Annexure-11

# BAILADILA IRON ORE DEPOSIT No. 4

## EXPLORATION REPORT

INVESTIGATION, RESEARCH & DEVELOPMENT DIVISION
NATIONAL MINERAL DEVELOPMENT CORPORATION LIMITED
HYDERABAD ( A. P. )

NOVEMBER, 1975

# BAILADILA IRON ORE DEPOSIT No. 4

## EXPLORATION REPORT

INVESTIGATION, RESEARCH & DEVELOPMENT DIVISION
NATIONAL MINERAL DEVELOPMENT CORPORATION LIMITED
H Y D E R A B A D ( A.P. )
NOVEMBER, 1975

## CONTENTS


| CHAPTER | | PAGE |
|---|---|---|
| I. | INTRODUCTION & OBJECTIVES OF STUDY | I-(1)-I-(11) |
| II. | GEOLOGICAL SET UP | II-(1)-II-(7) |
| III. | DESCRIPTION OF THE DEPOSIT | III-(1)-III-(3) |
| IV. | ORE TYPES | IV-(1)-IV-(6) |
| V. | ORE RESERVES & WASTE HANDLING | V-(1)-V(7) |
| VI. | CHEMICAL CHARACTERISTICS | VI-(1)-VI-(4) |
| VII. | ORE DRESSING TESTS | VII-(1)-VII-(11) |
| VIII. | STATISTICAL STUDIES | VIII-(1)-VIII-(3) |
| IX. | SUMMARY | IX-(1)-IX-(6 ) |

## LIST OF TABLES


| Sl. No. | Table No. | Description |
|---|---|---|
| 1. | 4.1 | Average grade of the ore types and their incidence. |
| 2. | 5.1 | Cross-Section-wise distribution of Ore Reserves. |
| 3. | 5.2 | Benchwise distribution of ore reserves. |
| 4. | 5.3 | Inside Waste tonnages in different benches. |
| 5. | 6.1 | Details of Ore Type-wise Reserves and Grade of Mineable portions of ore in different benches (Entire Deposit.) |
| 6. | 6.2 | Details of Ore Type-wise Reserves and Grade of Mineable portions of Ore in different benches (north Block) |
| 7. | 6.3. | Details of Ore Type-wise Reserves and Grade of Mineable portions of Ore in different benches (South Block) |

## LIST OF PLATES ( In separate volume)



| Sl. No. | Plate No. | Description | | Scale |
|---|---|---|---|---|
| 1. | 1 | Location Plan | | 1":1 mile |
| 2. | 2 | Topographic Plan | | 1:1000 |
| 3. | 3 | Geological Plan | | 1:1000 |
| 4. | 4 | Bore hole Grid Plan | | 1:5000 |
| 5. | 5A to L | Cross Sections | | 1:1000 |
| 6. | 6A | Plan of adit No.1 | | 1:100 |
| 7 | 6B | Plan of adit No.2 | | 1:100 |
| 8. | 7A | Slice Plan (1200 Mts) North Block showing mineable Ore portion | | I;1000 |
| 9. | 7B | -do- | (1188 mts) | " |
| 10. | 7C | -do- | (1176 mts) | " |
| 11. | 7D | -do- | (1164 mts) | " |
| 12. | 7E | -do- | (1152 mts) | " |
| 13. | 7F | -do- | (1140 mts) | " |
| 14. | 7G | -do- | (1128 mts) | " |
| 15. | 7H | -do- | (1116 mts) | " |
| 16. | 7I | -do- | (1104 mts) | " |
| 17. | 7J | -do- | (1092 mts) | " |
| 18. | 7K | -do- | (1080 mts) | " |
| 19. | 7L | -do- | (1068 mts) | " |
| 20. | 7M | -do- | (1056 mts) | " |

| Sl. No. | Plate No. | Description | | Scale |
|---|---|---|---|---|
| 21. | 7N | Slice Plan (1044 mts.) North Block showing mineable Ore portions | | 1:1000 |
| 22. | 7O | -do- | (1032 mts.) | " |
| 23. | 7P | -do- | (1020 mts.) | " |
| 24. | 8A | Slice Plan (1152 mts.) South block showing mineable ore portions. | | 1:1000 |
| 25. | 8B | -do- | (1140 mts.) | " |
| 26. | 8C | -do- | (1128 mts.) | " |
| 27. | 8D | -do- | (1116 mts.) | " |
| 28. | 8E | -do- | (1104 mts.) | " |
| 29. | 8F | -do- | (1092 mts.) | " |
| 30. | 8G | -do- | (1080 mts.) | " |
| 31. | 8H | -do- | (1068 mts.) | " |
| 32. | 8I | -do- | (1056 mts.) | " |
| 33. | 8J | -do- | (1044 mts.) | " |
| 34. | 8K | -do- | (1032 mts.) | " |
| 35. | 8L | -do- | (1020 mts.) | " |
| 36. | 9 | Plan showing the float ore areas of Eastern & Western Flanks of Deposit No.4 | | 1:5000 |

## LIST OF FIGURES


| | | |
|---|---|---|
| Fig. No.1-A | Regional Plan of Bailadila Range | 1:1 mile |
| Fig. No.1-B | Geological Plan of Deposit No. 4 | 1:5000 |
| Fig No.2 | Spatial distribution of Ore reserves : Bench-wise and Section-wise | |
| Fig. No.3 | Bench-wise distribution of Fe, $SiO_2$, $Al_2O_3$ with the respective averages. | |


## LIST OF ANNEXURES


| | |
|---|---|
| Annexure I | - Details of rain fall and temperature data at Deposit No. 4 |
| Annexure Ia | - List of Triangulation stations and their co-ordinates. |
| Annexure Ib | - List of bore holes drilled by N.M.D.C. at Bailadila Deposit No. 4 |
| Annexure II a&b | - Details showing estimation of Ore Reserves on the basis of sectional measurements of North & South blocks. |
| Annexure IIIa&b | - Details of Float Ore calculations of Eastern and Western flanks. |
| Annexure IV | - Distribution and Analyses of Ore Types based on Borehole data |

# CHAPTER - I

## 1.1 INTRODUCTION:

Bailadila Range of Bastar District in Madhya Pradesh is well known for its content of vast reserves of Iron Ore distributed into fourteen deposits. Some of the deposits are known to possess the richest concentration of Iron in the World.

National Mineral Development Corporation has already developed a highly mechanised mine at Deposit No.14 for export to Japan.

Another mine at Deposit No.5 is at an advanced stage of development. At present the entire system of Deposit No.5 mine has been designed to handle 6 million tonnes of R.O.M. ore to yield about 4 million tonnes of sized ore per annum with a provision for an increase in handling capacity. Presently Lump Ore production from Deposit No.5 and Deposit No.14 mines is totally committed for export to Japan in pursuance with the long term agreement. Government of India have now decided to set up a Steel Plant at Visakhapatnam based on iron ore from Bailadila. The capacity of the plant is expected to be 3.2 million tonnes of ingot steel per year requiring about 5.3 - 5.5 million tonnes of iron ore per year of which about 2.1 million tonnes would be lump ore.

contd....2/-

Additional source to supply this ore from Bailadila is therefore, imperative.

1.2 Deposit No.4 is situated in the Northern continuity of Deposit No.5. So, downhill conveyor, screening and loading facilities of Deposit No.5 can possibly be utilised for handling Deposit-4 mine ores when its handling capacity is increased or modified suitably. The crushed ore from Deposit-4 can be brought to primary surgepile near the mouth of the tunnel and conveyed with ore. ore of Deposit-5 through the downhill conveyor in tunnel of Deposit-5 mine to Bacheli (this has a capacity to handle about 10 m.t. of crushed ore per annum, and this can handle 4 m.t. of ore from Deposit-4 in addition to projected 6 m.t. of Bailadila-5 Ore), where screening and loading facilities on suitable modification and expansion can be used and this would be an important factor in reducing the cost of production of ore from Bailadila complex.

Deposit-4 thus can be taken up for supplying the ore requirements of Visakhapatnam Steel Plant. With a view to develop Deposit No.4 into a mine, National Mineral Development Corporation took up the detailed geological exploration at Deposit No.4, to establish the distribution pattern of the ore and its chemical and physical characteristics. It may be mentioned that no initial exploration was carried out on Deposit No.4 prior to

contd....3/-

N.M.D.C's taking up of exploration work.

1.3 The geological exploration of Deposit-4 was taken up in November, 1968. The scheme was sanctioned by Government of India, at an estimated cost of Rs.12.50 lakhs, vide letter No.5/24/67-M.VI dated 21.3.1968 of Ministry of Mines and Metals. With the Government decision to set up a Steel Plant at Visakhapatnam, the exploration scheme of Deposit No.4 was intensified. Govt. thereafter approved the revised scheme of exploration at a cost of Rs.40.97 lakhs (including 12.50 lakhs vide above sanctioned letter). An interim exploration report incorporating results of the work was prepared in April '73.

In order to carry out further investigation and prepare the Detailed Project Report, in addition to Rs.40.97 lakhs, Board of Directors approved Rs.77.97 lakhs in their 146th Meeting held on 24.7.1973.

Against the total sanction of Rs.118.94 lakhs on detailed investigation of Deposit-4, the total expenditure since the commencement of the work upto 31.3.1975 was Rs.105.56 lakhs.

N.M.D.C. has completed all geological exploration works. Some engineering studies and tests required in connection with preparation of D.P.R. are yet to be completed. Some expenditure are thus yet to be incurred.

contd....4/-

1.4 LOCATION:

Deposit No.4 is situated just to the North of Deposit No.5 on the Western ridge of Bailadila Range and is flanked by Galli Vally to the East coming down from the top of the ridge to 300-400 metres and in the west the deposit overlooks the rolling plateau of Bastar below a height of 600 metres.

The deposit can be approached from Raipur or Visakhapatnam by National Highways upto Jagadalpur, which is connected to Bhansi or Bacheli by all weathered road (State Highway) leading to Kirindul (Plate-1). From Bhansi, Deposit No.4 can be approached by jeepable road via Maharaja of Bastar's Guest House (distance from Bhansi 14 Kms.); and from Bacheli, Deposit No.4 can be approached by a newly constructed road via Deposit 5 (Distance 27 Kms.).

1.5 METEOROLOGICAL RECORDS:

At Deposit No.4 the rainfall and temperatures were recorded since 1969. The maximum rainfall recorded in a year is 492 Cm. and lowest 264 Cms. with average of 350 Cm. (Annexure-I).

Contd....5/-

The lowest minimum temperature recorded is 2.0° C. in the month of December/January, the highest maximum temperature recorded is 42°C in the month of May. The daily variations of temperatures are 12°C, in rainy season 25°C in winter and 18°C in summer.

1.6 Exploration by N.M.D.C.

Prior to N.M.D.C. exploration, no exploration was done at Deposit No.4. The initial geological work of Deposit 4 was started in November, 1968, followed by detailed exploratory works subsequently. The works carried out were as follows:-

1.6.1 Surveying:

An area of 3 Sq. Km. was completely surveyed and a topographic map on 1:1000 scale with 2 metres contour interval was prepared (Plate-2). Survey was done by triangulation and techeometry, carrying over the reduced level from the Deposit No.5 and fixing a main base line A-A1 and two check lines A-46 - A47 and A.122-A. 124. In order to keep the uniformity with Deposit 5, the central axial line of Deposit 5 was extended upto CS 36 in Deposit 4 and was deviated to 153° 33' for the rest of the length. Cross-sections

contd.....6/-

have been laid at 125 metres strike interval (same as at Deposit 5)and have been serially numbered from CS 31 to 36 and CS 37 to 62 from South to North (CS 30 being the last CS at Deposit 5). The bearing of Central axial line is N-40° from CS 31 to 36 and CS 37 to CS 62 is N 13° 30'. The bearing of CS lines from CS 31 to 36 N 103° 130 and from 37 to 62 is N 103° 30'. The location of pits and boreholes and other stations were fixed with the help of triangulation. The list of the triangulation stations with their coordinates and R.Ls. are in the Annexure-I(a).

1.6.2 Geological Mapping:

Initially Geological mapping on a scale of 1:4000 was done to bring out broad feature of ore boundary, ore types and structure. It was followed by detailed mapping of an area of 2.2 Sq. Km. on a scale of 1:1000 by delineating the ore types, intercalations, plotting of all structural elements and contacts of ore body with BHQ or Shale more clearly. The geological plan on 1:1000 scale has been reduced to scale of 1:5000 for the purpose of further planning of exploratory schemes etc.

1.6.3 Pitting:

Pitting was done mainly for two purposes. A total of ~~83~~ 95 shallow pits with depths varying from 2 to 5

contd....7/-

metres have been done dispersed over the entire area in soil covered areas to expose the hard rock or to demarcate the ore boundary with waste rock or boundaries of different types of ore types. Secondly, deep pits varying in depth from 5 to 11 metres were made in different ore types to know the physical characteristics of ore.

1.6.4 Core Drilling:

Core drilling was done to know the behaviour and depth extention of the ore body. It was started in March 1969 but intensified from February, 1971. In the first phase the locations of the boreholes were planned on 125 m x 125 m. grid pattern and in second phase at 62.5 metres interval (Plate-3). A total of 6085.65 metres drilling has been completed in 81 boreholes at Deposit No.4. The summary of the borehole particulars are given in the Annexure-I(b). Besides the above quantum of drilling, additional drilling would be, however, necessary for detailed mine planning and for quality control purposes.

1.6.5 Aditing:

A total of 400metres aditing was done in two adits. Adit No.1 was driven on Cross-section No.41 at the R.L. of 1101 metres. from Eastern side, for

contd...8/-

170 metres and 30 metres on the western slope at same level. The major length had been in soft and collapsing formation which prevented making the adit through. Adit No.2 was driven on CS 56 at the R.L. of 1140 from western side for a length of 200 metres. Mapping of the adit walls was done on a scale of 1:100 scale (Plate No. 6 A&B). Individual blasts were sampled for size and chemical analysis of different fractions. Bulk samples for ore dressing and metallurgical tests were drawn from these adits as given in the detail elsewhere.

1.6.6 Chemical Analysis:

1. Drill Cores:

The core as well as the sludge samples have been analysed for Fe, $SiO_2$, $Al_2O_3$ and LOI for each type run. Few samples were analysed for FeO, P and S contents.

2. Adit Samples:

Besides channel samples along the wall of the adit, at every one metre interval, fractional samples of the blasted ore after screening at various sizes have been analysed.

contd....9/-

1.6.7 Preparation of Plans:

The geological cross-sections at 125 metres interval have been prepared on the basis of the available data. Based on the borehole data and available geological informations, tentative bench slice plans have been drawn for 16 benches (on 12 metres interval) showing the types of ore, grade and mineable ore portions.

1.6.8 Collection of Bulk Samples for Batch Scale and Pilot Plant Tests:

As a part of investigation, bulk samples were drawn for each type of ore for ore dressing tests. Ores of each type have been collected from different places so as to get the representative distribution of each ore type. All the type ore samples have been collected by blasting at selected spots. Bulk samples have been collected in two different stages. In the first stage a total of 104 tonnes of primary samples for batch scale tests have been drawn for all types of ore. The quantity of each types of ore have been coned and quartered. Out of 4 tonnes of final sample of each type of ore prepared, two tonnes each were sent to Research and Development Laboratory, N.M.D.C.,

contd...10/-

Hyderabad and two tonnes each (except flaky ore and Blue dust) to National Metallurgical Laboratory, Jamshedpur for batch scale tests. In the second stage, a total of 560 tonnes of primary samples have been drawn for all types of ore for pilot plant studies. Representative samples of each type of ore sent to N.M.L. are as follows:-

| | |
|---|---|
| Steel Grey Hematite | 30 tonnes |
| Blue Grey Hematite | 28 tonnes |
| Laminated hematite | 42 tonnes |
| Lateritic & Limonitic Ore & | 32 tonnes |
| Flaky Ore & Blue Dust | 68 tonnes |
| Total | 200 tonnes |

1.6.9 Ore Dressing Tests:

Ore dressing tests were carried on type samples at N.M.D.C's R & D Laboratory, Hyderabad and at N.M.L. one composite sample was also tested at R & D Laboratory. Pilot Plant tests are yet to be completed by N.M.L.

1.7 EXPLORATION OF FLOAT ORES:

Float ores at Deposit 4 occur on eastern (Galli Valley) and western flanks. The float ores have been explored systematically by putting pits on a grid pattern in both the areas. A total number

contd...11/-

of 80 pits were put on western flank in a grid pattern to work out the aerial extent, depth and concentration of float ore. Similarly, on the eastern flank a total number of 50 pits were put in a grid pattern(Plate No.9).

1.7.1 Scheme of Exploration:

Float ore areas both on eastern and western slopes were mapped with traverses. Pitting was done on a grid of 125 m x 100 m. on an area between CS 50 and 54 on eastern flank and between CS 59 and 60 on western flank and on a grid of 125 m x 200 m. in the rest of the area. There are also extensive pockets of float at the foot hills of western flank, which require exploration to be done.

The present report summarises the results of the above works.

# CHAPTER - II

## GEOLOGICAL SET UP

2.1 A. Regional Geology:

Previous Works:

The earliest mention about the occurrence of Iron Ore in Bailadila Range was made by Mr.P.N.Bose in 1899. Mr. Crookshank and Dr. P.K. Ghosh of Geological Survey of India, mapped the area on 1" = 1 mile scale (Fig.1-A) in 1934 and Dr. Crookshank's paper on Bailadila Iron Ore Deposits was published in 1938 whereas the G.S.I. memoir by him was published in 1965. Heron (1946), I.B.M. (1960 and onward) and N.M.D.C. Limited have also proved the ore reserves of some of the deposits of Bailadila ranges. Dr.A.K.Chatterjee (1964-65) published details on mode of occurrence, and petromineralogy of Iron Ores in the range.

2.1.2 Regional Geology:

The Rock of Bailadila Range belong to "Bailadila Iron Ore Series", which correspond in age closely to Iron Ore series elsewhere in India, e.g., Singhbhum, Mysore areas. This series overlies Bengpal series with metabasaltic traps and tuffs intervening and is followed up by Granites and Gniesses (with

contd....2/-

Basaltic lavas and doleritic intrusions). The Bailadila series is sub-divided into:-

Sub-recent laterite
Iron Ores } Iron formation
Banded Iron formation }
Ferruginous shales/or phyllites, tuffs and cherts
White quartzite and locally conglomerates.

2.1.3 The Iron formation rocks are predominantly of oxide facies and can be grouped into 4 main types.

2.1.4 Fine-banded type:

This type has got very fine bands of hematite and quartzite, the thickness of each band varies from a fraction of a mm to maximum of 1 mm, they are mostly cherty give rise to compact laminated hematite ore after enrichment.

2.1.5 Coarse-banded type:

These constitute coarsely banded hematite quartzites. The thickness of silica band varies from 1 mm to 6 mm and at times upto 1 cm. The intervening iron content bands varying in thickness from 1 to 3 mm. The silica bands contain grains of hematite and hematite band contain chert grains. They give rise to laminated hematite after enrichment.

contd....3/-

2.1.6 Cherty metallic iron formation consist of metallic hematite and chert without any trace of banding. The grains are of very fine to medium sizes. They often give rise to steel grey hematite or Blue Dust.

2.1.7 Minor rocks of silicate composition are also seen Iron silicates like minnesotaite, stilphomelane, have been reported, along with some intraformational conglomerates. They have not been enriched much.

2.1.8 <u>Enrichment of Ore</u>:

Enrichment of Iron Formation rocks resulted in formation of Iron Ores, by one of the following ways:-

1. Substitution of Iron for Siliceous material carried by water.
2. By leaching out of silica and followed by consolidation and/reconstitution of remaining iron with or without significant replacement of silica by Iron.
3. Enrichment of shales by process of lateritisation.

2.1.9 <u>Regional Structure</u>:

Crookshank recognised two synclines and an anticline for the two ridges and valley respectively. These have been effected by later cross-folding. The main folds are asymetrical and in general overturned

contd.....4/-

with N.S. trend and axial plane dipping steeply eastwards. The folds close to the south in the southerly ridges of Deposit No.13 and 14. The dips vary from $45^{\circ}$ to subvertical, the fold geometry has become complicated because of super-imposition of two sets of later folds - a) Easterly trending and b) N.Wly trending.

The regional trend of strike is nearly N-S with steep easterly dip, swinging a few degrees away from vertical to both east and west wards.

2.2 Geology of Deposit No.4:

2.2.1 Stratigraphy:

Deposit No.4 is situated in the North of Deposit 5 and south of Deposit No.3.

The geological succession at Deposit No.4 is shown below:-

Soil cover and laterite
Iron Ores ) Iron formation
Banded Iron formation )
Ferruginous shales/slates, tuffs & cherts
White quartzite and conglomerates.

2.2.2 Quartzite and conglomerate bed:

Conglomerate bed consisting of rounded pebbles and cobbles of quartzite, hard slate and subordinate

contd....5/-

quantity of trap-rocks are exposed to the south of the divide point as well as along the Southern extremity of Deposit No.4. Quartzite and Ferruginous sandstone are exposed along the eastern flank in the gully nallah cuttings.

2.2.3 Ferruginous shales and slate:

Pink and purple coloured (at places white) shale and slate are exposed on the entire eastern flank of the deposit. The shale has given rise to laterite and Kaoline at places. The shales often grade to tuffs and some are definitely altered variants of tuffs.

2.2.4 Iron Formation:

Following types are found in the area;-

i) Coarse, wavy and crenulated banded hematite quartzite.

ii) Fine-even banded hematite/magnetite quartzite

iii) Magnetite-quartzite without clear banding.

They are exposed on western flank of the hill. They strike N - N. 15$^{O}$E in the northern parts and swing to N 35$^{O}$E to NE - towards the southern end. Exposure of the B.H.Q. at places - is attributed to faults which

contd.....6/-

brought the BHQ/J in juxtaposition to enriched iron ores.

The enrichment of Iron formation has caused the ore deposition, the type of ores depend on original rock from which enrichment has taken place, degree of enrichment, and later lateritisation etc.

2.2.5 Structure:

The ridge of the Deposit No.4 is forming a syncline. The structural features are as shown below:

| | |
|---|---|
| 1. Dip & Strike:- | Strike varies from N-S to N 15°E-S 15°W for the entire area except for the Southern part where it changes to N 35°E - S 35°W to NE-SW the dip is invariably steep between 60° to 85° dipping east with certain exceptions to west due to wavy nature. |
| 2. Folding:- | Deposit No.4 occupies the western ridge which itself form a synclinal structure. Two prominent directions of minor fold axis are seen. One N 80°E and the other S 40°E with a plunge of 75° to 80°. These represent later folds. The main regional N-S trending fold-axis is not well represented in minor structure. |
| 3. Faulting:- | The ore body is dissected by 4 sets of faults which have resulted in shifting the ore body. The prominent directions are N 20°E, N 80 E to E-W and N 40°W. Most of these faults have been traced. The faults have led to change in ore types. Large incidence of Flaky Ore and blue dust may partly be ascribed due to direct or indirect effects of these faults. |

Apart from these some sympathetic faults are also found. Brecciation and secondary silicification can be noticed along many faults.

# C H A P T E R - III

## DESCRIPTION OF THE DEPOSIT

3.1 GENERAL:

The ore body in Deposit No.4 occurs as Northern continuation of Deposit No.5, separated from Deposit No.5 by a narrow parting of about 150 metres of laterite and poorer lateritic ore. On the northern side Deposit No.4 is separated from Deposit No.3 by a parting of unenriched banded hematite quartzite.

