# Indian Minerals Yearbook 2020

## (Part- III : MINERAL REVIEWS)

## 59th Edition

# RARE EARTHS

## (ADVANCE RELEASE)

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**May, 2022**

# 24 Rare Earths

The term "rare earth" arises from the minerals from which they were first isolated, which are common oxide-type minerals (earths) found in Gadolinite extracted from one mine in the village of Ytterby, Sweden. However, with the exception of the highly-unstable promethium, rare-earth elements are found in relatively high concentrations in the earth's crust with cerium being 25$^{th}$ most abundant element in the earth's crust at 68 parts per million.

Rare Earths are a group of 17 elements starting with lanthanum in the periodic table of elements and include scandium and yttrium. They are moderately abundant in earth's crust but not concentrated enough to make them economically exploitable. The REEs find key applications in defence, electronics, energy systems etc. For instance, magnets made from rare earths are many times more powerful than conventional ones. Along with energy critical elements (ECE), such as, lithium which has become ubiquitous battery material, REEs have emerged as strategic elements essential for sustainable energy systems.

The Rare-earth Elements (REE) are a collection of 17 elements, namely, scandium, yttrium and lanthanides (15 elements in the periodic table with atomic numbers 57 to 71, namely, lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb) and lutetium (Lu).

Although these elements tend to occur together, the lanthanide elements are divided into two groups. The light elements are those with atomic numbers 57 to 63 (La, Ce, Pr, Nd, Pm, Sm and Eu) and the heavy elements are those with atomic numbers 64 to 71 (Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu).

REEs are characterised by high density, high melting point, high conductivity and high thermal conductance. A number of rare-earth minerals contain thorium and uranium in variable amounts, but they do not constitute essential components in the composition of the minerals.

The principal sources of REE are bastnaesite (a fluorocarbonate which occurs in carbonatites and related igneous rocks), xenotime (yttrium phosphate) commonly found in mineral sand deposits, loparite which occurs in alkaline igneous rocks and monazite (a phosphate). The rare earths occur in many other minerals and are recoverable as by-products from phosphate rock and from spent uranium leaching. In India, monazite is the principal source of rare earths and thorium. Monazite is a complex phosphate of thorium and Rare Earth minerals [(Ce, La,Nd, Th,Y) $PO_4$] and this is radio active in nature .

## RESERVES/RESOURCES

The mineral monazite is a prescribed substance as per the Notification under the Atomic Energy Act, 1962. AMD has been carrying out its resource evaluation for over six decades. It occurs in association with other heavy minerals, such as, ilmenite, rutile, zircon, etc. in concentrations of 0.4 – 4.3% of total heavies in the beach and inland placer deposits of the country.

The resource estimates of monazite in the beach and inland placer deposits have been enhanced from 12.47 million tonnes in 2016 to 12.73 million tonnes in 2020. The statewise breakup of 12.73 million tonnes was not provided by Department of Atomic Energy. However, the resources of monazite as updated up to 2016 by AMD is given in Table -1.

**Table – 1: Resources of Monazite**

(In million tonnes)

| State | Resources* |
|---|---|
| **All India** | **12.47** |
| Andhra Pradesh | 3.69 |
| Gujarat | 0.003 |
| Jharkhand | 0.21 |
| Kerala | 1.84 |
| Maharashtra | 0.004 |
| Odisha | 3.06 |
| Tamil Nadu | 2.46 |
| West Bengal | 1.20 |

**Inclusive of indicated, inferred and speculative categories.*
***Source :*** *As per letter received from Department of Atomic Energy dated 26/07/2018. The resources of beach sand minerals (BSM) viz. Ilmenite, Rutile, Zircon, Garnet, Leucoxene, Monazite and Sillimanite were last updated in the year 2016 by AMD.*

The major deposits which contain monazite (thorium and REE ore mineral) are :

1. Chavara barrier beach and Eastern Extension, Kollam district, Kerala
2. Manavalakurichi beach sand deposit, Kanyakumari district, Tamil Nadu
3. Sathankulam Teri sand deposit, Tamil Nadu
4. Ovari Manapadu Teri Sand deposit, Tamil Nadu
5. Navaladi-Ovari Teri Sand deposit, Tamil Nadu
6. Kuduraimoli Teri Sand deposit, Tamil Nadu
7. Bhimunipatnam beach sand deposit, Andhra Pradesh
8. Kandivalasa beach sand deposit, Andhra Pradesh
9. Kalingapatanam beach sand deposit, Andhra Pradesh
10. Srikurmam beach sand deposit, Andhra Pradesh
11. Bhavanapadu beach sand deposit, Andhra Pradesh
12. Gopalpur beach sand deposit, Odisha
13. Chhatrapur beach sand deposit, Odisha
14. Brahmagiri beach sand deposit, Odisha

## EXPLORATION & DEVELOPMENT

The exploration and development details, if any, are furnished in the Review on "Exploration & Development" under "General Reviews".

