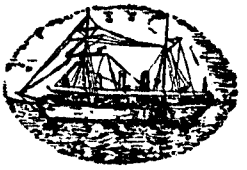

SYMPOSIUM ON CORALS AND CORAL REEFS

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THE INDUSTRIAL USES OF CORALS IN INDIA

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THE air and water are absolutely essential for the existence of mankind. Like that for the existence of industry, there are minerals of various nature. Of these, limestone and lime are cheap materials and mostly used in industries in one form or the other, directly or indirectly in the process. Even the use of other raw materials such as iron ore, coal, crude oil, sulphur and salt are only second or at best equal to the quantity of limestone used in industry. Limestone is available in abundance to the extent of 3 to 4% of the elements in the earth's crust. Of the very many varieties of its occurrence in nature, coral limestone is one in which dominant part is the fossilised coral.

Availability in India

From the surveys so far conducted the coral reefs either living or dead have been located in Gulf of Kutch, Laccadives, Maldives, Palk Bay and Gulf of Mannar. On the Maldive corals some study has been made and its growth rate has been found to be 25.6 mm per annum. Mr. R. Bruce Foote was the first to mention about the presence of coral reefs and coral islands off the Tirunelveli and Ramnad coasts in his Memoir on the Geology of Madurai and Tirunelveli Districts. There is a chain of small islands, from Hare Island near Tuticorin upto Kutchathivu near Rameswaram. The islands are five to nine miles from the coast. The areas of these islands range from 60 acres to 600 acres. The coral reefs are found in abundance around all these islands. The islands contain only hard calcareous sandstone and certain islands have coral reefs covered with thick layers of sand. Large quantities of coral reefs broken by waves are

washed ashore in these islands indicating the presence of large reefs around. In the Laccadives the fishermen find these coral reefs an obstruction to the free approach to the shore in their fishing boats. Generally the coral reefs are a hazard for navigation and in many cases, in the fringing reefs and atolls, portions of the reefs have had to be cut away and removed in order to provide a navigable channel to the harbour or the lagoon.

The Rameswaram Island contains large deposits of coral limestone on the land and in the fringing reefs around the island on the northern side from Mandapam to Rameswaram. On the land under the swamps roughly 9,000 tonnes per acre can be recovered as limestone. The deposits are about five feet thick containing all varieties of semi-fossilised corals.

In the Kutch the beach sand itself contains fragments of shells and corals very rich in lime, and these are used for manufacturing cement. Coral stones are also available in the dead reefs.

The corals are very rich in lime with a specific gravity of 1.6. The other elements present such as silica, alumina, iron and magnesia are very low. Since it is taken out of sea water, washable salts absorbed by corals are present in very small quantities. The following analysis will give an idea of its high purity and composition:

$CaCO_3$	....	....	99.5%
$MgCO_3$	....	....	0.5%
$Ca_3P_2O_5$	....	....	0.2%

The upraised reefs of Rameswaram are of slightly inferior quality as the following analysis shows.

CaO	....	....	49.25 %
Al_2O_3	....	....	0. 2 %
Fe_2O_3	....	....	0. 8 %
SiO_2	....	....	5. 8 %
MgO	....	....	0. 7 %
K_2O	....	....	Trace.
P_2O_3	....	....	0. 3 %
Loss in ignition		....	40. 0 %

The coral limestone is very porous and the fine sand rich in silica enters these pores and increases the silica and alumina content.

Industries Based on Corals

1. Cement

In Australia after the Great Barrier Reef Expedition the value of these calcareous material and coralline deposits was realised and the Queensland Cement and Lime Company was started to exploit these reserves. In our country in Gulf of Kutch one cement unit is already using these materials in Sikka Even the sand in that area contains rich calcium because of the presence of shell grits and coral fragments. From this sand cement is manufactured and to some extent to supplement this raw material coralline material is added. The advantage of these raw materials unlike other stones is that the whole deposit is uniform in character. The physical and chemical properties are most satisfactory as a basic raw material for manufacture of high-grade portland cement.

