Found: Eq. Wt. 296·5. $C_{12}H_{13}O_4N_3S$ requires Eq. Wt. 295·0). UV spectrum λ_{max}^{EtOH} 285 nm (log ε 3·71), 274 nm (3·78), 267 nm (3·81) and 215 nm (4·01).

α-Benzenesulphonamido β-2-benzimidazolyl L(−) n-propionic acid ($R^p H_2$)—N-Benzenesulphonyl L(−) aspartic acid (0·11 mole) and *o*-phenylene-