



FIG. 4.10 TYPICAL GEOLOGICAL CROSS-SECTION
A DEPOSIT IN GOA

SCALE-1:1000

is either poor in quality or limited in thickness. Sometimes below the lumpy low grade ore, the powdery ore is either earthy or even absent.⁽²⁴⁾

The iron ore deposits are localised in a general NW-SE direction over a length of 95 km from Naibagh in the NW on the Goa-Maharashtra border to Salginim in the SE near Goa-Karnataka border. A broader pattern of distribution of deposits can be clearly observed from North Goa to South Goa. In the northern part along river Madei, the larger and richer iron ore deposits occur. In the central portion (lying between river Madei in the north and Costi village in the south), the iron ore deposits are moderate in size and comparatively poor in quality, and they are generally associated with manganese ore deposits of low to medium grade. And in South Goa, i.e. south of Nissanvol, the iron ore deposits are few, irregular in shape and generally poor in quality while the associated manganese deposits are large in size and rich in quality.⁽²⁴⁾

Based on the physical properties, the iron ores of Goa are classified as massive ore, platy ore, concretionary ore, mixed ore, earthy ore, laminated ore and powdery ore. The powdery ore of Goa popularly known as "Blue dust" is a well-known variety which occurs in Goan deposits in substantial quantity. It is fine grain of haematite or magnetite and the size is generally below 6 mm. The colour of the ore is blue to bluish-black. It is loosely packed with considerable amounts of voids and pore spaces between and generally present at depth below the hard, compact ore and laminated ore. The iron content in the ore varies from 58 to 67 percent and the specific gravity of in situ ore from 2.8 to 3.0. Invariably the powdery ore is richer in Fe content than lumpy ore occurring above it.⁽²⁴⁾

In Goa State, from northwest to southeast, more than thirty iron ore deposits have been identified. These are given as under.⁽²⁴⁾

- (1) Advalpale, (2) Nanora, (3) Bicholim-Sirigao,
- (4) Bordem-Savorna, (5) Sanguelim,
- (6) Arvalem, (7) Cudnem-Dignem-Surla,
- (8) Velguem-Pale (9) Pissurlem-Sonshi,
- (10) Usgao, (11) Conquirem, (12) Poicut-Siudem

- (13) Sacorda (14) Sonal-Devens
- (15) Gavanem-Malpona (16) Balcornem,
- (17) Bimbol-Sigao, (18) Suctioli-Taitoli,
- (19) Codli, (20) Santona-Quirlapale, (21) Costi,
- (22) Dudal, (23) Kalay, (24) Maulinguem,
- (25) Tolem-Motto, (26) Barazan-villena,
- (27) Sirigal-Undorna-Angod,
- (28) Rivona-Columba, (29) Canvorem-Navelim,
- (30) Sulcornia-Vichundrem, (31) Netorlim,
- (32) Camona-Conda and (33) Betul.⁽²⁴⁾

Among these, Bicholim-Sirigao and the Velguem-Pale are the best deposits in the entire Goa State. Both these deposits are located in North Goa district. Another district of Goa is South Goa where the iron ore deposits are comparatively smaller in size. The important deposits of North Goa district are described as under:⁽²⁴⁾

North Goa District⁽²⁴⁾

Bicholim-Sirigao deposit: The Bicholim-Sirigao deposit is the best deposit of Goa State. It is situated between Bicholim in the south-east and Sirigao in the north-west. The deposit occurs on a N 50 - 60° W trending anticlinal fold, overturned to the south-west and its nose portion refolded in shape of "S" with a plunge of about 22 - 27° towards N 60° W. The southern limb of the fold extends for a length of about 4 km from Bicholim - Piligao road in the south-east to about 500 m north-east of Sirigao hill while the northern limb extends for a length of about 2 km from Bordem in the south-east to about 500 m north-east of Sirigao hill. Between the two limbs of the anticlinal fold, which are ore-bearing, there is a barren phyllitic tract which represents the axial portion of the fold.

The deposit consists of two orebodies, a larger south-western one and a smaller north-eastern. The total length of the south-western body between Bicholim-Piligao to Sirigao hill is about 6.25 km and the width varies from 70 to 550 m. The north-eastern orebody is about 1.25 km in length and the width varies from 115 m to 140 m. Both these orebodies are thoroughly explored by drilling and proved up to the bottom (F/W).

As regards the quality of ore, the best grade of ore in south-eastern orebody is present in the

section in between Lamgao and Sirigaon hill. Here, the Fe content in lumpy ore ranges from 60 to 63 percent and in powdery ore from 64 to 66 percent. In Selton Mosque hill area, the lumpy ore contains 57 to 59 percent Fe and the powdery ore 61 to 63 percent Fe. In section between Bicholim-Maem road and Lamgaon, the lumpy ore contains 57 to 61 percent and powdery ore 63 to 65 percent Fe. Along the northern and north-western slope of Sirigao, the lumpy ore contains 57 to 59 percent Fe and powdery ore from 61 to 64 percent Fe.

In the north-western orebody, the lumpy ore is platy to massive and contains 59 to 61 percent Fe, and the powdery ore which is deep blue in colour, contains 62 to 65 percent Fe.

Velguem-Pale deposits⁽²⁴⁾: Velguem-Pale deposit is among the best deposits of Goa after Bicholim-Sirigao deposit, which extends from the river Madei in the south to Sonus village in the north, over a distance of about 6 km in a general N 30° W direction.

The deposit occurs essentially on the crest and on the south-western limb of an asymmetrical anticlinal fold whose axis runs in a N 30° W direction for the major length and changes to N 60° W owing to a dip fault in the north-westerly tip. Generally, the dip of the beds on the south-western limb is gentler than that on the north-eastern limb; on the south-western limb, it varies from 17 to 60° and on the north-eastern limb, it varies from 50 to 85°. The width and the thickness of the deposit are seen to vary from place to place depending upon the amount of dip of the bed, the angle of slope of the ground and the amount of erosion that the bed has suffered.

The north-western portion of the deposit between Sonus and Velguem for a length of about 2.5 km is generally referred to as Velguem section of the deposit and the remaining portion to the south-east is referred to as Pale section.

The Velguem section of the deposit has formed on an asymmetrical anticlinal fold whose axis trends in a general N 60° W direction. The lumpy ore in this section of the deposit contains

57 to 61 percent Fe and the powdery ore 63 to 66 percent Fe.

The Matta-Dando deposit occupies the crest and the south-western limb of an asymmetrical anticlinal fold whose axis trends in a general N 30° direction. The average grade of the ore in this area contains 58 to 62 percent Fe in lumpy ore; in the powdery ore, Fe varies from 63 to 67 percent.

The Pale section of the deposit extends from the NE-SW flowing nala, about 500 m east of Velguem in the north-west to the river Madei in the south-east for a distance of about 3.5 km. In this section, Fe content in the lumpy ore varies from 57 to 61 percent and in the powdery ore from 64 to 66.5 percent.

To the south-east, the deposit extends for a length of about 800 m and has a maximum width of about 220 m. In this portion of the deposit, Fe content in the lumpy ore varies from 58 to 62 percent, whereas in powdery ore, it varies from 63 to 67.5 percent.

The south-most portion of the deposit is about 1.1 km long and the maximum width is about 260 m in the central portion of the area on the crest of the hillock and it tapers down to about 80-100 m on either side along the strike. Here, Fe content in the lumpy ore is 56 to 61 percent and in the powdery ore 62 to 65 percent.

Cudnem Dignem-Surla deposit: The deposit extends from a point 2.25 km south-west of Onda and west of the Onda Usgno road in the north-west of Surla hill, located about 1 km east of Dergunvado in the south-east. The deposit has a length of about 3.5 km and a width ranging from 100 m in the south-eastern portion to about 60 m in central portion and about 220 m in the north-western portion. At one place in south-east, the deposit pinches out completely for a short distance. The grade of the ore is seen to distinctly deteriorate towards south-east.

In Cudnem area, out of the two limbs of the anticlinal fold, the north-eastern limb has much better concentration of ore than south-western limb. The lumpy ore and powdery ore of north-eastern portion contain 58 to 62 percent Fe and

62 to 68 percent Fe, respectively, whereas the south-western orebody contains 57 to 60 percent Fe in lumpy ore and 62 to 64 percent Fe in powdery ore.

In Dignem area again, there are two limbs of anticlinal fold. The lumpy and powdery ore qualities are more or less similar to those of Cudnem area.

The portion of the deposit lying in Surla area has been fairly very well-explored by drilling. The lumpy ore in this section is hard compact and platy to massive in nature; practically, the entire lumpy ore zone has already mined out, the remaining is powdery ore which contains Fe 64 to 66 percent.⁽²⁴⁾

Codli deposits:- The Codli deposits include a number of medium to small irregular and lensoid deposits located between Danconda in the north and Quirlapale in the south and Condeapar river in the east and Dabal in the west. The deposits exhibit a general N 30° W strike. The deposits are located on the crests and on the scarp slopes of the mounds.

The deposit near Danconda varies from 45 to 300 m in length, and from 25 to 100 m in width. The Fe content in lumpy ore varies from 57.5 to 61 percent and in powdery ore from 62 to 65 percent. The deposit present at the WSW and SW of Codli and NE of Quirlapale varies from 75 to 280 m in length and from 50 to 150 m in width. This area is presently being worked by M/s Sesa Goa Ltd. The Fe content in lumpy ore as well as in powdery ore is more or less same and it varies from 59 to 63 percent.⁽²⁴⁾

4.1.2.7 Maharashtra

In Maharashtra, iron ore deposits are found associated with the iron ore group of Archaeans. It comprises older schists and unclassified crystallines overlain by metamorphosed sedimentary rocks, such as quartzites, banded ferruginous quartzites, schists, phyllites, etc. These metasedimentary rock formations are intruded by dolerite, granite gneisses, etc. The iron ore deposits are derived mostly from the banded ferruginous quartzite by leaching of silica. The economically viable deposits are located in

Chandrapur and Sindhudurg districts and smaller deposits in Gadchiroli, Kolhapur and Bhandara districts. Besides minor occurrences of iron ore are also reported from Nagpur, Nanded, Satara and Yeotmal districts of Maharashtra.^(5,8,25)

Sindhudurg District

The iron ore deposits located in Sindhudurg district are Redi, Tirvade-Ajgaon-Guldave, Sateli-Satarda, Sateli-Talwane, Talwane-Ajgaon, Kalne, Pondye Degve-Banda, Galel, Galel North and Galel South. Among these, Redi iron ore deposit is highly potential and major one. Other deposits are comparatively smaller and located all around the Redi area. The description of Redi deposit is given in detail whereas others are described briefly as under :

Redi Deposit : Redi deposit is located in Redi village, i.e. close to Redi port. The area is generally covered by laterite. Other outcrops in the area are quartzites and banded haematite quartzites of Dharwar age. The geological sequence of the area is given in Table 4.11⁽⁵⁾

TABLE 4.11 : GEOLOGICAL SUCCESSION OF REDI DEPOSIT

Recent and sub-Recent	Laterite and Alluvium
Extrusives	Deccan Traps
Intrusives	Dolerite, Chromite-serpentine rock, granite, pegmatite, etc
Kaladgi Series	Phyllites, mica schist, biotite-garnet granulites, Sandstones conglomerates, micaceous sandstones and quartzites
Archaeans	Banded haematite quartzites, ferruginous quartzites, phyllites, etc.

