

MINERAL RESOURCES IN INDIA

ECONOMIC GEOGRAPHY

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Mineral Resources in India

Earth's crust is made up of different metals, which are extracted from minerals. Almost everything is made up of minerals.

Minerals

- A Mineral is a natural substance of organic as well as inorganic origin with definite physical as well as chemical properties.
- Minerals are formed in various types of geological environment, under varying conditions.
- The natural process creates minerals without any human interference.
- They can be identified based on their physical properties such as density, color, hardness, and chemical properties such as solubility.
- Minerals are extracted from the ores.

Ore

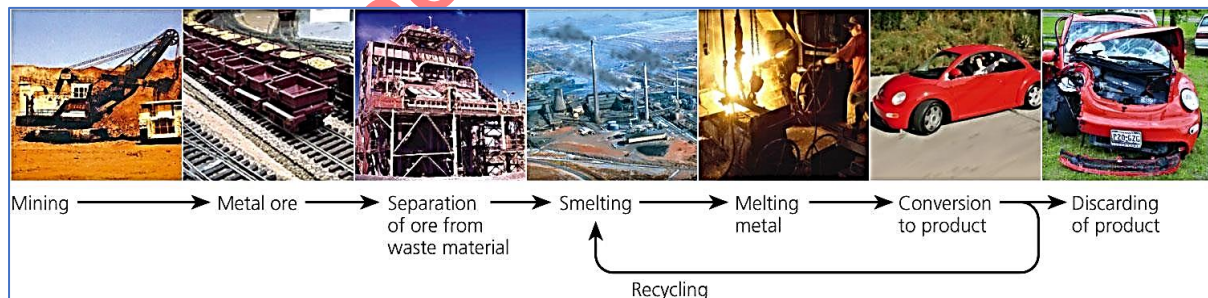
The ore is used to describe an accumulation of any minerals mixed with other elements.

For economical viable extraction, mineral content must be high.

Types of ores and their desired material extracted are:

- Magnetite - Iron
- Bauxite - Aluminium
- Limestone - Lime • Sandstone - Silica.

The Life Cycle of a Metal Resource



Importance of Minerals

- Minerals are the backbone of industrial development because of usage.
- Minerals are used for making tools, implements, machines, etc.
- Minerals are used in the manufacturing of jewelry, coins, utensils, decorative items, etc.
- Minerals are used for construction work.
- Minerals are used for health purposes.

In short, Minerals are used in many forms of life to lead a happy and comfortable life.

Properties of Minerals

- Minerals are non-renewable 'exhaustible' resources.
- Minerals are present in impure form and takes million of years to form.
- Minerals are distributed unevenly throughout the world.

How are minerals extracted?

Mining, Drilling, and Quarrying can extract minerals.

- **Mining:** Mining is the process of taking out minerals from rocks buried under the earth's surface
 - **Open Cast Mining:** The minerals that lie at a very low depth or shallow depths are taken out by removing the top layer or surface layer is known as "Open Cast Mining."
 - **Shaft Mining:** Deep bores, called shafts, have to be made to reach mineral deposits that lie at great depth. It is known as "Shaft Mining."
- **Drilling:** Petroleum and natural gas occur far below the earth's surface. Deep wells are bored to take them out; this is called "Drilling."
- **Quarrying:** Minerals that lie near the earth's surface are simply dug out by the process known as "Quarrying."

Distribution of Minerals

- Minerals are unevenly present on the earth's surface.
- All minerals are exhaustible, i.e., will exhaust after a certain time.
- However, these minerals take a long time to form, but they cannot be replenished immediately at the time of need.
- More than 97% of coal reserves occur in the valleys of Damodar, Sone, Mahanadi, and Godavari rivers.

