Offshore Sand Exploration Around Kaluthara-Beruwala Area

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Abstract: Offshore minerals are used as a raw mineral for various types of industries around the world. The exclusive economic zone belonging to Sri Lanka more than eight times land area of the country, offering huge potential for extraction and exploitation of minerals. Industrial sector, including mining and minerals, should grow to achieve the development of the country. Therefore this study was carried out to investigate the offshore sand mineral potential around Kaluthara – Beruwela area. About 200 samples were collected from sea floor, from a grid of 500m, 1000m Easting and Northing respectively. Investigation was carried out to identify the variation of particle size and mineral content around the Kaluthara area by sieve analysis. For each sample, particle size distribution curves were plotted and mean particle sizes, sorting and skewness were obtained. Heavy mineral content was also determined using gravity separation, magnetic separation; high tension separation and microscopic observation. Resource maps were plotted and mineral resources areas were demarcated.

Key words: Offshore minerals, Particle size, Skewness, Sorting Index, Sieve analysis

1. Introduction

Sri Lanka needs at least 9 million cubic meters of sand annually to meet the demand of the local construction market. This will be supplied from the rivers in the country. River sand known as "non renewable resources" is considered to have caused a lot of environmental problems during and after the course of mining. Therefore the government as well as various environmental lobbies do not encourage river sand mining due to adverse environmental effects. This situation has caused drastic shortage of sand. Hence, local construction is severely hampered. Mining of river sand for construction purposes has become a major environmental, social and economic issue in the recent past. The average rate of increase in demand for construction sand during in the last six years has been estimated to be round 10%. Unless otherwise a suitable alternative is introduced to the local market, building trade is going to face grave difficulties.

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As an alternative for river sand, use of offshore sand has been suggested since the use of offshore sand is now a common practice, throughout the world.

The largest beach sand deposit which is 6.5 km in length with an average width of 60 m located at Pulmoddai. The deposit is estimated to contain nearly 4,000,000 tons of raw sands. Offshore mineral exploration is important because of the resource hidden under the sea bed, where can be utilized properly by granting prospecting and exploration licenses. The exclusive economic zone belonging to Sri Lanka more than eight times land area of the country, offering huge potential for extraction and exploitation of minerals. Industrial sector, including mining and minerals, should grow to achieve the development of the country.

In this study, we have carried out an exploration program to find out suitable sand deposits around Kaluthara-Beruwala area. .Results shows, existence of large minable sand deposits that can be used for the future demands.

2. Methodology

267 Sand samples were collected at 12 km x 11.5 km off the river mouth areas of Kaluthara-Beruwela area. Fig. 4 shows the sampling location. GPS readings of all the locations were recorded. The collected samples were preserved by deep freezer before analysis. Samples were dried at 60 °C for 24 hours and moisture content was calculated. Coning and quartering was done to reduce the samples by considering the weight and particle size. Reference samples (50% of original) were kept for each analysed sample.

3. Sample analysis

All samples were subjected to sieve analysis and graphs were plotted for particle size distribution.
Mean grain size, sorting and skewness were determined.

Mean grain size

$$M = \frac{\phi 16 + \phi 50 + \phi 84}{3} \quad \text{.....(1)}$$

Skewness

$$S = \frac{\phi 84 + \phi 16 - 2(\phi 50)}{2(\phi 84 - \phi 16)} + \frac{\phi 95 + \phi 5 - 2(\phi 50)}{2(\phi 95 - \phi 5)} \quad \text{..(2)}$$

Sorting Index

$$D = \frac{\phi 84 - \phi 16}{4} + \frac{\phi 95 - \phi 5}{6.6} \quad \text{...(3)}$$

Where,

Φ5- Grain size of 5% of cumulative weight
Φ16- Grain size of 16% of cumulative weight
Φ50- Grain size of 50% of cumulative weight
Φ84-Grain size of 84% of cumulative weight
Φ95- Grain size of 95% of cumulative weight

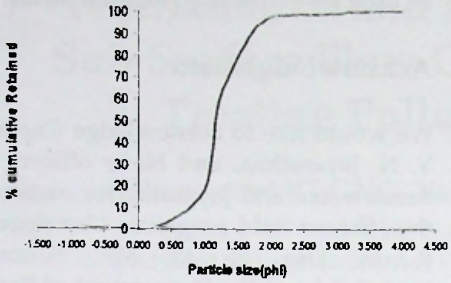

Figure 1. Particle size distribution of an arbitrary sample

4. Results

Variation of mean grain size with Distance to river mouth was plotted as shown in figure 2. It could be seen that coarse, medium and fine sand are concentrated between 6000m to 10000m from the shore.

