# ECONOMIC MINERALS AND RELATED INDUSTRIES IN SRI LANKA

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*" A substantial effort must be made in the area of non -traditional exports. The pattern of export led growth in Sri Lanka would have to focus on the full exploitation of local resources, the promotion and growth of activities enjoying locational advantages due to the geographical position of the country and the optimum utilization of the country's educated and adaptive manpower. Since our land, mineral and marine resources are still not fully exploited, there is considerable growth potential in these areas. Several high quality minerals such as graphite, ilmenite, apatite,clay and silica sands have still not been exploited satifsfactorily. There is also much scope in a number of manufacturers."*

*- Minister of Finance, Mr. Ronnie de Mel in his 1984 Budget Speech*

Sri Lanka possesses a fair amount of mineral deposits in spite of its small size. Based on some of these deposits, a good number of industries have been set up in the country. If Sri Lanka is to achieve greater economic independence and move towards prosperity while earning much needed foreign exchange and arresting unemployment, it is essential that these industries are expanded on a scientific basis. It is heartening to note that some of the major mineral industries are taking steps to do just that.

Industries based on mineral sands, graphite, salt and phosphate are in various stages of attracting foreign collaboration in order to expand production As the present government has created a very favourable climate for foreign investment, one would expect that the other industries will follow suit As far as Sri Lanka's industrial minerals are concerned their full potential is yet to be realised This paper presents a short account of the important mineral deposits in Sri Lanka, a brief discription of related industries, and prospects for further development

## APATITE

In 1971 the Department of Geological Survey located a very large deposit of phospate bearing mineral, apatite, at Eppawala. It has been estimated that about 60 million tonnes of reserves are available. Initial studies have indicated that the deposit occupies an area of 3 square miles. Drilling reveals that the deposit extends to 400 feet or more from the surface.

The general formula of apatite can be represented as $Ca_5(PO_4)_3$ (F, Cl, O4). The chlorine, fluorine and hy droxyl ions can replace each other to give pure end members known as chlor, fluor and hydroxy apatite respectively. Chemical analyses have shown that Eppawala apatite is richer in chlorine than fluorine and hence may consist mostly of chlor apatite (Cao 53.8%, P2 O5 41% Cl 6.8%). Phosphorus is one of the three major plant food elements. It aids in nutrition and hastens maturity and ripening of fruits, particularly of grains. Phosphorus also promotes the development of the root system and other underground organs.

As the solubility of raw apatite is rather low, its direct use as a fertilizer is limited. Therefore rock phosphate should be converted into more soluble phosphate, thus increasing the amount of phosphorus available to plants. Industrially, finely ground rock phosphate is converted to superphosphate,which is fairly soluble,by the treatment of mineral acids such as sulphuric,hydroric, nitric or orthophosphoric. In spite of the fact that hydrochloric acid is produced locally,sulphuric acid is preferble as in the case of the former, calcium chloride which is undesirable owing to its highly hygroscopic nature, is formed as a by product. In 1978, the development of the resource was undertaken by the State Mining and Mineral Development Corporation. The Corporation has chosen the Agrico Chemical Company of the USA as a collaborator. The project cost was initially estimated at about $ 400m. It has been agreed to establish a plant capable of producing 530,000 tons per annum (tpa) of diammonium phosphate for export and 50, 000 tpa of triple superphosphate for domestic use. This projects still awaits final approval of the government. Meanwhile, the State Mining and Mineral Development Corporation has produced increasing quantities of apatite since 1978. Its annual production of apatite has been as follows:

| Year | Quantity (Mt. Tons) |
|---|---|
| 1978 | 3,660 |
| 1979 | 8,671 |
| 1980 | 14,076 |
| 1981 | 15,294 |
| 1982 | 13,993 |
| 1983 | 15,727 |

## CLAY

There are four types of industrial clays in Sri Lanka. They are china clay, ball clay, fire clay and earthenware clay. China clay or kaolinite (sometimes incorrectly termed as kaolin) in the chief raw material used in the manufacture of porcelain and ceramic ware. Kaolinite ($Al_2O_3\ 2SiO_2\ 2H_2O$) deposits are found as a sedimentary formation at varying depths in Boralesgamuwa and Meetouagpda area. These deposits are associated with quartz, mica, feldspar and heavy minerals such as ilmenite and monazite. The mining and processing of kaolinite are being carried out by the Ceylon Ceramics Corporation, at its clay refineries in Boralesgamuwa and Meetiyagods. Kaolinite is also used as a filler and coating in the paper industry and also in the manufacture of numerous products such as paints and tooth pastes.

It is also used in the rubber industry and in the manufacture of fiberglass. Chemically ball clay is very much similar to chine clay. The difference lies in particle size and in the amount of impurities. The ball clay owes its name to the fact that it was originally dug out of the ground in blocks or balls. Ball clay is noted for its toughness, plasticity, better binding power and low refractoriness. It is used along with china clay as a raw material in the ceramic industry. Deposits of ball clay are found in Bolgoda and Dediyawala areas. Fire clay possesses a remarkable resistance to heat and is termed refractory clay. It is used to manufacture refractory parts for kilns and furnaces. Earthenware clay in raw state is red, brown or grey as a result of the presence of iron oxide. When fired, the colour may vary from pink to red brown, It is mainly used for manufacture of pottery.

