

*Occurrence of Thorium Bearing Minerals in Sri Lanka*

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*Progress of Survey of Nuclear Raw Material with Emphasis on  
Locating Thorium and Uranium Mineralization and Demarcating  
Radiogenically Hazardous Areas  
(Project SLR-2009)*



by

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*Occurrence of Thorium Bearing Minerals in  
Sri Lanka*

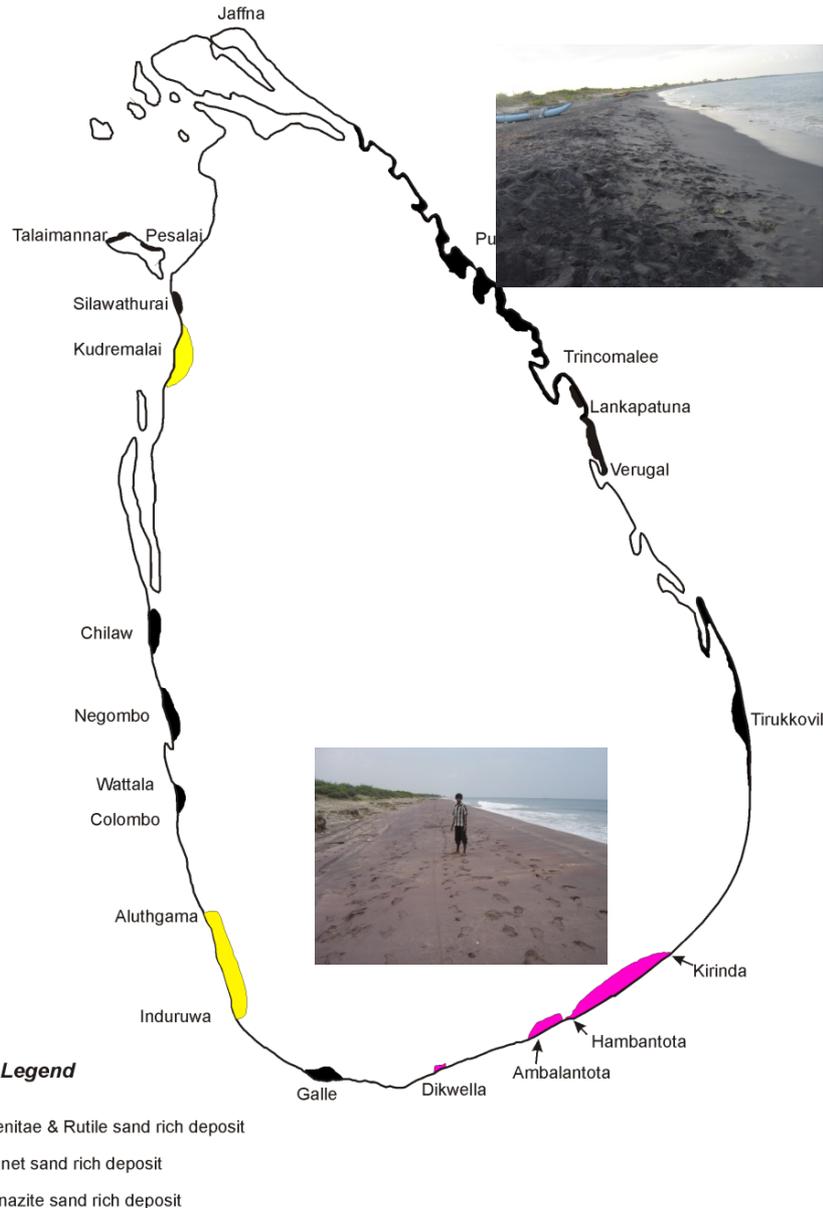
## Introduction

- Detailed geological surveys to identify economically viable Thorium bearing mineral occurrences have so far not been performed within the area covered by Sri Lankan Mainland.
- The first survey for the Monazite sands was conducted by Waylands and Coates during 1910's along coastal area centred on Beruwala.
- During late fifties and early sixties, preliminary radiometric surveys were conducted in several parts of the country, particularly in SW sector, by the GSMB (then Geological Survey Department). In these surveys, number of thorium bearing mineral occurrences was identified. These include, Thorianite, Thorite, Monazite and Allanite. Thorium is found in considerable quantities in these minerals. These surveys were conducted with the assistance of Canadian Government under the Colombo Plan program.
- In 1997, the Geological Survey of Canada conducted a marine geophysical survey in nearshore area off Panadura - Beruwala in SW Sri Lanka in order to study off-shore minerals. The survey was funded by UNDP.
- In 1979, islandwide preliminary stream sediment survey was conducted by the GSMB and AEA with the technical assistance of IAEA to identify Uranium Mineralization.

