



**GS PRE CUM MAIN**

**FOUNDATION COURSE**  
*for CSE - 2021-22*

**GEOGRAPHY**

**MINERALS**

*by*

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## Resources

- Resources are anything either in the form of energy or any material useful for human being.
- Natural materials become resources when humans value them.
- It is a **dynamic** concept. The uses and values of resources change from culture to culture and from time to time. E.g. until human being did not know to harness Uranium it was not considered as a resource.
- Resources are spatially distributed varying in quantity and quality.
- Some resources are finite, while others can be replenished at varying rates. However, humans need to balance short-term rates of use against long-term availability to ensure a sustainable future.

## Mineral Resources

- Mineral resources are naturally occurring physical materials constituting part of Earth that people need and value. Generally resources are solid in nature but they are also in liquid form E.g. Crude oil.
- Mineral resources are classified in three types: **Metallic**, **Non-Metallic** and **Energy resources**.

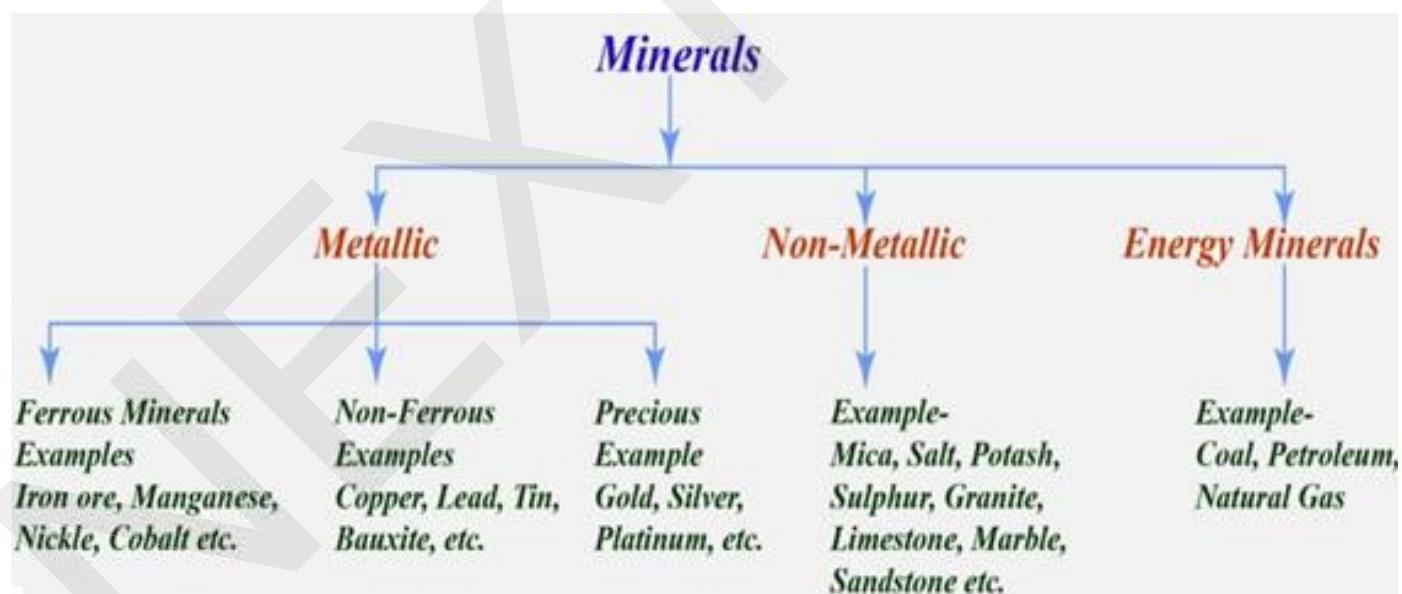


Figure 1: Classification of Minerals



Figure 2: Spatial distribution of minerals in India

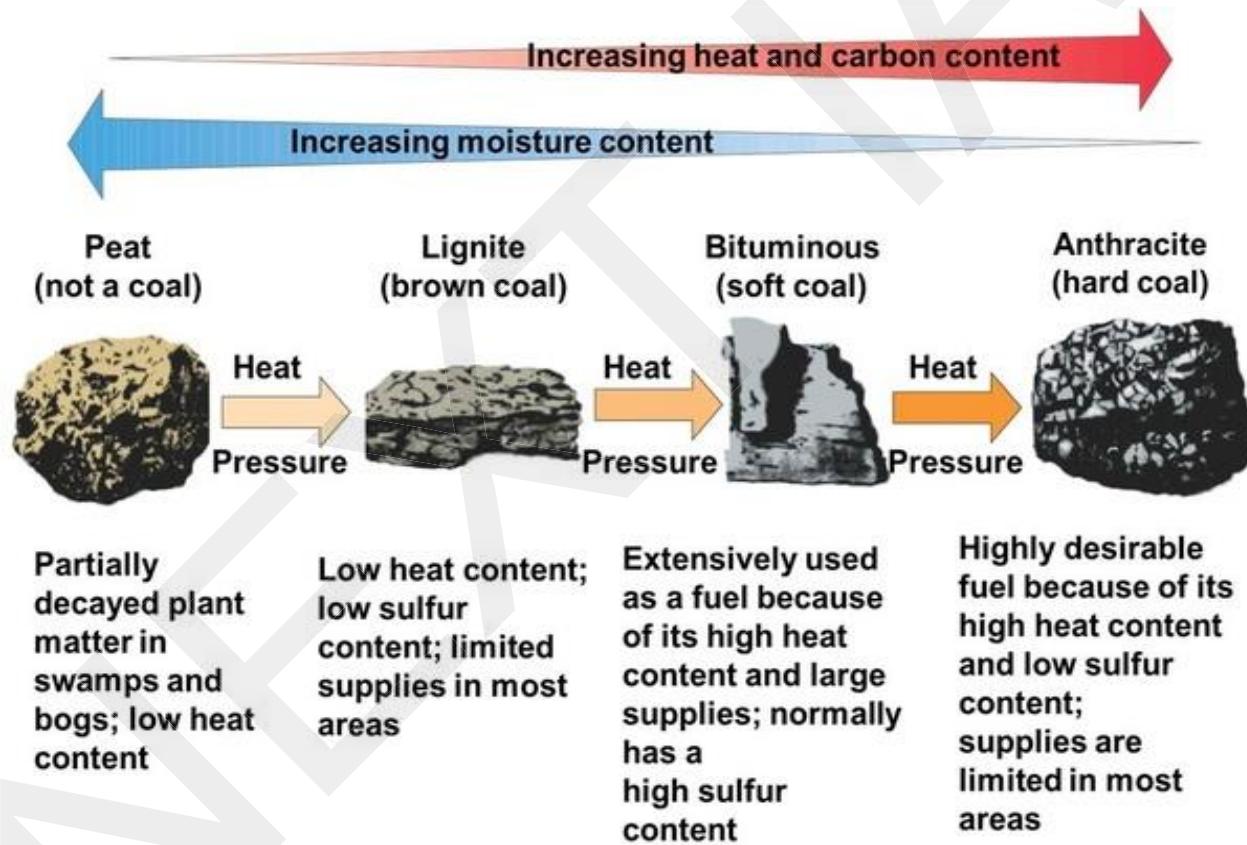
## Energy Resources

- Fossil Fuel
  - Coal
  - Crude Oil
  - Natural Gas
- Atomic Minerals

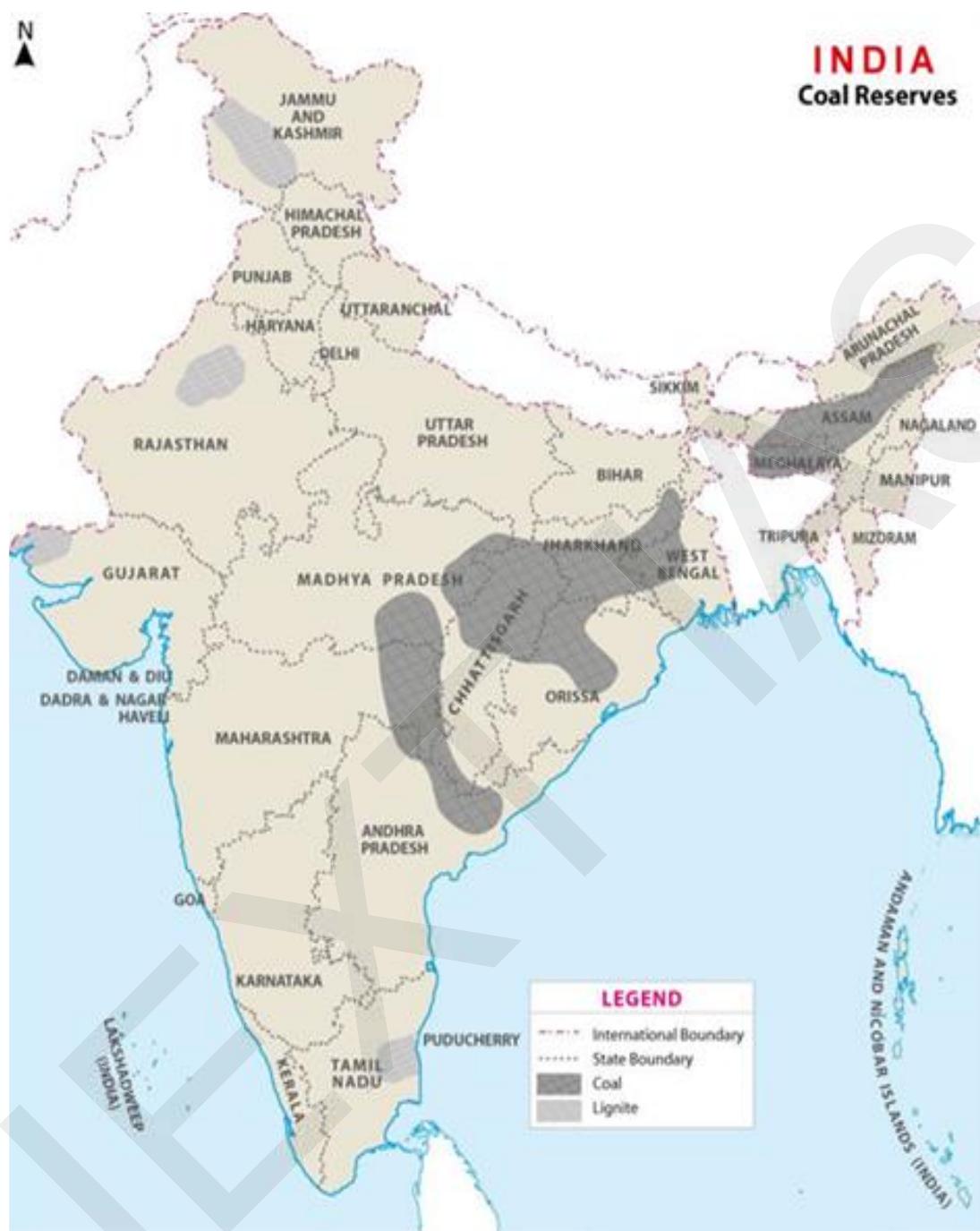
### Fossil Fuel

- **Coal**
  - Coal is a solid fossil fuel and a sedimentary rock composed primarily of Carbon.
  - It is primary or main source of energy in India.
  - Around 55% of electricity generation is from coal in India.
  - The maximum coal consumption worldwide is for thermal power plants. It is also used in Iron and Steel industry (coking coal) and Cement industry. The coal consumption in India is nearly 900 MT. In India, high grade coal is imported from Indonesia, Australia, etc.
  - India is a Coal rich country. Indian coal is mainly from Gondwana period. It is mainly in bituminous form.
  - In coal production, China is the largest producer and India comes second.
  - Total coal reserves wise U.S.A. is at the top in the world. Then chronologically come Russia, Australia, China and India and so on. (2020 data in MMT)
  - According to the Geological Survey of India the total coal reserve of India is 319 BT. The annual coal production in India is 750 MT.