The two china clay refineries of the Ceylon Ceramics Corporation produce 700 tpa. The Corporation's main factories are situated at Negombo and Piliyandala. It also has nearly 10 factories producing tiles and another 10 factories producing wall tiles. A total of 7,000 tpa of ceramic ware - which includes domestic crockery, wall tiles, sanitary ware, mosaic tiles, electro - ceramics, ornamental and fancy ware - are produced by the Corporation. Lanka Porcelain Ltd. at its factory at Rattota manufactures porcelain mainly for export. Products of Lanka Wall Tiles Ltd ., in Balangoda too are meant for export.

In March last year, the Dankotuwa Porcelain (Pvt) Ltd. a subsidiary of the Ceylon Ceramics Corporation was commissioned. This factory, one of the largest in Asia for porcelain manufacture, is export-oriented. According to the Corporation, export orders have been received from several countries including the USA and Canada.

## DOLOMITE

Dolomite is a double carbonate of calcium and magnesium. These deposits are found mainly in the hill country in areas such as Kandy and Matale; and also in the Badulla and Ratnapura areas. Although this mineral has a value as a fertilizer, its use is rather limited because of its low solubility. However, dolomite can be used for several other purposes such as manufacture of scouring powder, floor polish and water colours, foundry bricks, manufacture of magnesia, and as fillers in the rubber industry. It is also used in mechanised glass factories and the ceramics, enamel and porcelain industries. About 15,000 tpa of dolomite is extracted from deposits in the Central Province. However, its use has been limited due to the preference for imported Kieserite and commercial Epsom salt. The mode of production of dolomite in this country needs further development. The Industrial Development Board has come up with suggestions to establish small scale plants to manufacture about 2,5000 tpa of 250 mesh dolomite with comparatively low investment and reasonably low running costs.

## FELDSPAR

Feldspar is generally an anhydrous silicate of aluminium usually found in combination with potassium, sodium, calcium or barium. In the ceramic industry, feldspar is used as a bonding or coating material. The glass industry is another important consumer of this mineral. Feldspar is also used in the enamel, abrasive and scouring soap industries. Mining of feldspar is carried out in the Matale area. The largest deposits are located at Kaikawala and these are exploited by the Ceylon Ceramics Corporation. Reserves at Kaikawala which persist to a depth of 600 feet are estimated at 3 million tonnes. The Corporation has also mined large deposits in the Talagoda and Rattota areas. There is potential for export of feldspar in crushed and fine ground form.

## GEMS

Sri Lanka has earned a high reputation for its gems. Although there are four other gem bearing areas in the world in South Africa, South America, Burma and Thailand no other country, with the possible exception of Brazil, produces such a variety of gemstones as Sri Lanka does. The country's economy has been greatly boosted by the gem industry. In recent years the ex-

TABLE 1
Production and Sales of Ceramic Ware 1979-1983
(Ceylon Ceramics Corporation)

| Production (Tonnes) | 1979 | 1980 | 1981 | 1982 | 1983 |
|---|---|---|---|---|---|
| Crockery 3,572 | 3,281 | 2,967 | 3,461 | 3,769 | |
| Sanitary Ware | 804 | 1,075 | 1,045 | 1,030 | 1,126 |
| Ball Clay - Raw | 1,196 | 9,821 | 8,095 | 8,554 | 10,725 |
| -Refined | | 1,636 | 1,139 | 737 | 1,255 |
| Kaolin | 5,870 | 6,614 | 7,316 | 8,206 | 7,976 |
| Insulators | 280 | 361 | 287 | 267 | 291 |
| Mosaic Tiles | 1,734 | 1,879 | 1,733 | 901 | 67 |
| Tiles and Bricks ('000) | 25,316 | 25,793 | 24,903 | 19,715 | 19,289 |
| Quartz (upto Aug'83) | | | | | 512 |
| Feldspar (upto Aug'83) | | | | | 1,547 |
| Hydrated Lime (upto Aug'83) | | | | | 1,012 |
| Value of Production(Rs.000) | 132,718 | 190,517 | 199,079 | 200,776 | |
| Value of Sales (Rs.000) | 142,816 | 207,106 | 219,085 | 375,312 | |
| Foreign Exchange Savings (Rs.000) | 139,979 | 212,170 | 59,393 | 94,055 | |
| Foreign Exchange Earnings (Rs.000) | 11,087 | 14,630 | 9,394 | 2,732 | |

Source: *Ceylon Ceramics Corporation*

port of gems has brought in about Rs 500 million annually in foreign exchange to the country. In 1982 the figure reached Rs.695 million and in 1983 Rs.940 million. This figure does not include the earnings through sales to tourists. The actual values could have been much higher if not for the illicit trade in gems.

