Harnessing and Utilization of Our Mineral Resources

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Minerals today, are vital for a developing country like ours and are indispensible for modern industry. Modern structures, roads and machines, are all built of materials obtained from minerals. Military strength provided by arms and ammunition is largely of mineral origin. Soil fertility is maintained by mineral fertilizers and water. Modern scientific and technological achievements, such as space travel have also been possible because of minerals. It is therefore of the utmost importance that we harness and utilize our mineral resources to the best advantage to the nation.

In the highly industrialised countries, both the total and per capita consumption of every mineral is very high. The mineral consumption of nations with predominantly agrarian economies on the other hand is low. These countries call themselves underdeveloped and very often strive to industrialise. Sri Lanka belongs to this latter group of countries. However, it has to be pointed out that we in Sri Lanka have only twenty-five thousand square miles to provide us with all the minerals we need. But a country like the Soviet Union for instance, which extends almost half way round the globe can probably name any mineral they want and find it within their territory. It is therefore all the more important that we carefully harness the scarce mineral resources we possess and conserve and use them to the best advantage.

From the time of the Sinhalese Kings, Sri Lanka was considered essentially an agricultural country. In colonial times, the major part of her revenue was derived from the agricultural industries, tea, rubber, coconut and rice. Consequently all development work was geared to the development of these industries and our mineral resources were neglected. We had to import all our cement, ceramics and a major portion of our brick and tile from abroad. The only mining industry prevalent at that time was graphite, and this too was done to cater to the needs of our colonial masters who exported the graphite to provide them with raw materials needed for industries in their home country. This situation continued for quite a long time, until during World War Two, due to the restriction of imports, several pilot scale factories were started in Sri Lanka for the production of ceramic ware, brick and tiles using locally available raw materials. With the cessation of hostilities, a concentrated effort was made to find out what mineral raw materials were available in the country which could be utilized for industry. Such a survey was found all the more necessary at that time, as we did not have a proper inventory of our mineral resources and therefore were unable to assess the mineral potential and industrial potential of Sri Lanka. Further, because of the falling prices of our main products, tea, rubber and coconut and the increased cost of production of these commodities due to increases in fuel, fertilizer and machinery, we had to look for other sources of income. Minerals and products derived from them therefore constituted important alternatives as sources of revenue and employment.

A full-scale systematic mineral exploration programme in Sri Lanka was first started in the late thirties by the Department of Mineralogy, (now the Geological Survey Department) and a large part of the effort in the early stages was devoted to traverses across the length and breadth of the country looking for minerals of economic value at or near the surface. Substantial progress was made during that time and with the limited resources available, it was possible to identify some of the potential economic minerals, such as the superficial limonitic iron-ores of the South Western Sector of the Island, the china clay deposits, the beach mineral deposits and the Muthurajawela peat deposits. However, these techniques could not be applied for hidden or buried mineral deposits. These underground deposits could only be explored by adopting the more modern scientific prospecting techniques. These are geophysical, geochemical and radiometric, and are based on a more methodical search for ore bodies on a knowledge of the mineralogy, structure, and geological history of an area and factors favouring mineralisation. By the use of these techniques together with aerial photographs and diamond drilling techniques, the Geological Survey Department was able to harness interesting new findings of minerals which could be economically exploited.

The various surveys and programmes conducted by the Geological Survey Department over the years led to the discovery of an ever increasing number of economic important minerals both in hard rock and in the alluvial deposits derived from the weathering of rock which are as follows :—

Iron Ores
Limonite, geothite and magnetite.

Limestone minerals
Sedimentary, coral, shell and crystalline.

Radioactive minerals
Monazite, thorianite, allanite.

Magnesium minerals
Dolomite, magnesite.

Titanium minerals
Ilmenite, rutile.

Zirconium minerals
Zircon, baddelyite.

Silicate minerals
Vein quartz, silica sands, zircon sands, feldspar, serpentinite garnet sands, cordierite, sillimanite.