The Deposit No.4 is 4.4 Km. in length. The ore body can be divided into two blocks which are separated by unenriched BHQ at cross-section No. 45. The northern block has a strike length of 2.2 Km.(i.e.) from CS - 46 to CS - 62 and the southern block has a strike length of 2.1 Km. (i.e.) from CS - 31 to CS -45. Out of 2.2 Kms. of length of north block the main ore zone occupies 2.00 Kms. and out of 2.1 Km. length of south block the main ore zone occupies 1.5 Kms. and the rest is occupied by lateritic ore at the two ends of the Deposit (Fig.No.1B).

3.2 ORE BODY:

The ore body occurs along the top of the ridge and is characterised by narrow width, which varies from 250 metres to a minimum of 80 metres.

contd...2/-

The deposit is bounded by a deep valley on western side and Galli nala on eastern side. The ore extends to a maximum of 130 metres in depth. The deposit becomes shallower in depth on eastern side. The eastern flank of the deposit is mostly covered by laterites and Canga. Small cliffs composed of hard massive ores occur on the western side of the deposit. Western boundary is often marked by sharp contacts against the BHQ. The general strike is N - S with easterly dip. The amount of dip varies from $40^{\circ}$ to $80^{\circ}$. The deposit has a general synformal structure. The ore body is however, disturbed by several faults of oblique and transverse in nature. Most of these faults have been traced on the geological plans prepared. The ore body is also characterised by cross-folding.

Because of cross-folding the width of the ore body at places is wider and narrower and the bottom configuration also gets quite corrugated. Folding and faulting has resulted in fragmentation of the ore making it more friable.

3.2.1 The nature and behaviour of the ore body in different sections is reflected in the detailed geological plan (Plate-3) and cross-sections. (Plate-5A to 5L).

contd.....3/-

3.2.2 Float Ores:

Besides the main deposit large quantity of float ore occurs on eastern and western slopes of the deposit. The float ore is of high grade on western side compared with the eastern side.

3.3 BOUNDARIES OF ORE BODY WITH OTHER ROCK TYPES:

3.3.1 Ore BHQ Contact:

BHQ occurs against ore body at the northern extremity as well as on the western slope. Besides small isolated BHQ outcrops are also located inside the deposit. The ore changes to soft leached BHQ and then to hard BHQ in depth as observed in the boreholes.

3.3.2 Shale Contact(tuff?):

Shale or lateritised shale in general occupies the eastern part of the ore body. The boreholes located in the eastern side of the deposit are bottommed by shale/tuff. The shales on the eastern side are lateritised and at some places capped by low grade ore-outcrops.

3.3.3 BHQ within the Ore Body:

BHQ bodies of various dimensions occur as continuous or discontinues bands/lenses/patches at different places within the ore body(Some of these BHQ are unleached BHQs). These may possibly be considered as parts of unenriched ramnants of present iron formations.

# CHAPTER - IV

## ORE TYPES

4.1 **Ore Type Grouping:**

4.1.1 Ore types recognised during the geological mapping and core logging are incorporated in the plan. These types showed different physical properties ranging from hard compact to friable ores and sandy blue dust and also variation in chemistry. Based on physical and mineralogical properties(easily distinguishable megascopically) the ores in Deposit No.4 have been grouped in five dominant types.

4.1.2 **Ore Types:**

The ore types of Deposit No.4 are as follows:-

| | |
|---|---|
| Type I | Steel Grey hematite |
| Type II | Blue grey hematite |
| Type III | Laminated hematite |
| Type IV | Lateritic & Limonitic Ore |
| Type V | Flaky Ore & Blue Dust. |

Besides the physical characteristics, Fe content of the ore types is also considered as one of the factors in the above grouping.

4.2 **Incidence:**

Tentative slice plans have been drawn up to mineable bottom limit of 1020 mts. Based on the

contd.....2/-

Table - 4.1

Table showing average grade of the Ore Types and their incidence

(Qty. in million tonnes)

| Type | NORTH BLOCK | | | | % incidence | SOUTH BLOCK | | | | % incidence | OVERALL | | | | Overall % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Quantity | Fe % | $SiO_2$ % | $Al_2O_3$ % | | Quantity | Fe % | $SiO_2$ % | $Al_2O_3$ % | | Quantity | Fe % | $SiO_2$ % | $Al_2O_3$ % | |
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. | 16. |
| I Steel grey hematite | 5.976 | 67.05 | 0.64 | 1.19 | 9.50 | 6.159 | 66.52 | 1.77 | 1.56 | 13.60 | 12.135 | 66.78 | 1.21 | 1.38 | 11.20 |
| II Blue grey hematite | 8.671 | 67.26 | 0.71 | 1.02 | 13.80 | 3.676 | 66.05 | 2.42 | 1.04 | 8.10 | 12.347 | 66.89 | 1.22 | 1.03 | 11.40 |
| III Laminated hematite | 17.004 | 64.68 | 1.60 | 2.57 | 27.10 | 10.384 | 64.67 | 1.23 | 2.61 | 23.00 | 27.388 | 64.67 | 1.46 | 2.58 | 25.40 |
| IV Lateritic & Limonitic Ore | 2.039 | 58.73 | 2.39 | 5.72 | 3.30 | 2.023 | 59.15 | 2.03 | 5.23 | 4.50 | 4.062 | 58.94 | 2.21 | 5.48 | 3.80 |
| V Flaky Ore & Blue Dust | 29.071 | 66.45 | 2.38 | 0.92 | 46.30 | 22.955 | 65.75 | 2.82 | 1.11 | 50.80 | 52.026 | 66.13 | 2.57 | 1.00 | 48.20 |
| Total | 62.761 | 65.89 | 1.78 | 1.56 | - | 45.194 | 65.34 | 2.24 | 1.69 | - | 107.955 | 65.65 | 1.97 | 1.62 | - |

borehole as well as other geological data, ore blocks have been made typewise and gradewise. The overall incidence and average grades of the ore types have been computed on this basis. Table 4.1 summarises these results.

4.3 Description and Occurrence of Ore Types:

4.3.1 Type-I - Steel Grey Hematite:

It is very hard compact and steel grey in colour. Generally it has a massive appearence and does not show any laminations. Steel grey hematite is closely jointed with fillings of chert and limonite along the joints. This type is exposed on the western side of the deposit and also in the cliff. The incidence of ore type as worked out from the slice plan is 11.20%. Accordingly, the total quantity of steel grey hematite works out at 12.135 million tonnes. The average grade of the ore type worked out from slice plan is as follows:

| | |
|---|---|
| Fe | 66.78 % |
| $SiO_2$ | 1.21 % |
| $Al_2O_3$ | 1.38 % |

contd....3/-

4.3.2 Type-II - Blue Grey Hematite:

It is also quite hard and massive in nature. It is less hard compared to steel grey hematite. Sometimes this type of ore is characterised by laminations. Blue grey hematite is persistent in depth and is mostly exposed on the cliff.

The incidence of ore type as worked out from slice plans is 11.40% and thus the total quantity works out to 12.347 million tonnes.

The average grade of this type as computed from slice plans is as follows:-

| | |
|---|---|
| Fe | 66.89% |
| $SiO_2$ | 1.22% |
| $Al_2O_3$ | 1.03% |

4.3.3 Type-III - Laminated Hematite:

Laminated hematite is characterised by close laminations. Laminated ore has undergone much alternations. and the inter laminae are often filled with laterite and limonite. This ore type is soft and breaks along the lamination planes. It is quite common(next only to blue dust-flaky ore) and is exposed throughout the deposit.

The incidence of ore type as worked out from slice plans is 25.40% and the total quantity thus

contd....4/-

estimated is 27.388 million tonnes. The average grade worked out from the slice plan is as follows:-

| | |
|---|---|
| Fe | 64.67% |
| $SiO_2$ | 1.46% |
| $Al_2O_3$ | 2.58% |

4.3.4 Type-IV - Lateritic & Limonitic Ore:

Alteration of the hematitic ores have resulted in lateritic and limonitic ores. This type occurs on the surface and slopes of the deposit. The incidence of this type of ore is much less. It is dark brown to yellow in colour with goethite and hematite in varying proportions. This type is low in Fe content with high alumina. The incidence of this ore type as worked out from the slice plans is 3.80%. The quantity of ore is estimated at 4.06 million tonnes. The average grade of the ore worked out from the slice plan is as follows:-

| | |
|---|---|
| Fe | 58.94% |
| $SiO_2$ | 2.21% |
| $Al_2O_3$ | 5.55% |

4.3.5 Type - V - Flaky Ore & Blue Dust:

It is bluish grey in colour. This type is very loose with fine and coarse grains of hematite and

contd....5/-

occasional hematitic flakes. At shallower depths flaky ore content is more whereas in depth it becomes more powdery and sandy. Along CS 41 and a few other places, this type crops out on the surface also. Barring the cliff zone, the ore in general is constituted of this type. This type is the major constituent in the deposit. The incidence of this ore type as worked out from slice plan is 48.20%. The quantity of this type is estimated at 52.026 million tonnes. The average grade of flaky ore and blue dust is as follows:-

| | |
|---|---|
| Fe | 66.13% |
| $SiO_2$ | 2.57% |
| $Al_2O_3$ | 1.00% |

4.4 Microscopic Characters of the Ore Types:

The microscopic characteristics of the ore types have been studied and a separate report has been prepared by R & D Division. (Beneficiation Studies with Iron Ore samples from Bailadila Deposit No.4).

The major ore minerals present are hematite, goethite followed by very minor amounts of magnetite and traces of lepidocrocite and rarely pyrite. Most of the first generation hematite present was martite in nature. Alternate bandings of hematite and

contd.....6/-

goethite indicated initial compositional variation. A second generation hematite was formed due to dehydration of primary goethite. This latter hematite displays much stronger blood red internal reflection than earlier generation martite. Relict magnetite grains are visible in sections studied. Yellow ochre, lateritic and siliceous minerals form the gangne.

4.5 Based on the borehole data the incidence of types of ores and their average grade are summarised below:

| Ore Type | | Incidence % | Average Grade Fe% | $SiO_2$% | $Al_2O_3$% |
|---|---|---|---|---|---|
| I. | Steel grey hematite | 12.05 | 67.23 | 0.99 | 1.12 |
| II. | Blue grey hematite | 9.80 | 67.72 | 0.77 | 0.90 |
| III. | Laminated hematite | 23.15 | 64.95 | 1.89 | 2.19 |
| IV. | Lateritic & Limonitic Ore | 5.90 | 58.47 | 2.57 | 6.08 |
| V. | Flaky Ore and Blue Dust | 29.35 | 65.96 | 3.19 | 0.93 |
| | Total | 100.00 | 65.53 | 2.14 | 1.69 |

Distribution and analyses of ore types in each borehole are at Annexure No. IV.

# C H A P T E R - V

## ORE RESERVES AND WASTE HANDLING

5.1 Method of Estimation:

The calculation of ore reserves of Deposit No.4 has been done on cross-sectional basis as well as on the basis of bench slice plans.

5.2 Sectional Estimation:

Geological cross-sections have been drawn at 125 metres strike interval. The area of ore body (and also ore-types) was calculated by graphic method and volume obtained by assuming the cross-section interval or the influence of the ore types of the section concerned. Wherever the ore body is pinching and/or the section is represented by waste, the influence of that section is suitably changed or omitted for calculation of the ore reserve (Annexure-III-a&b).

5.2.1 Tonnage Factor:

Specific gravity of different types of ores have been determined in the laboratory. Based on the results and after giving due consideration for porosity and joints etc., the tonnage factor(tonnes per Cu.metre) of the ore types arrived are as follows:

contd....2/-

| | | |
|---|---|---|
| 1. | Steel Grey hematite | 4.2 |
| 2. | Blue grey hematite | 4.0 |
| 3. | Laminated hematite | 3.5 |
| 4. | Lateritic & Limonitic Ore | 3.5 |
| 5. | Flaky Ore & Blue Dust | 3.4 |

5.2.2 Reserves:

The section-wise computation of reserves of the deposit are shown in the Table 5.1. As has been mentioned in the Chapter-III - "Description of the Ore body", the ore body is divided into two blocks. The estimated reserves in North and South blocks are 69.01 and 50.85 million tonnes respectively with a total reserve of 119.86 million tonnes.

5.3 Estimation based on Bench Slice Plan:

In order to have uniformity with Deposit No.5 and for future integrated development, the same bench levels of Deposit No.5 have been assumed for Deposit No.4 also. Accordingly, the upper most bench would be at the R.L. of 1200 metres and the succeeding lower benches at 12 metre interval. Though the ore body extends upto a level of 972 metres in south block, the bottom mineable bench has been tentatively fixed for the purpose of present report at 1020 metres R.L.

contd....3/-

5.3.1 Basis:

In all 16 bench slice plans have been drawn. All the bench slice plans have been drawn on the basis of ore types. The major constituent ore type within column of 12 metres has been projected in a particular bench (Plates 7 & 8).

5.3.2 Tonnage Factor:

In case of slice plans also the tonnage factors mentioned at 5.2.1 are adopted.

5.3.3 Reserves:

The benchwise calculation indicated a total mineable reserves of 107.955 million tonnes upto the R.L. 1020. The details of the benchwise as well as type-wise reserves are shown in Tables 6.1, 6.2 and 6.3.

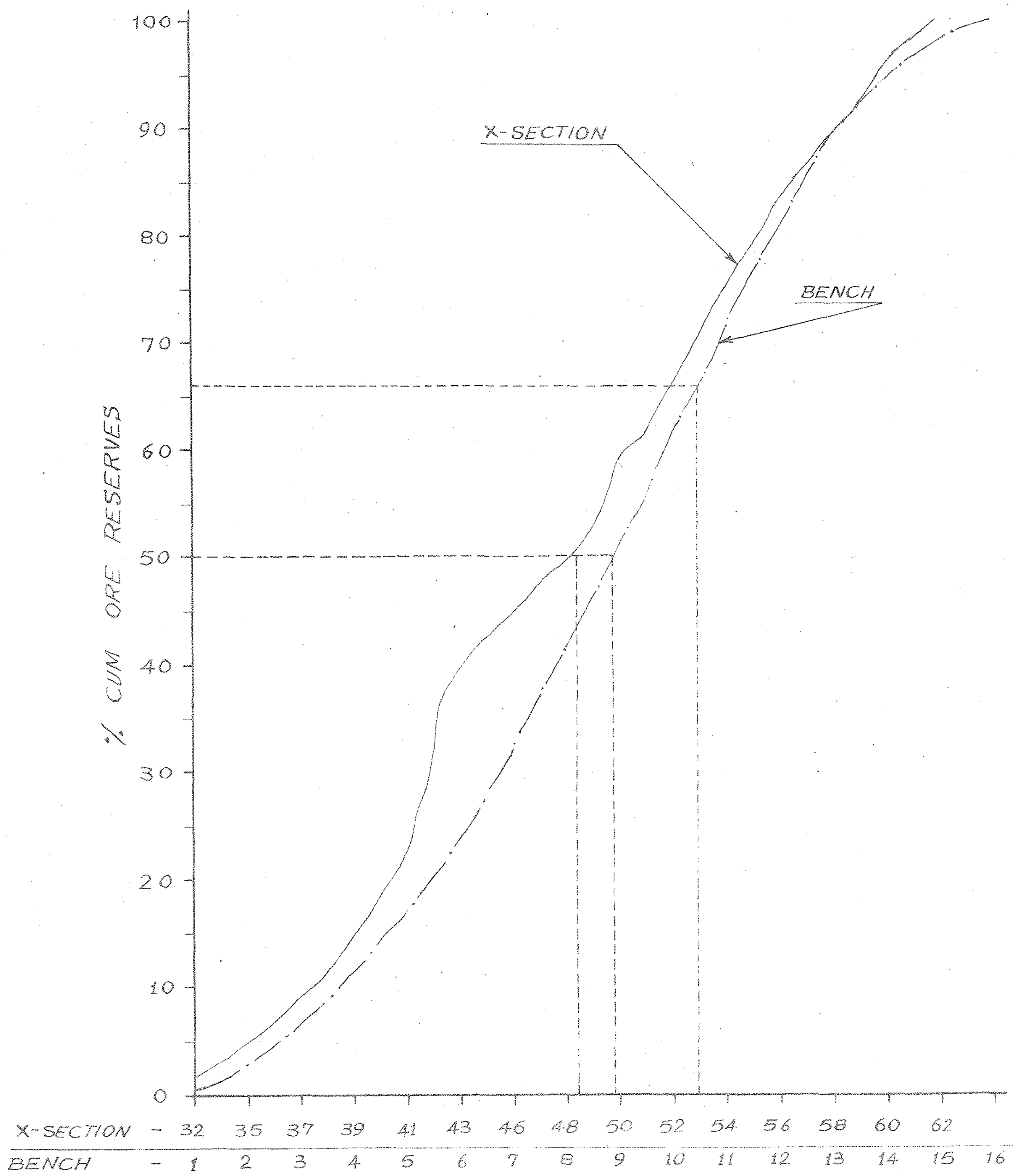
The benchwise ore reserve increases progressively from 6.04 lakh tonnes in 1st bench to 115.00 lakhs tonnes in 10th bench (Total reserves of North and South blocks) and below that level the reserves progressively decreases to 21.90 lakh tonnes in 16th bench (the last mineable block).

5.4 Overall Bench-wise Section-wise distribution of Ore types and its implications:

Based on the results submitted in the

contd....4/-

FIG. NO.- 2




| | | | | |
|---|---|---|---|---|
| 4 | | | | |
| 3 | | | | |
| 2 | | | | |
| 1 | | | | |
| REV | REVISION DESCRIPTION | MADE BY | CHECKED BY | DATE |

BAILADILA IRON ORE DEPOSIT NO.-4

## SPACIAL DISTRIBUTION OF ORE RESERVES BENCH WISE & SECTION WISE

| | | | |
|---|---|---|---|
| DRAWN BY | C.S. SHASTRY | PLANNED BY | |
| TRACED BY | T.C. DHAMIJA | APPROVED BY | DR.A.K. CHATTERJEE |
| CHECKED BY | C.S. SHASTRY | PLATE No. | FIG. NO.- 2 |
| SCALE | DATE:- 21.10.1975 | DRG. No. BLD-4/093 | |

INVESTIGATION AND RESEARCH DIVISION

NATIONAL MINERAL DEVELOPMENT CORPORATION LIMITED, HYDERABAD

Table 5.1 and 5.2 a graph (Fig.2) has been drawn showing the benchwise cumulative reserves (in %) and also sectionwise cumulative-reserves (in %). Thus graph would greatly facilitate any decision that may be taken regarding selection of site for crushing plant and obtaining the centre of gravity of ore deposit. It may be seen from the figure that at the R.L. of 1104 metres along the line between CS 48 and 49 is 50% concentration line of the ore reserves and this area may serve as a suitable site for locating the crushing plant provided other parametres are not unfavourable. Similarly, 2/3rd of the reserves are available upto the R.L. of 1086 metres.

5.5 Float Ores:

Float ore occurs in the western and eastern slopes of the deposit with a depth varying from 0.50 to 7.27 metres.

Extensive pitting has been done on grid pattern and the depth of the float ore zone is established. Besides the depth, the float ore and soil ratios have also been determined. The total reserves of float ore at Deposit No.4 is 9.63 million tonnes. Out of the above total reserves, the float ore reserves of

contd....5/-

## TABLE 5.1

### Cross-Sectionwise Distribution of Ore Reserves

(~~Tonnage~~ Reserve in lakh Tonnes)

| Cross Section | Reserves | Percent Reserve | Cumulative percent Reserve. | Cross Section | Reserves | Percent Reserve | Cumulative percent reserve |
|---|---|---|---|---|---|---|---|
| 32 | 22.35 | 1.86 | 1.86 | 55 | 40.37 | 3.37 | 78.99 |
| 34 | 9.75 | 0.81 | 2.67 | 56 | 56.16 | 4.69 | 83.68 |
| 35 | 13.20 | 1.10 | 3.77 | 57 | 25.32 | 2.11 | 85.79 |
| 36 | 26.44 | 2.21 | 5.98 | 58 | 30.94 | 2.58 | 88.37 |
| 37 | 46.05 | 3.84 | 9.82 | 59 | 39.12 | 3.26 | 91.63 |
| 38 | 19.71 | 1.64 | 11.46 | 60 | 50.26 | 4.19 | 95.82 |
| 39 | 41.74 | 3.48 | 14.94 | 61 | 25.65 | 2.14 | 97.96 |
| 40 | 43.42 | 3.62 | 18.56 | 62 | 24.48 | 2.04 | 100.00 |
| 41 | 67.57 | 5.64 | 24.20 | | 1198.58 or 119.86 million tonnes. | | |
| 42 | 130.38 | 10.88 | 35.08 | | | | |
| 43 | 62.62 | 5.22 | 40.30 | | | | |
| 44 | 25.29 | 2.11 | 42.41 | | | | |
| 46 | 28.30 | 2.36 | 44.77 | | | | |
| 47 | 35.60 | 2.97 | 47.74 | | | | |
| 48 | 13.05 | 1.09 | 48.83 | | | | |
| 49 | 47.89 | 3.99 | 52.82 | | | | |
| 50 | 64.63 | 5.39 | 58.21 | | | | |
| 51 | 39.56 | 3.30 | 61.51 | | | | |
| 52 | 48.34 | 4.03 | 65.54 | | | | |
| 53 | 59.05 | 4.96 | 70.50 | | | | |
| 54 | 61.34 | 5.12 | 75.62 | | | | |

Table - 5.2

Benchwise Distribution of Ore Reserves

| Bench No. | Reserves | Percent Reserves | Cumulative per-cent Reserves |
|---|---|---|---|
| 1 | 6.04 | 0.56 | 0.56 |
| 2 | 25.99 | 2.41 | 2.97 |
| 3 | 43.12 | 4.46 | 7.43 |
| 4 | 47.28 | 4.38 | 11.81 |
| 5 | 61.32 | 5.68 | 17.49 |
| 6 | 72.59 | 6.72 | 24.21 |
| 7 | 89.67 | 8.31 | 32.52 |
| 8 | 101.49 | 9.40 | 41.92 |
| 9 | 101.68 | 9.42 | 51.34 |
| 10 | 115.00 | 10.65 | 61.99 |
| 11 | 106.66 | 9.88 | 71.87 |
| 12 | 101.15 | 9.37 | 81.24 |
| 13 | 81.34 | 7.53 | 88.77 |
| 14 | 60.03 | 5.56 | 94.33 |
| 15 | 39.29 | 3.64 | 97.97 |
| 16 | 21.90 | 2.03 | 100.00 |
| | 1079.55 | | |

or

107.95 million tonnes

western side is estimated at 8.00 million tonnes (Average Grade Fe% 65.60) and on eastern side (i.e. Galli Valley) 1.63 million tonnes (Average grade Fe% 63.37). The reserves and details of calculations are at Annexure-III (a) & (b).

5.6 Waste Handling:

The waste at Deposit No.4 is present through-out the eastern part of the deposit. As may be seen from the cross-sections, the ore body dips towards east with shale/lateritised shale occurring over this on the eastern slopes particularly on the North block. Laterite analysing less than -55% Fe on the top as well as below the laterite capping would be required to be removed as waste during actual mining.

The various forms of waste are -

1. Laterite cappings analysing below -55% Fe occurring as overburden.
2. Shale occurrences within the deposit.
3. Highly siliceous type(i.e.) transitional formation, between BHQ and Shale. Ore.
4. Occurrences of BHQ/BHJ within the ore body often ∠ result of block- ∠ are the faulting.

