

Status of Heavy Mineral Investigation off Konkan Coast

The occurrence of onshore placers of ilmenite along the Konkan coast of Maharashtra is known since 1935. The Directorate of Geology and Mining, Maharashtra estimated the reserves of ilmenite to be 4 m.t. in the area extending from Undi to Purangad for a stretch of 48 km. To study the offshore extension of promising onshore placers, investigation was taken up by GSI during field seasons 1976-77 and 1977-78 by collecting grab samples from hired local boats. This revealed the presence of black sands within the bays of Mirya, Neora, Ratnagiri, Kalbadevi and Ganapathipule to a water depth of 13 m.

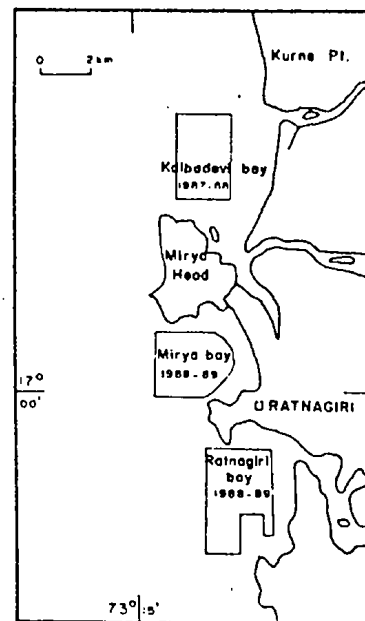
In 1975, the National Institute of Oceanography initiated offshore surveys off the Konkan coast from Jaigarh in the north to Vijaydurg in the south for 130 km long stretch. The surveys consisted of echo-sounding (1889 line km), shallow seismic profiling (895 line km), magnetics (1228 line km) and sea bed sampling (1320 grab, 66 cores and 41 bulk samples). From seismic profiles, thickness of heavy mineral sands was estimated to be between 2 and 10 m in the area. The surveys indicated ilmenite bearing sands to cover more than 96 km² of the sea bed. The surface sands were estimated to contain 11 to 57% of ilmenite, titanomagnetite and hematite. Assuming an average ilmenite-concentration of 10% and minimum thickness of 1 m, the reserves are inferred to be about 12.5 million tonne.

With the acquisition of the coastal research vessel *Samudra Shaudhikama* by GSI, geological sampling including grab, vibro and piston cores and shallow seismic surveys were carried out in the territorial waters between Rajpur in the south and Jaigarh in the north during the field seasons 1984-85 and 1985-86.

Further investigation of the ilmenite placers off the Konkan coast was carried out by Geological Survey of India in the field seasons 1988-89 and 1989-90, during which SS-84 and SS-91 cruises were taken up in three most promising bays. SS-84 covered Kalbadevi bay while SS-91 covered Mirya and Ratnagiri bays. Exploration for heavy minerals in the bays consisted of grab sampling, vibrocoring, bathymetric surveys and magnetic and shallow seismic profiling; the latter two were of limited scope, because they were mainly done

outside the targeted area of geological sampling owing to the shallowness of the bays. The quantum of work done during the two cruises is given below :

	<i>Kalbadevi</i> (SS-84)	<i>Ratnagiri</i> (SS-91)	<i>Mirya</i> (SS-91)
Area covered	6.25 km ²	6.5 km ²	6.5 km ²
Grab stations	9 Nos.	38 Nos.	18 Nos.
Vibro cores	40 Nos.	30 Nos.	30 Nos.
Bathymetry	35 LKMs	50 LKMs	30 LKMs
Magnetic survey	12 LKMs	58 LKMs	30 LKMs
Shallow seismic	35 LKMs	70 LKMs	26 LKMs
Side Scan	—	12 LKMs	—



Konkan offshore sectors where heavy mineral exploration have been taken up.

Bathymetric map prepared for the Kalbadevi bay shows an E-W depression in the central part of the bay. It also displays a steeper slope in the eastern part which becomes very gentle in the western part. Both Ratnagiri and Mirya bays are characterised by uneven topography with cropping out of bed rock above the water level at places (Brun Muddle Rock in Ratnagiri and Button Rock in Mirya).

