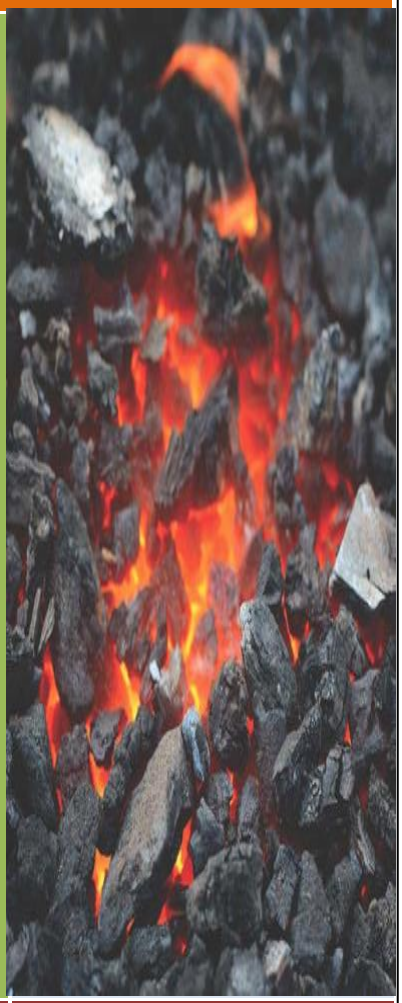
REGIONAL GEOGRAPHY OF INDIA

MINERAL AND POWER RESOURCES

WITH SPECIAL REFERENCE TO

IRON ORE, COAL AND PETROLEUM



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COMPILED BY-

DIPANKAR CHAKRABORTY

COLLEGE TEACHER

RANIGANJ GIRLS' COLLEGE

OBJECTIVE:TO FIND OUT THE DISTRIBUTION AND UTILIZATION

MINERALS

Introduction

The term 'Mineral' means a class of substances occurring in nature, of definite chemical composition and usually, a characteristic crystal structure, but sometimes also includes rocks formed by these substances. A mineral is an element or chemical compound that has been formed as a result of geological processes. Mineral resources are found on or in the earth in reasonable amounts and are mined for their potential uses or their intrinsic values. Mineral resources are non-renewable and include **metals (e.g. iron, copper, and aluminum), and non-metals (e.g. salt, gypsum, clay, sand, phosphates).** Earth's economic resources include thousands of minerals and every segment of human society uses the mineral resources, in one form or another, everyday, directly or indirectly. Minerals are referred to as the essential building blocks of the geosphere, but in view of their immense commercial and industrial importance, these are literally the building blocks of the economy.

Minerals in general have been categorized into three classes: **fuel, metallic and non-metallic.** Minerals are valuable natural resources being finite in nature. They constitute the vital raw materials for many basic industries and are a major resource for development. Demand for minerals is increasing world-wide with the increase in population and the associated consumption demands of individuals. The mining of earth's natural resources is, therefore, accelerating and it has accompanying environmental consequences.

Minerals include deposits of oil resources, natural gas resources, coal and lignite resources, metallic and non-metallic minerals. Since the resources are generally found underground (hence commonly referred to as subsoil assets), the quantity of resources that one might reasonably expect to be extracted is not known with any large degree of precision. Consequently, a key factor in the measurement of mineral and energy resources is the concentration and quality of the minerals and energy resources in the deposit, since this will influence not only the cost of extraction, but also the degree of confidence regarding the quantity that can be extracted in future.

Ores are concentrations of minerals in rock that are high enough to be economically extracted for use. An ore is an occurrence of rock or sediment that contains sufficient minerals with economically important elements, typically metals, that can be economically extracted from the deposit.

From an economic view-point and based on the content and usage of the minerals, these can be categorized as given in **Table 1**.

Table 1: Classification of minerals

S. No.	Group	Minerals
1.	Metallic Minerals (Ferrous Group)	Chromite, Iron, Manganese
2.	Metallic Minerals (Non-Ferrous Group)	Antimony, Bauxite, Copper, Lead & Zinc, Platinum group of metals
3.	Precious & Semi-precious Minerals	Diamond, Emerald, Garnet, Gold, Ruby, Sapphire, Silver
4.	Strategic Minerals	Cobalt, Molybdenum, Nickel, Rare Earth Elements, Tin, Titanium, Tungsten, Vanadium
5.	Fertilizer Minerals	Phosphate(Apatite), Rock Phosphate, Potash, Pyrite, Sulphur
6.	Refractory Minerals	Andalusite, Graphite, Kyanite, Magnesite, Sillimanite
7.	Ceramic and Glass Mineral	Wollastonite
8.	Other Industrial Minerals	Asbestos, Borax, Diatomite, Fluorite, Limestone, Marl, Perlite, Rock Salt, Vermiculite, Zircon
9.	Minor Minerals	Ball Clay, Barytes, Bentonite, Calcite, Chalk, China Clay, Corundum, Diaspore, Dolomite, Dunite, Feldspar, Fire Clay, Fuller's Earth, Granite, Gypsum, Laterite, Marble, Mica, Ochre, Pyrophyllite, Quartz & Silica Sand, Quartzite, Talc/Steatite/Soapstone, Shale, Slate