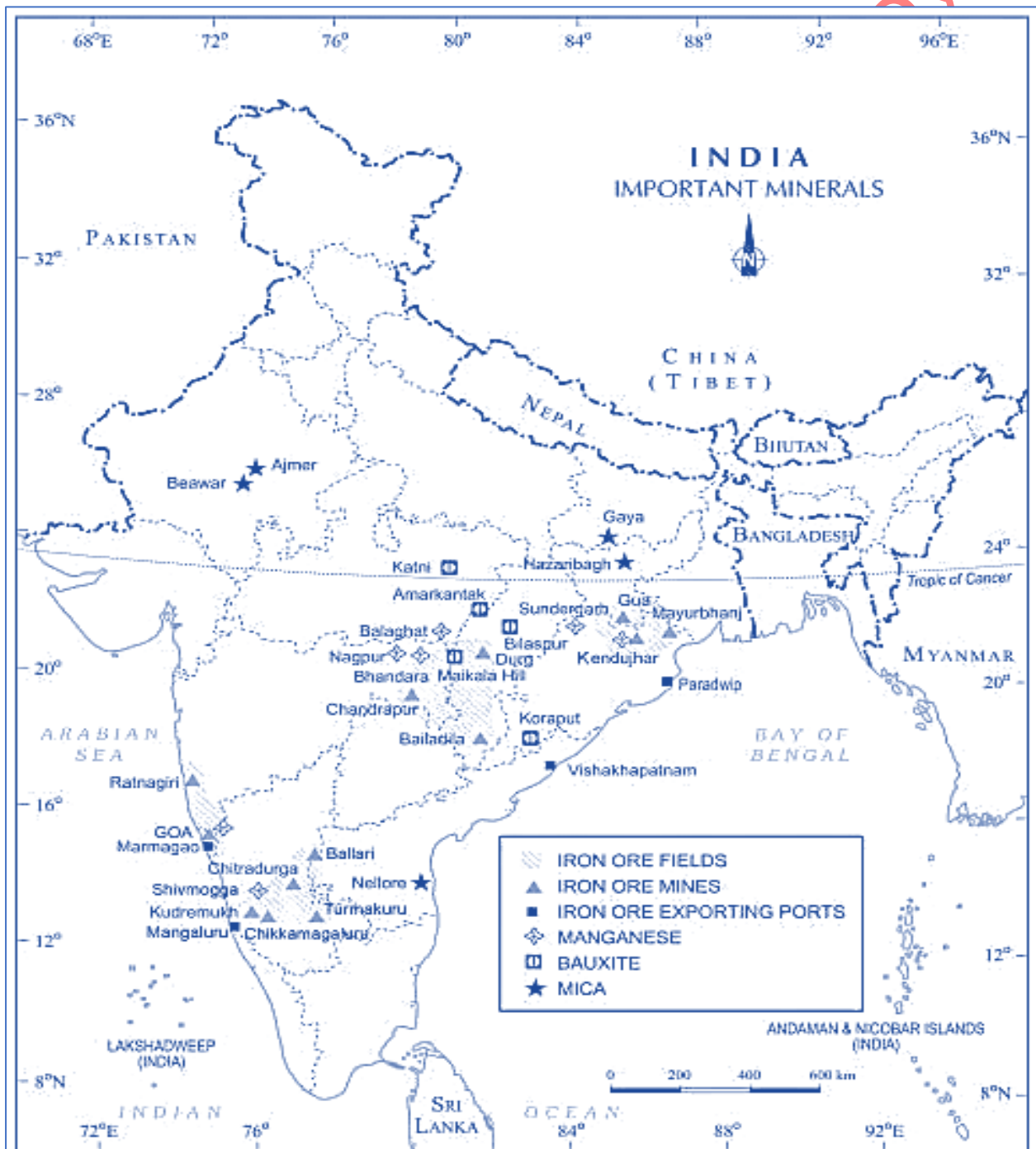
Petroleum reserves in India are located in the sedimentary basins of Assam, Gujarat, and Mumbai High

Mode of Occurrence of Minerals

Minerals are found in the following places:

- **In igneous and metamorphic rocks:** The smaller occurrences are called veins and the larger occurrences are called lodes. They are usually formed when minerals in liquid/molten and gaseous forms are forced upwards through cavities towards the earth's surface. Examples: tin, copper, zinc, lead, etc.
- **In sedimentary rocks:** In these rocks, minerals occur in beds or layers. Coal, iron ore, gypsum, potash salt and sodium salt are the minerals found in sedimentary rocks.

- **By decomposition of surface rocks:** Decomposition of surface rocks and removal of soluble constituents leaves a residual mass of weathered material which contains ores. Bauxite is formed in this way.
- **As alluvial deposits:** These minerals are found in sands of valley floors and the base of hills. These deposits are called placer deposits. They generally contain those minerals which are not corroded by water. Examples: gold, silver, tin, platinum, etc.
- **In ocean water:** Most of the minerals in ocean water are too widely diffused to be of economic importance. But common salt, magnesium and bromine are mainly derived from ocean waters.