The iron ore, which occurs under a capping of laterite varying in thickness from 1.5 to 9 m, has been derived by the supergene alteration of banded-haematite-quartzites, which have been enriched by the leaching away of silica and simultaneous enrichment of iron oxide to give rise to haematite iron ore. The depth of enrichment is variable. At places, even associated phyllites have been enriched and some of the concentrations in the phyllite show a fairly good grade of iron ore. The types of ores found in the area are lateritic iron ore, massive iron ore, laminated or biscuity iron ore and

friable or powdery (blue dust) iron ore and also partially leached banded-haematite-quartzite as ore.^(5,25)

The laterite ore is mainly confined to horizon between the laterite and compact iron ore in a zone of 1.5 to 4.5 m immediately beneath the laterite capping. The iron content in lateritic iron ore is generally 55 to 58 percent with a fair proportion of limonite, goethite and lithomarge in subordinate amounts.

The massive or hard massive iron ore is found beneath the laterite capping and also below the lateritic iron ore. Its thickness may be as much as 3 to 6 m. This variety of ore is also found as thin bands and lenses within the soft and porous laminated variety. It is dense, hard and compact with shining steel grey and metallic lustre on the freshly fractured surface. Sometimes, the ore alters superficially to limonite. The thin partings of this ore are also noticed along the fissure and joint planes. Its specific gravity is comparatively higher and the iron content varies from 62 to 65 percent.⁽⁵⁾

Laminated or biscuity ore which also occurs below the lateritic iron ore or some lenses below the massive ore are soft and porous. It forms the greatest portion of the deposit and is characterised by its laminar and porous texture. The laminae generally vary from 1 to 25 mm and show distinct bedding. The open spaces between the laminae are partly filled up with powdery type of ore. The ore has often a biscuit-like appearance and in some cases shows minor folds. The specific gravity of this type of ore is low and the more porous types are less rich in iron content than the compact ones. The iron content of this type of ore varies from 58 to 62 percent.

The friable ore or blue dust occurs as pockets and lenses within the laminated ore. Sometimes it includes pieces of lumps or laminated ore within it. The blue dust is dark blue-grey to black in colour and is quite rich in iron content which varies from 63 to 66 percent. Partially leached banded-haematite-quartzites are very hard compact rocks and contain 45 to 48 percent iron.⁽⁵⁾

Association of gold in iron ores of Konkan area of Sindhudurg district :- Gold is reported to occur both in laterite profile and in the powdery ore zone of Redi and Kalne areas in Konkan region, Sindhudurg district. During the year 1990, GSI reported incidence of less than 1.0 ppm gold in laterite and iron ores of Kalne area. Later in 1993, as a result of preliminary examination and systematic sampling of Redi and Kalne areas, it was identified that the associated gold values vary from 0.06 to 0.16 ppm in the laterite profile and in the powdery ore zone. Though the gold values reported are not economically significant, however, it is important to note their persistent nature and the need to analyse whether gold values are associated with iron ore mineralisation or parent BHQ in the area. If so, what could be the control on gold mineralisation, possible loci of gold concentration and average gold content.⁽²⁶⁾

Tirvade-Ajgaon-Guldave deposit:- There are total 4 orebodies admeasuring 200 to 750 m in length and 5 to 35 m in width. The deposit is spread over a strike length of about 4.2 km. The strike of the deposit is E-W to ENE- WSW with high dips towards north. The iron ore of this area contains 60-63 percent Fe, 3 to 4 percent SiO₂, 1 to 2 percent Al₂O₃ and 0.03 to 0.04 percent P. There is another block, namely Tirvade "B". This portion of the deposit is fully covered by laterite. The strike length of this deposit can be traced up to 300 m. The ore which is low grade and friable in nature contains Fe 58.03 percent.⁽²⁵⁾

Sateli-Satarda deposit : The iron ore of this deposit occurs as lensoid bodies within ferruginous quartzites and ferruginous phyllites. The strike of the orebody is ENE-WSW to almost E-W with high dip towards north. The ore is of low grade which contains Fe 50.71 to 59.79 percent and SiO₂ 4.38 to 7.79 percent.⁽²⁵⁾

Sateli-Talwane deposit : In this deposit, there are three discontinuous lenses ranging from 200 to 425 m in length. The strikes are WNW-ESE to NW-SE with 40 to 50° dip towards NNE to NE. The iron ore of this deposit is poor in quality which shows 55 to 56 percent Fe and 5.72 to 6.98 percent SiO₂.⁽²⁵⁾

Talwane-Ajgaon deposit : In this deposit, iron ore occurs for a strike length of 500 m with a width of 50 m. The orebody strikes WNW-ESE with high dip towards north. This deposit contains very poor quality ore. The Fe content in the ore is 54.3 percent and SiO₂ 7.79 percent.⁽²⁵⁾

Kalne deposit: The iron orebody of this deposit extends for about 500 m in length and 100 m in width. This area also contains black iron ore. The Fe content in iron ore of this area varies from 54 to 64 percent, Al₂O₃ 3.74 to 11.52 percent, SiO₂ 1.2 to 15 percent, Mn in traces to 15 percent.⁽²⁵⁾

Galel deposit : The orebody of this deposit extends for about 800 m in length and 75 to 225 m in width. The strike of the orebody follows the trend of the hill in NNE-SSW direction. The Fe content in the ore varies from 51.25 to 60.27 percent.⁽²⁵⁾

The other two deposits, i.e. Galel North and Galel South are adjoining areas. The orebody of Galel North is in same strike direction and its strike length is about 800 m and width varies from 75 to 225 m. The ore is low grade. The iron body of Galel South is about 1,500 m in length and 50 to 200 m in width. The ore of Galel South analyses Fe 55 to 60 percent.

Phondye deposit : In this deposit, the iron orebody extends for about 800 m in length and 25 m in width. The strike of the orebody is in E-W to ESE-WNW direction and the dips vary from 40 to 80° towards south and south-west. The ore is generally of poor quality which analyses Fe 52.50 to 59.2 percent, SiO₂ 1.28 to 5.18 percent, Al₂O₃ 4.12 to 17.32 percent and Mn 0.66 to 8.25 percent.

Degva Banda deposit : In this deposit, the general strike of the orebody is N 10° W to S 10° E to N-S with 58 to 70° dip towards west. Friable orebody extends over 300 m strike length. The thickness of laterite over the ore zone varies from 3 to 14 m. The thickness of ore zone varies from 5 to 25 m. The lateritic iron ore of this deposit analyses 47.62 to 50.85 percent Fe and friable ore 57.93 to 62.37 percent Fe.⁽²⁵⁾

Chandrapur District

The iron ore deposits of this district are generally confined to the northern part of the district. The important deposits are Lohara, Pipalgaon and Asola. Here rocks of pre-Cambrian age consist of a series of schist and banded-haematite-quartzite and are believed to have been enriched at places to form iron ore lenses. The Lohara deposit covering an area of 409 m x 122 m is located on a hill at a maximum height of 45.7 m above ground level. It is surrounded by intrusives granite and composite gneiss. The orebody is lenticular and the ore is hard massive haematite.⁽⁵⁾

The general strike of the orebody is N 30° E-S 30° W with steep dips of 60 and 80° towards east or west. The Fe content in the ore is generally high. The iron ore of this area analyses Fe 63.0 to 69.23 percent, SiO₂ 0.14 to 3.24 percent and Al₂O₃ 0.08 to 1.83 percent.⁽²⁵⁾

The Pipalgaon deposit form a lenticular band flanking the hill located about 0.8 km to the south of the village. The orebody is 182.8 m in length, 12.19 m in width and 9.14 m thick. This area contains considerable amount of float ore besides the main orebody. The quality of ore is generally of high grade. Iron samples of this area analyse Fe 69.62 percent, SiO₂ 1.56 percent, Al₂O₃ 1.07 percent and P 0.09 percent.⁽²⁵⁾

The Asola iron orebody appears in an elongated lenticular shape which forms a narrow ridge. The strike of the banded-haematite-quartzite is N 70° W -S 70° E with dip due N 20° E varying from 40 to 70°. There are three bodies, i.e. Western, Central and Eastern and their dimensions (i.e. length x width x depth) are 121.9 m x 12.19 m x 4.29 m, 182.8 m x 27.04 m x 6.09 m, and 182.88 m x 9.14 m x 3.05 m, respectively. The average Fe content in ore is 62.91 percent, SiO₂ 8.25 percent, Al₂O₃ 2.48 percent and P 0.08 percent.⁽²⁵⁾

Gadchiroli District

One of the biggest iron ore deposit of Maharashtra, namely Surjagarh deposit is located in Gadchiroli district. The other deposits/occurrences of iron ore reported from

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this district are Bhamragarh, Dewalgaon, Puser and Damkodwadvi hill range, etc.

Surjagarh deposit : The crescent-shaped Surjagarh hill range occurs at about 608 m height above the ground level. The iron ore formation consists of ferruginous phyllites and banded-haematite-quartzite. The general strike of the iron ore formation follows the trend of the hill range. On the Wurra hill, the main iron ore deposit shows WNW-ESE strike and dip at 60 to 70° towards south. Here, four types of ores, i.e. massive, porous, laminated and soft are met with and the iron content is high 64-68 percent.^(25A)

Puser deposit : Puser is a small deposit. Here, a small wedge-shaped inlier of Dharwar rocks is surrounded by granite gneiss. The inlier consists of three distinct rock types, viz. chlorite-garnet schists, banded ferruginous quartzite and sericite quartzites. The strike of the banded-haematite-quartzite is almost E-W and dip towards south varying from 50 to 60°. The ore is generally high grade. In ore, Fe content varies from 60.87 to 69.81 percent, SiO₂ 0.005 to 3.02 percent and P 0.002 percent.^(25A)

Bhamragarh deposit : In this deposit, iron ore occurs as pockets and lenses on the top and slopes of the hill. The general trend is N-S. The iron ore is mainly lateritic and massive. The quality of the ore is generally poor.