## Introduction cont.....

- According to historical records, Thorianite was first discovered in Sri Lanka in 1904 by Dr. Ananda Coomaraswamy. During this period, it was reported that several tons of thorianite were exported.
- Concentrations of Monazite in beach sands around Beruwala were exploited using a small experimental plant during the period of 1918 to 1922. About 450 tons of Monazite were reported to be recovered from approximately 3000 tons of raw sand during this period.
- In 1956, a separation plant was fixed at Katukurunda area near Kalutara by the GSMB as a pilot plant to process mineral sands.
- According to available records, an average of 1000 tons of sand per year with Monazite concentrations of 6 – 8% were processed at the plant and exported to Japan.
- In early eighties, the separation plant had to be abandoned due to various reasons.

Map Showing Principal Beach Mineral sand Occurrences in Sri Lanka



## Principal Mineral Sand Occurrences in Sri Lanka

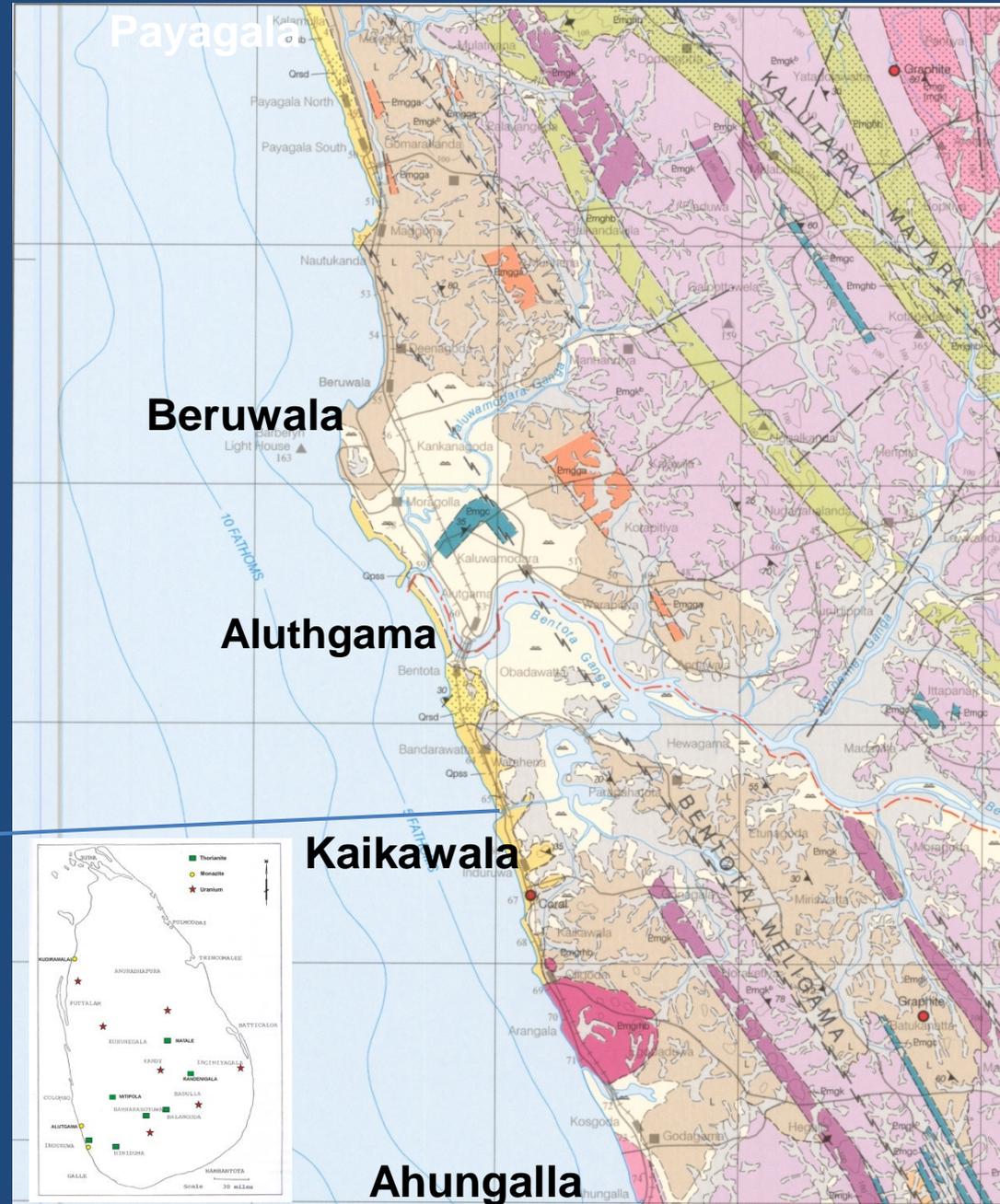
- Varying concentrations of heavy mineral sands (ilmenite, rutile, garnet, zircon, monazite, etc..) occur in beach sands of the country.
- However, only at certain locations that these occurrences are sufficiently concentrated for economic exploitation.
- Of these occurrences, Monazite sands are known to occur fairly along the coastal stretch covering Authgama – Beruwala – Induruwa in SW sector and Kudiramalai in NW sector of the island.
- Notable amounts of Thotianite sands are also reported in beach sands along Beruwala – Induruwa areas.
- In addition, Monazite and Thorianite sands are reported to occur in lesser concentrations within Pulmuddai, Thirukkivil and Galle mineral sand occurrences.