All types of gemstones with the exception of diamond, opal and turquoise are found here. Most common Sri Lankan gems are sapphire, ruby, aquamarine, topaz, tourmaline, garnet, spinel and zircon. Among the gemstones unique to this country are sinhalite, a magnesium aluminium borate, taaffeite, a magnesium berryllium aluminate and ekanite, a complex silicate of uranium, thorium, calcium iron and lead. The best known gem-bearing area is in the Sabaragamuwa Province. Nearly 80 percent of the chief gem mines are found in this area. It covers an area of about 1,800 square miles between Avissawella, Kamburupitiya and Moneragala. Among the villages famous for gems are Balangoda, Ehiliyagoda, Pelmadulla, Rakwana and Ratnapura. Other locations in the Okkampitiya - Elahera areas as well as in Nuwara Eliya, Horton-Plains, Maskeliya and Kandy also yield some gemstones. Approximately 7,000 gem pits are scattered throughout the country.

Gems can be broadly classified as precious and semi-precious. Aquamarines, garnet, tourmaline, zircon, topaz, quartz, amethyst and moonstones fall into the category of semi-precious stones.

Blue, pink, yellow and star sapphires, rubies, star rubies and alexandrite are precious stones. Catseyes are technically classified as semi-precious, though their rarity makes them very expensive, specially when the quality is good. Gemstones are found embedded in layers of gravel and sand in river beds, swamps and buried in river valleys. Moonstones, tourmaline, garnet, and amethyst are exceptions as they are generally mined from weathered parent rocks. The extent of the gem gravels generally varies but usually has been between a few metres in breadth and about 30 metres in depth. When the depth is not more than 15 metres, exploiting the deposits is a relatively simple affair. When the gem-bearing gravels are located deeper, mining becomes difficult owing to the unconsolidated nature of the surrounding gravels which require support. The only form of mechanization is the use of water pumps to empty the water that collects at the bottom of the pit. A simple washing process is used to separate heavier gems from the lighter gravels. Although mechanically operated cutting and polishing machines are available, the lapidary work of the bulk of the Sri Lankan gemstones is done using hand machines of primitive construction.

The value of exports of gems from Sri Lanka, on an official basis, has kept fluctuating over the years, despite the very generous concessions granted to gem exporters. The value of gems exported officially had dropped from Rs. 531 million in 1978 to Rs. 302 million in 1981. This fall in earnings was attributed partly to the fact that some of the gem-bearing areas had been exhausted as a result of intensive mining.

**TABLE 2**
**Value of Exports of Gems from Sri Lanka**

| Year | Value (Rs.mn.) |
|---|---|
| 1971 | 3.9 |
| 1972 | 12.5 |
| 1973 | 140.8 |
| 1974 | 108.7 |
| 1975 | 180.2 |
| 1976 | 261.4 |
| 1977 | 297.9 |
| 1978 | 531.0 |
| 1979 | 490.1 |
| 1980 | 458.1 |
| 1981 | 301.6 |
| 1982 | 684.9 |
| 1983 | 940.4 |

Source: *Sri Lanka Customs*

However, it appears that some gem traders were exporting their gems through illegitimate channels. This aspect was highlighted by the Minister of Einance during his 1984 Budget Speech.

Although there has been a significant improvement in the gem industry owing to the presence of the State Gem Corporation, there are some areas which need further improvement. The local gem business is still in the hands of few traders with miners getting only a fraction of the profits. Illicit gemming is still going on and according to the Customs, gem smuggling has not stopped either, Modernisation of gem mining and processing as well as cutting and polishing could also help the industry.

## GRAPHITE

Graphite is cystalline carbon identicaal in composition with charcoal and diamond. It has been one of the main minerals mined and exported by Sri Lanka over the last 160 years. There are three principal types of graphite: they are vein-graphite, flake and amorphous. Sri Lankan graphite falls into the vein - graphite category which can be further sub-classified into cystalline and amorphous forms. Both these types occur in this country. Sri Lanka's graphite has a high percentage of carbon, the balance consisting of ash, grit and volatile matter.

During the late 19th century and the early part of the 20th century graphite was a major item of export, being almost as important as tea, and rubber. In 1899 for instance the earnings from graphite exports were Rs 22 million, which amounted to 20 per cent of the total export earnings in that year. In 1983 this mineral ranked sixth among the Sri Lanka's items of export. For nearly 100 years, the production of graphite was in the hands of the private sector. In 1971 the graphite mining industry was handed over to the then State Graphite Corporation, not the State Mining and Mineral Development Corporation. The production today is centred on two underground operations at Bogala and Kahatagaha-Kolongaha. There are two experimental mines at Rangala. The State Mining and Mineral Development Corporation has also opened-up two more abandoned mines at Siyambalapitiya and Pussehena.

