



GOVERNMENT OF ORISSA
MINING AND GEOLOGY DEPARTMENT

(REPORT ON THE MINERAL DEPOSITS OF ORISSA)

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MINERAL DEPOSITS IN ORISSA

PURI DISTRICT

Lime stone—Kankar deposits are found one mile south of Telbari in Dasapalla State and one mile north-east of Bariegochoa and three furlongs north of Salapagaudaghati. The deposits of Tilberi contain about 36,000 cft. and they are not of great commercial value. Available reserves are very much limited and transport difficulty forbids any attempt at commercial exploitation, but it may be burnt locally for lime.

Magnetite—The deposit is found west of Tentulipali in Dasapalla area and being very small is of no economic importance.

Mica—The deposits are found in Saliagochoa, Tumandi and Borasobi of Dasapalla area and one mile north of Serauda in Khandpara. In Dasapalla area, the mica content of Pegmatite is very low and it is badly folded and crushed. The maximum size of good mica does not exceed one sq. inch, and so it does not appear to be of any commercial importance and the deposits in the last two places are too insignificant. The maximum thickness is also only about 1 ft. Muscovite mica of ruby colour occurs as horizontal flakes and is usually very small in size.

Manganese—These deposits are found near Kutni and Satagandaghati in Dasapalla area and also found mixed with iron near Indigaria, Lakshmiprasad, Chaitenpur, etc. The bands are much small in Dasapalla area and they are of no importance.

Stilbite—The deposit occurs north-west of Barapali. The Zeolite generally occurs either as transparent, highly cleavable plate or white lumps with radiating fibres. Veins thinner than three inches frequently contain flesh-coloured or pink Zeolite.

Iron—Iron is found over a wide area in the ex-State area of Ranpur in association with laterite. These are suitable for local smiths for iron manufacture, but useless for any large-scale iron industry.

Clay—White clay is found south-east of Chaktasahi in Ranpur area of the district. The mineral is used as writing chalk in the schools of the State but it is useless commercially.

Red clay is also found south-west of Khandpara and about half a mile south of Madhuban. There are rich deposits of red clay which are generally used for painting and dyeing. These clays are of no commercial value except for the limited local demand.

Gold—Gold is found in Sunamubi Nallah of Khandpara area. Minute traces of gold have been found in the sands of this Nallah and are collected on the opposite side of Khandpara town by local people through panning of the sand. No auriferous quartz veins have been located. The deposit is hardly of any commercial importance.

Khondalite and Laterite—These materials are found throughout the plain country of ex-State area of Ranpur and are used as building materials. The current cost of working 100 slabs of size $2' \times 1\frac{1}{2}' \times \frac{1}{2}'$ is eight rupees. This material is not expected to find a market outside the State.

Felspars and Quartz—They are found about a mile and a half to the south of the village Kaska. The individual veins are small and rather decomposed. The rock is composed mainly of white potash felspar and white or grey quartz. Several hundred tons of the material suitable for ceramic industry may be available. But the high cost of transport at Rs. 10 per ton either by Mahanadi river or by road to Khurda hinders the commercial exploitation. The total amount is however very insignificant.

Ornamental stone—Khondalites which are used for architectural purposes are found in the hills south of Madra Inspection Bungalow. Though the deposits are inexhaustible, they are not worked regularly. There can be good demand for Khondalites for architectural purposes.

Mineral spring—It is found in the midst of paddy fields north of Tarabala in Khandpara. The temperature of the water is in the neighbourhood of 140°F and a strong smell of sulphuretted hydrogen pervades the locality.

Sand—The ground surrounding the hot spring noted above is constituted of white sandy soil which contains a white efflorescent salt having an acrid taste. The percentage of salt however is very small. The sand contains a little of muddy element which together with the salt can easily be removed by washing. The washed sand, though containing some ferromagnesian minerals mainly Biotite, is fairly pure.

KORAPUT DISTRICT

Manganese—Important deposits of Manganese in the district are found at the following places :—

Kutingi, Devajhola, Mandhara, Kutili, Santemra in Rayagada and Laxmipur subdivisions. Out of these the deposits at Devajhola and Kuttingi are promising. Deposits in the Laxmipur subdivision show a reserve of about 5 million tons (Upto a depth of 50). The quality is mostly that of second and third grade manganese ore although in Devajholla a good quantity of first grade ore sometimes reaching the mark of chemical grade ore is found. The ore bodies are present as lenses or individual beds in Khondalites. The minerals are usually Pyrolusite and Psilomelane.

Other minor occurrences of Manganese in the district are seen at Khalkona, Pukli, Dumriputtu, Koraput.

