

Geology and Mineral Resources of Orissa

Orissa, situated on the eastern seaboard of India is one of the gifted parts of the world, where a gamut of mineral resources exist in bounty. The state is endowed with large reserves of bauxite, chinaclay, chromite, coal, dolomite, fireclay, graphite, gemstones, iron ore, limestone, manganese ore, mineral sand, nickel ore, pyrophyllite and quartz. Recent discovery of diamond in the Dharambandha area of Nuapada district by the State Directorate of Geology has added a coloured feather in the cap of the state. Other minerals of the state include copper ore, lead ore, titanium bearing vanadiferous magnetite, talc/ soap stone and high magnesia igneous rocks. Recent boom of the mineral industry has turned the state into a hotspot, with entrepreneurs from all over the world crowding for their share of fortune.

The rich mineral wealth of the state is attributed to its favourable geological setup. Situated on the eastern fringe of the peninsular India, Orissa has about 72.5% of the area occupied by Precambrian metamorphic rocks (of Archaean and Proterozoic age) which host the majority of the minerals. The Gondwanas hosting the coal resources occur over about 8% of the land mass. The Tertiary and Quaternary formations, occupying rest of the area, provide avenues for aluminous/ nickeliferous laterite and heavy minerals (in beach sand).

The Archaean rocks in northern Orissa include the Supracrustal belts of metasedimentary rocks including Iron Ore Super Group having deposits of iron, manganese, gold and basemetals. These are also represented by the gneisses, granite, migmatite (Singhbhum, Bonai and Mayurbhanj Plutons) and mafic/ ultramafic intrusives. These intrusives are associated with the chromite, titaniferous vanadiferous magnetite and PGM. The Bastar cratonic complex of Archaean age in the Western Orissa includes gneisses, granite, migmatite and Strontium-Tantalum-Niobium bearing pegmatites.

Proterozoic rocks in the western Orissa exhibit platformal sedimentary formations and associated limestone deposits. In north-western Orissa they contain metasediments of low to medium metamorphic grade classified as the Gangpur Group, which host manganese, limestone and Lead-Zinc deposits. In central and southern Orissa, the Proterozoics are represented by the Easternghats granulite belt comprising

of khondalite, charnockite, migmatite, anorthosite and alkaline rocks accounting for the mineralisation of bauxite, manganese, graphite and gemstones.

The Mesozoic rocks of Gondwana Super Group host the major coal resources of the state.

Formations of Cenozoic age occupy the eastern coastal plains in form of alluvial sediments, ash beds and low level laterite, providing avenues for occurrence of beach sand minerals and building materials. The deltaic fans extending into offshore regions play hosts for oil and gas.

Orissa has a lion's share of the Country's mineral reserves. The chromite, nickel, bauxite, iron ore and coal resources of the state respectively stand at a staggering 83, 92, 55, 38 and 26 percent of India's total reserves. Some of these minerals also account for a visible spot in the world's mineral map. The state's mining revenue during 2009-10 amounted to Rs.2020.71 crore.

Several mineral based industries have already come up in the state. The major ones include Rourkela Steel Plant, Alumina refinery and smelter of Nalco at Damanjodi and Anugul, Charge chrome plants at Baminipal, Bhadrak, Choudwar and Theruvali by OMC, FACOR, ICCL and IMFA respectively, Mineral sand separation unit at Chhatrapur by IRE. Many cement and sponge iron plants have been set up. Coal based thermal power plants have been set up at Talcher, Kanihan and Banaharpali. Captive thermal power plants have also been set up by NALCO, RSP, ICCL, INDAL etc. and many more are in the pipeline.

The dynamic State Government of Orissa has left no stone unturned in cashing in on the attention it has been getting from different business houses in recent times. The visionary Chief Minister with his view on the future development of the state has signed 79 MoUs with various companies to setup mineral based industries with a total proposed investment of Rs 3,65,327.20 crores, which is supposed to provide value addition to the mineral wealth thereby augmenting employment and enhancing the economic standard of the public. The huge mineral resources of the state, 480 km long coastal stretch, the liberalised economic policy of Govt. of India, Industrial Policy 2007 and availability of infrastructural support makes the state an investor's paradise.