  - In India coal reserves are found in the states of Jharkhand (Jharia coal field in Dhanbad district), Odisha, Chhattisgarh, West Bengal, Madhya Pradesh, Telangana, Maharashtra etc. (2018 data)
  - Coal distribution in India is mainly in low lying areas like river valleys (Godavari basin, Damodar basin, Son basin, Mahanadi basin, etc), old rift valley.
- **Formation of Coal**
  - It is associated with Low Land Areas.
  - Coal is formed from plants and vegetation buried 'in situ' or drifted in from outside to a place, which got covered by deposits of sediments.
  - Coal formation takes place in sedimentary rocks.
  - Since the plant material accumulated under water, in the swamps, decay was inhibited due to lack of oxygen. Methanogen bacteria partially decay the sediments.
  - Partial decay will lead to Peat formation (1st stage). It is youngest form of coal. It is not useful.

- Peat is changed into coal after many centuries of being compressed by the weight of sediments. It first changes into a low-grade coal known as Lignite /brown coal (2nd stage).
- Lignite coal has more water content and relatively hard in nature and emits smoke largely. The percentage of carbon in the lignite is higher than in peat. There are also deposits of Lignite in India, especially in North-East area, Rann of Kuttchh (Gujarat), and in Tamil Nadu (Neyveli mine).
- Continued pressure and heat from the earth changes Lignite into Bituminous (3rd stage). More than 95% of Indian coal is of bituminous form.
- If the heat and pressure were great enough, then Anthracite coal (4th stage) would be formed. It is hard coal which has the highest heat and carbon content. Accordingly, energy content is **greatest in anthracite coal and lowest in lignite**.



**Figure 3:** Types of Coal and their properties



**Figure 4: Coal Reserves in India**

- **History of Coal Mining in India**

- India has a long history of commercial coal mining covering nearly 220 years starting from 1774 by East India Company in the Raniganj Coalfield along the Western bank of river Damodar. It was the first coal mine of India.
- For about a century the growth of Indian coal mining remained sluggish for want of demand but the introduction of steam locomotives in 1853 gave a fillip to it.
- Coal Mines (special provisions) Act was introduced in 2015 to bring about transparency in coal sector. It also introduced e-auction for coal mines.