Graphite—It is found half a mile of south-west of the village Majikelan. Country rock is Khondalite. It occurs in kaolinised and decomposed Granite and also Pegmatites intruding them or as veins, and pockets of different behaviours with overburden of loose soil. Quality is not good but Railway station is near and till recently it was under exploitation.

Graphite is also found at Chuchukona. It occurs as acicular and massive bands in the foliation of Khondalites. The quality is good

Iron—Iron is found in many places of Koraput such as Hirapur hill, Santemara, Garbaria hill, Madhugulmi, Gunnayyapada, Siraguda and Doraguda. At Hirapur hill it occurs at 300'—500' above the general level of the ground. The grade is medium to low. It is present in coarse and fine grained Quartzites, and the float contains pure and sandy Haematite. Better grade Haematite is mainly seen at Beluapani in Hirapur. Limonite is present at Punjipakna and Ambadevi. Reserve is nearly 10,000,000 tons. Working projects are remote. Railhead and road from Umerkot to the Orebody is not present. Iron found in other places except Hirapur hill is not good in grade and extent.

Gold—Placer gold is found in Govindapalli, Kyangu and Kollaru. The placer gold is collected by panning of sand and gravel of the Kolab river and its tributaries which show Hornblende Gneiss, Quartzites, Sericite schists traversed by Gneissic granite with number of quartz veins and pegmatite veins which yield gold. No opinion can be given on the prospect before undertaking further investigation. Presently the prospects are remote.

Red ochre—The deposit occurs at Kandagaun below a laterite capping of nearly 60'. It is not good for export but is good for local consumption. Fairly large deposits are present. Old quarries should be further opened to explore the band of ochre, at greater depths.

Yellow Ochre—It is found in Boipariguda. The deposit occurs below 3'-4' of alluvium formed by decomposition of Hornblende Gneiss. This Clay shows pockets of yellow clay resembling Ochre. It is not worth working.

Potters clay Kaolin and Fireclay—Pottery clay deposits are found in the immediate vicinity of Jeypore, Demsaguda, Badasal, in huge quantity and are being used in the Jeypore factory. They are formed by weathering of nearby Charnockites. High reserves are expected and can be used for roofing tiles, drain pipes, and cooking articles, etc. Kaolin is found in Bairaniguda, Aduguda, Musfuguda, but is sandy and stained due to the presence of iron, formed by hydro-thermal action of Gneissic rocks. Fireclay is present at Deodar, at the top of the reddish shale and quartzite. Its Plasticity is good, shrinkage is 39 per cent and it stands 1400°c of temperature. Further investigation may reveal more reserves.

Limestone—Extensive deposits of flux grade Limestone are found in the Sirivada-Gupteswar area under Ramgiri P. S. and Kundajodi and Dumajodi areas under the Kotpad Taluk. The total reserve in these areas will be of the order of 40 million tons. These limestones can also be utilised for production of lime. Near the village Nandivada under Malkangiri Taluk huge deposits of Cement-grade limestone are found with a possible reserve of 15 million tons. These deposits are associated with Shales of the Cuddapah series of rocks. Recently a huge deposit of Cement-grade limestone of excellent quality was found on the Salur border under the Pottangi Taluk in an area of nearly 12 sq. miles. The Limestone is mostly Calcitic, Siliceous, Saccharoidal and sometimes Apatitic. The reserves in this area will be of the order of 40 million tons for an uniform depth of 30'.

Apart from these, many minor occurrences of Limestone and Lime-kankar are found throughout the district.

Mica—It is found near Baluguda, Borigumma and Limka near Koraput. Systematic prospecting may yield good results. Quality is good. Reserves are not commercial. Ruby and colourless varieties of Muscovite Mica are found in pegmatite vein cutting basic Hypersthene Hornblende rocks.

CUTTACK DISTRICT

Calcutufa—The deposit is found one mile north-east of Balikiar village ($20^{\circ} 34' : 85^{\circ} 1'$) in Narsinghpur. The estimated ore reserves are 4,500 tons. It is a small deposit and the transport difficulty is considerable. Prospects do not appear to be bright. Another deposit is found one mile north of Barasingha village. The deposit is small and being out of the way has little economic value.

Mica—Mica is found near about half a mile north-east of Matalpūr ($20^{\circ} 30' : 85^{\circ} 15'$). The size is barely two square inches, but it is badly stained and sheared.

About two miles north-west of Barabhijia in Tigiria some mica deposits are found. Books of mica which are small in size are associated with Quartz and Felspar. Along with ruby mica, black mica with a small amount of Beryl also occurs. Large books of mica are highly sheared.