# Monazite Occurrences in Aluthgama – Beruwala – Kaikawala Coastal Stretch

Geological Map of the Area Covered by Payagala – Beruwala – Aluthgama – Kaikawala – Ahungalla Areas



Monazite (including ilmenite) bearing beach sand at Kaikawaka



# Identified Locations of Radioactive Mineralization in Sri Lanka

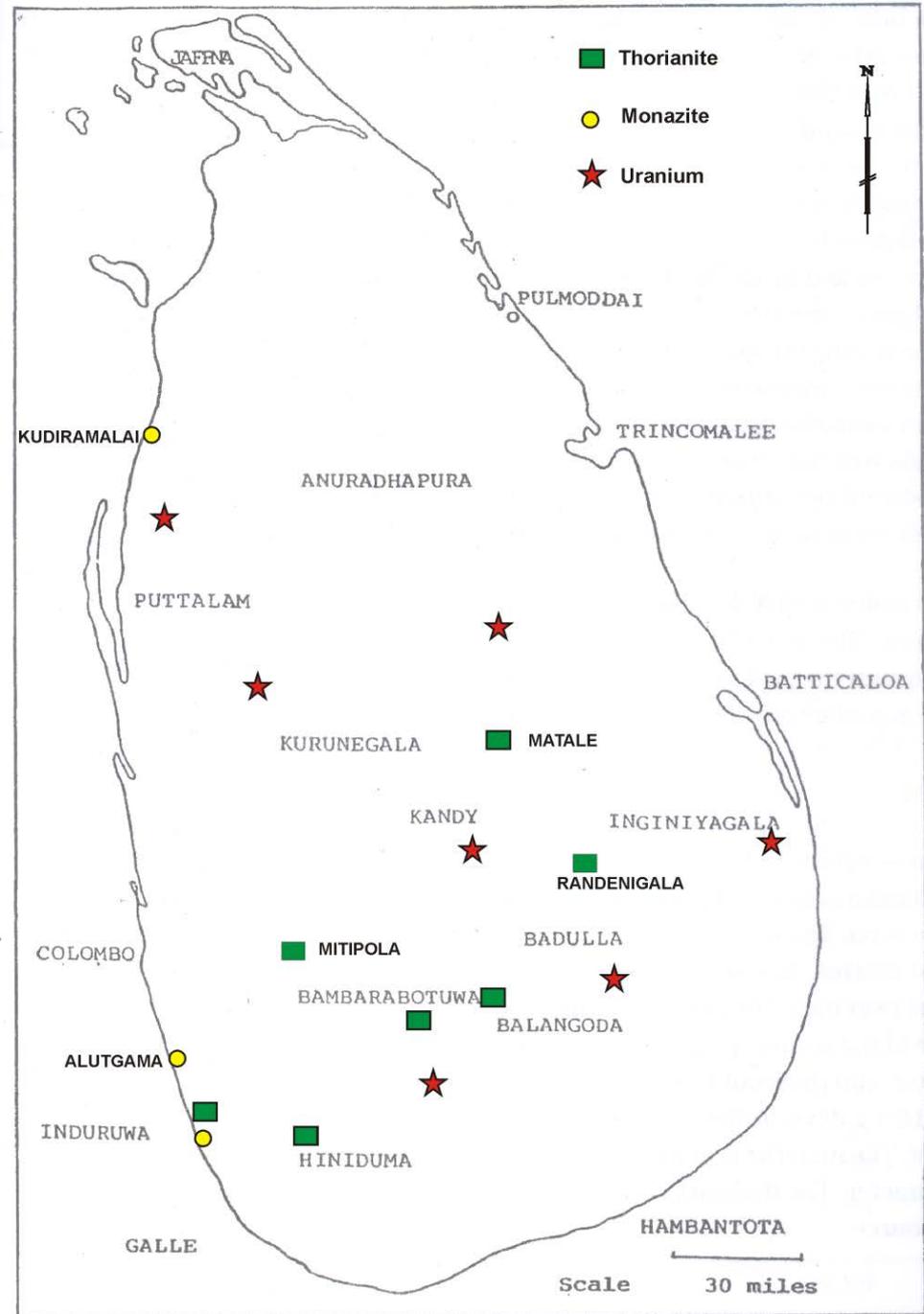
During, preliminary radiometric surveys conducted in several parts of the country particularly in SW sector, by the GSMB (then Geological Survey Department) with the financial assistance of Canadian Government in late fifties and early sixties

