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OSCOM: PIONEERS IN RESOURCES MANAGEMENT

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Abstract
Natural deposits in the costal Odisha stretches in the form of RARE EARTH are a gift for utilization of humanity. The local issues like rehabilitation, displacement did not deter to establish OSCOM. The Indian Rare Earth (IRE) Ltd, OSCOM, a public sector under taking under the administrative control of Department of Atomic energy took up its production. Atomic minerals division of IREL had carried out investigation during 1958 and found out abundant sand deposits over a stretch of 150 K.M along the coast of Bay of Bengal. Of the several deposits located the one close to the village Matikhalo near District HQ town Chatrapur is the most extensive single deposits of the highest content of heavy mineral. IREL established a mineral sand complex named as OSCOM (Orissa Sand Complex) in 1976 with total capital outlay of over Rs 135 crores to explore natural resources. OSCOM started its commercial production in October 1986. It is the leading producer of beach sand minerals and rare earth chemicals in the country such as Ilemenite, Rutile, Zircon, Monazite, Sillimanite and Garnet. Our focus in the present article is to assess the operational efficiency of OSCOM in the management of rarest of rare natural resources i.e. Rare Earth.

The present article is a study on the resource utilization by OSCOM, Chatrapur.

Key Words: Operational Efficiency, Commercial Production, Rare Earth, Atomic Mineral, Heavy Metal .

Introduction

Economically not so developed Odisha's mineral deposits are large, and as a percenge of all-India resource stock, there is fairly heavy concentration in respect of Bauxite, Chromites, Graphite, Manganese, Nickel ore, Coal and Iron ore though they are not of high grade variety, as claimed by Industrial houses. The rate of cumulative exploitation has remained low, except in the case of Graphite (in Ganjam) and Manganese ore (in Raygada). Even value addition within the State has remained relatively low due to faulty policies of state and central govt. Recent developments like Coalgate scam, Supreme Court's prohibitory orders for Niyamgiri and Khandadhar area and local issues regarding rehabilitation of displaced, lengthy regulatory mechanism etc remained bottleneck for proper exploitation of mineral resources in Odisha.

The condition of South Odisha is not very different. The delayed statutory clearance of Panchamali Bauxite reserve is a regular threat on Nalco's aluminum production, While Maikanch's local law and order problem putting hindrance to Balco's Raygada project. Natural deposits in the costal stretches in the form of RARE EARTH are a gift for utilization of humanity. The local issues like rehabilitation, displacement are also in place. The Indian Rare Earth (IRE) Ltd, a public sector under taking under the administrative control of Department of Atomic energy took up its production. Atomic minerals division of IREL had carried out investigation during 1958 and found out abundant sand deposits over a stretch of 150 K.M along the coast of Bay of Bengal. Of the several deposits located the one close to the village Matikhalo near District HQ town Chatrapur is the most extensive single deposits of the highest content of heavy mineral. IREL established a mineral sand complex named as OSCOM (Orissa Sand Complex) in 1976 with total capital outlay of over Rs 135 crores to explore natural resources. OSCOM started its commercial production in October 1986. It is the leading producer of beach sand minerals and rare earth chemicals in the country such as Ilemenite, Rutile, Zircon, Monazite, Sillimanite and Garnet. Our focus in the present article is to assess the operational efficiency of OSCOM in the management of rarest of rare natural resources i.e. Rare Earth.

Objective of the Study

The main objective of this study on OSCOM is to assess the operational competency of the plant in fulfilling the corporate objective of enhanced market accessibility. We intend to focus in this article the strength, opportunities, weakness and possible threat for OSCOM-to achieve the corporate objective.

Research Methodology

We have resorted to, all the available printed reports duly published by IREL while preparing the article used. We have also mingled with company workers to have first information regarding the production process, the possible lacunae in the system so that wastages are limited. Oral information from departmental heads, managers covering different operations was also sought, to know about the strategic points. Literature study on the related topics have also been made from research articles

and website of the IREL to have an in depth knowledge about the operations and the usages of the IREL and the product respectively. Since the data collected are primarily from secondary sources, the limitations of the secondary data are inherent.