MINERAL RESOURCES OF ORISSA						
MINERAL	DISTRIBUTION	LOCATION	GEOLOGY	RESERVE	USES	
BAUXITE	Koraput District	Panchpatmali, Pottangi, Maliparbat, Ballada, Kodingamali, Hatimali, Kakrimali, Chintamgundi, Kornapadikonda, Medamgundi etc.	Associated with Eastern Ghat Super Group of Rocks i.e. Khondalites and Charnockites; Occur as blankets capping the parent rocks on plateau tops.	1810 Million tonnes with >40% Al ₂ O ₃ and <0.5% SiO ₂	Aluminium industry Refractory industry Chemical industry Petroleum industry	
	Raygada District	Baphilimali, Sasubohumali, Pasangmali, Majhigaonmali, Sijimali, Tikrimali, Budharajamali, Taljhir, Dabuguda, Nangalghatmali etc.				
	Malkangiri District	Korkanda, Siktapalli and Korpalli				
	Kalahandi District	Karlapat-Pollingpadar, Kutrumali-Tangridongar, Lanjigarh Niyamgiri, Keluamali, Krishunmali etc				
	Kandhamal District	Anamini Parbat, RukuniCuttack, Demoli, Ushabali etc.				
	Kendujhar District	Dholkata pahar				Occur over metatholeitic basalt.
	Sundargada District	Tantra, Kodalia , Jaldihi, Kusumdihi etc.				Associated with manganiferous shales, shales , phyllites of Nuamundi Group
	IRON ORE	Kendujhar District	Roida-Bhadrasahi, Unchabali, Jajang, Jurudi, Belkundi, Bolani, Khandbandh, Katamati, Thakurani, Gandhamardan, Joda-East, Haromoto, Guali, Kasia, Malangtoli etc.			Iron ore bands occur in layered BIF along with volcano-sedimentary rock piles known as Iron Ore Super Group
Sundargada District		Barsuan, Taldihi, Kalta, Khajuridihi, Ganua, Koira, Kurmitarpahar, Rantha, Mankarnacha, , Badamgarh pahar, Baliapahar Mithihurda-Basada etc.				
Mayurbhanj District		Suleipat, Ghusura, Gorumahisani, Badampahar, etc.				
Jajpur District		Daitari-Tomka				

CHROMITE	Jajpur District	Sukinda Ultramafic complex.	Occur as intrusive into Precambrian metamorphites as well as differentiated layered igneous complexes	173.80 million tonnes of all categories with 40 to 45% Cr ₂ O ₃	Chromium metal, Various alloys with iron, nickel, cobalt, tungsten etc. Chromium compounds Refractory industry
	Kendujhar District	Boula-Nuasahi Igneous complex.			
	Baleswar District	Bhalukasuni			
MANGANESE	Kendujhar District	Joda, Chormalda, Katasahi, Jurudi, Parelipado, Roida, Sidhamata, Dubna, Jaribahal (Palsa), Katasahi-Kolha-Rudkela, Gurda	Confined to Shale formation of Horse shoe synclinorium belonging to Precambrian Iron Ore Super Group	119.81 million tonnes	Iron and Steel Industry Ferromanganese industry Dry cell (battery) Chemical industry
	Sundargada District	Orahari, Patamunda, Malda, Mahulsukha, Nuagaon, Teheral, Sarkundo, Kusumdihi, Gonusa, Dendulo, Kanthor-Koira, Oraghat, Kolmong			
		Ghariajor-Manmunda area	Associated with Gangpur Group of rocks		
	Rayagada District	Nishikhal, Podakana, Khurigaon, Anajori, Liliguma, Ambadola, Rukunibari, Loharapara, Bhalumaska	Associated with Eastern Ghats Super Group of Rocks i.e. quartzites, Khondalites calc-gneiss and calc-granulites as tabular bodies.		
	Balangir District	Champasar, Bharatbahal, Rengali, Tamiya, Babja, Ucchabapali, Banipali, Biarpali, Gadashankar, Bhaludungri			
COPPER	Debagada District	Adash	Associated with Eastern Ghats Super Group of Rocks i.e. Khondalites and Charnockites .Pyroxene granulite is the main host rock.	3.09 million tonnes with cut-off grades of 0.8% Cu,	Electrical equipment, conductive wires, Auto ancilliary, semis & alloys
	Mayurbhanj District	Kesarpur	Occur within sheared metabasics belonging to Proterozoic s of Eastern Singbhum		