and studies on gem bearing sediments in different gem bearing areas

as well as studies on sporadic rock samples in several parts of the country,

number of thorium bearing mineral occurrences was identified. These include, Thorianite, Thorite and Allenite.

Detailed studies are required to check their extensions and economic viability



## Uranium Mineralization in Sri Lanka

## Simplified Geological Map of Sri Lanka Showing Nine Anomalous Areas Identified For Uranium Mineralization (After Preliminary Survey)

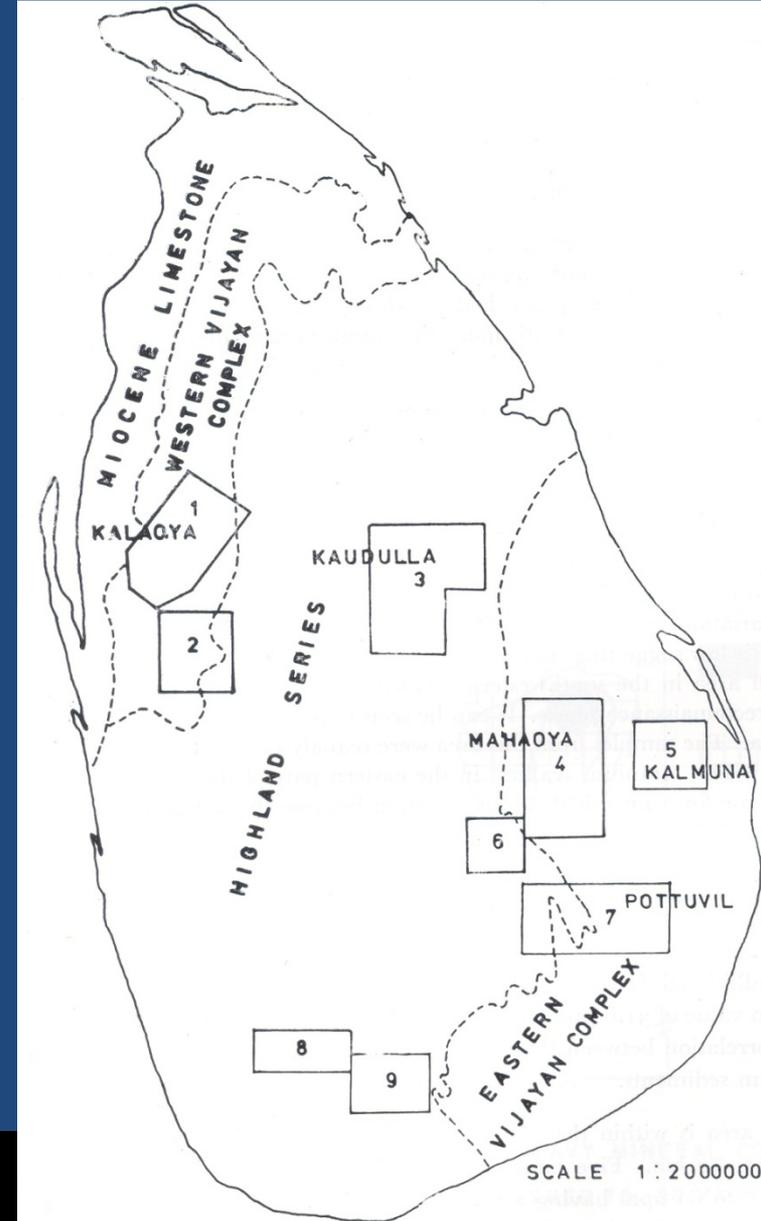
In 1979, islandwide preliminary stream sediment survey was conducted by the GSMB (then Geological Survey Department) and AEA with the technical assistance of IAEA to identify Uranium Mineralization of the country. The survey was a preliminary type exploration programme and it was continued upto 1983.