Copper minerals
Chalcopyrite.

Phosphorous minerals
Apatite.

Mica minerals
Phlogopite, muscovite and biotite.

Carbon minerals
Graphite, peat.

Clay minerals
China clay, ball clay, pipe, brick and tile clay and clay suitable for cement.

Gemstones
Several varieties of which the most important are :—

Sapphire, ruby, alexandrite, catseye, emerald, aquamarine, topaz, tourmaline, garnet, spinel, zircon, moonstone, iolite and quartz.

There are a host of other minerals which have been discovered during the mineral exploration programme, but the quantities so far discovered are small and are therefore not economically feasible at present. However, with further work it will be possible to discover the sources of origin of these minerals and discover more of them which could eventually be used in industry.

Having discovered a large variety of minerals which could be used as raw material for various industries, let us now consider how these have been harnessed and put into use for the best advantage to the nation. One of the earliest industries to be established (as a direct result of the discovery of valuable limestone deposits in the Jaffna Peninsula and clay deposits in Mannar), was a factory for the manufacture of cement at Kankesanturai in the late forties. Again after the discovery of a further 20 million tons of high grade limestone and adequate clay resources at Puttalam, a second cement factory was established there. The manufacture of cement is now in charge of the Cement Corporation. The Corporation has further expanded its output of cement by setting up a grinding plant at Galle and hopes to put up a factory in the South using the limestone available there.

Consequent to the discovery of economically valuable deposits of kaolin, fire clay, ball clay, quartz, feldspar and dolomite, all the raw materials required for the establishment of an ever expanding ceramic industry are now available locally, with the result that four factories have been established for the manufacture of ceramic ware, wall tiles, electro ceramics, and miscellaneous ornamental and fancy ware in various parts of the island. Two factories have been set up for refining kaolin. These supply the refined kaolin to the various ceramic factories and also to the local paint, paper and rubber industries.

As a direct result of a systematic study of the clay deposits of the island, a variety of products using clay are being manufactured throughout the country, which, until recently were imported. The cottage industry manufactures about 350 to 400 million bricks per annum, unglazed tiles of the Mangalore pattern type are produced in abou fifty modern factories resulting in a total production of over fifty million tiles per annum.

Earthenware pipes and floor tiles are also produced in Sri Lanka. With the establishment of a refractories factory at Hanwela, we will be in a position to use our zircon sillimanite and dolomite as raw materials for this factory and will be self-sufficient with respect to furnace linings needed for the ceramic and steel factories. Up to now, the crystalline limestone — the dolomitic variety, although found in large quantities has had only a limited use, chiefly in the ceramic industry and in agriculture for correcting magnesium deficiency in soils. However, this kind of limestone can be used to manufacture magnesia. The raw materials needed, namely sea water and dolomite are available in Sri Lanka and the possibility of producing magnesia here is very promising. The British Peridore Company produces magnesia by this method.

With proved reserves of iron-ore, both of the limonitic and magnetic variety of about 12 million tons, it will not be long before Sri Lanka will establish a smelting plant to utilize iron ore. The Steel Corporation has already established a plant at Oruwela with Soviet aid for this purpose. The proposal is to operate it in three stages. The first stage is to use imported iron ingots, the second to use scrap iron and finally our own iron-ore. The first two stages have already begun and plans are ahead with the last stage to use our iron-ore. The Seruwila deposit is by far the most promising as it contains apart from magnetite, apatite and copper minerals. Once this deposit is exploited it will be possible to recover apatite and copper as well as a by-product.

The beach sands of Sri Lanka contain valuable minerals like ilmenite, rutile, zircon, monazite, sillimanite and garnet. These are scattered round the coast of Sri Lanka but concentrated at various points along the beach, particularly at Pulmoddai. The Mineral Sands Corporation has been entrusted to exploit and develop these sands. In their factory at Pulmoddai, the Corporation is geared to produce 90,000 tons of refined ilmenite, 12,000 tons of rutile, 8,000 tons of zircon, 500 tons of monazite and 200 tons of sillimanite. All the minerals they produce at present are exported in bulk, without processing to developed countries like Japan.