- In 1973 'Nationalization' had taken place and in 2015 'De-Nationalization' was done.
- In Parliament, The Mines and Minerals (Development and Regulation) Amendment Act was passed in March 2021. It amends the MMDR Act, 1957. MMDR Act, 1957 divides minerals into 2 parts-
  - **Major minerals**
    - (i) The major minerals cover fuel minerals consisting of coal, lignite, petroleum and natural gas and other major minerals i.e. metallic minerals including atomic minerals and non-metallic minerals.
    - (ii) **Mineral Conservation and Development Rules (MCDR), 1958** are applied on these minerals.
  - **Minor minerals**
    - (iii) Minor minerals are revised and notified from time to time in the Gazette of India.
    - (iv) These minerals fall outside the purview of MCDR Rules, their statistics are collected by the State Geological Departments under the **Minor Mineral Concession Rules** framed by the respective State Governments.

Major Minerals		Minor Minerals	
Fuel Minerals	Major Metallic Minerals	Major Non-Metallic Minerals	
Coal	Copper Ore	Diamond	Gypsum
Lignite	Iron Ore	Graphite	Mica
Petroleum (Crude)	Zinc	Asbestos	Quartz
Natural Gas	Chromite	Limestone	Bentonite
	Manganese Ore	Selenite	Marble

- <https://ibm.gov.in/?c=pages&m=index&id=1589>
- <https://mines.gov.in/writereaddata/UploadFile/Ebookonmineralssector635911539399033616.pdf>

**Table 1:** Major and Minor Minerals

- **Coal Mines of India**

Jharkhand	Jharia, Bokaro, Karnpura, Ramgarh mines
West Bengal	Raniganj mines
Odisha	Talcher, Ib coal mines
Madhya Pradesh	Singrauli coal mine
Telangana	Singareni mine
Chattisgarh	Korba mine

**Table 2:** Coal Mines in India

- **Mining types**

- **Underground mining**

- It is suitable for extraction of deeper coal seams.
- Underground coal production in India shows a declining trend as several underground mines are closed every year. It constituted only 6.74% in the financial year 2016-17.
- However, 60% of the total coal production in the world is from underground mines.

- **Open cast mining**

- It is suitable for extraction of shallow coal seams.
- Due to less production cost, mechanization and less wastage, opencast methods dominate in India (93.26% of the total production in the financial year 2016-17)

- **Rat hole mining**

- A rat hole mine comprises a deep vertical shaft with narrow horizontal tunnels, two to four feet in dimension, dug on its sides.
- Miners go into these horizontal tunnels for hundreds of feet to take out coal. It can be called a type of underground mining.
- Primitive tools are used to build and operate these mines. Here, accidents are common and most of them are not even reported.
- The National Green Tribunal (NGT) banned it in 2014, on grounds of it being **unscientific and unsafe** for workers.

**Impacts-**

- (i) The water sources of many rivers **turned acidic**.
- (ii) The water also has high concentration of **sulphates, iron and toxic heavy metals, low dissolved oxygen (DO) and high Biological Oxygen Demand (BOD)**, showing its degraded quality.
- (iii) The **roadside dumping of coal** is a major source of air, water and soil pollution.
- (iv) Off road movement of trucks and other vehicles in the area for coal transportation also adds to the environmental, ecological damage of the area.

- **Crude Oil**

- It is mainly made from Marine Fossils. Therefore, mostly found near coastal areas.
- In shallow water near continental shelf, algae get buried under the sediments. After millions of years crude oil gets formed. It can be found offshore (continental shelf) and onshore (on coastal land). In India crude oil is formed because of the Arabian Sea and the Tethys Sea (Assam, Rajasthan).
- In India it is found offshore in Mumbai high (Maharashtra), Ankleshwar (Gujarat), Digboi (Assam) (1st exploration by Britishers), Barmer (Rajasthan), Krishna-Godavari basin (Andhra Pradesh).
- 80% of the crude demand is fulfilled by imports from Iraq, USA, and Saudi Arabia.

- Crude oil exporting areas and countries – Persian Gulf region, Siberian/ Arctic region, Gulf of Mexico area, Caspian sea area, Venezuela, North sea near Norway.
- Crude oil is measured in ‘barrels’ and a barrel contain 159 liters of oil.
- There are 3 main crude oil benchmarks worldwide-
  - **Brent crude oil benchmark**
    - (v) Crude oil extracted from the North Sea near Norway and the United Kingdom is sold at the Brent Crude Oil Benchmark.
    - (vi) Crude oil of this region contains high percentage of Sulfur which is good to extract diesel of good quality.
  - **West Texas Intermediate (WTI) benchmark**
    - (vii) Oil of this benchmark is extracted from American oil wells.
    - (viii) It is transported through a pipeline and stored in Oklahoma, USA.
    - (ix) It is used to make low sulfur gasoline and low sulfur diesel.
  - **Dubai and Oman benchmark**
    - (x) Oil extracted from Arab countries is sold by referencing this benchmark.
- **Organization of Petroleum Exporting Countries (OPEC)**
  - OPEC is a **permanent, intergovernmental organization**, created at the **Baghdad Conference in 1960**, by **Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela**. It is headquartered in Vienna, Austria.
  - There are total 13 member countries. Other eight countries include- Libya, the United Arab Emirates, Algeria, Nigeria, Angola, Equatorial Guinea, Congo, and Gabon.
  - It aims to manage the supply of oil in an effort to set the price of oil in the world market, in order to avoid fluctuations that might affect the economies of both producing and purchasing countries.
  - OPEC membership is open to any country that is a substantial exporter of oil and which shares the ideals of the organization.
  - The non-OPEC countries which export crude oil are termed as OPEC plus countries.

**Figure 5:** OPEC member countries

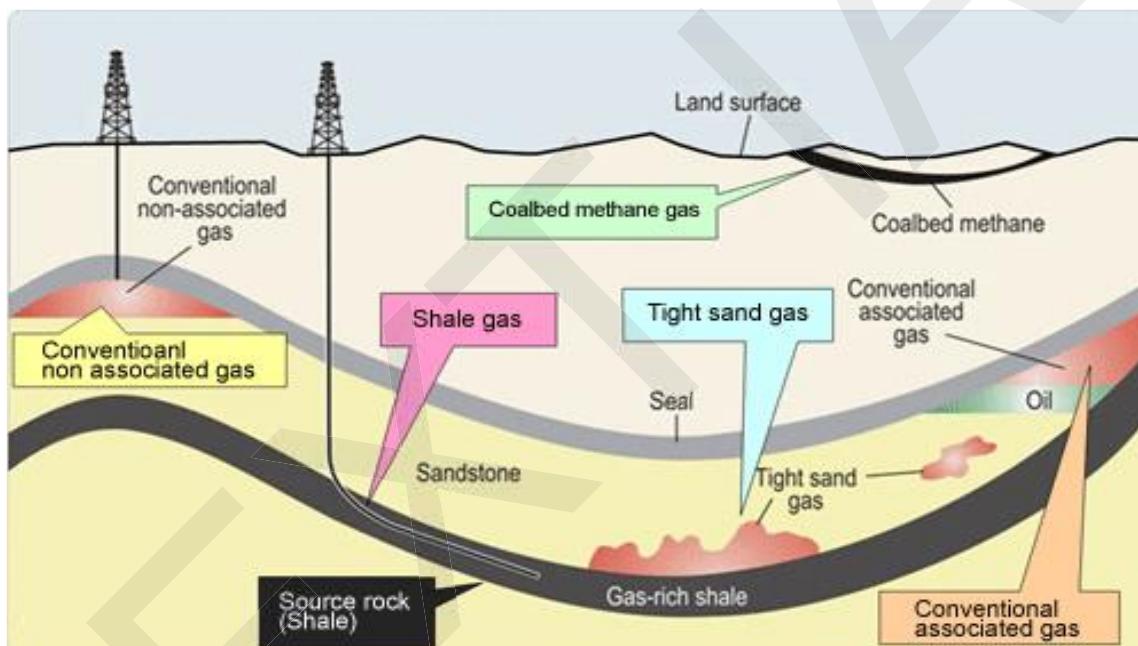
- **Production wise countries-**
  - 1<sup>st</sup> – U.S.A. (Shale rock oil)
  - 2nd – Saudi Arabia
  - 3rd – Russia
- **Consumption wise countries-**
  - 1<sup>st</sup>- U.S.A.
  - 2nd- China
  - 3rd- India
- **Importing countries-**
  - 1<sup>st</sup>- China
  - 2nd- U.S.A.
  - 3rd- India
- Top country in terms of total reserves- Venezuela
- In the last 5 years (2015-2020) because of technological advancement like **Fracking technology** in USA has help reducing the prices of crude oil.