Classification of Mineral Resources

In order to allow for comparability across countries, a standard classification, 'United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources' (UNFC), is prescribed for presenting the mineral resources of the country. UNFC is a generic principle-based system in which quantities are classified on the basis of three fundamental criteria i.e. **economic viability, feasibility study and geological knowledge** of the deposit, by using a numeric codification.

As per UNFC, the resources are broadly categorised into 'reserves' and 'remaining resources'. According to the norms of this system, **economically mineable part of measured and/or indicated mineral resources have been placed under 'reserve' category**. Those quantities which have not been found economically viable due to the present techno-economic, environmental, social, legal, etc. factors and also the quantities estimated based on only geological assessments have been placed under 'remaining resources' category.

The UNFC consists of a three-dimensional system with the three axes- **Geological Assessment, Feasibility Assessment and Economic Viability –** representing the respective criteria. In this three-digit-code-based system, the first digit denotes the economic viability axis, the second digit denotes the feasibility axis, and the third digit, the geologic axis. The three axes are further discussed in the following paragraphs.

Geological Assessment: The process of geological assessment is generally conducted in stages of increasing details and the successive stages of geological investigations, i.e., reconnaissance, prospecting, general exploration and detailed exploration, generate resource data with a clearly defined increasing degree of geological assurance. At the initial reconnaissance stage, estimates are based on regional geological studies and mapping, airborne and indirect methods, preliminary field inspections as well as geological inference and extrapolation, while at the end of the detailed exploration, tonnage, densities, shape, physical characteristics, grade and mineral content of the resource can be estimated with a high level of confidence. These four stages are, therefore, used as geological assessment categories in the classification and are represented by the 4 codes, i.e., 1 (detailed exploration), 2 (general exploration), 3 (prospecting) and 4 (reconnaissance).

Feasibility Assessment: An essential part of the process of assessing a mining project is the feasibility assessment studies. The successive stages of feasibility assessment, i.e., geological study as initial stage followed by prefeasibility study and feasibility study/mining report are described in the UNFC by the codes 3, 2 and 1 respectively.

Economic Viability: The degree of economic viability (economic or sub-economic) is assessed in the course of prefeasibility and feasibility studies. A prefeasibility study provides a preliminary assessment with a lower level of accuracy as compared to that of a feasibility study which assesses the economic viability in detail. **The three categories of economic viability have codes 1, 2 and 3 in decreasing order, with 1 representing resources that are economically mineable, '2' representing those**

which are possibly economically viable subject to changes in technological, economic, environmental and/or other relevant condition and '3' representing the remaining resources.

Thus, the highest category of resources under UNFC system will have the code (111) and lowest category, the code (334).

Under the SEEA-Central Framework, a slightly different categorization is adopted, wherein resources are classified under three classes –A, B and C.

> **Class A: Commercially** recoverable resources (Including on-production projects, projects approved for development and projects justified for development)
>
> **Class B:** Potentially commercially recoverable resources (Including economic and marginal development projects pending and development projects on hold)
>
> **Class C:** Non-commercial and other known deposits (Potential commercial projects may also satisfy the requirements for Extraction and sale have been confirmed to be economically viable)

Mineral Accounts

Mineral and energy resources are a unique type of environmental asset that can be extracted and used in economic activity but cannot be renewed on any human timescale. Since they cannot be renewed, there is particular interest in understanding the rate at which these assets are extracted and depleted, the overall availability of these assets, and the sustainability of the industries that exploit them.

Asset accounts for mineral and energy resources organize relevant information, including the quantities and values of stocks of the resources and the changes in these over accounting periods. Flows of extraction, depletion and discoveries are central to the asset account and these, in turn, can provide valuable information regarding the availability of individual resources, allowing an analysis of how the stocks change over time as a result of these activities and the changes in the economic conditions.

Mineral asset accounts can be made up as either a physical accounts or as a monetary account. The unit used for the physical accounts can be tonnes, cubic meters and oil equivalents depending on what is most appropriate for the asset in focus. The important thing is of course that the same unit is used throughout the account so that the book keeping system of the account can be maintained (i.e. adding changes to the opening stock gives the closing stock). For the monetary

accounts, the currency unit of the country owning the assets will typically be used. Both current prices and fixed prices can in principle be applied. Viewed narrowly, the process of accounting for subsoil assets are confined to define and measure the level of stocks in physical terms and to place a value on these.