## PRODUCTION AND PRICES

Indian Rare Earth Limited (IREL), a Mini Ratna Company, is a Government of India Undertaking under the Department of Atomic Energy (DAE) and KMML, a Kerala State Government Undertaking, are actively engaged in mining and processing of beach sand minerals from placer deposits. IREL is the only entity processing monazite to produce Rare Earth (RE) compounds. The production of rare earth for the year 2018-19 and 2019-20 was 4,215 and 5,048 tonnes respectively. Domestic demand for the rare-earths is limited at present and is mainly catered to by IREL for rare earth elements available in Indian deposits (5 Nos.) and by resorting to import for rare-earth elements (rest of 17) not available in Indian resources. As reported by KMML (The Kerala Minerals & Metals Ltd.) monazite is a strategic mineral and cannot be sold in commercial market. Therefore, the prices are not available.

## MINING AND PROCESSING

Mining of beach sand is being carried out by IREL and KMML. The installed capacity of monazite (96% pure) separation plant of IREL at Manavalakurichi is 6,000 tpy while that of KMML at Chavara is 240 tpy. Details regarding mining and processing, etc., are provided in the Review on 'Ilmenite and Rutile'.

## INDUSTRY

IREL has a plant at Udyogamandal, Aluva, located in Ernakulam district, Kerala, wherein the monazite obtained from Manavalakurichi is chemically treated to separate rare earths in its composite chloride form and thorium as hydroxide upgrade.

By May 2015, the Rare Earth Extraction Plant (REEP) at OSCOM, Odisha was commissioned for production after statutory clearance from AERB. REEP design has provision for expanding the capacity of processing rare-earth minerals from 10,000 tonnes per annum to 20,000 tonnes per annum in near future.

The Company has signed MoU for 2019-20 with Department of Atomic Energy (DAE), Government of India. IREL has also signed an MoU with M/s UstKamenogorsk Titanium and Magnesium Plant JSC, Kazakhstan, for setting up of Ti Slag plant in India.

The production of rare-earth compounds by IREL is furnished in Table-2.

IREL implemented flow sheet developed by BARC and has produced 50 kg Nuclear Grade Gadolinium Oxide (99.99%). Same can be converted into Gadolinium Nitrate which is used by NPCIL. The Company invited research projects pertaining to products in the value chain of Ilmenite, zircon and rare-earth compounds, improvement in recovery energy efficiency, etc. IREL Technology Development Council (IRELTDC) has also approved five projects valuing Rs 296.86 lakhs during the financial year 2019-20 in the field of development of high-tech zirconia ceramic components like plates, tubes, grinding media, blanks for dental implant; Neodymium metal; 99.99% pure gadolinium oxide/ nitrate and rare earth compounds for eco-friendly dyeing in Textile Industry.

**Table – 2: Production of Rare-earth Compounds**

(In tonnes)

| Product* | Specification | Installed capacity (tpy) | Production | | |
|---|---|---|---|---|---|
| | | | 2017-18 | 2018-19 | 2019-20 |
| RE chloride | REO 45% min. $CeO_2$/REO 45% min. | 11,200 | 2724 | 4215 | 5048 |
| High Pure RE compounds- REO | TO>78%, F>26% $CeO_2$/TO>45% | 2250 | 69 | 137 | 243 |
| TSP** | - | 13500 | 4313 | 5015 | 5845 |

***Source**: Indian Rare Earths Ltd*

** RED plant produces HPRE (High Pure Rare Earths) Compounds primarily La Carbonate, Cerous Carbonate and Nd-Pr Oxalate and Samarium Oxalate.*

*** REEP - Plant at OSCOM Produced TSP & RE Chloride RE: Rare Earths.*

Further, in-house Research & Development carried out by IREL during 2019-20 are :

1) Process developed and implemented on pilot-scale for production of 99.8% pure Samarium and 99.99% pure Gadolinium. Similarly laboratory scale process implemented towards production of 99.5% pure Dysprosium.