**Figure 6:** Energy map of India

- **Natural Gas**
  - It is the cleanest fossil fuel and consists primarily of Methane. Propane, Butane, Pentane and Hexane are also present.
  - Its cost is less as compared to petrol and diesel.

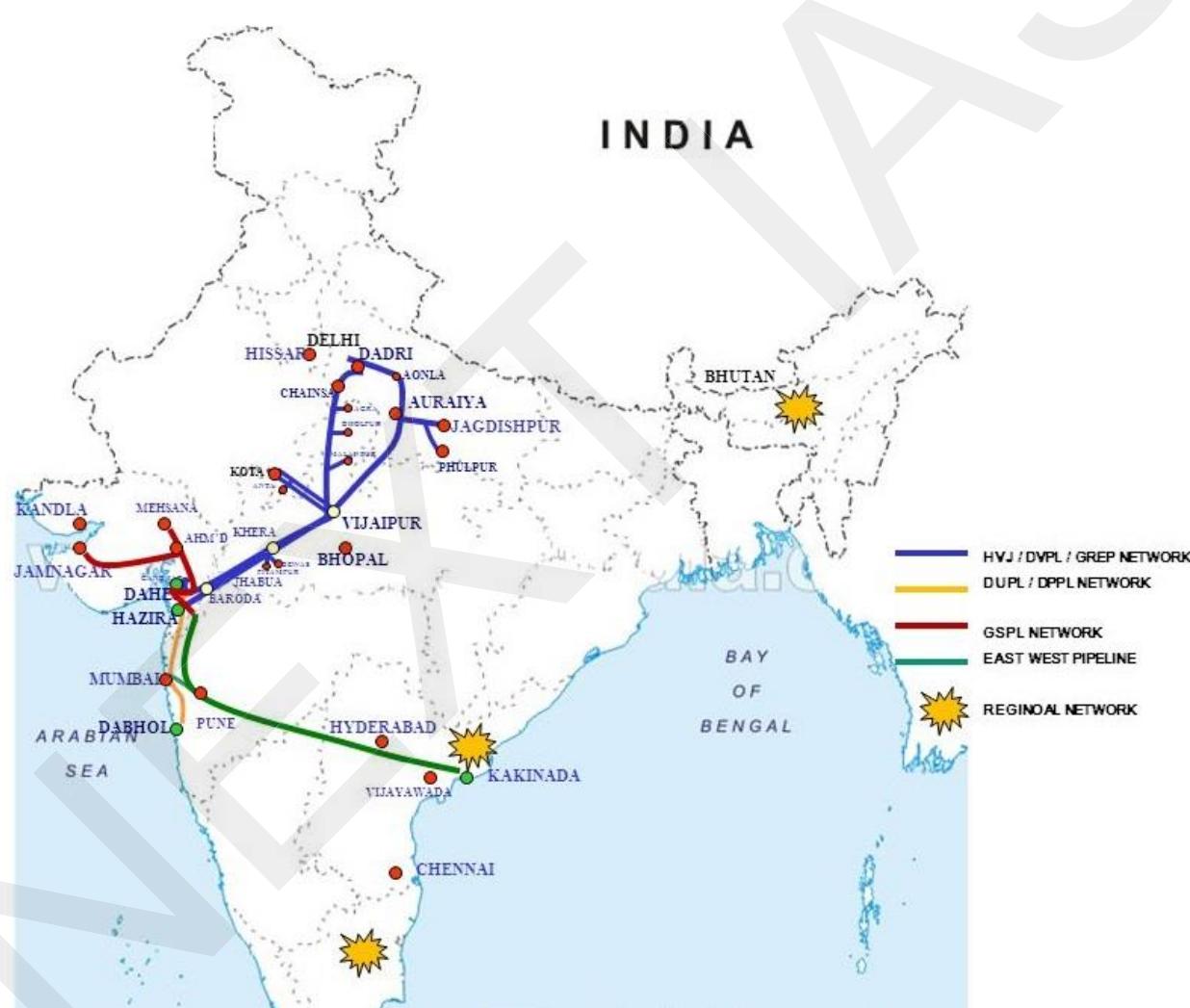
- Natural gas is found with petroleum deposits and is released when crude oil is brought to the surface. It can be used as a domestic and industrial fuel.
- In India, Jaisalmer, Krishna Godavari Basin, Tripura, Assam, Gulf of Khambhat, Cuddalore district of Tamil Nadu and some areas offshore in Mumbai have natural gas resources.
- The world average share of natural gas in the energy basket is 23%, it is only 6% for India.
- **Natural Gas Formation**
  - Natural gas was formed millions of years ago when plants and tiny sea animals were buried by sand and rock.
  - Layers of mud, sand, rock, plant, and animal matter continued to build up until the pressure and heat turned them into oil and natural gas.



**Figure 7:** Natural Gas reserves and extraction process

- India import largely from gulf countries like Oman, Saudi Arabia. The Import of Natural gas by India is nearly 25%.
- Natural gas reserves wise Russia and production wise U.S.A. is the top country in the world.
- Liquefied petroleum gas (LPG) is a Mixture of Butane and Propane.
- Piped natural gas (PNG) is better than LPG because of less pollution.
- Chemically, Shale gas is similar to Natural gas, the only difference is shale gas is associated with shale rock and Natural gas is associated with limestone, sandstone etc.
- Often natural gases contain substantial quantities of Hydrogen Sulfide or other organic sulfur compounds. In this case, the gas is known as "sour gas."
- Coal-bed methane is called 'sweet gases' because of lack of hydrogen sulfide.

- On the market, natural gas is usually bought and sold not by volume but by calorific value.
- In practice, purchases of natural gas are usually denoted as MMBTUs (millions of British thermal unit (BTU or Btu)) = ~1,000 cubic feet of natural gas.
- **Natural Gas Pipelines**
  - **Hajira-Vijaypur-Jagdishpur (HVJ) Gas Pipeline**
    - This pipeline has been constructed by Gas Authority of India Limited (GAIL) to transport gas.
    - It is 1,750 km long and connects Hazira in Gujarat to Vijaipur in Madhya Pradesh and Jagdishpur in Uttar Pradesh.