Some mica deposits are also found in Athgarh area on the southern slope of Hatimunda Parbata, Madhupali, Parsurampur and Brāhmapur. They are small in size and appear to have little economic value. Some mica are found in Kadalibadi, Krushnapur and these also give the same result as above.

Ilmenite and Garnet Sands—They are found in the bed of Padanala south of Manpur village. The deposit is of no economic value.

Kankar—It is found only in Barkali and Kajipada areas ($20^{\circ} 27' : 18^{\circ} 7'$) ($20^{\circ} 25' : 85^{\circ} 20'$) of the district. This Kankar is collected after the rains are over and is sent to Cuttack for lime burning. It is not of economic value. Since the reserve is small,

Graphite—Near Barabhajia impure Graphite is found.

Clay—It is found in Sampada village. The clay is not of superior quality and the overburden is so thick that it would not be possible to work the clay commercially. It is also found in Rautapur where the same conditions are found.

Manganese—At about two furlongs west of Manitiri a deposit is found. Quality and quantity is poor and it is of no economical value.

Iron ore (Haematite)—Haematite occurs in Tomka range about 20 miles from Jajpur-Keonjhar Road Railway Station. Its reserves are estimated at 27,000,000 tons of ores. Various sizes and all grades of ore varying from compact and high grade types to porous low grade nature, are found here.

Haematite also occurs (Reserve 27,000,000 tons) at Kansa about 28 miles from Jajpur-Keonjhar Road Railway Station. The ore is Haematite associated with shale. It is semicompact to porous and is reported to be fairly high grade (Fe. 55·60 per cent). The enrichment of iron was probably brought about through leaching of alumina and silica from the ferruginous Shale and Tuff.

In Tungeisuni about 28 miles from Jajpur-Keonjhar Road Railway Station, deposits of Haematite containing 2 to 3 lakh tons of ore are found. The ore which is of float type is similar to the ore near Tomka and consists of boulders of Haematite, sometimes enclosed in a late ite matrix. The deposit is small. Haematite is also found in the hill north of Tungeisuni.

At Badsil about 11 miles west of Jajpur-Keonjhar Road Railway Station Haematite is found and the reserve is about 2·3 lakh tons. Boulders of Haematite are found in the foot of the hill and the adjacent area. Banded Haematite Quarzite is seen at higher levels of the hill. Iron ore is also found in Sukinda ($20^{\circ} 58' : 85^{\circ} 85'$) about 18 miles by road from Jajpur-Keonjhar Road. As detailed work has not yet been done an idea of reserve can not be made. The percentage of iron is 66·6 per cent.

Magnetite—It is found at Bichakanr about 22 miles from Jajpur-Keonjhar Road Railway Station. Further work in this area is bound to increase the estimated reserves.

Pottersclay—It is noticed at Kendupali area ($20^{\circ} 19' : 85^{\circ} 22'$) in the district. This material may be useful in the manufacture of earthen utensils, pipes, tiles, etc.

Coal—It is found in Gondwana basin of Cuttack and Puri near Siddeshwar hill in the Cuttack district. It is said that a 6 inches thick seam of coal lies under the bank of Mahanadi here. Drilling may reveal further details.

Chromite—In Sukinda, Chromite deposits are found which extend from Saruabil to Maruabil in the Dhenkanal border. The reserve appears to be promising and the grade is also high.

BOLANGIR DISTRICT

Graphite—The deposits are found in many places of the district such as Barghati in Sadar subdivision (about 9 miles south of Patnagarh), Lohakhan, north of Dunda about six miles from Titlagarh, Sagadhat, Muribahal and Dharmagarh. Detailed investigation to reveal the nature of the deposit is essential. It is found also in Matupalli, Chinmikhali, Dhamakhaman, Belgad and Maujkelan. All these have been leased out. It is mostly a mixed variety.

Kaolin—It is found at Basuadanagrui and the reserve here is about 1,000 tons up to a depth of 30,. It is of no economic importance.

Manganese—Manganese is now being worked in several places in Patnagarh subdivision. It is exported to Vizag port through Titlagarh, Kantabanji and other Railway Stations. It is also found in Kotsamatia. Average sample of the material analysed is as follows :—

Insoluble residue	..	..	..	77.34 per cent
Fe.	..	..	..	4.15 per cent
Mn.	..	..	..	10.75 per cent

The process of manganese enrichment here has not been sufficient to produce any workable quantity of manganese ore of commercial importance.

Garnet—It is found in Birmaharajapur subdivision. Garnet occurs in abundance in association with schist rock of this locality. It is of medium size and tough. The material is very well suited for the manufacture of abrasives. It is also found in Binka area in Singhasan pahar.