Orissa Sand Complex (Oscom) Mine of IRE : An Overview

Location: The District HQ town of Chatrapur and the village Matikhalo is situated along the eastern coast in Ganjam district of Orissa state (top sheet no: 74a/15 and 74e/3). The area is bound on the four sides by Rushikulya River on the northeast, the coastline of Bay of Bengal on the south –east, Kandla River (Gopalpur creek) on the north-west.

The origin of the deposit belongs to the parent rock types available in the Eastern Ghats and the Western Ghats mountain ranges which contain these minerals in very low concentration to call for profitable extraction. The main source rocks are khondalites, charnockites, gneiss, granites, and sandstones etc. When the source rocks are subjected to weathering processes, the minerals are liberated from it and transported downward by running water and rivers. A tropical climate with heavy rainfall assists in the weathering process. The liberated minerals transported downward are deposited at the seashore in an unsorted condition. The river Rushikulya acted as transportation agent for the heavy minerals and deposition in Bay of Bengal.

The actual sorting and concentration takes place due to the actions of two principal agents i.e. action of waves and surfs and the action of the wind. Ocean waves and surfs play predominant role in the concentration of the heavy minerals. A breaking wave takes all the foreshore minerals to the beach but the backwash carries only the lighter minerals back to the sea. Repeated action of waves results in sorting and the concentration of heavy minerals in beach placer deposit. After the concentration is over, action of the wind further enriches concentration by blowing away the finer and the lighter sand particles, thus leaving the in-situ deposit rich in heavy minerals.

Stratigraphically, the deposit is of recent age and its country rock belongs to Pleistocene age. No fault planes, joints or geological disturbances exist in the deposit. For the purpose of evaluation and presentation of the deposit, the OSCOM deposit is divided into two sectors viz. SOUTH and NORTH, each consisting of two parts I and II. Area wise south sector-I consists of 5.02 sq.k.ms South sector-II consists of 4, 89 sq.kms, North sector-I consists of 4.35 sq. k.ms and north sector-ii consists of 11.27 sq.kms .The entire deposit is formed of beach mineral and having different grain size. No overburden exists over ore body and the ore body is fully exposed to atmosphere. The heavy mineral percentage is higher in the central part of the deposit (23.81%) than in the northern portion (19.36%) and the southern portion (19.3%). In the OSCOM site reserve of rare sands is 230 million Tones. Heavy minerals content is 15-20% of which Ilmenite is 65%, Garnet is17%,Sillimanite is 17%, Rutile is 3%, Zircon is 3%, Monazite is 2%, Quartz others 3%. It has already been stated that OSCOM started its commercial production of beach sand minerals and Rare Earth chemicals in 1986. Apart from this it has also got a Thorium plant for the production of Thorium nitrate and a Zirconium plant for the productions various grades of Zirconium and it's by –product. OSCOM is a Profit making unit of IREL with a sales Turnover of about Rs 1400 to Rs 1500 million.

Oscom's Mission and Vision

- Production of mantle GR. THORIUM
- Value addition on ZIRCON by chemical processing
- Value addition on ILMENITE by chemical processing
- Chemical processing of MONAZITE TO TH. CONC. & RECL
- Separation of individual RE SALTS NITRATE

To emerge as an international leader in the area of mining & separation of beach sand minerals as well as production of value added materials by;

- New business policy adoption,
- Expanding the plant capacity,
- Break through R&D innovative technology etc.

Uses of Minerals of Oscom, IREL

ILMENITE is utilized in the manufacture of titanium dioxide (a white pigment), which is used in the paint plastic and rubber industries and also for the manufacture of titanium alloys. The chemical composition of Ilimenite is TiO_2 (50%) and Fe oxides (47%).

