

**REPORT ON REGIONAL MINING GEOLOGICAL STUDY FOR CHINA CLAY
MINE OF NAGOUR DISTRICT, RAJASTHAN
(Program Year 2012-13)**

0.1 The important clay deposits of Rajasthan are located in Bikaner, Jaipur Bhilwara and Nagaur districts. Isolated deposits of clay also occur in the districts of Alwar, Bharatpur, Sawai madhopur, Sikar, Kota, Bundi, Chittorgarh, Pali and Jodhpur. In Nagaur about 65 leases are granted, In that 57 clay mining leases are covered during the study. Nagaur district falls almost in the central part of Rajasthan covering an area of 17,718 sq.km. The district is bounded by the latitudes $26^{\circ}02'12''$ to $27^{\circ}37'39''$ and longitudes $73^{\circ}05'20''$ to $75^{\circ}24'$.

0.2 These leases are located in Survey of India Topo sheets number- 45E/16, 45E/13 and 45F/14 and are bounded by Latitude: $27^{\circ}05' - 26^{\circ}30'$ north and Longitude: $73^{\circ}50' - 74^{\circ}00'$ east. The total area covered by these leases is 256.7292 hectares.

0.3 Geologically, Nagaur district is occupied by the Delhi Supergroup rocks, Erinpura Granite, Malani Igneous suite, Marwar supergroup rocks and Jogira Fuller's Earth/Kuchera Khajwana series rocks. Delhi Super group comprises the Raialo, Alwar and Ajabgarh Groups. Raialo Group is mainly represented by conglomeratic quartzite, dolomitic and calcitic marbles and garnetiferous schis

0.4 The lease areas are plain terrain, comprise of dry agricultural patta land.

0.5 The regional strike of the clay bed varies from NW-SE with dip of around 1° to 2° towards NE.

0.6 There is no surface indication of clay deposits. The clay bed occur around 15-20 m below surface. It has overlain by Grit & kanker

and Ferruginous sand Stone/ silica sand. The thicknesses of overburden vary from mine to mine.

0.7 Mineralogically, most of the clay in the leases is china clay constituting 46-51% of SiO_2 , 32-38% of Al_2O_3 and 0.13 -1.55 % Fe_2O_3

0.8 The exploration so far carried out in the leases is on a very low scale mainly because of similar litho units. Some of the mines have carried out exploration 10m below the working pit. There is no other clay bed below the existing clay bands.

0.9 Total 115 Exploratory pit/Bore/Shaft have been proposed in 57 lease holds to know the behavior of clay occurrences and existence of another clay band below the existing clay bands. Total 76 nos of Exploratory pit/Bore/Shaft have been carried out till the time of the present study.

0.10. The total resources of clay in 57 mining leases have been estimated to be 35.86 million tons. The resources estimated in the non - mining leases have been assessed around 594.4 million tons.

0.11. During 2011-12 only 38 mines reported production of china clay and the total production was only 330085 tons. The main reason of this low level of production is lack of regular demand.

0.12. No mechanical beneficiation units for upgradation or value addition of ROM have been established in any lease. The low grade generated in some mines also sold at low price. Mostly entire mined out minerals are sold.

0.13. Exploration undertaken in the mining leases is not sufficient to estimate reserves under UNFC in true sense. Hence the sufficient exploration has to be proposed in the mining plan and the same has to be implemented strictly.

REPORT ON REGIONAL MINING GEOLOGICAL STUDY OF SOAPSTONE MINES OF BAGESHWAR DISTRICT, UTTARAKHAND

(Program Year 2012-13)

- (i) The present Study has been assigned vide Chief Controller of Mines letter no. K-11011/1/2012-13, CCOM dated 03.04.2012. As a result 30 soapstone mines of Bageshwar district were identified in Uttarakhand. The study report has been prepared based on the Guidelines received from Chief Mining Geologist vide letter number B-283(1) GMMMC/2012 dated 6/12/2012. All these mines/areas are also located in very difficult hilly terrain. For the purpose of fulfillment of the study 30 soapstone mines located in Bageshwar district were inspected and studied. The tour for this purpose of Bageshwar (Uttarakhand) mines was taken up w.e.f. 10th May 2012. The fieldwork was completed in five spells and last field work was completed on 2/2/2013.
- (ii) Mining leases for soapstone in Uttarakhand State have been granted mostly over a small area on steep hills slopes. The mining lease area ranges from 0.81 hectare to 220.14 hectares. Soapstone occurs normally under 0.5 to 3m-soil cover, 70-90% of M.L. areas comprise of agriculture fields. In the mining leases covered under the present study exploration has been proposed by putting trial pits of 5 x 5m x 4-5m dimension as per geological condition. But in most of the mining leases proposals have not been implemented except the Papon Mine of J.S. Khetwal, Wadura Mine of P.S. Garia, Jharkot Mine of N.S. Corporation, Oliagaon Mine of Amba mines & Minerals, Rankot Maithra Mine of H.C. Lohani & Khunoli Seunora of Parvatiya mines where the pits have been dug as per the proposal. No additional exploration in the soapstone mines of the area has been carried out. However, most of the mines are worked extensively.
- (iii) On the perusal of the table no 5 has revealed that there is only one mine i.e. Oliagaon mine of M/S Amba Mines & Minerals where reserves/resources have been increased by about 26%. The reserves have been increased as depth for category 111 is considered as 12m vertical from the surface whereas earlier depth was considered as 6m. The depth of 12m is considered based on mining activities carried out during the last five years.
- (iv) A total reserve of soapstone have been estimated of the order 7702068 3086391, and 7627270 tonnes in respect of mines covered under UNFC reserves/resource 111, 121/122, and 333 categories in respect of mines covered in the present study on the basis of field observations and approved mining plan / scheme of mining. Details are given in Table 6A.
- (v) In the mining leases covered under the present study exploration has been proposed by pitting of 4-5m x 4-5m x 4-5m dimension of pits. No other methods of exploration like drilling or exploratory mining have been proposed except few mines where exploration have been proposed by way of bore hole drilling in recently approved scheme of mining. But in most of the mining leases proposals have not been implemented except the Papon Mine of J.S. Khetwal, Wadura Mine of P.S. Garia, Jharkot Mine of N.S. Corporation, Oliagaon Mine of Amba mines & Minerals, Rankot Maithra Mine of H.C. Lohani & Khunoli Seunora of Parvatiya mines where the pits have been dug as per the proposal. Exploration & working also affected due to non-availability of private land falling in the ML area.
- (vi) Mining of soapstone in this area is carried out by opencast method manually on a very small scale using simple implements along with occasional use of other mining machinery like JCB. Out of 30 mines covered in the study 25 mines have approved mining plans or approved scheme of mining at present. Most of mines are worked without forming systematic benches of proposed height of 3m. Steep vertical faces & uneven floor with some times deviation in site of working from the site approved in mining plan / scheme of mining are also observed.