**TABLE 3**
**Production and Sales of Graphite**

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 |
|---|---|---|---|---|---|---|
| Production (Metric tons) | 10,579 | 9,491 | 7,124 | 7,463 | 8,267 | 5528 |
| Sales - quantity (Metric tons) | 11,427 | 10,933 | 6,759 | 4,670 | 3,197 | |
| Sales - value (Rs.Mn.) | 67.7 | 89.5 | 94.0 | 114.8 | 73.8 | |
| Exports - value (Rs.Mn.) | 59.3 | 74.6 | 85.2 | 100.9 | 59.1. | |

Source: *State Mining and Mineral Development Corporation*

The importance of graphite in other industries is related to its refractory quality, lubricant charactaristics and electrical properties. Graphite is very useful as a refractory ramming material in metallurgical industries, especially in the production of iron and steel. Crucibles made from graphite are used in foundry smelting of steel and non ferrous metals including precious metals. A mixture of clay and graphite is used to make pencils. Graphite is mixed with manganese oxide to manufacture dry cell batteries. Graphite is also widely used as a lubricant in mechanical parts and to make carbon brushes. Brake linings which are made of friction materials are generally impregnated with graphite to ease the transfer of heat generated by braking friction. In the nuclear industry graphite is used in the manufacture of moderators and reflector blocks.

Sri Lankan graphite is under severe competition from several graphite producing countries. The main competitors are Korea, Austria, Germany, USSR, China and Mexico. The greatest threat is from Malagasy where graphite can be obtained from easily worked graphite deposits. The resession in the industrial world too had a considerable effect on the graphite market. During the period 1973-1981, the output of graphite has been around 10,000 tonnes. In 1980, it went as low as 7,300 tonnes as the world economic recession worsened.

Consequently, graphite production in Sri Lanka is dependent on overseas markets. In 1983 the Graphite Corporation had to slow down on its production due mainly to marketing constraints and both production and sales were comparatively low.

By the end of 1982 the Sri Lanka government decided to mount a project to develop the country's graphite industry. The cost of the project has been assessed at Rs.660 million. The Asian Development Bank has agreed to fund part of the project. This project will commence once the government makes a final decision taking the local component of the expenses (Rs.260 - 280 million) into consideration. Meanwhile, the State Mining and Mineral Development Corporation (SMMDC) is considering the establishment of a graphite based industry in Sri Lanka with foreign collaboration. The Ceylon Ceramics Corporation has established a factory for the production of graphite crucibles for the domestic market. The SMMDC is also planning to set up a high quality graphite crucibles unit with a foreign collaborator entirely for the export market.

## IRON ORE

Sri Lankan iron ore deposits can be broadly put into two categories. One of them is hydrated iron oxides (limonite and geothite) and the other is magnetite. The limonite variety has been located mainly in the Ratnapura district and to a lesser extent in the Galle and Matara districts.

Production at the Steel Corporation during the years 1982 and 1983 has been below the budgeted amounts in respect of all items. When compared with the previous years performance production reached its peak in 1980 but since then there has been a gradual decrease. This is due to adverse market conditions. There has been a decrease in sales mainly due to increased competition from imports and the Corporation has been compelled to cut back on their production plans, as seen in the following table

Most of these deposits are found at or near the surface. The limonite re-

**TABLE 4**
**LOCAL PRODUCTION OF BASIC STEEL ITEMS**

| Products | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 up to August |
|---|---|---|---|---|---|---|
| Rolled Sections (m.t.) | 33,111 | 45,355 | 52,704 | 38,991 | 22,797 | 15,504 |
| Steel Foundry (m.t.) | 633 | 800 | 673 | 406 | 477 | 262 |
| Fabricated Steel (mt.) | 251 | 338 | 457 | 257 | 203 | 152 |
| Welding Electrodes (Kgs. | - | - | - | - | - | 17,682 |
| Billets Local (m.t. | - | - | - | - | - | 7,188 |
| Tor Steel Unit (m.t.) | - | - | - | - | - | 13,183 |
| Wire Mill (m.t.) | - | - | - | - | - | 1,382 |
| Value of Production (Rs.m.n.) | 268.1 | - | 507.8 | 478.6 | 310.2 | 209.8 |

Source: *Ceylon Steel Corporation*

serves have been estimated at 2.2 million tonnes. The magnetite deposits have been discovered at Panirendawa and Seruwila. The deposit at Panirendawa is expected to contain about 5.6 million tonnes of magnetite of high grade. The most promissing iron ore deposit is found at Seruwila. It is also a magnetite deposit. In terms of quality as well as quantity this deposit is assumed to be superior to any other iron ore deposits.

In 1961, the Ceylon Steel Corporation was established. The Corporation's factory consists a rolling mill, a wire mill, foundry section and a ribbed steel production unit. This factory relies on imported billets as starting material. Annually about 35,000 tonnes of steel billets are imported for this purpose. Stage II of the project commenced operation in July 1982, with the installation of an electric arc smelting furnace of a capacity of 25 tonnes. This stage II relied completely on local available steel scrap. The furnace was capable of producing 60,000 tonnes of finished products annually. The furnace and its accessories have been valued at Rs.183 million. This stage of the project was capable of saving a vast amount of foreign exchange as it did not need imported material but scrap obtained from the CGR and some local industries.