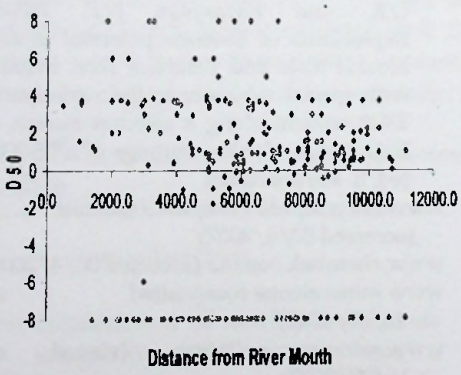

Figure 2. Variation of mean grain size with distance to river mouth

Variation of Mean Grain size with depth to sample point was plotted and it is shown below. It shows that sand is concentrated depths in between 0 - 10m and 20 - 30m.

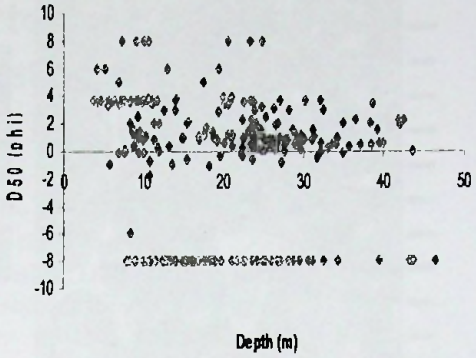

Figure 3. Variation of Mean Grain size with Depth

According to (Kumara et al, 2006) the most commonly found particle size of the Ilmenite is in the range of +125µm to +250µm. Therefore heavy mineral concentrated areas are denoted by white and light ash colour in figure 5.

Mean Grain size of construction sand laid around medium and coarse and it can be identified by using Figure 5.

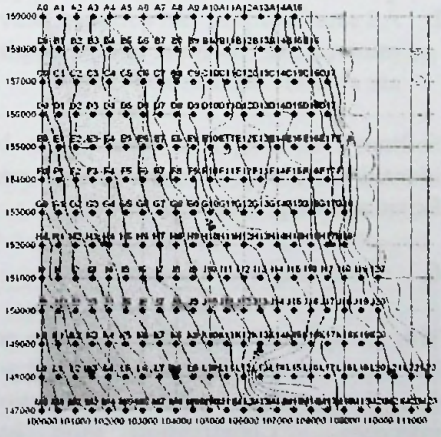

Figure 4. Bathymetric map of investigated area

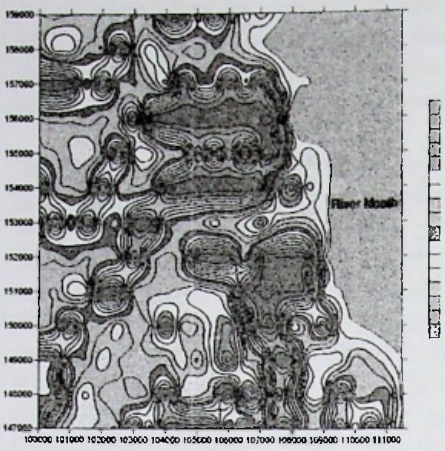

Figure 5. Grain size distribution of heavy minerals

5. Discussion

Overall results of the above two charts and resource map we can say that sand deposit are located thought offshore around the Kaluthara area and there are sediment between Corel reefs and Rock Mountains and most are,

1. Suitable as construction sand due its particle size distribution
2. All sand samples can contains heavy mineral due to most sand samples are suitable particle size range.

Sediment flowing path clearly can be identified using Mean Grain size Resources map.

6. Conclusion

This study confirmed that the there are lot of sand deposits around Kaluthara area that can be used for construction purposes. Construction sand has specific particle size distribution and specific Mean grain size. Most of Experimented samples lied between this range and having above mean grain size.

However, these deposits also contains appreciable amount of ilmenite that can be used for extracting Titanium metal.

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