Dewalgaon deposit : In this deposit, iron ore is associated with banded iron ore formation. The length of the deposit is about 503 m, width varies from 9 to 18 m and depth is about 9 m. The average Fe content in the ore is 59.6 percent, SiO₂ 2.9 percent, Al₂O₃ 2.24 percent and P - 0.02 percent.⁽²⁵⁾

Damkod Wadvi hill range : In Damkod Wadvi hill range, there are nearly fourteen deposits/occurrences of iron ore, namely (i) Damkod-Meta I (ii) Damkod - Meta II (iii) Wadvi-Meta (iv) Matvarsi-Meta (v) Chota Wadvi (vi) Udaikoti (vii) Mea Meta (viii)Kakaguda Meta (ix) Gurunjer Meta (x) Tarmake Meta (xi) Karanjer Meta (xii) Mohondi Meta (xiii) Kumdur Meta and (xiv) Hitapad.⁽²⁵⁾

The State Directorate of Geology & Mining, Maharashtra has estimated a total iron ore reserve of about 32.35 million tonnes for these deposits. Among these, the Hitapad, Mea Meta, Matvarsi Meta and Damkod Meta I & II are bigger deposits.

The Damkod Meta I deposit is located about 12 km, NE of Gatte village. Here, there are two parallel lenses of iron ore. The length of the outcrops is 47 m and 301 m and width 9 m and 15 m, respectively. The Fe content of the ore is 64.5 percent, SiO₂ 3.58 percent, Al₂O₃ 2.2 percent and P - 0.024 percent. The Damkod Meta II deposit is located to the NE of Damkod Meta I. The length of the two orebodies here is 240 and 109 m, respectively, while width of both the bodies is 18 m. The Fe content in the ore is 65.23 percent.

In Matvarsi Meta area, the general strike of the orebody is NE-SW with dip varying between 65 and 70° towards NW. The ore contains Fe 64.73 percent, SiO₂ 2.41 percent, Al₂O₃ 2.01 percent and P 0.034 percent.

Mea Meta is the largest deposit in Damkod-Wadvi range. Here, in all 9 orebodies of varying dimensions have been located. The strike of the iron orebodies varies from E-W to NNE-SSW. The area also contains float ores. The iron ore of this area contains Fe 65.91 percent, SiO₂ 2.62 percent and Al₂O₃ 1.48 percent.

Apart from the above mentioned 3 districts (Sindhudurg, Chandrapur and Gadchiroli), occurrences of iron ore are reported from Bhandara district (Khursipar and Kanholi areas) and Ratnagiri district (Malvan, Kunda and Savantvadi). Minor occurrences are also reported from localities of Kolhapur, Nagpur, Satara, Yeotmal districts, etc.^(7,8,25)

4.1.2.8 Andhra Pradesh

Most of the iron ore deposits of Andhra Pradesh are found associated with rocks of Dharwar sediments or Purana formations. However, some low grade deposits/ occurrences of iron ores are known also from Upper Gondwanas and within the laterite cappings on Deccan Traps. Both haematite and magnetite

deposits occur in the State. The total recoverable reserves of haematite and magnetite ores in the State are of the order of 464.6 million tonnes, of which about 90 percent are of magnetite ore and remaining 10 percent of haematite ores. The magnetite ore deposits are mainly located in Prakasham district whereas haematite ore deposit are found in Anantapur, Cuddapah, Kurnool, Nellore and Khammam districts. Minor deposits/occurrences of iron ore are also reported from Adilabad, Chittoor, Guntur, Karimnagar, Krishna, Medak, Nizamabad, Vishakhapatnam, Srikakulam and Warrangal districts of Andhra Pradesh.^(5,16)

Anantapur District

In this district, iron ore occurs within Dharwars near Balapuram and Siddapuram villages in Rayadurg taluk. Iron ore associated with banded-haematite-quartzite occurs in the locality 4.8 km north-west of Malapanangudi. An iron ore band of about 9 m thick is traced for about 1.5 km along the strike which extends in the adjoining Karnataka State. In Velpumadugu area, pockets of haematite ore occur associated with banded ferruginous quartzite in an area of 60 x 60 m on the north-western slope of the ridge, 1.6 km north-east of Velpumadugu. Minor occurrences of limonitic iron ores with high silica content are noticed in association with banded magnetite quartzites and ferruginous grits of Dharwars near Kambadur, Gollapalle, Oddapalem and Mucharlappalle areas.^(16,27)

Cuddapah District

In this district, Chabali area contains patches of iron ores in association with ferruginous Pulivendla quartzites and shales. The ore of this area is generally hard and often shaly in appearance and tends to be soft on exposure. Fe content in ore varies from 54 to 68 percent. Other iron ore-bearing areas of this district are Rajampet, Ponduluru-Venkatapalli, Erraguntikota, Mantapampalle, Pendlimari and Pagadalapalle.^(3,16)

Kurnool District

In Kurnool district, a number of high grade haematite deposits occur between Veldurti and Ramallakota along a prominent zone of fault traced in the Archaeans and the basal

Cuddapahs. The orebodies occur in the form of large lenses over a distance of 8 km between those villages. The ore consists mostly of specular haematite with Fe content varying from 50 to 60 percent, silica 3 to 18 percent, phosphorus from traces to 0.04 percent, and very low sulphur.^(16,27)

Nellore District

Lenticles and thin bands of haematite occur associated with Dharwar quartzites near Rassuapalem, 13 km from Nayudupeta in Nellore district. Part of this deposit has been worked in the past. Other areas where minor deposits/ occurrences of iron ore are Chundi hills, west of Polenane Cheruvu and in the Swarnamukhi river valley between Iresalemare and Ircola.

Khammam District

In Khammam district, iron ore deposits exist between Cheruvupuram and Kottagudem. These deposits are classified as iron ores associated with Pakhals and iron ore associated with banded-haematite-quartzite of Dharwar age. The deposit associated with Pakhals are comparatively larger and richer. The hill, about 5 km north of Bayyaram, contains two bands of high grade iron ore. Haematite quartzite suitable as iron ore is also traced in the Motala-Timmapur area.^(16,27)

Prakasham District

Prakasham district is important for magnetite-type of iron ore deposits. Bands of magnetite-quartzite occur in different parts. These bands are grouped into two (1) The Ongole group and (2) The Gundalkamma group. The Ongole group comprises Pernametta, Ongole, Konijedu and Sanampudi bands. In Ongole area, banded magnetite quartzite folded into asymmetrical anticlines and synclines occurs in Konijedu hill and in adjoining Marlapads hill, 12 km SW on Ongole. During 1969-70, Japanese expert Dr Okdo drilled nearly 10 boreholes in this area and estimated reserves of 99 Mt and 6 Mt of BMQ ore in these two areas. The present reserve (as on 1.4.1990) estimates of about 417.87 Mt of magnetite ore of Andhra Pradesh mainly comes from Ongole group of deposits.^(16,27)

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The other magnetite ore-bearing group, i.e. Gundalkamma group is comparatively less important than the Ongole group of deposits both in quality and quantity. This group comprises Byrepalle, Errapale, Timmavaram and Manikesvaram deposits.

4.1.2.9 Tamil Nadu

When compared with the vast deposits of Bihar, Orissa, Madhya Pradesh and Karnataka, iron ore deposits of Tamil Nadu appear meagre. But in the context of recent advancement in producing iron and steel from magnetic ores, the importance of magnetite-quartzite-type of ore deposits of Tamil Nadu has increased.

A number of magnetite-quartzite bands of variable thickness are known to occur in different parts of the State, especially the area to the north of Kaveri river is very much important. The deposits occur in Salem, Tiruchirapalli, Dharampuri, South Arcot & North Arcot and Nilgiri districts. Besides, minor occurrences are also reported from other parts of the State but most of them appear to be uneconomical. The districtwise description of the deposits is given below:^(5,16)

Salem & Tiruchirapalli Districts

The magnetite quartzite rocks of Salem and Tiruchirapalli districts form a series of ridges and hillocks. The ore bands form part of Dharwarian sequence and are intercalated with mica schist, chlorite schists, garnetiferous amphibolites and gneisses. The ore consists of banded magnetite quartzite, which is the metamorphosed equivalent of the original sedimentary beds similar to those of Bihar, Orissa and Madhya Pradesh. The ores are generally mixture of magnetites and quartzites. A little haematite and amphibole are sometimes found intimately associated with magnetite. The bands are irregular in thickness and thicken and thin down, within short distance.⁽¹⁶⁾

In Salem district, larger magnetite-quartzite bands occur at Kanjamalai and Godumalai. In Kanjamalai hill, three bands and few subsidiary ones are known to occur. The lowest of the three with an average thickness of 18.3 m is traced over 17.7 km ; and the middle and deeper ones

are each 7.6 m thick and 9.6 km long. In addition, several bands of varying dimensions occur in the area around Godumalai. The ore essentially consists of quartz and magnetite and is known to contain Fe 30 to 40 percent. The magnetite quartzite bands of varying length and thickness are also traced near Sittilingi Malathangi, Tumbal, Alangadu, Suryagaddi and Paduvalva areas.^(5,16)

In Tiruchirapalli district, magnetite quartzite bands are located in Valasiramani and Urakkari areas.

Dharampuri District

In this district, the Tirthamalai deposit is important one. The ores of this deposit analyse Fe 36.7 percent and P₂O₅ 0.14 to 0.19 percent. The northern extension of Tirthamalai deposits and the deposit of Alambadi areas are the richer portions of the deposits.

South Arcot and North Arcot Districts

Mineral Development Project in Tamil Nadu under UNDP carried out exploration for iron ore in South Arcot and North Arcot districts and in areas around Tiruvannamalai. In South Arcot district, magnetite quartzite bands were traced in north-west of Talankunam and near Budamangalam.

Nilgiri District

Fairly rich bands of magnetite occur with the gneissose rocks of Nilgiri Hills. The most important beds were found near Karachola, about 2.5 km west of Kotagiri and on a spur of Dodabetta. Pure stringers of haematite interfoliated with gneiss are noted at Jackatalla. Other areas where iron ore occurrences are found with Dharwarian rocks are Tatarvenu, Arvankadu and Devla.⁽¹⁶⁾

4.1.2.10 Kerala

In the State, numerous bands of iron ore (magnetite) varying in strike length from a few metres to a few kilometers have been reported from charnockite and gneissic groups of rocks. It is reported from Calicut, Kottayam, Mallapuram, Palghat and Quilon districts. The important occurrences are in Calicut district. The districtwise description is given below :⁽¹⁶⁾

Calicut-Kozhikode Districts

In this district, important occurrences are reported from Cheruppa, Eleyettimala, Nanminda, Naduvallur, East and West Hill bands and Alanpara area.

Cheruppa: Iron ore occurs as magnetite-quartz- diopside-hypersthene rock in the form of a steeply dipping discontinuous band over a strike length of 675 m in ENE-WSW direction. Drilling has indicated that iron orebody has a thickness varying from 44 m to 56 m.