Types of Minerals

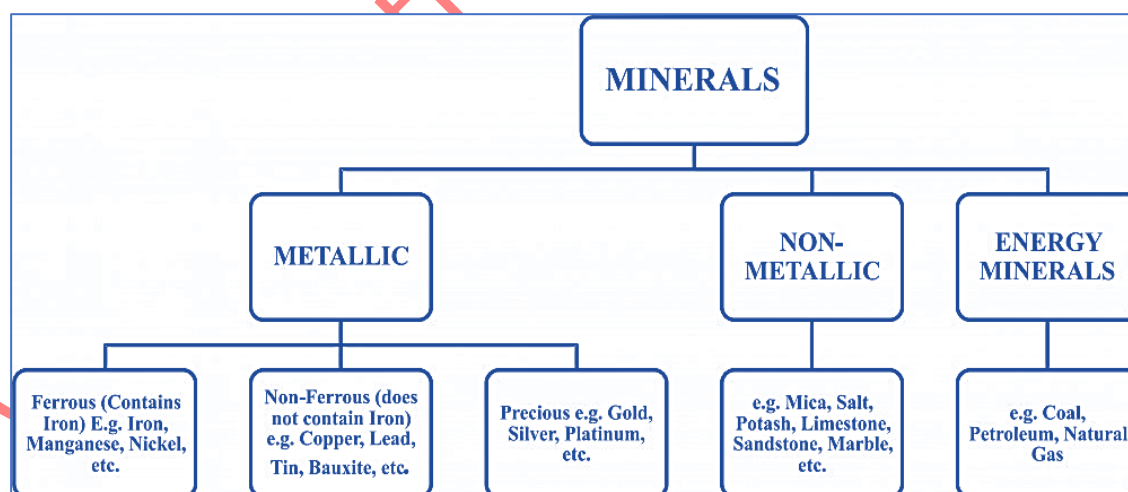
Over 2000 minerals have been identified, and only a few have been abundantly found. A basic classification for minerals is:

- Native elements. Eg. Gold, Silver, Mercury, graphite, diamond.
- Oxides. e.g., corundum (incl. sapphire), hematite, spinel.
- Hydroxides. Eg. Goethite, brucite.
- Sulfides. Eg. Pyrite, galena, sphalerite.
- Sulfates. Eg. Baryte, gypsum.
- Carbonates. Eg. Calcite, magnesite, dolomite.
- Phosphates. Eg. Apatite, monazite.
- Halides. Eg. Fluorite, halite (rock salt).
- Silicates (most common)
- Orthosilicates. Eg. Garnet, olivine.
- Ring silicates. Eg. Tourmaline, beryl.
- Chain silicates. Eg. Pyroxenes, amphiboles.
- Sheet silicates. Eg. Muscovite mica, biotite mica, clay minerals
- Framework silicates. Eg. Quartz, feldspars, zeolites

Classification of minerals based on chemical and physical properties

Minerals are classified into three types:

1. Metallic
2. Non-metallic
3. Energy resource



Metallic minerals:

- Metallic minerals are those minerals from which material extracted is of metallic nature
- Metallic minerals are further classified into:
 - Ferrous Minerals

- Non-Ferrous Minerals
- Precious Minerals

Ferrous Minerals

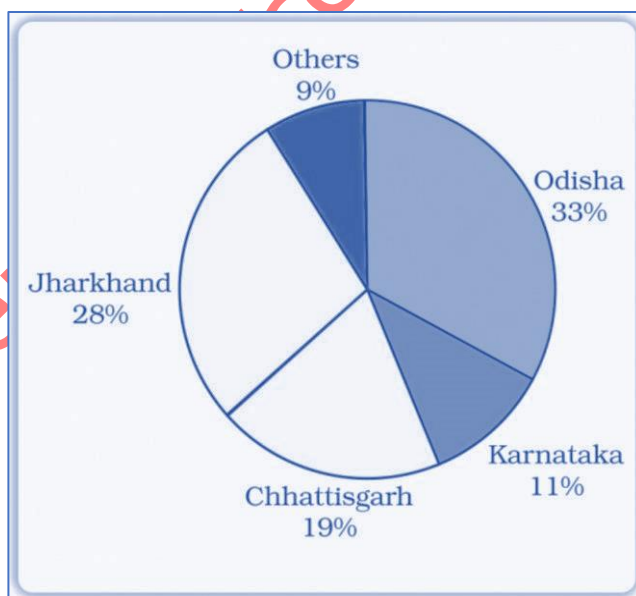
Ferrous minerals account for about three-fourths of the total value of the production of metallic minerals.

