CHAPTER 1

INTRODUCTION
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1.0.0. GENERAL:-

Nature (God) has given many unreplenishable mineral resources to mankind. Limestone is one such and it forms the back bone of cement industry. The limestone having specific characters is only suitable for the manufacture of cement. In Andhra Pradesh limestone occurs in the Rayalaseema, Palnadu and in Telengana regions. Limestone is the main raw material for cement manufacturing. It's not that the entire limestone is useful; only certain parts of the limestone having specific character and specification are only useful.

M/s Jayajothi cements Ltd, Chennai, has taken a few areas in Banaganapalli mandal, Kumool district for their cement plant at Yanakandla.

Prof. Y.Venkatarami Reddy, Registrar and Professor of Geology, of S.V.University, Tirupati, who always thinks in an innovative way, suggested to the author of the thesis, to approach the Managing Director of M/s Jayajothi Cements Pvt Ltd, Chennai, and seek permission to carry out the geological work in their area. The author approached the management and requested for permission. The management kindly accorded permission to work on the deposit. Hence, the limestone deposit has been studied in detail from a research angle. The title of the thesis is "Geology, Exploration and Environmental aspects of the Limestone mining around Yanakandla village of Banaganapalli Mandal, Kumool district, Andhra Pradesh, India, using remote sensing data and GIS".
There are many limestone areas in the Kurnool district. The limestone from certain areas is used as building material mainly for flooring that is popularly known as 'Betamcherla Marble'. The present work has reflected that the so called 'Marble' has higher content of CaCO₃ and is very suitable for the manufacture of cement.

1.1.0. LOCATION, ACCESSIBILITY AND COMMUNICATION:-

The study area is located in Survey of India topographical map No.571/3 and is situated at 1.5km west of Yanakandla Village, bounded by 15° 15' 20" to 15° 22' 20" North Latitudes and 78° 11' 30" to 78° 11' 45" East Longitudes covering an area of 316 acres. The Yanakandla village is of Banaganapalli mandal, Kurnool District Andhra Pradesh. (Fig. 1-1)

Yanakandla village is well connected by road. It is located between Betamcherla on the east north east, that is about 12km and to Banaganapalle in the west south west that is around 4km. (Fig. 1-2). The district Head Quarters, Kurnool, is at a distance of 65km in the direction of west North West of Yanakandla. Further, the State Capital, Hyderabad is located at a distance of 285km from Yanakandla.

The nearest railhead is at Betamcherla, on the Nandyal – Dronachalam, meter gauge railway section and Dhone also known as Dronachelam, a railway junction is on the Secunderabad – Guntakal section of the South – Central Railway is at a distance of 47km from the Yanakandla village, i.e., via Betamcherla. Thus, the area is easily approachable both by road and by railways.
Fig. 1-2. General location and accessibility map of the lease area
1.2.0. PHYSIOGRAPHY AND DRAINAGE:

Topographically, the area is studied by hills of different heights. The beds of limestone are horizontally disposed. Hence, geomorphologically the terrain has many 'Mesa' and 'Plateau' type of land forms. The entire terrain is constituted by the rocks of Kumool Group.

The base contour in the Yanakandla area is at 250m above m.s.l. Further, to the west of the area, the hills located in reserved forest rise to 344-399 m above m.s.l. In the buffer zone the hills are mainly restricted to the western and southern part. Agricultural lands forming the plain grounds are mostly observed in the eastern part of the area.

The drainage is mainly sub-parallel and is controlled by structure, i.e., by lineaments. Internal drainage is also noticed suggesting that the lithology in the covered terrain is represented by limestone.

1.3.0 FAUNA AND FLORA:

In respect of fauna only wild goats, deers and hares are observed. A few reptiles are also noticed. Though the adjacent area is marked in the topographical maps as 'Reserved Forest', no trees worth the name are noticed. Very scanty thorny bushes are covering the so-called 'Reserved Forest'. The plains have mainly agricultural activity and mango, lemon (citrus), plantains are seen as plantations.