**Figure 8: HVJ Pipeline**

- **Jamnagar-Loni LPG Pipeline**
  - This 1,269 km long pipeline has been constructed by Gas Authority of India Limited (GAIL).
  - It connects Jamnagar in Gujarat to Loni near Delhi in U.P. and passes through the states of Gujarat, Rajasthan, Haryana and U.P.

- Pradhan Mantri Urja Ganga Project
  - It is a natural gas pipeline of length 2540 km and is under construction from the states of Uttar Pradesh to Odisha.
  - The state of UP gets the gas line of length 338 km. Bihar state will get about 441 km long line. Jharkhand, a state in east India, gets 500 KM long and another state in eastern India, West Bengal, will have the pipe line of length 542 km and Odisha gets benefited by 718 km pipeline as per the specifications of project details issued in public.
  - The project is committed to provide the household members health safety by providing clean fuel with the piped gas to the locals of Varanasi and later to [Bihar](#), [Jharkhand](#), [West Bengal](#) and [Odisha](#).



**Figure 9:** Coverage of PM Urja Ganga Pipeline Project

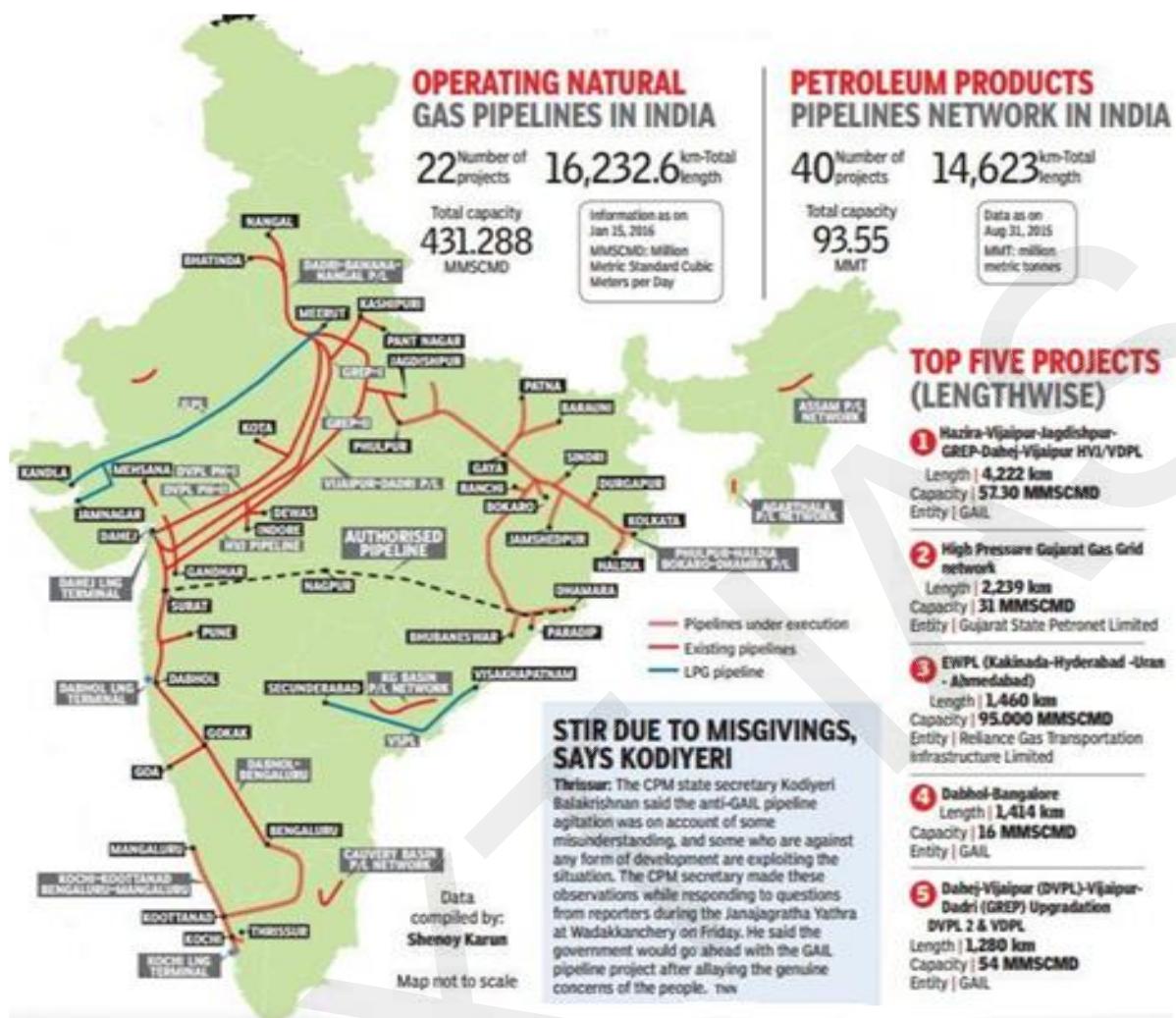


Figure 10: Natural Gas Pipeline infrastructure in India

Natural gas pipelines

<https://www.henergy.com/wp-content/uploads/2019/07/india-map.jpg>

### TAPI Project

- TAPI Pipeline, also called **Peace pipeline**, is a 1,814km natural gas pipeline that originates from Turkmenistan and passes through Afghanistan and Pakistan to reach India.
- It aims to monetize Turkmenistan's gas reserves and supply them to neighboring countries to promote the use of natural gas and improve energy security.
- The project is being developed by **TAPI Pipeline Company (TPCL)**, a consortium established by four individual state-owned gas companies Turkmengaz (Turkmenistan), Afghan Gas (Afghanistan), Interstate Gas Service (Pakistan), and **Gas Authority of India and Indian Oil (India)**.



**Figure 11:** Trans-Afghanistan Pipeline (TAPI Pipeline)

- **Shale Gas**
  - Shales are fine-grained sedimentary rocks that can be rich sources of petroleum and natural gas.
  - Shale gas refers to natural gas that is trapped within these shale formations.
  - **Formation**
    - The low permeability of the shale greatly inhibits the gas from migrating to more permeable reservoir rocks higher.
  - **Extraction**
    - Over the past decade, the combination of horizontal drilling and hydraulic fracturing has allowed access to large volumes of shale gas the potential of which was unutilized for long.
    - Without these, shale gas production would have been economically unfeasible because the natural gas would not flow from the formation at high enough rates to justify the cost of drilling as in the case of conventional oil.
  - Shale oil and conventional crude oil have different kinds of impurities.