5.6.1 Overburden and Inside Waste:

In the bench slice plan all the overburden

contd....6/-

## Table - 5.3

### Table showing the Inside Waste Tonnages in different benches.

( in tonnes )

| Bench No. & Level | North Block | South Block | Total |
|---|---|---|---|
| 1 - 1200 | 7,130 | - | 7,130 |
| 2 - 1188 | 1,47,540 | - | 1,47,540 |
| 3 - 1176 | 87,730 | - | 87,730 |
| 4 - 1164 | 31,320 | - | 31,320 |
| 5 - 1152 | -- | - | -- |
| 6 - 1140 | 99,180 | - | 99,180 |
| 7 - 1128 | 3,67,140 | 1,300 | 3,68,440 |
| 8 - 1116 | 7,39,210 | 1,04,830 | 7,44,040 |
| 9 - 1104 | 9,57,000 | 1,11,360 | 10,68,360 |
| 10 - 1092 | 13,62,420 | 3,20,450 | 16,82,870 |
| 11 - 1080 | 1,98,360 | 6,82,080 | 8,80,440 |
| 12 - 1068 | -- | 5,18,520 | 5,18,520 |
| 13 - 1056 | 1,16,580 | 76,560 | 1,93,140 |
| 14 - 1044 | 62,640 | 85,260 | 1,47,900 |
| 15 - 1032 | 64,380 | 1,51,380 | 2,15,760 |
| 16 - 1020 | 1,54,860 | 2,95,800 | 4,50,660 |
| Total | 43,95,490 | 23,47,540 | ~~67,43,030~~ 66,43,030. |

and inside waste blocks have been calculated. The total quantity is estimated at 6.74 million tonnes constituting 6.2% of the mineable portion. The bench-wise inside waste quantities are given in Table 5.3.

5.6.2 Stripping Waste:

For maintenance of adequate bank slopes during mining, some quantity of waste is required to be handled. Preliminary computations on the basis of 45° bank slopes (this requires to be ascertained after actual tests) have given the quantities of stripping waste with bottom level as 16th bench in south block and 12th bench North block at 16.87 million $M^3$ or 46.01 million tonnes of excavation. (Assuming 2.9 Sp. gravity). The major portion of this waste would be shale/tuff along the eastern side. If the mineable limit is shifted upwards (i.e.) from the present bottom level of 16th bench, this excavation can be reduced considerably. This, however, reduce the mineable reserves accordingly. Preliminary computation reveals, if the bottom level is fixed at 16th and 15th bench in south block and 10th bench in north block the stripping waste quantum will become 36.26 million tonnes and 32.77 million tonnes. The total mineable reserve would also come

contd.....7/-

down at the same time to 95.05 million tonnes and 93.48 million tonnes (as summarised below).

| Sl. No. | Mineable limit | Ore reserves m.t. | Waste million $M^3$ | Waste Qty. in m.t. | % |
|---|---|---|---|---|---|
| 1. | South block 16th bench & North block 12th bench | 102.14 | 16.87 | 46.01 | 45.40 |
| 2. | South block 16th bench & North block 10th bench | 95.05 | 12.51 | 32.26 | 38.10 |
| 3. | South block 15th bench and North block 10th bench | 93.48 | 11.31 | 32.77 | 35.00 |

However, it may be noted that the steep dip of the Iron Ore body and general topography have led to the necessity of handling proportionately large quantum of stripping waste in case of Deposit No.4.

# CHAPTER - VI

## CHEMICAL CHARACTERISTICS

6.1 GENERAL:

The ores mainly consists of hematite with laterite, goethite and limonite. Magnetite or Martite is found occasionally in minor amounts.

The chemical characteristics were based on the analytical results of borehole samples as below:

1. 4250 for Fe
2. 3500 for Fe, $SiO_2$, $Al_2O_3$,
3. 50 for P & S.

In all 16 bench slice plans have been drawn. Block grades in individual slice plan have been assessed as the arithmetic mean of the borehole grade falling in the block. Wherever, the boreholes are not present in the block, average grade for the block has been computed by taking overall grade of the type ore for the entire deposit or the borehole values of the upper and lower benches.

The benchwise reserves and average grade of the ore (North block and south block) on the basis of -55% Fe cut off has been summarised in Tables 6.1, 6.2 and 6.3.

contd....2/-

Table - 6.1

Table showing details of Ore Type-wise Reserve and Grade of Mine[illegible]le portion of Ore in different benches.

(ENTIRE DEPOSIT)

(Reserve in lakh tonnes)

| Type | Bench R.L. of the floor | 1 1200 | 2 1188 | 3 1176 | 4 1164 | 5 1152 | 6 1140 | 7 1128 | 8 1116 | 9 1104 | 10 1092 | 11 1080 | 12 106[illegible] | 13 1056 | 14 1044 | 15 1032 | 16 1020 | Type-wise total | Incidence % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| I Steel Grey Hematite | Reserves | - | - | 3.52 | 77.40 | 14.07 | 13.38 | 9.20 | 11.70 | 10.31 | 11.21 | 8.12 | 11.72 | 8.77 | 6.86 | 4.23 | 0.86 | 121.35 | 11.20 |
| | Fe | - | - | 64.89 | 66.35 | 66.74 | 65.93 | 68.67 | 68.22 | 67.33 | 67.22 | [illegible] | 65.91 | 65.54 | [illegible] | 65.77 | 68.39 | 66.78 | |
| | $SiO_2$ | - | - | 0.99 | 0.88 | 0.60 | 0.86 | 0.35 | 0.58 | 0.85 | 1.35 | 0.68 | 2.56 | 2.08 | 2.72 | 2.57 | 0.46 | 1.21 | |
| | $Al_2O_3$ | - | - | 2.29 | 1.50 | 0.75 | 2.12 | 0.46 | 0.73 | 0.95 | 1.13 | 0.80 | 1.32 | 2.83 | 2.53 | 2.30 | 0.44 | 1.38 | |
| II Blue grey hematite | Reserves | 0.16 | 2.01 | 6.04 | 3.61 | 8.05 | 9.58 | 15.31 | 12.81 | 11.13 | 11.92 | 12.04 | 11.11 | 8.61 | 5.73 | 3.32 | 2.04 | 123.47 | 11.40 |
| | Fe | 64.79 | 64.79 | 63.41 | 65.99 | 65.92 | 67.81 | 67.96 | 68.19 | 65.88 | 67.76 | 65.89 | 66.15 | 68.07 | 67.60 | 67.64 | 67.16 | 66.89 | |
| | $SiO_2$ | 0.51 | 0.51 | 2.40 | 0.21 | 0.43 | 0.77 | 0.69 | 0.90 | 1.66 | 0.79 | 1.48 | 3.79 | 0.710 [illegible] | 0.57 | 0.66 | 0.62 | 1.22 | |
| | $Al_2O_3$ | 3.05 | 3.05 | 2.55 | 1.05 | 1.21 | 1.04 | 0.79 | 0.84 | 1.75 | 1.04 | 0.55 | 0.61 | 0.65 | 0.67 | 0.69 | 0.63 | 1.03 | |
| [illegible] Laminated hematite | Reserves | 0.06 | 9.65 | 25.64 | 24.14 | 18.75 | 16.67 | 26.27 | 31.64 | 28.86 | 31.31 | 26.64 | 23.75 | 10.06 | 2.12 | -- | 0.32 | 273.88 | 25.40 |
| | Fe | 64.00 | 63.83 | 62.92 | 65.53 | 66.19 | 62.91 | 64.82 | 64.51 | 65.70 | 65.96 | 65.51 | 64.37 | 65.20 | 62.56 | -- | 66.71 | 64.67 | |
| | $SiO_2$ | 1.09 | 1.06 | 1.09 | 1.60 | 1.08 | 0.91 | 1.57 | 2.42 | 1.11 | 0.97 | 1.69 | 1.65 | 1.49 | 4.65 | -- | 1.80 | 1.46 | |
| | $Al_2O_3$ | 4.06 | 4.12 | 3.41 | 3.33 | 1.48 | 2.71 | 2.14 | 2.84 | 2.56 | 2.13 | 1.49 | 3.19 | 2.66 | 1.02 | 0.5 | 0.57 | 2.58 | |
| IV Lateritic & Limonitic Ore | Reserves | 5.82 | 5.27 | 3.84 | 1.11 | 2.81 | 1.55 | 3.39 | 6.68 | 4.44 | 1.19 | 3.90 | 0.59 | - | - | - | - | 40.62 | 3.80 |
| | Fe | 57.90 | 59.74 | 59.84 | 56.63 | 58.57 | 57.71 | 58.66 | 59.29 | 61.66 | 57.17 | 57.55 | 58.36 | - | - | - | - | 58.94 | |
| | $SiO_2$ | 2.10 | 1.72 | 1.31 | 0.42 | 2.04 | 2.57 | 4.22 | 1.69 | 0.82 | 12.77 | 1.82 | 2.98 | - | - | - | - | 2.21 | |
| | $Al_2O_3$ | 6.93 | 5.15 | 5.55 | 7.71 | 5.29 | 6.08 | 7.03 | 5.91 | 2.97 | 2.02 | 4.72 | 5.76 | - | - | - | - | 5.48 | |
| V Flaky Ore & Blue Dust | Reserves | - | 9.06 | 9.08 | 11.02 | 17.64 | 31.41 | 35.50 | 38.66 | 48.94 | 59.37 | 55.96 | 53.98 | 53.90 | 45.32 | 31.74 | 18.68 | 520.26 | 48.20 |
| | Fe | - | 64.73 | 66.54 | 66.54 | 67.16 | 65.30 | 66.00 | 66.77 | 66.34 | 66.78 | [illegible]6.11 | 65.00 | 65.63 | 66.49 | 67.63 | 65.74 | 66.13 | |
| | $SiO_2$ | - | 1.20 | 1.63 | 2.87 | 0.83 | 3.78 | 2.97 | 2.30 | 2.06 | 2.18 | 2.37 | 4.01 | 3.05 | 2.16 | 2.09 | 2.53 | 2.57 | |
| | $Al_2O_3$ | - | 1.99 | 0.91 | 0.79 | 0.60 | 0.93 | 0.98 | 1.19 | 0.99 | 0.88 | 0.80 | 1.00 | 1.23 | 1.24 | 1.05 | 1.07 | [illegible] 1.00 | |
| Total | Reserves | 6.04 | 25.99 | 48.12 | ~~47.28~~ 117.28 | 61.32 | 72.59 | 89.67 | 101.49 | ~~101.68~~ 103.68 | 115.00 | 106.[illegible] 106.66 | 101.[illegible] 101.15 | [illegible] 81.34 | [illegible] 60.03 | [illegible] 39.29 | 21.90 | 1079.55 | |
| | Fe | 58.15 | 63.39 | 63.56 | 64.69 | 66.20 | 65.08 | 65.99 | 65.92 | 66.12 | 66.27 | 65.53 | 65.04 | 65.82 | 66.35 | 67.43 | 65.97 | 65.65 | |
| | $SiO_2$ | 2.04 | 1.19 | 1.37 | 1.65 | 0.87 | 2.16 | 1.95 | 1.92 | 1.58 | 1.73 | 1.93 | 3.26 | 2.50 | 2.16 | 2.02 | 2.27 | 1.97 | |
| | $Al_2O_3$ | 6.79 | 3.50 | 2.92 | 2.38 | 1.21 | 1.68 | 1.46 | 1.91 | 1.57 | 1.27 | 1.06 | 1.49 | 1.52 | 1.99 | 1.17 | 0.99 | 1.62 | |

Table - 6.2

Table showing details of Ore Type-wise Reserve and Grade of Mineable portion of Ore in different Benches.

(NORTH BLOCK)

(Reserve in lakh tonnes)

| Type | Bench R.L. of the floor | 1 1200 | 2 1188 | 3 1176 | 4 1164 | 5 1152 | 6 1140 | 7 1128 | 8 1116 | 9 1104 | 10 1092 | 11 1080 | 12 1068 | 13 1056 | 14 1044 | 15 1032 | 16 1020 | Type-wise total | Incidence % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| I Steel Grey hematite | Reserves | - | - | 3.52 | 7.40 | 14.70 | 13.28 | 8.65 | 7.23 | 2.85 | 0.30 | 0.35 | 1.51 | 0.60 | - | - | - | 59.76 | 9.50 |
| | Fe | - | - | 64.89 | 66.35 | 66.74 | 65.95 | 68.76 | 68.73 | 68.65 | 66.32 | 67.11 | 67.37 | 67.37 | - | - | - | 67.05 | |
| | $SiO_2$ | - | - | 0.99 | 0.88 | 0.60 | 0.85 | 0.32 | 0.34 | 0.52 | 0.82 | 0.71 | 0.61 | 0.61 | - | - | - | 0.64 | |
| | $Al_2O_3$ | - | - | 2.29 | 1.50 | 0.75 | 2.11 | 0.42 | 0.56 | 0.83 | 2.04 | 1.50 | 1.10 | 1.10 | - | - | - | 1.19 | |
| II Blue grey hematite | Reserves | 0.16 | 2.01 | 6.04 | 3.61 | 7.95 | 9.32 | 14.88 | 11.02 | 7.48 | 7.37 | 4.56 | 1.63 | 2.47 | 3.67 | 2.50 | 2.04 | 86.71 | 13.80 |
| | Fe | 64.79 | 64.79 | 63.41 | 65.99 | 65.94 | 67.84 | 67.99 | 68.99 | 66.42 | 68.09 | 68.69 | 67.27 | 67.27 | 67.54 | 67.61 | 67.16 | 67.26 | |
| | $SiO_2$ | 0.51 | 0.51 | 2.40 | 0.21 | 0.42 | 0.78 | 0.69 | 0.43 | 0.91 | 0.47 | 0.45 | 0.57 | 0.57 | 0.46 | 0.62 | 0.62 | 0.71 | |
| | $Al_2O_3$ | 3.05 | 3.05 | 2.55 | 1.05 | 1.18 | 1.04 | 0.79 | 0.38 | 1.46 | 0.81 | 0.52 | 0.94 | 0.94 | 0.54 | 0.63 | 0.63 | 1.02 | |
| III Laminated hematite | Reserves | 0.06 | 9.65 | 25.64 | 24.14 | 18.38 | 11.94 | 15.80 | 19.81 | 14.84 | 15.67 | 9.99 | 3.74 | 0.38 | - | - | - | 170.04 | 27.10 |
| | Fe | 64.00 | 63.83 | 62.92 | 63.53 | 66.31 | 63.94 | 65.72 | 64.28 | 65.70 | 65.88 | 66.13 | 65.59 | 65.57 | - | - | - | 64.68 | |
| | $SiO_2$ | 1.09 | 1.06 | 1.09 | 1.60 | 1.09 | 0.96 | 1.38 | 3.49 | 1.30 | 1.36 | 1.89 | 3.51 | 1.66 | - | - | - | 1.60 | |
| | $Al_2O_3$ | 4.06 | 4.12 | 3.41 | 3.33 | 1.45 | 2.64 | 1.81 | 3.45 | 2.41 | 1.49 | 0.88 | 1.30 | 1.27 | - | - | - | 2.57 | |
| IV Lateritic & Limonitic ore. | Reserves | 5.82 | 5.27 | 3.84 | 1.11 | 1.23 | 0.06 | 0.84 | 0.04 | 0.10 | 0.86 | 0.63 | 0.59 | - | - | - | - | 20.39 | 3.30 |
| | Fe | 57.90 | 59.74 | 59.84 | 56.63 | 58.70 | 58.47 | 58.47 | 58.47 | 58.47 | 56.68 | 58.47 | 58.36 | - | - | - | - | 58.73 | |
| | $SiO_2$ | 2.10 | 1.72 | 1.31 | 0.42 | 1.36 | 2.57 | 2.57 | 2.57 | 2.57 | 16.69 | 2.57 | 2.98 | - | - | - | - | 2.39 | |
| | $Al_2O_3$ | 6.93 | 5.15 | 5.55 | 7.71 | 4.29 | 6.08 | 6.08 | 6.08 | 6.08 | 0.46 | 6.08 | 5.76 | - | - | - | - | 5.72 | |
| V Flaky Ore & Blue Dust. | Reserves | - | 9.06 | 9.08 | 11.02 | 17.64 | 30.79 | 32.28 | 27.58 | 27.81 | 31.08 | 23.12 | 24.77 | 18.73 | 15.39 | 8.20 | 4.16 | 290.71 | 46.30 |
| | Fe | - | 64.73 | 66.54 | 66.54 | 67.16 | 65.34 | 66.11 | 67.14 | 66.81 | 66.82 | 66.29 | 65.16 | 67.21 | 66.94 | 68.11 | 68.04 | 66.45 | |
| | $SiO_2$ | - | 1.20 | 1.63 | 2.87 | 0.83 | 3.77 | 2.52 | 2.06 | 2.24 | 2.01 | 2.73 | 3.76 | 1.87 | 1.74 | 1.16 | 0.60 | 2.38 | |
| | $Al_2O_3$ | - | 1.99 | 0.91 | 0.79 | 0.60 | 0.91 | 0.91 | 0.95 | 0.95 | 0.94 | 1.15 | 1.26 | 0.64 | 0.61 | 0.52 | 0.49 | 0.92 | |
| | Benchwise Reserve | 6.04 | 25.99 | 48.12 | 47.28 | 59.27 | 65.39 | 72.45 | 65.68 | 53.08 | 55.28 | 38.65 | 32.24 | 22.18 | 19.06 | 10.70 | 6.20 | 627.61 | |
| | Fe | 58.15 | 63.39 | 63.56 | 64.69 | 66.45 | 65.55 | 66.63 | 66.75 | 66.53 | 66.24 | 65.55 | 65.29 | 67.19 | 67.05 | 67.99 | 67.75 | 65.89 | |
| | $SiO_2$ | 2.04 | 1.19 | 1.37 | 1.65 | 0.81 | 2.24 | 1.81 | 2.03 | 1.69 | 1.84 | 2.17 | 3.41 | 1.69 | 1.49 | 1.03 | 0.61 | 1.78 | |
| | $Al_2O_3$ | 6.79 | 3.50 | 2.92 | 2.38 | 1.05 | 1.49 | 1.08 | 1.56 | 1.43 | 1.07 | 1.00 | 1.32 | 0.70 | 0.59 | 0.58 | 0.54 | 1.56 | |

Table - 63

Table Showing Details of Ore Type-wise Reserve and Grade of Mineable portions of Ore in different Benches.

( SOUTH BLOCK )

(Reserve in Lakh Tonnes)

| Type | Bench R.L. of floor | 1 1200 | 2 1188 | 3 1176 | 4 1164 | 5 1152 | 6 1140 | 7 1128 | 8 1116 | 9 1104 | 10 1092 | 11 1080 | 12 1068 | 13 1056 | 14 1044 | 15 1032 | 16 1020 | Type-wise total | Incidence % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12 | 13. | 14. | 15. | 16. | 17. | 18. | 19. | 20. |
| I | Reserves | - | - | - | - | - | 0.10 | 0.55 | 4.47 | 7.46 | 10.91 | 7.77 | 10.21 | 8.17 | 6.86 | 4.23 | 0.86 | 61.59 | |
| | Fe | - | - | - | - | - | 64.05 | 67.34 | 67.41 | 66.83 | 67.25 | 68.06 | 65.69 | 65.41 | 65.45 | 65.77 | 68.38 | 66.52 | 13.60 |
| | $SiO_2$ | - | - | - | - | - | 1.59 | 0.88 | 0.97 | 0.97 | 1.37 | 0.68 | 2.85 | 2.19 | 2.72 | 2.57 | 0.46 | 1.77 | |
| | $Al_2O_3$ | - | - | - | - | - | 3.61 | 1.12 | 1.00 | 1.00 | 1.11 | 0.77 | 1.35 | 2.96 | 2.53 | 2.30 | 0.44 | 1.56 | |
| II | Reserves | - | - | - | - | 0.10 | 0.26 | 0.43 | 1.79 | 3.65 | 4.55 | 7.48 | 9.48 | 6.14 | 2.06 | 0.82 | - | 36.76 | |
| | Fe | - | - | - | - | 64.05 | 66.93 | 66.93 | 63.31 | 64.79 | 67.22 | 64.18 | 65.96 | 68.39 | 67.72 | 67.72 | - | 66.05 | 8.10 |
| | $SiO_2$ | - | - | - | - | 1.59 | 0.67 | 0.67 | 3.82 | 3.19 | 1.31 | 2.11 | 4.35 | 0.77 | 0.77 | 0.77 | - | 2.42 | |
| | $Al_2O_3$ | - | - | - | - | 3.61 | 1.06 | 1.06 | 3.69 | 2.34 | 1.42 | 0.57 | 0.56 | 0.53 | 0.90 | 0.90 | - | 1.04 | |
| III | Reserves | - | - | - | - | 0.37 | 4.73 | 10.47 | 11.83 | 12.02 | 15.64 | 16.65 | 20.01 | 9.68 | 2.12 | - | 0.32 | 103.84 | |
| | Fe | - | - | - | - | 60.32 | 60.32 | 63.47 | 64.91 | 65.71 | 66.04 | 65.14 | 64.15 | 65.19 | 62.56 | - | 66.71 | 64.67 | 23.00 |
| | $SiO_2$ | - | - | - | - | 0.78 | 0.78 | 1.85 | 0.63 | 0.87 | 0.58 | 1.58 | 1.30 | 1.49 | 4.65 | - | 1.80 | 1.23 | |
| | $Al_2O_3$ | - | - | - | - | 2.90 | 2.90 | 2.63 | 1.81 | 2.74 | 2.78 | 1.87 | 3.55 | 2.72 | 1.02 | - | 0.57 | 2.61 | |
| IV | Reserves | - | - | - | - | 1.58 | 1.49 | 2.55 | 6.64 | 4.34 | 0.33 | 3.27 | - | - | - | - | - | 20.23 | |
| | Fe | - | - | - | - | 58.47 | 57.68 | 58.73 | 59.30 | 61.73 | 58.47 | 57.37 | - | - | - | - | - | 59.15 | 4.50 |
| | $SiO_2$ | - | - | - | - | 2.57 | 2.57 | 4.77 | 1.69 | 0.78 | 2.57 | 1.68 | - | - | - | - | - | 2.03 | |
| | $Al_2O_3$ | - | - | - | - | 6.08 | 6.08 | 7.35 | 5.91 | 2.90 | 6.08 | 4.46 | - | - | - | - | - | 5.23 | |
| V | Reserves | - | - | - | - | - | 0.62 | 3.22 | 11.08 | 21.13 | 28.29 | 32.84 | 29.21 | 35.17 | 29.93 | 23.54 | 14.52 | 229.55 | |
| | Fe | - | - | - | - | - | 63.66 | 64.98 | 65.87 | 65.74 | 66.03 | 66.00 | 64.87 | 64.79 | 66.27 | 67.47 | 65.08 | 65.75 | 50.80 |
| | $SiO_2$ | - | - | - | - | - | 4.53 | 3.57 | 2.90 | 1.83 | 2.36 | 2.12 | 4.23 | 3.68 | 2.37 | 2.41 | 3.09 | 2.82 | |
| | $Al_2O_3$ | - | - | - | - | - | 2.23 | 1.70 | 1.81 | 1.05 | 0.81 | 0.57 | 0.78 | 1.55 | 1.29 | 1.24 | 1.24 | 1.11 | |
| Total | Benchwise Reserve | - | - | - | - | 2.05 | 7.20 | 17.22 | 35.81 | 48.60 | 59.72 | 68.01 | 68.91 | 59.16 | 40.97 | 28.59 | 15.70 | 451.94 | |
| | Fe | - | - | - | - | 59.06 | 60.35 | 63.29 | 64.39 | 65.47 | 66.30 | 65.52 | 64.93 | 65.31 | 66.02 | 67.22 | 65.29 | 65.34 | |
| | $SiO_2$ | - | - | - | - | 2.51 | 1.48 | 22.54 | 1.73 | 1.47 | 1.63 | 1.80 | 3.19 | 2.81 | 2.47 | 2.39 | 2.92 | 2.24 | |
| | $Al_2O_3$ | - | - | - | - | 5.94 | 3.44 | 3.07 | 2.56 | 1.72 | 1.46 | 1.09 | 1.58 | 1.83 | 1.47 | 1.39 | 1.18 | 1.69 | |

6.2 Average Grade of the Deposit:

The average grade of the deposit has been computed after considering all materials having +55% Fe as ore. The distribution of Iron values of samples show wide variation and the deposit consists of different grades. This variation is much wider in the top benches whereas it is consistant to some extent in the lower benches. If the lateritic and limonitic ore is separated, the average grade of the deposit is observed to change noticeably.