Eleyettimala: Here, iron ore occurs interbedded with biotite, biotite-diopside and biotite-hornblende gneisses and granulites. The iron ore formation is in the form of a south-west plunging overturned antiform cross-folded at its eastern end into a south-west plunging synform. Drilling indicated that iron ore has an average thickness of about 21 m on the southern limb, 15 m on the northern limb and 15 to 50 m on the crest of the fold.

Nanminda: Iron ore of this block occurs interbedded with country rocks as in Eleyettimala block. The iron ore formation is exposed as three doubly plunging synforms over an area of 0.22 sq km.

Naduvallur: Iron ore formation or magnetite-quartz- grunerite-diopside rock of Naduvallur block occurs as three doubly plunging synformal patches and is mostly exposed on the surface. It occurs interbanded with country rocks-biotite, biotite-hornblende and biotite-diopside gneisses and granulites as in other blocks. The total exposed area of the formation is about 0.17 sq km. The vertical thickness varies from just 1 m near margin to 40 and 50 m in the troughs of synclines and in areas of local recumbent folding. In the exposed area, the formation is in oxidised state.

East & west hill band: The band of magnetite quartzite skirting the west and east hills in the northern part of Kozhikode town occupies an area of 0.1 sq km. The band here is about 40 m in width and extends for a length of about 1,700 m. It occurs in the form of a

hook-shaped body with the strike varying from E-W to NNE-SSW. The dip is 60 to 70°, mostly to the south except in the north, and at the eastern end, it is to the west. The west & east hill band actually forms the southern and eastern part of a tunnel-shaped east plunging isoclinal trough. The northern limb of which is disconnected as seen from the detached outcrop on the Tourist Bungalow hill. Unlike other major deposits, the west & east hill band makes up a low ridge in the heart of Kozhikode town.⁽¹⁶⁾

Alanpara area : This deposit is located along the crest of a 2-km long NNW-SSE trending hill ranges in the foot hills of the Western Ghats. Iron ore formation (magnetite-quartz-grunerite gneiss) interbedded with biotite-hornblende gneiss occurs in the form of an isoclinal synform plunging at 50 - 55° towards SSE with reversed eastern limb and normal western limb, both dipping towards ENE at angles varying from 60 to 80°. It is exposed as bands and lenses with a total strike length of 2,660 m. Drilling has indicated that the iron orebody varies in thickness from 20 m to 60 m on the limbs and attains a maximum of 145 m on the trough of the fold.⁽¹⁶⁾

Kottayam District

Minor magnetite ore bands occur west of Kabyar estate in Kitapara, north-west of Idikki-Kallipara area, south of Panamkutty and in Nullaninad area near Neriya Mangalam. In Eranalu and Rendar, an impersistent band of magnetite quartzite with a maximum width of about 25 m is also noticed.

Palghat District

Numerous thin bands of magnetite quartzite are located in this district. In the Attapaly valley, five such bands are located.

- (1) Between Galachimala, Narasimanika and Malleshwaram Mallai.
- (2) Near Anakatti checkpost
- (3) Between Sriveni Estate and Munnarghat
- (4) South of Sriveni Estate
- (5) Between Sriveni Water Works Muttikulam and Sungaparai

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Other occurrences include magnetite quartzite bands in the vicinity of Kilur, Mannambatti, Karivallur, Valur, Nadupati, north west of hill and west of Elival.⁽¹⁶⁾

4.1.2.11 Rajasthan

Small deposits and minor occurrences of iron ore are found in Udaipur, Jaipur, Jhunjhunu, Sikar, Alwar, Bharatpur, Bhilwara, Banswara and Bundi districts of Rajasthan. Among these, the deposits of Udaipur, Jaipur, Jhunjhunu and Sikar districts are of some importance. Udaipur and Jaipur districts contain exclusively haematite ore deposits whereas Jhunjhunu and Sikar districts contain both haematite and magnetite deposits. Rajasthan State contains about 9.5 million tonnes of total recoverable reserves of which about 9.1 million tonnes are haematite ore and 0.4 million tonnes magnetite ore. The deposits of Jaipur and Udaipur districts contain about 85% of the total iron ore reserves of the State. Districtwise brief description of important areas is given below:^(5,28)

Jaipur District

Morija deposit : This deposit is located at about 38 km NW of Jaipur at Morija-Banol villages. The iron ore deposit extends over a strike length of 4.5 km. It occurs as bands of massive haematite intercalated with coarse ferruginous grit of Alwar Series. The ore of this area analyses Fe_2O_3 94.55 percent, Al_2O_3 2.38 percent, SiO_2 2.15 percent and P 0.018.

Lalsot deposit : The Lalsot area is located at a distance of about 91 km from Jaipur. The area can be approached via Dausa. The iron ores of this deposit are associated with ferruginous quartzite of Delhi Super-Group. Both low and medium grade haematite ores are found in this deposit. Medium grade ore analyses Fe up to 64.67 percent.⁽²⁸⁾

Nimia deposit: Nimia area is situated about 24 km north of Dausa railway station in Dausa tehsil of Jaipur district. This deposit has been extensively worked in the past; however, major portion of the deposit is still untouched. It occurs in crystalline limestone and forms irregular lenticular masses. Fe content in ore varies from 56 to 60 percent.⁽²⁸⁾

Rampura deposit: Minor occurrence of micaceous haematite varying in thickness from 0.6 m to 2.5 m is reported from Rampura area where the iron ore is found associated with mica schist.

Udaipur District

Nathara-ki-Pal deposit: This deposit is situated near Thana village of Sarada tehsil of Udaipur district. In this area, iron ore mineralisation extends over strike length of 800 m with an approximate width of 30 m, and depth 30 to 130 m. The quality of ore of this deposit is in general poor.⁽²⁸⁾

Jhunjhunu District

Taonda deposit : This area is situated about 0.8 km to the east of Taonda village. Both haematite and magnetite ores occur together. Micaceous haematite is also noticed at places. High grade ore of this area contains Fe 65 to 70 percent and medium and low grades from 55 to 65 percent.

Minor occurrences of iron ore also reported around Raipur, Jaintapura, Kali Pahari in Jhunjhunu district.⁽²⁸⁾

Sikar District

Minor deposits/occurrences of iron ore are reported from Narda-Nanagwas, Bagoli Sarai areas.

4.2 RESERVES^{29,30}

The systematic exploration of minerals was started in the year 1881 when the Geological Survey of India was set-up by Imperial Government to work for Indian geology resources. However, later, due to increase in production, awareness and shortages of minerals, a momentum was given to mineral exploration activities. After Independence, Geological Survey of India, Indian Bureau of Mines and Directorates of Geology and Mining of the State Governments put the efforts and brought out the existence of vast mineral resources. To keep a track of the new discoveries of mineral deposits, resources and exploitation, the Indian Bureau of Mines, in consultation with other exploratory agencies, began to prepare and maintain the National Mineral Inventory since

1970-71 with a policy of updating the same after every five years.

The National Mineral Inventory of Iron Ore as on 1.4.1990 has identified all the important iron ore-bearing States as well as districts of the country and compiled the iron ore reserves of both haematite and magnetite, separately. The States which contain both haematite and magnetite reserves/resources are Karnataka, Bihar, Goa, Andhra Pradesh, Maharashtra, Assam and Rajasthan. The States which contain only haematite reserves/resources are Madhya Pradesh, Orissa and Uttar Pradesh and the States which contain only magnetite reserves/resources are Tamil Nadu, Kerala and Nagaland. The reserves in each case have been tabulated in two groups, i.e. (a) Reserves in freehold areas and (b) Reserves in leasehold areas.

The reserves are classified both categorywise and gradewise. The various grades of reserves of haematite include (i) lumps, high grade (ii) lumps, medium grade (iii) lumps, low grade (iv) fines, high grade (v) fines, medium grade (vi) fines, low grade (vii) lumps, unclassified (viii) fines, unclassified and (ix) black iron ore. Besides the haematite ore, various grades of magnetite ores are coal washery, foundry and metallurgical grades.

4.2.1 Categorisation of Reserves

The reserves of iron ore have been mainly categorised into Proved (Measured), Probable (Indicated) and Possible (Inferred). Keeping in view the recommendation of Working Group of Mineral Exploration Committee setup by the Government of India, the two other categories, i.e. Conditional resources and Prospective resources have been included in the National Mineral Inventory as on 1.4.1990. All these categories are defined as under :

Proved (Measured) : Proved reserve is the reserve for which tonnage has been computed from the dimensions revealed in the outcrops, trenches, workings and drill-holes and for which the grade has been computed from the results of detailed sampling. The sites of inspection, sampling and measurements are closely spaced, the geology and character of the deposit are defined so well that the size, shape and iron

content are well established. The computed tonnage and grade are judged to be accurate within the limits which are stated and no such limit is judged to differ from the computed tonnage or grade by more than 20 percent.⁽²⁹⁾

Probable (Indicated) : Probable reserve is the reserve for which tonnage is computed partly from specific measurements, samples or production data and partly from projections for a reasonable distance based on geological evidence. The sites available for inspection, measurement and sampling are too widely or otherwise unappropriately spaced to outline the ore completely or to establish its grade throughout.⁽²⁹⁾

Possible (Inferred) : Possible reserve is the reserve for which quantitative estimates are based largely on a broad knowledge of the geological character of the deposits and for which there are few, if any, samples of ore measurements. The estimates are based on an assumed continuity or repetition for which there is geological evidence. The evidence may also include a comparison with deposits of similar type. Bodies that are completely concealed may be included if there is specific geological evidence of their presence.⁽²⁹⁾

Conditional Resources : It is a part of 'Identified Resources' which will become 'Reserves' with favourable changes in economic and legal conditions, such as cost of production, selling price, technology, market and infrastructural facility. These reserves are not presently economic or if economic held in abeyance on legal or political grounds.

Prospective Resources : It is a part of 'Undiscovered Resources' comprising estimates not based on measurements of basic parameters but are made in known mineral districts/belts on several promises, such as exploration beyond the explored lateral and vertical limits and projections made on the basis of indirect evidences.

4.2.2 Gradewise Classification of Reserves

The classification of reserves into various grades is purely based on naturally occurring state. The lumps and fines of haematite ore are

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classified on the basis of four chemical constituents, i.e. Fe, SiO₂, Al₂O₃ and P. The various grades are specified as under :

Fe	-	(+)	65%
SiO ₂	-		0.5 to 3.15%
Al ₂ O ₃	-		3% (max)
P	-		0.1 % (max)
(ii) Medium grade lumps & fines			
Fe	-		62-65%
SiO ₂	-		0.6 to 4%
Al ₂ O ₃	-		4 % (max)
P	-		0.1 % (max)
(iii) Low grade lumps & fines			
Fe	-	(-)	62%
SiO ₂	-		1 to 8 %
Al ₂ O ₃	-		2 to 6 %
P	-		0.1 %

(iv) Unclassified lumps & fines - Where the ranges of minimum and maximum values of chemical constituents are too wide to be filled into any of the above grade, estimate is kept under unclassified grade.

