Bulletin of Pure and Applied Sciences.
Vol.38 F (Geology), No.2,
July-December 2019: P.218-224

Print version ISSN 0970 4639
Online version ISSN 2320 3234
DOI: 10.5958/2320-3234.2019.00021.0

Available online at www.bpasjournals.com

Original Article

Analysis of Geological Factors for Successful Dolomite Mining Exploration at Venkatampalli Village, Narpala Mandal, Anantapur District, Andhra Pradesh

T. Madhu[1,], O. Vijaya Kumari[2], G. Rajeev Kumar[3], E. Chaitanya Reddy[4]*

Author's Affiliations:
[1]Assistant professor, Department of Geology, Sree Venkateshwara University, Tirupathi, Andhra Pradesh 517502, India.
[2]Research Scholar, Department of Geology, Sree Venkateshwara University, Tirupathi, Andhra Pradesh 517502, India.
[3]Department of civil engineering, St. Martin's Engineering College, Secunderabad, Hyderabad, Telangana 500014, India.
[4]Department of civil engineering, St. Martin's Engineering College, Secunderabad, Hyderabad, Telangana 500014, India.

***Corresponding Author: T. Madhu**, Assistant professor, Department of Geology, Sree Venkateshwara University, Tirupathi, Andhra Pradesh 517502, India.

E-mail: madhuteliki@gmail.com

(Received on 13.08.2019, Accepted on 29.10.2019)

ABSTRACT

Mining exploration includes different geological aspects for profitable mineral extraction. By consideration of all factors for successful mining such as preparation of mineral plan, environmental management plan, waste disposal management, water management, geology, and pre cautions. Venkatampalli village is one of the richest mineral resources of the dolomite is used as a flux in the steel making, as well as in sinter making. The size of the dolomite should be +10 mm to – 30 mm for steel making and it should be 10mm for sinter making, 0.5 mm to 2 mm consumed for fertilizer industries. The maximum water table is about 150 metre from the level of ground. Thus the water table is much below the proposed working depth and the mining operations will not affected by the water regime. The expected life of the mine is around 50 years. In land environment retaining wall with waste lumps on slopes of the dump to prevent the erosion and dust generation from the dump. There is no chance for generation of toxic and hazardous element from this mine.

KEYWORDS: *Dolomite, Disposal of Waste Management, Conceptual Mining plan, Environmental Management Plan*

1. INTRODUCTION

Sri Vishnu Mines and Mineral Pvt. Ltd has applied Mining Lease for Dolomite mineral in Sy no 265/1F/P of Venkatamplaali (Vil), Narpala (Md),Anantapur Dist, Andhra pradesh over an extent of 77.297 Ha (191 Acre) for a period of 20 years.

2. DETAILS OF THE AREA

The area lies in Topo sheet No 57 F/13 & F/14 of Survey of India and falls at Latitude 14° 46′ 49.6′′ to 14° 47′ 24.0′′ and Longitudes 77° 50′34.5′′ to 77° 51′08.8′′.

Table 1: Details of the area in respect of which Mining Lease to be granted

District & State	Mandal	Village	Sy. No	Area in Ha	Owner ship
Anantapur & Andhra Pradesh	Narpala	Venkatampalli	265/1F/P	77.297 Ha (191 Acre)	Govt. Revenue Land

The applied area is about 1.5 Km from the Venkatampalli village in North – East Direction. There is a metal road approachable to Mining Lease area at a distance of 3.0 km from the Main road (Anantapur – Tadiparti) High way (Table. 1).

3. INFRASTRUCTURE

The Applied area is about 22 km from the Anantapur town. The nearest Railway Station is Tadipatri Railway station at a distance about 16 Km from the Mining Lease area. Majority of workers and staff will come from nearby villages. Narpala is the Mandalhead quarter which is about 12 km from the applied area and having facilities like High school, College, health Centre, Postal, Telegraph and bank facilities. The power line is passing near bythe Mining lease area at a distance of 3.5 km .There is a Right Bank High Level Canal of Tungabadra Dam water passing near the mining Lease area at North- West Flank . The Deposit is located at Latitudes14° 46′ 49.6′′ to 14° 47′ 24.0′′and Longitudes77° 50′34.5′′ to 77° 51′08.8′′. by Topo Sheet No 57 F/13 & F/14.