GARNET is used in the manufacturing of abrasives, grinding wheels for polishing glass/TV tubes, as sand blasting media, in water filtration, water jet cutting and in antiskid surface and alternate to granite floor tiles, cleaning pipes. It is also used for forester and polishing of picture tubes. The chemical composition of this mineral is that it is a complex silicate mineral.

SILLIMANITE is employed in the manufacture of high temperature refractories. It is used in steels, glass industry, and cement industry for hest treatment. The chemical component of this mineral is 65%ZrO_2+33%SiO_2.

RUTILE is need in coating of welding electrodes for the production of titanium dioxide and titanium tetrachloride, used for the production of titanium metal/sponge .It is used for making paint warmish , automobile shipping industry .The chemical composition of this mineral is 94%Tio2

ZIRCON is applied in foundries, ceramics and refractory, also used in the manufacture of Zirconium chemicals/metal and alloys in nuclear applications. It is used in nuclear reactor. The chemical composition of this mineral is 65%ZrO_2+33%SiO_2.

MONAZITE is a raw material for production of rare earths, thorium and uranium compounds. It is essential in aerospace industry and in high technology industry .The chemical composition of this mineral is (Ce, La, Y, Th) PO_4 (Uranium 0.03%).

Uses of Rare Earth

RARE EARTH CHLORIDES are used in the manufacture of misch metal, used for making lighter flints, in the production of catalysts for cracking petroleum, in the manufacture of metallic shops which find use as driers in paints, as starting material for the production of pure rare earths and rare earth compounds, for the removal of organic impurities and decolourisation of paper mill effluents, and in the manufacture of special ferrous casting.

RARE EARTH FLUORIDES are used in the manufacture of arc carbon electrodes to increase the arc intensity rare earth alloys, production of nodular cast iron special steels.

RARE EARTH OXIDES are applied in the arc carbon industry to increase the arc intensity by factor 10; the emitted light is identical to natural sunlight, used for glass polishing in optical glass composition and refractory materials.

CERIUM OXIDE as components of the polishing of optical lenses, plate, glass, television tube, face plates, prism etc. It also finds application in the solid state devices, ultra violet absorption glass, radiation protective glasses, discoloration etc.

CERIUM HYDRATE is used in the manufacture of polishing composition in the discoloration of glass, as pacifiers, as ingredients in the ultraviolet absorbers in special glasses ,as catalyst component of paint and printing ink drivers ,as an alloying agent for gaining growth control and in ferrous metallurgy.

GADOLINIUM is used in the manufacture of gadolinium-gallium-gamete (GGG) substrates per magnetic bubbles. It is also used in the nuclear reactors as a neutron absorbers, medical imaging, nuclear industry (neutron absorption), optical magnetic records, and ceramics for electronics, glass lasers, and single crystal scintillate.

EUROPIUM OXIDE is an activator for preparing phosphorus for color TV tubes and fluorescent lights.
TERBIUM is used in luminescence applications.
DYSPORIUM is used in luminescence, phosphorus applications for nuclear industry.
HOLMIUM has applications in nuclear industry.
ERBIUM finds it's applications in nuclear reactors, ceramics, glass coloring, optic fiber, medical application and lasers.
THORIUM NITRATE AND THORIUM OXIDES is used in gas mantle industry and for starters in fluorescent tubes, and for making fuel elements for nuclear reactors.

Geographical Distribution of Heavy Mineral Reserve of India (As on 2000) in Million tons.