Although State 11 was metallurgically successful, it had to be closed down in 1983 when its products could not compete with imported materials In spite of difficulties the Corporation decided to re-start the operation in early 1984

## LIMESTONE

Lime stone is a valuable raw material as it is used in many major industries such as cement, fertilizer, ceramics, sugar and bleaching powder. As the acti-

Lime stone is a valuable raw material as it is used in many major industries such as cement, fertilizer, ceramics,

**TABLE 5**
**PRODUCTION OF CEMENT IN SRI LANKA (Metric Tons)**

| YEAR | PORTLAND CEMENT | MASONARY CEMENT |
|---|---|---|
| 1977 | 362,860 | - |
| 1978 | 575,061 | - |
| 1979 | 591,797 | 68,800 |
| 1980 | 551,076 | 71,723 |
| 1981 | 630,944 | 74,731 |
| 1982 | 468,840 | 68,789 |
| 1983 | 446,469 | 33,099 |

Source : *Ceylon Cement Corporation*

sugar and bleaching powder. As the activities in agriculture and construction have been greatly encouraged by the present government, there has been a sharp increase in the demand for limestone. It has been estimated that at least 15,000 tonnes of lime will be needed annually for government housing development alone. Limestone deposits are found in the central hills and in the northern region. The sources of limestone are available in abundance.

However, they are hard to mine and also contain impurities; as a result there is a higher demand for coral lime which is easy to mine and comparatively purer. The range of coral mining and processing is generally confined to a 50 mile stretch from Ambalangoda to Dondra head. Coral mining activities while providing a good income to the people involved has also created many problems. A unique and valuable coral reef ecosystem has been threatned with near extinction. More alarming is the fact that the coral mining leads to coastal erosion, with the removal of the natural barriers of the sea beach which curb a direct attack by waves on the beaches.

## CEMENT

Massive development programmes started in recent years have led to a boom in cement production. The Ceylon Cement Corporation finds it hard to meet the demand. The Corporation's major cement works are located at Kankesanthurai and at Puttlam. The Corporation also has a grinding plant in Galle which uses limestone derived from Kankesanthurai. The Ceylon Cement Corporation produces about 2.5 million tonnes annually. In 1983 a public company called Lanka Cement Ltd., was commissioned. It is expected that the company will be initially producing 0.6 million tonnes of cement annually.

Also in 1983, a local private firm went into collaboration with Japanese firm to set up a Rs 400 million cement complex in China Bay, where the clinker will be imported for this project, which has a production capacity of 200,000 tons of cement per annum From September 1984 it hopes to produce 17,000 to 20,000 tons of cement per month. When the new plant at K K S is also at capacity production about 225,000 tons is expected to be available for export. In view of this situation there are possibilities that the country will be self-sufficient in cement and even have a surplus in the near future. This surplus would have to be exported to bring in foreign exchange.

## MICA

Mica is a complex silicate of aluminium with potassium, magnesium, iron sodium and traces of many other elements. Two of the most common varieties are muscovite and phlogopite. Large thin flakes measuring several inches in diameter are common. Particles as small as 0.5 micron have been found in association with clay minerals. Mica is very useful in making con-

densers. It can also be used as an insulating material. Mica in ground form is used as a decoration on wall paper. Mica deposits are found in the Badulla and Haputale districts. Although the quality of mica mined from shallow surface pits is rather low, it is believed that good quality sheet is available at depth. The State Mining and Mineral Development Corporation has been examining the potential for mica. In 1982 about 300 tonnes of mica

The Corporation was engaged in manufacturing vermiculite mica as there was a greater demand for this variety. In 1982 almost 300 tonnes of mica was exported to Japan- Production, exports and total income from mica over the last six years was as follows:

| Year | Production (Mt tons) | Exports (Mt. tons) | Total Earnings (Rs.Mn) |
|---|---|---|---|
| 1978 | 240 | 140 | .4 |
| 1979 | 308 | 275 | 1.0 |
| 1980 | 145 | 88 | .4 |
| 1981 | 182 | 168 | 1.0 |
| 1982 | 291 | 292 | 1.8 |
| 1983 | 171 | 111 | .7 |

Source: *State Mining and Mineral Development Corporation*

## MINERAL SANDS

Ilmenite, rutile, monazite and zircon are collectively termed mineral sands, Ilmenite (FeOTiO2) contains between 50 - 60 per cent of titanium ovide. Its dark colour is due to the presence of iron oxide. Rutile (TiO2) is at least 95 percent titanium oxide. Metallic titanium when produced commercially possesses unusual properties for many applications, particularly in the manufacture of aircrafts, spacecrafts, missiles and supersonic jets. The titanium paints consist of pure titanium oxide as a mineral base. Ferrocarbon titanium is alloyed with steel to make high speed steels. Rutile is also used in the ceramic industry. Zircon (Zrsio4) is used as foundry sand and in the manufacture of refractories. It can also be used a raw material for the manufacture of crucibles. Monazite is utilised mainly to produce thorium and rare earth elements. The practical importance of thorium is connected with utilisation of nuclear energy.