The magnetite ore reserves are classified into metallurgical, coal washery and foundry grades.

4.2.3 Analysis of All-India Statewise Reserves of Iron Ore

The total all-India in situ reserves of haematite and magnetite ores together are of the order of 16,835 Mt, conditional resources 5,941 Mt and prospective resources 1,480 Mt. Out of the all-India total in situ reserves of 16,835 Mt, the recoverable reserves work out to be 12,745 Mt which come from the States of Karnataka 3,446.6 Mt (27.04 percent), Bihar 2,971.9 Mt (23.31 percent), Orissa 2,666.7 Mt (20.92 percent), Madhya Pradesh 2,045.3 Mt (16.04 percent), Goa 926.7 Mt (7.27 percent), Andhra Pradesh 464.5 Mt (3.64 percent), Maharashtra 176.3 Mt (1.38 percent), Kerala 35.4 Mt (0.27 percent), Rajasthan 9.6 Mt (0.07 percent) and Tamil Nadu 1.0 Mt (0.007 percent). The Statewise shares of conditional resources and prospective resources of haematite and magnetite ores are given in Tables 4.12 and 4.17, respectively.

Out of the total all-India recoverable reserves of 12,745 Mt, haematite ore reserves are of the

order of 9,602 Mt. and magnetite reserves 3,143 Mt., which constitute about 75.3 percent and 24.7 percent, respectively, or say, the recoverable reserves and haematite and magnetite ores of the country are in the ratio of 3:1.

The total recoverable reserve of 9,602 Mt of haematite ore is contributed by the States of Bihar 2,966.9 Mt (30.89 percent), Orissa 2,666.7 Mt (27.77 percent), Madhya Pradesh 2,045.3 Mt (21.30 percent), Karnataka 928.4 Mt (9.66 percent), Goa 762.2 Mt (7.93 percent), Maharashtra 176.3 Mt (1.83 percent), Andhra Pradesh 46.7 Mt (0.48 percent) and Rajasthan 9.1 Mt (0.09 percent) (See Table 4.12).

The total recoverable reserves of 3,143 Mt of magnetite ores come from the States of Karnataka 2,518.2 Mt (80.12 percent), Andhra Pradesh 417.8 Mt (13.29 percent), Goa 164.5 Mt (5.23 percent), Kerala 35.4 Mt (1.12 percent), Bihar 5.0 Mt (0.15 percent), Tamil Nadu 1.0 Mt (0.03 percent) and Rajasthan 0.5 Mt (0.015 percent) (See Table 4.17).

The categorywise position of recoverable reserves of haematite ore on all-India basis are 4,689.2 Mt under proved category (48.8 percent), 2,824.3 Mt under probable (29.4 percent) and 2,088.3 Mt under possible category (21.7 percent). The Statewise position of the categorywise recoverable reserves of haematite ore are given in Table 4.13. Similarly, out of the all-India total recoverable reserves of 3,143 Mt of magnetite ore, the proved category of reserves are 1,766.2 Mt (56.2 percent), probable reserves 781.8 Mt (24.9 percent) and possible reserves 594 Mt (18.9 percent) (See Table 4.18).

4.2.3.1 Analysis of All-India Statewise, Districtwise Recoverable Reserves of Haematite Ore in Leasehold and Freehold Areas

Out of the all-India total recoverable reserves of 9,602 Mt of haematite ore, the reserves in leasehold areas are 7,129.3 Mt and in freehold areas 2,472.5 Mt, which works out to be 74.2 percent and 25.7 percent, respectively. The Statewise details of reserves in leasehold areas as well as the freehold areas are given in Table 4.14 and the position of Statewise, districtwise,

categorywise and gradewise recoverable reserves of haematite ore in leasehold areas are given in Table 4.15 and freehold areas in Table 4.16.

4.2.3.2 Analysis of All-India Statewise, Districtwise Recoverable Reserves of Magnetite Ore in Leasehold and Freehold Areas

Out of the all-India total recoverable reserves of 3,143 Mt of magnetite ore, the recoverable

reserves in leasehold areas are 579.5 Mt and in freehold areas 2,563.2 Mt, which works out to be 18.4 percent and 81.6 percent, respectively. The Statewise details of recoverable reserves of magnetite ore of leasehold areas and freehold areas are given in Table 4.19 and districtwise, categorywise and gradewise recoverable reserves of leasehold and freehold areas are given in Table 4.20 and 4.21, respectively.

TABLE 4.12: ALL-INDIA STATEWISE RESOURCES OF IRON ORE (HAEMATITE)

(UNIT : '000 TONNES)

STATE	IN SITU RESERVES (100%)	RECOVERABLE RESERVES (100%)	CONDITIONAL RESOURCES (100%)	PROSPECTIVE RESOURCES (100%)
ANDHRA PRADESH	7,1207.1	46,740.1	59,000.0	--
ASSAM	--	--	12,600.0	--
BIHAR	3,393,475.2	2,966,961.9	5,153.0	1,000,000.0
GOA	967,458.2	762,231.0	--	--
KARNATAKA	1,233,499.8	928,421.4	12,055.0	--
MADHYA PRADESH	2,539,340.0	2,045,311.1	72,530.0	480,000.0
MAHARASHTRA	210,367.7	176,348.6	--	158.0
ORISSA	3,506,806.3	2,666,762.9	58,740.0	--
RAJASTHAN	17,380.4	9,143.7	--	--
UTTAR PRADESH	--	--	38,000.0	--
ALL-INDIA	11,939,535	9,601,921	258,078	1,480,158

Figures up to 0.5 and above rounded-off to the nearest integers and less than 0.5 are considered as zero in all-India totals.

(See TABLE 4.13 on next page)

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TABLE 4.13: ALL-INDIA STATEWISE CATEGORYWISE RECOVERABLE RESERVES OF IRON ORE (HAEMATITE)

(UNIT : '000 TONNES)

STATE	PROVED	PROBABLE	POSSIBLE	TOTAL
ANDHRA PRADESH	3322.3 (7.1)	5771.1 (12.3)	37646.8 (80.5)	46740.1 (100.0)
BIHAR	1386580.9 (46.7)	1228875.0 (41.4)	351506.0 (11.8)	2966961.9 (100.0)
GOA	362560.5 (47.6)	200258.5 (26.3)	199412.0 (26.2)	762231.0 (100.0)
KARNATAKA	510639.2 (55.0)	252531.1 (27.2)	165251.1 (17.8)	928421.4 (100.0)
MADHYA PRADESH	900835.6 (44.0)	463229.1 (22.6)	681246.4 (33.3)	2045311.1 (100.0)
MAHARASHTRA	83934.7 (47.6)	35951.0 (20.41)	56462.9 (32.0)	176348.6 (100.0)
ORISSA	1441404.7 (54.1)	631738.8 (23.7)	593619.4 (22.3)	2666762.9 (100.0)
RAJASTHAN	20.5 (0.2)	5961.9 (65.2)	3161.3 (34.6)	9143.7 (100.0)
ALL-INDIA TOTAL	4689299 (48.8)	2824316 (29.4)	2088306 (21.7)	9601921 (100.0)

Note : Figures in parentheses indicate percentage

Figures up to 0.5 and above rounded-off to the nearest integers and less than 0.5 are considered as zero in all-India totals.

Source: NMI as on 1.4.90 (IBM)

TABLE 4.14: ALL-INDIA STATEWISE IN SITU, RECOVERABLE AND CONDITIONAL RESOURCES OF IRON ORE (HAEMATITE) IN LEASEHOLD AND FREEHOLD AREAS

(UNIT : '000 TONNES)

(a = Leasehold areas)

(b = Freehold areas)

STATE	IN SITU	RECOVERABLE	CONDITIONAL RESOURCE
ANDHRA PRADESH	a = 23687.9 b = 47519.2	a = 16647.0 b = 30093.1	a = - b = 59000.0
ASSAM	a = - b = -	a = - b = -	a = - b = 12600.0
BIHAR	a = 3148260.5 b = 245214.7	a = 2796498.9 b = 170463.0	a = 3153.0 b = 2000.0
GOA	a = 963941.2 b = 1768.0	a = 761035.0 b = 1196.0	a = - b = -
KARNATAKA	a = 778000.0 b = 455499.6	a = 590721.1 b = 337700.3	a = 1365.0 b = 10690.0
MADHYA PRADESH	a = 1055458.3 b = 1483882.0	a = 797511.1 b = 1247800.0	a = 20000.0 b = 52530.0
MAHARASHTRA	a = 41563.7 b = 168804.0	a = 35155.6 b = 141193.0	a = - b = -
ORISSA	a = 2692313.3 b = 814493.0	a = 2129815.8 b = 536947.1	a = 58687.0 b = 53.0
RAJASTHAN	a = 3046.8 b = 14333.6	a = 1976.9 b = 7166.8	a = - b = -
UTTAR PRADESH	a = - b = -	a = - b = -	a = - b = 38000.0
ALL-INDIA TOTAL	a = 8706271.7 b = 3231514.1	a = 7129361.4 b = 2472559.3	a = 83205.0 b = 174873.0

Source: NMI as on 1.4.90 (IBM).⁽³⁰⁾

MONOGRAPH : IRON ORE

TABLE 4.15: STATEWISE, DISTRICTWISE, GRADEWISE RECOVERABLE RESERVES IN LEASEHOLD AREAS (HAEMATITE)

(UNIT : '000 TONNES)