LEAD AND ZINC	Sundargada District	Sargipalli – Galena, Chalcopyrite, Sphalerite, Cerussite, Azurite, Malachite, Covellite.	Confined to Garnetiferous biotite schist within Gangpurs	Sargipalli deposit – 1.89 million tonnes between 220 m & 60 m with 6.73% Pb, 0.33% Cu and 51 PPM of Ag at 3% cut off. *Sargipalli mine has been closed since 2001-02	Storage battery industry, Paint industry, chemicals, alloys, cables, ammunition Galvanising industry, dry cell, chemicals
	Balangir District	Saintala area	Occur as fracture fillings in quartz veins		
	Baragada District	Kermeli area.			
	Kalahandi District	Sisakhal area.			
	Debagada District	Gangajal area.			
MINERAL SAND	Ganjam Coast	All along Ganjam coast from A.P.-Orissa border to Ganjam-Puri border. Important Sector are: Gopalpur Sector, Chhatrapur Sector and Prayagi Sector	Eastern Ghats Super Group of rocks on weathering release the heavy minerals ,which are carried into the sea by many rivers , tidal waves, littoral drift, wind action etc. have played their part in the concentration of heavy minerals.	226.24 million tonnes. 12% approximately.	(i)Ilmenite : Source of titanium, used for manufacture of titanium dioxide & ferro-titanium alloys (ii)Rutile: Source of titanium used for titanium dioxide pigment welding electrodes production of titanium sponge & metal (iii)Zircon: Foundaries, ceramics, refractories (iv)Sillimanite: Manufacture of high temperature refractories (v)Garnet: Used as abrasive (vi)Monazite: Production of Rare Earth Compounds – Thorium, Uranium Helium
	Puri Coast	On both side of Chilka lake Paikrapur-Bajrakot Sector and Brahmagiri Sector			
NICKEL ORE	Sukinda valley (Jajpur District) Kansa sector	Saruabil, Sukrangi, Kamarda, Kaliapani, Bhimtangar mines and Kansa sector	Occur as nickeliforous laterite (as over-burden in chromite mines) overlying the serpentinised dunite-peridotite bed rock	Reserve In Sukinda valley (with cut off of 0.5% Ni)—174 million tonnes	Stainless steel, nickel plating, coil making, electronic industry
	Mayurbhanj District	Similipal complex			

PLATINUM	Kendujhar	Baula_Nuasahi complex, Amjori sill	Associated with Singhbhum-Orissa craton comprising high grade schist and gneiss intruded by layered mafics and ultramafics		Auto catalyst, Jewellery, dentistry, industrial application.
	Jajpur	Sukinda valley			
	Baleswar	Bhalukasuni			
	Dhenkanal	Bhuban, Asurba, Maulabhanj, Kathpal and Ostapal			
TIN ORE (Cassiterite)	Malkangiri District	Bijapadar, Vederupalli, Durmaguda, Mohapadar, Kurumpalli, Gurupada, Permanasu	Associated with metasedimentaries and metabasics of Bengpal Group intruded by pegmatites and quartz veins and also as secondary placers		Tin metal, packing material, tin plates, alloys with other metals, chemical use
ASBESTOS	Malkangiri District	MV – 76 Uruvalley Madatalguda Billiguda Maharajpalli MV-114 MV-96	Occur in the contact of granite gneiss and amphibolite	Not estimated	Used for asbestos cement products such as asbestos cement sheets, pipes, brake linings, insulation mill boards, asbestos paper, and fire proof paints, clothes etc.
CHINA CLAY	Mayurbhanj District	Joshipur, Chanchbani, Dumuria, Jamda, Kadodiha, Jamkeswar & Thakurmunda .Dhobadiha, Kalapathuria, Sorisbari, Jamkesar, Kalikapur, Ramchandrapur, Kathkaranjia, Nanua, Nijli, Mangalpur, Tikasil etc.	Occur in a long belt stretching from southern Singhbhum to Mayurbhanj extending upto Kendujhar in the Singhbhum Granite belt	314 mt.	Ceramic, pottery industry, cement industry, textile, paper, rubber, paint
	Kendujhar District	Unchheibera, Guras, Bholpara, Pradhanpara			
	Nawarangpur District	Devdhara, Sorispadar, Ambagan			
	Rayagada District	Kudingmali			
	Baragada District	Khola			