2) Process developed for production of marketable grade sodium tripoly phosphate (STPP) from Trisodium phosphate, a by-product generated from REEP operations.

3) Developed flow sheet for production of Thorium fluoride from Thorium nitrate for non-nuclear applications (as per priority theme areas of IRELTDC) for use in as Multilayer anti reflective optical coatings on thermal imaging lenses for applications such as aerial thermography, thermography in aerospace, automotive, military, Chemical Industry, Electronics Industry, thermal control mirror to prevent heat build ups and solar cell applications.

4) Flow-sheet developed for separation of heavy minerals for the subsidiary of IREL (IREL-IDCOL Limited) in Odisha

IREL is actively pursuing setting up of greenfield operations in Kanyakumari district of Tamil Nadu and Bramhagiri district of Odisha. The proposal for harnessing the beach sand mineral deposits in Tamil Nadu by constituting a Joint Venture Company with the nominated State Government Agency, TAMIN, is under active consideration by the State Government.

Ambadongar RE Project has been initiated to harness the carbonatite deposit explored by AMD in the state of Gujarat. Initially, about 1.55 Ha of the deposit is proposed to be harnessed, which will be further extended based on the exploratory results of AMD. Action has been initiated to establish the technical feasibility and financial viability of the project.

# POLICY

In order to safeguard the strategic interest of the nation it is expedient in larger national interest to prohabit the grant of operating rights in terms of any reconnaissance permit exploration license or production lease of atomic minerals as defined in part-B of the first schedule of the MM(DR) Act, 1957.

A Notification No. S.O.2685 (E) dated 27.07.2019, was issued for reserving the prospecting and mining rights of offshore minerals under Offshore Areas Minerals (Development and Regulation) Act, 2002 exclusively to Government or a Government owned company or a corporation owned or controlled by the Government.

As per Gazette Notification No 26/2015-2020 dated 21.08.2018, the export of rare-earth compounds classified as Beach Sand Minerals (BSM), namely, [Ilmenite, Rutile, Leucoxene (Titanium-bearing mineral), Zircon, Garnet, Sillimanite and Monazite (Uranium and Thorium)], shall be regulated in terms of Sl No 98A of Chapter 26 Schedule 2 of ITC (HS) Classification.

Other minerals under Code 2617 are freely exportable, except those which have been notified as prescribed substances and controlled under Atomic Energy Act 1962.

As per the Foreign Trade Policy, import policy under ITC(HS), 2017 Schedule 1, the import policy on the import of ores & concentrates of rare-earth metals (under HS Code 25309040) and of rare-earth oxides including rutile sand (HS Code 26140031) are permitted 'freely' whereas export policy under ITC(HS) 2017 Schedule 2, the export policy on the export of ores and concentrates of rare-earth metals (under HS Code 25309040) are permitted 'freely' and of rare-earth oxides including rutile sand (HS Code 26140031) are permitted through STE (State Trading Enterprise), Indian Rare Earth Limited (IREL).

Export of Beach Sand Minerals have been brought under STE and shall be canalised through Indian Rare Earths Limited (IREL). Beach sand minerals, permitted anywhere in the export policy, will now be regulated in terms of policy under at Sl. No. 98A of Chapter 26 of Schedule 2 of the Export Policy.

As per Gazette Notification No : GSR.134 (E) dated 20.2.2019, the particulars of threshold values for atomic minerals in respect of Beach Sand Minerals (BSM) shall be regulated as Schedule A [Rule 2(1)(m) and Rule 36] (Table-3).

**Table - 3 : Particulars of Threshold Value for Atomic Minerals**
**[See Rule 2(1)(m) and Rule 36]**

| | |
|---|---|
| Uranium-bearing tailings left over from ores after extraction of copper and gold, ilmenite and other titanium ores. | 60 ppm $U_3O_8$ and/or 250 ppm $ThO_2$. |
| Zirconium-bearing minerals and ores including zircon. | All cases of zirconium-bearing minerals occurring in Beach Sand Minerals and other placer deposits in association with monazite are notified as above threshold (i.e., the threshold is 0.00% monazite in Total Heavy Minerals), irrespective of monazite grade.<br>In other cases, zircon containing less than 2000 ppm of hafnium. |
| Beach Sand Minerals i.e. economic heavy minerals found in the teri or beach sand, which include ilmenite, rutile, leucoxene, garnet, monazite, zircon and sillimanite | All cases of Beach Sand Minerals and other placer deposits in association with monazite are notified as above threshold (i.e. the threshold is 0.00% monazite in Total Heavy Minerals), irrespective of monazite grade. |