- (vii) The waste material, which is also referred sometimes as interburden, is mined simultaneously with soapstone. It mainly comprises of dolomite, phyllites and low-grade magnesite. It is also stacked near the working pits unsystematically, sometimes not on approved sites. The waste material generated is stacked temporarily and used for construction of retaining walls around agriculture fields, check dams in nalas, parapet wall and repair /construction of foot path, roads and civil structures etc. Apart from this bulk of waste material from the temporary site is used for backfilling of mined out area and restoring back to its original use of agriculture.
- (viii) A total no of 71 violations for 20 mines were pointed out till end of February 2013. Till end of February 2013, a total of 25 violations have so far been complied. Three court cases have been filed on 24/1/2013 and six mines were suspended under rule 13(2) during the year or before this year.
Occurrence of soapstone is observed up to the pit bottom and geological evidences are clearly indicative that the soapstone still persists beyond the pits in depth. But mining is done generally up to 15m.depth barring few mines where it has gone upto 18m. Lessees may be advised to explore the depth continuity further below the existing pit bottoms by putting trial pits/bore holes & worked the deposit if technically & economically feasible.
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- (x) The mine waste, which comprises of soil, Phyllites, and dolomite, is generated during the mining operations. Lessees may be advised to keep the proper record of the soil and waste generation. Soil and dolomitic waste should be stacked separately. After back filling the mining pits with waste material, the soil may be utilized for carpeting the area so as to reclaim back to its original use of agriculture.
- (xi) Dumping of waste material needs more attention in some mines where substantial quantity of waste material is dumped near the nalas /streams. Waste material should be stacked systematically at the approved sites of mining plan/scheme of mining and dead dumps located in area should be properly terraced and stabilized by afforestation of local varieties. Adequate number of wire crated retaining walls, toe walls & check dams etc may be constructed at vital points to check the further rolling of mine waste to down slope. Regular check on quality of water of streams may also be kept and water analysis may be carried out periodically and submitted to RCOM/OIC, IBM Dehradun.

RMGS Report of 30 Lease hold Areas of Bauxite, in Vill. Mewasa & Virpur of Jamnagar, District, Gujarat State

0.00 ABSTRACT

The present mining geological study covers 30 lease holds (area 587.7541 ha) out of 137 MLs during the RMGS 2012-13. in the bauxite mining belt at Jamnagar district of Gujarat State. The stratigraphy of the area established by the previous workers of GSI showing distribution of bauxite deposit below the Gaj beds in Kalyanpur, Taluka, Jamnagar district: Bauxite deposits of Jamnagar district occur as lenticular pocket concentration within lateritic sheets of relatively smaller extensions upto depth ranging from 2 to 6m and OB upto 1.5m . Bauxite mine sections revealed following 4 different zones. (1) Hard massive zone (2) Nodular or concretionary zone (3) Pisolitic & Oolitic Zone Powdery/Clayey or earthy zone. In the approved documents, proposal for certain trial pits and Boreholes were made, but proposed exploration could not be taken up as almost all the mines are closed due to the policy of state government. During inspection, necessity of more exploration by trial pits and Boreholes were observed. Total reserves as on 1/04/2012 are 24308300 tonnes in 30 ML areas of Jamnagar district. Insitu bauxite is mixed grade. High and low grades in the ratio of 10:90 developed after sizing and sorting during the mining process. The production pattern indicates sudden slump from 2007-08 in Gujarat state from 11.9 million tonnes to 9 lacs tonnes in 2011-12 and further expected to be lowered during 2012-13 which is due to the state govt. policy. Jamnagar district contributes over 90% of the state production. The cost of production of low grade ranges from Rs 140 to 392/ tonne and high grade Bauxite ranges from Rs 414 to 530/tonne except Virpur Pillidhar ML of M/s Natraj Ceramics where cost is Rs 1439/tonne. Forest area, marine national park, marine sanctuary falling within the CRZ boundary are the major points to be given due attention while clearance in Virpur, Mewasa. The violations of Rule 12(3) were pointed out in 9 cases, 13(1) in 13 cases, 23(B) (3) in 5, 23(E)(2) in 18, 23(F) in 6, 24(1) in 10, 42(1)(C) in 6, 45(5)(a) in 3,

45(5)(b) in 3 cases. Out of these violations 11 cases of 23E(2), 10 cases of 13(1), 4 cases of 24(1)(c), and 2 cases of 42(1)(c) were complied.

About all the mines covered under study are closed for the last 2 years except 2, Pilidhar mines of M/S Natraj ceramics and chemicals ltd. And Virpur of M/S Prabhudas Vitthaldas. Few mines have shown the production of last 2 years between 8 to 20 tonnes per year. Pilidhar mines have produced 150424 tonnes during 2010-11 and 2011-12. Virpur mines have produced 4626 and Mewasa mines of M/S Tushar Minerals have produced 2700 tonnes only during the last 2 years. Total 5 years production of 30 mining leases under study (2007-8 to 2011-12) is 3088171 tonnes, out of which Pilidhar mine of M/S Natraj ceramics & chemicals (360616) and Virpur of M/S Prabhudas Vitthaldas (2340766) have produced 2701382 tonnes, which is more than 87% of total production.

**REPORT ON REGIONAL MINING GEOLOGICAL STUDY OF BAUXITE MINES
OF LOHARDAGA & GUMLA DISTRICTS, JHARKHAND STATE**

(Program Year 2012-13)

EXECUTIVE SUMMARY(ABSTRACT):

The outcome of the study as per the objectives is as follows:

(i) TO DETERMINE QUANTUM OF EXPLORATION ALREADY CARRIED OUT IN THE STUDY AREA, FIND OUT GAPS IN EXPLORATION THROUGH STUDY OF PLANS AND SECTIONS AND FIELD VISIT AND SUGGEST FUTURE REQUIREMENT OF EXPLORATION LEASE-WISE:

Keeping in view the nature of mineralisation and the degree of exploration done, further requirement of exploration in each of the mine covered during the study were proposed in the mining plan/ scheme. In all it requires 377 boreholes and 82 DTH to prove the ore body in the mines covered during the study in years to come. Keeping in view the nature of mineralisation and the degree of exploration done, and based on observation during the study period, It has been envisaged that exploration should be continued up to full depth of mineralization covering (+) 30% Al_2O_3 to (-) 40% i.e upto 30% Al_2O_3 and till the base rock is properly ascertained.

(ii) ASSESSMENT OF LOW GRADE BAUXITE RESOURCES WITHIN THE LEASEHOLDS:

The low grade Bauxite (+) 30 % to (-) 40% Al_2O_3 resource estimation during the study period has been carried out only in one mine of Organized sector i.e in Pakhar Bauxite Mine (8.09 Hc) of M/s HINDALCO Industries Ltd is to the tune of 352272 (348298+3974) MT. The other mine of the owner i.e Pakhar Bauxite Mine (109.507 Hc), the resource estimation upto 30% Al_2O_3 is under process. In rest other mines, the same could not be considered due to lack of exploration data. It is a beginning to educate and induce the lessees to carry out exploration in line with new threshold value to estimate the low grade resources for future requirement, which will be streamlined in due course of time.

The Bauxite having Al_2O_3 - 30-40% and SiO_2 - <5%, at present scenario do not have any market demand and thus its present market value can not be assessed. With the technological development the market demand may change in future and with this aim, the Bauxite having 30% Al_2O_3 (Min) might find its place in National /International market with greater demand and cost effectiveness.

(iii) STATUS OF BENEFICIATION PROCESS ADOPTED IN THE STUDY AREA, QUANTUM OF LOW GRADE ORES AVAILABLE FOR BENEFICIATION, FUTURE TREND AND SUGGESTION MEASURES FOR BENEFICIATION OF LOW GRADE ORES:

No beneficiation practice is adopted in the mines under the study area except for manual sizing, sorting and blending.

(iv) SUGGESTIONS FOR TAKING INTO CONSIDERATIONS THE CONSTRAINTS AND ITS FUTURE MEASURES:

All the eighteen (18) mines of Non-organized sector have been suspended due to lack of Environmental Clearance (EC) since June, 2012, thus hampering production and ultimately to the considerable revenue loss of the State exchequer.