6.2.1 The average grade computed for all borehole assay values (+55% Fe) is -

| | |
|---|---|
| Fe | 65.53% |
| $SiO_2$ | 2.14% |
| $Al_2O_3$ | 1.69% |

6.2.2 On the basis of bench slice plans the average grade of the deposit arrived is -

| | |
|---|---|
| Fe | 65.65% |
| $SiO_2$ | 1.97% |
| $Al_2O_3$ | 1.62% |

6.3 Benchwise Ore Chemistry:

Benchwise ore chemistry is detailed below:

6.3.1 Iron:

Average iron value for the entire deposit

contd....3/-

varies from 58.15% Fe in first bench to 67.43% Fe in 15th bench. In the North Block the average value of Fe increases from 58.15% in 1st bench to 64.69% Fe in 4th bench. Below this level, the benchwise average grade of iron values is consistently high varying between the limits 65.29 to 67.99%.

In the South block, the average value of Fe increases from 59.05% in 5th bench (Top most bench in South block) to 64.39% Fe in 8th bench. Below this, again the bench averages (Iron) reflect a similar high values in Iron varying between 65.3 to 67.2% Fe. The benchwise Fe values are plotted in graph (Fig.No.3).

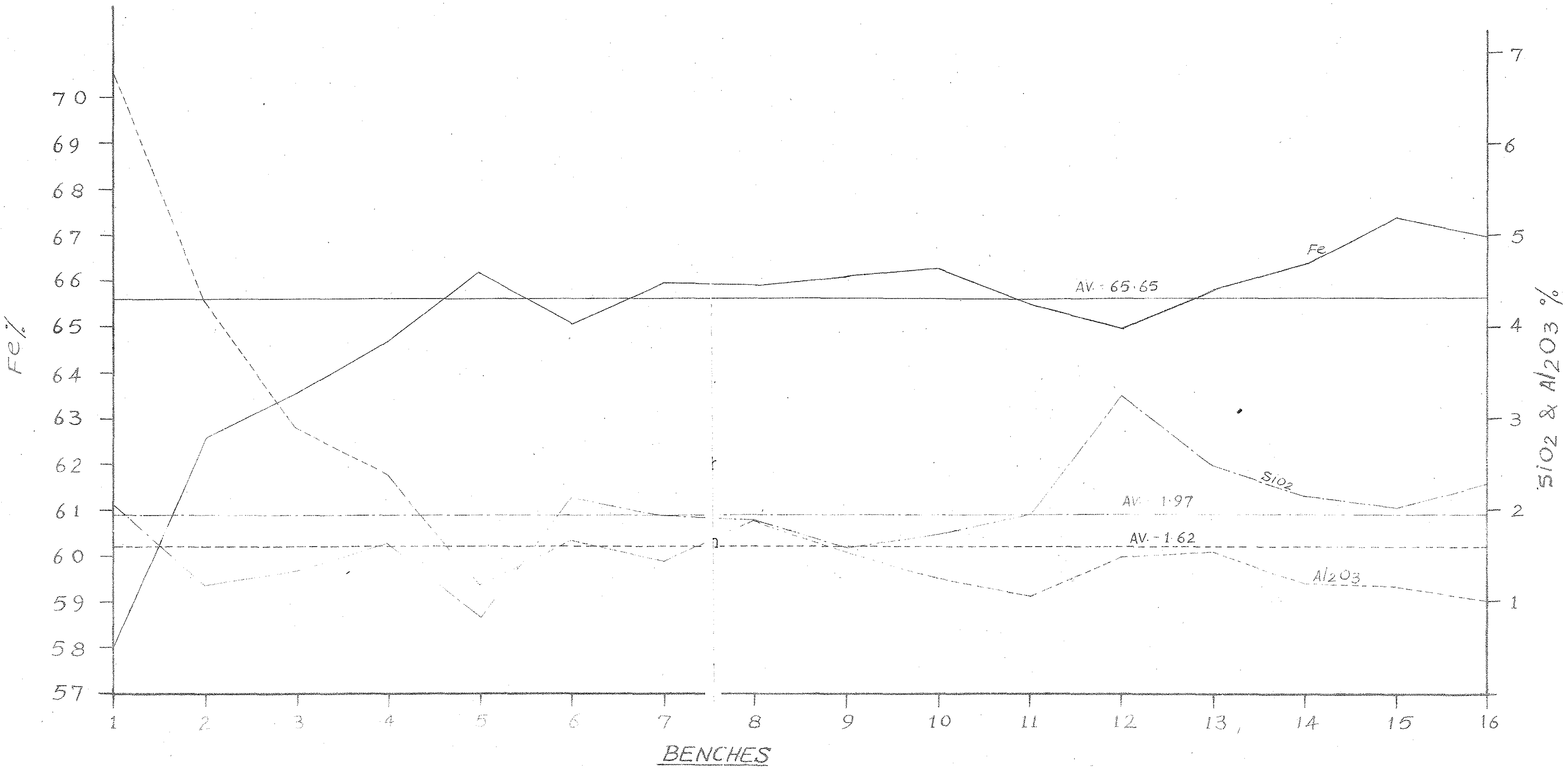
6.3.2 Silica and Alumina:

Average Silica value for the entire deposit varies from 0.87% in 5th bench to 3.26% in 12th bench. Silica values in different benches of North and South blocks vary widely between 0.61 % and 3.41%. However, the silica values in South block are higher than those in North block because of BHQ intercalations.

The average $Al_2O_3$ value for the entire deposit decreases progressively from 6.79% in 1st

contd....4/-

FIG. NO.-3




BAILADILA IRON ORE DEPOSIT NO-4

BENCHWISE DISTRIBUTION OF Fe, $SiO_2$ & $Al_2O_3$ WITH THE RESPECTIVE AVERAGE

| | | | |
|---|---|---|---|
| DRAWN BY | | PLANNED BY | |
| TRACED BY | T.C. DHAMIJA | APPROVED BY | DR.A.K. CHATTERJEE |
| CHECKED BY | C.S. SHASTRY | PLATE No. | FIG. NO.-3 |
| SCALE | DATE - 17.10.1975 | DRG. No. | BLD-4/092 |

| REV. | REVISION DESCRIPTION | MADE BY | CHECKED BY | DATE |
|---|---|---|---|---|
| 4 | | | | |
| 3 | | | | |
| 2 | | | | |
| 1 | | | | |

INVESTIGATION AND RESEARCH DIVISION
NATIONAL MINERAL DEVELOPMENT CORPORATION LIMITED, HYDERABAD

bench to 0.99 in 16th bench for the whole deposit.

Alumina values in different benches in North block vary from 6.79% in 1st bench to 0.54% in 16th bench, thus showing a progressive decreasing trend in general. Alumina values in South block decreases from 5.94% in 5th bench (Top bench in South block) to 1.18 in 16th bench, with a similar downward trend.

Silica : $Al_2O_3$ ratio changes from 1:3.3 in 1st bench through 1:1 in 8th bench to 2.3 : 1 in 16th bench.

The relations between Fe vs Silica and Alumina in different benches is shown on a graph (Fig. No.3).

6.3.3 Phospherous & Sulpher:

The ores of Deposit No.4 are characterised by low phosphorous and sulpher contents. The assay of phosphorous for 50 samples varies between 0.0011% to 0.1693% and averages at 0.05%. Sulphur occurs only in traces.

6.3.4 L.O.I.

The L.O.I. varies from 15-16% in lateritic ores to 0.1% in high grade ore. The average of LOI is computed at 3.89% for the entire deposit.

# CHAPTER - VII

## ORE DRESSING TESTS

7.1 GENERAL:

Bulk samples of different types of ore have been collected to determine physical and chemical characteristics of different size fractions, minerographic studies, bulk densities, shatter tests and decrepitative tests.

For the above purpose, the representative ores of different types have been collected by blasting from various locations and from adits. Bulk samples have been collected in two different stages. In the first stage a total of 104 tonnes of primary samples were collected for batch scale tests. In the second stage a total of about 560 tonnes of primary samples were collected for pilot plant studies.

7.2 Batch Scale Tests:

As has been mentioned, a total 104 tonnes of primary samples collected for different types of ores are as follows:-

| | | |
|---|---|---|
| 1. | Steel grey hematite | 16 tonnes |
| 2. | Blue grey hematite | 16 tonnes |
| 3. | Laminated hematite | 24 tonnes |
| 4. | Lateritic Ore | 16 tonnes |
| 5. | Flaky Ore & Blue Dust | 32 tonnes |

contd... 2/-

About 4 tonnes of sample was prepared for each type of ore after coning and quartering the primary sample. Out of these 4 tonnes of each type, two tonnes were sent to Research and Development Laboratory of N.M.D.C. at Hyderabad for tests on batch scale.

M/s M.N.Dastur & Co., Consultants for the proposed Visakhapatnam Steel Plant desired to conduct ore dressing tests on different types of ore from Deposit No.4 at National Metallurgical Laboratory. Accordingly, the remaining two tonnes of each type sample (except Flaky Ore and Blue Dust) was sent to National Metallurgical Laboratory, Jamshedpur. A report (Studies on Crushing, screening of eight iron ore samples from Deposits 4 and 5) was submitted by N.M.L. in the month of January, 1975.

7.3 Results of Batch scale tests conducted on composite sample and individual ore types by R & D Laboratory N.M.D.C.

7.3.1 Individual Ore Types:

A separate report has been prepared (Ref: Benificiation Studies for iron ore samples from Deposit No.4) in this regard. However, the results of wet screening with individual type samples(except Flaky Ore & Blue Dust) after crushing to -40 m.m.

contd....3/-

are detailed in Table. In case of flaky ore and Blue dust the dry screening results are included in the Table below:

## RESULTS OF WET SCREENING WITH INDIVIDUAL TYPE SAMPLES

| Sample | Product | Wt% | Assay% | | | Distribution % | | |
|---|---|---|---|---|---|---|---|---|
| | | | Fe. | $SiO_2$ | $Al_2O_3$ | Fe | $SiO_2$ | $Al_2O_3$ |
| Steel grey hematite | -40+10mm | 82.5 | 68.12 | 0.43 | 1.23 | 82.6 | 80.6 | 79.9 |
| | -10+6mm | 3.8 | 67.68 | 0.31 | 1.36 | 3.8 | 2.7 | 4.1 |
| | Classifier sand | 9.3 | 68.04 | 0.54 | 0.48 | 9.3 | 11.4 | 3.5 |
| | Cl.O'flow (by diff) | 4.4 | 66.85 | 0.53 | 3.61 | 4.3 | 5.3 | 12.5 |
| | HEAD | 100.0 | 68.04 | 0.44 | 1.27 | 100.0 | 100.0 | 100.0 |
| Blue grey hematite | -40+10mm | 80.6 | 67.69 | 0.87 | 0.64 | 81.1 | 77.9 | 60.0 |
| | -10+6 mm | 4.4 | 67.41 | 0.79 | 1.26 | 4.4 | 3.9 | 6.4 |
| | -Cl.sand | 11.0 | 66.11 | 0.78 | 1.98 | 10.8 | 9.5 | 25.3 |
| | Cl.O'flow | 4.0 | 61.08 | 1.96 | 1.77 | 3.7 | 8.7 | 8.3 |
| | HEAD | 100.0 | 67.24 | 0.90 | 0.86 | 100.0 | 100.0 | 100.0 |
| Laminated Hematite | -40+10mm | 45.8 | 65.63 | 0.77 | 4.89 | 47.4 | 25.9 | 44.3 |
| | -10+6 mm | 9.2 | 63.95 | 0.60 | 3.60 | 9.3 | 4.1 | 6.5 |
| | Cl.Sand | 30.1 | 62.28 | 1.24 | 5.50 | 29.6 | 27.4 | 32.8 |
| | Cl.O'flow | 14.9 | 58.46 | 3.89 | 5.57 | 13.7 | 42.6 | 16.4 |
| | HEAD | 100.0 | 63.40 | 1.36 | 5.06 | 100.0 | 100.0 | 100.0 |
| Mixed limonitic & lateric hematite. | -40+10mm | 57.2 | 65.64 | 0.50 | 1.95 | 58.1 | 41.2 | 45.3 |
| | -10+6 mm | 6.6 | 65.58 | 0.53 | 2.18 | 6.7 | 5.0 | 5.8 |
| | Cl.Sand | 25.2 | 64.77 | 0.93 | 2.48 | 25.2 | 33.7 | 25.4 |
| | Cl.O' flow | 11.0 | 58.36 | 1.27 | 5.27 | 10.0 | 20.1 | 23.5 |
| | HEAD | 100.0 | 64.62 | 0.70 | 2.46 | 100.0 | 100.0 | 100.0 |

contd...4/-

Chemical and Size Analysis of Flaky Ore and Blue Dust as received (Dry Screening)

| Size | Wt% | Fe% | $SiO_2$% | $Al_2O_3$% | L.O.I.% |
|---|---|---|---|---|---|
| + 12.7 mm | 4.9 | 66.45 | 1.07 | 1.42 | 0.92 |
| + 6.3 mm | 9.4 | 68.14 | 1.00 | 1.06 | 0.38 |
| + 65 mesh | 50.3 | 66.78 | 2.41 | 0.97 | 0.25 |
| + 100 mesh | 2.6 | 62.03 | 7.14 | 1.35 | 0.57 |
| + 200 mesh | 9.3 | 63.84 | 6.60 | 1.12 | 0.56 |
| -200 mesh | 23.5 | 64.97 | 4.15 | 1.03 | 0.52 |
| HEAD (Cal ) | 100.0 | 66.07 | 3.13 | 1.04 | 0.40 |

7.3.2 Composite Sample:

Based on the proportions of ore types in the deposit a composite sample has been prepared, with the proportions of ore types as follows:-

| | | | |
|---|---|---|---|
| Type | I | Steel grey hematite | 10% |
| Type | II | Blue grey hematite | 8% |
| Type | III | Laminated hematite | 22% |
| Type | IV | Lateritic & Limonitic Ore | 12% |
| Type | V | Flaky Ore & Blue Dust | 48% |

The above proportions of ore types have been taken only on the basis of the interim report prepared in April 1973. The proportions/incidence of ore types in this detailed report are given in the Chapter-IV. The wet screening results of the composite

contd.....5/-

sample is detailed in the table given below:

Results of Wet Screening Test results with Ore crushed to -40 m.m.

| Product | Wt% | Fe% | $SiO_2$% | $Al_2O_3$% |
|---|---|---|---|---|
| -40 +10 mm | 36.0 | 67.08 | 0.80 | 1.66 |
| -10 + 6 mm | 7.6 | 67.08 | 0.66 | 2.02 |
| Classifier Sand | 31.0 | 66.90 | 2.14 | 1.84 |
| Classifier Over-flow | 25.4 | 61.98 | 4.01 | 1.88 |
| Total | 100.0 | 65.73 | 2.02 | 1.80 |

7.4 Results of Batch scale test results conducted on individual types(except flaky ore & Blue dust) by N.M.L., Jamshedpur.

7.4.1 Individual Ore Types:

A separate report has been prepared(Ref:- Studies on Crushing and Screening of eight Iron Ore samples from Deposit 4 & 5) by N.M.L. However, the results of wet screening with individual type samples (except flaky ore and Blue dust) after crushing to -40 mm is detailed in the table given below:

contd.../-

| Products | | Wt% | Fe% | $SiO_2$% | $Al_2O_3$% |
|---|---|---|---|---|---|
| I Steel grey hematite | -40+10mm washed lumps | 81.9 | 66.6 | 0.9 | 1.4 |
| | -10mm Sand | 16.5 | 65.5 | 1.3 | 2.0 |
| | slime | 1.6 | 40.8 | 10.4 | 18.1 |
| | Head(Calc) | 100.0 | 66.0 | 1.12 | 1.76 |
| II Blue grey hematite | -40+10mm washed lumps | 81.5 | 68.0 | 1.0 | 0.9 |
| | -10mm sand | 17.7 | 65.3 | 1.3 | 1.1 |
| | Slime | 0.8 | 50.0 | 9.4 | ~~9.4~~ 11.5 |
| | | 100.0 | 67.4 | 1.12 | 1.0 |
| III Laminated hematite | -40+10mm washed lumps | 50.0 | 64.4 | 0.6 | 3.0 |
| | -10mm Sand | 39.4 | 62.2 | 1.1 | 3.8 |
| | Slime | 10.6 | 51.5 | 5.9 | 23.8 |
| | | 100.0 | 62.18 | 1.36 | 5.52 |
| IV Lateritic &Limonitic Ore. | -40+10mm washed lumps | 57.8 | 66.64 | 0.8 | 3.1 |
| | -10mm sand | 32.4 | 65.52 | 1.1 | 4.7 |
| | Slimes | 9.8 | 41.00 | 4.1 | 11.3 |
| | | 100.0 | 63.7 | 1.2 | 4.4 |

contd.....7/-

7.5 Tumbler, Abrasion and Shatter Indices:

Tests have been conducted for the Tumbler Abrasion and shatter indices by Research and Development Laboratory, N.M.D.C., Hyderabad. They are 72.3%, 13.6% and 93.00% respectively.

7.6 Pilot Plant Tests:

As mentioned earlier in this Chapter, a total of 560 tonnes of primary samples collected for different types of ore are as follows:-

| | Ores | Tonnes |
|---|---|---|
| 1. | Steel grey hematite | 92 |
| 2. | Blue grey hematite | 89 |
| 3. | Laminated hematite | 115 |
| 4. | Lateritic & Liminotic Ore | 96 |
| 6. | Flaky Ore & Blue Dust | 158 |

The above samples were coned and quartered and the final samples were prepared. A total of 200 tonnes of samples have been sent to N.M.L. for pilot plant tests. The quantities of each type of ore sent are as follows:-

| | | |
|---|---|---|
| 1. | Steel grey hematite | 30 tonnes |
| 2. | Blue grey hematite | 28 tonnes |
| 3. | Laminated hematite | 42 tonnes |
| 4. | Lateritic & Limonitic Ore | 32 tonnes |
| 5. | Flaky Ore & Blue Dust | 68 tonnes |
| | | 200 |

contd....8/-

For preparation of the composite sample the proportions of ore types mentioned in this report are being sent to N.M.L.

7.7 Test Results:

The results of the above individual types of ore and composite samples are yet to be received.

7.8 Proportions and Chemical characteristics of Lump and fine fractions for the deposit:

7.8.1 Based on the batch scale test results of R & D Labs., N.M.D.C. and N.M.L. on individual ore types and the distribution of ore types as computed from slice plans, the proportions and chemical characteristics of lump and fine fractions have been computed for the whole deposit and is summarised below. It becomes necessary to mention that since no sample of flaky ore/blue dust was sent to N.M.L., the dry screening test results for this ore type have been taken from those of the Research and Development Laboratory, N.M.D.C.

contd....9/-

| Product | R & D Labs. N.M.D.C. Wt% | Fe% | SiO2% | Al2O3% | N.M.L. Jamshedpur Wt% | Fe% | SiO2% | Al2O3% |
|---|---|---|---|---|---|---|---|---|
| Lump(-40+10mm) | 34.6 | 66.89 | 0.71 | 2.36 | 35.7 | 66.18 | 0.82 | 1.94 |
| Fines(-10mm +65 mesh) | 43.2 | 65.92 | 1.78 | 1.98 | 43.9 | 65.71 | 1.83 | 1.78 |
| Slime(-65mesh) | 22.2 | 63.57 | 4.11 | 2.00 | 20.4 | 62.09 | 5.17 | 4.44 |
| Head(ROM) | 100.0 | 65.73 | 2.04 | 2.11 | 100.0 | 65.14 | 2.15 | 2.38 |

7.9 <u>Tentative Five Year Production Programme for arriving at Chemical Characteristics & Ore types of ROM ore.</u>

As desired by Dastur & Co., Consultants, Visakhapatnam Steel Plant in their meeting on 17.10.75 a preliminary computation was made for production of 4 million tonnes (ROM) per year to arrive at the chemical characteristics and proportions of types of ore of the ROM ore. While computing the average grade and the proportions of types of ore one normal option of bench opening has been considered. However, any change in opening of the bench would change the results depending on ore type incidence in such development. The average grade of R.O.M. for the

contd....10/-

first five years are as follows:-

| | Fe% | $SiO_2$% | $Al_2O_3$% |
|---|---|---|---|
| 1st year | 63.90 | 1.03 | 2.63 |
| 2nd year | 64.79 | 1.15 | 2.21 |
| 3rd year | 64.59 | 1.29 | 2.41 |
| 4th year | 64.95 | 1.88 | 2.15 |
| 5th year | 65.41 | 1.22 | 2.05 |

The proportions of types of ore for the first five years are as follows:

| | 1st year | 2nd year | 3rd year | 4th year | 5th year |
|---|---|---|---|---|---|
| 1. Steel grey hematite% | 25.20 | 21.4 | 2.1 | 9.3 | 18.80 |
| 2. Blue grey hematite% | 35.00 | 3.50 | 2.9 | 11.2 | 5.40 |
| 3. Laminated hematite% | 18.00 | 43.9 | 58.70 | 42.1 | 44.00 |
| 4. Lateritic & Limonitic Ore% | 17.10 | 6.3 | 6.3 | 2.0 | 1.10 |
| 5. Flaky Ore & Blue Dust | 4.70 | 24.9 | 30.0 | 35.4 | 30.70 |

Assumptions:

1. During actual mining the grade is likely to get diluted in certain areas in contact with waste rocks.

contd.....11/-

2. 1st bench will be completely excavated during preparation of benches, and the quantities to be excavated in the remaining benches during the preparation have been excluded from these computations.

3. One normal option of bench opening has been considered for their computation.

---oOo---

# CHAPTER VIII

## STATISTICAL STUDIES

8.1 The full set of exploration data were subjected to Statistical analysis with a view to computing a) the accuracy of over all ore tonnage estimated, and b) the accuracy of overall ROM grade estimated from the bore hole values. For the purpose of computing the accuracy of the tonnage estimates, Russian emprical formula was used while standard statistical formulea were used for computing reliability of ROM grade estimates.

8.2 Accuracy of Overall ore tonnage estimates.

The following empirical formula (Russian) was used to arrive at the reliability of the total tonnage estimated.

$$a^2 = \frac{\phi^2 \times P}{N} \quad \text{Where } \phi = \frac{V}{K.M.}$$

a = prediction accuracy in %

$\phi$ = coefficient of complication

P = probability factor (2 at 95%)

M = modulus of complication of Ore Waste Contact.