Many projects of IREL have been initiated such as capacity expansion of Mineral Separation Plant of OSCOM, Rare Earth Permanent Magnet Plant and Rare Earth Theme Park. Agencies to implement these projects are in place and the projects will be commissioned within the next 2-3 years. New areas of operations, such as, Rare Earths in Ambadongar, Gujarat or Atomic Minerals in Odisha and Tamil Nadu are also in advanced stage of development.

During the year 2019-20, License to Operate (LTO) office has been established for centralised monitoring & managing the regulatory compliances, required to achieve and sustain the targeted production plans. Centralised monitoring and control of statutory compliances is enabled through database dashboards. Units are sensitised for complying with the statutory requirements at regular intervals. Manavalakurichi and OSCOM units are continuing their operations in a sustainable manner. OSCOM has deposited the statutory fees as desired under Stage-I Forest Clearance towards obtaining the Stage-II Forest Clearance. Chavara Unit is in the final stage of receiving the environment clearances for its mining lease areas. LTO office establishes the processes & tools for proactive information gathering and structuring of regulatory requirements.

Rare Earth Permanent Magnet plant will be set up in BARC campus, Achitapuram, Vizag, for production of Samarium-Cobalt permanent magnet for use in Atomic Energy, Defence and Space sectors. Environment clearance and clearance from Design Safety Review Committee and Safety Committee, BARC for carrying out site activities have been received. Detailed engineering has been completed and appointment of contractor to commence site activities on Engineering Procurement Construction (EPC) model too has been done.

Subsidiary IREL- IDCOL Limited (IIL), the Joint Venture company has been established to harness the beach sand mineral deposit in the state which in turn will widen the footprint of the Company. Ground work towards declaration of the precise area is in the final stages at the State after completion of DGPS survey and preparation of cadastral map. DPR for the project has been prepared. Pre-project activities such as, obtaining environment clearance, preparation of mining plan, etc necessary for execution of the mining lease deed will be taken up in 2020-21.

# USES & CONSUMPTION

The Rare Earth Permanent Magnet (REPM) in Vizag and Rare Earth and Titanium Theme Park (RETTP) in Bhopal have kick started with the funding assistance of Government of India, which will enhance the visibility of IREL in the strategic and niche sector.

Environmental clearance for REPM project has been received from MoEF&CC and M/s MECON Limited, Bengaluru, has been appointed as consulting firm for detailed engineering. As regards RETTP project, lease deed execution towards land has been completed. A Letter of Understanding has been inked with BARC towards developing and transferring laboratory-scale technologies in the value chain of Rare Earths which will be suitably upscaled by IREL to pilot-scale and installed in the theme park.

In addition, IREL has been assigned the responsibility of carrying out civil construction works on behalf of BARC for the 5 million liters per day (MLD) hybrid seawater desalination plant at OSCOM. About 60% construction of plant building has been completed.

Execution of Supplimentary Mining Lease deed for OSCOM Mines till a period up to the year 2047 has been completed under the provisions of AMCR 2016. Communication on precise area of the Bramhagiri Mineral Sands Deposit in Puri district under AMCR, 2016 is in the final stages of issuance by the Government of Odisha.

Rare earth materials are utilised in a wide range of critical products enabling many emerging green energy technologies, high-tech applications and defence systems, such as, hybrid cars, plug-in-hybrid electric-vehicles (PHEVs), the latest generation of efficient wind power turbines, computer disc drives, missile guidance systems, etc. The lanthanide elements as a group have magnetic, chemical and spectroscopic properties that have led to their application in a wide range of end-uses. Cerium finds application in polishing of glass items like lenses & display screens of cathode-ray tubes, liquid-crystal displays & plasma-display panels, in petrol & diesel fuels as fuel additive and along with lanthanum for replacement of cadmium in red pigments. Mixed salts of the cerium group of elements, other than fluorides are used in medicine, non-irritating antiseptic dressings, waterproofing agents and fungicides in textile manufacture. The principal uses of commercially pure cerium compounds that are in the form of nitrate is in the manufacture of incandescent gas mantles and cerium compounds as oxide. It also finds usage as a polishing agent of glass. Cerium compounds are also used in ceramic and glass as colouring pigments and also as catalysts in Chemical Industry.