## Shale gas reserves all over the world

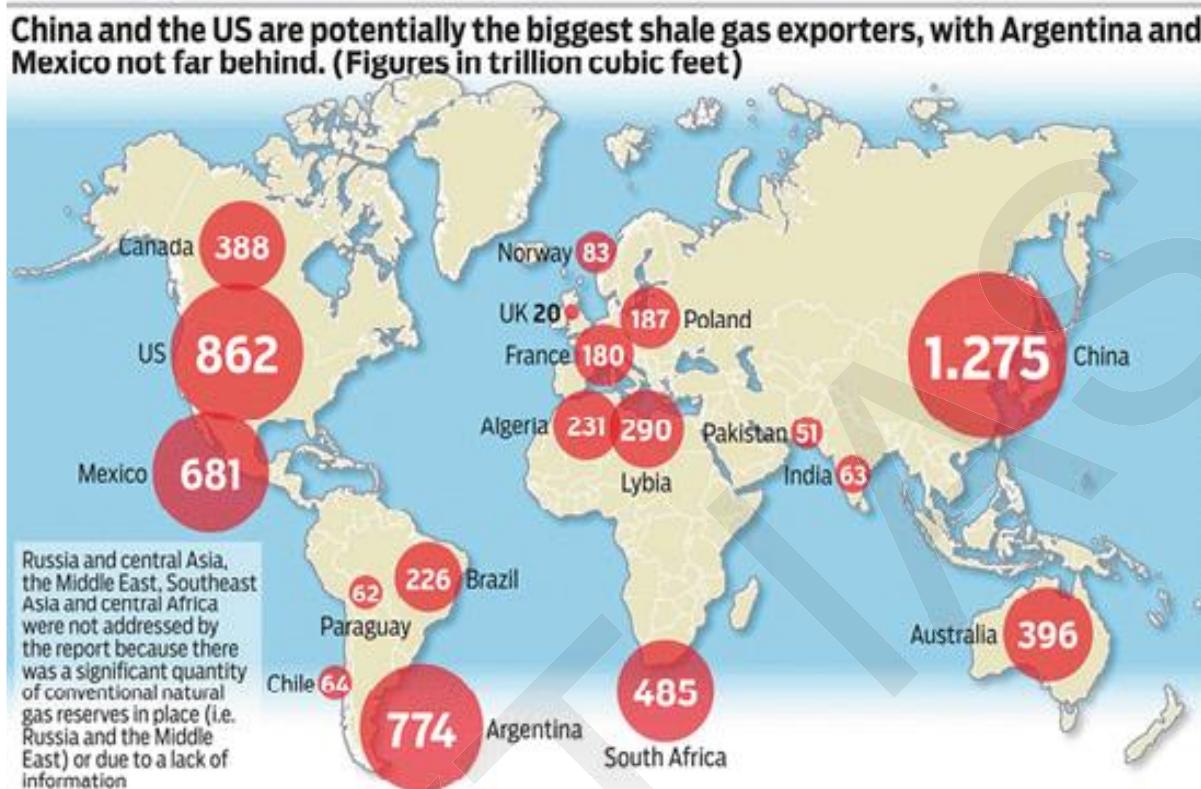


Figure 12: Shale Gas reserves in the world

- **Hydraulic Fracturing**

- Known as Fracking, this is a process in which more than a million gallons of fluid is injected into rock formations.
- This fractures the rock and stimulates the flow of natural gas or oil, thus increasing the volumes of gas or oil that can be recovered above ground.
- The fluid used in hydraulic fracturing commonly consists of water, Proppant and chemical additives.
- A Proppant is a solid material, typically sand, ceramic pellets or other small particles, designed to keep an induced hydraulic fracture open.
- The chemically induced fractures can extend several hundred feet away from the wellbore.

### Atomic Minerals

- **Uranium and Thorium** are the main atomic minerals. Other atomic minerals are beryllium, lithium and zirconium.
- India has no significant reserves of Uranium. All needs are met through imports.
- Uranium deposits occur in **Tummalapalle mine in Andhra Pradesh, Jadugoda mine of Jharkhand**, some uranium is found in the copper mines of Udaipur in Rajasthan. etc.

- India imports uranium from **Kazakhstan, Australia, Canada, Namibia** etc.
- Production wise Kazakhstan is the top country and in terms of total reserve Australia ranks first.
- The largest sources of Thorium comprise the **monazite sands**.
- Monazite sands occur on east and west coasts and in some places in Bihar. But the largest concentration of **monazite** sand is on the **Kerala coast**. It is also found in Odisha coast and Tamil Nadu coast.
- Atomic Minerals are used in Nuclear Energy, Nuclear Power Plant, Weapon, Military Purposes etc. These are the most-important non-fossil energy resources.
- Atomic Mineral Directorate for Exploration and Research (AMD) is headquartered in **Hyderabad**.

### Metallic Minerals

Metallic minerals are divided into two categories-

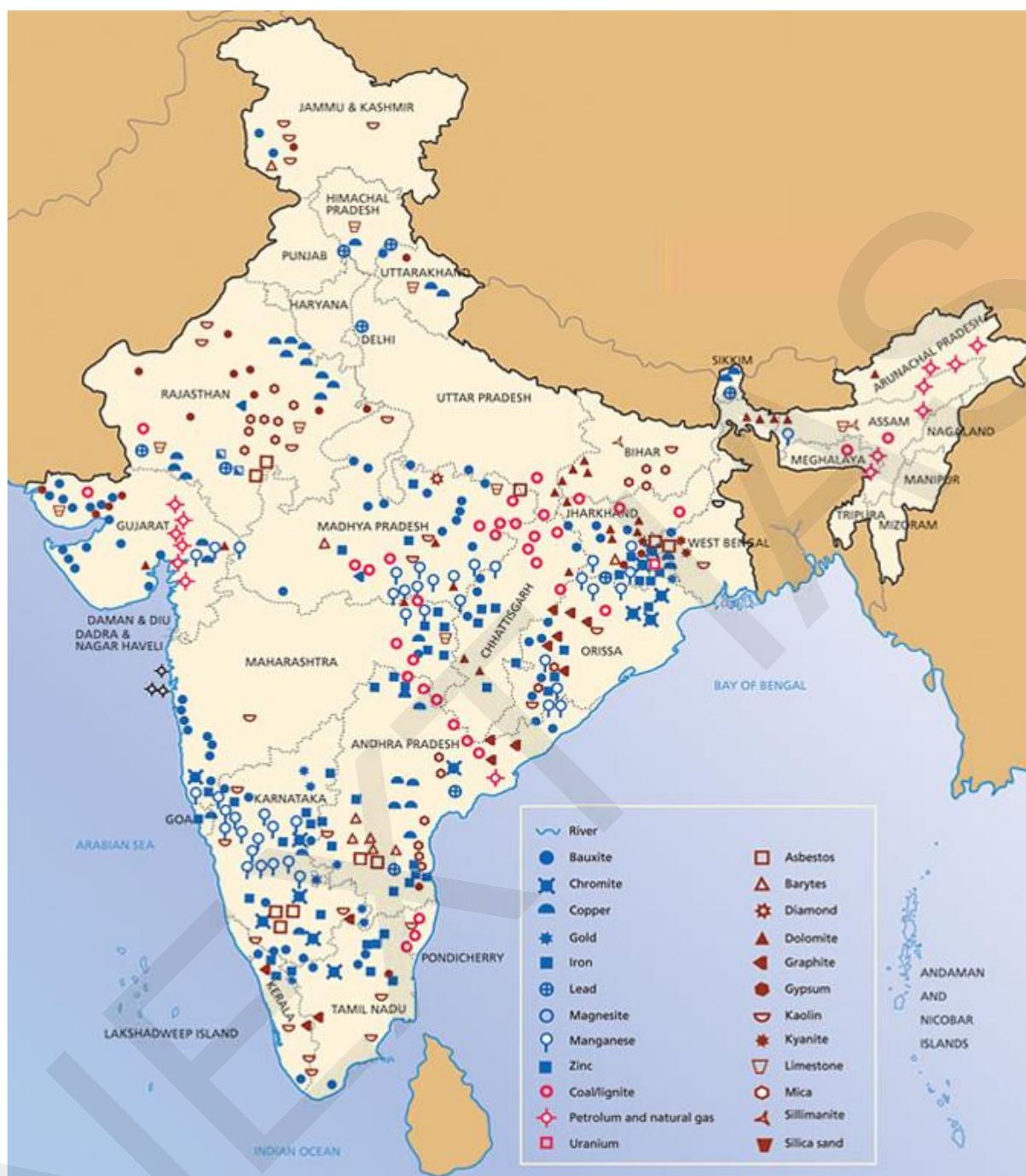
- Ferrous**
  - Iron, Manganese, Chromium, Cobalt**
  - India** is rich in Iron, Manganese and Chromium.
- Iron**
  - In impure form it is called as Iron ore (Ore is impure form of metal).**
  - Famous ores of Iron are-
    - Magnetite** ( $Fe_3O_4$ ) - 60-72% Iron content
    - Hematite** ( $Fe_2O_3$ ) - 60-70% Iron. India is rich in Hematite.
    - Limonite** ( $FeO(OH).nH_2O$ ) - Approximately 50% Iron
    - Siderite** ( $FeCO_3$ ) - Less than 50% Iron