Sri Lanka has earned an international reputation for its mineral sands. The country's beach placer deposit at Pulmuddai extends for about 4.5 miles along the coast and reaches about 250 yards in width and about ten feet below the low water mark. The other important concentrations of minral sands deposits are at Kaikawela and Polkotuwa to the south of Colombo, and at Kudremala point to the south of Mannar. The Pulmuddai deposit is estimated to contain about 4 million tonnes of raw materials, whose composition is 70 - 72 percent ilmenite, 8-10 percent zircon, 8 percent rutile, 0.3 percent monazite and 1 percent silimanite.

The Ceylon Mineral Sands Corporation is responsible for the exploitation of mineral sands in Sri Lanka. Its Pulmuddai plant is capable of processing 140, 000 tpa of raw dry sand. Ilmenite is recovered using magnetic seperators. In 1978 and expanded rutile and zircon recovery plant commenced operations. The current rate of production of ilmenite is of the order of 40,000 tonnes per year. With the commissioning of the new plant 1978 the production of rutile increased to 11,300 tonnes per annum tpa. The Corporation is capable of recovering 10,000 tpa of zircon. In 1983 production of ilmenite and zircon showed significant increases over that of 1982. at present all of the Corporation's ilmenite and rutile is exported to Japan. Zircon is sold to Europe and Japan. The value of ilmenite exports has moved up steadily in recent years while the value of rutile exports have gone up even faster. See Table 5.

Mining of these mineral sands is concentrated on deposits on the northeast coast from Mullativiu to Nilaveli. Exploration by the Geological Survey Department (GSD) has revealed additional deposits. The total reserves of heavy minerals is now estimated at around 13 million tons.

A deposit of cuprieferous magnetite has also been discovered at Seruwila The GSD in collaboration with Bureau de Recherches Geologiques et Minieres has identified some 3.5 million tons of ore containing 1 to 1.5 percent Cu and 40 perce nt Fe.

An on-shore survey conducted by SIMCO Ltd., in a joint collaboration project between the State Mining and Mineral Development Corporation and the Intersite B.V. of Netherlands, completed in 1981 has indicated prospects of large deposits of heavy minerals. The Corporation was seeking assistance to do a further detailed survey to establish the exact quantities. Also, a contract was signed with M/s. Voest Alphine AG. of Austria in April 1982 for the erection of a Wet Gravity Upgrading Plant and a Wet Magnetic Separation Plant and these were expected to be commissioned late in 1984.

## SILICA SAND

Quartz and silica sand are two abrasive materials that are abundant in Sri Lanka. Silica (SiO2) is also used to manufacture glass. Most important deposits of silica are found at Marawila and in the Ampanavallipurum area near Point Pedro. In Nattandiya, the deposits spread over an area of 1,500 acres with an average thickness of about 4 ft. Ithas been estimated that in Nattandiya alone there is about 6 million tonnes of silica which contains 98 per cent silica, less

## TABLE 6
## PRODUCTION AND EXPORTS OF ILMENITE, RUTILE AND ZIRCON

| 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | |
|---|---|---|---|---|---|---|
| Ilmenite | | | | | | |
| Production '000 | | | | | | |
| Mt. tons | 34.5 | 55.4 | 34.0 | 80.0 | 68.3 | 80.5 |
| Exports (Quantity) | | | | | | |
| '000 mt. tons | 37.1 | 30.5 | 36.7 | 41.5 | 47.0 | |
| Exports (Value)Rs. mn. | 9.0 | 7.8 | 9.9 | 13.9 | 15.3 | |
| Rutile | | | | | | |
| Production '000 | | | | | | |
| mt. tons | 11.3 | 14.7 | 12.8 | 13.3 | 7.2 | 8.1 |
| Exports (Quantity) | | | | | | |
| '000 mt. tons | 9.4 | 14.6 | 12.2 | 2.1 | 15.4 | |
| Exports (Value) Rs.mn. | 26.3 | 49.3 | 55.7 | 13.5 | 74.7 | |
| Zircon | | | | | | |
| Production '000 | | | | | | |
| mt. tons | 3.1 | 1.4 | 3.0 | 3.3 | 5.8 | 5.7 |
| Exports (Quantity) | | | | | | |
| '000 mt. tons | | 3.2 | 2.0 | 4.6 | | |
| Exports (Value)Rs. mn. | | 1.9 | 1.3 | 4.8 | | |

Source: *Mineral Sands Corporation*

than 1 per cent iron oxide (Fe2O3) and titanium dioxide (TiO2). This is an ideal raw material for glass manufacture. Rayo Glass Ltd. produces 2,500 tpa of glass melt from which white and amber bottles are made. The company has plans to produce 30,000 bottles per day. The abrasive properties of quartz and silica make them useful in the manufacture of sand papers and other abrasive products. Sri Lanka also has high quality natural abrasive materials such as corundum and garnet. Garnet sand is available on the southern coast of the island.