Grab sampling indicates the absence of any appreciable thickness of sediments around the topographic highs. Heavy mineral bearing silty sand with varying proportions of shells covers the sea bed in the bays to a water depth of 9-13 m. Beyond this depth and off promontories, the area is blanketed by olive grey silty clay.

Vibrocoreing was carried out to study the down depth behaviour of HM bearing sands in the nearshore areas of the bays and to know whether these sands continue offshore below the top clays as inferred from seismic profiles by NIO scientists. In Kalbadevi bay, three operations of coring were attempted at 250 m interval, but the large drift of the vessel made the attempt not worth continuing. Hence thereafter, vibrocoreing was done on 500 m x 500 m grid in both the cruises.

Repeated attempts in the NE corner of the Kalbadevi bay and in the areas around Button Rock in Mirya bay did not succeed in recovering samples. The cores recovered from Kalbadevi bay varied from 0.37 to 4.43 m in length, giving a recovery percentage of 7.4 to 88.6. Cores varying in length from less than 20 cm to 4.80 m were recovered from the 30 stations of Ratnagiri bay. In Mirya bay, samples were recovered from only 26 stations out of the 30 stations attempted for coring. Penetration was generally less than 1.5 m in the sandy nearshore areas in both Ratnagiri and Mirya bays whereas in the outer clay zones, penetration was much higher, recovering cores of more than 4 m length.

Subsampling of the cores for heavy mineral studies was at 1 m interval in Kalbadevi cores and 50 cm in Ratnagiri and Mirya cores, irrespective of lithological variation. It resulted in a total of 90 subsamples from Kalbadevi and 220 samples together from Ratnagiri and Mirya bays. In addition, magnetic susceptibility at 10 cm interval has been studied for all the cores.

The lithologs of the cores show that the different lithounits intersected in the core are silty sand, silty clay, shell and gravel beds. These zones are of widely varying thickness and laterally non-correlatable, suggesting that they are small lenses of limited lateral extent. Below the top sand and clay, generally occurs a shell rich zone with gravels and pebbles of laterite and basalt, which probably represents the lowermost unit in the sediment column overlying the weathered bed rock.

Thick clay is also observed to occur below the top heavy mineral bearing sands in near shore areas, from where long cores have been recovered. The longer

cores recovered from the outer parts of the bays do contain thin intercalations of HM bearing sands within thick clay zones, but these do not appear to be the off-shore extension of HM sands in the nearshore areas of the bays. The sampling data indicate that HM sands in Ratnagiri and Mirya bays have only limited distribution both in space and time.

Ilmenite and titano-magnetite are the only two economic minerals in the bay sediments which are concentrated in very fine sand and coarse silt fractions. Heavy minerals in different size fractions were separated using bromoform. Magnetite was separated from the heavy concentrates using a hand magnet or isodynamic separator at low amperage of 0.05 Amp. and ilmenite at 0.3 Amp. Grain mounts were prepared for magnetite, ilmenite and the nonmagnetic fraction at 0.3 Amp. and individual grains were counted. Impurities which got into magnetite and ilmenite (mainly clinopyroxene) were discounted from the wt % of magnetite and ilmenite computed and the amount of ilmenite "intruded" into the nonmagnetic fraction added to the wt % of ilmenite.

The laboratory analyses of the Kalbadevi samples have been completed and resources available have been estimated. Ilmenite varies from 1 to 40% and magnetite from 0.8 to 8% in bay sediments. Conservative estimation of ilmenite and magnetite in Kalbadevi down to a depth of 2 m from sea bed is of the order of 2.29/3.12 and 0.44/0.68 million tonne respectively over an area of 6/8.45 km².

Laboratory analyses of samples of Mirya and Ratnagiri bays are in progress. Available data indicate that these sediments are leaner than those of Kalbadevi in respect of ilmenite content. The proportion of ilmenite in these sediments is generally equal to or slightly higher than magnetite. As such, substantial resources of ilmenite are not expected from these two bays.

One bulk sample of about 5 tonne of sediments from Kalbadevi has been sent to IRE, Chavara for beneficiation studies.

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