- Provide a strong base for the development of the metallurgical industry.
- India exports a good quantity of ferrous minerals.

IRON ORE is an example of ferrous minerals.

IRON ORE:

- Iron ore is the basic mineral and is the backbone of industrial development.
- India is rich in good quality iron ores.
- Magnetite is the finest iron ore with a very high content of iron up to 70%. It has excellent magnetic properties because of which it becomes very valuable for the electrical industry.
- Hematite ore is the most important industrial iron ore; in terms of quantity usage. The iron content of hematite is 50-60%.



Major Iron Ore Belts in India:

- Badampahar mines in the Mayurbhanj and Kendujhar districts of Orissa have high-grade hematite ore. Additionally, hematite iron ore is mined in Gua and Noamundi in Singhbhum district of Jharkhand.
- **Durg Bastar Chandrapur Belt:** This belt lies in Chhattisgarh and Maharashtra. The Bailadila range of hills in the Bastar district of Chhattisgarh has very high-grade hematite ore. This hilly range has 14 deposits of super high-grade hematite ore. Iron from these mines is exported to Japan and South Korea via Vishakapatnam port.
- **Bellary Chitradurga Chikmagalur Tumkur Belt:** This belt lies in Karnataka.

The Kudremukh mines located in the Western Ghats are a 100 percent export unit. The ore from these mines is transported as slurry through a pipeline to a port near Mangalore.

MANGANESE

Manganese is the other example of Ferrous Minerals.

- Manganese is mainly used in the manufacturing of steel and ferromanganese alloy.
- Nearly 10 kg of manganese is required to manufacture one tonne of steel.
- It is also used in manufacturing bleaching powder, insecticides, and paints.
- Odisha is the largest producer of manganese ores in India. It accounted for one-third of the country's total production in 2000-01.

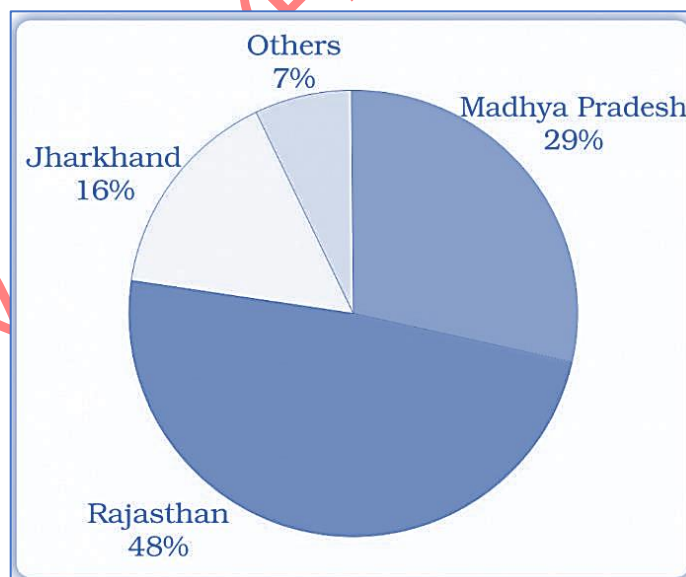
Non-ferrous Minerals

Copper, Bauxite, Lead, Zinc, Gold, etc.

- The availability of Non-Ferrous minerals in India is NOT of a satisfactory level.
- E.g., Copper, Bauxite, Lead, Zinc, Gold, etc.
- These minerals play a vital role in a number of metallurgical, engineering, and electrical industries.

COPPER

- Copper is mainly used in electrical cables, electronics, and chemical industries.
- Copper is a good conductor of electricity.
- India doesn't have good reserves of copper.
- **Leading producers of copper in India are:**
 - Khetri mines of Rajasthan.
 - The Balaghat mines in Madhya Pradesh.
 - Singhbhum district of Jharkhand.



BAUXITE

- Bauxite is a clay-like substance, out of which aluminum is obtained.
- Aluminum is incredibly popular because it is Lightweight, Strong, Durable, Ductile, Malleable, etc.
- Amarkantak Plateau, Maikal hills, and the plateau region of Bilaspur-Katni are the main areas of bauxite deposits.
- In 2009-10 Orissa was the largest producer of bauxite in India with 34.97%.
- Panchpatmali in Koraput district is the most important center of the bauxite deposit in Orissa.