## MINERALS FROM THE SEA

Sea water contains an average of 3.5 per cent of various elements in solution. Thus, each cubic mile of sea water holds about 166 million tonnes of solids. As a source of minerals, the sea has been little exploited in relation to its potential. Of the 60 or so elements known to be dissolved in sea water only a few have been commercially extracted. Minerals that can be successfully extracted from the sea include salt, gypsum, epsom, bromine and iodine. Although sea water contains traces of precious metals such as gold, the economic recovery of such metals has not been successful. For further details see table 7.

## SALT

The National Salt Corporation which is the sole organisation engaged in the production of salt has 17 solar evaporation units which have a total combined production capacity of 250, 000 tons per annum (tpa). However, the production is kept at a lower level as the local demand does not exceed 120,000 tpa. (See table 8) The export of the product is hampered owing to the high cost of freight. There are many chemicals that can be manufactured starting from salt. They are caustic soda, washing soda, bleaching powder, hydrochloric acid and gaseous chlorine. Only 2 per cent of Sri Lanka's total production is used for the manufacture of chemicals. Production of these chemicals is presently done by the Paranthan Chemicals Corporation which operates the caustic soda plant. The government is considering the setting up of a second caustic soda/chlorine plant. There is a great demand for caustic soda which is an important raw material in the paper industry. The National Salt Corporation is collaborating on a Rs 100 million project with the Paranthan Chemicals Corporation and the National Paper Corporation to establish a plant to manufacture 700 tpa caustic soda/ Chlorine at Embilipitiya. Unlike the traditional method which uses the diaphrag - cell technique, this project is to be based on the latest membrane cell production technology.

## TABLE 7
## Minerals Available in Sea Water

Basis: 1 cubic mile

| Minerals | Quantity |
|---|---|
| Sodium Chloride | 128 million tonnes |
| Magnesium Chloride | 18 " " |
| Magnesium Sulphate | 8 " " |
| Calcium Sulphate | 6 " " |
| Potassium Sulphate | 4 " " |
| Calcium Carbonate | 578 thousand tonnes |
| Magnesium Bromide | 350 " " |
| Bromine | 300 " " |
| Strontium | 60 " " |
| Boron | 21 " " |
| Flurone | 6 " " |
| Barium | 900 tonnes |
| Iodine | 700 " |
| Arsenic | 260 " |
| Rubidium | 200 " |
| Silver | 40 " |
| Copper, Lead and Zinc | 30 " |
| Gold | 25 " |
| Uranium | 7 " |

A chemicals industry is a fundamental requirement for the speedy industrialisation of a country and with this as one of its objectives the Paranthan Chemicals Corporation commenced commercial production of chlorine, caustic soda and sulphuric acid at the beginning of the 1960s. Although the Corporation is mainly concerned with the production and disposal of caustic soda and liquid chlorine, limited quantities of table salt are also produced for sale locally. Hydrochloric acid,Ferric chloride, Zinc chloride are other items being produced. as seen in table 9.

**Table 8**
**Production and Sales of Common Salt by the National Salt Corporation**

| Year | Production | Sales |
|---|---|---|
| 1977 | 46,360 (tons) | 120,586 (tons) |
| 1978 | 149,268 ( " ) | 113,059 ( " ) |
| 1979 | 121,443 ( " ) | 110,615 ( " ) |
| 1980 | 127,161 ( " ) | 120,924 ( " ) |
| 1981 | 104,344 (mt.tons) | 116,094 (mt. tons) |
| 1982 | 169,232 ( " " ) | 106,329 ( " " ) |
| 1983 Upto August | 84,603 ( " " ) | 69,820 ( " " ) |

Source: *National SAlt Corporation*

## Conclusion

In order to transform in an underdeveloped Sri Lankan economy into a developed one, the industrial sector will have to play a dominant role. As the Minister of Finance pointed out in his 1984 budget speech, it is imperative that our mineral resources are exploited to the full. Involvement in the industry by the private sector is being encouraged by the present government which favours an open economy.

The Government has recently authorized private sector participation in the refractories project of the Ceylon Ceramics Corporation and projects initiated by several other state corporations including the State Mining and Mineral Development Corporation, the Hardware Corporation and the Ceylon Mineral Sands Corporation. Enterepreneurs should explore the possibilities of getting involved in similar mineral-based industries. For example, it may be possible for private miners to open some of the old abandoned graphite mines with technical advice from the SMMDC. The private sector should also consider setting up of graphite-based industries. Among such possible industries are the manufacture of cinema arc carbon, carbon arc electrodes, midget electrodes for dry cells, carbon brushes, colloidal graphite lubricants, greases, paints and crucibles. Small scale indigenous industries based on local minerals such as clay, glass-sand and limestone are comparatively easier to realize.