COAL	Anugul - Dhenkanal District	Talcher Coalfield	In the Barakar and Karaharbari formation of Lower Gondwana	65226.86 million tonnes non-coking coal.	Thermal power generation
	Sambalpur-Jharsuguda Dist.	Ib River Coalfield	Kamthi/Raniganj Formation		
	Other areas	Uneconomic coal occurrences are found in following basins- Athgarh basin, Gaisilat basin, Athmallick basin, Katrinjia Basin.			
FIRE CLAY	Cuttack District	Talbasta, Brahmabasta, Ghantikhal.	Athgarh Formation of Upper Gondwana	175.53million tonnes	Refractory bricks, Sanitary ware
	Khurda District	Jagannath Prasad, Andharua, Bantal			
	Anugul District	Confined to Talcher Coalfields Jagannath Colliery, South Balanda Colliery, Kaniha, Telisinga	In the Barakar and Karaharbari formation of Lower Gondwana		
	Baragada District	Telipali, Buramunda, Gaisilat			
	Ib River Coalfield area	Belpahar, Jurabaga, Darlipali, Rampur, Kuropali, Baria pahar, Lukopoli, Khinda, Rail, Ainlapali, Kirwara, Belpur, Siarmal, Kulda, Ratansera, Lakhampur, Bundia, Bholamal etc.			

LIMESTONE	Sundargada District	Biramitrapur-Raibaga, Hatibari-Purnapani, Gatitangar, Lanjiberna, Khatkurbahal, Kiringsera, Bimta, Khairtola	Associated with Biramitrapur Formation of Gangpur Group	1007.2million tonnes	Cement Industry Iron and Steel Industry Glass industry Chemical industry Sugar industry Fertiliser industry
	Koraput District	Sunki, Dumajodi-Kundajodi, Parasagudi, Binsuli, Gupteswar	Associated with Eastern Ghats Super Group of rocks		
	Malkangiri District	Kottametta, Nandiveda, Uskalvagu	Limestone occur interbanded with shale, phyllite and quartzite of Vindyan Super Group		
	Nuapada District	Chandpala, Sagundunguri, Deobahal, Rohapadar, Gorramura.	Associated with Eastern Ghats Super Group of Rocks and in Khariar Highland Group of rocks		
	Balangir District	Dhamandanga, Kuliadaha, Hial	Associated with Eastern Ghats Super Group of Rocks		
	Baragada District	Dungri, Banjipalli,- Jampalli Putka-Saramsil	Associated with Proterozoic cover sediments		
DOLOMITE	Sundargada District	Biramitrapur-Raibaga, Gamardihi, Turmura, Lefripara, Dublabera, Sapai river section, Litibera	Associated with Biramitrapur Formation of Gangpur Group	330.90 million tonnes.	Refractory Industry (Blast Furnace Lining) Alloys industry Glass Industry Steel Industry
	Baragada District	Nuapara - Putka	Associated with Proterozoic cover sediments		

GRAPHITE	Anugul	Dandatopa, Akharkata, Adeswara Kamalpur, Girida	Occur within Eastern Ghat Mobile Belt, associated with khondalite, quartzite, calc-silicate, granulite, charnockite, basic granulites and quartzofeldspathic gneisses cross cut by leptynites and pegmatites.	4.40 million tonnes	Crucible Industry, pencil, brick lining, battery, lubricants paint
	Baragada	Temrimal, Tentulikhunti, Hardatal, Ranjitpur, Dahigaon, Menaramunda			
	Balangir	Gerdi, Fulmati, Ganjaudar, Rengali, Sargipalli-Golomunda, Dhandamunda, Godgadbahal, Mahulpati, Banjipali, Dukukamal, Beherapani, Beheramunda, Sapmunda, Mohanilaha, Malisira, Sargibahal			
	Kalahandi	Sargipada, Gaidar, Singjharan, Lamer, Badibahal			
	Kandhamal	Madagurha (Tumudibandh), Bargaon, Dhursi, Mahabali			
	Nuapada	Kirkita, Dharamsagar, Gandabahali			
	Rayagada	Lakhajharan, Bandhamandi, Sanamaturu, Malimunda, Kumbhibhata, Gundrugaoon			
	Nayagada	Narajpada			
	PYRO-PHYLLITE	Kendujhar District			
Mayurbhanj District		Jashipur, Gorumahisani, Bangiriposi and Manada			

