ORIGINAL RESEARCH PAPER

Volume-8 | Issue-2 | February-2019 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

THE STRUCTURE AND GEOMORPHOLOGY OF THE HILLS NARJI LIMESTONE AS REFLECTORS OF THE CEMENT GRADE LIMESTONE IN BANAGANAPALLE AND BETAMCHERLA AREAS OF KURNOOL SUB-BASIN OF THE CUDDAPAH BASIN, ANDHRA PRADESH, INDIA

Earth Science

R. Guru Bhaskar* Research Scholar, S.V.University, Tirupati, Andhra Pradesh, India *Corresponding Author

Y. Venkatarami Reddy Department of Geology, S. V. University, Tirupati, Andhra Pradesh, India

V. Gope Naik Department of Geology, S. V. University, Tirupati, Andhra Pradesh, India

ABSTRACT

The Kurnool Group of rocks are supposed to be sub-horizontal in disposition without any structure. In fact these formations exhibit dips up to < 5^0 when observed carefully. Locally, the limestone reflects anticlines and synclines. Occasionally, gently plunging antiforms are also observed. A few joints of open type are noticed that taper down. Further, the hills constituted by the rocks of Kurnool Group reflect 2nd order / mature topography, i.e., the synclinal hills and anticlinal valleys. This observation has been used to find out the middle massive limestone that is of cement grade especially if the terrain is covered by soil or by agricultural activity. This has been studied in detail in the Betamcherla and Banaganapalle mandals and found to be applicable to other mandals, where the terrain is mostly soil covered like Kolimigundla and other areas. By this study it can be stated whether the sub-crop in the covered terrain is dark grey limestone that has higher percentage of CaCO3 or light grey limestone that has higher to good percentage of CaCO3, i.e., is above the cut-off grade of 79% of CaCO3. The details are presented.

KEYWORDS

Kurnool sub-basin, Narji Limestone, 2nd order topography, Elephant skin weathering, Stylolites

INTRODUCTION:

The structure of the Kurnool rocks is generally considered as sub-horizontal and are devoid any major folding. The structural features are better interpreted from the satellite product and are subsequently checked in the field. From a distance the beds look perfectly horizontal following the contours. But, by the close examination it is found that there are areas, where the Kurnool rocks are affected by even plunge folds. The detailed field study has indicated that there anticlinal valleys and synclinal hills representing 2nd order topography. The Narji Limestone is divisible into lower flaggy limestone, ***middle massive limestone*** and upper flaggy limestone (King 1872 and Dutt 1962). It is the middle massive limestone that is mainly cement grade can be further divided into different units that are of cement grade. The outcrop level features like elephant skin weathering and stylolites also help in the recognition of grade of the limestone. The stratigraphy, structure and evolution of the Kurnool sub-basin was discussed in detail (Nagaraja Rao eta al 1987).

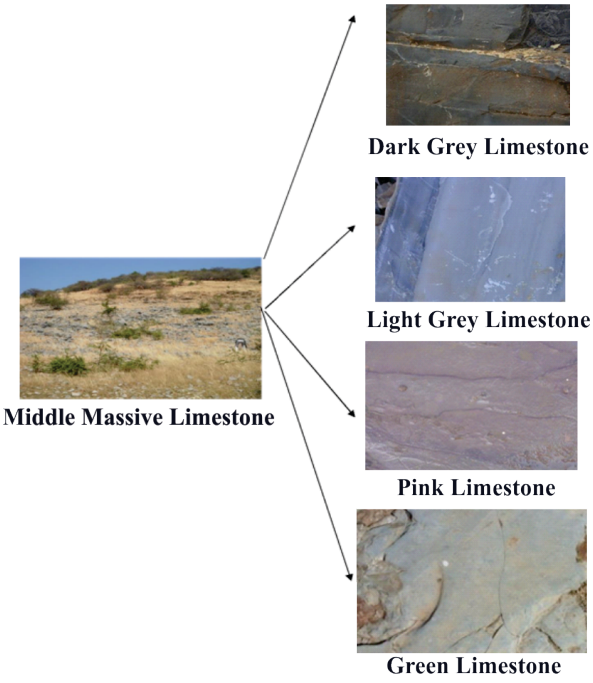

Fig.1. The Lithological Sequence Of Middle Massive Limestone.