Minerals	Chemical Formula	% of Iron
<b>Hematite</b>	$Fe_2O_3$	70.0
<b>Magnetite</b>	$Fe_3O_4$	72.4
<b>Limonite</b>	$2Fe_2O_3.3H_2O$	59.8
<b>Siderite</b>	$FeCO_3$	48.2

**Table 3:** Iron Ores and their chemical composition

- India is rich in Iron reserves. Worldwide reserves (2019 data)-
  - 1st - Australia
  - 2nd- Brazil
  - 3rd -China
  - 4th - India
  - 5th - Russia

- Production wise China ranks first.
- In India iron is found in Chotanagpur plateau (Odisha leads in India). In Odisha, it is found in districts of Keonjhar (Kiriburu mine), Sundargarh (Barabil-koira mine), and Mayurbhanj (Badampahar mine). Iron from these areas is used in steel plant of Jamshedpur, Bokaro, Rourkela, and Durgapur. In Jharkhand, west Singhbhum district is famous for Naomundi mines. In Chhattisgarh, Bastar plateau, Dantewada district, Bailadila mine (famous for its Export). Karnataka -Bababudan hill Chikmagalur area, Bellari hospet area etc. Goa also has iron ore.
- India exports its Iron to Japan, European countries, China etc.
- **Manganese**
  - India is rich in Manganese deposits.
  - In India it is found in Odisha (Kalahandi, Bolangir, Koraput (KBK region)), Madhya Pradesh (Balaghat, Chindwada), Maharashtra(Nagpur, nhandara)
  - Manganese (Mn) is used in Batteries and to make Hard steel.
  - The Countries leading in Manganese are Zimbabwe, Russia, China, Australia and India.
- **Chromium**
  - It is found in Chromium ore.
  - Chromium is a major mineral
  - It is found in Odisha (Sukinda (nearly 90%)).
  - India is in the top three in terms of Chromium reserve.
  - Worldwide reserves (Shipping grade)-
    - 1st - Kazakhstan (41%)
    - 2nd - South Africa (36%)
    - 3rd - India (18%)
- **Cobalt**
  - Occurrences of Cobalt are reported from Singhbhum District, Jharkhand; Kendujhar and Jajpur districts, Odisha; Jhunjhunu district, Rajasthan; Tuensang district, Nagaland, Jhabua and Hoshangabad districts, Madhya Pradesh. These reserves are not enough for Indian consumption so India also imports Cobalt.
  - It is used in Lithium-Ion batteries. Lithium Ion reserves are rich in countries like Bolivia, Argentina, Chile. This area forms South American Triangle.
  - Democratic Republic of Congo is the leading producer of Cobalt.



**Figure 13:** Metallic and non-metallic mineral distribution in India

[http://ismenvis.nic.in/WriteReadData/UserFiles/image/Miscellaneous/political\\_minerals%20map\(1\).jpg](http://ismenvis.nic.in/WriteReadData/UserFiles/image/Miscellaneous/political_minerals%20map(1).jpg)

- **Non-Ferrous**
  - Bauxite, Gold, Silver, Copper, Lead etc.
- **Bauxite**
  - India is rich in Bauxite.
  - Bauxite is an ore of Aluminium.
  - In India, the state which is rich in Bauxite is Odisha (KBK region).

- In terms of reserves, Guinea in Africa continent tops the chart. The country which comes next is Australia.
  - In terms of Production, Australia ranks first.
  - In terms of Aluminium Production, China ranks first.
- **Gold**
    - In India gold is found in Karnataka (Kolar gold field-now shut down- deepest mine of India, Huttis mines), Andhra Pradesh (Ramgiri mines) etc.
    - Worldwide Australia ranks first in gold reserve.
    - In terms of Production, China ranks first. South Africa was at top till recent years.
    - China and India are top importers of gold.
  - **Diamond**
    - It comes in non-metallic category.
    - In coal area, high pressure lead to formation of diamond
    - Kimberley Diamond is the purest form of diamond.
    - The countries famous for diamond are Democratic Republic of Congo, South Africa, Botswana
    - In India Panna region of Madhya Pradesh, Andhra Pradesh (Kohinoor from Golconda region), Telangana are source of Diamond.
  - **Copper**
    - Copper is found mainly in
      - I. Madhya Pradesh (Malanjkhand in Balaghat district)
      - II. Rajasthan (Khetri mine in Jhunjhunu district. It is the oldest mine of India)
      - III. Jharkhand (Musabani mine in east Singhbhum)
    - Ores of copper are Cuprite and Chalcopyrite.
    - Copper ore has very less impurity.
    - Chile is top in copper reserve and production. Atacama Desert in Chile is famous for Copper.
  - **Mica**
    - It is a non-metal.
    - Mica is a very good insulator that has a wide range of applications in electrical and electronics industry.
    - India is one of the foremost suppliers of Mica to the world.
    - Mica-bearing igneous rocks occur in Andhra Pradesh, Bihar, Jharkhand, Maharashtra, and Rajasthan.
    - India is top in Sheet Mica production.
    - Nellore in Andhra Pradesh is first in India in production and Kodarma district of Jharkhand is second.
    - Mica of white color called as ruby mica or muscovite, pink color mica is called as Biotite.