DIMENSION STONE	Anugul District	Gobinda Pana Sahi, Durgapur Panasahi	Eastern Ghats Super Group of rocks consisting of khondalites, leptynite, charnockite, pyroxene granulite, nephelene syenite , granite etc. can be categorised as dimension stone.	463.53 million cubic metres of all varieties.	As polished blocks & tiles for flooring kitchen Platforms, wall panels, table tops, in commercial complexes, domestic houses, monuments, temples , platforms, tomb stones, land scaping etc. Many coloured varieties are used for flower vases, name plates. pen stands, paper weights, statues & modern sculptures.
	Dhenkanal District	Mahapada, Haripur, Radhadeipur			
	Gajapati District	Raghunathpur, Sanadola, Sanatundi, Baguda, Lubarsingi, Sundaraba, Sabarapalli, Kankargurha, Taraba, Ranala, Nuasahi, Ragaisingi, Bhramarpur, Tundari & Sauri, Marlaba, Barahapadar, Mahulpadar, Kuddada, Jhingiriguda, Puigurha, Hatimunda, Kharia, Burhamali, Guruduma, Laxmipuram, Venkatpuram, Salkijeyppore, Addanguda, Appanayupeta, Antarba, Jamudiha, Poibandha, Khariguma, Bariabandha, Dengama, Kandha Adaba, Narayanpur, Khariaguda, Mandimera.			
	Ganjam District	Gudiapalli area, Dakhinpur, Lanja, Sukunda, Lathi, Bada Dumula, Kandasara, Dasipur, Mathura, Radhamohanpur, Gobinda nagar, Krushnanagar, Nuaparha, Baranga, Dutipur, Gopalpur, Sarahanaipalli, Manikyapur, Hinjicut, Pathan Punji, Kirtipur, Sahaspur, Butasarsingi, Purusottampur, Khetapalli, Patapur, Gudiali, Mandalpur, Matisahi, Kohibiradi, Nuamundia, Bishnuchakra, Kanteipalli, , Olamba, Chakunda, Baragada, Badangi, Ekatapur, Matisahi etc.			
	Nawarangpur District	Cheptiamb, Karlapada, Samarcharan, Hatibari, Tohra			
Nuapada District	Bhaira, Dalipathara, Damarkhol				

	Cuttack District	Murdamekh, Paikregeda, Jagannath Prasad, Saradapur Patna, Jogibahali, Kakuria, Pancham, Sukad, Sitarampur, Ghantapara, Bhejiapara, Basantpur, Ramachandrapur, Mulikata, Tagila, Rusigara, Kanpur			
QUARTZ & QUARTZITE	Boudh, Baragada, Kandhamal, Kendujhar, Jharsuguda, Kalahandi, Mayurbhanj, Nuapada, Subarnapur, Nabrangpur, Rayagada & Koraput districts	Numerous occurrences of Boudh, Baragada, Kandhamal, Kendujhar, Jharsuguda, Kalahandi, Mayurbhanj, Nuapada, Subarnapur, Nabrangpur, Rayagada & Koraput districts	Quartz occurs in the form of veins and as a constituent of pegmatites. In Orissa, quartz and silica sand deposits are located in the Precambrian terrains Quartzite occurs as beds interstratified with other meta-sedimentaries	70.30million tonnes	Ceramic, fertilizers, abrasives, electrical, paint, rubber, chemical and textile industries with different specifications. Transparent varieties of quartz such as rock crystals, amethyst, citrine, rose quartz and smoky quartz are used as semiprecious gem stones. Quartz is a piezoelectric material and is used in radio circuit, radars, ultrasonic devices, chronometers etc. Quartzites are used in refractory, iron and steel making, ferro-silicon, glass & ceramics etc.
HIGH MAGNESIA ROCKS	Jajpur District	Sukinda area	Dunite, peridotite, serpentinite, pyroxenites mostly associated with Iron Ore Super Group	Not esimated	Used as flux in blast furnace for steel making in place of dolomite
	Kendujhar District	Managovindpur. Boula Nuasahi area			
	Dhenkanal District	Bhuban –Asurbandh- Maulabhanj			
	Baleswar District	Bhalukasoni near Nilgiri			
	Sundargada	Rajabera, Jharbeda			
	Sambalpur District	Thelkobadi of Kuchinda Sub-division			