The Environmental Clearance is a time long process with several stages, which requires at least 2-3 years. All efforts should be made to simplify the procedure for EC resulting in less time consumption. Thus, the mines will not remain suspended for a longer period hampering production and revenue loss.

Forest area is also a bottle neck for mineral exploration. As a result the Bauxite deposit in forest land is still unexplored within the study area. Thus total estimation of Bauxite reserve/resource in the State could not be ascertained.

If permission for exploration is given by the Forest deptt. in forest area, at least estimation of Bauxite could be made so that it can be used in future as a strategic point of view.

(v) ISSUES, PROBLEMS AND SUGGESTIONS :

The main issues, problems and remedial measures are discussed below in brief:

(i) The glaring issue/problem of Bauxite belt in the State covering districts of Gumla, Lohardaga and Latehar is the law and order problem.

(ii) The other bottleneck is the communication problem throughout the field.

If roads can be constructed and maintained by local authority with the help of State agency and proper transport system is maintained or run by them then in that case transportation in the area will be smooth and law and order problem can be minimized to some extent.

Latest high power mobile transmission system is required to be commissioned in the entire Bauxite belt of Gumla, Lohardaga and Latehar districts of the State to smother the connectivity bottleneck.

Transportation and communication are the foremost important issues in the development of any area.

(vi) ANY SUGGESTIONS/RECOMMENDATION ON MINERAL CONSERVATION, SCIENTIFIC DEVELOPMENT AND ENVIRONMENTAL PROTECTION:

(a) The leasehold area covered by non-organized sector has to be explored in detail. Pre-feasibility/feasibility study is required for proper estimation and delineation of Bauxite mineralization.

(b) Proper chemical analysis of core logs of Bauxite horizon along with detail exploration is also essential for preparation of slice plan of each mine/leasehold to know the depth wise variation in grade of Bauxite in the entire Bauxite area which will be fruitful for sweetening of low grade ore of each mine in the area.

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RMGS ON BAUXITE MINES OF JHARKHAND STATE (REGL. OFFICE, RANCHI)

REPORT ON REGIONAL MINING GEOLOGICAL STUDY OF LIMESTONE MINES IN JAINTIA HILLS
& EAST KHASI HILLS DISTRICT OF MEGHALAYA & IRON ORE MINES IN SINGHBHUM DISTRICT
LOHARDAGA & GUMLA DISTRICTS, JHARKHAND STATE

(Program Year 2012-13)

0.0.1 EXECUTIVE SUMMARY

0.0.1.1 The Regional Mining Geological Study of Limestone mines in East Khasi Hills & Jaintia Hills district of Meghalaya and iron ore mines in Singhbhum (west) district of Jharkhand State has been programmed for Kolkata regional office under MCCM Division during the year 20012-13 to review the Iron ore & Limestone resources as per UNFC system vis-à-vis exploration carried out and supplemented by feasibility study.

0.0.1.2 Limestone varying from cement grade to chemical grade is available in Meghalaya that is suitable for manufacture of cement, lime and hydrated lime, precipitated and activated calcium carbonate, calcium carbide and acetylene black, bleaching powder etc. Southern part of the state abounds in limestone of various grades and extent. Regionally, a continuous belt occurs from western end of the state in Garo Hills to the eastern end in Jaintia hills, continuing further in to Mikir Hills of Assam. The developed sections are found in Therriaghat and Mawlong-Ichhamati areas of Khasi Hills where five bands of limestone occur. In the Lakadong and Lumshnong areas of Jaintia Hills, three beds of limestone has been reported whereas in Siju Area of Garo Hills only one bed is developed.

0.0.1.2.1 Geologically, the sedimentary rocks of the area form a part of the Cretaceous-Tertiary sedimentary sequence that occupies the southern fringe of Meghalaya Plateau. The calcarenaceous and calcareous formations of the region belong to the Jaintia Group of Eocene period which are considered equivalents of Sylhet Limestone Formation of the Bengal Basin. The Jaintia Group is essentially a calcareous facies representing shelf sediments and has been divided into three formations, viz., the Langpar, the Shella and the Kopili Formations. The Langpar Formation, the basal member of Jaintia Group, consisting of calcareous shale, calcareous sandstones and impure lime stones rests over a thick group of conglomeratic beds that overlie non-conformably the Sylhet Traps on the margin of the plateau. The Shella Formation of which the lithological units of the area form a part, consists of three sandstone and three limestone members beginning with a sandstone over the Langpar Formation. These lithological units have been designated successively (from older to younger) as Therria Sandstone, Lakadong Limestone, Lakadong Sandstone, Umlatodoh Limestone, Nurpuh Sandstone and Prang Limestone, which together account for a total thickness of about 540 m.

0.0.1.2.2 Iron ore deposits of Singhbhum (west) district of Jharkhand covered during the study consisting essentially of Haematite and occurs on the banded hematite Quartzites/Jasper. Generally the deposits occupy the crests or the slopes of the hills. It is observed that good grade deposits are in the high hills with steeper slope. Occasionally narrow, irregular deposits are also found in the plateau. But towards the interior, where the terrain is flat or gentle sloping, the concentration of iron is poor and the ore becomes shally admixed with laterite. The depth of ore concentration vary from deposit to deposit. Generally at or near the surface the deposit consist of hard massive or lumpy ore and hard laminated ore followed by friable and soft laminated ore. The following type, extent and surface indication identified during field visit of the region which approximately assess the nature, size and quality of the deposit beneath it.

- a) **Massive to bedded ore** it patches and lenses of laterite occurs on the crests and slopes of high hills generally contains below a large and high grade deposit with 12 to 30 meters thick lumpy ore horizon at the surface, followed by blue dust at depth. At the surface there may be little or no laterite overburden.

- b) **Laterite with bands, beds and lenses of ore** noticed at the apex and slopes of hills, hillocks and mounds usually contains below a medium sized deposit of moderate grade. The deposit may have overburden of laterite or mixed ore at the surface for about 3 to 9 mtrs. followed by a zone of lumpy ore for about 8 to 25 mtrs. and then blue dust at depth.
- c) **Brecciated ore with laterite** traced on the top and slopes of hillocks and mounds often contains below a small to medium size deposit with high grade ore. In this type of deposit, at the surface 3 to 8 mtrs. laterite with angular pieces of high grade ore is noticed. The incidence of ore pieces increases at depth and gives place to a 6 to 15 mtrs. thick zone of hard bedded ore with little or no laterite with some shale bands. The zone of bedded ore is followed at depth by a zone of small size deposit with generations of fines.
- d) **Concretions of haematite and limonite in laterite** noticed at the top of the low hills and mounds contains below a small deposit of medium grade ore. The ore occurs in the form of concretions of haematite and limonite in laterite and extends in depth up to 15 to 20 mtrs. and gives place at depth to mere ferruginous shales.
- e) **Narrow bands, beds, pieces and concretions of haematite, limonite and ferruginous manganese ore in laterite** noticed on moderately high hills, hillocks and mounds and occurs in the mixed zones where both iron & manganese-ore occur as small pockets, lensoid bodies & bouldery concretions in laterite. The two ores sometimes occur in one and the same quarry face. The ore extends to a maximum depth of about 15 to 20mtrs. At depth, ferruginous shales with thin bands and lenses of banded ferruginous quartzite occurs.
- f) **Angular pieces of Iron ore in soil** seen on low mounds and hillocks covered with rich vegetation generally contains below narrow irregular deposits of moderate grade. Below a thick zone of soil with angular pieces of Iron ore, a thick zone of friable quartzite with narrow beds, bands and pieces of ore exists followed by friable quartzite with some blue dust. However, these blue dusts may not be recovered as it is intimately admixed with friable quartzite.