- Aluminum is used in Automobiles, Aircraft, Spacecraft, Packaging (Cans, Foil, frame). Food and beverage containers, etc.

Diamond

Diamond deposits in India

Till now, all India resources of diamonds were placed at around 31.86 million carats.

By grades, about 2.37% of resources are of Gem variety, 2.64% of Industrial variety and the bulk of the resources (95%) are placed under the Unclassified category.

By States, the distribution of diamond deposits is as following

- Madhya Pradesh accounts for about 90.18% resources
- Andhra Pradesh 5.72%
- Chhattisgarh 4.09%

Diamond occurrences are reported since prehistoric times in the country. Presently, diamond fields of India are grouped into four regions:

- South Indian tract of Andhra Pradesh, comprising parts of Anantapur, Cuddapah, Guntur, Krishna, Mahabubnagar and Kurnool districts
- Central Indian tract of Madhya Pradesh, comprising Panna belt
- Behradin-Kodawali area in Raipur district and Tokapal, Dugapal, etc. areas in Bastar district of Chhattisgarh
- Eastern Indian tract mostly of Odisha, lying between Mahanadi and Godavari valleys.

In India, there is only one mine at Majhgaon in Panna (Madhya Pradesh) of NMDC for a production capacity of 84,000 carats and the total diamonds recovered from this mine so far are little more than 1 million carats.

Precious Minerals

Gold

Gold Deposits in India

In India, the total resources of gold ore are estimated at 494 million tonnes, of which 24 million tonnes only are placed in reserve category and the remaining 470 million tonnes under the resource category.

The total resource in terms of metal (primary gold) is at 659.84 tonnes.

By states, largest resources in terms of gold ore (primary) are located in

- Bihar (45%)
- Rajasthan (23%)
- Karnataka (22%)
- West Bengal (3%)

- Andhra Pradesh and Madhya Pradesh (2% each)
- The remaining 3% resources of ore are located in Chhattisgarh, Jharkhand, Kerala, Maharashtra, and Tamil Nadu.

In terms of metal content,

- Karnataka
- Rajasthan
- Bihar, Andhra Pradesh
- Jharkhand, etc.
- Karnataka (22): Kempinkote, Manighatta, South Kolar cluster mines, KGF west reefs, Hanni Ajjampur, Karajgi, Chinmulgund, Ganajur, Kuluvalli, Bhavihal, Mangalgatti, Lakkikoppa, Hiriyur, Hosur-Champion, Yeliserur, Hiremagur, Buddini Maski, Kadoni, Uti South-West, Hutti North-Prospect, Jainapur, Wandalli, and Surapalli
- Andhra Pradesh (5): Bhadrampalle, Ramapura, Venkatampalli, Chinnabhari, and Jibutil
- Madhya Pradesh (1): Gurharpahar Sankorwa
- Chhattisgarh (3): Sonakhan, Sonadehi, and Pathalgaon cluster
- Jharkhand (2): Parasi and Lawa

Silver

Silver Deposits in The World

- 80 % of all silver produced in the world comes as a by-product of industrial processes and so silver mining is concentrated in only a handful of countries.
- Exclusive silver mining forms a paltry 20% of overall silver production, with the main demand arising from industrial needs.
- Mexico is the world leader in terms of silver production from mines, followed by countries such as Peru, Australia, China, Chile, Bolivia, USA, and Russia, among others.
- Since the 1980s, silver production has been outpaced by consumption giving rise to rates over the years.

Silver Deposits in India

- **India is not a major producer of silver.**
- Imports drive most of the silver consumption in India.
- It generally occurs with lead, zinc, copper, and gold ores and is extracted as a by-product of electrolysis or chemical methods. The chief ore minerals of silver are Argentine, stephanite, pyrargyrite, and proustite.