GOLD	Mayurbhanj District	Suriagoda, Jagaguda, Ghutudihi, Maredihi, Janudihi, Jhabukucha, Jharadihi, Amdiha, Joshipur, Surda Dhusurapahar (Suleipat)	Occur within boulder-pebbly-quartz conglomerate associated with metasediments and metabasites of Iron Ore super Group	Not definite	Ornament, metallurgical etc.
	Kendujhar District	Gopur, Salaikena, Dimirimunda, Rangadihi, Gajipur, Odal, Kushkala, Kardangi, Kalima, Koilisuta	Occur within quartz vein associated with Iron Ore Super Group of rocks		
	Sundargada District	Digajharan, Malidihi, Ghoger	On the bank of Ib river		
	Koraput District	Dasmantpur-Govindpalli, Kusumghati, Kyang, Kaliaguda	On the bank of Kolab river		
	Anugul District		In Tikira river		
PRECIOUS AND SEMIPRECIOUS STONES					
AQUA-MARINE	Sambalpur District	Charbati, Beldihi	Associated with Eastern Ghats Granulite Belt interbanded with mafic and ultramafic complexes, anorthosites, and alkaline complexes intruded by granites, pegmatites and quartz vein Contact of beryl bearing pegmatite with ultramafic rocks	Not esimated	As semi-precious stone
	Balangir District	Saraibahal, Sukulimuri, Guchhepalli, Desand, Chhanchanabhata			
	Subarnapur District	Badmal, Mursundi, Bairagipalli, Amarpalli			

CHRYSO-BERYL	Sambalpur District	Meghpal (Ranchipada)	Occur within pegmatites in khondalite suit of rocks	Not esimated	As semi-precious stone
	Rayagada District	Paikadalkguda, Karlaghati, Karanjguda			
	Koraput District	Turia			
	Kandhamal District	Belghar			
	Balangir District	Ghumsar	Associated with pegmatite intruding into quartzo-feldspathic gneiss		
	Kalahandi District	Sirjapalli, Tundla, Muribahal			
GARNET	Anugul District	Nuagaon, Parhang, Biribolei, Barkotia	Occur in high grade pelitic schist, amphibolites, calc granulite etc.	Not esimated	As semi-precious stone
	Dhenkanal District	Ghagarmunda, Katamunda, Asanabahal, Tipeijharan			
	Debagada District	Budido, Palsama, Jharposhi			
	Subarnapur	Siali, Naktamunda, Binika, Subarnapur			
	Boudh District	Boudh, Ramgarh, Kantamal, Manmunda			
	Kalahandi District	Banjipadar, Sargidua, Ghatpara			
	Nuapada District	Sardhapur, Patialpada, Damjhar, Patialpada, Budhapada, Mantritarai			
	Sambalpur District	Bagdhopa, Tabloi			
	Balangir District	Khaliapalli, Kesaipalli, Luhuramunda,			
RUBY	Kalahandi District	Jhillingdhar, Hinjlibahal, Kerumunda	Contact of pegmatite and ultramafic rocks associated with cordierite-sillimanite-garnet schists and para gneisses	Not esimated	As semi-precious stone
SAPPHIRE	Nuapada District	Katamal, Karlakot, Amera	High grade pelitic schist at the contact of alkali syenite and pegmatite	Not esimated	

DIAMOND	Nuapada District	Kalamidadar valley of Nuapada district Mahanadi river bed particularly from Binika in Subarnapur district to Madhapur in Boudh district.	Diamond occurrences are associated with olivine-lamproite pipes within Bastar cratonic complex or at the interface of Bastar cratonic complex and Proterozoic cover sediments around Kalamidadar of Nuapada district . The secondary diamond occur in association with pebble and gravel of Mahanadi river particularly from Binika in Subarnapur district to Madhapur in Boudh district	Not esimated	Jewellery, oil drilling, grinding, cutting & polishing,
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Source : DG, GSI, IBM