0.0.1.9 CONCLUSION

0.0.1.9.1 While covering 16 leaseholds under the present study in Jharkhand state, it has been noted that renewal of mining leases is pending in respect of almost all the leases with the Government of Jharkhand. Such pendency of the renewal of the mining leases have certain adverse effects in taking investment decisions by the mine management for taking up further exploration and systematic development of the mines which in turn affects the conservation of minerals and protection of mine's environment in the area. Hence, the pending cases of renewal application of mining leases of the area need be sorted out expeditiously. (Action-Government of Jharkhand)

0.0.1.9.2 It was observed during the study that in a number of Iron mining leases the pits / quarries had attained considerable depth. But, separate and systematic benches in the overburden and waste materials could not be formed and proper height and width of the benches could not be maintained because of non-availability of surface right vis-à-vis broken area adjoining to the pits / quarries, mostly in forest areas for lateral extension of the pits / quarries. This has resulted in either unsystematic mining or premature abandonment of the workings in spite of existence of ore in the lateral directions or in depth. This aspect is required to be sorted out by the Forest Department in the interest of conservation of minerals and protection of mine's environment. In most of the leases, the targeted exploration of the approved mining plan could not be achieved for want of forest clearance. This aspect is required to be sorted out by the Forest Department in the interest of systematic & scientific development of mines. (Action: - Lessees & Department of Environment & Forest)

0.0.1.9.3 In number of mines, low-grade iron ore (Fe content below 50 %) from old waste dump are sold to the market. The same was not having any market prior to the year 2000. Even in some cases iron ore having Fe content below 45% are being dispatched by blending with higher grade. As a result, in almost all the non-captive mines, there is no sub-grade stock at all. Under the above situation, since the threshold value defines the lower limit of sub-grade ore and upper limit of waste, it is high time to re-fix the threshold value of iron ore since low-grade iron ore upto 45%Fe and even below it is presently marketed. (Action:- Indian Bureau of Mines)

0.0.1.9.4 The market of iron ore fines for export has slump with export duty rising to 30% of FOB value. There is hardly any export of low grade fines. Pellet manufacturing is highly capital intensive. Therefore Government may consider some tax rebate to pellet plants for use of the low-grade fines. (Action:- Indian Bureau of Mines)

0.0.1.9.5 In Lumshnong area, Jayantia hills, all the three Sylhet limestone members viz. Upper (Prang), Middle (Umlatadoh) and Lower (Lakadong) are present. As already mentioned in earlier chapter, as per established stratigraphy, the thickness of Prang limestone is ± 200 mtrs, Umlatadoh Limestone- 122 mtrs. & combined thickness of Lakadong sandstone & Limestone-192 mtrs. Due to the small lease area of all the limestone leases granted in Lumshnong sector, none of the limestone unit can be explored or exploited upto its full thickness. As such the mine will be abandoned leaving the limestone horizon at depth since there will be no further scope of development due to the space problem and traditional mining may continue in these abandoned

mines. This is a serious endanger to conservation and needs attention by Govt. of Meghalaya before granting any lease. (Action- SGPB-Meghalaya)

0.0.1.9.6 The Nangtra Limestone lease area of Lafarge Umiam Mining Pvt.Ltd. in East Khasi Hills district was explored by 2997.75 mtrs of core drilling in 41 nos. of holes (max. depth 128.00 mtrs., min. depth 30.15 mtrs.) at 200m X 100m grid. Limestone in the area is exposed at surface.

The limestone formation occurring over the area belongs to Prang Limestone unit (Thickness \pm 200 mtrs.), being the topmost member of Shella Formation. The base of this limestone member is not exposed in the present mining block. Further north beyond the present mining block, the Prang limestone is seen to rest conformably over a narrow sandstone member, about 20-25 mtrs. thick, designated as Nurpuh Sandstone in local litho-stratigraphic sequence. The Nurpuh Sandstone in turn conformably overlies a lower limestone member designated as Umlatodoh Limestone (Thickness \pm 120 mtrs.) which is exposed over the southern slopes of Nongtra hill lying further north of the area. At the south end of the block, the Prang Limestone beds are overlain by the shales and siltstones of Kopili Formation, the boundary between the two units being structurally disturbed and marked by an E-W trending fault.

Therefore the area requires exploration (drilling) at depth from 90 mRL (maximum drilling depth) to prove the base of Prang limestone and presence of Umlatodoh Limestone below Nurpuh sandstone unit. (Action:- Indian Bureau of Mines).

0.0.1.9.7 The Komorrah Limestone mine of Komorrah Limestone Mining Co. in East Khasi Hills district is having a lease area of 240.55 hect. The area is under operation since pre-independence. The Limestone is exposed in surface. But except some small pits and 7 nos. of bore holes for a cumulative meterage of 553.00 meters, no other exploration has been carried out. In this area, highly south dipping (50° - 60°) limestone beds belonging to the Upper Sylhet (Prang) and Middle Sylhet (Umlatodoh) members of Shella formation are encountered. The dip of the beds becomes gentler in the northern part of the area. The Upper Sylhet limestone member (Prang) is found in juxtaposition with the shales of the younger Kopili formation depicting a fault in the south of the lease area.

The area requires detailed exploration by deep drilling in a grid interval of 100mtrs. X 100mtrs. specially in the northern part of the area to prove the base of Prang limestone and presence of Umlatodoh Limestone unit. (Action:- Indian Bureau of Mines)

0.0.1.9.8 A detailed study of exploration carried out in the area by different agencies & field traverse of the area (Mawmluh Limestone mine of Mawmluh Cherra Cements Ltd) during inspection reveals that the deposit is of composite nature made up of limestone in the upper part and dolomite in the lower part. There is a transitional zone of dolomitic limestone in between. In the Mawmluh Hill, limestone occurs in the upper part followed by pure dolomite in lower part. Therefore, the lease area requires detailed drilling at depth to prove the existence of dolomite and estimation of reserve/resources of dolomite (Action:- Indian Bureau of Mines)

**REPORT ON REGIONAL MINING GEOLOGICAL STUDY OF CHROMITE MINES OF
SUKINDA VALLEY OF ODISHA STATE**

(Program Year 2012-13)

EXECUTIVE SUMMARY

1. The Regional Mining Geological Studies (RMGS) of Chromite Mines of Sukinda valley has been programmed during the year 2012-13. The purpose of the present study is as outlined as under:

- (i) to review the resource estimation as per UNFC system with notified threshold value as new cut off vis-a-vis exploration carried out and supplemented by feasibility study
- (ii) to explain and discuss the potential for establishing further continuity (both laterally and down dip) and further requirements of drilling (Core/DTH)
- (iii) exploration expenditure incurred/ proposed to critically assess the incremental increase of mineral reserve/resource by way of appointing geologist

The author has carried out MCDR inspections of twenty mines in three spells (i.e. 5-12.07.2012, 17-23.09.2012, 5-10.12.2012) with a view to ensure effective implementation of MCDR'1988 by pointing out violations observed and follow up for their compliance and at the same time, the data were collected to fulfil the main objectives of this study.

2. The Chromite resources in the world are of the order of 7,500 million tonnes, of which South Africa and Zimbabwe accounts for 73 % and 12.4 % respectively while India has merely 2.5 % of world resources. Our country is producing about 11 % of the world's production. The chrome ore was discovered in India in 1949 and its mining started at Sukinda Chromite Mine by M/S Tata Steels Ltd. for the first time in 1960. The First Chrome Ore Beneficiation plant (COBP) was also commissioned in 1990 by M/S Tata Steels Ltd.