By states, largest resources in terms of silver ore are located in

1. Rajasthan accounts (87%)
2. Jharkhand (5%)

3. Andhra Pradesh (4%)
4. Karnataka (2%).

In terms of production, the following states are the top producer of silvers in the country

1. Andhra Pradesh (42.43%)
2. Bihar-Jharkhand (32.18%)
3. Rajasthan (25.03%)
4. Karnataka (0.36%).

Non-Metallic

Graphite

- Graphite, also known as plumbago or blacklead or mineral carbon, is a stable form of naturally occurring carbon.
- Natural graphite is categorized into two commercial varieties (i) crystalline (flaky) graphite and (ii) amorphous graphite.
- Both flaky and amorphous varieties of graphite are produced in India.
- The quality of graphite depends upon its physical qualities and carbon content.
- Graphite is used as a raw material in a large number of industries such as crucible, foundry facing, dry cell battery, lubricants, pencils, and paints, etc.

Graphite deposits in India

India is the second-largest producer of graphite in the world, preceded by China. The total resources of graphite in India, till April 2013 is placed at about 188.67 million tonnes.

By states, total Graphite resources are distributed in the following manner: -

- Arunachal Pradesh accounts for 39% of the total resources
- Jammu & Kashmir (33%),
- Odisha (10%), Jharkhand (9%)
- Tamil Nadu (4%),

However, in terms of reserves,

1. Jharkhand has the leading share of about (52%)
2. Tamil Nadu (41%)
3. Odisha (6%)

Active mining centers of graphite are in

- **Jharkhand** - Latehar & Palamu districts
- **Odisha** - Bargarh, Nuapada, Rayagada & Balangir districts
- **Tamil Nadu** - Madurai & Sivagangai districts

Mica

- Mica is a mineral that is made up of a series of plates or leaves.
- The mica sheets can be so thin that a thousand of them can be layered into a few centimeter-thick mica sheets.
- Mica has excellent dielectric strength, low power loss factor, insulating properties, and resistance to high voltage.
- Mica is widely used in electric and electronic industries.
- Mica deposits are found on the northern edge of the Chota Nagpur plateau.
- Koderma-Gaya-Hazaribagh belt of Jharkhand is the leading producer of mica.
- Ajmer in Rajasthan and Nellore in Andhra Pradesh are the other important producers of mica

Limestone

- Limestone is found in sedimentary rocks of most geological formations.
- It is found in the association of rocks composed of calcium carbonates or calcium and magnesium carbonates.
- It is the base raw material for the cement industry.
- It is also used for the smelting of iron ore in the blast furnace.
- Major producers of Limestone in India are Karnataka, Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Rajasthan, and Gujarat.

There Are Several Ways to Remove Mineral Deposits (1)

- Surface mining
- Shallow deposits removed
- Overburden removed first
- Spoils: waste material
- Subsurface mining
- Deep deposits removed

There Are Several Ways to Remove Mineral Deposits (2)

- Type of surface mining used depends on
- Resource
- Local topography
- Types of surface mining
- Open-pit mining
- Strip mining
- Contour strip mining
- Mountaintop removal

Top Mineral Producer in India (State-wise) and Other Countries

MINERAL	TYPE	MINES	TOP PRODUCERS (STATES)	TOP PRODUCERS (COUNTRIES)
IRON ORE	Metallic (Ferrous)	Barabil – Koira Valley (Orissa) Bailadila Mine (Chattisgarh) Dalli-Rajhara (CH) – the largest mine in India	1. Odisha 2. Chattisgarh 3. Karnataka	1. China, 2. Australia, 3. Brazil 4. India
MANGANESE	Metallic (Ferrous)	Nagpur– Bhandara Region (Maharashtra) Gondite Mines (Orissa) Khondolite deposits (Orissa)	1. Odisha 2. Maharashtra	1. South Africa 2. Australia 3. China
CHROMITE	Metallic (Ferrous)	Sukinda Valley (Orissa) Hasan Region (Karnataka)	1. Odisha 2. Karnataka 3. Andhra Pradesh	1. South Africa 2. Kazakhstan 3. India
NICKEL	Metallic (Ferrous)	Sukinda Valley (Orissa) Singhbhum Region (Jharkhand)	1. Odisha 2. Jharkhand	1. Indonesia 2. Phillippines 3. Canada
COBALT	Metallic (Ferrous)	Singhbhum Region (Jharkhand) Kendujhar (Orissa) Tuensang (Nagaland)	1. Jharkhand 2. Odisha 3. Nagaland	1. Democratic Republic of Congo 2. China 3. Canada