State	Ileminite	Rutile	Leucoxene	Monazite	Zircon	Garnet	Sillimanite
Odisha	45.5	1.88	.04	1.18	1.44	32.61	21.23
A.P	100.1	4.42	2.92	2.29	4.43	48.99	47.02
T.N	97.62	4.82	4.58	1.73	8.34	24.37	21.66
Maha'stra	3.04	-	.84	-	-	-	-
Kerala	99.52	6.62	4.42	1.35	5.44	1.13	38.75
Bihar	.74	.01	-	.22	.08	-	.08
W.B	2.08	.19	-	1.22	.39	-	1.65
Total	348.15	17.94	12.83	7.99	20.12	107.1	130.39

Global Demand of Rare Earth Materials

As per Lynas Market research data the total demand for Rare earth is 140 kilo tons. Chinese companies continued to dominate global supply with over 90% of Rare Earths production. The Rare earth demand rebound after the financial crisis, combined with tightening export supply by China. OSCOM, India is among the non China players in rare earth production. The demand for rare earth element is derived from the production of their end use products, such as flat panel displays, automobiles, catalysts, etc. An increase in demand for the final product would lead to increase in demand for Rare Earth Element (REE). The demand for REE is estimated at 136100 tons in 2010, with global production around 134000 tons annually. The different is covered by above-ground stocks or inventories.

Supply Aspect of Rare Earth Materials

China is the major producer of rare earths in the world with a record share of 97% in 2010. In consequence, as far as rare earth consumption is concerned, china is only the topper. According to Industrial Minerals Company of Australia (IMCOA) prediction the demand for rare element will be 185000 metric tons in 2015. During this , the Chinese output may reach 140000 tons per year while Chinese Rare Earth Industrial Association estimates its demand to reach at 130000 tons due to its stringent export quota & tighter environmental legislation significant export taxes and withdrawal of VAT rebate run for 20-30 years. Based on these estimates the non- china annual output would need to be between 45000mt to 70000mt to meet the global demand for REE.

Marketing Aspect

The system approach is being followed in decision making process pertaining to the marketing function, which is based on inputs from market dynamics, macro scenario in the industrial segment and the international market. The various parameters pertaining to above are suitably embedded in decision making process through Management Information system (MIS). Marketing activities are performed as per the policies in vogue and the delegation of power to senior functionaries by the Board of Directors. The Board of Directors is the apex body involved in formulation of policies and strategic decision making related to marketing operation. The marketing function arises are slapped with the accountability as prescribed by the Govt. of India. Sale turnover of OSCOM has already reached Rs 3600 million this year this include around Rs 1000 million from export. The marketing of REE by OSCOM is carried under centrally controlled mechanism. The corporate office at Mumbai takes all decision regarding the Marketing mix. Some of the important data on marketing detailed below. Products &Pricing of different REE are as follows

Product	Production tons/year	Prices /ton as on December-2012
Illmenite	2,20,000	Rs 17,000/-
Rutile	10,000	Rs 1,18,000/-
Zircon	8,000	Rs 94,400/-
Monazite	4,000	Not disclosed
Garnet	10,000	Rs 5500/-
Silimanite	30,000	Rs 10000/-

Promotion: The productions of OSCOM are generally used by different Industrial houses for finished products. Hence no high value promotional activities are done. As has already stated, china contributes around 97% of the total contribution of REE. India's contribution is only 3%.The Major customer of OSCOM are USA, UK, France, Germany, Norway and Japan. Since it has no port facility it depends on road & railway transport to the nearest port at Vishakhapatnam. On domestic front different industries get these basic raw materials from OSCOM. Some of them are listed below.

ILMENITE

Cochin mineral and rutile ltd	Aluva
DCW ltd	Sahupuram
Travancor Titanium product ltd	Kerala
Kilburns Chemicals Ltd	Tuticorin
Kolmac	Kolkata

RUTILE

GEE Ltd	Kolkata
Esab India ltd	Kolkata
Malu Electrodes pvt ltd	Nagpur
D & H sacheron electrodes ltd	Indore
VCA minerals and metal ltd	Chennai

ZIRCON

Astron cera	Himatnagar/salal
Tirupati microtech pvt ltd	Pondicherry
Nuclear Fuel complex	Hyderabad
SEPR refractory India ltd	Palakkad
Opaque ceramics p ltd	Himat nagar