Department of Atomic Energy (DAE), has accorded in principal approval for futuristic proposal of IREL towards setting up of rare earth theme park which inter alia includes setting up of pilot plants in the value chain of rare earths, skill-cum-enterpreneur development center. This will be a first of its kind theme park in the country.

To produce samarium-cobalt (Sm-Co) magnet for meeting national objectives, a Special Purpose Vehicle (SPV) has been formed. Production of Sm-Co metal and magnet is based on technologies developed by BARC, Mumbai & DMRL, Hyderabad. Activities for firming up the investment, plant location etc., are under progress.

Supply of Nuclear Grade Ammonium diuranate (NGADU) from new source, i.e, the newly commissioned monazite processing plant at OSCOM, Odisha has commenced.

Subsequent to identification and development of conditions for dissolution of Rare Earths (REE) from fly ash generated at lignite coal fired thermal power plant at Neyveli, Tamil Nadu, studies were taken up to understand the overall process efficiency and precipitate dissolved rare earths in purified form.

Cerium, lanthanum and neodymium are used as glass additives in optical lenses and display screens, as catalysts in automobiles to reduce sulphur dioxide emission, in multilayer capacitors and along with yttrium in magnesium, aluminium and hydrogen storage alloys. Mischmetal which is an alloy of cerium with small amounts of other rare-earth metals is used in lighter flints, for desulphurisation in steel and foundry, and with lanthanum alloys, in batteries and hydrogen storage systems meant for electronics and hybrid cars. Cerium oxide is used in glass polishing industries.

Lanthanum oxide and neodymium compounds are used in special glass manufacture. Lanthanum

finds application in X-ray films as phosphors; yttrium in advanced ceramics like nitrides,Y-stabilised ceramics, etc., and gadolinium in magnet alloys. Yttrium, europium and terbium are used as phosphors in displays of computers, TV, etc. and with lanthanum, cerium & gadolinium as phosphors in fluorescent and halogen lamps. Neodymium, samarium, dysprosium, praseodymium and terbium have application as high intensity magnets in electronics, electric motors and audio equipment. Lanthanum, erbium and ytterbium have application in fibre optics and lasers. Lanthanum and yttrium find application in solid oxide fuel cells. Scandium is used mainly in aluminium alloys for sporting goods. Scandium in minor amounts is used in semiconductors and special lighting, including halogen bulbs. Mixed rare-earth products are used as catalysts in petroleum refining and fluid cracking. Neodymium is used in welding in heavy industries and also in MRI scanners. Praseodymium is not a primary element for any specific use, but finds use as a substitute for neodymium in magnets.

Samarium is used essentially for the Sm-Co magnets. Europium is a primary component of phosphorus and is responsible for white light in compact fluoroscent lamps when used with terbium compounds.

Erbium used as fibre optic has emerged in the nineties as a remarkable tool for communication technology through which high quality rapid data in tight pulses can be transferred in speed unthinkable in the past.

The main application for neodymium-iron-boron (Nd-Fe-B) magnets are in automobiles for anti-lock brakes, and in computer hard disk drives, videos, CD-ROMs used in many small-size electronic consumer products, such as, digital cameras, where major advantage is their small sizes. Nickel metal hydride (Ni MH) batteries, containing mischmetal, a mixture of rare-earth compounds, are used mainly in portable electronic equipment, such as, laptops, camcorders and mobile phones. Though, the market for batteries for portable electronic equipment is growing strongly, the Ni MH batteries are increasingly replaced by lithium-ion batteries.

Ground monazite is digested with caustic soda lye to produce trisodium phosphate (TSP) and mixed hydroxide slurry. This slurry is used for production of diverse rare earth compounds. Elaborate solvent extraction and ion exchange facilities were built to produce individual RE oxides, like oxides of Y, Ce, Nd, Pr and La of specific purities. India is the second largest supplier of yttrium in the world and the maximum production is reported from the plant in Kerala. Uranium values present in monazite which are recovered in the form of nuclear grade ammonium diuranate (ADU) are vital supplement to the indigenous supply of uranium. Thorium is separated in its pure oxalate form. A part of it is taken to OSCOM for further processing by solvent extraction to produce thorium nitrate. A small part of the purified thorium nitrate is converted to nuclear grade thorium oxide powder for supply to Bhabha Atomic Research Centre (BARC) and Nuclear Fuel Complex (NFC) for developing thorium-based fuel for nuclear reactors. IREL has built a large stockpile of impure thorium hydroxide upgrade associated with rare earths and unreacted materials.