Based on the results of this survey, total of nine areas were identified for detailed studies on areas centred on following townships.

Area 1 – Kala Oya	Area 2 – Galgamuwa
Area 3 – Polonnaruwa	Area 4 – Maha Oya
Area 5 - Kalmunai	Area 6 – Passara
Area 7 – Pottuvil	Area 8 – Rakwana
Area 9 – Udawalawe	

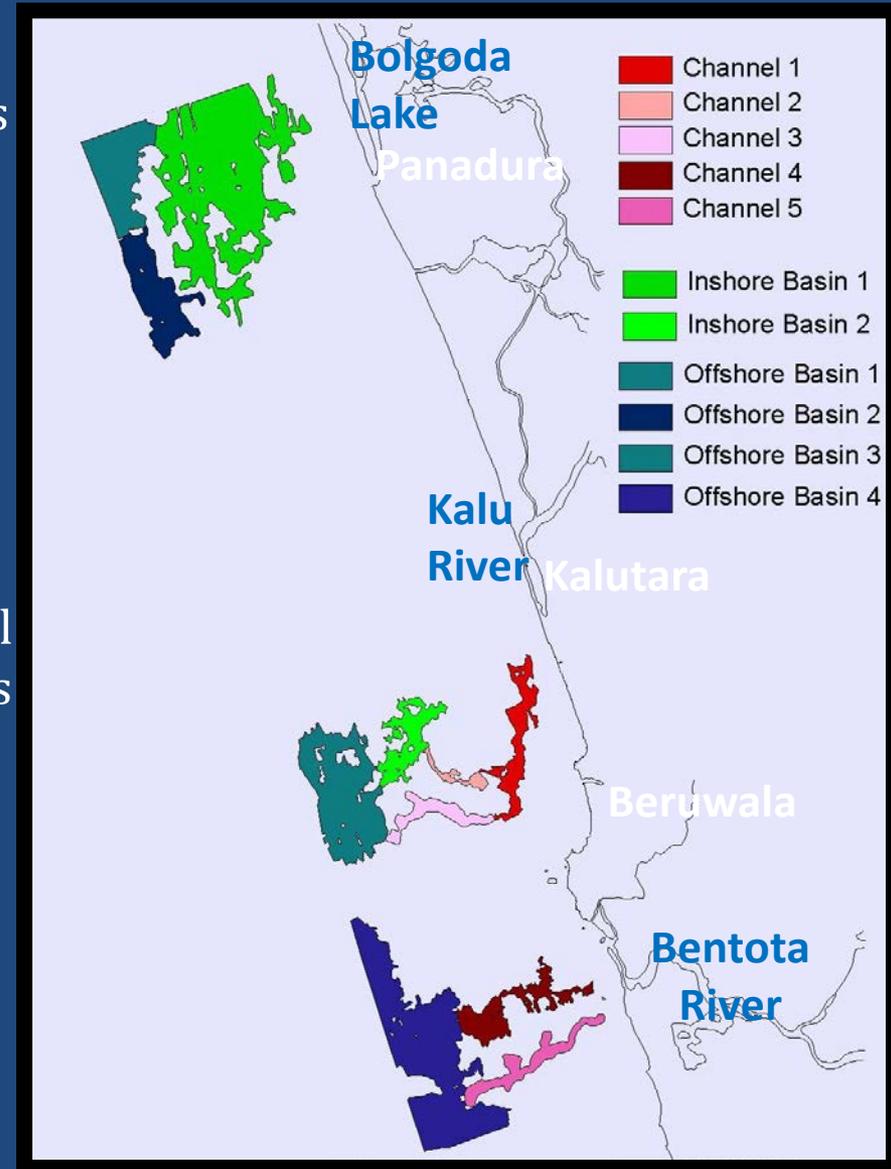
Except for the Kala Oya area, rest of the eight areas are mainly composed of highly metamorphosed rocks. In Kala Oya area, sedimentary rocks of Jurassic age (shales and arkose sandstones) are confined.