SILIMANITE

Maithan Ceramics	Dhanbad/
Manishri refractory ceramics pvt ltd	Odisha
TRL krosaki refractories pvt ltd	Odisha
Gargi hutten albertus pvt ltd	Thane/Navi Mumbai
Sri natraj ceramics and chemicals	Jam nagar/ Gujarat

QUALITY CONTROL: The plant products are low potency radio active in nature. Maximum quality may enhance the radioactive exposure hence by Atomic Energy guideline; it follows ALARA (As Low as Reasonably Achievable) policy so at least 97% purification is achieved for almost all products.

Strategic Value Addition in Oscom

Recovery from thorium value chemical processing of monazite to separate the contained thorium value (~8% Tho2) in the form of thorium hydroxide concentrate happen to be the most fundamental value addition activity of the company carried out for last 50 years or so. In the recent time thorium is separated as its pure oxalate form. A part of it is taken to OSCOM for its further processing by solvent extraction to produce about 150-200 TPA of its thorium nitrate for is mantle application. A small part of the purified thorium nitrate is converted to nuclear grade thorium oxide powder to meet the requirement of Bhabha Atomic Research centre (BARC) and Nuclear Fuel complex (NFC) for developing thorium based fuel for our nuclear reactors.

Recovery of Uranium Value in OSCOM

In recent time IREL has got engaged through its Rare Earths Division, in activity involving recovery of uranium value present in Indian monazite in the form of nuclear grade Ammonium Di Uranate (ADU) to supplement the indigenous supply scenario for uranium as required in the Indian Nuclear Power programmers. In addition to monazite, REE has developed facilities for recovering uranium value from other secondary resource as well.

NON STRATEGIC VALUE ADDITION IN OSCOM

In another effort on value addition to zircon, a pilot plant (capacity-3.5 TPA) was set up by OSCOM to produce a whole range of zirconium stabilized with CaO, MgO and rare earths. The most talked about value addition activity of IREL is setting up of a Chemical plant at OSCOM consisting of a Synthetic Rutile (SR) Production unit, an Acid Regeneration Unit. The SR facility is equipped with two roasters, two claimers, sixteen digesters for carrying out reduction of limonite, leaching of reduced limonite with concentrated hydrochloric acid. The leached liquor is treated in the AR unit to regenerate 20% grade HCI for its recycle and reject iron as fine iron oxide powder. The SR unit was stopped in 1997 as it was not financially viable. The company now intends to use the roasters and coalminers for the production of partially value added materials like reduced and metalized limonite.

Research & Development Facility

R & D centers of IREL are located at Mineral Research and Development Centre (MRDC), Kollam, Technical Service Division (TSD), OSCOM, Chatrapur and Rare Earths Division (RED), Aluva. MRDC undertakes constancy projects on mineral separation i.e. sand beneficiation, etc., along with mineral separation investigation to improve yield and products. The facilities include various magnetic, gravity, hydraulic and electrostatic separators, floatation cells, grinding mills, vacuum filters, microscopes and analytical instruments i.e. ICP, UV spectrometer, etc. STD, OSCOM is equipped with analytical instrument i.e. X-ray diffraction meter, thermal analyzer, atomic absorption spectrometer, UV spectrometer, particle size analyzers, etc for study and development of processes for manufacturing synthetic rutile, stabilized and partially stabilized Zirconia, gem grade Zirconia, etc. RED, Aluva develops solvents extraction and ion exchange-based processes for presentation of pure rare earth chemicals. In addition The XRF and XRD machines are installed recently to do research on Nano product.