The gem and graphite industries are two of the oldest industries in Sri Lanka. Until recently these industries were in the private sector, but now they have been handed over to state sponsored Corporations. After the take-over, the State Gem Corporation was established in 1971 to develop the gem industry of the island. Gem mining is however, carried out by the private sector. All gem exports from Sri Lanka have to be channelled through the Corporation. The Corporation has made a significant contribution towards establishing a sound gem industry. The known figure for the value of gem exports in 1971 was two million rupees. The export figure for 1977 was over 200 million rupees. The revenue from the

export of gems is increasing daily and before long will be one of our chief foreign exchange earners. Graphite mining is at present carried out by the State Graphite Corporation. Graphite mined in Sri Lanka has a very high carbon content and is in great demand all the world over. Grades over 99 percent carbon are common. The bulk of the graphite mined is exported. The local consumption is negligible, except for some used in the manufacture of graphite crucibles and pencils. The State Graphite Corporation has also undertaken the development of the mica industry which has been neglected over the years. Mica occurs at a number of points. Systematic surveys are now being conducted to locate commercially valuable deposits and to establish this industry, too, on a firm footing.

Sri Lanka is rich in silica deposits. Vein quartz of extreme purity (over 99% silica) is found as scattered deposits. Pure quartzites occur in the central high lands and they can be traced for miles. Both these forms find use in the ceramic industry. High grade silica sands are found in various parts of the island particularly at Nattandiya, Madampe, Chilaw, Jaffna and Trincomalee. These sands are ideally suited as raw material for glass manufacture. A factory is now being set up with Chinese aid to produce sheet glass using these silica sands as raw materials. When this factory comes into production we should be able not only to produce our requirements of sheet glass but also to cater for an export market.

Thus with the discovery of these mineral resources of Sri Lanka which we were hitherto unaware of, it is now clear that our country is fairly well provided with resources of certain minerals, specially of the industrial type. Based on these deposits, a number of factories have been set up. However, a deeper analysis shows that some of these minerals are under-utilized or not utilized at all. Since minerals are a non-renewable commodity it is absolutely essential that we secure their optimum utilization by processing and developing them. Therefore, if the industries already established or about to be established are to prosper, a comprehensive programme of work will have to be undertaken both on the minerals, the processed material and by-products. Such a programme has become all the more necessary today as some minerals are not processed for want of appropriate technology to process them. The beach mineral industry for instance has been in existence for the last fifteen years and produces valuable minerals like rutile, ilmenite, zircon, monazite and sillimanite, all of which are exported to other countries without processing them here. The ilmenite is sold at 18 US dollars per ton. If however, we can convert this to titanium slag or synthetic rutile it would fetch 175 to 200 US dollars a ton. If this can be processed further to titanium dioxide pigments it would fetch 1000 US dollars a ton. Again, monazite, a thorium-rich rare earth phosphate is a valuable source for making compounds of thorium, rare-earths and phosphorus. The tremendous potential for thorium in nuclear reactors, and the rare-earth chlorides as catalysts in petroleum refining makes monazite an important mineral for the future. Countries like India and Brazil, which also produce monazite, have completely prohibited by law the export of this mineral in the unprocessed form. It is therefore opportune that Sri Lanka, too, follow the example of these countries and if necessary stockpile this mineral, till it is possible to establish a technology to process it. The same should apply to other radioactive minerals like thorianite and allanite found in Sri Lanka. Again, if we examine other mineral industries like graphite which have been mined and exported from this country for over a century, not a single graphite based industry of any significance has been established here. However, there is a great demand for our graphite from developed countries because of its high quality and suitability for making crucibles, electrodes, carbon rods and lubricants.