Physical asset accounts for mineral and Power resources

Physical asset accounts for mineral and energy resources should be compiled by type of resource and include estimates of the opening and closing stock of mineral and energy resource and changes in the stock over the accounting period. The measurement units used to compile and present the relevant information will vary by type of resource. However, for accounting purposes, the same measurement unit should be used, for a single resource, to record the opening and closing stocks and the changes in the stocks over an accounting period. It is noted that a total for each class of deposit across different resource types cannot be meaningfully estimated owing to the use of different measurement units for different resources. It may, nevertheless, be possible to aggregate certain subsets of resources, for example, energy resources, by using a common measurement unit such as joules or other energy units.The changes in the stock in physical terms should consider all types of changes – discoveries, reappraisals, extraction, catastrophic losses and reclassification.

Present Scenario of minerals in India

Mineral resources are finite and non-renewable and their judicious use and conservation are very essential for the survival of human civilization. In Indian context, it can be seen that we have a fairly large variety of mineral deposits and our endowment is quite adequate with exception of few deficient minerals. Considering the ever-increasing population, growth rate of economy and demand, these mineral resources are bound to get exhausted sometime in future. Thus, the knowledge of endowment of mineral resources and their effective management are of utmost importance in order to provide an uninterrupted sustainable supply of minerals to meet the domestic demand as well as for foreign trade in order to boost the national economy. In this journey of mineral exploitation, concept of conservation and ecological balance should always be remembered.

The country is endowed with huge resources of many metallic and non-metallic minerals. India has significant mineral resources of **Coal (4th largest reserves in the world), Iron ore, Manganese ore (7th largest reserve in the world as in 2013), Mica, Bauxite (5th largest reserve in the world as in 2013),** Chromite, Natural gas, Diamonds, Limestone, Titanium and Thorium (world's largest along coast of Kerala shores). India's oil reserves, found in Bombay High off the coast of Maharashtra, Gujarat, Rajasthan and in eastern Assam meet 25% of the country's demand.

Not surprisingly, therefore, mining sector is an important segment of the Indian economy. Since independence, there has been a pronounced growth in the mineral production both in terms of quantity and value. India produces as many as 95 minerals, which includes 4 fuel, 10 metallic, 23 non-metallic, 3 atomic and 55 minor minerals (including building and other materials)1. Mining sector, being one of the core sector of economy, provides basic raw materials to many important industries like power generation (thermal), iron and steel, cement, petroleum and natural gas, petro-chemicals, fertilisers, precious & semi-precious metals/stones, electrical & electronics equipment, glass and ceramics etc. The rapid urbanization and projected growth in the manufacturing sector in India is likely to result in a surge in the demand for minerals. India occupies a dominant position in the production of many minerals across the globe. India's ranking in 2015 as compared to world production was 2nd in barytes, and talc/ steatite/ pyrophyllite, 3rd in chromite, coal & lignite and zinc (slab), 4th in kyanite/ andalusite/ sillimanite, 5th in iron ore, and Steel (Crude), 6th in bauxite ore, 7th in manganese ore and 8th in aluminium.

Source: Annual Report 2017-18, Ministry of Mines

Though the percentage share of "mining and quarrying" in GDP in India ranges between 2.5 to 3, in view of its use as a major input in the secondary sector – manufacturing, construction, electricity, gas and water supply, the "indirect share" of the industry is much higher and hence, the industry cannot be disregarded in any of the plans formulated for the country's economic growth.

Spatial distribution of resources

Most of the metallic minerals in India occur in the peninsular plateau region in the old crystalline rocks. **Over 97 per cent of coal reserves occur in the valleys of Damodar, Sone, Mahanadi and Godavari. Petroleum reserves are located in the sedimentary basins of Assam, Gujarat and Mumbai High i.e. off-shore region in the Arabian Sea. New reserves have been located in the Krishna-Godavari and Kaveri basins.** Most of the major mineral resources occur to the east of a line linking Mangaluru and Kanpur. Minerals are generally concentrated in three broad belts in India. There may be some sporadic occurrences here and there in isolated pockets. These belts are:

The North-Eastern Plateau Region: This belt covers Chhotanagpur (Jharkhand), Odisha Plateau, West Bengal and parts of Chhattisgarh. It has variety of minerals viz. iron ore coal, manganese, bauxite, mica.