STATE/DISTRICT	PROVED WITH %	PROBABLE WITH %	POSSIBLE WITH %	TOTAL WITH %	GRADE
ANDHRA PRADESH ANANTPUR	782.8 (19.0)	1807.4 (43.8)	1539.4 (37.3)	4129.6 (100)	Lumps high grade
	693.9 (44.5)	863.8 (55.5)	--	1557.7 (100)	Lumps medium grade
	669.2 (28.3)	902.0 (38.2)	789.8 (33.5)	2361.0 (100)	Fines high grade
	1176.5 (32.5)	2164.8 (64.8)	--	3341.3 (100)	Fines medium/ high grade
TOTAL OF ANANTPUR	3322.4 (29.2)	5738.0 (50.4)	2329.2 (20.5)	11389.6 (100)	
KRISHNA	--	--	2.7 (100)	2.7 (100)	Lumps medium grade
	--	--	13.5 (100)	13.5 (100)	Lumps low grade
	--	--	15.8 (100)	15.8 (100)	Lumps & fines medium grade
	--	--	1.0 (100)	1.0 (100)	Unclassified
	--	--	117.9 (100)	117.9 (100)	Not known
TOTAL OF KRISHNA	--	--	150.9 (100)	150.9 (100)	
KURNOOL	--	--	117.6 (100)	117.6 (100)	Lumps medium grade
	--	--	40.1 (100)	40.1 (100)	Lumps low grade
	--	28.0 (15.3)	154.7 (84.7)	182.7 (100)	Lumps, Unclassified grade
	--	--	19.5 (100)	19.5 (100)	Fines medium grade
	--	--	7.7 (100)	7.7 (100)	Fines low grade
	--	5.1 (15.7)	27.1 (84.3)	32.2 (100)	Fines unclassified
--	--	224.6 (100)	224.6 (100)	Not known	
TOTAL OF KURNOOL	--	33.1 (5.3)	591.3 (94.7)	624.4 (100)	
NELLORE	--	--	3650.0 (100)	3650.0 (100)	Lumps low grade
	--	--	525.0 (100)	525.0 (100)	Fines low grade
TOTAL OF NELLORE	--	--	4175.0 (100)	4175.0 (100)	
KHAMMAM	--	--	228.3 (100)	228.3 (100)	Lumps medium grade
	--	--	8.0 (100)	8.0 (100)	Lumps low grade
	--	--	13.0 (100)	13.0 (100)	Fines medium grade
	--	--	57.8 (100)	57.8 (100)	Not known
TOTAL OF KHAMMAM	--	--	307.1 (100)	307.1 (100)	

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Table 4.15 (Contd.)

STATE/DISTRICT	PROVED WITH %	PROBABLE WITH %	POSSIBLE WITH %	TOTAL WITH %	GRADE
BIHAR	--	--	33.0	33.0	Lumps low grade
BHAGALPUR			(100)	(100)	
SINGHBHUM	34440.0 (100)	--	--	34440.0 (100)	Lumps high grade
	241681.9 (32.3)	428764.2 (57.4)	77118.0 (10.3)	747564.1 (100)	Lumps medium grade
	258102.0 (68.6)	113337.0 (30.1)	4598.0 (1.2)	376037.0 (100)	Lumps low grade
	--	--	62626.0 (100)	62626.0 (100)	Lumps, unclassified grade
	412409.0 (42.9)	513250.8 (53.4)	35145.0 (3.7)	960804.8 (100)	Fines medium grade
	332028.0 (69.8)	138523.0 (29.1)	4949.0 (1.0)	475500.0 (100)	Fines low grade
	--	--	52574.0 (100)	52574.0 (100)	Fines unclassified grade
	36080.0 (100)	--	--	36080.0 (100)	Lumps & fines medium grade
	50840.0 (100)	--	--	50840.0 (100)	Blue dust
TOTAL OF SINGHBHUM	1365580.9 (48.8)	1193875.0 (42.7)	237010.0 (8.5)	2796465.9 (100)	
GOA	2181.0 (89.3)	184.0 (7.5)	78.0 (3.2)	2443.0 (100)	Lumps medium grade
NORTH GOA	5343.0 (39.7)	4406.0 (32.7)	3697.0 (27.4)	13446.0 (100)	Lumps low grade
	9211.0 (86.8)	1403.0 (13.2)	0.0 (0.0)	10614.0 (100)	Fines high grade
	67129.0 (59.3)	34153.0 (30.2)	11936.0 (10.5)	113218.0 (100)	Fines medium grade
	72484.0 (49.6)	46793.0 (32.0)	26839.0 (18.3)	146116.0 (100)	Fines low grade
	8860.0 (57.8)	5053.0 (32.9)	1425.0 (1.3)	15338.0 (100)	Fines unclassified grade
	257.0 (59.9)	172.0 (40.1)	0.0 (0.0)	429.0 (100)	Lumps & fines high grade
	1222.0 (65.1)	654.0 (34.9)	0.0 (0.0)	1876.0 (100)	Lumps & fines medium grade
	23961.0 (43.7)	7029.0 (12.8)	23849.0 (43.5)	54839.0 (100)	Lumps & fines low grade
	1006.0 (2.3)	769.0 (1.8)	41479.0 (95.9)	43254.0 (100)	Lumps & fines unclassified grade
	1266.0 (69.9)	295.0 (16.3)	249.0 (13.8)	1810.0 (100)	Black iron ore
	4768.0 (78.0)	599.0 (9.8)	749.0 (12.2)	6116.0 (100)	Others
TOTAL OF NORTH GOA	197688.0 (48.2)	101510.0 (24.8)	110301.0 (27.0)	409499.0 (100)	

MONOGRAPH : IRON ORE

Table 4.15 (Contd.)

STATE/DISTRICT	PROVED WITH %	PROBABLE WITH %	POSSIBLE WITH %	TOTAL WITH %	GRADE
SOUTH GOA	804.0 (41.6)	1131.0 (58.4)	--	1935.0 (100)	Lumps medium grade
	13416.0 (27.7)	16384.5 (33.8)	18677.0 (38.5)	48477.5 (100)	Lumps low grade
	65.0 (20.6)	250.0 (79.4)	--	315.0 (100)	Lumps unclassified grade
	1673.0 (82.0)	240.0 (11.8)	128.0 (6.3)	2041.0 (100)	Fines high grade
	24524.0 (78.2)	4951.0 (15.8)	1883.0 (6.0)	31358.0 (100)	Fines medium grade
	78979.5 (44.2)	51902.0 (29.1)	47730.0 (26.7)	178611.5 (100)	Fines low grade
	5633.0 (73.5)	2036.0 (26.5)	--	7669.0 (100)	Fines unclassified grade
	481.0 (100)	--	--	481.0 (100)	Lumps & fines high grade
	2503.0 (97.1)	75.0 (2.9)	--	2578.0 (100)	Lumps & fines medium grade
	18864.0 (82.6)	3725.0 (16.3)	249.0 (1.1)	22838.0 (100)	Lumps & fines low grade
	--	--	4743.0 (100)	4743.0 (100)	Lumps & fines unclassified grade
	2058.0 (19.7)	5347.0 (51.1)	3059.0 (29.2)	10464.0 (100)	Black iron ore
	6898.0 (22.6)	11380.0 (37.2)	12296.0 (40.2)	30574.0 (100)	Others
8974.0 (95.0)	477.0 (5.0)	--	9451.0 (100)	Unclassified	
TOTAL OF SOUTH GOA	164872.5 (46.9)	97898.5 (27.8)	88765.0 (25.3)	351536.0 (100)	
KARNATAKA BELLARY	136726.1 (77.8)	19723.0 (11.2)	19239.8 (11.0)	175688.9 (100)	Lumps high grade
	55039.0 (57.2)	33945.1 (35.3)	7232.0 (7.5)	96216.1 (100)	Lumps medium grade
	--	246.2 (100)	--	246.2 (100)	Lumps low grade
	30.9 (++)	87701.4 (99.8)	170.3 (0.2)	87902.6 (100)	Lumps unclassified grade
	30988.4 (74.8)	5374.2 (13.0)	5051.0 (12.2)	41413.6 (100)	Fines high grade
	77152.6 (61.0)	47156.2 (37.3)	2075.8 (1.6)	126384.6 (100)	Fines medium grade
	70.9 (34.2)	54.4 (26.3)	82.0 (39.5)	207.3 (100)	Fines low grade
	7.7 (++)	21895.3 (99.1)	188.6 (0.9)	22091.6 (100)	Fines unclassified grade
	--	--	226.8 (100)	226.8 (100)	Others
	--	--	17.0 (100)	17.0 (100)	Unclassified
	179.5 (18.2)	626.3 (63.4)	181.3 (18.4)	987.1 (100)	Not known
TOTAL OF BELLARY	300195.1 (54.4)	216722.0 (39.3)	34464.6 (6.3)	551381.7 (100)	

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INDIAN DEPOSITS AND RESERVES

Table 4.15 (Contd.)

STATE/DISTRICT	PROVED WITH %	PROBABLE WITH %	POSSIBLE WITH %	TOTAL WITH %	GRADE
BIJAPUR	432.0 (24.6)	1323.0 (75.4)	--	1755.0 (100)	Lumps medium grade
	288.0 (37.4)	483.0 (62.6)	--	771.0 (100)	Fines medium grade
	--	200.0 (100)	--	200.0 (100)	Fines low grade
TOTAL OF BIJAPUR	720.0 (26.4)	2006.0 (73.6)	--	2726.0 (100)	
CHICKMAGALUR	7826.0 (100)	--	--	7826.0 (100)	Lumps low grade
	3354.0 (100)	--	--	3354.0 (100)	Fines low grade
TOTAL OF CHICKMAGALUR	11180.0 (100)	--	--	11180.0 (100)	
CHITRADURGA	--	2096.0 (50.7)	2035.9 (49.3)	4131.9 (100)	Lumps medium grade
	--	3633.8 (100)	--	3633.8 (100)	Lumps unclassified grade
	--	226.3 (41.9)	313.9 (58.1)	540.2 (100)	Fines medium grade
TOTAL OF CHITRADURGA	--	5956.1 (71.7)	2349.8 (28.3)	8305.9 (100)	
DHARWAR	--	920.0 (17.4)	4358.0 (82.6)	5278.0 (100)	Lumps medium grade
	--	395.0 (24.4)	1223.0 (75.6)	1618.0 (100)	Fines medium grade
	--	13.5 (100)	--	13.5 (100)	Not known
TOTAL OF DHARWAR	--	1328.5 (19.2)	5581.0 (80.8)	6909.5 (100)	
NORTH KANARA	--	1892.0 (57.4)	1405.0 (42.6)	3297.0 (100)	Lumps low grade
	--	--	598.0 (100)	598.0 (100)	Lumps unclassified grade
	--	51.0 (45.5)	61.0 (54.5)	112.0 (100)	Fines medium grade
	--	--	524.0 (100)	524.0 (100)	Fines low grade
	--	100.0 (100)	--	100.0 (100)	Black iron ore
TOTAL OF NORTH KANARA	--	2043.0 (44.1)	2588.0 (55.9)	4631.0 (100)	
TUMKUR	--	192.7 (4.6)	4004.6 (95.4)	4197.3 (100)	Lumps medium grade
	--	78.0 (37.1)	132.0 (62.9)	210.0 (100)	Lumps unclassified grade
	--	49.0 (4.7)	988.9 (95.3)	1037.9 (100)	Fines medium grade
	--	48.8 (38.5)	78.0 (61.5)	126.8 (100)	Fines unclassified grade
	--	--	15.0 (100)	15.0 (100)	Not known
TOTAL OF TUMKUR	--	368.5 (6.6)	5218.5 (93.4)	5587.0 (100)	

MONOGRAPH : IRON ORE

Table 4.15 (Contd.)