The Topography is hill terrain. The highest and lowest elevations in the applied area is 325 m RL and 430 m RL from the assumed benchmark of 325 m RL .The Rain water flows along the gentle slope and connect into the existing drainage . Annual rain fall is .350 mm – 450 mm and Maximum temperature is 45°C during summer and 18°C during winter season. The Humidity is about 70 %n in the Rainy season. The working and Geological Plan cross sections has been prepared on scale of 1: 2000 RF .with contour interval of 10 m enclosed vide plate no 3.

4. GEOLOGY

The geological formation of the region belongs to Vempalle stage of Papaghani series of lower Cuddapah system (Nagaraju, A, et al. 2019).

Table 2: The stratigraphic sequence of the rocks of Cuddapah basin

---------- Unconformity ----------		
Upper Cuddapah	Krishna Series	Srisailam Stage
		Kolamnela Stage
		IrlaKonda Stage
---------- Unconformity ----------		
Upper Cuddapah	Nallamalai Series	Cumbum Stage
		BairenKonda Stage
---------- Unconformity ----------		
Upper Cuddapah	Cheyair Series	Tadipatri Stage
		Pulivendla Stage
---------- Unconformity ----------		
Lower Cuddapah	Papagani Series	Vempalle Stage
		Gulcheru Stage
---------- Unconformity ----------		

Archen Gneisses and Schists. The rock types are belongs to Vempalli stage of Papagani series (Table. 2). The general strike of the rocks exposed is NEE to SWW and dip varies from 5° to 10° towards south. The entire lease area is covered with dolomite mineral a s outcrops and weathered dolomitic limestone is seen in the area.

Study area has covered 1.0m thick soil layer and 2.0 to 3.0m thickness of Weathered and Siliceous Dolomite, Chert and Flint. Dolomite ore covered by the study area in various thicknesses such as 0.5m thickness some of the portion and some of the areas have 35m thickness also. Siliceous dolomite maintained good thickness such 10 to 15m.

Dolomite ore is proved in tons 7, 09, 44, 813 and probable quantity is 1, 79, 12, 013 tons. The total quantity is 8, 88, 56, 826 tons.

5. PREFERABLE MINING METHOD

The Method of Mining operations are of Mechanized with deep hole Drilling and Blasting Practice and deploy of Heavy Earth Moving Machineries' HEMM. The Bench height should be maintained of 6.0 mts and the width should be more than the Height (Fig. 2). The stripping Ratio in the Dolomite Mineral mine is <0.5. While starting the mining operations, the top soil about 1.0 m thickness can be removed by the excavator and the siliceous dolomite of 2.0 m thickness below the soil can be removed by Jack hammer drilling and blasting practice. Care should be taken to separate the soil and siliceous dolomite mineral. The orientations of the proposed benches are North West and south east Direction and advancing from south to North. The proposed production will be 17, 17,220 tons per annum during mining plan period. It was proposed to work by Mechanized opencast Mining method by Deep Hole Drilling and Blasting and Heavy explosives used. The pit slope can be maintained at 60° (Adriano Guido, 2018 et.al).

Based on the mode and the method of mining adopted and taking into the consideration of Geological parameters, Geo technical field observations, Rules and Regulations, method of mining operations, feasibility and economical and statistical data made there off.

The slopes are designed based on the conditions of the strata and structural attitudes of both Hanging wall and foot wall formations. The ultimate pit limit so drawn on the basis of the field studies, Exploration data and the updated Geological mapping carried out so far in the area remains very tentative.

However, based on the future exploration the defined, ultimate pit limit is likely to be changed. The said Ultimate pit limit is demarcated on the working and Geological plan and enclosed as plate no III Since there is Drilling and blasting in the said mine , to excavate /exploit the mineral and waste .Initially , it will be drilled and blasted and excavate the ROM by deploy of HEMM and Transport the same to the Stock yard. The gradient of the roads with in the mine pit will be maintained not exceeding 1:16 and not exceeding 1:10 between bench to bench connectivity.

Mine Drainage

The Rain water is very scanty in this area so no elaborate arrangements for drainage of rain water are required. The mining area in hilly terrain at an altitude of 430 m RL and lower altitude is 325 mtr RL from the assumed Benchmark of 325 mtr RL. There is no chance of encountering underground sources of water and also there are no water logged areas above the level of proposed workings. So there is no danger for the inrush of water in the working quarry. Much of the rain water will be drained automatically due to natural source (Chakravorty, S L 1973).

Disposal of Waste Management

The waste consists of highly siliceous dolomitic rock, Chert, Flint and Top soil etc. Totally 72,304 Tons of rejection as waste is likely to be generated (Table. 3).