Steatite—It is found in Jibandadar, about 40 miles from Sambalpur Rly. station and the ore reserve is over 100,000 tons. Detailed investigation would reveal the extent of the deposit. It is used for making pots.

Kaolin—In the western and south-western hill tracks of sadar subdivision and north-west of Mendah these deposits occur. They are not of any economic importance.

Galena—Deposits of galena are found in Bolangir district in the areas mentioned below:—Dunguripali, Badipara, Kuargon, Brahmani, Kumbhari and Nuapara. Details about the quantity and quality for commercial exploitation of the deposits are not known as yet.

SAMBALPUR DISTRICT

Coal—It is found in the Gondwana formation of Rampur in this district and the estimated reserves are of the order of about 140,000,000 tons. Mining is in operation at Rampur, Ib River and Orient Collieries. Deposits are also found near Hirakud Reservoir.

Fireclay—In the coal measures mentioned above, fireclay also occurs capping the deposits. They are being mined at Belpahar and are located at several other places.

Lead—Lead ore is known to occur in Jharasuguda tahasil. Detailed work is needed for ascertaining the reserves and quality.

Limestone—It is found at places in the Mahanadi valley in Sambalpur district. The reservoir is to submerge permanently the high magnesian Limestones and a horizon of argillaceous Limestones out-cropping near Padampur in the Mahanadi river bed. It would also submerge a part of the Dungri limestone. The other bands of Limestone are subject to flooding during a part of the year which include those at Santmal and Badamal, etc.

Diamond—It is found in the “Vindhyans” of the neighbouring Barapahar hills.

Asbestos—Asbestos is found near Gochara and the deposit is promising.

Clay—Clay is found at Binjipali. The reserves are about 18,000 tons. This Lithomargic clay can be used for refractory purposes.

Bauxite—Deposits of Bauxite are known to occur in the Dandimal and Saipura areas. Detailed investigation is needed to ascertain further details.

Graphite—Graphite deposits are found in Rairakhol and Padmapur areas. They are being mined at present.

Manganese—It is found near Rairakhol in the district. Details regarding the quality and quantity are not known.

DHENKANAL DISTRICT

Manganese—The deposits occur about two furlongs west of Mantiri. The ore consists mainly of Psilomalane and occurs in laterites. A sample on analysis yielded 24.83 per cent of manganese. Transport facilities are good. This deposit is poor in quality and quantity for commercial purposes.

Manganese ore deposits are also found in Sangamalia. The ore occurs in Khondalite series and is suitable for making ferro-manganese, if they are found high in manganese and low in phosphorous. Detailed investigation is needed here for further data.

Manganese ore is also found in (1) Santipur, (2) Nala S. E. of Δ 1551, (hillock), (3) Hatasimali, (4) Talaipathar Rems, (5) Akharkata, (6) Tileswar. Deposits (1) and (4) are not of economic importance and detailed investigation is needed for the rest.

Coal—Coal is found mostly in Talcher. The best coal contains about 8 per cent ash and 13 per cent moisture. The ratio of volatiles to fixed carbon is also high. It is not ideal for despatch to distant destinations. Local market is desirable. It is being worked out at present.

Clay—Clay is found at Sampoda. The over burden is of laterite. Colour is yellowish, although at times white clay is seen. It is gritty and non-plastic. The clay is not of superior quality and the over-burden is so thick that it would not be possible to work the clay commercially.

Fireclay—Fireclay is found in Talcher in the coal measures. From the boring it appears that a fireclay bed 7 ft. thick and about 75 ft. below ground is present which is suitable for manufacture of fire-bricks.

Fireclay deposits are also found 3 miles from Talcher near Kankil Joragudai. Detailed information is not available on these deposits.

Glass Sands—These deposits are found in Talcher with the Gondwana rocks of the coal field. Detailed investigation of the glasses and is needed in this area. Transport facilities are good.

Glasses and deposits are also found in Tangiria Parbat of Bajrakot.

Mica—It is found in Athgarh State (Latitudes $20^{\circ} 26'$ — $20^{\circ} 40' 30''$. Longitudes $85^{\circ} 33'$ — $85^{\circ} 52'$) and Nuabandha. The reserve is scanty. The mica books are 4 to 6 sq. inches in size but they are much cracked, sheared and stained. The deposit is therefore of no economic importance.

It is found also in Talcher area and occurs in pegmatites in the northern portion. The pegmatite bearing area requires proper prospecting.