STATE/DISTRICT	PROVED WITH %	PROBABLE WITH %	POSSIBLE WITH %	TOTAL WITH %	GRADE
MADHYA PRADESH BASTAR	210927.0 (100)	--	--	210927.0 (100)	Lumps high grade
	46996.0 (100)	--	--	46996.0 (100)	Lumps low grade
	--	--	19690.0 (100)	19690.0 (100)	Lumps unclassified grade
	181294.0 (100)	--	--	181294.0 (100)	Fines high grade
	65714.0 (100)	--	--	65714.0 (100)	Fines low grade
	--	--	13120.0 (100)	13120.0 (100)	Fines unclassified grade
	32155.0 (48.5)	34180.0 (51.5)	--	66335.0 (100)	Blue dust
TOTAL OF BASTAR	537086.0 (88.9)	34180.0 (5.7)	32810.0 (5.4)	604076.0 (100)	
DURG	48280.0 (100)	--	--	48280.0 (100)	Lumps & fines high grade
	103510.0 (100)	--	--	103510.0 (100)	Lumps & fines medium grade
	16722.0 (100)	--	--	16722.0 (100)	Lumps & fines low grade
	20825.0 (100)	--	--	20825.0 (100)	Lumps & fines unclassified grade
TOTAL OF DURG	189337.0 (100)	--	--	189337.0 (100)	
JABALPUR	540.3 (17.3)	1658.0 (53.1)	925.5 (29.6)	3123.8 (100)	Lumps medium grade
	--	--	339.9 (100)	339.9 (100)	Lumps low grade
	60.6 (100)	--	--	60.6 (100)	Lumps unclassified grade
	192.7 (82.8)	40.1 (17.2)	--	232.8 (100)	Fines medium grade
	245.4 (100)	--	--	245.4 (100)	Blue dust
	45.6 (100)	--	--	45.6 (100)	Others
	--	--	50.0 (100)	50.0 (100)	Not known
TOTAL OF JABALPUR	1084.6 (26.5)	1698.1 (41.4)	1315.4 (32.1)	4098.1 (100)	
MAHARASHTRA CHANDRAPUR	43.4 (12.9)	292.0 (87.1)	--	335.4 (100)	Lumps medium grade
	21.0 (1.7)	1192.0 (98.3)	--	1213.0 (100)	Lumps unclassified grade
	--	82.0 (100)	--	82.0 (100)	Fines medium grade
	4.4 (1.4)	298.0 (98.6)	--	302.4 (100)	Fines unclassified grade
TOTAL OF CHANDRAPUR	68.8 (3.2)	1864.0 (96.4)	--	1932.8 (100)	

INDIAN DEPOSITS AND RESERVES

Table 4.15 (Contd.)

STATE/DISTRICT	PROVED WITH %	PROBABLE WITH %	POSSIBLE WITH %	TOTAL WITH %	GRADE
GADCHIROLI	--	63.0 (61.2)	39.9 (38.8)	102.9 (100)	Lumps high grade
SINDHUDURG	1717.0 (51.6)	130.0 (3.9)	1480.0 (44.5)	3327.0 (100)	Lumps low grade
	1976.0 (64.2)	90.0 (2.9)	1013.0 (32.9)	3079.0 (100)	Lumps unclassified grade
	1594.0 (48.1)	360.0 (10.9)	1360.0 (41.0)	3314.0 (100)	Fines medium grade
	5593.0 (54.2)	160.0 (1.6)	4560.0 (44.2)	10313.0 (100)	Fines low grade
	7384.0 (62.4)	360.0 (3.0)	4083.0 (34.5)	11827.0 (100)	Fines unclassified grade
	1260.0 (100)	--	--	1260.0 (100)	Lumps & fines unclassified
TOTAL OF SINDHUDURG	19524.0 (58.9)	1100.0 (3.3)	12496.0 (37.7)	33120.0 (100)	
ORISSA CUTTACK	20400.0 (100)	--	--	20400.0 (100)	Lumps medium grade
	--	5886.0 (100)	--	5886.0 (100)	Lumps unclassified grade
	12000.0 (100)	--	--	12000.0 (100)	Fines low grade
	--	1472.0 (100)	--	1472.0 (100)	Fines unclassified grade
	8600.0 (100)	--	--	8600.0 (100)	Blue dust
TOTAL OF CUTTACK	41000.0 (84.3)	7358.0 (15.2)	--	48358.0 (100)	
DHENKANAL	--	--	3300.0 (100)	3300.0 (100)	Lumps medium grade
	--	--	1095.0 (100)	1095.0 (100)	Fines medium grade
TOTAL OF DHENKANAL	--	--	4395.0 (100)	4395.0 (100)	
KEONJHAR	106199.0 (40.1)	111020.0 (42.0)	47338.0 (17.9)	264557.0 (100)	Lumps high grade
	214321.5 (71.0)	40153.8 (13.3)	47375.6 (15.7)	301850.9 (100)	Lumps medium grade
	111085.0 (64.3)	46520.6 (26.9)	15168.8 (8.8)	172774.4 (100)	Lumps low grade
	295.0 (41.7)	250.0 (35.3)	163.0 (23.0)	708.0 (100)	Lumps unclassified grade
	26866.0 (57.5)	16716.0 (35.8)	3105.0 (6.7)	46687.0 (100)	Fines high grade
	85146.2 (79.7)	16410.4 (15.4)	5268.0 (4.9)	106824.6 (100)	Fines medium grade
	155649.0 (68.4)	68485.9 (30.1)	3503.4 (1.5)	227638.3 (100)	Fines low grade
	562.0 (3.0)	3760.0 (20.3)	14183.0 (76.6)	18505.0 (100)	Fines unclassified grade
TOTAL OF KEONJHAR	700123.7 (61.4)	303316.7 (26.6)	136104.8 (11.9)	1139545.2 (100)	

MONOGRAPH : IRON ORE

TABLE 4.15 (Concl.d.)

STATE/DISTRICT	PROVED WITH %	PROBABLE WITH %	POSSIBLE WITH %	TOTAL WITH %	GRADE
MAYURBHANJ	--	--	3676.2 (100)	3676.2 (100)	Lumps medium grade
	--	--	9260.3 (100)	9260.3 (100)	Lumps low grade
	--	--	41898.8 (100)	41898.8 (100)	Lumps unclassified grade
	--	--	5938.7 (100)	5938.7 (100)	Fines medium grade
	--	--	2642.6 (100)	2642.6 (100)	Fines low grade
	--	--	30.0 (100)	30.0 (100)	Fines unclassified grade
TOTAL OF MAYURBHANJ	--	--	63446.6 (100)	63446.6 (100)	
SUNDERGARH	1277.0 (83.5)	126.0 (8.2)	126.0 (8.2)	1529.0 (100)	Lumps high grade
	239552.0 (86.6)	11113.0 (4.0)	25989.5 (9.4)	276654.5 (100)	Lumps medium grade
	77380.0 (54.0)	63330.0 (44.2)	2673.0 (1.9)	143383.0 (100)	Lumps low grade
	106589.0 (97.1)	--	3161.0 (2.9)	109750.0 (100)	Lumps unclassified grade
	548.0 (83.5)	54.0 (8.2)	54.0 (8.2)	656.0 (100)	Fines high grade
	103348.0 (86.1)	4711.0 (3.9)	11966.5 (10.0)	120025.5 (100)	Fines medium grade
	68508.0 (54.8)	55984.0 (44.7)	632.0 (0.5)	125124.0 (100)	Fines low grade
	94523.0 (97.5)	--	2426.0 (2.5)	96949.0 (100)	Fines unclassified grade
TOTAL OF SUNDERGARH	691725.0 (79.1)	135318.0 (15.5)	47028.0 (5.4)	874071.0 (100)	
RAJASTHAN JAIPUR	--	86.1 (13.9)	533.4 (86.1)	619.5 (100)	Lumps low grade
	--	--	226.9 (100)	226.9 (100)	Lumps unclassified grade
	--	86.1 (43.8)	110.5 (56.2)	196.6 (100)	Fines low grade
	--	--	3.6 (100)	3.6 (100)	Fines unclassified grade
	--	--	634.0 (100)	634.0 (100)	Unclassified
TOTAL OF JAIPUR	--	172.2 (10.2)	1508.4 (89.8)	1680.6 (100)	
JHUNJHUNU	--	--	17.4 (100)	17.4 (100)	Lumps low grade
	--	--	38.0 (100)	38.0 (100)	Lumps unclassified grade
	--	--	17.4 (100)	17.4 (100)	Fines low grade
	--	--	38.0 (100)	38.0 (100)	Fines unclassified grade
	20.5 (14.8)	34.9 (25.1)	83.4 (60.1)	138.8 (100)	Unclassified
TOTAL OF JHUNJHUNU	20.5 (8.2)	34.9 (14.0)	194.2 (77.8)	249.6 (100)	
SIKAR	--	--	46.7 (100)	46.7 (100)	Others

Note : Figures in parentheses indicate percentage

Source : NMI as on 1.4.90 (IBM) ⁽³⁰⁾

INDIAN DEPOSITS AND RESERVES

TABLE 4.16 : STATEWISE, DISTRICTWISE, CATEGORYWISE RECOVERABLE RESERVES IN FREEHOLD AREAS(HAEMATITE)

STATE/DISTRICT	PROVED	PROBABLE	POSSIBLE	TOTAL
ANDHRA PRADESH	--	--	2400.0	2400.0
ANANTPUR	--	--	(100)	(100)
CUDDAPAH	--	--	110.0	110.0
	--	--	(100)	(100)
GUNTUR	--	--	24000.0	24000.0
	--	--	(100)	(100)
KURNOOL	--	--	279.1	279.1
	--	--	(100)	(100)
NELLORE	--	--	96.0	96.0
	--	--	(100)	(100)
KHAMMAM	--	--	3208.0	3208.0
	--	--	(100)	(100)
TOTAL OF ANDHRA PRADESH	--	--	30093.1	30093.1
	--	--	(100)	(100)
BIHAR	21000.0	35000.0	114463.0	170463.0
SINGHBHUM	(12.3)	(20.5)	(67.1)	(100)
GOA	--	850.0	--	850.0
NORTH GOA	--	(100)	--	(100)
SOUTH GOA	--	--	346.0	346.0
TOTAL OF GOA	--	850.0	346.0	1196.0
KARNATAKA	171624.2	16146.3	8421.0	196191.4
BELLARY	(87.5)	(8.2)	(4.3)	(100)
CHIKMAGALUR	10920.0	--	13489.8	24409.8
	(44.7)	--	(55.3)	(100)
CHITRADURGA	--	1571.8	8376.0	9947.8
	--	(15.8)	(84.2)	(100)
DHARWAR	--	--	8060.0	8060.0
	--	--	(100)	(100)
NORTH KANARA	--	4589.0	61677.0	66266.0
	--	(6.9)	(93.1)	(100)
SHIMOGA	16000.0	--	320.0	16320.0
	(98.0)	--	(2.0)	(100)
TUMKUR	--	1800.0	14705.3	16505.3
	--	(10.9)	(89.1)	(100)
TOTAL OF KARNATAKA	198544.2	24107.0	115049.1	337700.3
	(58.8)	(7.1)	(34.1)	(100)
MADHYA PRADESH	153311.0	425101.0	593396.0	1171808.0
BASTAR	(13.1)	(36.3)	(50.6)	(100)
BETUL	--	--	8.0	8.0
	--	--	(100)	(100)
GWALIOR	300.0	--	410.0	710.0
	(42.3)	--	(57.7)	(100)
JABALPUR	19717.0	2250.0	50757.0	72724.0
	(27.1)	(3.1)	(69.8)	(100)
RAJNANDGAON	--	--	2550.0	2550.0
	--	--	(100)	(100)
TOTAL OF MADHYA PRADESH	173328.0	427351.0	647121.0	1247800.0
	(13.9)	(34.2)	(51.9)	(100)

MONOGRAPH : IRON ORE

Table 4.16 (Concl.d.)