The South-Western Plateau Region: This belt extends over Karnataka, Goa and contiguous Tamil Nadu uplands and Kerala. This belt is rich in ferrous metals and bauxite. It also contains high grade iron ore, manganese and limestone. This belt packs in coal deposits except Neyveli lignite. This belt does not have as diversified mineral deposits as the north-eastern belt. Kerala has deposits of monazite and thorium, bauxite clay. Goa has iron ore deposits.

The North-Western Region: This belt extends along Aravali in Rajasthan and part of Gujarat and minerals are associated with Dharwar system of rocks. Copper, zinc has been major minerals. Rajasthan is rich in building stones i.e. sandstone, granite, marble. Gypsum and Fuller's earth deposits are also extensive. Dolomite and limestone provide raw materials for cement industry. Gujarat is known for its petroleum deposits.

The Himalayan belt is another mineral belt where copper, lead, zinc, cobalt and tungsten are known to occur. They occur on both the eastern and western parts. Assam valley has mineral oil deposits. Besides oil resources are also found in off-shore-areas near Mumbai Coast (Mumbai High).

At the state level, the top five mineral rich States are Rajasthan, Andhra Pradesh, Karnataka, Jharkhand, and Tamil Nadu. The prominent minerals of some of the mineral-rich States are shown in the **Table 2.**

Table 2: Important minerals in the States of India

S. No.	State	Prominent Minerals
1	Andhra Pradesh	Garnet, Barytes, Ball clay, China clay, Dolomite, Feldspar, Fireclay**, Iron**, Quartzite, Manganese, Laterite, Mica, Ochre, Quartz/silica sand, Talc/soapstone/ steatite, Vermiculite
2	**Assam**	**Petroleum & Natural Gas, Coal**
3	Chhattisgarh	**Coal, Dolomite, Bauxite, Iron**, Fireclay, Limestone, Quartzite, Quartz/silica sand
4	Goa	Iron, Bauxite
5	Gujarat	Bauxite, Marl**, Petroleum & Natural Gas**, Chalk, Bentonite, China clay, Dolomite, Lignite, Limestone, Laterite, Quartz/silica sand, Fireclay, Manganese, Talc/soapstone/ steatite
6	Jharkhand	**Coal, Graphite, Bauxite, Iron, Copper**, Kyanite, Dolomite, Manganese, Talc/soapstone/ steatite
7	Karnataka	Gold**, Iron**, Manganese, Limestone, Dolomite, Dunite, Magnesite, Quartz/silica sand, Granite, Silver, China clay, Chromite, Copper, Quartzite
8	Madhya Pradesh	Diamond, Copper, Manganese, Rock phosphate, Limestone, Diaspore, Laterite, Bauxite, **Coal**, Pyrophyllite, Dolomite, I**ron**, Ochre, China clay
9	Maharashtra	Fluorite, Kyanite, Bauxite, Manganese, Coal, Iron, Limestone, Quartz/ silica sand, Quartzite, Sillimanite, Dolomite
10	Odisha	Chromite, Garnet, Bauxite, Manganese, Iron, Quartzite, Dolomite**, Coal**, Pyrophyllite, Titanium Minerals, Dunite, Limestone, Quartz/ silica sand
11	Rajasthan	Lead & zinc, Wollastonite, Silver, Copper, Limestone, Rock phosphate, Talc/soapstone/ steatite, Gypsum, Ochre, Bentonite, Fuller's earth, Feldspar, Calcite, Ball clay, China clay, Dolomite, Fireclay, Iron, Lignite, Mica, Quartz/silica sand, Granite, Manganese
12	Tamil Nadu	Vermiculite, Dunite, Fireclay, Graphite, Lignite, Limestone, Magnesite, Quartz/silica sand, Titanium Minerals, Zircon, Sillimanite, Bauxite, Feldspar
13	Telangana	**Coal**, Manganese, Limestone, Barytes, Dolomite, Feldspar, Quartz/silica sand, Laterite, Shale, China clay, Iron
14	Uttar Pradesh	Diaspore, Pyrophyllite, Silica sand**, Coal**

S. No.	State	Prominent Minerals
15	**West Bengal**	**Coal, China clay, Fireclay, Granite, Quartz/silica sand**

Source: Annual Report 2017-18, Ministry of Mines

New discoveries in proved reserves

Table- 3 gives the cases where the proved reserves, which did not exist in 2005, now have a positive value, depicting thereby a scope for newer activities in the State.