Deposits are also found in many other places of the district such as Barabhajia and occur in pegmatite veins. Though longer books of mica are found in places they are highly sheared and are of no commercial use. In Rampur (1 mile N. W. of Rampur), large books of Mica are seen in the pegmatite veins. Detailed investigation is needed, here Transport and labour facilities are good.

Besides mica is found in Jarak, Gopalpur, Sanakhomeri, Kharad. The quality of mica in these areas is poor.

Zircon—It is found in Rampur but the deposit is scanty. The quantity is too small and quality is poor.

Kankar—Kankar is found in many places of this district, such as Khirasahi, East of Raghunathpur, Charagaria, Muktaposi, Gundachamali, Dimiria.

Gold—It is found in Batalinadi near Katni, Ramiala river near Guandachamali. A small amount of placer gold is obtained from the panning of stream-sands. Detailed investigation is needed in this area.

It is also found in Tickara and Anuli rivers. Investigation is needed in these areas also.

Iron ore—Deposits of iron ore are found in Nuapara, Tebudu and Raijharan areas. Smelting of Iron was noted in the aforesaid villages. The ore is not of economic importance. Other deposits are found at Sankhamur, Nandijhar and Sanbughdari. The combined reserve of these places will be of the order of 1.4 million tons.

MAYURBHANJ DISTRICT

Vanadium Bearing Titaniferous Magnetite—It is found near Kumardhobi and a thorough estimation of reserve is needed. Its probable reserves are one million tons. It is also found near Dublabera.

Deposit are also found near Kaduani containing a reserve of about 20 million tons, Betajharan containing a reserve of 86,000 tons and Amdebera where the deposit is scanty.

Iron Ore—Haematitic iron ore is found in Gorumahisani, Sulaipat, Badamapahar and Hathisikly. These areas can supply high grade ores for about 50 to 60 years or more. All these areas are leased out. The ores from these places are utilised by the Tata Iron and Steel Company at Jamshedpur.

It is also found near Chirtabania containing Vanadium.

Lead ore—A deposit of lead ore was examined almost on the fire line east of Kochilaghati. Galena occurs in Quartz veins cutting the mica and Chlorite schist, Phyllites and Epidiorites. They are seen as big and small veins or disseminations in Quartz veins.

Lead ore is also found in Pithabata area.

Kyanite and Dumortierite—These deposits are found 3 furlongs east of Panijia and to the east of it. The Alumina (Al_2O_3) content is 56-58 per cent and it is being transported to Calcutta via Rupsa. The area has since been leased out for mining.

It is also found in Kusumbandh where reserve is scanty.

Asbestos—Asbestos deposits are found near Joshipur and Mayurbhanj border north of Bahalda. Some portion of this area has already been leased out. The material is good for refractory purposes.

Glass sand—Glass sand deposits are found in the hillocks east of Souri and Quartzite hills west of Baldhia Bandha. Reserve is considerable.

White clay—It is found near Kurma, Joshipur, Chanchabani and Dumuria. Reserves are considerable. Sand left in washing vats could be used for glass on a second wash. Deposit is good. The reserve at Joshipur are 100,000 tons of Grade I and 40,000 tons of Grade II in Chanchbani 75,000 tons of Grade I and 37,500 tons of Grade II and in Kurma 50,000 tons of Grade I and 20,000 tons of Grade II respectively.

Clay was also found near Sankerko school, but the deposit is scanty.

Kaolin—Kaolin is found in Dumuria where an estimated reserve of 11,797,50 tons out of which 89,313 tons of refined clay is present. Working facilities are good and it is under lease.

Gold—Gold is found near Sapaghara but the reserves are scanty.

Kankar—The deposit is found near Nanda-Bisai Road, Kusumbandh, Balidiha, Kuchai and its reserve is of moderate amount. It is also found in small quantities near Kaptipada area.

Laterite—Laterites are found at Tangiriapahar and Dalapahar.

BALASORE DISTRICT

Magnetite—The deposit is found near Gadasahi in Nilgiri and about 200,000 tons of ore occur in this area.

Asbestos—This is also found in this district but the deposits do not appear to be large enough to be of any commercial value.

Road metal and Ballast—These are found throughout the district. The supply is inexhaustible. It is the only supplier of suitable railway ballast and road metal in this part of the country.

Kankar—Kankar deposit are found in the district. The supply is practically inexhaustible.

Besides these Sand Clay Mica and Plastic Clay are found in many parts of the district. The occurrences are not sufficient for commercial purposes.

SUNDERGARH DISTRICT

In Bonai subdivision economically good deposits of iron and manganese ore are known.