N = No. of bore holes

V = Coeff. of variation of thickness

K = coeff of impurities

contd..2

The following values were obtained for the above parameters from the borehole data

$$V = \frac{31.2}{66.4} = 0.47$$

$$K = 0.93$$

$$M = 0.70$$

$$\phi = 0.72$$

substituting their value in the above formula, the accuracy in the Ore tonnage computation at 95% C.L. works out to ± 11.7% ≈ ± 12%. This means that total tonnage of ore estimated at 119.86 mt. is likely to vary between 119.86 ± 14 Mt. at 95% CL.

8.3 Accuracy of overall ROM grade estimates.

The various statistical parameter's required for this computation were estimated. This included the estimation of variance and covariogram in different directions. These parameters were estimated for Fe, $SiO^2$ and $Al_2O_3$ separately. To these experimental covariagram, theoritical models were fitted which are as follows:-

for Fe = $Cov(d) = 7.36\ e^{-d/185}$ along strike

$= 7.36\ e^{-d/62}$ along dip

for Si = $Cov(d) = 7.08\ e^{-d/125}$ along strike

$= 7.08\ e^{-d/150}$ along dip

for Al = $Cov(d) = 3.66\ e^{-d/125}$ along strike

$= 3.65\ e^{-d/50}$ along dip.

contd...3

Using these values and functions, and the standard expressions/procedures for the accuracy computation, following confidence limit of the mean grade estimates of ROM have been calculated.

| AVERAGE GRADE | CONFIDENCE LIMITS OF THE MEAN AT 95% C.L. |
|---|---|
| Fe% 65.65 | ± 0.40 |
| $SiO_2$% 1.92 | ± 0.34 |
| $Al_2O_3$% 1.62 | ± 0.20 |

-----

# CHAPTER IX

## SUMMARY.

### Objectives:

Detailed investigation of Bailadila Deposit No.4 was taken up by N.M.D.C. to prepare a detailed project report for the mine to be developed to meet the demands of Visakhapatnam Steel Plant. Detailed surveying and geological mapping on 1:1000 scale, about 6085 meters of core drilling, driving of two adits of 400 meters length and collection of bulk samples for batch scale and pilot plant tests have been completed. The present report summarise the results of the above works.

### Description of the Ore Body.

Deposit No.4 occurs as northern continuation of Deposit No.5, separated from Deposit No.5 by a narrow parting of about 150 meters of laterite and poorer lateritic ore. Deposit No.4 is 4.4 km. in length. The ore body can be divided into two blocks which are separated by outcrops of BHQ at cross-section No.45. South Block extends from CS 31 CS 45 and North block from CS 46 to CS 62. Out of 4.4 km length, the main ore zone occupies 3.6 km length. The ore body occurs

contd...2..

along the top of the ridge and is characterised by narrow width which varies from 250 meters to a minimum of 80 meters. The ore extends to a maximum of 130 meters in depth. The deposit becomes shallower in depth on eastern side. The general strike is N-S with easterly dip. The amount of dip varies from $40^{\circ}$ - $80^{\circ}$. The deposit has a general synoformal structure which is further complicated by at least two sets of later folds and a series of faults.

ORE RESERVES:

A total of 32 cross sections at regular intervals (125 meters) were drawn and the total reserve estimated from these sections are 119.86 million tonnes. Cross section wise reserves have also been calculated separately.

Tentative geological slice plans have been drawn for 16 projected mining benches ( each 12 meters height) with top bench having RL 1200 meters.

Total mineable reserves upto 1020 meters level (16 bench) amount to 107.955 million tonnes. 108

Total float ore reserves on eastern and western flanks of Deposit No.4 is estimated at 9.63 million tonnes.

contd....3...

Waste Handling.

Total waste to be handled in the form of inside waste has been estimated at 6.74 million tonnes constituting 6.2% of the mineable potion. In addition to inside waste, considerable quantities of stripping waste are required to be mined to maintain the bank slopes of the deposit for different mineable limits.

Average grade:

The average grade of the deposit on the basis of slice plans is:

| | |
|---|---|
| Fe % | 65.65 |
| SiO2% | 1.97 |
| Al2O3% | 1.62 |

Average Iron values for the entire deposit varies from 58.15% in 1st bench to 67.43% in 15th bench. Average silica value varies from 0.87% in 5th bench to 3.26 in 12th bench. The silica values on southern block are higher than northern block. Alumina values for the entire deposit decreases progressively from 6.79% in 1st bench to 0.99% in 16th bench. Silica & Alumina ratio increases from 1:3.3 in 1st bench to 2.3:1 in in 16th bench.

contd....4

## ORE TYPES

Five distinct ore types have been recognised based on the physical and mineralogical properties. The average grade, reserves and incidences of the individual ore types on the basis of slice plans have been estimated as follows:

| Type | Reserve in mt. | Incidence % | Fe% | $SiO_2$% | $Al_2O_3$% |
|---|---|---|---|---|---|
| I-Steel grey hematite | 12.135 | 11.20 | 66.78 | 1.21 | 1.38 |
| II-Blue grey Hematite | 12.347 | 11.40 | 66.89 | 1.22 | 1.03 |
| III-Laminated hematite | 27.388 | 25.40 | 64.67 | 1.46 | 2.58 |
| IV-Lateritic & Limonitic Ore | 4.060 | 3.80 | 58.94 | 2.21 | 5.55 |
| V-Flaky Ore & Blue Dust | 52.026 | 48.20 | 66.13 | 2.57 | 1.00 |
| Total | 107.955 | | 65.65 | 1.97 | 1.62 |

contd......5

## ORE DRESSING TESTS.

On the basis of batch scale test results on individual type ore samples by R&D labs, Hyderabad and N.M.L., lump and fine recoveries and grades have been computed for the whole deposit and is summarised below:

| Product | R&D Labs NMDC | | | | N.M.L. | | | |
|---|---|---|---|---|---|---|---|---|
| | Wt.% | Fe.% | $SiO_2$% | Al2O3% | Wt.% | Fe.% | $SiO_2$% | Al2O3% |
| Lump (-40 mm +10mm.) | 34.6 | 66.89 | 0.71 | 2.36 | 35.7 | 66.18 | 0.82 | 1.94 |
| Fines (-10mm +65mesh) | 43.2 | 65.92 | 1.78 | 1.98 | 43.9 | 65.71 | 1.83 | 1.78 |

The grades would get diluted proportionately during actual mining because of Waste rock intercalations.

### Tentative five year production programme and average quality of ROM ore.

Tentative production programme for the first five years with 4 million tonnes of ROM per year show the following grades and proportion of ore types.

| Year | ROM grade | | |
|---|---|---|---|
| | Fe% | SiO2% | Al2O3% |
| 1st year | 63.90 | 1.03 | 2.63 |
| 2nd year | 64.79 | 1.15 | 2.21 |
| 3rd year | 64.59 | 1.29 | 2.41 |
| 4th year | 64.95 | 1.88 | 2.15 |
| 5th year | 65.41 | 1.22 | 2.05 |

contd.....6

| Year | S.G.H. % | B.G.H. % | L.H. % | Lat & limo ore % | Flaky ore & B.D. % |
|---|---|---|---|---|---|
| 1st year | 25.20 | 25.00 | 18.00 | 17.10 | 4.70 |
| 2nd year | 21.40 | 3.50 | 43.90 | 6.30 | 24.90 |
| 3rd year | 2.1 | 2.9 | 58.70 | 6.30 | 30.00 |
| 4th year | 9.3 | 11.2 | 42.1 | 2.00 | 35.4 |
| 5th year | 18.8 | 5.40 | 44.0 | 1.10 | 30.70 |

## Statistical Studies.

Statistical studies of the whole set of exploration date have revealed that the overall ore tonnage estimations are accurate within ± 12% accuracy while the accuracy (at 95% C.L) in grade estimations of the total reserves are:

± 0.40 % for Fe.

± 0.34 % for Sio2

± 0.26 % for Al203

-----

Vk.

RAIN FALL AT DEPOSIT NO.4

Annexure - I

(Rainfall in m.m.)

| ear 1. | Jan. 2. | Feb. 3. | March 4. | April 5. | May 6. | June 7. | July 8. | August 9. | Sept. 10. | Oct. 11. | Nov. 12. | Dec. 13. | TOTAL 14. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 969 | - | - | - | - | - | 250 | 2278.5 | 921.2 | 1089.2 | 104.5 | 89.6 | 188.0 | 4921 |
| ax.Rainfall n 24 hrs/Date | - | - | - | - | - | - | 271.5/31 | 115/31 | 322.2/20 | 30.6/11 | 46.2/26 | 76.1/8 | -- |
| 970 | - | 20.9 | 47.0 | 15.6 | 97.3 | 433.8 | 792.2 | 1198.9 | 650.5 | 86.5 | -- | -- | 3342.7 |
| ax.Rainfall/ n 24 hrs/date | | 20.9/19 | 38.8/5 | 11.9/7 | 38.8/23 | 65.4/12 | 135/23 | 248.8/23 | 160/3 | 86.5/13 | -- | -- | -- |
| 971 | 92.0 | 52.6 | 0.1 | 84.5 | 116.1 | 516.2 | 564.7 | 687.2 | 290.1 | 452.9 | -- | -- | 2856.4 |
| ax.Rainfall/ n 24 hrs.Date | 45/27 | 28/27 | 0.1/23 | 42/19 | 47/30 | 85/5 | 100/25 | 76.2/16 | 69.6/5 | 167/16 | -- | -- | -- |
| 972 | - | 4.5 | - | 41.5 | 4.4 | 479.1 | 1320.7 | 431.9 | 272.7 | 306.6 | 11.8 | -- | 2872.6 |
| ax.Rainfall/ n 24hrs/Date | - | 3/22 | - | 27.4/11 | 3.4/12 | 87.7/28 | 360.2/5 | 108.1/23 | 94.8/11 | 89.2/7 | 7.8/1 | -- | -- |
| 973 | - | - | 1.9 | 86.0 | - | 271.9 | 1849.1 | 1417.4 | 259.6 | 361.2 | 15.0 | -- | 4262.1 |
| ax.Rainfall/ n 24 hrs/Date | - | - | 1.9/4 | 86/14 | - | 112.4/7 | 275.6/14 | 214.7/22 | 65.1/4 | 76.2/3 | 15/13 | -- | -- |
| 974 | - | - | - | 96.8 | 144.0 | 347.6 | 354.9 | 1153.1 | 288.9 | 219.9 | 31.1 | -- | 2636.3 |
| ax.Rainfall/ n 24 hrs/Date | - | - | - | 34/24 | 38/22 | 79/17 | 85.4/11 | 248.2/8 | 40.7/24 | 79.5/9 | 22/21 | -- | -- |

contd. . . 2/-

## TEMPARATURE DATA at Dep 4

(Degrees in Centi Grade)

| Year 1. | | JAN. 2. | FEB. 3. | MARCH 4. | APRIL 5. | MAY 6. | JUNE 7. | JULY 8. | AUG. 9. | SEPT. 10. | OCT. 11. | NOV. 12. | DEC. 13. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1970 | | | | | | | | | | | | | |
| verage temparature for the month | Max. | - | - | - | - | - | - | 25.28 | 25.05 | 25.42 | 27.25 | 22.42 | 22.49 |
| | Min. | - | - | - | - | - | - | 18.44 | 17.94 | 18.58 | 16.04 | 10.67 | 6.93 |
| | Mean | - | - | - | - | - | - | 22.41 | 21.50 | 22.00 | 21.64 | 16.20 | 14.71 |
| verage tempara-ture difference | Heighest | - | - | - | - | - | - | 9.17 | 11.60 | 10.00 | 15.00 | 16.60 | 17.78 |
| | Lowest | - | - | - | - | - | - | 2.78 | 3.05 | 2.75 | 8.30 | 11.11 | 13.60 |
| | Mean | - | - | - | - | - | - | 6.83 | 7.11 | 6.83 | 11.21 | 11.73 | 15.55 |
| xtreme tempara-ture | Max. | - | - | - | - | - | - | 26.94 | 29.17 | 29.44 | 28.33 | 26.67 | 24.44 |
| | Min. | - | - | - | - | - | - | 17.22 | 16.67 | 16.94 | 11.11 | 4.44 | 5.00 |
| 1971 | | | | | | | | | | | | | |
| verage tempara-ture for the month | Max. | 24.18 | 26.89 | 31.33 | 33.66 | 34.70 | 24.70 | 24.50 | 24.55 | 27.00 | 26.44 | 24.60 | 23.55 |
| | Min. | 9.38 | 12.33 | 15.22 | 17.26 | 19.10 | 19.50 | 18.80 | 19.34 | 19.23 | 17.47 | 11.60 | 8.00 |
| | Mean | 16.78 | 19.61 | 23.28 | 25.46 | 26.90 | 22.60 | 21.65 | 21.94 | 23.12 | 21.93 | 18.10 | 15.78 |
| verage tempara-ture difference. | Heighest | 17.78 | 18.33 | 21.11 | 21.00 | 18.00 | 12.00 | 7.50 | 10.00 | 11.00 | 20.00 | 15.00 | 18.00 |
| | Lowest | 12.50 | 12.22 | 14.17 | 13.00 | 11.50 | 1.10 | 2.00 | 1.50 | 4.50 | 2.50 | 9.50 | 11.50 |
| | Mean | 14.48 | 12.39 | 16.67 | 16.40 | 15.60 | 5.20 | 5.70 | 5.53 | 7.73 | 8.97 | 13.00 | 15.50 |
| xtreme tempara-ture | Max. | 26.67 | 29.17 | 34.72 | 34.50 | 37.00 | 31.50 | 27.00 | 29.00 | 30.50 | 31.50 | 25.50 | 25.00 |
| | Min. | 5.00 | 10.00 | 18.33 | 13.00 | 17.00 | 18.00 | 18.00 | 18.00 | 18.00 | 13.50 | 9.50 | 4.50 |
| 1972 | | | | | | | | | | | | | |
| verage tempara-ture for the month | Max. | 24.46 | 28.60 | 34.06 | 35.30 | 37.18 | 33.45 | 29.66 | 30.68 | 33.85 | 33.82 | 26.20 | 30.98 |
| | Min. | 8.38 | 12.60 | 16.00 | 20.20 | 23.14 | 22.50 | 13.95 | 13.38 | 13.02 | 10.78 | 12.10 | 7.77 |
| | Mean | 16.42 | 20.60 | 25.97 | 27.75 | 30.16 | 27.97 | 21.80 | 22.03 | 23.43 | 22.30 | 19.15 | 19.38 |

contd....3/-

| 1. | | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Temperature difference | Height | 19.00 | 21.00 | 21.50 | 17.50 | 17.50 | 19.00 | 20.00 | 21.50 | 26.50 | 28.00 | 19.50 | 29.60 |
| | Lowest | 13.50 | 10.00 | 12.50 | 13.00 | 11.50 | 3.50 | 6.00 | 13.50 | 16.00 | 17.00 | 7.50 | 13.50 |
| | Mean | 16.08 | 16.00 | 16.18 | 15.10 | 14.04 | 10.95 | 15.71 | 17.30 | 24.35 | 23.04 | 14.10 | 11.21 |
| Extreme temperature. | Max. | 27.00 | 37.00 | 37.50 | 38.00 | 41.00 | 41.50 | 35.00 | 36.00 | 36.00 | 36.50 | 28.50 | 34.00 |
| | Min. | 6.00 | 8.50 | 16.00 | 18.00 | 19.50 | 19.50 | 10.00 | 10.00 | 9.50 | 6.50 | 7.00 | 3.50 |
| 1973 | | | | | | | | | | | | | |
| Average Temperature for the month | Max. | 33.90 | 36.20 | 35.93 | 39.11 | 37.77 | 30.82 | 24.34 | 24.48 | 26.36 | 28.10 | 26.53 | 26.61 |
| | Min. | 6.60 | 8.96 | 15.00 | 23.85 | 23.83 | 21.93 | 19.40 | 19.36 | 19.44 | 18.80 | 13.44 | 10.63 |
| | Mean | 20.75 | 22.58 | 25.[illegible] | 31.48 | 30.80 | 26.27 | 22.67 | 21.92 | 22.90 | 23.45 | 19.98 | 18.62 |
| Average Temperature difference | Height | 30.50 | 29.50 | 28.50 | 19.00 | 19.00 | 14.50 | 10.00 | 11.50 | 11.50 | 14.00 | 17.50 | 20.00 |
| | Lowest | 26.00 | 23.00 | 13.50 | 12.50 | 9.00 | 2.50 | 1.50 | 0.50 | 2.00 | 3.50 | 5.50 | 12.0 |
| | Mean | 27.30 | 27.24 | 20.93 | 15.26 | 13.94 | 9.50 | 4.96 | 5.12 | 6.92 | 9.30 | 12.09 | 15.98 |
| Extreme temperature | Max. | 36.00 | 39.00 | 41.50 | 42.00 | 42.50 | 38.50 | 30.00 | 30.00 | 31.00 | 31.50 | 30.00 | 29.00 |
| | Min. | 2.00 | 6.50 | 7.00 | 21.00 | 22.00 | 20.50 | 17.00 | 18.00 | 18.50 | 16.50 | 9.00 | 8.50 |
| 1974 | | | | | | | | | | | | | |
| Average temperature for the month | Max. | 27.04 | 31.02 | 35.31 | 34.07 | 37.07 | 32.62 | 27.27 | 24.56 | 28.98 | 28.80 | 28.86 | 27.41 |
| | Min. | 9.20 | 14.53 | 19.83 | 17.29 | 18.33 | 22.28 | 20.09 | 20.00 | 19.96 | 18.66 | 12.48 | 8.31 |
| | Mean | 18.12 | 22.77 | 27.57 | 26.68 | 27.70 | 27.45 | 23.68 | 22.28 | 24.47 | 23.73 | 20.67 | 17.82 |
| Average temperature difference | Height | 20.50 | 19.50 | 20.00 | 22.50 | 24.00 | 16.00 | 16.05 | 9.00 | 14.00 | 19.00 | 19.50 | 20.50 |
| | Lowest | 12.50 | 10.50 | 9.00 | 14.00 | 11.00 | 1.00 | 2.00 | 0.50 | 3.50 | [illegible].00 | 12.50 | 17.50 |
| | Mean | 17.80 | 16.77 | 14.70 | 20.31 | 18.4 | 10.88 | 8.85 | 4.55 | 9.02 | 10.14 | 16.39 | 19.03 |
| Extreme temperature | Max. | 30.00 | 35.00 | 37.50 | 40.50 | 40.50 | 38.60 | 32.50 | 29.00 | 33.00 | 33.00 | 30.00 | 30.00 |
| | Min. | 6.50 | 12.00 | 16.00 | 15.00 | 16.00 | 19.50 | 18.50 | 18.50 | 17.50 | 12.00 | 10.00 | 6.00 |

ANNEXURE - I(a)

## List of Triangulation Stations with their coordinates and reduced levels

| Station Number 1. | LATITUDE 2. | DEPARTURE 3. | Reduced levels 4. | REMARKS 5. |
|---|---|---|---|---|
| A0 | 0.000 | 0.00 | 1103.123 | |
| A | 0.000 | 0.000 | 1075.740 | |
| A1 | 116.1036 N | 31.5753 E | 1071.393 | |
| A2 | 75.9704 N | 88.4477 W | 1085.010 | |
| A3 | | | | |
| A4 | 342.1440 S | 48.8455 E | | |
| A5 | 268.4740 S | 56.9697 E | | |
| A6 | 189.7390 S | 62.9483 W | 1091.668 | |
| A7 | | | | |
| A8 | 50.7230 S | 87.0016 W | 1091.226 | |
| A9 | 217.2786 N | 79.6257 W | 1097.673 | |
| A10 | 113.4454 N | 171.2991 W | 1108.389 | |
| A11 | 229.5364 N | 175.4991 W | 1125.873 | |
| A12 | 204.5564 N | 307.0304 W | 1163.879 | |
| A13 | 298.5858 N | 240.6404 W | 1157.122 | |
| A14 | 273.8024 N | 350.4404 W | 1131.327 | |
| A15 | 433.3000 N | 260.8000 W | 1154.122 | |
| A16 | 506.1000 N | 174.8000 W | 1156.830 | |
| A17 | 585.0000 N | 253.6000 W | -- | |
| A18 | 562.0000 N | 170.5000 W | -- | |
| A19 | 676.4500 N | 165.7000 W | -- | |
| A20 | | | | |
| A21 | | | | |
| A22 | | | | |
| A23 | 136.3759 N | 333.3158 W | 1165.464 | |

Contd...../-

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| A24 | 10.8000 N | 274.0000 W | 1142.157 | |
| A24/1 | 216.2349 N | 382.2428 W | 1124.272 | |
| A24/2 | 412.7656 N | 455.1978 W | 1088.829 | |
| A25 | 49.0000 S | 282.4000 W | 1151.240 | |
| A26 | 131.8285 S | 227.2335 W | 1133.037 | |
| A26/1 | | | | |
| A26/2 | | | 1088.829 | |
| A27 | 129.6942 S | 296.7605 W | 1152.355 | |
| A28 | 36.7616 S | 365.1268 W | 1171.702 | |
| A29 | 98.1804 S | 466.1935 W | 1189.846 | |
| A30 | 34.1086 N | 409.0219 W | 1136.054 | |
| A31 | 133.4036 N | 429.1885 W | 1100.611 | |
| A32 | 228.3131 N | 540.5021 W | 1038.027 | |
| A32/1 | | | 1095.162 | |
| A33 | 140.9686 S | 445.6428 W | 1202.820 | |
| A34 | 229.9784 S | 357.0962 W | 1182.463 | |
| A35 | 291.8283 S | 291.6685 W | 1178.103 | |
| A36 | 362.2925 S | 101.7765 W | 1142.293 | |
| A37 | - | - | - | |
| A38 | 304.2619 S | 358.0829 W | 1186.432 | |
| A39 | 232.5881 S | 451.2230 W | 1208.139 | |
| A40 | 362.2053 S | 404.6540 W | 1185.142 | |
| A41 | 368.2978 S | 495.4055 W | 1204.799 | |
| A42 | 430.4931 S | 428.6743 W | 1179.250 | |
| A43 | 542.6405 S | 596.6789 W | 1204.409 | |
| A44 | 602.6681 S | 536.3489 W | 1173.735 | |
| A45 | 709.9162 S | 664.3335 W | 1197.662 | |