Table 3: New discoveries in proved reserves

S. No.	Mineral group	Minerals	State with nil proved reserves in 2005 and a positive entry in 2015
1.	Metallic Mineral (Ferrous)	**Iron Ore (Magnetite)**	Chhattisgarh, Karnataka, Odisha
2.	Metallic Mineral (Ferrous)	Manganese Ore	Gujarat
3.	Fertilizer Mineral	Apatite	Andhra Pradesh
4.	Precious & Semi-precious Mineral	Garnet	Odisha
5.	Precious & Semi-precious Mineral	Gold Ore (Primary)	Jharkhand
6.	Refractory Mineral	Graphite	Chhattisgarh
7.	Refractory Mineral	Sillimanite	Andhra Pradesh
8.	Strategic Mineral	Titanium Minerals	Odisha
9.	Minor Mineral	Ball Clay	Gujarat
10.	Minor Mineral	Bentonite	Gujarat, Rajasthan
11.	Minor Mineral	Chalk	Gujarat
12.	Minor Mineral	Dolomite	Uttarakhand
13.	Minor Mineral	Feldspar	West Bengal
14.	Minor Mineral	Fire Clay	Chhattisgarh
15.	Minor Mineral	Fuller's Earth	Rajasthan
16.	Minor Mineral	Granite (Dimension	Rajasthan

S. No.	Mineral group	Minerals	State with nil proved reserves in 2005 and a positive entry in 2015
17.	Minor Mineral	Laterite	Andhra Pradesh, Gujarat, Madhya Pradesh
18.	Minor Mineral	Mica	Andhra Pradesh
19.	Minor Mineral	Pyrophyllite	Jharkhand
20.	Minor Mineral	Quartzite	Jammu & Kashmir
21.	Minor Mineral	Quartz-Silica Sand	Himachal Pradesh
22.	Minor Mineral	Shale	Andhra Pradesh, Madhya Pradesh
23.	Minor Mineral	Slate	Andhra Pradesh, Haryana
24.	Other Indl. Mineral	Marl	Gujarat

Other Indl. Mineral: Other Industrial Mineral

Exhaustion of proved reserves: That the stock of minerals is finite is already being experienced in the country, with a vast number of minerals vanishing from the economic sphere. **Table 4** lists the cases where the proved reserves have reduced to 'zero' during 2005-2015.

Table 4: Exhaustion of proved reserves

S. No.	Mineral Group	Minerals	States where mineral has been exhausted
1.	Metallic Mineral (Ferrous)	Chromite	Maharashtra
2.	Metallic Mineral (Ferrous)	Iron Ore (Magnetite)	Jharkhand
3.	Metallic Mineral (Ferrous)	Manganese Ore	Goa
4.	Metallic Minerals (Non-Ferrous)	Bauxite	Andhra Pradesh, Kerala
5.	Metallic Minerals (Non-Ferrous)	Copper Metal& Ore	Andhra Pradesh
6.	Metallic Minerals (Non-Ferrous)	Lead Metal& Lead-Zinc Ore	Andhra Pradesh, Odisha
7.	Fertilizer Mineral	Apatite	West Bengal
8.	Fertilizer Mineral	Pyrite	Bihar, Rajasthan
9.	Fertilizer Mineral	Rock Phosphate	Uttarakhand
10.	Precious & Semi-precious Mineral	Gold Metal& Ore (Primary)	Andhra Pradesh
11.	Precious & Semi-precious	Ruby	Odisha

S. No.	Mineral Group	Minerals	States where mineral has been exhausted
12.	Precious & Semi-precious Mineral	Silver Metal& Ore	Andhra Pradesh, Odisha
13.	Refractory Mineral	Graphite	Karnataka, Rajasthan
14.	Refractory Mineral	Kyanite	Karnataka, Rajasthan
15.	Refractory Mineral	Magnesite	Rajasthan
16.	Refractory Mineral	Sillimanite	Rajasthan
17.	Strategic Mineral	Tin Metal& Ore	Odisha
18.	Strategic Mineral	Titanium Minerals	Kerala, Maharashtra
19.	Strategic Mineral	Vanadium Metal & Ore	Maharashtra
20.	Minor Mineral	Barytes	Himachal Pradesh
21.	Minor Mineral	Calcite	Madhya Pradesh
22.	Minor Mineral	China Clay	Delhi, Maharashtra, Odisha
23.	Minor Mineral	Corundum	Chhattisgarh
24.	Minor Mineral	Feldspar	Karnataka, Maharashtra
25.	Minor Mineral	Fire Clay	Jharkhand, Maharashtra
26.	Minor Mineral	Ochre	Jharkhand, Karnataka
27.	Minor Mineral	Pyrophyllite	Maharashtra
28.	Minor Mineral	Quartzite	Bihar, Haryana
29.	Minor Mineral	Quartz-Silica Sand	Haryana, Jharkhand
30.	Minor Mineral	Talc-Steatite-Soapstone	Bihar, Gujarat, Odisha, Tamil Nadu
31.	Other Indl. Mineral	Asbestos	Odisha, Rajasthan
32.	Other Indl. Mineral	Diatomite	Rajasthan
33.	Other Indl. Mineral	Fluorite	Gujarat, Rajasthan
34.	Other Indl. Mineral	Limestone	Nagaland, Uttarakhand
35.	Other Indl. Mineral	Perlite	Gujarat
36.	Other Indl. Mineral	Rock Salt	Himachal Pradesh
37.	Other Indl. Mineral	Vermiculite	Rajasthan