**Table 9**
**Production of Salt-related products by the Paranthan Chemicals Corporation**

| Year | Caustic Soda | Liquid Chlorine | Table Salt | Hydrochloric Acid | Ferric Chloride | Zinc Chloride |
|---|---|---|---|---|---|---|
| 1977 | 1,515 | 662 | 559 | 560 | 108 | 110 |
| 1978 | 1,865 | 1,156 | 486 | 668 | 110 | 121 |
| 1979 | 1,723 | 1,274 | 519 | 1,041 | 78 | 63 |
| 1980 | 1,827 | 1,456 | 521 | 982 | 123 | 74 |
| 1981 | 1,729 | 1,339 | 498 | 979 | 108 | 59 |
| 1982 | 1,407 | 845 | 365 | 627 | 117 | 45 |
| 1983 | 1,420 | 903 | 520 | 563 | 90 | 32 |

Source: *Paranthan Chemicals Corporation*

Kaolin which is a valuable raw material for ceramics, the paper and paint industries, can also be used as a refining agent in the sugar industry and also to make dielectric parts for electronic equipment. Garnet sands may be used to make sand papers. At present mica is exported in the raw state. Mica may be processed to produce sheets to be used in insulating materials for electrical appliances.

The mineral sands industry is heavily dependent on exports for its survival. There are possibilities of establishing domestic manufacturing industries based on these resources. In this way value-added mineral products could be available for the more diverse industrial markets.

Once the Eppawala phosphate project is completed, Sri Lanka would be a major producer of phosphate fertilizer, capable of producing 530,000 tpa of diammonium phosphate and 50,000 tpa of triple super phosphate.

As a source of minerals, the potential of the sea is enormous. Apart from salt, chemicals that can be extracted from sea water include magnesium sulphate, magnesium chloride, calcium sulphate, bromine and iodine. Sri Lanka's maritime boundaries cover an area of 4 times its size and therefore the amount of marine minerals available to the country is almost limitless. Ectraction of marine minerals

and production of chemicals from them can no doubt be a profitable business. Demand for caustic soda, for instance, is growing annually by about 12 percent. This growth in demand is mainly due to the increased demand for pulp and paper. This year the Ceylon Petroleum Corporation has planned to commence off-shore oil exploration in collaboration with a Canadian firm. If, successful, this venture could make a tremendous impact on the nation's economy.

At present most of Sri Lanka's valuable minerals are exported almost in raw state. Processing of minerals increases their value by a great margin. In some cases, the increase may be twenty fold or more. It is time that this country considers the processing of minerals before exporting them.

There are several reasons why the potential of local minerals has not been fully exploited. Inability to find the capital, non-availability of technology in the past, low level of entrepreneurship and a hostile international climate may have been some of them. Political and social pressures too may have inhibited effective policy adaptation. The international market for some of the mineral commodities too has gone through a difficult period in recent years because of a slowing down in the rate of economic growth in some of the industrialised countries. The need for foreign investment to supplement local capital resources, technology and access to export markets has now been recognised. The recent tendency of international mining companies to strengthen their investment and exploration efforts in industrialised countries at the expense of their activities in developing countries has nothing to do with the natural potential for mineral resources in developing countries. It is largely based on political, fiscal and economic considerations. To counteract this tendency it is necessary to strengthen mutual trust and stability and to create conditions which attract foreign investment and investors who will bring in the technical expertise and technology.

Some of the Sri Lankan industries are faced with marketing difficulties because of the competition from imported products. A classic example of this situation is the closure of stage II of the Ceylon Steel Corporation project where an electric arc furnace worth over Rs.180 million was left idling.

Stage II which was commissioned in mid 1982 had to be shut down in 1983 being unable to compete with imported products. Since early 1984 Stage II has been back in operation, however, and its future remains bleak unless remedial action is taken. Considering the advantages flowing from such enterprises through the use of indigenous raw materials, generating of employment and savings of foreign exchange, a re-examination of the present tariff structure so as to ascertain the degree of protection that needs to be afforded to the local industry merits some consideration.

Another state venture that had to face similar competition is the Paranthan Chemicals Corporation which manufactures and sells caustic soda and chlorine, Hydrochloric acid, Zinc oxide, Ferric chloride and table salt. Its production and sales were affected in 1982 as a result of the lower prices of imported finished products and substitute products. Imported caustic soda and chlorine were cheaper than the locally manufactured products and Hydrochloric acid sales were affected as several customers switched to the use of imported Sulphuric acid.

Local manufacturers generally prefer to use imported raw materials of superior quality unless the quality of the locally available raw material is acceptable to them. For example, although china clay is available in Sri Lanka, the quality of the mineral is not quite acceptable for industries such as paper and paint, owing to its low brightness. It may be possible to improve the brightness of local china clay by chemical or electrolytic treatment. There are a number of similar cases. The domestic market may not be adequate for profitable running of some industries. The alternative is to look to the international market. The quality of the finished products must be improved to be able to compete with products of other countries. Therefore, it is of utmost importance to encourage research and development work on local mineral resources. Appropriate research projects may be carried out at the universities and research institutes where scientific personnel and laboratory facilities are available. State Corporations and prospective manufacturers who would be the ultimate beneficiaries of such work could provide funds for research projects. Similar action by the business community can ensure not only economic progress but also an eventual return on investment.

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