Contd.../-

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| A46 | 893.9101 S | 570.0017 W | | |
| A47 | 899.7963 S | 699.3893 W | 1182.777 | |
| A48 | 904.2948 S | 802.2009 W | 1202.204 | |
| A49 | 583.8579 S | 722.1071 W | 1209.398 | |
| A50 | 916.1528 S | 900.1413 W | 1159.926 | |
| A51 | 942.0630 S | 1080.9277 W | 1091.483 | |
| A52 | -- | -- | 1129.096 | |
| A53 | 687.3048 S | 921.6019 W | 1106.880 | |
| A54 | 712.2323 S | 988.0495 W | 1074.853 | |
| A55 | 576.0226 S | 981.0434 W | 1079.593 | |
| A56 | 513.2129 S | 874.4258 W | 1142.095 | |
| A57 | 426.9841 S | 850.1259 W | 1122.687 | |
| A58 | 286.5051 S | 713.3039 W | 1130.577 | |
| A59 | 252.2821 S | 813.9864 W | 1081.977 | |
| A60 | 224.5799 S | 751.7241 W | 1092.290 | |
| A61 | 41.0379 S | 653.2615 W | 1091.693 | |
| A62 | 174.4456 S | 577.2361 W | 1154.907 | |
| A63 | 271.7148 S | 630.8641 W | 1159.797 | |
| A64 | 106.6600 S | 479.7683 W | 1189.370 | |
| A65 | 236.6853 S | 534.2057 W | 1187.607 | |
| A66 | 412.7656 S | 641.2218 W | 1200.289 | |
| A67 | 972.5767 S | 588.7410 W | 1167.488 | |
| A68 | 989.3903 S | 530.1037 W | 1156.953 | |
| A69 | 1093.4113 S | 555.6417 W | 1150.399 | |
| A70 | 1148.9519 S | 758.8970 W | 1183.887 | |

contd..../-

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| A71 | 1215.1913 S | 577.1846 W | 1138.989 | |
| A72 | 1305.6355 S | 644.0266 W | 1138.006 | |
| A73 | 1329.0144 S | 768.6337 W | 1148.370 | |
| A74 | 1420.9805 S | 675.7243 W | 1183.617 | |
| A75 | 1513.1084 S | 764.3661 W | 1136.652 | |
| A76 | 1505.2297 S | 685.0810 W | 1127.842 | |
| A77 | 1620.3817 S | 624.9860 W | 1113.933 | |
| A78 | 1637.2477 S | 757.4783 W | 1136.460 | |
| A79 | 1694.4720 S | 654.0363 W | 1114.089 | |
| A80 | 1766.2542 S | 783.8699 W | 1137.172 | |
| A81 | 1815.9161 S | 686.1528 W | 1113.760 | |
| A82 | 1927.9771 S | 673.3998 W | 1105.729 | |
| A82/1 | 1995.1081 S | 653.7213 W | 1090.596 | |
| A82/2 | 2219.4705 S | 599.9254 W | 1044.590 | |
| A83 | 1842.2259 S | 784.1572 W | 1139.951 | |
| A84 | 1948.1493 S | 837.9513 W | 1158.786 | |
| A85 | 2030.4821 S | 852.7748 W | 1166.724 | |
| A86 | 1839.4273 S | 891.5654 W | 1099.225 | |
| A87 | 1776.3629 S | 813.7380 W | 1121.436 | |
| A88 | 1742.6629 S | 890.0550 W | 1073.238 | |
| A89 | 1710.9652 S | 810.7048 W | 1113.094 | |
| A90 | 1646.0569 S | 859.5796 W | 1069.343 | |
| A91 | 1546.1204 S | 855.1054 W | 1095.119 | |
| A91/1 | -- | -- | 1072.000 | |
| A92 | -- | -- | 1111.178 | |
| A93 | 1453.9589 S | 850.8003 W | 1090.955 | |
| A94 | 1380.1233 S | 873.2089 W | 1076.054 | |
| A95 | 1421.3045 S | 780.9389 W | 1136.382 | |

contd.../

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| A96 | 1322.3109 S | 825.9065 W | 1123.125 | |
| A97 | 1263.8533 S | 909.4923 W | 1055.065 | |
| A98 | 1230.8343 S | 856.4749 W | 1089.895 | |
| A99 | 1102.3233 S | 893.6320 W | 1126.868 | |
| A100 | 1036.3119 S | 795.2720 W | 1190.654 | |
| A101 | -- | -- | 1174.630 | |
| A102 | 2052.6966 S | 738.9454 W | 1109.633 | |
| A103 | 2153.8731 S | 724.1407 W | 1086.391 | |
| A104 | 2121.3229 S | 814.5338 W | 1126.566 | |
| A105 | 2082.2056 S | 876.7232 W | 1159.268 | |
| A106 | 2205.5411 S | 903.6318 W | 1149.632 | |
| A107 | 2058.2042 S | 932.3693 W | 1147.595 | |
| A108 | 2201.1922 S | 959.6530 W | 1137.928 | |
| A109 | 2305.9696 S | 923.7229 W | 1130.341 | |
| A110 | 2289.9741 S | 814.1514 W | 1098.302 | |
| A111 | 2463.0481 S | 889.0570 W | 1084.454 | |
| A111/1 | 2453.9761 S | 800.6367 W | 1060.858 | |
| A111/2 | 2553.7511 S | 877.8944 W | 1067.588 | |
| A111/3 | -- | -- | 1061.850 | |
| A112 | 2482.6291 S | 984.5492 W | 1126.947 | |
| A113 | 2568.5821 S | 964.2748 W | 1099.385 | |
| A114 | 2614.1831 S | 1028.4513 W | 1113.463 | |
| A115 | 2654.4371 S | 1021.5904 W | 1104.477 | |
| A116 | 2677.0571 S | 1067.6827 W | 1102.654 | |
| A117 | 2757.1071 S | 1030.4687 W | 1084.567 | |
| A118 | 2812.5616 S | 1166.9138 W | 1105.672 | |

contd..../-

| 1. | 2. | | 3. | | 4. | 5. |
|---|---|---|---|---|---|---|
| 9 | 2883.3926 | S | 1106.5164 | W | 1081.645 | |
| 20 | 2989.5796 | S | 1205.7343 | W | 1083.256 | |
| 1 | 2986.8691 | S | 1307.6418 | W | 1093.904 | |
| 2 | 3032.2979 | S | 1255.5943 | W | 1081.355 | |
| 3 | 3056.8596 | S | 1365.7519 | W | 1086.884 | |
| 4 | 3140.2879 | S | 1313.1439 | W | 1085.733 | |
| 5 | 3180.0761 | S | 1494.6729 | W | -- | |
| 6 | 2989.0173 | S | 1428.9544 | W | 1056.187 | |
| 7 | 2818.6710 | S | 1278.9583 | W | 1038.168 | |
| 8 | 2766.1872 | S | 1197.7967 | W | 1073.770 | |
| 8/1 | 2875.0142 | S | 1251.0573 | W | | |
| 9 | 2749.0313 | S | 1242.7356 | W | 1027.425 | |
| 0 | 2672.5173 | S | 1226.9463 | W | 1006.108 | |
| 1 | 2509.0533 | S | 1213.5550 | W | 992.767 | |
| 2 | 2411.9572 | S | 1154.8416 | W | 1015.308 | |
| 3 | 2550.0331 | S | 1094.0190 | W | 1085.433 | |
| 4 | -- | | -- | | 1068.593 | |
| 5 | -- | | -- | | -- | |
| 6 | 2355.0331 | S | 1000.2369 | W | 1117.664 | |
| 7 | 2235.6552 | S | 1150.0283 | W | 1024.250 | |
| 7/1 | -- | | -- | | 1055.619 | |
| 8 | 2114.9932 | S | 1033.1323 | W | 1076.861 | |
| /1 | | | | | 1090.630 | |
| /2 | | | | | 1080.780 | |
| /3 | | | | | 1080.000 | |
| /4 | | | | | 1057.870 | |
| /5 | | | | | 1046.700 | |
| /6 | | | | | 1091.550 | |
| | | | | | 1102.089 | |
| | | | | | 1094.472 | |
| | | | | | 1102.139 | |

[redacted] 1.2

**ANNEXURE-1 (b)**

## List of Boreholes Drilled by N.M.D.C. at Bailadila Deposit No.4

| Sl. No. | Borehole Number | Location | Date of Commencement | Date of closing | Depth | R.L. | Latitude | Departure | Formation at the bottom of the hole |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. |
| 1. | 31B | 17 metres west of C.A.L. | 1..8.73 | 2.11.73 | 77.00 | 1084.428 | 3136.474 S | 1419.316 W | Shale |
| 2. | 32B | 67 metres West of C.A.L. | 30.10.72 | 1.12.72 | 82.30 | 1085.974 | 3038.0891S | 1352.4603W | Ore |
| 3. | 33C | 3 Metres East of C.A.L. | 29.6.73 | 26.7.73 | 42.40 | 1086.186 | 2976.828 S | 1228.9372W | BHQ |
| 4. | 33.5C1 | On C.A.L. | 19.3.74 | 27.3.74 | 42.50 | 1085.13 | 2928.6956S | 1187.6993W | Shale |
| 5. | 34B | 45 metres West of C.A.L. | 6.12.72 | 31.1.73 | 90.90 | 1095.522 | 2848.4556S | 1180.2746W | Shale/BHQ |
| 6. | 35B | 61 metres West of C.A.L. | 26.6.72 | 23.10.72 | 112.00 | 1091.37 | 2743.897 S | 1115.183 W | BHQ |
| 7. | 35.5C | On C.A.L. | 8.11.73 | 1.12.73 | 50.00 | 1085.51 | 2736.1871S | 1028.6387W | Shale |
| 8. | 36B1 | 62.5 metres East of C.A.L. | 14.10.73 | 14.2.74 | 100.30 | 1106.637 | 2649.5200S | 1036.521 [illegible] | Ore/BHQ |
| 9. | 36C | On C.A.L. | 20.6.73 | 2.7.73 | 29.00 | 1072.122 | 2688.408 S | 989.273 W | Shale/BHQ |
| 10. | 37B | 45 metres West of C.A.L. | 22.6.71 | 19.5.71 | 11.35 | 1119.60 | 2545.5000S | [illegible] | Shale |
| 11. | 37B1 | 125 metres West of C.A.L. | 11.3.74 | 16.6.74 | 79.00 | 1084.12 | 2538.15[illegible] | [illegible]9.8368W | Ore |
| 12. | 37C | On Central Axial Line | 27.2.71 | 27.5.71 | 58.25 | 1098.370 | 2566.7453S | [illegible].5319W | Shale |
| 13. | 37.5C1 | 62.5 metres East of C.A.L. | 4.10.74 | 26.10.74 | 61.00 | 1073.86 | 2519.149 S | [illegible] | Shale/BHQ |
| 14. | 38B | 62.5 metres West of C.A.L. | 14.6.71 | 30.10.71 | 38.50 | 1113.35 | 2427.7521[illegible] | [illegible] | Ore |
| 15. | 38C | On Central Axial Line | 24.7.73 | 10.10.73 | 69.00 | 1101.539 | 2445.0[illegible] | 931.[illegible] | BHQ |
| 16. | 38.5B1 | 62.5 metres West of C.A.L. | 4.4.74 | 18.6.74 | 39.25 | 1125.82 | 2368.[illegible] | [illegible] | Ore |
| 17. | 38.5C1 | 62.5 metres East of C.A.L. | 11.9.74 | 10.10.74 | 72.00 | 1082.00 | 2398,506 S | [illegible]3.892 W | Shale |
| 18. | 39B | 61 metres West of C.A.L. | 12.2.73 | 13.6.73 | 95.00 | 1131.430 | 2310.2365S | 951.8447W | Ore |
| 19. | 39C | On C.A.L. | 27.1.71 | 18.5.71 | 58.50 | 1116.627 | 2323.4193S | 9[illegible]3.1993W | B.H.Q. |
| 20. | 39.5B1 | 62.5 metres West of C.A.L. | 26.4.74 | 18.6.74 | 46.00 | 1135.280 | 2248.009 S | 949.059 W | Ore |
| 21. | 39.5C1 | On C.A.L. | 22.6.74 | 18.8.74 | 97.50 | 1130.685 | 2262.749 S | 888.1149W | BHQ |
| 22. | 40B (Angular Borehole) | | 19.11.74 | 24.1.75 | 18.60 | 1098.016 | 2173.101 S | 987.458W | Ore |
| 23. | 40C (Angle Borehole) 45° towards West of C.A.L. | 3 metres West of C.A.L. | 22.6.71 | 23.3.71 | 100.20 | 1138.60 | 2201.7563S | 877.5080W | Ore |
| 24. | 40.5B1 | 62.5 metres West of C.A.L. | 21.6.74 | 6.9.74 | 82.40 | 1142.390 | 2126.998 S | 918.8048W | Ore |
| 25. | 40.5C1 | On C.A.L. | 26.7.74 | 23.9.74 | 81.00 | 1139.880 | 2140.0770S | 858.718 W | Ore |
| 26. | 41B (Angle Borehole) | 120 metres West of C.A.L. (45° towards C.A.L.) | 3.5.73 | 6.12.73 | 61.00 | 1101.120 | 2054.25 S | 961.12 W | Ore |
| 27. | 41C | C.A.L. | 30.10.70 | 21.1.71 | 66.30 | 1149.50 | 2080.0933S | 845.816 W | BHQ/BHJ |
| 28. | 41D | 125 metres East of C.A.L. | 19.5.70 | 25.9.70 | 85.00 | 1092.50 | 2112.100 S | 723.50 W | Shale |
| 29. | 41.5B1 | 62.5 metres West of C.A.L. | 9.10.74 | 24.1.75 | 45.00 | 1165.30 | 2003.945 S | 891.382 W | Ore |
| 30. | 41.5 C1 | 62.5 metres East of C.A.L. | 23.8.74 | 26.9.74 | 85.50 | 1125.85 | 2033.354 S | 769.307 W | Ore |
| 31. | 42B | 82.5 metres West of C.A.L. | 27.4.73 | 27.9.73 | 117.70 | 1116.629 | 1938.1400S | 399.4800W | Ore |
| 32. | 42C | On C.A.L. | 27.10.70 | 2.5.71 | 76.00 | 1151.02 | 1958.4303S | 817.125 W | Ore |
| 33. | 42C1 | 62.5 metres East of C.A.L. | 10.12.73 | 13.3.74 | 112.75 | 1126.16 | 1973.9071S | 755.4148W | Ore |
| 34. | 43C | On C.A.L. | 16.3.73 | 18.4.73 | 114.70 | 1138.451 | 186.7673S | [illegible].4340W | Ore |
| 35. | 44C | Actually 44.5C on C.A.L. | 15.10.73 | 25.1.74 | 94.60 | 1135.460 | 1646.372 S | 750.532 | Ore |

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10 |
|---|---|---|---|---|---|---|---|---|---|
| 36. | 46C | On C.A.L. | 20.4.72 | 19.5.72 | 53.85 | 1132.07 | 1471.2401S | 702.6424W | Ore |
| 37. | 47B | 83 metres West of C.A.L. | 4.5.72 | 7.8.72 | 104.00 | 1145.76 | 1329.4602S | 754.4417W | BHQ/Shale |
| 38. | 47B1 | 125 metres West of C.A.L. | 4.2.73 | 14.4.74 | 101.25 | 1138.855 | 1320.9372S | 794.3922W | Ore |
| 39. | 48B | 100 metres West of C.A.L. | 30.5.72 | 28.6.72 | 65.60 | 1163.810 | 1209.5544S | 741.3166W | Shale |
| 40. | 49A | 250 metres West of C.A.L. | 11.3.74 | 23.4.74 | 98.00 | 1138.34 | 1049.9073S | 859.593 W | Ore |
| 41. | 49B | 145 metres West of C.A.L. | 1.6.72 | 28.6.72 | 80.05 | 1183.57 | 1073.9759S | 757.021 W | Shale/BHQ |
| 42. | 49B1 | 62.5 metres West of C.A.L. | 6.12.73 | 11.12.73 | 40.00 | 1166.048 | 1092.997 S | 678.1740W | Shale |
| 43. | 49.5A1 | 187.5 metres West of C.A.L. | 25.11.74 | 24.1.75 | 27.50 | 1194.50 | 1003.8119S | 782.302 W | Ore |
| 44. | 50A | 314 metres West of C.A.L. | 24.9.72 | 23.11.73 | 63.00 | 1161.06 | 917.193 S | 892.082 W | Shale/BHQ |
| 45. | 50B | 211 metres West of C.A.L. | 17.7.72 | 5.2.73 | 90.65 | 1199.586 | 934.5743S | 793.1614W | Ore |
| 46. | 50B1 | 125 metres West of C.A.L. | 15.11.72 | 3.1.73 | 46.20 | 1181.207 | 954.0284S | 719.0926W | Shale |
| 47. | 50.5A1 | 187.5 metres West of C.A.L. | 17.10.74 | 18.11.74 | 85.00 | 1190.63 | 881.567 S | 749.930 W | Shale |
| 48. | 51A | 191 metres West of C.A.L. | 15.7.72 | 9.11.72 | 71.25 | 1191.167 | 814.4636S | 744.2621W | Ore |
| 49. | 51C | 19 metres West of C.A.L. | 19.7.73 | 31.7.73 | 51.00 | 1170.787 | 859.764 S | 574.1300W | Shale |
| 50. | 52A | 190 metres West of C.A.L. | 1.1.73 | 31.1.73 | 115.10 | 1194.942 | 697.7300S | 714.8888W | BHQ |
| 51. | 52B | 143 metres West of C.A.L. | 6.11.72 | 23.12.72 | 97.00 | 1196..55 | 708.8270S | 668.1526W | Shale/BHQ |
| 52. | 52.5A | 187.5 metres West of C.A.L. | 6.8.73 | 1.2.74 | 133.90 | 1201.10 | 638.020 S | 716.140 W | BHQ/BHJ |
| 53. | 53A | 187.5 metres West of C.A.L. | 9.2.73 | 9.3.73 | 90.00 | 1208.102 | 578.130 S | 697..3400W | BHQ |
| 54. | 53B | 133 metres West of C.A.L. | 8.12.72 | 6.2.73 | 95.00 | 1201.235 | 585.5148S | 630.1628W | Ore |
| 55. | 53B1 | 62.5 metres West of C.A.L. | 21.12.73 | 18.1.74 | 53.00 | 1178.315 | 606.1616S | 564.2609W | BHQ/BHJ |
| 56. | 53.5B1 | 125 metres West of C.A.L. | 25.11.74 | 24.1.75 | 80.75 | 1207.80 | 530.474 S | 607.932 N | BHQ |
| 57. | 54A | 153 metres West of C.A.L. | 18.10.72 | 1.12.72 | 35.00 | 1208.790 | 462.7959 S | 622.2894W | BHQ |
| 58. | 54B | 75 metres West of C.A.L. | 31.1.73 | 10.4.73 | 108.50 | 1195.534 | 481.050 S | 544.070 W | BHQ/Shale |
| 59. | 54.5B1 | 62.5 metres West of C.A.L. | 17.5.74 | 21.6.74 | 67.00 | 1201.744 | 422.644 S | 520.2295W | BHQ |
| 60. | 55B | 62.5 metres West of C.A.L. | 3.11.72 | 16.11.72 | 40.75 | 1206.150 | 358.5993S | 500.3583W | BHQ |
| 61. | 55B1 | 125 metres West of C.A.L. | 25.6.74 | 15.7.74 | 53.50 | 1201.339 | 347.0968 | 565.2595W | BHQ |
| 62. | 55C | On C.A.L. | 5.5.73 | 16.8.73 | 70.00 | 1191.162 | 376.811 S | 444.138 W | Ore |
| 63. | 56A | 114 metres West of C.A.L. | 21.2.73 | 26.3.73 | 73.00 | 1187.182 | 228.6439S | 527.6701W | BHQ |
| 64. | 56B | 47 metres West of C.A.L. | 28.8.72 | 18.10.72 | 85.50 | 1207.874 | 246.273 S | 460.6552W | BHQ |
| 65. | 56C | 15 metres West of C.A.L. | 14.2.73 | 10.4.73 | 97.00 | 1199.049 | 25[illegible].564 | 529.564 W | BHQ/Shale |
| 66. | 56.5B1 | 62.5 metres West of C.A.L. | 7.7.74 | 6.9.74 | 90.00 | 1202.200 | 179.409 S | 460.600 W | Ore/BHQ |
| 67. | 57B | 68 metres West of C.A.L. | 23.1.72 | 18.1.72 | 108.90 | 1193.97 | 115.4104S | 45[illegible].4065W | Ore |
| 68. | 57B1 | 128 metres West of C.A.L. | 12.12.[illegible] | 24.1.75 | [illegible].25 | 115[illegible].70 | 109.7760S | 520.949 W | BHQ |
| 69. | 58B | 125 metres West of C.A.L. | 23.4.73 | 21.[illegible]3 | 41.70 | 1108.324 | 17.110 N | 482.660 W | Ore |
| 70. | 4B | 57 metres West of C.A.L. on CS58 | 5.4.69 | 12.4.70 | 10[illegible] | 1157.10 | 9.1102 N | 409.3031W | Ore |
| 71. | 58.5B1 | 62.5 metres West of C.A.L. | 11.9.74 | 31.10.7[illegible] | 80.00 | 1149.20 | 60.892 N | 398.901 W | Ore |
| 72. | 3C | 42 metres South of C.S.60 | 9.3.69 | 15.1.70 | 84.00 | 1163.17 | 191.480 N | 314.450 W | Ore |

Contd..../-

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. |
|---|---|---|---|---|---|---|---|---|---|
| 73. | 59B | 125 metres West of C.A.L. | 13.3.73 | 11.5.73 | 32.20 | 1099.213 | 137.400 N | 450.300 W | BHQ |
| 74. | 59B1 | 62.5 metres West of C.A.L. | 31.3.74 | 21.6.74 | 75.30 | 1134.98 | 123.5576 N | 390.4195W | Ore |
| 75. | 59.5B1 | 62.5 metres West of C.A.L. | 29.8.74 | 7.11.74 | 72.50 | 1131.05 | 186.089 N | 373.841 W | Ore |
| 76. | 60B | 125 metres West of C.A.L. | 16.5.73 | 27.6.73 | 95.00 | 1091.711 | 259.8900N | 419.040 W | Ore |
| 77. | 60B1 | 62.5 metres West of C.A.L. | 31.1.74 | 3.8.74 | 86.00 | 1125.014 | 246.2544N | 363.3954W | Ore |
| 78. | 61D | 47.5 metres West of C.A.L. | 8.1.73 | 24.1.73 | 47.25 | 1154.670 | 340.4683N | 228.2777W | BHQ |
| 79. | 61D1 | 125 metres East of C.A.L. | 20.12.74 | 12.3.74 | 81.90 | 1130.048 | 323.5514N | 151.6351W | BHQ/BHI |
| 80. | 62C | On C.A.L. | 24.1.73 | 24.4.73 | 115.80 | 1158.327 | 474.8297 N | 243.2990W | Ore |
| 81. | 62D | 81 metres East of C.A.L. | 31.5.73 | 25.6.73 | 50.00 | 1140.122 | 457.027 N | 170.321 W | BHQ |

-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-

# TABLE

## ORE RESERVE ESTIMATES OF SOUTH BLOCK (SECTIONWISE)

| Sl. No. | Cross Section | Area M² Type I | Area M² Type II | Area M² Type III | Area M² Type IV | Area M² Type V | TOTAL | Length of Influence | Volume M³ Type I | Volume M³ Type II | Volume M³ Type III | Volume M³ Type IV | Volume M³ Type V | Total Volume |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 32 | -- | -- | 1290 | 530 | 2615 | 4435 | 40 | -- | -- | 180600 | 74200 | 366100 | 620900 |
| 2. | 34 | --- | -- | 1170 | 345 | 1005 | 2520 | 107.5 | -- | -- | 125775 | 37087.5 | 108037.5 | 270900 |
| 3. | 35 | 292 | -- | 2065 | 575 | -- | 2932 | 125 | 36500 | --- | 258125 | 71875 | -- | 366500 |
| 4. | 36 | 340 | -- | 3305 | 134 | 2097 | 5876 | 125 | 42500 | -- | 413125 | 16750 | 262125 | 734500 |
| 5. | 37 | 3403 | 965 | 3045 | 475 | 2345 | 10233 | 125 | 425375 | 120625 | 380625 | 59375 | 293125 | 1279125 |
| 6. | 38 | 3320 | -- | 745 | -- | 315 | 4380 | 125 | 415000 | -- | 93125 | -- | 39375 | 547500 |
| 7. | 39 | -- | 5421 | 1460 | -- | 2395 | 9276 | 125 | -- | 677625 | 182500 | -- | 299375 | 1159500 |
| 8. | 40 | 4988 | 1100 | 2535 | 1025 | -- | 9648 | 125 | 623500 | 137500 | 316875 | 128125 | -- | 1206000 |
| 9. | 41 | 5756 | -- | 3969 | 1268 | 4023 | 15016 | 125 | 719500 | -- | 496125 | 158500 | 502875 | 1877000 |
| 10. | 42 | -- | -- | 7190 | 2590 | 19172 | 28952 | 125 | -- | -- | 898750 | 323750 | 2396500 | 3619000 |
| 11. | 43 | -- | -- | 757 | 807 | 12350 | 13914 | 125 | -- | --- | 94625 | 100875 | 1543750 | 1739250 |
| 12. | 44 | -- | 165 | -- | 870 | 4585 | 5620 | 125 | -- | 20625 | -- | 108750 | 573125 | 702500 |
| | | 18099 | 7651 | 27531 | 8619 | 50902 | 112802 | | 2262375 | 956375 | 3440250 | 1079287.5 | 638438.5 | 14122675 |