The Sukinda Ultramafic belt, which contributes about 95 % of chromite reserves of the country, is located in Jajpur & Dhenkanal districts of Odisha. It occupies an area of 50 Sq. Km in Jajpur and Dhenkanal district. The area falls in the Survey of India Toposheet Nos. 73 G/12, 73 G/16 and 73 H/13.

The Sukinda Ultramafic Belt is confined to a NE-SW trending valley lying between the Daitari hill range in the north and the Mahagiri range in the south and extends from Tomka in the east to Kathpal in the west. The Sukinda Chromite Belt is 2-5 Km wide and 25 Km long.

RMGS OF CHROMITE MINES OF SUKINDA VALLEY OF ODISHA

(REG. OFFICE, BHUBANESWAR)

REPORT ON REGIONAL MINING GEOLOGICAL STUDY OF BAUXITE MINES OF
JABALPUR, KATNI, REWA, SIDHI & ANNUPUR DISTRICTS, MADHYA PRADESH

(Program Year 2012-13)

EXECUTIVE SUMMARY:-

As per the Annual programme for the year 2012-13, this Regional Mining Geological Study of cluster of 40 bauxite mines of Katni, Rewa, Sidhi and Annupur, districts of Madhya Pradesh (M.P.) were taken up for the RMGS. The bauxite mines of these districts are generally underlain by lithomarge clay, sandstone and overlain by siliceous/ ferruginous clay/ laterite and soil. Exploratory work has been done by owners itself by putting trial pits/ trenches and ultimately mineralized area has been converted into working pits. Bauxite occurs on the Upper Bhandar and Upper Rewa sand stone.

1) To review and high light all problems and prospects in the mining belt which impede the optimal development of belt with respect to the present status of exploration and development of belt and gaps therein with respect to monitoring and implementation of mining plans/ schemes.

Most of the bauxite mines are closed due to so many reasons such as many of the mine owners do not have approved MP/MS and environment clearance etc. Presently Mine owners who have no approved MP/MS, are being served notice against the violation of rule 12(3) and 13(1) simultaneous with suspension of mining activities under rule 13(2) of MCDR, 1988 by the IBM. State Govt. has also stopped the issue of pit pass to the mine owners which have either higher production than proposal given in production programme of MP/MS or have no Approved mining plan/ mining. So, to restart the mining activity, mine owners are advised to submit mining plan/ mining scheme/ modified due time.

2) To review the reserves position in the belt and identify the gaps of exploration while estimating the reserves/ resources under UNFC.

In the mines covered under the study,

During the inspection, it is seen there is not any significant gap in exploration. The detail ear-marking of reserves and grade has been done and given in a table form under chapter 7.00 as per the UNFC code.

The present production level of Bauxite for the last five years has been given in detail under chapter 9.2. This table shows the deviation between the proposed and

actual production. During the five years, some of the mines were marked for excess production of the Bauxite, for which the appropriate action has been initiated.

Although most of the mines were closed due to so many reasons and if all of them start working. There are total 54 bauxite mines in Katni, Rewa, Sidhi and Anuppur, districts of Madhya Pradesh (M.P.). Out of which 7 mines have recently closed due to falling under forest area.

3) To review the total generation of low grade and sub grade ore and waste as per the present market and supply scenario.

No sub grade is generated in any of the mines covered under the study.

4) To identify the problems related to scientific development of mines.

Bauxite of this area is mostly of alum, metal & refractory grade. Some owners are working with simultaneous back filling. Some owners have developed proper benches within ore and over burden. Some of the mine owners have started manual sorting and screening of dumps and back filled area owing to more demand of consuming industries. It is because of probably changed in advanced technology.

6) Violation and compliance position:

The violation and show cause notices were already issued to the party, some of which has been complied also. The details has been given in a table in chapter 12.0.

**REPORT ON REGIONAL MINING GEOLOGICAL STUDY OF FIFTEEN INDIVIDUAL
BAUXITE MINES / LEASES TO REASSESS THE RECOVERY PERCENTAGE OF SALEABLE
PRODUCT, FROM ROM IN BALARAMPUR, KABIRDHAM AND SARGUJA DISTRICTS OF
CHATTISGARH STATE, DURING PROGRAMME YEAR 2012-13.**

Abstract:

A project oriented mining geological study of bauxite mines in Balarampur, Kabirdham and Sarguja districts was taken up as a part of the annual programme (2012-13) of Nagpur Regional Office, Indian Bureau of Mines. In total there are 3 bauxite mining leases in force in Balarampur, 2 in Kabirdham and 10 in Sarguja districts respectively.

Total 15 bauxite leases comprising 15 numbers of mines were covered under regional mining geological studies in Balarampur, Kabirdham, Sarguja districts of Chhattisgarh state. This study consisted of five bauxite clusters namely Daldali, Barima, Kesra, Mainpat, Samri-Kudag-Tatijharia. Total area covered by 15 leases is 5199.284 Ha out of which about 162.15 Ha falls under forest land.

Out of the 15 bauxite mines covered under regional mining geological studies, only six were working mines and nine mines were non-working due to pending statutory clearances.

Some part of the study area being forest are affected by naxalite activity due to their remote location, but bauxite mining has given employment to the locals which brought all round development of these areas under CSR. Though mining has major impact on land degradation, but systematic work by the private companies engaged in mining of bauxite has benefited the locals beyond their imagination.

The result of recovery test carried out to assess quantity of saleable product, sub-grade material and the rejects at the selected leases under study area are –

| Sr. No. | State | District | Name of Mine | Name of Owner (M/S) | Area in ha. | Results of recovery test |
|---------|-------|------------|---------------|---------------------|-------------|---|
| 1 | C | Balarampur | Samri | Hindalco | 2146.746 | 57.93 |
| 2 | | | Tatijharia | Hindalco | 1218.762 | 52.94 |
| 3 | | | Kudag | Hindalco | 377.116 | 50.22 |
| 4 | H | Kabirdham | Bodai Daldali | Balco | 626.117 | 65 to 71 |
| 5 | A | | Daldali | Mahavir Minerals | 38.211 | Mine closed for no approved statutory document. |
| 6 | T | Sarguja | Mainpat | Balco | 639.169 | Mine closed for EC |
| 7 | I | | Barima | CMDC | 80.410 | Mine closed for no approved statutory document. |
| 8 | S | | Barima | CMDC | 11.705 | Mine closed for no approved statutory document. |
| 9 | G | | Kesra | CMDC | 4.900 | Mine closed for want of fresh tender. |
| 10 | A | | Barima | CMDC | 4.764 | Mine closed for want of fresh tender. |
| 11 | R | | Barima | CMDC | 4.610 | Mine closed for want of fresh tender. |
| 12 | H | | Barima | CMDC | 4.304 | Mine closed for want of fresh tender. |
| 13 | | | Kesra | CMDC | 20.34 | Mine closed for no approved statutory document. |
| 14 | | | Kesra | CMDC | 13.13 | Mine closed for no approved statutory document. |
| 15 | | | Kesra | CMDC | 9.00 | Mine closed for want of fresh tender. |

It is observed that the highest resource of bauxite is found in the district of Balarampur. Moreover the reserves have been reclassified under UNFC. Accordingly, major bauxite reserves estimated, falls under proved (111) category.

The mines have been developed by forming benches of average 2 – 4m height and 7 – 8m width whereas slope angles vary from 30-35°. The slopes are almost stable except in some mines where the thickness of bauxite horizon is more.