Other Indl. Mineral: Other Industrial Mineral

Mineral Resources at National Level

S. No.	Mineral	Unit	2005				2010				2015			
			Proved Reserves	Probable Reserves	Remaining Resources	Total Resources	Proved Reserves	Probable Reserves	Remaining Resources	Total Resources	Proved Reserves	Probable Reserves	Remaining Resources	Total Resources
1	Andalusite	000 tonnes		0	18450	18450	0	0	18450	18450	0	0	28201	28201
2	Antimony Metal	tonne		0	174	174	0	0	174	174	0	0	174	174
3	Antimony Ore	tonne		0	10588	10588	0	0	10588	10588	0	0	10588	10588
4	Apatite	000 tonnes	6126	20	20719	26865	2089	2	22139	24229	28	2	24016	24045
5	Asbestos	000 tonnes	2974	3067	15696	21736	1700	811	19656	22167	20	5	22923	22947
6	Ball Clay	000 tonnes	14787	17743	46761	79291	12293	4485	66616	83394	33526	15967	85250	134743
7	Barytes	000 tonnes	31640	2673	39891	74203	29558	2026	41150	72734	50449	898	35324	86671
8	Bauxite	000 tonnes	538946	360441	2390433	3289820	321258	271681	2886681	3479620	434043	222378	3240442	3896863
9	Bentonite	000 tonnes	0	25061	505513	530573	0	25061	543307	568367	13926	659	568303	582888
10	Borax	tonne		0	74204	74204	0	0	74204	74204	0	0	74204	74204
11	Calcite	000 tonnes	3218	3524	15832	22574	1265	1399	18281	20945	928	2521	19555	23004
12	Chalk	000 tonnes					3266	1065	585	4916	4215	848	1687	6750
13	China Clay	000 tonnes	101522	120600	2373539	2595661	124117	53040	2528050	2705207	140456	89012	2711775	2941243
14	Chromite	000 tonnes	30892	35236	146936	213064	31652	22318	149377	203347	64465	37745	241805	344015
15	Coal	Million tonnes	92959	117089	37795	247843	109800	130654	36359	276813	131614	143242	31741	306597
16	Cobalt	Million tonnes		0	45	45	0	0	45	45	0	0	45	45
17	Copper Metal	000 tonnes	1644	2740	7034	11418	1605	3164	7518	12287	2128	607	9424	12158
18	Copper Ore	000 tonnes	135461	231851	1024933	1392245	133388	260983	1164086	1558457	162971	44795	1303730	1511496
19	Corundum	tonne	317	288	83191	83796	0	598	740194	740792	200	0	293496	293696
20	Diamond	000 carats	606	600	3376	4582	1045	0	30876	31922	960	0	30876	31836
21	Diaspore	tonne	1662218	1462815	2212362	5337395	1469687	1389987	3125144	5984818	3242363	4640071	2310817	10193251
22	Diatomite	000 tonnes	634	0	2251	2885	0	0	2885	2885	0	0	2885	2885
23	Dolomite	000 tonnes	407794	577361	6547953	7533108	431567	306619	6992372	7730558	431749	246133	7737008	8414890
24	Dunite	000 tonnes	12714	115359	39855	167928	14894	2243	168231	185368	10848	1919	175050	187817
25	Emerald	Kg.									0	0	55869	55869
26	Feldspar	000 tonnes	19221	18829	52732	90782	24545	19958	87832	132335	173383	146459	313726	633567
27	Fire Clay	000 tonnes	26898	32403	645462	704763	14375	15730	683416	713521	13294	13742	695792	722828
28	Fluorite	000 tonnes	8585	629	10952	20166	4566	146	13502	18214	225	64	17893	18182
29	Fuller's Earth	000 tonnes	0	58	256594	256652	0	58	256594	256652	3941	0	257438	261379
30	Garnet	000 tonnes	6720	14256	36680	57656	3252	16073	37638	56963	9918	2866	43377	56161
31	Gold Metal	tonne		0	6	6	0	0	6	6	0	0	6	6