### Ore Reserves of South Block

| | Type of Ore | Volume M³ | Sp. gravity | Reserves (Tonnes) |
|---|---|---|---|---|
| I | Steel Grey hematite | 2262375 | 4.2 | 95,01,975 |
| II | Blue grey hematite | 956375 | 4.0 | 38,25,500 |
| III | Laminated hematite | 3440250 | 3.5 | 120,40,875 |
| IV | Lateritic and Limonitic Ore | 1079287 | 3.5 | 37,77,506 |
| V | Flaky Ore and Blue Dust | 6384387 | 3.4 | 217,06,917 |
| | Total | 141,22,675 | | 508,52,772 |

TABLE

## ORE RESERVE ESTIMATES OF NORTH BLOCK (SECTIONWISE)

| Sl. No. | Cross Section | Area M² | | | | | | Length of Influence | Volume M³ | | | | | M³ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Type I | Type II | Type III | Type IV | Type V | TOTAL | | Type I | Type II | Type III | Type IV | Type V | Total Volume |
| 1. | 46 | -- | -- | -- | 240 | 6050 | 6290 | 125 | -- | -- | -- | 30000 | 756250 | 786250 |
| 2. | 47 | -- | -- | 3060 | - | 4850 | 7910 | 125 | -- | -- | 382500 | -- | 606250 | 988750 |
| 3. | 48 | -- | 2615 | 280 | - | -- | 2895 | 125 | -- | 326875 | 38000 | -- | -- | 361875 |
| 4. | 49 | -- | 1955 | 315 | -- | 8370 | 10640 | 125 | -- | 244375 | 39375 | -- | 1046250 | 1330000 |
| 5. | 50 | 5910 | 8000 | -- | 450 | -- | 14360 | 125 | 738750 | 1000000 | -- | 56250 | -- | 1795000 |
| 6. | 51 | 4870 | -- | 930 | 310 | 2680 | 8790 | 125 | 608750 | -- | 116250 | 38750 | 335000 | 1098750 |
| 7. | 52 | 2400 | -- | 2700 | 910 | 4730 | 10740 | 125 | 300000 | -- | 337500 | 113750 | 591250 | 1342500 |
| 8. | 53 | -- | -- | 3400 | 1620 | 8100 | 13120 | 125 | -- | -- | 425000 | 202500 | 1012500 | 1640000 |
| 9. | 54 | -- | -- | 8450 | 700 | 4480 | 13630 | 125 | -- | -- | 1056250 | 87500 | 560000 | 1703750 |
| 10. | 55 | -- | -- | 4600 | 570 | 3800 | 8970 | 125 | -- | -- | 575000 | 71250 | 475000 | 1121250 |
| 11. | 56 | -- | 620 | 3440 | 1430 | 6990 | 12480 | 125 | -- | 77500 | 430000 | 178750 | 873750 | 1560000 |
| 12. | 57 | 1280 | 2260 | 1190 | -- | 900 | 5630 | 125 | 160000 | 282500 | 148750 | -- | 112500 | 703750 |
| 13. | 58 | -- | 580 | 3930 | 225 | 2140 | 6875 | 125 | -- | 72500 | 491250 | 28125 | 267500 | 859375 |
| 14. | 59 | 700 | 3400 | 2040 | -- | 2550 | 8690 | 125 | 87500 | 425000 | 255000 | -- | 318750 | 1086250 |
| 15. | 60 | 2600 | 1420 | 4540 | 1150 | 8900 | 18610 | 75 | 195000 | 106500 | 340500 | 86250 | 667500 | 1395750 |
| 16. | 61 | -- | -- | 5700 | -- | -- | 5700 | 125 | -- | -- | 712500 | -- | -- | 712500 |
| 17. | 62 | -- | -- | 3210 | 970 | 6700 | 10880 | 62.5 | -- | -- | 200625 | 60625 | 4178750 | 680000 |
| Total | | 17760 | 20850 | 47785 | 8575 | 71240 | 166210 | | 2090000 | 2535250 | 5545500 | 953750 | 8041250 | 19165750 |

### Ore Reserve of North Block

| Type of Ore | | Volume M³ | Sp. gravity | Reserves (Tonnes) |
|---|---|---|---|---|
| I | Steel grey hematite | 2090000 | 4.2 | 87,78,000 |
| II | Blue grey hematite | 2535250 | 4.0 | 101,41,000 |
| III | Laminated hematite | 5545500 | 3.5 | 194,09,250 |
| IV | Lateritic and Limonitic Ore | 953750 | 3.5 | 33,38,125 |
| V | Flaky Ore & Blue Dust | 8041250 | 3.4 | 273,40,250 |
| | Total | 19165750 | | 690,06,625 |

ANNEXURE - III (a)

## DETAILS OF FLOAT ORE EXPLORATION AT DEPOSIT NO.4
## (WESTERN FLANK)

| Sl. No. (1) | Pit No. (2) | Depth of ore in mts. (3) | Volume of Ore $M^3$ (4) | Average Bulk Density of Ore (5) | Weight of Ore (Tonnes) (6) | Volume of soil $M^3$ (7) | Average Bulk density of soil (8) | Weight of soil (Tonnes) (9) | Recovery Percent (10) | [illegible] (11) | Remarks (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5 | Complete BHQ | | - | - | - | - | - | - | | - |
| 2 | 6 | Ferruginous Shale | | - | - | - | - | - | - | | - |
| 3 | 7 | Ferruginous Shale | | -- | - | - | - | - | - | | - |
| 4 | 8 | 0.42 | 0.25 | 2.5 | 0.625 | 0.87 | 1.8 | 1.56 | 28.66 | | - |
| 5 | 9 | 1.39 | Measurements not taken | | - | - | - | - | - | [illegible] | - |
| 6 | 10 | 3.70 | 3.60 | 2.5 | 9.00 | 2.56 | 1.8 | 4.60 | 66.18 | [illegible] | - |
| 7 | 11 | 4.50 | 6.71 | 2.5 | 16.77 | 4.39 | 1.8 | 7.90 | 67.98 | [illegible] | - |
| 8 | 12 | 2.50 | 4.35 | 2.5 | 10.97 | 3.03 | 1.8 | 5.45 | 66.81 | [illegible] | - |
| 9 | 13 | Mixed with BHQ | - | - | - | - | -- | - | - | | - |
| 10. | 14 | Complete BHQ | - | - | - | - | - | - | - | | - |
| 11 | 15 | 2.24 | 2.29 | 2.5 | 5.72 | 1.54 | 1.8 | 2.77 | 67.37 | [illegible] | - |
| 12 | 16 | 3.85 | 5.75 | 2.5 | 14.37 | 5.18 | 1.8 | 9.32 | 60.66 | [illegible] | - |
| 13 | 17 | 7.07 | 7.81 | 2.5 | 19.52 | 5.47 | 1.8 | 9.84 | 66.48 | [illegible] | - |
| 14 | 18 | 5.60 | 6.36 | 2.5 | 15.90 | 5.43 | 1.8 | 9.77 | 61.94 | [illegible] | - |
| 15 | 19 | 2.20 | 1.14 | 2.5 | 2.85 | 4.53 | 1.8 | 8.15 | - | [illegible] | - |
| 16 | 20 | 3.50 | 3.54 | 2.5 | 8.85 | 2.08 | 1.8 | 3.74 | 70.29 | [illegible] | - |
| 17 | 21 | Complete BHQ | - | - | - | - | - | - | - | | - |
| 18 | 22 | Not taken up | - | - | - | - | - | - | - | | - |
| 19 | 23 | Complete BHQ | - | - | - | - | - | - | - | | - |
| 20 | 24 | Insitu ore | - | - | - | - | - | - | - | | - |
| 21 | 25 | BHQ | - | - | - | - | - | - | - | | - |
| 22 | 26 | BHQ | - | - | - | - | - | - | - | | - |
| 23 | 27 | Insitu Ore | - | - | - | - | - | - | - | | - |
| 24 | 28 | BHQ | - | - | - | - | - | - | - | | - |
| 25 | 29 | Not taken up | - | - | - | - | - | - | - | | - |
| 26 | 30 | BHQ | - | - | - | - | - | - | - | | - |
| 27 | 31 | BHQ | - | - | - | - | - | - | - | | - |
| 28 | 32 | 2.22 | 1.43 | 2.5 | 3.57 | 2.19 | 1.8 | 3.94 | 47.54 | | - |
| 29 | 33 | 3.00 | 3.87 | 2.5 | 9.67 | 2.52 | 1.8 | 4.53 | 68.10 | | - |
| 30 | 34 | Insitu Ore | - | - | - | - | - | - | - | | - |
| 31 | 35 | Westhered BHQ | - | - | - | - | - | - | - | | - |
| 32 | 36 | 4.40 | 5.73 | 2.5 | 14.32 | 2.35 | 1.8 | 4.23 | 77.20 | | - |
| 33 | 37 | 3.40 | 2.75 | 2.5 | 6.87 | 3.86 | 1.8 | 6.94 | 49.64 | | - |
| 34 | 38 | No float ore | - | - | - | - | - | - | - | | - |
| 35 | 39 | 3.70 | 5.08 | 2.5 | 12.70 | 2.88 | 1.8 | 5.18 | 71.03 | | - |
| 36 | 40 | 4.00 | 6.53 | 2.5 | 16.32 | 2.27 | 1.8 | 4.08 | 80.00 | | - |
| 37 | 41 | 1.11 | - | - | - | - | - | - | - | | - |
| 38 | 42 | 1.50 | 1.00 | 2.5 | 2.5 | 1.90 | 1.8 | 3.42 | 42.23 | | - |
| 39 | 43 | - | No float ore(complete BHQ) | | - | - | - | - | - | | - |
| 40 | 44 | 0.61 | No float ore | | | | | | | | - |
| 41 | 45 | 6.12 | 4.44 | 2.5 | 11.1 | 1.15 | 1.8 | 2.07 | 84.28 | | - |
| 42 | 46 | 4.32 | 3.42 | 2.5 | 8.55 | 2.57 | 1.8 | 4.62 | 64.92 | | - |
| 43 | 47 | 4.38 | 5.81 | 2.5 | 14.52 | 8.02 | 1.8 | 14.43 | 50.15 | | - |
| 44 | 48 | 1.17 | (Stack measurement not taken) | | - | - | - | - | - | | - |
| 45 | 49 | 5.50 | 8.33 | 2.5 | 20.82 | 7.04 | 1.8 | 12.67 | 62.17 | | - |
| 46 | 50 | 2.85 | 4.40 | 2.5 | 11.00 | 2.32 | 1.8 | 4.17 | 72.51 | | - |
| 47 | 51 | 4.60 | 2.64 | 2.5 | 6.60 | 5.25 | 1.8 | 9.45 | 58.88 | | - |
| 48 | 52 | 1.52 | (Stack measurements not taken) | | | | | | | | - |
| 49 | 53 | 0.51 | Insitu ore | - | - | - | - | - | - | | - |
| 50 | 54 | 1.75 | 1.38 | 2.5 | 3.45 | 1.62 | 1.8 | 2.91 | 54.24 | | - |
| 51 | 55 | 0.73 | 1.13 | 2.5 | 2.82 | 1.22 | 1.8 | 2.19 | 56.29 | | - |
| 522 | 56 | No float ore | - | - | - | - | - | - | - | | - |
| 53 | 57 | 1.31 | 0.43 | 2.5 | 10.75 | 0.87 | 1.8 | 1.57 | 40.53 | | - |
| 54 | 58 | 2.90 | 1.85 | 2.5 | 4.62 | 2.65 | 1.8 | 4.77 | 49.20 | | - |
| 55 | 59 | 6.07 | 13.09 | 2.5 | 32.72 | 7.20 | 1.8 | 12.96 | 71.63 | [illegible] | - |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | 60 | 5.01 | 6.74 | 2.5 | 16.85 | 6.16 | 1.8 | 11.08 | 60.33 | 65.03 | - |
| 57 | 61 | 5.25 | 7.01 | 2.5 | 17.52 | 4.63 | 1.8 | 8.33 | 67.77 | 69.29 | - |
| 58 | 62 | 5.274.00 | 14.00 | 2.5 | 35.00 | 12.50 | 1.8 | 22.50 | 60.87 | 69.39 | - |
| 59 | 63 | 1.17 | - | (Stack measurements not taken) | | - | - | - | - | 67.52 | - |
| 60 | 64 | 7.27 | 8.64 | 2.5 | 21.60 | 6.65 | 1.8 | 11.97 | 64.34 | 66.45 | - |
| 61 | 65 | 1.00 | - | (Stack measurements not taken) | | - | - | - | - | - | - |
| 62 | 66 | 0.50 | - | -do- | | - | - | - | -- | 62.44 | - |
| 63 | 67 | - | - | No float ore | - | - | - | - | - | - | - |
| 64 | 68 | - | - | No float ore | - | - | - | - | - | - | - |
| 65 | 69 | 4.88 | 5.05 | 2.5 | 12.62 | 7.88 | 1.8 | 14.[illegible] | 47.09 | 66.96 | - |
| 66 | 70 | 3.11 | 5.23 | 2.5 | 13.07 | 3.26 | 1.8 | 5.[illegible] | 69.04 | 61.17 | - |
| 67 | 71 | - | - | Complete BHQ | - | - | - | - | - | - | - |
| 68 | 72 | 2.86 | 2.94 | 2.5 | 7.35 | 4.44 | 1.8 | 7.99 | 47.91 | 5[illegible].06 | - |
| 69 | 73 | - | - | No float ore | - | - | - | - | - | - | - |
| 70 | 74 | - | - | No float ore | - | - | - | - | - | - | - |
| 71 | 75 | - | - | Complete BHQ | - | - | - | - | -- | - | - |
| 72 | 76 | 3.16 | 3.02 | 2.5 | 7.55 | 2.77 | 1.8 | 4.86 | 59.23 | 68.07 | - |
| 73 | 77 | 4.72 | 28.42 | 2.5 | 71.05 | 25.48 | 1.8 | 45.86 | 60.73 | 64.22 | - |
| 74 | 78 | 1.22 | 1.25 | 2.5 | 3.12 | 2.35 | 1.8 | 4.23 | 42.45 | 67.03 | - |
| 75 | 79 | 5.20 | 7.72 | 2.5 | 19.30 | 9.81 | 1.8 | 17.65 | 52.23 | 63.69 | - |
| 76 | 80 | - | - | BHQ | - | - | - | - | - | - | - |
| 77 | 81 | 1.90 | 2.56 | 2.5 | 6.40 | 3.21 | 1.8 | 5.77 | 52.59 | 65.65 | - |
| 78 | 82 | - | - | BHQ | - | - | - | - | - | - | - |
| 79 | 83 | 1.70 | 1.76 | 2.5 | 4.40 | 1.19 | 1.8 | 2.14 | 57.28 | 65.46 | - |
| 80 | 84 | - | - | Not taken up | - | - | - | - | - | - | - |

I Average Depth of ore = 3.17 Mts. or 3.00 Mts.
II Average Recovery percentage = 60.22% or 60%

Reserve Estimate:

| | | | |
|---|---|---|---|
| District 'A' | .. | 10,00,000 | $M^2$ |
| District 'B' | .. | 1,75,000 | $M^2$ |
| Total | .. | 11,75,000 | $M^2$ |

Reserves = Area x Average depth x Average Sp.gravity* =
= 11,75,000 x 3.00 x 2.28 = 8,037,000 Tonnes or
Say 8.00 Million Tonnes.

* 60% of the insitu Sp.gravity(3.8)

| Average Grade: | Fe% | $SiO_2$% | $Al_2O_3$% |
|---|---|---|---|
| | 65.60 | 1.21 | 2.05 |

ANNEXURE - III (b)

# DETAILS OF FLOAT ORE EXPLORATION OF DEPOSIT-4
## (EASTERN FLANK)

| Sl. No. | Pit No. | Depth of ore in mts. | Volume of ore $M^3$ | Bulk Density of Ore | Weight of Ore (Tonnes) | Volume of soil | Bulk density of soil | Weight of soil (Tonnes) | Recovery % | Fe% | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| 1 | 1 | 2.20 | 2.23 | 2.3 | 5.12 | 2.16 | 1.8 | 3.88 | 57 | | -- |
| 2 | 2 | 2.00 | 2.16 | 2.3 | 4.97 | 2.44 | 1.8 | 4.39 | 53 | | -- |
| 3 | 3 | 4.00 | 3.15 | 2.3 | 7.24 | 3.16 | 1.8 | 5.69 | 56 | | -- |
| 4 | 4 | - | Float ore only surfacial | | - | - | - | - | --- | | -- |
| 5 | 5 | - | -do- | | - | - | - | - | --- | | -- |
| 6 | 6 | 1.60 | 1.42 | 2.3 | 3.27 | 3.16 | 1.8 | 5.69 | 36 | | -- |
| 7 | 7 | - | | | | | | | | | |
| 8 | 8 | - | | | | | | | | | |
| 9 | 9 | - | No Float Ore | | | | | | | | |
| 10 | 10 | - | | | | | | | | | |
| 11 | 11 | 1.41 | 1.51 | 2.3 | 3.47 | 2.52 | 1.8 | 4.54 | 455 | | -- |
| 12. | 12 | 0.56 | 1.41 | 2.3 | 3.24 | 1.26 | 1.8 | 2.29 | 59 | | -- |
| 13 | 13 | - | No Float Ore | - | - | - | - | - | -- | | -- |
| 14 | 14 | 0.50 | 0.99 | 2.3 | 2.28 | 0.55 | 1.8 | 0.99 | 70 | | -- |
| 15. | 15 | 3.00 | 8.17 | 2.3 | 18.79 | 2.52 | 1.8 | 4.54 | 80 | | -- |
| 16 | 16 | 0.50 | 1.23 | 2.3 | 2.83 | 1.19 | 1.8 | 2.14 | 57 | | -- |
| 17 | 17 | 1.00 | 0.35 | 2.3 | 0.80 | 2.73 | 1.8. | 4.90 | 23 | | -- |
| 18 | 18 | 1.80 | 3.47 | 2.3 | 7.98 | 2.24 | 1.8 | 4.03 | 66 | | -- |
| 19 | 19 | 1.50 | Measurements not taken | | - | - | - | - | --- | | -- |
| 20 | 20 | - | No float ore | | - | - | - | - | --- | | -- |
| 21 | 21 | - | No float ore | | - | - | - | - | --- | | -- |
| 22 | 22 | 1.00 | Measurements not taken | | - | - | - | - | --- | | -- |
| 23 | 23 | 1.45 | Measurements not taken | | - | - | - | - | --- | | -- |
| 24 | 24 | -- | No float ore | | - | - | - | - | --- | | -- |
| 25 | 25 | 0.92 | 1.17 | 2.3 | 2.69 | 1.51 | 1.8 | 2.72 | 50 | | -- |
| 26 | 26 | 1.52 | 1.89 | 2.3 | 4.35 | 1.15 | 1.8 | 2.07 | 67 | | -- |
| 27 | 27 | 0.70 | 0.92 | 2.3 | 2.12 | 0.65 | 1.8 | 1.17 | 64 | | -- |
| 28 | 28 | 0.50 | 0.66 | 2.3 | 1.52 | 0.46 | 1.8 | 0.83 | 65 | | -- |
| 29 | 29 | - | No float ore | - | - | - | - | - | --- | | -- |
| 30 | 30 | 1.80 | 2.70 | 2.3 | 6.20 | 0.62 | 1.8 | 1.12 | 85 | | -- |
| 31 | 31 | 0.45 | 0.46 | 2.3 | 1.06 | 0.63 | 1.8 | 1.13 | 49 | | -- |
| 32 | 32 | 1.00 | 1.10 | 2.3 | 2.53 | 0.53 | 1.8 | 0.95 | 73 | | -- |
| 33 | 33 | 0.42 | No float ore (only surfacial) | | - | - | - | - | --- | | -- |
| 34 | 34 | 0.45 | 0.24 | 2.3 | 0.55 | 0.42 | 1.8 | 0.75 | 42 | | -- |
| 35 | 35 | 2.00 | 2.44 | 2.3 | 5.61 | 1.16 | 1.8 | 2.08 | 73 | | -- |
| 36 | 36 | 1.00 | Assumed depth as pit was not excavated upto bottom due to huge boulders | | | | | | -- | | -- |
| 37 | 37 | 4.00 | 2.95 | 2.3 | 6.78 | 1.26 | 1.8 | 2.27 | 75 | | -- |
| 38 | 38 | 4.75 | 4.53 | 2.3 | 10.42 | 3.96 | 1.8 | 7.13 | 59 | | -- |
| 39 | 39 | 3.14 | Measurements not taken | | - | - | - | - | --- | | -- |
| 40 | 40 | 2.08 | 1.59 | 2.3 | 3.66 | 1.61 | 1.8 | 2.99 | 55 | | -- |
| 41 | 41 | - | Measurements not taken | | - | - | - | - | --- | | -- |
| 42 | 42 | 1.00 | -do- | - | - | - | - | - | --- | | -- |
| 43 | 43 | 1.00 | -do- | | -- | - | - | - | --- | | -- |
| 44 | 44 | 1.80 | 1.33 | 2.3 | 3.06 | 1.05 | 1.8 | 1.89 | 62 | | -- |
| 45 | 45 | 0.50 | Measurements not taken | | - | - | - | - | --- | | -- |
| 46 | 46 | | -do- | | - | - | - | - | --- | | -- |

Average depth = 1.50 Mts.
Average Recovery = 58.00%
Reserve Estimation: -

District 'A' 332,925 $M^2$
District [illegible] 162,875 $M^2$
Total [illegible] $M^2$ or Say 4,95,000 $M^2$

| Average Grade | $SiO_2$ | $Al_2O_3$ |
|---|---|---|
| 63.37 | 1.37 | 3.90 |

Total Reserves = Area x Average depth x Average Sp.gravity* = 4,95,000 x 1.5 x 2.204 = 16,36,470 Tonnes
or Say 1[illegible] million tonnes.