Iron ore—Rich deposit of iron ore have been noted at various places in the Koira plateau, but the most outstanding are those on the western margin of the table-land. The ore is distributed along the range consisting of Majumachan Pahar, Karalpani Pahar, Erna Pahar, Samalaibar Pahar, Bichakani Pahar and Bhandrahar Pahar.

Following types of ore are met with generally:—

- (1) Hematite debris cemented with laterite
- (2) Lateritic iron ore
- (3) Powdery Hematite
- (4) Laminated Hematite
- (5) Massive steel grey Hematite

The estimates of reserves are of the order of 400,000,000 tons.

Manganese ore—Large deposits of lateritoid Manganese deposits consisting chiefly of Pyrolusite and Psilomelane are found in various localities in eastern table land of Bonai and other parts of Sundergarh.

The deposits in the following localities are being worked out by various parties :—

(1) Orahuri ($21^{\circ}54'21''-85^{\circ}14'56''$), (2) Narayanpassi ($21^{\circ}55'53''-85^{\circ}14'53''$), (3) Kasuala Pits ($21^{\circ}55'53''-85^{\circ}14'1''$), (4) Ballihulli ($21^{\circ}52'17''-85^{\circ}11'56''$), (5) Dengura ($21^{\circ}52'18''$), (6) Sarigarh ($21^{\circ}51'35''-85^{\circ}12'26''$) ($21^{\circ}51'35''85''$), (7) Lohnakani ($21^{\circ}49'46''-85^{\circ}9'25''$), (8) Luc ($21^{\circ}48'-85^{\circ}10'11''$), (9) Bhutura ($21^{\circ}47'32''-85^{\circ}9'46''$) and Jullatnagar ($21^{\circ}48'14''-85^{\circ}8'46''$).

Mostly 2nd and 3rd grade ore occurs in these areas with 1st grade ore and rarely with Chemical grade ore.

Gold—Alluvial gold has been recorded from Brahmani river and other tributaries from times immemorial.

Asbestos—Asbestos of the long fibred Tremolite variety occurs as irregular veins in the Ultra basic rocks near Rangea village. Careful prospecting would probably bring to light a good number of veins in this area.

Talc and Soapstone—Numerous bands of Talc and talcose rock are found associated with sheared Chlorite-Talc Schists and ultra basic rocks in the Granite country around Sisurdih and Bande-Bhuin High grade Talc is developed where the formations have been further affected by subsidiary cross and oblique shears. The mineral occurs in the following localities :—

(1) W. S. W. and S. W. of Bhaludungri

(2) Several places between Sisurdih and Bandebhuin

(3) Near Jonadihi

(4) At the western foot of the 1,223" hill near Khajuribahal
The deposits near Bhaludungri are of superior quality.

Limestones—Exposures of Limestones and Dolomites occur at a number of places in the plain country 6 to 10 miles east of Birmitrapur, occurring over an area of 8 miles by 5 miles, between Koverama and Deo river included within the northern Epidiorite ridge and the high hills of phyllite to the north.

Almost the whole width of the Limestone in the Bajnathpur hill which is being quarried by Tatas is of uniform good variety, flux grade lime. Reserves are of the order of about 10 million tons (consists of Hathibari Gutitangar and Purnapani block).

The deposit at Birmitrapur is the largest in Gangpur producing good quality fluxgrade Limestone and furnace grade Dolomite. The reserves of Limestone are 274,600,000 tons and that of Dolomite is about 252,000,000 tons.

Limestone deposits are found at Dublabara. It is estimated to contain only about 160,000 tons and the quality is not also very good.

Vast deposits of cement grade Limestone and also Dolomites are found in Lanjiberna, Katang, Khatmarbahal, Ludhikutoli region near Rajgangpur. The reserves in the area is estimated to be 1,204,875 tons.

At Purkapli and Kadupara Limstone deposits of a poorer grade are found.

A Dolomite belt runs between Jaraikela Panposh and Amghat areas. The reserves are of the order of about 5,89,500 tons. This area is not of much importance as the ore is of poor quality and quantity.

GANJAM DISTRICT

Iron—Between the villages Rangamunda and Palupur, pockets of low grade Limonite mixed with lateritised Khondalite are present. It is used for local smelting of iron.

China clay—In the nala south-east of the village Bramhapur there is a small exposure of China clay.

Mica—Near village Ramagad of Ramgiri Muttah of R. Udaigiri taluk on the northern flank of a hill, flakes of Muscovite mica are found. Detailed information is not available.

Mica is found in Pegmatites near Dwargaon, Mohan and Odaba. It is Ruby mica but the quantity is not encouraging.

Oalc Tufa—It has been found near Nuagad in the Naugad muttah in the R. Udaigiri taluk. The quality of the material is suitable for lime burning.