S. No.	Mineral	Unit	2005				2010				2015			
			Proved Reserves	Probable Reserves	Remaining Resources	Total Resources	Proved Reserves	Probable Reserves	Remaining Resources	Total Resources	Proved Reserves	Probable Reserves	Remaining Resources	Total Resources
32	Gold Metal (Primary)	tonne	67	18	406	491	71	40	549	660	53	17	585	655
33	Gold Ore (Placer)	000 tonnes	0	0	26121	26121	0	0	26121	26121	0	0	26121	26121
34	Gold Ore (Primary)	000 tonnes	15554	3700	371035	390289	16046	8079	469570	493695	10404	6824	484611	501840
35	Granite (Dimension Stone)	000 cu.m.	23010	1107014	36295978	37426002	35742	227951	45966609	46230302	35742	227951	46056100	46319793
36	Graphite	000 tonnes	5164	5586	158025	168775	3685	4347	166818	174850	4230	3731	186926	194887
37	Gypsum	000 tonnes	40803	27855	1168218	1236876	22494	16603	1247402	1286499	35141	1481	1292891	1329513
38	Iron Ore (Haematite)	000 tonnes	4945328	2058840	7626220	14630388	5982042	2111505	9788551	17882098	4053033	1368719	17065215	22486967
39	Iron Ore (Magnetite)	000 tonnes	14339	44165	10560977	10619481	15972	5783	10622304	10644059	30351	22349	10736455	10789155
40	Kyanite	000 tonnes	922	452	101239	102613	552	1023	101671	103246	639	49	104293	104982
41	Laterite	000 tonnes					13935	10778	446119	470832	98598	26134	581817	706549
42	Lead Metal	000 tonnes	1263	1328	4617	7207	398	1847	9304	11549	625	1858	10522	13004
43	Lead-Zinc Metal	000 tonnes		0	118	118	0	0	118	118	0	0	143	143
44	Lead-Zinc Ore	000 tonnes	62860	62894	396826	522580	20215	88765	576614	685594	31662	74454	643344	749460
45	Lignite	Million tonnes	4559	12747	19848	37154	6146	25344	8408	39897	6182	26282	11650	44114
46	Limestone	Million tonnes	7492	5223	162630	175346	8979	5948	170009	184935	9439	6897	186889	203225
47	Magnesite	000 tonnes	20862	55271	261749	337882	20852	21099	293222	335173	77867	4409	311711	393987
48	Manganese Ore	000 tonnes	76843	61307	240418	378568	97426	44553	288004	429983	62983	30494	402399	495876
49	Marble	000 tonnes		4701	1787934	1792635	103736	172759	1654968	1931463	0	4551	1941341	1945892
50	Marl	000 tonnes					133236	6740	11705	151681	117116	6740	11705	135561
51	Mica	tonne	1271	67299	325286	393855	169841	20901	341496	532237	82188	32245	520869	635302
52	Molybdenum Contained MoS2	tonne		1050	11590	12640	0	0	12640	12640	0	0	12668	12668
53	Molybdenum	000 tonnes	0	1500	17787	19287	0	0	19287	19287	0	0	19372	19372

S. No.	Mineral	Unit	2005				2010				2015			
			Proved Reserves	Probable Reserves	Remaining Resources	Total Resources	Proved Reserves	Probable Reserves	Remaining Resources	Total Resources	Proved Reserves	Probable Reserves	Remaining Resources	Total Resources
	Ore													
54	Nickel Ore	Million tonnes		0	189	189	0	0	188	188	0	0	189	189
55	Ochre	000 tonnes	25747	22120	45573	93441	39863	15079	89319	144261	21960	14974	130859	167793
56	Perlite	000 tonnes	188	316	1385	1889	140	288	1978	2406	0	0	2406	2406
57	Platinum Group of Metals	tonne		0	14	14	0	0	16	16	0	0	16	16
58	Potash	Million tonnes		0	21815	21815	0	0	21815	21815	0	0	22508	22508
59	Pyrite	000 tonnes	27129	29597	1617675	1674401	0	0	1674401	1674401	0	0	1674401	1674401
60	Pyrophyllite	000 tonnes	9585	9905	14205	33695	12146	11129	32807	56083	16575	8357	34683	59616
61	Quartzite	000 tonnes	26419	72126	1046414	1144959	59004	27595	1164650	1251249	47759	35714	1575324	1658797
62	Quartz-Silica Sand	000 tonnes	271614	499895	2466704	3238213	272971	156249	3069809	3499029	433013	214509	3260298	3907820
63	Rare Earth Elements	tonne									0	0	25493	25493
64	Rock Phosphate	000 tonnes	33090	19633	252585	305309	20697	14081	261506	296284	43833	1975	266871	312679
65	Rock Salt	000 tonnes	8470	5060	0	13530	10036	5990	0	16026	0	0	16025	16025
66	Ruby	Kg.	143	1782	3346	5271	143	93	5113	5349	0	0	5349	5349
67	Sapphire	Kg.		0	450	450	0	0	450	450	0	0	450	450
68	Shale	000 tonnes					14992	339	580	15911	15027	445	3781	19253
69	Sillimanite	000 tonnes	457	10967	62916	74340	1693	2392	62902	66987	323	6179	63702	70204
70	Silver Metal	tonne	2283	3775	4154	10213	1592	6448	19589	27628	4310	2862	22810	29982
71	Silver Ore	000 tonnes	55752	60161	128721	244633	46109	141449	279426	466985	69277	81167	361511	511955
72	Slate	000 tonnes					0	0	2369	2369	19619	667	2586	22872
73	Sulphur (Native)	000 tonnes		0	210	210	0	0	210	210	0	0	210	210
74	Talc-Steatite-Soapstone	000 tonnes	65013	50516	196809	312338	54614	35413	178996	269023	72172	34319	209432	315923
75	Tin Metal	tonne	108	26	101103	101237	926	207	101142	102275	45	110	102259	102413
76	Tin Ore	000 tonnes	201	49	86303	86552	4	3	83719	83726	2	2	83721	83725
77	Titanium Minerals	000 tonnes	13621	11528	363240	388388	15271	6759	371966	393996	13552	868	399205	413626