MATERIAL & METHOD:

Lithostratigraphy of the middle massive limestone:

The middle massive limestone that forms the back-bone of cement industry in Andhra Pradesh is further divisible into lower green limestone followed by pink limestone that in turn is over lain by light grey limestone, which in turn is followed by the dark - grey limestone (Fig. 1).

Dark grey and light grey limestones are of cement grade. The dark grey generally analyses 83% of CaCO3 and the light grey analyses from 72% to 83% of CaCO3. Occasionally the top 1 – 2 meters of the pink limestone also analyses + 82% of CaCO3.The green limestone very rarely yields very insignificant quantity of +79% of CaCO3

ELEPHANT SKIN WEATHERING:

Elephant skin weathering is very common to dolomites and is insignificant in the limestones, but can be recognized occasionally. Similar type of weathering is noticed at a few places in the Narji Limestone.

Fig. 2a & 2b. Elephant Skin Type Of Weathering In The Narji Limestone, Anaganapalle Mandal, Kurnool District

The stress is on the importance of this physical parameter that reflects the grade of the limestone. It has been tested that the presence of the so-called elephant skin weathering or wrinkle structure reflects that the grade of the limestone will be good and it will be invariably cement grade with + 79% CaCO3. However, the feature simulating (Figs.2a & 2b) the elephant skin weathering is observed in the Narji Limestone of Betamcherla and other mandals.

STYLOLITES:

Stylolites are common features in carbonate rocks, especially in micritic limestone. They are mostly seen in homogenous rocks like carbonates and cherts etc. They range from microscopic scale (Malur and Nagendra 1988) to very mega scale (Park & Schot 1968 and Bathurst 1975). Stylolites in general run parallel to bedding, may be due to the pressure by the over burden. But stylolites that are inclined and inter-connecting (Kaduri 2013, Leehee et al 2014) are also observed in the Narji Limestone.

Stylolites are mainly pressure solution phenomenon, but can also form due to diagenesis.

Stylolites are classified geometrical by Park and Schot (1968) as indicated below.

1. Simple or primitive wave-like, 2. Sutured type, 3. Up-peak type (Rectangular type), 4. Down-peak type (Rectangular type), 5. Sharp-peak type (tapered and pointed), 6. Seismogram type

The significance of stylolites is generally in petrology, stratigraphy, structural geology and hydrology. But, the present stress is on the importance of these in identification of grade of limestone, especially its importance in recognizing the cement grade limestone in the areas of Narji Limestone.

Horizontal type of stylolites are seen in the limestone (Fig.3a). These are similar to simple or primitive type of stylolites of Park and Schot (1968). The stylolitic surface when exposed reflects minutely rugged surface (Fig. 3b)

Fig. 3a. Horizontal stylolites

Fig.3b. Minutely rugged surface of stylolite

FOLDS IN THE AREA:

The study has brought to light the mild tectonic imprint in the rocks of the Kurnool Group in the form of folds. There are tight shallow broad antiforms and synforms. The antiforms are common between two adjacent mesas capped by the Paniam Quartzite, as observed in the Erragudi, Palkuru and other areas. Occasionally gently plunging antiforms (Fig.4a & 4b) and tight antiformal structures are also noticed. The depth persistence of these folds is not expected to be high and these are not likely to create problem in the mining.

The Pathapadu hill itself represents a doubly plunging synform, with the axial trace trending towards SSE and NNW at a very shallow angle of 5^0 - 8^0. In the central part of the trough and antiforms having an axial trace trending NNW - SSE is observed.