Kankar—Large deposits of Kankar occur in many places of Ganjam district. Some of the localities where it is found are:— (1) Khurland R. F. near Parlakimedi, (2) Karigudakhondikuti-Gohribadi of Ghumsur taluk, (3) Gurabadi, Sadiapalli, (4) Rombha and Dodara bunda of Ghumsur Taluk, (5) Kalasingi near Garabundh in Parlakimedi Taluk, (6) Tuliura in Ghumsur Taluk, (7) V a r n a s i in Parlakimedi Taluk, (8) Luhagundi muttah, Govindapur muttah and Venkatarampur Chatrapur Taluk, (9) Khandadeba and Adaba muttas, (10) Mohana muttah, (11) Ekasingi and Haradanga of Berhampur Taluk.

Some of the deposits are suitable for burning of lime locally. The deposits in localities (1) to (4) are found to be extensive and a more detailed survey is necessary to obtain correct estimate of the reserves.

KEONJHAR DISTRICT

Manganese—Extensive manganese deposits occur in Keonjhar district to the west of Baitarani river in Champua subdivision which are being successfully worked out at present by various parties. Some of the important localities are as follows :—

- (1) Guruda ($19^{\circ} 53' : 85^{\circ} 23'$)
- (2) Palsa ($19^{\circ} 55' : 85^{\circ} 25'$)
- (3) Burda ($19^{\circ} 53' : 85^{\circ} 24'$)
- (4) Siljora I ($19^{\circ} 54' : 85^{\circ} 23'$)
- (5) Siljora II ($19^{\circ} 53' : 85^{\circ} 22' 30''$)
- (6) Kalimati ($19^{\circ} 52' : 85^{\circ} 25'$)
- (7) Mahaparbat ($19^{\circ} 52' : 85^{\circ} 26'$) etc.
- (8) Dhubna
- (9) Jampani

Out of these deposits those of 1, 2, 3, and 4 are worked out by Messrs. Serajuddin & Co.; 5, by Messrs. Rungta & Co.; 6 by Messrs. Serajuddin and M. L. Rungta & Co.; 7 by S. Lal & Co.

The deposits are all lateritoid and pocket deposits. They consist of all grades of manganese ore. A good amount of chemical grade ore is also recovered.

In Dhubna and Jampani there are secondary surface replacement deposits often found in rocks of Dharwarian age. They are known for their high iron, low manganese, low silica and very low phosphorous contents. They are mainly second and third grade ores.

The ores are seen as lenticular bodies or pockets

Iron—Some of the important iron ore deposits are found in the following areas:—

- (1) Joda East
- (2) Kiriburu
- (3) Gandhamardan Parbat
- (4) Thakurani
- (5) Mahaparbat
- (6) Kalaparbat
- (7) Langalota
- (8) Daiteri

The ore in these areas is chiefly Hematite which is present in massive, laminated, micaceous, powdery and lateritic or brecciated forms. The iron content is usually about 64 per cent. These ores have usually high iron, low sulphur and titanium, variable phosphorous contents.

According to Dr. M. S. Krishnan the total reserves of all these areas will be of the order of about 1,483,250,000 tons.

Kaolin—Kaolin is known to occur in the following places :—

- (1) About 1 mile N of Keonjhar
- (2) About 2 miles NNE of Jhumpra
- (3) About half a mile E of Tarini

The area (1) is prospective in view of both quality and quantity of the deposit. The prospects for the other two areas are not bright on account of transport difficulties and the poor quality of the material.

Talc Schist—About half way between the villages Amjora ($21^{\circ} 38' : 85^{\circ} 33'$) and Baliadih fairly extensive occurrences of Talc Schist have been recorded on either side of Machkandana. The available quantity is estimated at 100,000 tons. It contains about 25 per cent quartz which can however be eliminated. Quality of the material is good.

Chromite—Chromite occurs in the Anandapur subdivision, near village Nuasahi ($21^{\circ} 17' : 86^{\circ} 20'$) at a distance of about 20 miles to the east of the subdivisional town.

The deposits are presently being worked out by M/S. Serajuddin and Co. and M/S. M. A. Tulloch.

Magnetite—In the Baula State Forest area, several thick bands of Magnetite have been found to occur in the midst of the ultrabasic rocks of the area. These are similar in composition to the Vanadium bearing titaniferous Magnetite of Mayurbhanj district. Noteworthy deposits are the occurrences N. E. of Nuasahi and those at the south-eastern flank of the Phuljorihuri ($21^{\circ} 18' : 80^{\circ} 17'$) all within one to three miles from Nuasahi.