It is also observed that the economic mining depth for different mines varies from 3 to 6m (average) with stripping ratio's varying from 1:0.5 to 1:1.5.

While reviewing the aspect of overall future prospects in bauxite clusters, the life of clusters covered under the study can sustain for more than 15 years with the existing reserves at the present rate of production.

The yearly generation of sub grade material ranging from + 30 to 40% Al_2O_3 of the total production is utilised by blending with high grade ore for captive use or marketed directly.

ROM bauxite from the mines of BALCO in Kabirdham and Sarguja districts are transported to their alumina plant at Korba. The ROM bauxite from HINDALCO mine in Balarampur district is transported to their alumina plant at Renukut. The bauxite from CMDC mines area sold to BALCO and other buyers.

Partial backfilling in the worked out area is carried out by waste laterite. The study reveals that plantation of saplings as proposed in approved scheme of mining and mining plan documents are carried out for afforestation in the mined out areas.

As gathered from the company representatives, the amount of expenditure incurred on exploration by mining companies, is adequate.

REPORT ON REGIONAL MINING GEOLOGICAL STUDY OF CHINA CLAY, BAUXITE AND SILLIMANITE MINES OF THIRUVANTHAPURAM AND KOLLAM DISTRICTS OF KERALA STATE

Abstract: Regional Mining Geological Study (RMGS) of 24 number of china clay mining leases comprising of 87.1665 Ha (non-forest) in Thiruvanthapuram & Kollam Districts, two number of Bauxite mining leases comprising of 0.7237 Ha (non-forest) and 5 number of Sillimanite mining leases comprising of 558.3720 Ha (non-forest) located in Kollam District of Kerala state were covered under RMGS 2012-13. As per the revised guidelines of RMGS, the regional exploration already carried out by government agencies viz GSI, AMD and state DMG, Kerala in the study area are collected and reviewed. The exploration carried out by lessees after 01/04/2010 against proposals in approved MP/SOM are also reviewed in mine-wise. An incremental increase of 1,375,000 tonnes reserves and 82,500 tonnes resources of china clay have been assessed based on addition exploration carried out in 4 mining leases of china clay with exploration expenditure of 1.5 lakhs. There is no exploration in bauxite and sillimanite mines covered under study.

Considering UNFC field guide-lines and the review of exploration, already carried out in the region, it is noted that there is a huge gap in explorations. The required numbers of boreholes with grid pattern in China clay, Bauxite and mineral sand mines (Sillimanite) of Kollam and Thiruvananthapuram districts of Kerala covered under study have been assessed mine-wise. Accordingly, this office has requested the state DMG, Kerala regarding imposition of condition under Rule 27(3) of MCR, 1960 for implementation of exploration programme in mining lease as per time schedule prescribed by the Ministry of Mines vide their dated 23/12/2010. Subsequently, the DMG, Kerala, had directed all lessees in their state on 01/03/2013 to comply the instructions laydown by IBM and also imposing the condition under Rule 27(3) of MCR, 1960 for implementation of exploration programme while granting of mining lease.

The reserves of 8,751,340 tonnes & 6,006,443 tonnes of resources in China clay, 137,886 tonnes of resources in Bauxite and 1,224,354 tonnes of reserves & 733,258 tonnes of resources in sillimanite have been estimated under UNFC system as on 01/04/2012. Significant amount of mineral resources i.e. 4,333,508 tonnes of china clay were blocked within 7.5 m statutory safety zone, maintaining of proper of pit slope in china clay and safety distance from village/ Panchayat Road.

China clay, Bauxite and beach sand heavy minerals wealth of this region are located in densely populated and in other areas, Govt of Kerala has proposed IT related development activities in same mineral rich bearing areas. Therefore, in the interest of conservation of minerals, the state Govt. may explore the possibilities of allowing the mining of china clay with condition of backfilling the entire mined out area upto ground level within certain time frame work. Subsequently the techno-city and life science park could be established as per the state Government programme.

Kerala Beach sand mainly consists of Heavy minerals of 1) Ilmenite, 2) Rutile 3) Leucoxene 4) Sillimanite 5) Zircon and 6) Monazite. As per mineralogical study result and information collected from the lessees, the occurrence of Garnet in Kerala coast is in trace only. The percentage of heavy mineral in raw beach sand deposits decrease with increase in depth as well as further away from sea-shore. The mineral bearing sand lies between high and low tide area of beach is of replenishable nature due to tidal wave action of the sea. The review of production of heavy minerals for last 3 years and mineralogical study, it is noticed

that wt % of HM has been decreased considerably to 24 % in beach washing collection area as compare to 40 to 50 % during 1970 as per AMD report in beach zone. Further, it is reported and noticed during study that wt % of HM varies from place to place. Therefore, it is suggested that a scientific study by some Govt institution or dept. to be undertaken to assesses the quantum of reserves that could be reasonably considered under replenishable reserves annually.

During study the generation and utilization of sub-grade, waste and tailings are assessed with chemical analysis at our OD Lab. The processing units of china clay are utilizing the significant quantity of coarse sand tailings for construction purpose and fine sand tailings for back-filling of exhausted pits. The utilization of coarse sand tailings by mine owners was brought to the notice of the state DMG, Kerala on 23/10/2013 for suitable necessary action as per the provisions of relevant act and rules. Further, about 70 to 75% sand tailings generated in mineral separation plants of beach heavy mineral are being used for backfilling of exhausted pit.

Chennai Region:

**A REPORT ON REGIONAL MINING GEOLOGICAL STUDY OF LIMESTONE MINES IN
TIRUCHIRAPALLI & ARIYALUR DISTRICTS OF TAMILNADU STATE**

(Programme Year 2012-13)

As per Annual programme for the year 2012-2013, Regional Mining Geological study of the Limestone deposits of Thiruchirapalli, and Ariyalur Districts of Tamilnadu has been taken up. The Study area forms a part of the Cretaceous non – crystalline limestone exposed in these districts. The Limestone occurs in bedded form.

During the study it is examined that the quantum of exploration carried out and to be carried out in order to arrive at the reserves / resources as per the UNFC norms. However except five mechanized mines, other manual mines have not estimated the reserves as per the UNFC as the exploration carried out so far that are materially different or in compatible with UNFC standard. However some mines estimated UNFC reserves 111 by considering the existing depth reached in the present pit. Besides details about exploration agencies, expenditure on exploration, utilization of subgrade mineral, exploration committed in the MP/SOM, threshold value etc have been analyzed.

All the mines covered under the study are worked by open cast method. The mechanized captive limestone mines are forming regular benches of height ranging from 5 to 7.5 mts. The separate benches are formed in over burden and mineral in manual small mines also. The drilling and blasting is done by jackhammer drills / wagon drills, ANFO and slurry explosives. The mega rock breakers have been deployed in M/s Dalmia Bharat Ltd. instead of conventional method of drilling/ blasting for the exploitation of the limestone which helps in keeping the environmental parameters within permissible limits.

In most of the mines, boundary pillars are not fixed and also geo cadastral maps are not prepared in all the mines covered under study as per the recent circulars, as the agencies earmarked for preparing these maps are yet to be recognized by State Govt.

It is concluded that major quantity of Limestone produced in the area are mainly consumed in the manufacture of cement. The manual small mines are not finding market for selling their limestone to cement plants as all cement plants are having their own captive mines. As a result, small mines are intermittently worked and not maintaining their production schedules due to lack of demand. At the same time, some mines have produced excess quantity of production against their targeted production for which violation of MCD Rule 13(1) has been pointed out and sought the reason for the same.