Monazite contains about 25.28% $P_2O_5$ which can be recovered as a by-product for manufacture of fertilizers and production of elemental phosphorus or its salts. Beside, rare earths, thorium is also recovered from monazite. It is a source of atomic energy. An important use of thorium is for addition to tungsten in minute quantity (about 0.75%) to increase the ductility of tungsten wire and thus to facilitate its drawing into filaments used in electric lamps. Metallic thorium is also used in photoelectric cells and X-ray tubes and in certain alloys. Thorium is used as catalytic agent for various processes. Amongst thorium salts, thorium nitrate is used largely in the manufacture of incandescent gas mantles. Mesothorium, the chief radioactive element recovered as a by-product in the chemical treatment of monazite, is marketed usually in the form of its bromide and used in self-luminous paints or enamels. Mesothorium is also used in the treatment of certain types of cancer and skin diseases.

The reported consumption during 2017-18 to 2019-20 is not available.

# WORLD REVIEW

The total world reserves are estimated at 120 million tonnes of rare-earth oxides equivalent content (REO) of which China alone accounts for 44 million tonnes (37%) followed by Vietnam & Brazil (18% each) and Russia (10%) (Table- 4).

China holds the leading position among producers of rare-earth oxides with 180 thousand tonnes. The other major producers are Myanmar, Australia, USA, Russia, India, Vietnam and Malaysia (Table-5). Concentrates/partially-processed intermediate products are further processed at many locations in Europe, USA, Japan and China.

In China, the principal production centres of rare earths are located at Baotou, Inner Mongolia and in Jiangxi & Sichuan provinces. At Baotou, bastnaesite is recovered as a by-product of iron ore mining while in Sichuan and in Gansu, bastnaesite occurs as primary mineral. In Jiangxi, Guangdong, Hunan and Jiangsu provinces, the ion adsorption clays are the sources of the greater proportion of world yttrium production.

The Russian Rare Earths Industry is based on loparite, a titanium-tantalum niobate mined from Lovozero massif in the Murmansk region. rare-earth minerals have been recovered as by-products from titanium-bearing heavy sands, particularly in Australia and from tin dredging in Malaysia.

**Table – 4 : World Reserves of Rare Earths (By Principal Countries)**

(In '000 tonnes of REO equivalent content)

| Country | Reserves |
|---|---|
| **World: Total (rounded off)** | **120,000** |
| Australia[a] | [a]4,100 |
| Brazil | 21,000 |
| Burma | NA |
| Burundi | NA |
| Canada | 830 |
| China | 44,000 |
| Greenland | 1,500 |
| India | 6,900 |
| Madagascar | NA |
| Russia | 12,000 |
| South Africa | 790 |
| Tanzania | 890 |
| Thailand | NA |
| USA | 1,500 |
| Vietnam | 22,000 |
| Other countries | 310 |

*Source: USGS, Mineral Commodity Summaries,2021*

*[a] For Australia, Joint Ore Reserves Committee-complaint reserves were 2.8 million tons. NA - Not available*

**Table – 5 : World Production of Rare Earths Oxides (By Principal Countries)**

In tonnes(metric)

| Country | 2017 | 2018 | 2019 |
|---|---|---|---|
| China[b]* | 140000 | 180000 | 180000 |
| Myanmar* | 20000 | 34000 | 29000 |
| Australia[d] | 16003 | 17754 | 19737 |
| USA | 0 | 10800 | 15600 |
| Russia | 2500 | 2596 | 2620 |
| India[a] | 2724 | 4215 | 4200 |
| Vietnam* | 200 | 920 | 900 |
| Malaysia | 196 | 1012 | 71 |

*Source: BGS, World Mineral Production, 2015-19*

**) Estimated*

*a :Year ending 31st March following that stated.*

*b :Includes production from iron ore extraction, bastnaesite concentrates and ion absorption clays.*

*d :Year ending 30th June following that stated.*

# FOREIGN TRADE

## Exports

Exports of rare-earth Metals (Scandium & Yttrium) in 2019-20 decreased substantially by 32% to 8.41 tonnes from 12.44 tonnes in the previous year. Bhutan (90%) and UAE (9%) were the main buyers from India (Table-6).