It is necessary to undergo a detailed survey in order to identify promising areas / zones of Uranium mineralization within the identified anomalous areas



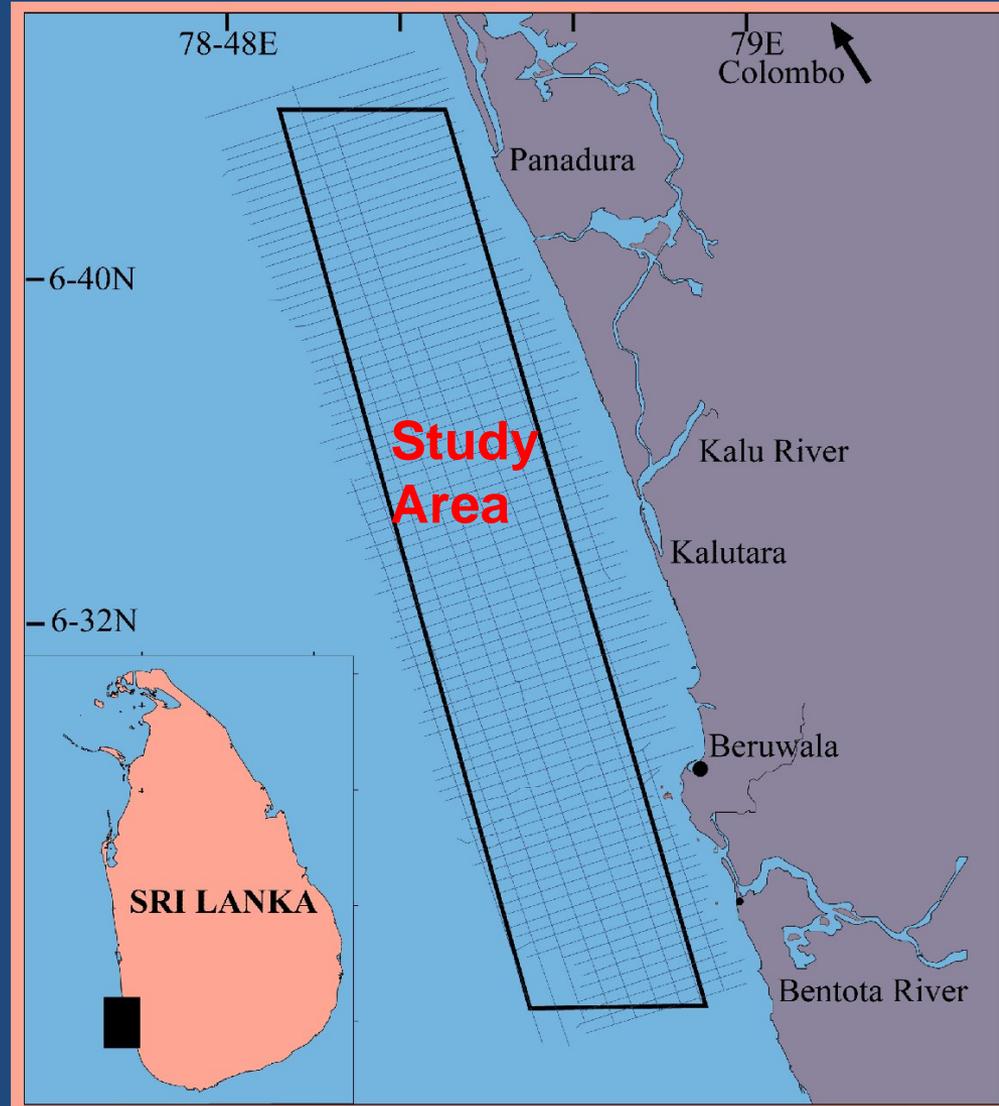
# Nearshore Geophysical Survey for Off-Shore Minerals in SW Sri Lanka