**REGIONAL MINING GEOLOGICAL OF IRON ORE MINES OF SINDHUDURG DISTRICT
OF MAHARASHTRA STATE**
(Programme Year 2012-13)

1. Summary

- Total five iron ore mining leases of Sindhudurg district of Maharashtra were covered under Regional Mining Geological study among the which four leases are working and one lease is under closure. All the leases are privately owned and operated. The total area covered under study is 219.69 ha.
- The study area falls in Konkan region of Maharashtra, the konkanlaying between the Arabian sea and the sahyadri range in narrow coastal low land barely 50 km wide. The geological formation of the study area belongs to Dharwarian age and the iron ore formation is the extension of the Goa formation, the ore bodies are associated with Banded Haematite Quartzite, ferruginous quartzite and ferruginous phyllite which occurs mostly below thick covers of laterite.
- The mines covered under study belongs to three deposits of sindhudurg district, namely, Redi deposit, Sateli-Satarda deposit and kalane deposit. Among these Redi deposit is highly potential and major one.
- Exploration has been done in all the leases covered under study by Government agency like DGM, Maharashtra state and also by lessees through private agencies available in the area.
- The study areas have been explored by government agency namely Directorate of Geology and Mining, Govt of Maharashtra (DGM) and also by the lessees. The exploration is undertaken by core drilling. About 134 bore holes were been drilled for the total meterage of about 8634.7 m in the study areas out of which most of the bore holes are located in Redi area. Lessee have undertaken exploration by drilling about 243 boreholes for a total meterage of 13670 m. It has been observed Redi Mining lease owned by M/S Gogate has been explored in detail in terms of corehole numbers as well as total meterage. It is observed that against a proposal of 104 boreholes to be drilled in Mining plan and scheme of mining period about 96 boreholes were drilled. However data on expenditure on exploration is available in respect of 66 boreholes which have been drilled for a total meterage of 3084.73 m involving a total expenditure of Rs 50.56 lakh.
- The total reserves/resources estimated from leases covered under study as per the latest approved mining plan and scheme of mining is 16.805 million tons out of which about 12.462 million tonnes fall under reserve and 4.343 million tonnes under resources. The Redi Block contains more than 10 million tonnes of reserves / resources. The incremental in reserve/ resource has been observed in Redi iron ore mine (Block-1) of M/s Gogate and Kalane iron ore mine of M/s Metal & Minerals which is about 11.385 million tonnes and 4.67 million tonnes, respectively.
- The present mining method is by open cast method by forming benches and deploying heavy earth moving machineries like ripper dozer, hydraulic

excavators, wheel loaders and tipper trucks and dumpers, etc. The benches are systematically maintained by keeping 5-6m height and 9-12m width with an ultimate pit slope between 22 to 27°. The sub-grade ore is being blended with good grade ore to make it saleable. As such no subgrade stacks are available at mineheads. The waste rocks observed in the mines covered under study consist of soft and hard laterites, Phyllitic clay, manganeseiferous clay, siliceous clay, BHQ and schists. The iron content of the waste varies from 23 to 32%. On an average about 2.76 million tonnes quantity of the waste was generated during last five years. No wet beneficiation plant for the up-gradation of the ROM ore has been established by any of the lessees.

**REGIONAL MINING GEOLOGICAL OF MANGANESE ORE MINES OF VIZIANAGARAM
AND ADILABAD DISTRICTS OF ANDHRA PRADESH**
(Programme Year 2012-13)

SUMMARY OF THE STUDY

As a part Regional Mining geological study, the Manganese ore Mines of Vizianagaram and Adilabad districts of Andhra Pradesh were taken up during the annual programme year 2012-2013. The area of mines studied bounded by latitude $18^{\circ} 14'$ to $18^{\circ} 42'$ and longitude $83^{\circ} 13'$ to $83^{\circ} 33'$ in Vizianagaram district and latitude $19^{\circ} 40'$ to $19^{\circ} 45'$ and longitude $79^{\circ} 29' 06''$ to $78^{\circ} 29' 45''$ in Adilabad district. The Manganese deposits of Vizianagaram district forms part of the plain that boarder Eastern ghat hill ranges and is occupied by rocks of the Khondalite group (Garnet-Sillimanite- graphite-schist-gneissic -garnet ferrous Quartzites, calc Gneissic granulite etc), Charnockites, Migmatites (Garentiferrous Quartz-feldspathic brutile, granulite etc), Pegmatites and Quartzite veins. The reef bodies of Manganese ore are tabular lenses conforming to the enclosing highly weathered rocks. Individual ore bodies may range up to 70m length and maximum 50m in width . The principal ore minerals area supergene in nature and include Wad, Pyrusite, Cryptomelane and Jacobsite. The pre Cambrian sedimentary formation in Adilabad region has been classified as a part of Penganga group. Manganese deposit in Adilabad occurs in the form of replacement deposit. It is deposited as thin bands between the cracks and in cavitised within the Limestone bed. Manganese bed of about 40cm have been found to exists below the top Limestone bed capped by soil. The ore horizon is highly fractured and jointed. It is also interbanded with Cherts and jasper bands. Chert and Jasper bands are inter layered within the total horizon that its separation into pure forms is beyond question.

The total resources of Manganese in India as 01.04.2005 are placed at 378.6 million tones . Out of which 138.2 million tones are categorized as reserves and balance 240.4 million tones are remaining resources. Andhrapradesh contributes about 4% of Indian resources.

Mining operations in Vizinagaram district are carried out by other than fully mechanized method of mining and by use of manual labour for extraction of ore body. Due to huge generation of waste in many mines outside waste dumping have been done. In Adilabad district, the mines have been developed by manual method of mining. Due to shallow nature of the deposit, simultaneous backfilling of mined out areas are carried out.

The mine-wise entire resources of the study area have been categorized under UNFC and furnished as under: (0000'tonnes)

| 111 | 121 | 122 | 211 | 221 | 222 | 333 | Total in 000't |
|------|-----|-----|-------|--------|-------|---------|----------------|
| 3907 | 707 | 144 | 30.38 | 60.058 | 3.089 | 3104.24 | 7956.29 |

The life of the mines varied from 5 years to 187 based on proposed production and average production achieved during the proposed period. The recovery factor for estimation of resources have been considered varying from 40 to 95%. The recovery% considered is higher side in case of Adilabad district.

The production of Manganese ore in India has been on a growing trend with overall demand of for the ore increasing during the last few years. (000' tonnes) (Table) (Source: IMY, IBM, Annual Returns)

| Name | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 |
|---------------------------|---------|---------|---------|---------|---------|-------------|
| India | 2115507 | 2550560 | 2789025 | 2491950 | 2881080 | 2121886 (P) |
| A.P | 64352 | 141803 | 184552 | 260628 | 282876 | 293750 |
| %contribution w.r.t India | 3.04 | 5.55 | 6.61 | 10.45 | 9.81 | 13.84 |
| Vijayanagara m & Adilabad | 48762 | 99020 | 138347 | 202407 | 255729 | 281497 |
| %contribution w.r.t India | 2.30 | 3.88 | 4.96 | 8.12 | 8.876 | 13.26 |

In Vizianagaram district, in most of the mines have through mining over the years have gone deeper depth along dipping side of ore body. The ores being dipping about sub-vertical angle are deep seated substantial waste handling is done. The ores being deep seated, there is limited scope for simultaneous backfilling in mined out areas. In most

Regional Mining Geological study of Manganese mines of Vizianagaram and Adilabad districts of Andhrapradesh during the annual programme year 2012-13, Indian Bureau of Mines, Hyderabad Region

of the developed mines, waste are being dumped outside lease area in private pata lands.