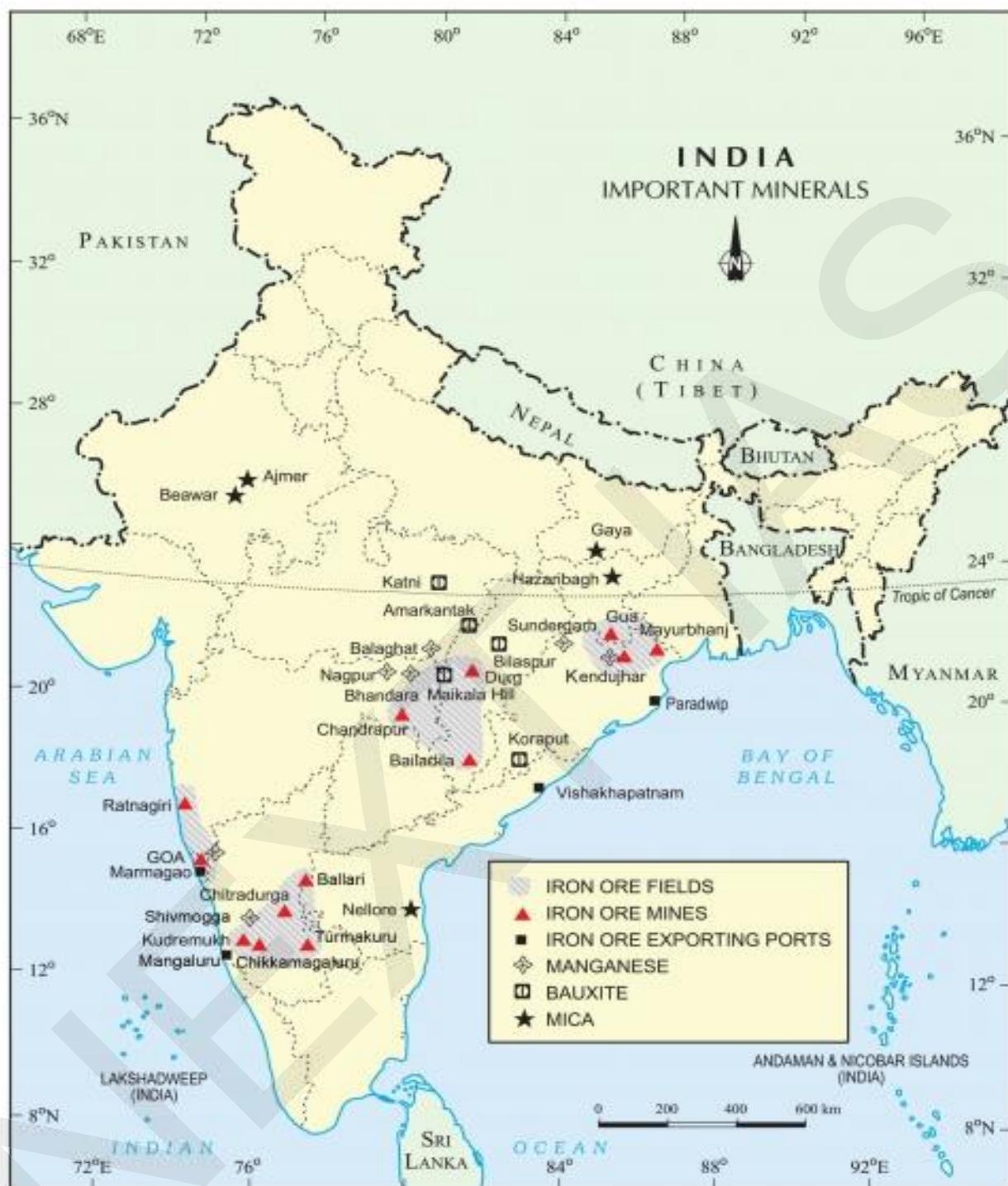


Figure 14: Mica distribution in India

### Rare Earth Metals/ Rare Earth minerals/ Rare Earth elements (REE)

- These are strategic minerals.
- These are a set of 17 nearly indistinguishable lustrous silvery-white soft heavy metals.
- It includes Scandium, Yttrium and elements of the Lanthanide series (15 elements).

- Rare-earth elements (REE) are necessary components of more than 200 products across a wide range of applications, especially high-tech consumer products, such as cellular telephones, computer hard drives, electric and hybrid vehicles, and flat-screen monitors and televisions.
- Significant defense applications include electronic displays, guidance systems, lasers, and radar and sonar systems.
- The amount of REE used in a product may not be a significant part of that product by weight, value, or volume, the REE can be necessary for the device to function. For example, magnets made of REE often represent only a small fraction of the total weight, but without them, the spindle motors and voice coils of desktops and laptops would not be possible.
- World-wise reserves of Rare Earth minerals-
  - 1st- China
  - 2nd- Vietnam
  - 3rd- Russia
  - 4th- Brazil
  - 5th- India
- **Monazite – Rare Earth Metals**
  - Monazite is a reddish-brown phosphate mineral containing rare earth metals.
  - Rare earths are a series of chemical elements found in the Earth's crust that are vital to many modern technologies, including consumer electronics, computers and networks, communications, clean energy, advanced transportation, health care, environmental mitigation, national defense, and many others.
  - Because of their unique magnetic, luminescent, and electrochemical properties, these elements help make many technologies perform with reduced weight, reduced emissions, and energy consumption; or give them greater efficiency, performance, miniaturization, speed, durability, and thermal stability.
- **In India**
  - India has the fifth-largest reserves of rare earth minerals in the world.
  - Indian Rare Earths Ltd. under the Department of Atomic Energy is the sole producer of rare earth compounds.
  - Monazite soils (thorium and some rare earth elements can be extracted from it) is found in Kerala, Tamil Nadu, Orissa etc.

- **Vanadium**

- China is the top country, Russia the second and South Africa is third country in the production of Vanadium.
- In India, north eastern states of Assam and Arunachal Pradesh are the leading producers.
- Vanadium is used in hardening of steel and large size battery production.

### **Government measures**

#### **1. Mines and Minerals Development and Regulation Act (MMDRA) 1957**

- This act forms the basic framework of mining regulation in India.
- This act is applicable to all mineral except minor minerals and atomic minerals.
- It details the process and conditions for acquiring a mining or prospecting license in India.
- Mining minor minerals comes under the purview of state governments.

#### **2. MMDR Amendment Act, 2015**

- It seeks to introduce a system of auctions to allocate mining licenses.
- A fixed percentage to the revenue of any mine will be allocated to development of the area around it, to be called a District Mineral Foundation (DMF).
- A National Mineral Exploration Trust will be set up to explore and promote non-coal minerals. It will be funded by a 2% levy from mining license holders.
- The licenses will have a validity of 50 years, compared to the previous 30 years.
- There will be no renewal of licenses, only the option of re-auction will be available.
- The mining and prospecting-cum-mining licenses may be transferred to another party by notifying the state government. The state government may charge a fee for such transfers.
- The amendment will make illegal mining, trespassing and violation of norms, a cognizable offence punishable up to 2 years imprisonment and/or fine.
- The state government will be allowed to set up special courts for such trials.

#### **District Mineral Foundation**

- (i) These are statutory bodies which work as a non-profit trust for the interest and benefit of persons and areas affected by mining related operations in such manner as may be prescribed by the State Government.
- (ii) Some “high priority” issues for DMFs are-
  - Drinking water
  - Health
  - Women and child welfare
  - Education
  - Livelihood and skill development
  - Welfare of aged and disabled
  - Sanitation

### 3. Pradhan Mantri Khanij Kshetra Kalyan Yojana (PMKKKY)

- The scheme is meant to provide for the welfare of areas and people affected by mining related operations, using the funds generated by District Mineral Foundations (DMFs).
- Objectives of the scheme are:
  - To implement various developmental and welfare projects/programs in mining affected areas that complement the existing ongoing schemes/projects of State and Central Government.
  - To minimize/mitigate the adverse impacts, during and after mining, on the environment, health and socio-economics of people in mining districts.
  - To ensure long term sustainable livelihoods for the affected people in mining areas.