The available tonnage will be of the order of 40,000 tons. Due to difficulty of approach and poorer quality than that of Mayurbhanj, prospects for economical exploitation are not bright.

Calc Tufa—Two occurrences of Calc Tufa have been noted near the southern border of the Keonjhar State and in the southern fringe of the Rebna State Forest. The northern occurrence is situated in the north-eastern foot hills of the ridge about one mile S. W. of Panoram. The southern occurrence is situated at the northern flank of the ridge south of a deserted hamlet Ponga. ($21^{\circ} 6' ; 85^{\circ} 53'$)

KALAHANDI DISTRICT

Manganese—A huge and promising Manganese belt extends from Dudsi, Kinchikhal to Lilliguma via Podkhona and Nishikhal. The deposit then runs in the N. W. direction towards Passangmali and is seen up to Tejimali. Traces of manganese deposits are seen on the Narla and Madanpur side.

Bauxite—Bauxite is found in the plateau of Khandmal Mali, Tejimali, Kutrumali; Bafalimali and Chandgiri parbat. Thorough investigations will be necessary for ascertaining the details. It is found in Khariar high lands of the Nawapara subdivision as pockets in laterites. Details can be ascertained by further detailed prospecting. For the present, the deposits appear to be prospective.

Graphite—Graphite is found in the Kasrupara area and in the area north of the railway line.

Kyanite—There are indications for the presence of Kyanite close to the Bauxite deposits.

Mica—Mica is found in Jayapatna and Ladugaon side.

Limestone—Lime Kankar is noticed in many parts of the district. Some of the areas are (1) The area between Mandel and Rekapur, (2) those around Asurgarh, (3) the area around Bankel village, (4) Near Dumal and Atanguda, (5) in Atharnala range near Gotumunda, (6) in Chura parbat near Kegaon. Of all these, the deposits at Atharnala are said to be prospective.

Iron—Some minor occurrences have been noted to the west of Khariar Highlands and to the S. E. of Nawapara.

BAUDH-PHULBANI DISTRICT

Calc Tufa—Deposits of lime carbonate in the form of lime stone and calciphyre occur in widely separated areas in the State.

Impure Limestone and Calciphyre occur in the Tel river just south of Malikud and over a large area near Dodirmal. Portions of the calciphyre near Dodirmal appear to be sufficiently rich in the calcareous element to be suitable for lime burning and cement manufacture. An average purer type collected from the area shows Cao 41.65 per cent and Mgo 0.36 per cent.

Chinaclay—Occurrences of Chinaclay are found near Deoghar and Phuljhari.

A small pocket of gritty clay which is stained with greyish colour is found to the east of Phuljhari which is disappointing.

Feldspar und Quartz—Veins of Pegmatite and Milky Quartz occur at several places, but those exposed near Talbahal are of importance for ceramic industry.

Garnet—Rich garnet patches are commonly seen in the Khendalite and gneisses in the State. They are usually uneconomicals.

Ilmenite—Fragments of Ilmenite and small patches of Ilmenite sand are found on the rocky grounds and nallah courses on the eastern slope of Dumargarh hill. The mineral occurs as small specks and dissemination in the Quartzose rocks forming portions of the hill mass.

Magnetite—Small deposits of Magnetite occur in association with Quartz veins traversing the country near Saliapadar and Someljori

Manganese—Indications of Manganese are seen on the northern slope of Sunakania hill and in the plain country three-fourths of a mile N. W. of Dodirmal.

Mica—Isolated exposures of Mica are seen near Kurumunda, Talbahal, Pankual, Damunda etc. Of all these, only Kurumunda deposits are of importance.

Non-plastic Clay—In the high bank of Tel river about three-fourths of a mile N. W. of Nabakhandir a thin seam of porous clay which has remarkable cleansing properties is found.

Ornamental Stone—Beautifully coloured fault clay occurs near the top of Khondalite hill (2,700') N. W. of Bankpaju. The clay is soft and can be worked into beads etc. The colour varies from white to various shades of yellow and red. The deposit is small.

Rock Crystal—Small transparent Quartz crystals are strewn over a considerable area amidst the rocky wastes in the scrubby jungle country about half a mile S. W. of Tarava.

All the crystals found are defective and not suitable for use in the industry.

Stilbite—Veins of pink Stilbite occurring as bunches of platy cleavable crystals are discovered in several localities in the district, the most important one being found on either side of the main road leading from Takulunda to Harbhanga where it crosses the nala flowing between Tukulunda and Laxmanpur. Thin veins of the mineral are also found to occur near Takudu near Dodirmal and north of Deogarh.