## Imports

Like export, imports of rare-earth Metals (Scandium & Yttrium) in 2019-20 decreased substantially by 26% to 473.64 tonnes as comapred to 643.41 tonnes in 2018-19. China (92%), Hong Kong (7%) were the main suppliers to India (Table-7).

**Table-6 : Exports of Rare Earth Metals (Scandium & Yttrium) (By Countries)**

| Country | 2018-19 (R) | | 2019-20 (P) | |
|---|---|---|---|---|
| | Qty (t) | Value (₹'000) | Qty (t) | Value (₹'000) |
| **All Countries** | **12.44** | **4474** | **8.41** | **3990** |
| Australia | - | 24 | - | - |
| Bahrain | 0.1 | 65 | - | - |
| Bhutan | 11.31 | 3947 | 7.55 | 3405 |
| Denmark | 0.02 | 14 | 0.04 | 41 |
| Ghana | - | - | 0.01 | 3 |
| Korea, Rep. of | - | - | 0.06 | 6 |
| Mauritius | 0.01 | 5 | - | - |
| Singapore | - | 50 | - | - |
| UAE | 1 | 311 | 0.75 | 490 |
| USA | - | 60 | - | 44 |

*Figures rounded off*

**Table-7 : Imports of Rare Earth Metals (Scandium & Yttrium) (By Countries)**

| Country | 2018-19 (R) | | 2019-20 (P) | |
|---|---|---|---|---|
| | Qty (t) | Value (₹'000) | Qty (t) | Value (₹'000) |
| **All Countries** | **643.41** | **278993** | **473.64** | **1.623** |
| Belgium | - | 8 | - | - |
| China | 623.1 | 256237 | 437 | 1454 |
| Czech Republic | - | 35 | - | - |
| Germany | 0.08 | 387 | - | 1.31 |
| Hong Kong | 10 | 4246 | 34 | 108.27 |
| Japan | - | - | 2 | 13.04 |
| UK | 0.03 | 488 | 0.08 | 6.38 |
| USA | 10.2 | 17592 | 0.56 | 39.54 |

*Figures rounded off.*

# FUTURE OUTLOOK

Geochemical surveys (4,695 sq km) have been carried out in different parts of the country by Atomic Minerals Directorate for Exploration and Research (AMD) for delineating targets for detailed investigations. AMD also carried out the Ground geophysical surveys (Regional: 652 sq km and Detailed: 399 sq km) for potential high chargeability low magnetic zones in Rajasthan; anomalous chargeability zones and deep-seated faults along Andhra Pradesh and extensions of potential fracture zones in Karnataka and Chhattisgarh. Airborne survey and remote sensing surveys over 26,966 line km have been carried out in parts of Rajasthan where discrete conductors and subsurface structural elements were delineated in parts of Alwar Basin.

Rare Metal and Rare Earth (RMRE) investigations surveys were carried out in parts of Odisha, Chhattisgarh, Karnataka, Rajasthan and Gujarat.

IREL has provision for expanding the capacity of processing rare-earth-mineral to 20,000 tonnes per annum in near future.

The EV car projects expected to boost demand for Rare-earth Magnets are likely to be put on a back burner as the industry will take some time to come back on rail.

IREL is actively pursuing setting up of greenfield operations in Kanyakumari district of Tamil Nadu and Bramhagiri district of Odisha. The proposal for harnessing the beach sand mineral deposits in Tamil Nadu by constituting a Joint Venture Company with the nominated State Government Agency, TAMIN, is under active consideration by the State Government.

As the country is gearing up towards e-mobility, green energy, e-office and other niche sectors there is need to secure rare-earth mineral resources in areas beyond the boundaries of the country. Towards the above, IREL has been given the mandate to explore and acquire rare-earth resources abroad towards which activities for constitution of a separate entity under the aegis of the Department have been taken up.

Rare-earth Magnets used in Automobiles, Consumer Durables, Smart Phones, Windmill, etc. are major end-use application for rare earths. The sales of most of these end of the chain markets are likely to see double digit reduction, this includes EV market that is a potential demand driver for Neodymium, Praseodymium and other magnetic rare earths in times to come. Demand for rare earths from Petroleum (FCC), Auto catalyst, Metallurgy, Polishing industry will stay subdued as the end-use industry would take longer to come out from the Covid-19 impact.