In the south a detailed survey has shown that these coralline deposits of Rameswaram island will be useful for manufacture of portland cement of Indian Standard Specification. The daily capacity of the plant can be 600 tonnes (2,00,000 tonnes per annum) and the deposits will last for over a period of 40 years

The analysis of the limestone available in Rameswaram is as follows and is suitable for cement manufacture :

$CaCO_3$: 86 %
MgCO : 0·5%

2. Chemicals

It is under very strange circumstances that the coral became useful for manufacture of chemicals in India. When the manufacture of calcium carbide started in the south the availability of low-phosphorus raw material was very difficult. This industry was facing a closure unless the phosphorus problem was solved Phosphorus in carbide is highly detrimental, since it will catch

fire due to auto-ignition and explosion. It had been earlier published in a report that coral limestone is useless for manufacture of carbide. Also the reports by one or two technical collaborators from abroad discouraged the use of coral. As most of the inventions happened by accident coral also came to be used by accident just to solve the phosphorus problem. Analysis of a piece of coral revealed that its P_2O_5 is as low as 0.02%, but the silica content was high in the particular piece. A further study on this, on the basis of the Great Barrier Reef Expedition, proved that it is possible to get low-phosphorus and high-calcium coral. It has been found by the scientists of Great Barrier Reef Expedition that in the case of reef-building coral a very great amount of phosphorus is excreted into water. The purity of lime in the coral reef is as high as 98% $CaCo_3$. The particular capacity of the coral to remove sediments by themselves makes the reef free from silica. The other impurities in the reef such as magnesium carbonate, sulphur are very very low. In the manufacture of chemicals the presence of magnesia and sulphur are highly objectionable. Magnesia is very hard to burn and thus increases the cost of production. Sulphur compounds affect the purity of the end products. Today about 20,000 tonnes of corals are used for the manufacture of calcium carbide by the Industrial Chemicals Ltd., Sankarnagar, in South India.

3 Metallurgical Uses.

Coral limestone has got considerable mechanical strength. For every tonne of pig iron produced a flux limestone of 300 kg. is required. This removes the silica, alumina, manganese and sulphur Since the coral is of very low phosphorus content in the steel making process this will be a boon. The calcium content of the coral reacts with the above impurities to form a slag in the iron furnaces which is tapped out. This slag can again give a product of slag cement for construction purposes. Normally with 55% pure iron about half tonne of slag is formed per tonne of pig iron produced. A normal analysis of slag will be as follows:-

SiO_2	....	36.0 %
Al_2O_3	....	12.4 %
CaO	....	41.5 %

MgO	....	6. 2 %
FeO	....	0.48 %
MnO	....	1.34 %
S	....	1.29 %

Many iron foundries and non-ferrous smelters will also be requiring small-scale fluxing for which coral stones are suitable.

In making glass this can be added to improve its mechanical properties by making it less fragile and stronger. The corals are low cost fluxes.

4. Paper Industry.

For recovery of caustic which will otherwise go waste coral lime can be used.

Coral stones can be used for acid neutralisation, for manufacture of calcium cynamide, calcium-based chemicals, lime, cement, in agriculture, mineral food, water treatment and in metallurgy.

5. Agricultural Uses.

Agriculture requires a large amount of calcium for mixed fertilizers, animal mineral food, poultry grits and neutralising agents. The present day indiscriminate use of chemical fertilisers in the soil makes the soil acidic quickly. The approximate pH value of the soil should be maintained at less than 7 to get a good yield and for plants to absorb more fertiliser added. In the course of the last three years in a small circle of about 200 miles about three thousand tonnes of lime have been consumed annually for which a large proportion of coral lime was utilised.

From one of the reports in 1881 by Col. Baker, the then Port Master of Pamban, we find that Ceylon was importing shiploads of corals for her estates. Coral stone is applied directly to soil or as lime.

6. *Other Uses.*

The coral limestone can be used in industry both for its physical and chemical properties. Physical uses are :

Masonry Unit,
Construction aggregate,
Ornamental buildings,
Filter and filter aid.