Two important mineral discoveries of great significance to Sri Lanka have been made by the Geological Survey Department in recent years. These are :-

(1) the apatite deposits at Eppawela and
(2) the copper magnetite deposit at Seruwila.

With the discovery of the apatite deposits the possibility of starting a phosphate industry in Sri Lanka has now almost become a reality. The deposit is estimated at 50 million tons with an average P_2O_5 content of 30 per cent. However, the Eppawala apatite is characterised by its low solubility, which is about 40 per cent less than that of Tunisian phosphate and 20 per cent less than the minimum value recommended for direct application. Any attempt to use this apatite as a direct application fertilizer, amounts to a wasteful expenditure of money and depletion of a valuable resource. From a study of its chemistry and mineralogy, it is recognised as a fluo-carbonate apatite. Beneficiation and treatment with sulphuric acid to convert it into super or triple superphosphate or conversion to fused magnesium phosphate by fusion with magnesium silicate are possible alternatives. High quality (magnesium silicate) serpentinite found to occur in the Uda Walawe area could be used for this purpose and experiments carried out in this direction have given encouraging results. Considering the price increases of phosphate fertilizers and the complex character of our apatite, further studies are obviously necessary both on the laboratory and pilot scale, followed by field trials to develop this apatite as a potential source of fertilizer and use, using a process that would be most advantageous to Sri Lanka. The copper-magnetite deposit at Seruwila is the first base-metal found in Sri Lanka. From investigations made so far only one fifth of the total mineralised area, it is estimated that 68,500 tons of metallic copper and 6.6 million tons of magnetite are available. Much more exploration work is required to cover the entire prospect to obtain a correct estimate of the grade and quantities of copper and magnetite (iron). Detailed studies will have to be made on the beneficiation and processing of the ore before commencing any extractive metallurgy. In addition to the iron and copper, apatite too, has been found in this deposit, which could be recovered once this deposit is exploited.

With a view to accelerating this exploration work, the Government has entered into an agreement

with a foreign firm for an expanded programme of exploration and before long it will be possible to know the total copper, magnetite, apatite and other minerals in this deposit and process these to the best advantage of the nation.

From the foregoing it is clear that Sri Lanka, although small in size, when compared to other Asian countries, has sufficient minerals, especially of the industrial type to start industries of its own. Based on these deposits, a number of industries have already been started, whilst some of them will be established once the initial exploration work is over and the feasibility studies are completed.

Mineral deposits are considered an exhaustible resource and it is now known that the richer mineral deposits of the world have been or are being exhausted and future need for metals and minerals must be met from larger deposits of progressively lower grade. In such a context, optimum utilization of our mineral resources becomes all the more important. As pointed out earlier, processing adds greatly to the value of mineral products. A further advantage, as is well known, would be to set up possible local industries based on the processed mineral raw materials and their by-products.

The mining and mineral industry has a tremendous future in Sri Lanka. The total value of our mineral commodities is now over 400 million rupees per annum. If however, we take the potential mineral deposits still unexplored, the value is almost double this amount. We have the resources and the man-power. What Sri Lanka lacks at present are trained mineral technologists, metallurgical chemists and the chemical engineers to handle the many problems that await the development of our minerals. For this purpose, the Government should consider the establishment of a single organisation, as in other developed countries, to undertake research and development of our mineral resources and work in close liaison with Corporations and other institutions engaged in the use of mineral raw materials. Such an establishment will not only help in the training of mineral technologists and chemists but also in the development of technology to process the minerals which are at present exported in the raw state.

In Sri Lanka as in other countries, the search for new mineral deposits is being continued. It is however left to the industrialists to intelligently and economically exploit these deposits. No industry based on local raw material can prosper, unless reserves and potentialities of the raw materials used are fully understood and the problems associated with their behaviour and use are solved. It is only then, that can we develop and build up the mineral industry in Sri Lanka into a major progressive and stable one for the future.