A Glimpse on the Importance of the Coastal Zone, its Problems and Suggestions for their Management – Tapas Kumar Mallik, Former Director, G.S.I., FD-317, Sector III, Salt Lake, Kolkata – 700106

Why Study the Coastal Zone?
Earth's history is linked with the coastal zone and the sea. Through the coastal tracts the Sea is receiving sediments which records the history of geological events. Society depends on the coastal zone for its biological diversity, mineral resources, for fulfilling recreational opportunities, for sustaining important industries, for waste disposal, transportation and also reflects the modification of climate. There is a massive increase in population living in this zone. Lots of problem arises due to storm damage, sea level rise, coastal erosion and siltation. Also there are many conflicts in this zone and an efficient management is necessary for sustainable development of the coastal resources.

Study of the Coastal Zone started in 1726 with Hutton's study on sea level changes and observations on lands. Subsequently, a number of workers carried out different types of work in the coastal zone specially on the beaches. In 1851, GSI was set up for Geological Mapping, Mineral Exploration and studies related to coasts. The amount of elevation of coasts was determined from study of raised oyster beds up to 3 m thick. Sorting takes place during transportation according to size, shape and specific gravity of the minerals and controlled by the processes as currents, waves, sea level changes etc. The jigging action of waves and surf tends to concentrate the heavy minerals in certain zones in the beaches and also in the submerged areas formed during the Pleistocene when the sea level was much below the present level.

Vast deposits of placer minerals occur in the stretches of coastal areas of Kerala, Tamil Nadu, Andhra Pradesh, Maharashtra, Orissa and in selected sectors of West Bengal. At present the industry is being dominated by IRE which accounts for 95% output. Mining will always require EIA study. Extensive dune sand deposits occur in Orissa coast and mined by OSCOM. Ilmenite, zircon, monazite, garnet, sillimanite are mined in Chatrapur, Orissa along a coastal belt of 18 km and an area of 26 sq km. 230 million tonnes of raw sand contains 20-25% heavy minerals. A number of new products have been developed here in addition to rare earth chlorides, fluorides, oxides, calcium oxide, hydrates etc. Ilmenite (FeO TiO2) and Rutile (TiO2) are the main Sources of Ti.

India is 4th largest after Mozambique, Australia and China. Ti is used for aerospace
applications, medical, automobile and jewellery. In India reserve of Ilmenite is 161 million tonnes. (Tamil Nadu 31%, A.P. 30%, Kerala 26% and Orissa 13%). World reserve of rutile is 155 tonnes. India is second after Australia. Segmented use of Ilmenite includes Paints 57%, Plastic 22%, Paper 12%, Others 9%. Titanium metal is used for making artificial hips, knees, heart valves, dental works etc. Aerospace Industry has the single largest market for Ti products due to its exceptional strength. In addition the metal is also used for jewellery, eyeglass, watches etc. Garent is mined by Indian Ocean Garnet, mine site is located NE of Kanyakumari. Blasting grade garnet (0.7 to 1.4 m) used for cleaning of ships, oil rigs, oil pipes, vessels boilers etc. Water Jet cutting grades (0.42 to 0.25 mm) is used for cutting stainless steel, titanium alloys, granites, glasses etc. Almandite is the best abrasive garnet.

Coastal Zone Management

The coastal lands are thickly populated Coastal waters are most productive. Episodic physical events like tsunami, hurricanes, algal blooms etc are common in coastal zones. Global climatic change, seal level rise, coastal erosion and the changing weather pattern is characteristic of coastal region. Conflicts from tourism and fishing is common. Development activities without considering the delicate ecosystem have invited a number of problems. The manmade causes include interruption in the sediment transport, reduction in sediment supply, sand mining, construction of ports, harbours or dams in the river, construction of seawalls etc. Problem has also been caused by encroachment of beaches and coastal lands including reclamation of wetlands. This will enhance the coastal flooding and salt water intrusion. Coastal pollution due to industrial discharge and urbanization is another recurring problem. Geological knowledge should be utilized in mitigation and understanding natural hazards. In spite of various problems of the coastal zone, a full exploitation of the coastal resource is possible by proper management. Future requirement points towards a conservative approach for the sustainable development of the coast. Hence a coastal zone management programme was thought leading to the formation of coastal regulation act which was notified by the Ministry of Environment and Forest in India in 1991.

The Coastal Regulation Act prohibited many activities like setting up of New industries, suitable mechanism of waste disposal etc. Permissible activities include construction for defence, ports, harbour, light houses, thermal power plants etc.

Important issues for consideration in the Coast Zone

1. Our first objective will be to solve societal problems like coastal erosion, earthquake hazard, tsunami effect, pollution etc. Climate changes are bound to occur due to human induced accumulation of carbon dioxide, nitrous oxide and methane which are increasing and causing higher global temperature, leading to melting of ice causing sea level rise and more erosion of the coast justifying a close monitoring of the beaches. The effect on inter tidal wetlands, coastal dunes should be monitored by satellite imagers and field traverse at regular intervals.

2. We have to concentrate on placer and calcareous sand deposits along the coasts.

3. Infrastructure should be developed with reference to instrument, manpower, public awareness and education. Proper attention should be given for the essential support needs like education, research, field activity, analytical facilities, model development, training.

4. Occurrence of relict mangrove forest all along the coastal sectors in West Bengal is a very interesting feature. Mangrove is a very important feature of the coastal zone. Usually they are restricted to intertidal zone and have a great capacity to recover from major natural disturbances. A number of animals are dependent on mangroves. Mangrove plants are also being inundated at a fast rate causing lot of problems. They are specially adaptable to flooding and salinity conditions and play an important role in soil formation, shoreline protection and their stabilization. They protect the coast by absorbing and reducing the impact of strong winds, tidal waves and floods that usually accompany the tropical states. They should be studied and preserved carefully.

5. There is an urgent need for evolving integrated national Earth science Policy and role of National Agencies. Close interactions with scientists of different disciplines will help in achieving our target.

6. There should be a proper mode for data dispersal.

7. Detail studies and likely impact of mining on various aspects of environment and ecology has to be covered before large areas are mined.

8. Stabilisation and conservation of dunes and formation of neo-dunes by artificial methods should be attempted.

9. Improved coastal protection measures like construction of seawalls, offshore submerged breakwaters, shore walls beyond high tide line, tsunami mounds etc. should be carefully designed. Constant watch on artificial structures and their maintenance should be followed.

10. Infrastructural development for tourism in the sea coast sites for fisheries, fish farming human settlement is to be considered carefully.

11. Much importance has to be given on studies on special aspects like ichnological studies or study of coastal cells. Study of trace fossils in recent sediments and in delta areas gives significant biological and environmental clues. They have been used in interpretations of paleo environment, paleo shorelines, in solving geotechnical problems. Some polychate burrows has been used for estimating annual rates of erosion and accretion successfully. Coastal Cell is the stretch of the coast between the boundaries which contain sediment movement. Careful Cell identification will give correct idea about transport and will help in efficient management.

12. Environment Impact Assessment has to be carried out for any mineral deposit and a number of important points should be remembered. Sustainability of the deposit, area and place of dumping and