1.4.0 CLIMATE AND RAINFALL:

The area experiences humid tropical climate. The summer months are very hot and the Mercury rises to $+42^\circ$ Celsius. Winter months are
pleasant, when the night temperature is about 13° Celsius to 15° Celsius and these months are ideal for fieldwork.

Rainfall is generally scanty. The average rainfall per annum is 650 mm. In the year 2007, it was less than the normal, i.e., 362.00 mm. Occasional depressions in the sea will supplement the scanty monsoon.

1.5.0. PREVIOUS WORK:-

The present topic is mostly a new approach for a doctoral degree. Hence, there is no previous account on the specified topic. However, an attempt is made to give a few details in respect of previous account in the concerned topics like Geology, Exploration and Environmental aspects.

1 5.1 Geology:-

Many earth scientists carried out work on the geology of the Cuddapah basin. The pioneering work was by Charles Oldham, William King and Robert Brucefoot. Their observations were presented in a classic way by William King, (1872). Later, Sen & Narasimha Rao, (1967), Narayana Swami, (1966), Nagaraja Rao & Ramalinga Swami (1976), Murty, (1985), Nagraja Rao & others, (1986), Meijreink & others, (1984) are worth the name for their contributions to geology of the Cuddapah Basin. Many more also have contributed to the geology of the basin. Dutt, (1962, 66), was the first person to divide the Narji limestone into upper flags, middle massive and lower flags. In fact, this classification is applicable in Kurnool sub-basin. In the Palnadu sub-basin this classification is not tenable. However the triple classification has helped in delineating the middle massive limestone that is very useful in cement industry.
1.5.2. Exploration:-

In general the exploration work has been carried out by standard procedure. As such references are very much less.

1.5.3. Environmental Aspects:-

The environmental aspects are followed by a set of standard format. The same is adopted in the present work. The references are given at a few places only. As they are limited.

1.6.0. METHODOLOGY:-

The thesis work has been carried out in three stages, namely,

1). Pre - field stage
2). Field stage and
3). Post - field stage

1.6.1. Pre - Field Stage -

During this stage, interpretation of satellite data and topographical maps has been done. The materials used are:

1). The satellite hard copy i.e., Gecoded sub - scene, 57 l/3 the details of which are,

a) Satellite. --- IRS 1D P6
b) Sensor --- L3
c) Path-Row --- 096-055
d) Acquired date --- 18th June, 2001
e) Band Number --- 2, 3, 4 (Blue, Green & Red)
2). Topographical map number — 57I/3, scale 1: 50,000
3). Glass table with lights and
4). Tracing film.

The imagery (hard copy) has been interpreted keeping it on the glass table and covering it with the tracing film.

1. Collection of satellite data, topographical maps of Survey of India and the existing literature.
2. The satellite data is geometrically corrected and enhanced data of PAN and LISS III are used. The hard copies (FCC) are of 1: 50,000 scale.
3. Preparation of various thematic maps. Viz, geological map, geomorphology map and structural map.
4. The geological and structural maps are prepared using the satellite data and the corresponding topographical map. The data is interpreted visually following the image signatures like, tone, texture, shape, size pattern, association and human influence.
5. The maps are checked for the quality of the data.

1 6 2 Field Stage (VISIT) -

Field visits were conducted to verify the maps prepared and the corrections or modifications were incorporated. Umpteen field photographs were taken.

Field work was carried out in the months of February and March 2007 and again in the month of June 2008. During the field visit, each map prepared in the pre-field stage was checked. Modifications wherever needed were incorporated.
Surface samples have been collected to find out total carbonate (TCO₃) in the area. This is in addition to the geological mapping and collection of structural data.

Exploration involving topographical survey using total station, planning of bore holes both core and DTH, was also done. Though the maps are prepared on 1:2000 scale. The scale has been reduced considerably to accommodate the map in the thesis in A3 size (1cm = 82m). This has been done to present the maps along with the text.