YEAR-WISE WASTE GENERATION AND STRIPPING RATIO

| Year | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 |
|-----------------|---------|---------|----------|----------|----------|---------|
| Cubic meter | 2006837 | 2921249 | 18950675 | 35379933 | 49813619 | 1881079 |
| Tonnes | 48762 | 99020 | 138347 | 202407 | 255729 | 281497 |
| Stripping ratio | 41.15 | 29.50 | 136.97 | 174.49 | 194.79 | 6.68 |

Waste material in Manganese mines of Adilabad district consist of hard soil, murrum, siliceous Limestone and Chert & other gangue minerals within the Manganese ore zone. The waste generation is not substantial. Further, since Manganese ore body of only about 0.5m occur below which lower band of Siliceous Limestone occur, in most of the mines, simultaneous backfilling of the mined out land are carried out.

YEAR-WISE WASTE GENERATION AND STRIPPING RATIO

| Year | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 |
|-----------------|---------|---------|---------|---------|---------|---------|
| Cubic meter | 0 | 16491 | 25105 | 37566 | 33410 | 69740 |
| Tonnes | 7807 | 12708 | 9427 | 11596 | 10262 | 6873 |
| Stripping ratio | - | 1.29 | 2.66 | 3.23 | 3.25 | 10.14 |

Geological Survey of India has carried out extensive prospecting work in Manganese deposits of Vizianagaram and Adilabad districts of Andhra Pradesh. The nature of work carried consisted of geological mapping, sampling, drilling of boreholes in some selective areas, study of ore body characteristic and resources estimation based on exploration carried out. In Vizianagaram area, the Manganese deposits have been subdivided into seven blocks and in Adilabad deposit the exploration cativity were confined to one block.

In the study area in Vizianagaram district, total 86 trial pits, 20 trenches, 169 core drilling with depth varying from 7m to 66m with 207 DTH drill holes with total meterage of have carried out. 5442.95m. The depth extension of ore body based on exploration carried out is vaying from 8.75 to 54m. Similarly, the strike extension of ore body based on exploration carried out varies from 128m to 1200m. In Adilabad district mines, total 26 trial pits, 26 trenches, 48 DTH drill holes with depth range of 2 to 9m have been carried out. Based on exploration carried out depth extension ore body up to 3.5 to 8m have been established. The strike extension of 150 to 820m have been established.

In present time, with stringent application of field guide lines of UNFC, although systematic exploration in form of core drilling and trial pitting have been carried out on regular grid pattern following the UNFC parameters, there is no significant

augmentation of resources. The resources are estimated based precisely of exploration carried out on specified grid pattern and up to depth to which exploration has been carried out. Based on the above factors, in most of the cases practically there was no augmentation of resources. However, in few cases, there was augmentation of resources. **(Refer Annexure 10)**. It is observed that in Vizianagaram district additional exploration in form of 25 trial pits, core drilling of 153 boreholes have been carried out with an estimated expenditure of Rs 105.22 lakhs taking into consideration drilling cost varying from Rs 3500 to 4000 per meter of drilling. Based on this exploration carried out, an additional resources of 0.037 Million tones have been augmented.

In Adilabad district additional exploration in form of 11 trial pits with an expenditure of Rs 0.55 lakh have been carried out. As a result, total resources in the district have been augmented with additional resources of 0.0009 million tones. **(Refer Annexure 10)**

The resources are likely to be augmented in future since a number of documents submitted for approval in this office are under processing based on additional core drilling carried out

In Vizianagaram district, 267 core drilling have been proposed with grid interval varying from 25x 25m to 50x50m up to the ultimate depth of mineralization. The grid pattern for such vein / band type deposit depend on the width of the ore band. In case of ore zone with shorter band width, exploration should be intensive with grid pattern should be 25x 25m or closer depending on the band width. In case of Adilabad deposit, since the ore body occurs at shallow depth, trial pitting is sufficient to establish the ultimate depth of ore body. Therefore, total 91 trial pits at a grid interval of 200x100m has been suggested to cover the entire potentially mineralised zone under G1 scale of exploration.

Agencies carrying out exploration in the area have been listed. The list of pending PL/ML application have been discussed.

Recovery % and on field bulk density of Manganese ores from two mines of Vizianagaram district and one mine from Adilabad district have been carried out by collection of bulk samples from different benches followed by coning & quartering. The final sample so prepared was subjected to manual sorting & sizing followed by screening. The different fractions of screened materials are weighed separately and recovery% of saleable ores have been determined. Similarly, the volume of the area from where the samples were collected was determined by measurement and in combination with total weight of the materials so removed, bulk density of the material was determined. In one of the mines of Vizianagaram district, the recovery factor

was calculated to be to be 55% & bulk density was calculated as 2.66 tonnes / m³. In other mine of Vizianagram and about 100%. On field bulk density of removed ores was determined to be 2.72 tonnes/meter³. In case of one mine of Adilabad, recovery% of the ores was determined to be about 99% taking into consideration about 20% saleable ores.

During the study period, as a part of scrutiny of Mining Plan / Scheme of Mining, the lessees were advised to carry out mineralogical study, bulk density & recovery% study by any Government or NABL accredited laboratory. As a result, two mines have carried out detailed mineralogical study of ores alongwith bulk density and recovery% test by Andhra University.

The beneficiation process carried out by the lessees have been studied. In most of the mines in Vizianagram district, manual sorting, sizing and screening are carried out and the recovery of saleable ore was calculated to be 55%. In case of mine, where runoff mine ores are after screening through rotary screening are subjected to mechanical washing and jigging, with feed grade of 25-30% Mn, recovery% by grade is 15% of +35%mn, 20% of 30-35% Mn, 10% of 25-30% mn, 15% of 20-25% Mn and 10% of below 10% Mn. With feed grade of 20-25% Mn, grade recovery is 5% of +35%Mn, 10% of 30-35% Mn, 20% of 25-30% Mn, 40% of 20-25% Mn and 25% of below 20% Mn. The lessee has also a manganese sintering unit, where Mn ore of below 5mm and less than 20% Mn ore is fed, the weight loss is about 8% and grade enhancement is about 4%. In the study area Manganese Oxide Plant has also been installed in which, 5-40mm size with more than 25% Mn ores are fed, the weight loss is about 15% with grade enrichment of 8%. In case another mine, It is observed that with feed grade of about 25% with size range of 0-50mm, +25mm has weight recovery of about 16% with grade up-gradation up to 28% Mn. With same feed grade, 10-25mm fraction has about 44% weight recovery with Mn% increasing up to 31%. Mn ore of 3-10mm size has a weight recovery of about 20% with Mn% increasing up to about 27%. The slurry containing -3mm size has weight recovery of about 20%. with feed grade of 10-10mm size of 22-24% Mn grade weight loss is about 10% with grade enhancement up to 28-30% Mn.

As a result of beneficiation followed by sintering low grade ores up to 17% Mn are feedable. Advantage of sinering is the fines ors of low grade of about 20% Mn which are otherwise no saleable are fed to sintering plant with grade up-grdation up to 28-30% Mn with 10% igation loss. Based on above factors, the resources have been estimated with 17% Mn as cut off limit in such mines. Thus sub-grade varies from 10-15% Mn. Based on this .MCDR compliance status has been discussed. Recommendations and suggestion for SGPB/CGPB and department have been discussed.