Table 3: The area required for dumping the same is calculated as under

Total Rejection	=	72,304 Tons
Loose Bulk Density considered	=	1.6 T / M^3
Total Volume	=	72,304 / 1.6 Bulk Density = 45190 M^3
Area required for Dump	=	45190 M^3 / 1.50 M = 30126 M^2or 3.0Hect

Hence, considering the slopes nearly 3.0 Hect areas is required for dumping.

The total waste of 72,304 Tons shall be systematically dumped in the predetermined area of barren zone. The dumping shall be done in bench like configuration in an ascending order starting from the lower most levels.

At lower most level, a strong retention wall will be constructed to check the rolling off or washing off silt. The height of the entire dump shall be maintained at 1.50 M with single bench of 1.50 M. An angle of repose shall be 28^o to30^o.

The environmental control measures shall be undertaken so that, no silt is allowed to flow down the dump slopes, carrying the solid particles along with the rain water and deposit in the water tanks. The dump is designed to have reverse slopes so that rainwater does not flow on the dump slopes.

- The top layer of the dumps shall be covered with topsoil, which has excellent property of water retention and supports good tree growth and vegetation (Raghunath, H.M., 1987).
- Creation of water garland drains to regulate and drain the rainwater and divert its course away from the dumping area.
- Provision of retention walls at the foot of the dumps providing sufficient check dams to check any silt flowing along with the surface runoff in the valleys.
- The contour terraces will be subjected to vegetation consisting of grass species to bind the loose particles. The dumps will be stabilized and vegetated.

- The dump slopes are stabilized by grass species, legumes and ageva roots and localspecies.
- Each dump level will be provided with retention wall constructed byusing the local bounders.

6. CONCEPTUAL MININGPLAN

Salient features of an updated conceptual plan of the mine covering the span of anticipated life of the mine, depicted on mine geological plans and sections with necessary statement annexed and supported by essential text, covering the basic and long term design features of mine covering exploration, mine development, optimum exploitation and utilization of mineral, waste and sub grade mineral management and environmental aspects (Fig. 1). The ensuing five year detailed programme should be part of the conceptual over all mining plan.

For any mine, preparation of Conceptual Mine Plan amounts to, fore seeing in totality and planning for mining and related activities through-out its life span, till such time all the usable minerals are exhausted to the economical limits and lease area is reclaimed to the extent possible. Apart from physico-chemical and mineralogical parameters which form primary basis for compilation of conceptual mine plan, several other factors such as grade of sub-grade minerals, marketability and the norms laid down by the Government agencies from time to time do play important roles (Sarma E.A.S Dr 2001). With ever increasing and changing needs of humanity, coupled with technological advancements, sub grade minerals of the date become marketable minerals in future.

Therefore, preparation of ideal conceptual mine plan for any mine is difficult and such plan prepared, remains acceptable only under given circumstances.

It cannot be overlooked that, any such plan undergoes amendments and revisions in the course of progressive stages of exploration and exploitation.

It is always borne in mind to bring back near natural shape to the area and its economic value is elevated. It is further ensured that, there is positive contribution to the environment and socio-economic development of the region.

The Conceptual Mining Plan covering the entire life of the mine, at 5 year period and conceptual period covering exploration, development, production, disposal of waste etc., is given below. The Dolomite ore Production and Development programme will be carried out during conceptual period.

Conceptual Scheme of mining plan for 20 years period is as follows. Time Frame of completion of mineral exploration programme in lease hold Ares. Give broad description, identifying potential area to be covered in the time frame:

No further Exploratron was proposed present geological reserves are as follows (Table. 4):

Table 4: The total geological Reserves are as follows

Mineral	Tonnage	Proposed Production	Life of the mine
dolomite	88856826	1717220	50 years

Weather ultimate pit limit has been determined and demarcated on surface. Weather the site (s) fro disposal of waste rock and un salvable minerals has/ have been examined for adequacy of land and suitability of long term use in the event of constitution of mining activity.

The waste material i.e gravel has to be removed on both sides along with dolomite and there is no sub grade mineral , all the dolomite material will be removed and it will be send to local steel manufacturing industries (Purnachandra Rao V and P Gopinathan 2019).