The Core has been logged and the summarised litho logs along with few samples of litho logs are also presented. The chemical data is also summarised and is presented to the extent needed.

The Environmental aspects like base line information, water quality, air quality, afforestation, land use land cover, and all environmental aspects are explained in the thesis in detail.

1 6 3 Post Field Stage -

During the post field stage extensive laboratory work, mainly involving the chemical analysis of the samples collected during field visit, was done in the chemical laboratory of M/s Jayajothi Cements Ltd at Yanakandla.

The chemical analysis involved analysis of TCO₃, six radicals (LOI, SiO₂, Al₂O₃, Fe₂O₃, CaO, MgO) for primary samples and eleven radicals (LOI, SiO₂, Al₂O₃, Na₂O, K₂O, Fe₂O₃, CaO, MgO, P₂O₅, Cl, S) for composite samples.
The chemistry of the limestone has been analysed by Ethylene Diamine Tetra Aceetic Acid (EDTA) method.

The data has been used for various purposes. These, details are given in the chapter on exploration.

The said information is documented in different chapters. Thus the entire thesis is divided into the following chapters.

(1) Introduction -

This explains the selection of the topic for doctoral degree. It also gives full details of the area and methodology that is adopted in the present work.

(2) Regional Geology -

This chapter gives detailed account on regional geology of which the Banaganapalli mandal area forms a small part. The knowledge of regional geology is very essential to know the relationship of the rock under discussion with the rest of the stratigraphy.

(3) Local Geology -

This presents the details of the local area in particular. It also documents the variety of limestone in respect of stratigraphy and colour. This is very essential as the grade of the limestone that is useful in the Cement Industry, is based on certain parameters like, stratigraphic position, color etc.
(4) Geomorphology:

Lithology and structure controls the evolution of land forms. This is one of the basic concepts of Geomorphology. Limestone in the subject area occurs mainly as mesas and also in the plains. In fact the knowledge of Geomorphology to a great extent gives clues to the Lithology. This information is presented in this chapter.

(5) Structure -

Structure, in general, of the Kurnool Rocks is mainly bedding that is sub-horizontal beds. As a result, mesa and plateaus are very common. However, the Yanakandla and the adjacent area have indicated clear synforms both plunging and non-plunging. The Yanakandla block doesn't reflect complicated structure, but forms a part of broad synform. This and other structural details are documented in this chapter.

(6) Exploration -

This is done adopting different stages. In the first stage, the subject area is surveyed on 1:2000 scale, using total station. In the second stage, the boreholes are planned, following the UNFC classification. The third stage is mainly drilling of both core and DTH. In addition, other details in respect of exploration are detailed in this chapter.
(7) Chemistry of the Limestone:-

This deals with the chemistry of the surface samples, Core and DTH samples. This also indicates the chemistry of the Limestone that is used in Cement Industry. The specifications and other parameters of chemistry are elaborated in this.

Calc - tuffa that has high CaCO₃ occurs in the plains and is associated with flags, usefulness as a sweetener in the manufacture of cement is also presented.

(8) Reserves -

The reserves are calculated for Proved, Probable and Inferred. In the present situation the entire Yanakandla block is considered for Proved reserves. Hence, only Proved reserves are documented. The Probable and Inferred reserves are briefly detailed. This has been done following the EFG classification of UNFC.

(9) Environmental Management -

Any mining is generally considered as a hazard to environment of a particular area. There are methods to maintain the environmental standards. Further, there are regulations and rules for Environmental Management. All the information regarding the said aspects is presented in the chapter on Environmental Management.
Summary and Conclusion -

The entire study has been summarised presenting the salient points. Conclusions are drawn based on the pre-field and post-field studies. An attempt has also been made to highlight the utility of the limestone that is used as a flooring material in the cement industry.