Coral limestone filter can be used for abrasives, calcium-calking compounds, ceramics, chewing gum, fabrics, floor coverings, insecticides, leather goods, paint, paper, phonograph records, putty, rubber, plastics, pottery and poultry grits.

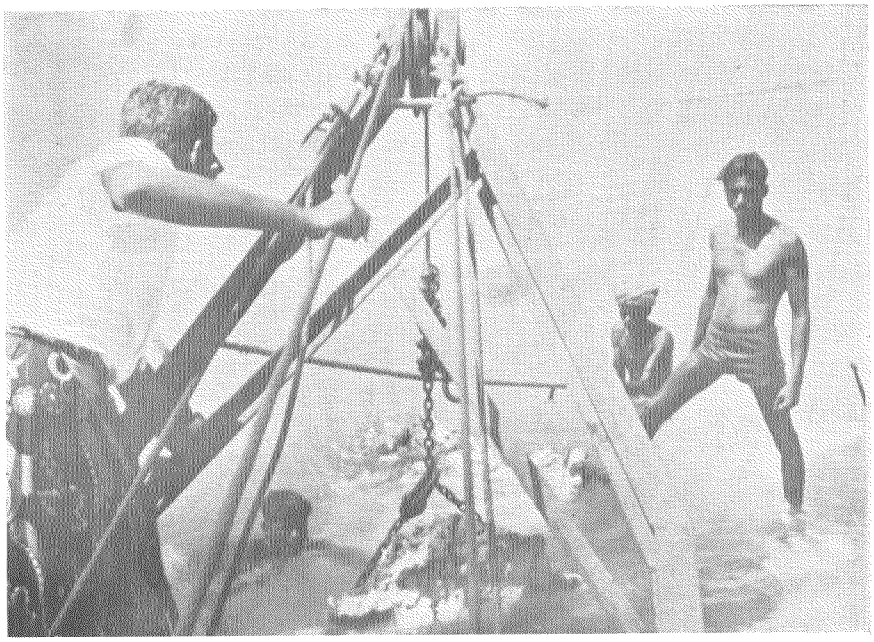
Corals in the coastal region of Ramnad and Tirunelveli have been widely used as building material. Big buildings, churches, naval dockyards have been constructed out of this. Very recently the road connecting Ramnad and Mandapam has been laid over a coral stone base. This road is about 24 miles and every furlong consumed roughly 1,500 tonnes. Apart from this on account of the cheapness of the material the rural roads are all formed out of this material.

How Coral is Mined

The present way of cutting coral stones are manual. The sailing boats from the shores opposite the reef reach the reefs during the low tide. The boatmen drive a long crowbar called 'Alavangu' into the soft reefs and lever it to break the stones. The broken pieces are loaded into the boat during high tide so that the boats will get sufficient water to come out of the reefs after loading. They reach the shore before evening and unload them. There is no systematic way of cutting the reefs as the boats sail according to the wind directions. The whole area of coral reefs gets disturbed.

There is at present a restriction imposed by the Government on the quantity of corals that can be cut and removed. This is meant as an aid in conservation, but is causing some hardship for the industry. It is not possible now to say with any certainty to what extent this is helpful since we have at present no idea about the rate of growth of the corals of this area and their rate of replenishment. There is need here for work on this aspect, from the results of which both the agencies of conservation and the industry can benefit.

The corals must be preserved, exploited and if possible cultivated so that it will be available for ever. This is possible only by scientific exploition by organised industries. The individuals who are at present mining it in a careless way will only spoil the reserves and the further growth and will not help the industry. It is time for us to set up a research wing for the study of corals around our country for the commercial exploitation since it is proved to be a valuable mineral for industry. This can be achieved only by the industries themselves coming forward to support such research and development, and it is hoped that the Central Marine Fisheries Research Institute would give necessary technical advice and facilities for work. The present symposium, therefore, is a timely one and the deliberations are being awaited with interest not only by the scientists but by the industrialists as well.



Coral Stones Being Collected from the Reefs

The Corals Unloaded on the Shore