Whether back filling of Pit(s) after recovery of mineral upto techno economically feasible depths envisaged .If so describe the broad features of the proposal. :

The total entire working will be back filled concurrent to mining operations.
Production of Dolomite mineral = 1717220 per year
Production of Dolomite mineral = 34344400 for 20 years
Development = 72304 per annum
Development = 1446080 for 20 years
After the plan period the conceptual scheme of mining will be modified and submitted to regional controller of Mines, Hyderabad. Ultimate Pit Limit is drawn at 45° from the bottom of mineral body.

7. ENVIRONMENTAL MANAGEMENT PLAN

The mining development in the study area needs to intertwine with judicious utilization natural resources within the limits of permissible assimilative capacity. The assimilative capacity of the study area is the maximum amount of pollution load that can be discharged in the environment without affecting the designated use and is governed by dilution, dispersion and removal due to natural physio-chemical and biological processes. The Environmental Management Plan (EMP) is required to ensure sustainable development in the study area. This chapter covers the genesis of pollution, the principal sources of pollution, the nature of pollution, the proposed measures required for meeting the prevailing statutory requirements of gaseous emissions, wastewater discharge characteristics, noise levels etc. for environmental management purpose in connection with the mining and mining related activities in the study area. This section discusses the management plan for mitigation/abatement impacts and enhancement of beneficial impacts due to mining (Kenward P. A., et al. 2009). The Environmental Management Plan (EMP) has been designed within the framework of various Indian legislative and regulatory requirements on environmental and socio-economic aspects (Mishra, P.C. 2004) Environmental Management Plan giving the environmental protection measures at mine to meet the stipulated norms of IBM/MOEF are as detailed.

Figure 1: Field study by map observations

Figure 2: Dolomite Formational Out Crops

Land Environment

The Environmental Management Plan of land environment is divided into the following three components.

- Solid waste management
- Reclamation of degraded areas
- A forestation/plantation/Greenbelt Development

Solid Waste Management

About 34200 TPA of waste will be generated during this plan period and this waste will be dumped on SSE side of the area. The waste dump will be stabilized by constructing

Retaining wall with waste lumps on slopes of the dump to prevent the erosion and dust generation from the dump. There is no chance for generation of toxic and hazardous element from this mine. During the first five years the waste dump will be stabilized by constructing retaining wall over a length of 76m, width 1m and height of 1.5m.

Plantation

Hundred saplings per annum during the scheme period in the vacant lands, on the dead dumps, on road side etc. A forestation will be made to achieve better survival rate. After care arrangements will be made on daily basis to ensure healthy survival of plantation.

Apart from the green belts and aesthetic plantation for eliminating fugitive emissions and noise control, all other massive plantation efforts shall be decided and executed with the assistance and co-operation of the local community. Based on the community needs the forestation would mainly aim at:

- Protection & Development of Natural Vegetation
- Protection of soil erosion
- Plantations of fuel wood blocks to meet the energy requirements

REFERENCES

[1]. Mishra, P.C. Sahu, H. B. And Patel R. K. Environmental pollution status as a result of limestone and dolomite mining- a case study. Pollution research, 2004, Vol. 23, Iss 3.

[2]. Chakravorty, S L, "National Mineral Policy", journal of Mines, Metals and Fuels. January 1973, p.11 6/2 Madan Street, Calcutta – 13.

[3]. Sarma E.A.S Dr, Holland Memorial Lecture, July 2001, The Mining Geological and Metallurgical Institute of India.

[4]. Nagaraju, A, Suresh, S, Killham, K and Hudson Edwards, K. Hydrogeochemistry of waters of mangampeta barite mining area, cuddapah basin, Andhra Pradesh, India. Turkish journal of engineering and environmental science. 30(2006), 203-2019

[5]. Raghunath, H.M., Groundwater. Wiley Eastern Ltd., New Delhi, p. 563, 1987.

[6]. Purnachandra Rao V and P Gopinathan, Late Quaternary sediments on the carbonate platform off western India: Analogues of ancient platform carbonates, Journal of Earth System Science, 10.1007/s12040-019-1112-y, 128, 4, (2019).

[7]. Kenward P. A., Goldstein R. H., Gonzalez L. A. And Roberts J. A., Precipitation of low temperature dolomite from an anaerobic microbial consortium: the role of methanogenic Archaea, Geobiology, 7, 5, (556-565), (2009)

[8]. Adriano Guido, Franco Russo, Domenico Miriello and Adelaide Mastandrea, Autochthonous Micrite to Aphanodolomite: The Microbialites in the Dolomitization Processes, Geosciences, 10.3390/geosciences 8120451, 8, 12, (451), (2018).