Fig. 4a & 4b Plunging Antiforms In The Yanakandla Area Of Banaganapalle Mandal

THE 2ND ORDER TOPOGRAPHY OF THE HILLS:

As the dips of the units are < 5^0, they follow the contours. But, close and careful observation has indicated that the beds are seen dipping into the hill. When a valley of different magnitude occurs between the hills, it is invariably an anticlinal valley. It has been observed that whenever the upper flaggy unit of the Narji Limestone occurs at the lower levels on the obsequent slope, the middle massive limestone that is of cement grade is seen in the valley. (Fig. 5a & 5b).

Figs. 5a & 5b. Anticlinal valley exposing the middle massive limestone – Palkur area.

The above concept has been tested in the field and to confirm the concept a few bore holes were drilled in the agricultural fields and soil covered terrain on way to Palkur of Banaganapalle mandal. The bore holes have indicated the presence of dark gery limestone underlain by the light grey limestone that are confirmed to be of cement grade below ground level. A cross-sectional block diagram is given (Fig. 6) indicating the grade and depth of the dark and light grey limestones for clarity of the concept.

The satellite image of LISS –III (Fig.7) is given for better appreciation of the new concept

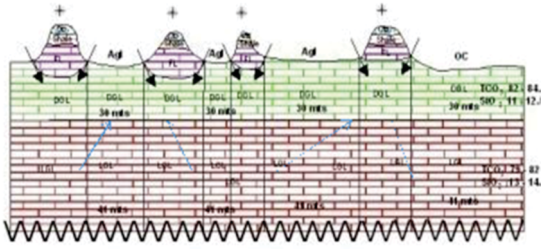

Fig. 6. 2nd Order Topography Of The Narji Limestone

Fig. 7. The valleys A---A' & B --- B' covered by agriculture and by soil respectively have extensive middle massive limestone of cement grade in Palkur area, Banaganapalle mandal

CONCLUSIONS:

The middle massive limestone of the Narji Limestone has four sub-units. Amongst the four the top two in general are of cement grade. Though the Narji Limestone is sub-horizontal in nature, it shows plunging anticlines occasionally. The features like elephant skin weathering, stylolites act as reflectors of cement grade of limestone. In addition, the 2nd order topography acts as a clue to locate the cement grade limestone even if the terrain is covered by soil or by agricultural activity. The satellite LISS – III data is found to be highly useful in the analysis of all lithological and structural details that lead to locate good grade limestone.

ACKNOWLEDGEMENTS:

The authors express sincere thanks to Dr. B.K.Nagaraja Rao, Former Director of Geological Survey of India for his guidance and encouragement throughout the work.

REFERENCES:

1. Bathurst, R. G. C., (1975). Carbonate Sediments and Their Diagenesis, Elsevier, Amsterdam, 658 pp.
2. Dutt, N. V. B. S. (1962). Geology of the Kurnool System of rocks in Cuddapah and the southern part of Kurnool district. Rec. Geol. Surv. India, 87, pp. 549 - 604
3. Kaduri, M. (2013). Interconnected Stylolite Networks: field observations, characterization, and 891 modeling, M.Sc. thesis, The Hebrew University.
4. King, W., (1872). The Kadapah and Karnul formations in Madras presidency. Mem. Geol. Surv. India, 8 (Pt. 1):pp. l-346.
5. Leehee Laronne Ben-Itzhak, Einat Aharonov, Ziv Karcz, Maor Kaduri, Renaud Toussaint. (2014). Sedimentary stylolite networks and connectivity in Limestone: Large-scale field observations and implications for structure evolution. Journal of Structural Geology, Elsevier, 2014,.
6. Malur and Nagendra (1988). Microstylolites in Late Precambrian carbonate rocks, Karnataka, South India. Journal Geological Society of India, vol. 32, pp 430-432.
7. Nagaraja Rao, B. K., Rajurkar, S. T., Ramalingaswamy, G., Ravindra Babu, B., 1987. Stratigraphy, structure and evolution of the Cuddapah basin. Geol. Soc. India Memoir 6, pp.33–86.
8. Park, Won C.; Schot, Erik H. (1968): "Stylolites: their nature and origin". Journal of Sedimentary Petrology. 38 (1): 175–191.