BAUXITE	Metallic (NonFerrous)	Balangir (Orissa) Koraput (Orissa) Gumla (Jharkhand) Shahdol (Madhya Pradesh)	1. Odisha 2. Gujarat	1. Australia 2. China, 3. Brazil
COPPER	Metallic (NonFerrous)	Malanjkhand Belt (Madhya Pradesh) Khetri Belt (Rajasthan) Kho-Dariba (Rajasthan)	1. Madhya Pradesh 2. Rajasthan 3. Jharkhand	1. Chile 2. China 3. Peru
GOLD	Metallic (NonFerrous)	Kolar Gold Field (Karnataka) Hutti Gold Field (Karnataka) Ramagiri Mines (Andhra Pradesh) Sunarnarekha Sands (Jharkhand)	1. Karnataka 2. Jharkhand	1. China 2. USA 3. South Africa
SILVER	Metallic (NonFerrous)	Zawar Mines (Rajasthan) Tundoo Mines (Jharkhand) Kolar Gold Fields (Karnataka)	1. Rajasthan 2. Karnataka	1. Mexico 2. Peru 3. China

LEAD	Metallic (NonFerrous)	Rampura Aghucha (Rajasthan) Sindesar Mines (Rajasthan)	1. Rajasthan 2. Andhra Pradesh 3. Madhya Pradesh	1. China 2. Australia 3. USA
TIN	Metallic (NonFerrous)	Dantewada (Chhattisgarh)	Chhattisgarh (the only state in India)	1. China 2. Indonesia 3. Peru
MAGNESIUM	Metallic (NonFerrous)	Chalk Hills (Tamilnadu) Almora (Uttarakhand)	1. Tamil Nadu 2. Uttarakhand 3. Karnataka	1. China 2. Russia 3. Turkey
LIMESTONE	Non-Metallic	Jabalpur (Madhya Pradesh) Satna (Madhya Pradesh) Cuddapah (AP)	1. Madhya Pradesh 2. Rajasthan	1. China 2. USA 3. India
MICA	Non-Metallic	Gudur Mines (Andhra Pradesh) Aravalis (Rajasthan) Koderma (Jharkhand)	1. Andhra Pradesh 2. Rajasthan 3. Orissa	1. China 2. Russia

DOLOMITE	Non-Metallic	Bastar, Raigarh (Chhattisgarh) Bimitrapur (Orissa) Khammam Region (Andhra Pradesh)	1. Chattisgarh 2. Andhra Pradesh	1. India
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ASBESTOS	Non-Metallic	Pali (Rajasthan) – largest mine Cuddapah (Andhra Pradesh)	1. Rajasthan 2. Andhra Pradesh 3. Karnataka	1. Russia 2. China
KYANITE	Non-Metallic	Pavri Mines (Maharashtra) – Oldest kyanite mine in India Nawargaon Mines (Maharashtra)	1. Jharkhand 2. Maharashtra 3. Karnataka	1. USA 2. China 3. Japan
GYPSUM	Non-Metallic	Jodhpur, Bikaner, Jaisalmer Rajasthan	1. Rajasthan 2. Tamil Nadu 3. Gujarat	1. USA 2. China 3. Iran
DIAMOND	Non-Metallic	Majhgawan Panna Mines (Madhya Pradesh) – only active diamond mine in India	1. Madhya Pradesh – only diamond producing state	1. Russia 2. Botswana 3. Democratic Republic of Congo
COAL	Non-Metallic (Energy)	Korba Coalfield, Birampur – Chhattisgarh Jharia Coalfield, Bokaro Coalfield, Girdih – (Jharkhand) Talcher field – (Orissa) Singaruli coalfields (Madhya Pradesh)	1. Jharkhand 2. Orissa 3. Chattisgarh	1. China 2. USA 3. India

PETROLEUM	Non-Metallic (Energy)	Lunej, Ankleshwar, Kalol– Gujarat Mumbai high– Maharashtra – largest oil field Digboi–Assam– Oldest oil filed in India	1. Maharashtra 2. Gujarat	1. USA 2. Russia 3. Saudi Arabia
URANIUM	Atomic	Jaduguda mine (Jharkhand) Tummalapalle mine (Andhra Pradesh) – largest mine Domiasiat Mine (Meghalaya)	1. Andhra Pradesh 2. Jharkhand 3. Karnataka	1. Kazakhstan 2. Canada 3. Australia
THORIUM	Atomic		1. Kerala 2. Jharkhand 3. Bihar	1. Australia 2. USA 3. India

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