Note: Pits 1 to 14 have not been considered

ANNEXURE - IV

## Distribution and Analyses of Ore Types based on Borehole Data

| Sl. No. | Bore Hole No. | Type-I length (in mts) | Type-I Fe | Type-I $SiO_2$ | Type-I $Al_2O_3$ | Type-II Length in metres | Type-II Fe | Type-II $SiO_2$ | Type-II $Al_2O_3$ | Type-III Length in metres | Type-III Fe | Type-III $SiO_2$ | Type-III $Al_2O_3$ | Type-IV Length in metres | Type-IV Fe | Type-IV $SiO_2$ | Type-IV $Al_2O_3$ | Type-V Length in metres | Type-V Fe | Type-V $SiO_2$ | Type-V $Al_2O_3$ | Type-VI Length in mts. | Type-VI Fe | Type-VI $SiO_2$ | Type-VI $Al_2O_3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. | 16. | 17. | 18. | 19. | 20. | 21. | 22. | 23. | 24. | 25. | 26. |
| 1. | 31B | 4.25 | 68.03 | 0.87 | 0.89 | 0.75 | 69.16 | 0.59 | 0.39 | 26.30 | 65.21 | 1.00 | 2.78 | 8.20 | 58.75 | 1.09 | 3.97 | 32.50 | 64.40 | 4.50 | 1.57 | 5.00 | 38.55 | 13.36 | 18.12 |
| 2. | 32B | - | - | - | - | 13.30 | 68.24 | 1.98 | 0.68 | 13.65 | 65.59 | 0.38 | 2.83 | 7.75 | 60.77 | 1.87 | 2.99 | 40.50 | 65.10 | 4.92 | 0.67 | 7.10 | 49.23 | 27.97 | 2.22 |
| 3. | 33C | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 42.50 | 39.42 | 12.16 | 11.22 |
| 4. | 33.5C | - | - | - | - | - | - | - | - | - | - | - | - | 5.00 | 58.59 | 1.60 | 10.04 | - | - | - | - | 37.50 | 30.34 | 17.33 | 28.89 |
| 5. | 34B | 3.09 | 69.23 | 1.04 | 0.46 | 13.85 | 67.12 | 1.26 | 1.96 | 9.90 | 62.22 | 3.49 | 4.46 | 8.05 | 59.81 | 1.29 | 0.11 | 34.15 | 64.87 | 3.82 | 1.84 | 21.95 | 26.79 | 15.73 | 10.22 |
| 6. | 35.5C | - | - | - | - | - | - | - | - | 9.30 | 63.23 | 1.02 | 3.89 | 18.25 | 57.31 | 1.59 | 8.27 | - | - | - | - | 22.45 | 45.65 | 10.22 | 13.69 |
| 7. | 35B | 34.70 | 66.24 | 1.77 | 0.75 | 0.20 | 69.30 | 0.96 | 0.97 | 36.10 | 64.51 | 3.68 | 0.90 | 7.50 | 56.32 | 2.31 | 10.61 | [illegible] | - | - | - | 33.50 | 46.84 | 26.06 | 1.81 |
| 8. | 36C | - | - | - | - | - | - | - | - | - | - | - | - | 5.50 | 57.74 | 1.52 | 9.03 | - | - | - | - | 23.50 | 33.21 | 15.81 | 6.84 |
| 9. | 36B1 | 21.40 | 68.31 | 0.42 | 1.03 | 10.85 | 67.70 | 0.71 | 1.28 | 5.60 | 65.04 | 1.95 | 2.06 | 4.40 | 59.16 | 1.88 | 6.47 | 50.30 | 64.49 | 3.67 | 1.72 | 7.75 | 45.09 | 12.41 | 13.04 |
| 10. | 37B | 21.15 | 67.54 | - | - | 1.45 | 67.19 | - | - | 74.90 | 65.64 | - | - | - | - | - | - | - | - | - | - | 13.85 | 37.54 | - | - |
| 11. | 37B1 | 40.65 | 68.58 | 0.54 | 0.44 | 38.35 | 68.42 | 0.73 | 0.51 | [illegible] | - | - | - | - | - | - | - | - | - | - | - | | - | - | - |
| 12. | 37C | - | - | - | - | - | - | - | - | 1.50 | 63.97 | - | - | 2.80 | 60.79 | - | - | - | - | - | - | 53.95 | 36.79 | - | - |
| 13. | 37.5C1 | 22.50 | - | - | - | - | - | - | - | 1.50 | 61.10 | 0.61 | 6.00 | 4.00 | 59.05 | 0.93 | 7.32 | 1.50 | 66.21 | 0.65 | 1.60 | 31.50 | 43.15 | 11.51 | 17.08 |
| 14. | 38B | 32.55 | 66.60 | - | - | 1.25 | 63.92 | - | - | 4.00 | 62.85 | - | - | 0.70 | 59.77 | - | - | - | - | - | - | - | - | - | - |
| 15. | 38C | 5.60 | 68.24 | 0.49 | 0.71 | - | - | - | - | 19.15 | 65.07 | 3.48 | 2.27 | 2.75 | 59.06 | 2.10 | 8.31 | 10.00 | 60.04 | 12.77 | 0.65 | 31.50 | 46.47 | 31.95 | 0.82 |
| 16. | 38.5B1 | 15.50 | 67.87 | 0.60 | 1.10 | 6.75 | 68.05 | 0.81 | 0.63 | 12.00 | 64.64 | 1.89 | 3.17 | 5.00 | 58.80 | 4.99 | 6.13 | - | - | - | - | - | - | - | - |
| 17. | 38.5C1 | 7.00 | 62.49 | 1.49 | 4.58 | 1.50 | 64.36 | 0.75 | 2.21 | 18.75 | 62.08 | 1.64 | 4.48 | - | - | - | - | - | - | - | - | 44.75 | 43.15 | 11.51 | 17.08 |
| 18. | 39C | 1.50 | 67.77 | - | - | 1.50 | 67.76 | - | - | 7.20 | 65.53 | - | - | 1.00 | 58.16 | - | - | 27.10 | 66.04 | - | - | 20.20 | 55.58 | - | - |
| 19. | 39.5C1 | - | - | - | - | - | - | - | - | 15.50 | 64.16 | 1.86 | 3.19 | 5.50 | 59.04 | 4.12 | 7.40 | 61.25 | 63.99 | 6.48 | 0.78 | 15.25 | 55.79 | 16.11 | 1.57 |
| 20. | 39.5B1 | - | - | - | - | 3.50 | 66.70 | 3.42 | 0.40 | 4.50 | 59.73 | 6.10 | 3.41 | - | - | - | - | 38.00 | 67.13 | 2.61 | 0.52 | - | - | - | - |
| 21. | 39B | 31.50 | 65.86 | 3.11 | 1.78 | 4.50 | 67.88 | 1.43 | 1.00 | 2.00 | 52.95 | 3.66 | 2.87 | 6.00 | 58.58 | 4.45 | 7.81 | 51.00 | 62.39 | 9.05 | 0.65 | - | - | - | - |
| 22. | 40C | 1.00 | 66.06 | - | - | 23.50 | 66.19 | - | - | 27.60 | 64.02 | - | - | 8.20 | 57.84 | - | - | 35.50 | 64.69 | - | - | 4.40 | 50.88 | - | - |
| 23. | 40B | 13.60 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 24. | 40.5C1 | 6.50 | 67.05 | 0.62 | 1.27 | 14.00 | 66.96 | 0.91 | 0.95 | 17.00 | 64.89 | 1.29 | 2.16 | - | - | - | - | 26.50 | 64.14 | 5.89 | 0.83 | 17.00 | 56.09 | 16.36 | 1.09 |
| 25. | 41B | 45.45 | 67.49 | 0.82 | 1.35 | 14.05 | 67.92 | 0.85 | 0.78 | 1.00 | 61.89 | 1.50 | 6.00 | 0.50 | 60.42 | 7.98 | 3.34 | - | - | - | - | - | - | - | - |
| 26. | 41C | 3.30 | 66.59 | - | - | 7.00 | 67.37 | - | - | 5.40 | 63.98 | - | - | 12.75 | 57.96 | - | - | 31.85 | 65.34 | - | - | 6.00 | 48.13 | - | - |
| 27. | 41D | - | - | - | - | - | - | - | - | 27.65 | 64.21 | - | - | 5.70 | 59.44 | - | - | - | - | - | - | 51.65 | 27.59 | - | - |
| 28. | 41.5B1 | 45.00 | 66.39 | 1.03 | 1.7[illegible] | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 29. | 40.5B1 | 24.90 | 66.39 | 2.80 | 1.06 | 7.00 | 66.05 | 1.03 | 0.47 | 14.25 | 65.01 | 3.82 | 2.15 | 0.25 | 60.80 | 7.80 | 1.96 | 35.00 | 65.99 | 3.62 | 0.82 | 1.00 | 58.11 | 5.25 | 2.40 |
| 30. | 42B | 5.00 | 68.29 | 1.26 | 0.42 | - | - | - | - | 44.00 | 67.34 | 2.22 | 0.79 | - | - | - | - | 68.70 | 65.45 | 4.95 | 0.58 | - | - | - | - |
| 31. | 41.5C1 | - | - | - | - | - | - | - | - | 45.00 | 65.09 | 0.76 | 2.10 | - | - | - | - | 40.00 | 66.21 | 2.78 | 0.81 | 0.50 | 51.[illegible] | 1.54 | 13.24 |
| 32. | 42C | 13.95 | 67.51 | - | - | 9.75 | 67.51 | - | . | 25.00 | 67.16 | - | - | 11.30 | 59.45 | - | - | 14.00 | 63.61 | - | - | 2.00 | 51.64 | - | - |
| 33. | 42C1 | 22.05 | 67.88 | 1.14 | 0.55 | 18.50 | 67.92 | 0.67 | 0.77 | 53.70 | 64.84 | 1.08 | 2.09 | 2.25 | 58.98 | 0.69 | 3.29 | 9.25 | 63.92 | 6.18 | 1.54 | 7.00 | 50.28 | 2.20 | 12.32 |
| 34. | 43C | - | - | - | - | 16.90 | 67.19 | - | - | 17.00 | 65.47 | - | - | 7.80 | 57.57 | - | - | 72.20 | 65.95 | - | - | 0.80 | 52.74 | - | - |
| 35. | 44C | - | - | - | - | - | - | - | - | 27.00 | 63.80 | 0.85 | 2.71 | 3.00 | 56.16 | 1.73 | 3.15 | 64.60 | 66.89 | 1.74 | 1.02 | - | - | - | - |

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. | 16. | 17. | 18. | 19. | 20. | 21. | 22. | 23. | 24. | 25. | 26. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36. | 46C | - | - | - | - | - | - | - | - | 9.25 | 63.80 | 3.19 | 3.07 | - | - | - | - | 6.10 | 64.94 | 5.03 | 1.29 | 38.50 | 22.75 | 23.01 | 26.15 |
| 37. | 47B | - | - | - | - | 52.00 | 67.52 | 0.82 | 1.36 | 13.00 | 63.93 | 0.74 | 4.41 | - | - | - | - | 5.00 | 62.82 | 7.89 | 1.06 | 34.00 | 51.27 | 18.97 | 3.80 |
| 38. | 47B1 | 4.50 | 67.08 | 2.19 | 1.07 | 5.70 | 67.33 | 1.66 | 0.64 | 27.60 | 63.59 | 4.96 | 1.98 | 2.40 | 54.70 | 5.06 | 1.31 | 61.05 | 67.20 | 2.02 | 0.85 | - | - | - | - |
| 39. | 48B | - | - | - | - | - | - | - | - | 12.20 | 63.54 | 0.92 | 2.15 | 1.10 | 57.50 | 5.75 | 14.06 | - | - | - | - | 52.30 | 32.99 | 15.03 | 24.14 |
| 40. | 49A | - | - | - | - | - | - | - | - | - | - | - | - | 2.50 | 59.98 | 3.89 | 5.30 | 95.50 | 68.07 | 1.16 | 0.76 | - | - | - | - |
| 41. | 49B | - | - | - | - | - | - | - | - | 3.20 | 66.48 | 0.23 | 2.57 | 18.00 | 55.41 | 0.66 | 8.02 | - | - | - | - | 58.85 | 26.52 | 18.82 | 24.58 |
| 42. | 49B1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 40.00 | 26.46 | 16.97 | 30.44 |
| 43. | 49.5A1 | 8.00 | 67.93 | 0.73 | 0.46 | 5.50 | 66.26 | 0.51 | 1.98 | 4.00 | 61.05 | 2.97 | 5.09 | 8.75 | 58.57 | 1.24 | 7.10 | - | - | - | - | 1.25 | 49.63 | 3.08 | 11.96 |
| 44. | 50A | 4.50 | 68.89 | 0.44 | 0.38 | 33.50 | 68.72 | 0.53 | 0.69 | - | - | - | - | 3.50 | 60.68 | 0.14 | 1.36 | 11.50 | 68.53 | 0.87 | 0.42 | 10.00 | 32.10 | 20.70 | 20.38 |
| 45. | 50B | 57.85 | 68.35 | 0.52 | 0.54 | 10.80 | 66.99 | 0.33 | 1.44 | 15.60 | 66.12 | 0.66 | 1.05 | 3.40 | 58.99 | 10.70 | 1.90 | 3.00 | 68.22 | 0.99 | 0.12 | - | - | - | - |
| 46. | 50B1 | - | - | - | - | - | - | - | - | 0.50 | 63.71 | 1.20 | 0.78 | 3.50 | 59.13 | 1.44 | 3.59 | - | - | - | - | 42.20 | 15.40 | 21.90 | 31.71 |
| 47. | 50.5A1 | 26.50 | 65.59 | 0.48 | 2.52 | - | - | - | - | 14.75 | 61.28 | 1.27 | 5.55 | 8.50 | 57.40 | 1.05 | 7.85 | - | - | - | - | 35.25 | 48.65 | 6.45 | 13.25 |
| 48. | 51A | 46.35 | 68.02 | 0.60 | 0.31 | - | - | - | - | 17.40 | 65.49 | 1.10 | 1.63 | 7.50 | 50.47 | 1.59 | 7.27 | - | - | - | - | - | - | - | - |
| 49. | 51C | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 51.00 | 31.67 | 16.69 | 22.38 |
| 50. | 52A | - | - | - | - | 0.70 | 67.69 | 0.16 | 0.55 | 22.15 | 65.76 | 0.37 | 1.33 | 18.30 | 58.83 | 0.56 | 3.87 | 56.95 | 66.50 | 2.32 | 1.00 | 17.00 | 52.06 | 14.72 | 4.81 |
| 51. | 52B | 20.30 | 67.35 | - | - | 21.80 | 68.67 | - | - | 9.90 | 68.26 | - | - | 2.40 | 63.25 | - | - | 25.20 | 68.52 | - | - | 16.90 | 53.51 | - | - |
| 52. | 52.5A | 15.00 | 66.93 | 0.80 | 1.28 | 24.50 | 67.79 | 1.19 | 1.03 | 15.25 | 63.72 | 0.89 | 2.75 | 0.50 | 47.86 | 3.15 | 15.21 | 71.75 | 65.81 | 2.13 | 1.51 | 6.90 | 38.48 | 37.76 | 5.06 |
| 53. | 53A | - | - | - | - | - | - | - | - | 23.65 | 65.23 | 2.12 | 1.45 | 16.15 | 59.32 | 1.87 | 5.99 | 41.60 | 64.79 | 3.86 | 0.99 | 8.60 | 41.09 | 21.38 | 10.11 |
| 54. | 53B | - | - | - | - | - | - | - | - | 58.60 | 65.85 | 1.44 | 1.75 | 10.50 | 57.76 | 1.44 | 6.01 | 25.90 | 64.57 | 5.16 | 0.86 | - | - | - | - |
| 55. | 53B1 | - | - | - | - | - | - | - | - | 13.10 | 65.24 | 0.85 | 2.69 | 7.00 | 58.17 | 0.87 | 7.69 | 27.80 | 66.84 | 2.45 | 0.70 | 5.10 | 46.22 | 32.20 | 0.71 |
| 56. | 53.5B1 | - | - | - | - | 4.50 | 66.88 | 0.24 | 1.08 | 5.00 | 64.42 | 0.54 | 3.09 | 2.50 | 58.67 | 17.50 | 9.16 | 52.60 | 67.51 | 8.49 | 0.79 | 1.96 | 51.65 | 22.98 | 0.95 |
| 57. | 54A | - | - | - | - | - | - | - | - | 5.00 | 61.70 | 0.49 | 2.50 | - | - | - | - | 19.30 | 66.42 | 1.79 | 0.81 | 11.70 | 52.27 | 16.67 | 3.62 |
| 58. | 54B | - | - | - | - | - | - | - | - | 81.60 | 64.48 | 2.73 | 1.88 | 6.10 | 58.35 | 2.54 | 7.99 | 15.00 | 65.74 | 2.95 | 0.89 | 5.80 | 54,27 | 20.56 | 0.45 |
| 59. | 54.5B1 | - | - | - | - | - | - | - | - | 18.75 | 66.96 | 1.09 | 1.84 | 7.00 | 55.26 | 1.27 | 12.19 | 12.25 | 62.89 | 11.70 | 1.17 | 29.00 | 46.25 | 30.16 | 0.84 |
| 60. | 55B | - | - | - | - | - | - | - | - | 17.50 | 65.79 | 3.39 | 0.95 | 1.50 | 56.76 | 4.36 | 5.46 | 13.00 | 67.16 | 1.07 | 1.08 | 8.75 | 50.51 | 17.36 | 7.44 |
| 61. | 55B1 | - | - | - | - | - | - | - | - | - | - | - | - | 18.75 | 61.45 | 5.91 | 3.34 | - | - | - | - | 34.75 | 42.53 | 33.99 | 2.24 |
| 62. | 55C | - | - | - | - | - | - | - | - | 26.00 | 60.41 | 2.86 | 6.28 | 5.00 | 57.78 | 0.81 | 10.27 | 30.00 | 67.31 | 0.69 | 0.79 | 9.00 | 49.31 | 3.71 | 14.80 |
| 63. | 56A | - | - | - | - | 11.80 | 67.56 | 0.45 | 1.20 | 30.45 | 67.15 | 0.97 | 1.63 | - | - | - | - | 28.75 | 67.72 | 1.57 | 0.68 | 22.00 | 30.76 | 50.81 | 0.94 |
| 64. | 56B | - | - | - | - | - | - | - | - | 6.50 | 64.76 | 0.65 | 1.51 | 7.60 | 60.51 | 1.17 | 3.11 | 66.80 | 65.61 | 1.97 | 0.36 | 4.60 | 53.83 | 8.89 | 7.01 |
| 65. | 56C | 1.40 | 67.21 | 0.52 | 1.72 | - | - | - | - | 48.60 | 66.22 | 1.02 | 1.92 | 1.00 | 54.16 | 0.86 | 8.55 | 20.00 | 63.96 | 3.53 | 2.25 | 26.00 | 50.60 | 6.07 | 9.70 |
| 66. | 56.5B1 | 8.00 | 67.64 | 0.92 | 0.84 | - | - | - | - | 24.00 | 66.99 | 0.72 | 1.18 | 4.00 | 57.79 | 3.20 | 8.18 | 54.00 | 66.86 | 2.91 | 0.54 | - | - | - | - |
| 67. | 57B | 18.35 | 67.41 | 0.35 | 1.30 | 30.50 | 68.39 | 0.54 | 0.56 | 9.70 | 65.49 | 0.89 | 2.83 | 4.60 | 59.84 | 1.62 | 5.15 | 20.75 | 65.07 | 4.49 | 0.82 | 21.00 | 42.16 | 12.26 | 15.09 |
| 68. | 57B1 | - | - | - | - | 21.50 | 68.38 | 0.69 | 1.83 | - | - | - | - | - | - | - | - | 24.00 | 68.78 | 0.61 | 0.05 | 7.75 | 36.14 | 46.81 | 0.26 |
| 69. | 58B | - | - | - | - | 8.65 | 68.26 | 0.91 | 0.57 | 7.25 | 63.97 | 4.51 | 2.27 | 5.40 | 57.90 | 9.96 | 2.68 | 15.30 | 65.08 | 3.62 | 1.66 | 5.10 | 46.38 | 21.55 | 7.40 |
| 70. | 4B | 5.55 | 66.75 | - | - | 4.45 | 67.68 | - | - | 56.50 | 65.05 | - | - | - | - | - | - | 4.90 | 67.57 | - | - | 35.60 | 31.40 | - | - |
| 71. | 58.5B1 | - | - | - | - | 24.50 | 65.49 | 1.00 | 1.61 | 28.00 | 64.75 | 1.30 | 1.87 | - | - | - | - | 22.50 | 65.49 | 2.67 | 0.82 | 5.00 | 24.38 | 19.84 | 29.15 |
| 72. | 59B | - | - | - | - | - | - | - | - | 5.55 | 63.46 | 7.39 | 0.61 | 6.30 | 57.18 | 14.13 | 2.35 | - | - | - | - | 20.35 | 41.79 | 37.71 | 0.88 |
| 73. | 59B1 | 17.70 | 67.84 | 0.69 | 1.02 | 42.40 | 68.17 | 0.47 | 0.76 | - | - | - | - | 2.10 | 61.82 | 2.75 | 4.42 | 13.10 | 68.61 | 0.42 | 0.29 | - | - | - | - |
| 74. | 3C | 14.15 | 66.72 | - | - | 14.20 | 68.11 | - | - | 25.80 | 64.91 | - | - | 3.30 | 57.84 | - | - | 25.90 | 66.51 | - | - | 0.25 | 43.93 | - | - |
| 75. | 59.5B1 | 28.45 | 67.13 | 0.68 | 0.85 | 29.25 | 68.16 | 0.47 | 0.49 | 6.80 | 67.83 | 0.61 | 0.62 | - | - | - | - | 11.90 | 68.27 | 0.85 | 0.68 | - | - | - | - |
| 76. | 60B | 7.40 | 67.48 | 0.35 | 1.14 | 4.40 | 68.15 | 0.49 | 0.73 | 14.20 | 64.54 | 0.91 | 3.29 | - | - | - | - | 69.00 | 67.47 | 1.59 | 0.61 | - | - | - | - |
| 77. | 60B1 | 22.00 | 67.28 | 0.63 | 1.39 | 34.75 | 67.39 | 0.53 | 0.86 | 23.75 | 65.20 | 1.01 | 2.80 | 5.50 | 58.69 | 3.37 | 7.25 | - | - | - | - | - | - | - | - |
| 78. | 61D | - | - | - | - | - | - | - | - | 36.25 | 64.75 | 3.62 | 1.64 | - | - | - | - | 1.00 | 64.67 | 1.11 | 2.43 | 10.00 | 44.91 | 22.08 | 8.32 |
| 79. | 61D1 | - | - | - | - | - | - | - | - | 69.20 | 64.24 | 3.30 | 1.95 | 5.40 | 61.04 | 2.32 | 4.87 | - | - | - | - | 7.30 | 50.23 | 3.33 | 13.67 |
| 80. | 62C | - | - | - | - | - | - | - | - | 30.50 | 64.15 | 0.37 | 1.48 | 10.60 | 58.04 | 1.54 | 5.20 | 73.70 | 66.06 | 3.30 | 1.03 | 1.00 | 51.37 | 11.60 | 1.49 |
| 81. | 62D | - | - | - | - | - | - | - | - | 4.35 | 65.46 | 2,32 | 3.12 | 3.50 | 59.40 | 4.51 | 7.12 | 23.20 | 64.88 | 3.67 | 1.79 | 18.95 | 53.71 | 10.20 | 5.67 |
| Total | | 733.55 | 67.23 | 0.99 | 1.12 | 597.85 | 67.72 | 0.77 | 0.9 | 1407.85 | 64.95 | 1.89 | 2.19 | 356.60 | 58.47 | 2.57 | 6.08 | 1787.30 | 65.96 | 3.19 | 0.93 | 1202.50 | | | |