Mining and Mineral Separation

Mining of raw beach sand containing the six heavy minerals and separation of the later in adequate purities happen to be the common activity of all the three Mineral Division namely Chavara, Manavala Kuruchi (MK) and OSCOM. As per as mining practice is concerned, they do differ from one division to other. For example at MK, all the raw sand required to operate the plant at its full capacity is collected by the fisherman of surrounding village from nearby beaches and supplied to the unit at a cost. At Chavara also beach washing is available but not in adequate quantity to meet the full requirement of the plant. The unit therefore adopts wet mining operation involving use of Dredge and wet Concentrator (DWC) to exploit the inland deposits away from the beaches.. In the case of OSCOM, the entire mining operations involves dredging of the mineral deposits on much larger scale (500 t/hr) augmented by smaller sized (~100) supplementary. The heavy mineral rich sand feed either in the form of beach washings or dredge concentrate is subjected to final concentration in a facility provided with a host of spirals to enrich the feed with 97-98% heavy minerals. Such upgraded material is next dried in a fluid bed drier to take on the separation of individual minerals/ores by taking advantage of the difference in their electrical, magnetic properties as well as specific gravity.

SWOT Analysis of IREL

Strength

- 3 decades of experience (operation and project implementation) in separation of beach sand minerals.
- 5 decades of experience in the processing of monazite and rare earths.
- Stock piling of thorium concentrate for nuclear application and supplying uranium concentrate to DAE units.
- R/D support from BARC- a sister unit of DAE.
- Proven track record as supplier of prescribed minerals and rare earth chemicals in the international market.
- All 4 units of IREL (R.E.DIVISION, OSCOM, MANAVALAKURCHI AND CHAVARA) are ISO 9002 certified.
- Trained manpower.
- Profit making company for the last 8-10 years.

Weaknesses

- Not done so well regarding value added products.
- Still high labor force and wage bill, though trying to prune down.

Opportunities

- Overall growth in TiO_2 pigment demand.
- Largest reserve in the world for illmenite scope of exploitation of huge beach sand deposits on higher scale
- Availability of old plants with low depreciation charged.
- Wide application of products in high technology areas.
- Availability of different grades of illmenite.
- Growing Indian market.
- Expansion through Joint Ventures in the context of mineral sand policy.

Threats

- Difficulty in acquiring mining land at reasonable cost due to local resistance particularly in Kerala.
- Unsupportive posture of the state governments by imposing Mineral Dues Clearance (MDC) levy.
- Abundance of Chinese R.E products in the world market.
- Opening up of beach sand mining for the private sector (domestic and international).
- Exposing the sector to international competition by deregulating imports of beach sand minerals and rationalizing import tariffs substantially.
- Merging of competitors and end-users leading to consolidation of markets. Threats of undue imposition of excise duty on IRE mineral products.

Conclusion and Suggestions

From the studies it is concluded that

1. IRE's OSCOM plant is one of the important and strategic installations of DAE. The potentials of 25 tons of Research grade uranium is possible to be extracted. This uranium will make us self sufficient in fulfilling on our research needs, however due to bureaucratic hazards the project has not yet seen the light so far.

2. It is having potentiality to become major player in REE market worldwide provided the rich content REE area of North side is ready for extraction. This area is still not acquired due to legal problems.
3. Silimnite, a titanium compound of aluminum are transported with heavy costing. Hence the strategic tie-up with Saraf group, aimed at value addition could not be materialized due to internal dispute among the Saraf's partners, although the land acquisition is already completed if this could be possible OSCOM's Profitability will rise.
4. Rutile sulphate plant has become defunct due to no demand for the product that fetches heavy loss to the organization. Although OSCOM has the capability to expand the product mix by adding new product to its kitty, policy guidelines are still awaited.
5. With the help of Central and State Govt. help OSCOM and IREL can compete effectively with private competitors if there is joint research operation inviting premier research organizations of the country.

Suggestions

1. Company should have tie-up with end user for building long term business prospects.
2. Central govt. should be more proactive while actively pursuing bilateral trade on REE.
3. More research should be conducted by joining hands with private and govt. research organizations for value addition.

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