STATE/DISTRICT	PROVED	PROBABLE	POSSIBLE	TOTAL
MAHARASHTRA CHANDRAPUR	--	--	246.0 (100)	246.0 (100)
RATNAGIRI	--	2813.0 (100)	--	2813.0 (100)
GADCHIROLI	63987.0 (47.0)	28421.0 (20.9)	43681.0 (32.1)	136089.0 (100)
SINDHUDURG	355.0 (17.4)	1690.0 (82.6)	--	2045.0 (100)
TOTAL OF MAHARASHTRA	4342 (45.6)	32924.0 (23.3)	43927.0 (31.1)	141193.0 (100)
ORISSA DHENKANAL	--	1120.0 (100)	--	1120.0 (100)
KEONJHAR	618.0 (0.3)	650.0 (0.3)	240619.0 (99.5)	241887.0 (100)
KORAPUT	--	--	2120.0 (100)	2120.0 (100)
MAYURBHANJ	--	--	350.0 (100)	350.0 (100)
SAMBALPUR	--	--	35000.0 (100)	35000.0 (100)
SUNDERGARH	7938.0 (3.1)	183976.1 (71.7)	64556.0 (25.2)	256470.1 (100)
TOTAL OF ORISSA	8556.0 (1.6)	185746.1 (34.6)	342645.0 (63.8)	536947.1 (100)
RAJASTHAN JAIPUR	--	54.8 (7.2)	702.0 (92.8)	756.8 (100)
JHUNJHUNU	--	--	710.0 (100)	710.0 (100)
UDAIPUR	--	5700.0 (100)	--	5700.0 (100)
TOTAL OF RAJASTHAN	--	5754.8 (80.3)	1412.0 (19.7)	7166.8 (100)

Note : Figures in parentheses indicate percentage

Source : NMI as on 1.4.90 (IBM).

TABLE 4.17 : ALL-INDIA STATEWISE IN SITU, RECOVERABLE & CONDITIONAL RESOURCES OF IRON ORE (MAGNETITE)

(UNIT : '000 TONNES)

STATE	IN SITU RESERVES (100%)	RECOVERABLE RESERVES (100%)	CONDITIONAL RESOURCES (100%)
ANDHRA PRADESH	1309700.0	417870.0	153841.0
ASSAM	--	--	11140.0
BIHAR	7382.0	5066.0	4235.0
GOA	187056.0	164556.0	37506.0
KARNATAKA	3350495.0	2518237.0	4432408.0
KERALA	39397.0	35457.0	44669.0
MAHARASHTRA	--	--	1960.0
NAGALAND	--	--	5280.0
RAJASTHAN	579.3	475.3	522084.0
TAMIL NADU	1433.6	1074.5	480443.0
ALL-INDIA	4896042.9	3142735.8	5693566.0

INDIAN DEPOSITS AND RESERVES

TABLE 4.18 : ALL-INDIA STATEWISE, CATEGORYWISE RECOVERABLE RESERVES OF IRON ORE (MAGNETITE)

(UNIT : '000 TONNES)

STATE	PROVED	PROBABLE	POSSIBLE	TOTAL
ANDHRA PRADESH	37870.0 (9.1)	380000.0 (90.9)	--	417870.0 (100.0)
BIHAR	936.4 (18.5)	2427.2 (47.9)	1702.4 (33.6)	5066.0 (100.0)
GOA	64865.0 (39.4)	3881.0 (2.4)	95810.0 (58.2)	164556.0 (100.0)
KARNATAKA	1662614.0 (66.0)	371323.0 (14.7)	484300.0 (19.2)	2518237.0 (100.0)
KERALA	--	24194.0 (68.2)	11263.0 (31.8)	35457.0 (100.0)
RAJASTHAN	4.3 (0.9)	10.0 (2.1)	461.0 (97.0)	475.3 (100.0)
TAMIL NADU	--	--	1074.5 (100.0)	1074.5 (100.0)
ALL-INDIA	1766289.7 (56.2)	781835.2 (24.9)	594610.9 (18.9)	3142735.8 (100.0)

Note : Figures in parentheses indicate percentage
Source : NMI as on 1.4.90 (IBM).⁽³⁰⁾

TABLE 4.19 : ALL-INDIA STATEWISE IN SITU, RECOVERABLE AND CONDITIONAL RESOURCES OF IRON ORE(MAGNETITE) IN LEASEHOLD AND FREEHOLD AREAS

(UNIT = '000 TONNES)

(a = Leasehold areas)

(b = Freehold areas)

STATE	IN SITU (100%)	RECOVERABLE (100%)	CONDITIONAL RESOURCE (100%)
ANDHRA PRADESH	a = - b = 1309700.0	a = - b = 417870.0	a = - b = 153841.0
ASSAM	a = - b = -	a = - b = -	a = - b = 11140.0
BIHAR	a = 7342.8 b = 39.2	a = 5034.6 b = 31.4	a = - b = 4235.0
GOA	a = 107101.0 b = 79955.0	a = 92596.0 b = 71960.0	a = 1997.0 b = 35509.0
KARNATAKA	a = 689000.0 b = 2661495.0	a = 481400.0 b = 2036837.0	a = 434000.0 b = 3998408.0
KERALA	a = - b = 39397.0	a = - b = 35457.0	a = - b = 44669.0
MAHARASHTRA	a = - b = -	a = - b = -	a = 1960.0 b = -
NAGALAND	a = - b = -	a = - b = -	a = - b = 5280.0
RAJASTHAN	a = 579.3 b = -	a = 475.3 b = -	a = - b = 522084.0
TAMIL NADU	a = - b = 1433.6	a = - b = 1074.5	a = - b = 480443.0
TOTAL OF ALL STATES	a = 804023.1 b = 4092019.8	a = 579505.9 b = 2563229.9	a = 437957.0 b = 5255609.0

Source : NMI as on 1.4.90(IBM).⁽³⁰⁾

MONOGRAPH : IRON ORE

TABLE 4.20 : STATEWISE/DISTRICTWISE, GRADEWISE RECOVERABLE RESERVES IN LEASEHOLD AREAS(MAGNETITE)

(IN TONNES)					
State/District	Proved with %	Probable with %	Possible with %	Total with %	Grade
BIHAR	934.3	2400.9	1631.9	4967.1	Coal washery
PALAMAU	(18.8)	(48.3)	(32.9)	(100)	Not known
	--	6.7	--	6.7	(100)
		(100)		(100)	
TOTAL OF PALAMAU	934.3	2407.7	1631.9	4973.8	
	(18.8)	(48.4)	(32.8)	(100)	
DALTONGANJ	2.0	19.6	39.2	60.8	Coal washery
	(3.5)	(32.1)	(64.4)	(100)	
GOA	--	2520.0	23850.0	26370.0	Metallurgical
SOUTH GOA	--	(9.6)	(90.4)	--	Others
	9945.0	1361.0	--	11306.0	(100)
	(88.0)	(12.0)	--	(100)	
	54920.0	--	--	54920.0	Unclassified
	(100)	--	--	(100)	
TOTAL OF SOUTH GOA	64865.0	3881.0	23850.0	92596.0	
	(70.1)	(4.2)	(25.8)	(100)	
KARNATAKA	476000.0	--	--	476000.0	Metallurgical
CHICKMAGALUR	(100)	--	--	(100)	Not known
	--	--	5400.0	5400.0	
TOTAL OF CHICKMAGALUR	476000.0	--	5400	481400	
	(98.9)	--	(1.1)	(100)	
RAJASTHAN	4.3	10.0	218.3	232.6	Foundary
JHUNJHUNU	(1.8)	(4.3)	(93.9)	(100)	
SIKAR	--	--	242.7	242.7	Foundary
	--	--	(100)	(100)	

Note : Figures in parentheses indicate percentage.

Source : NMI as on 1.4.90 (IBM).⁽³⁰⁾

TABLE 4.21 : STATEWISE DISTRICTWISE CATEGORYWISE RECOVERABLE RESERVES IN FREEHOLD AREAS (MAGNETITE)

STATE/DISTRICT	PROVED	PROBABLE	POSSIBLE	TOTAL
ANDHRA PRADESH PRAKASAM } ONGOLE }	37870.0	380000.0	--	417870.0
	(9.1)	(90.9)	--	(100)
BIHAR	--	--	31.4	31.4
PALAMAU	--	--	(100)	(100)
GOA	--	--	71960.0	71960.0
UNIDENTIFIED	--	--	(100)	(100)
KARNATAKA	1186614.0	290476.0	--	1477090.0
CHICKMAGALUR	(80.3)	(19.7)	--	(100)
SHIMOGA	--	80847.0	478900.0	559747.0
	--	(14.4)	(85.6)	(100)
TOTAL OF KARNATAKA	1186614.0	371323.0	478900.0	2036837.0
	(58.3)	(18.2)	(23.5)	(100)
KERALA	--	24194.0	9373.0	33567.0
KOZHIKODE	--	(72.1)	(27.9)	(100)
MALLAPURAM	--	--	1890.0	1890.0
	--	--	(100)	(100)
TOTAL OF KERALA	--	24194.0	11263.0	35457.0
	--	(68.2)	(31.8)	(100)
TAMIL NADU	--	--	1074.5	1074.5
NILGIRIS	--	--	(100)	(100)

Note : Figures in parentheses indicate percentage

Source : NMI as on 1.4.90 (IBM).⁽³⁰⁾

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