S. No.	Mineral	Unit	2005				2010				2015			
			Proved Reserves	Probable Reserves	Remaining Resources	Total Resources	Proved Reserves	Probable Reserves	Remaining Resources	Total Resources	Proved Reserves	Probable Reserves	Remaining Resources	Total Resources
78	Tungsten Contained WO3	tonne		0	142094	142094	0	0	142094	142094	0	0	142094	142094
79	Tungsten Ore	000 tonnes	0	0	87387	87387	0	0	87387	87387	0	0	87387	87387
80	Vanadium Metal	tonne	1914	8856	54620	65390	1145	458	63284	64887	0	0	64594	64594
81	Vanadium Ore	000 tonnes	491	5828	18529	24848	294	117	24308	24719	0	0	24634	24634
82	Vermiculite	tonne	1556664	206966	674631	2438261	1628475	75532	803003	2507010	1582906	49979	719582	2352467
83	Wollastonite	000 tonnes	7424	1109	11708	20242	2290	197	14083	16570	1953	288	14228	16469
84	Zinc Metal	000 tonnes	5503	5590	13167	24260	1938	10515	24212	36665	2872	7128	26363	36363
85	Zircon	tonne	2484687	1221225	569748	4275660	1025942	321528	1786483	3133953	1012205	146085	2264913	3423203
Source: 1. Provisional Coal Statistics, 2005-06;														
2. Coal Directory of India 2007-08, 2009-10, 2015-16;														
3. National Mineral Inventory at a Glance at 2005, 2010 and 2015.														

State-wise Balance Recoverable Reserves of Crude Oil and Natural Gas

Area/State	Crude Oil(MMT)			Natural Gas(BCM)		
	2005	2010	2015	2005	2010	2015
Arunachal Pradesh	**	3.53	1.64	**	2.07	0.79
Andhra Pradesh	4.71	3.68	10.94	42.28	36.09	41.79
Assam	171.59	168.18	165.91	174.94	134.01	149.38
Gujarat	191.98	121.78	119.41	93.11	69.27	63.79
Jharkhand (CBM)	0.00	0.00	0.00	0.00	3.78	29.01
Madhya Pradesh(CBM)	0.00	0.00	0.00	0.00	32.14	32.13
Nagaland	0.00	2.38	2.38	0.00	0.09	0.09
Rajasthan	#	80.48	37.32	#	13.57	36.93
Tamil Nadu	8.18	7.69	8.47	29.57	34.04	35.36
Tripura	**	0.08	0.07	**	27.11	30.74
West Bengal(CBM)	0.00	0.00	0.00	#	37.96	39.33
Offshore	409.58	295.70	289.46	763.09	707.40	792.66
Total Reserves	**786.04**	**683.51**	**635.59**	**1102.99**	**1097.54**	**1251.99**

Note: **:Included in Assam

#: Included in Offshore

Source: Petroleum and Natural Gas: Indian Petroleum and Natural Gas Statistics, 2010-11 and Petroleum and Natural Gas Statistics, 2016-17

These have been compiled using the following publications-

1. Coal & lignite: Provisional Coal Statistics, 2005-06 and Coal Directory of India 2007-08, 2009-10, 2015-16;
2. Petroleum and Natural Gas: Indian Petroleum and Natural Gas Statistics, 2010-11 and Petroleum and Natural Gas Statistics, 2016-17; and
3. Minerals: National Mineral Inventory at a Glance at 2005, 2010, and 2015.