- Analysis of the geophysical data quantifies the thickness and volume of recoverable granular sediments.
- In this survey, 11 potential granular resource sites were identified (with surface areas between 0.5 and 27km<sup>2</sup> and more than 2m thick dredgeable sediments).
- With the help of data gathered, surficial geology map of the survey area was prepared.
- According to the results, about 170 million of granular sediments are available in the top 2m depth.
- Monazite concentrations upto 1.1% were estimated based on the gamma ray spectrometry analysis.



# Nearshore Geophysical Survey for Identification of Off-Shore Minerals Resources, Particularly Monazite in SW Sri Lanka

- NARA & Geological Survey of Canada jointly conducted a marine geophysical survey in nearshore area off Panadura – Beruwala in 1997.
- It was funded by UNDP & UNRF.
- Studied distribution, depositional characteristics and estimated volumes of granular sediments.
- Sidescan Sonar System, Sub Bottom Profiler, Echo Sounder, were used in this study.
- 68 grab samples provided selective ground truth of the interpreted seabed units.



# Summary of the achievements of the surveying activities on U & Th.

- First survey conducted : late 1950 & early 1960.

Preliminary radiometric surveys in several parts of the country.

conclusion: detailed studies are required to check the extensions and economic viability of potential areas.

- Second survey conducted on 1979-1983 with the assistance of IAEA ( Preliminary survey).

Nine potential areas were identified.

Conclusion: Detailed studies are required to identify extensions and economical viability.

- Third survey conducted on 1997 ( funded by UNDP & UNRF- Marine geophysical survey.

Eleven potential areas were identified and mapped.

According to the results 170 million tons are available.

As per the UN classification this can be identified as a project of prospect under category E-3, F-3, Gb-4.

## Proposed Exploration Work to Study Promising Areas of Thorium / Uranium Mineralization

During last three decades (i.e 1983 to 2011), follow up work or additional work on thorium / uranium mineralization was not conducted within the country.

However, with the increasing worldwide demand for thorium, uranium and Rare Earth elements, GSMB and AEA have proposed a number of joint exploration programs under the Technical Assistance of IAEA to identify promising areas of thorium and uranium mineralization within the country. They are as follows.

1. Survey of radioactive raw materials with special emphasis on identification of promising areas of Thorium and Uranium mineralization covering the coastal zone of the country.
2. Conducting detailed follow up survey covering the nine promising areas identified during the islandwide preliminary stream sediment survey on Uranium Mineralization.
3. Conducting detailed follow up studies to check the extensions of thorium mineralization around the already identified sites in different parts of the country.

In addition, GSMB has already proposed a islandwide airborne magnetic and radiometric survey. From this survey it would be possible to outline prospect zones for radioactive minerals. The resultant airborne radiometric data integrated with other relevant geological and geophysical data will serve as a base map for ground follow up work for exploring commercially viable radioactive mineralized zones.

***Survey of Nuclear Raw Material with Emphasis on  
Locating Thorium and Uranium Mineralization and  
Demarcating Radiogenically Hazardous Areas  
(Project SLR-2009)***

# Project Team

- Bernard Prame (GSMB) – Local Project Counterpart
- Bandara (AEA) – Local Project Counterpart
- Udaya de Silva (GSMB) – Local Coordinator
- Shyamalee Siriwardana (Chemist)
- Sunil Dissanayake (Geologist)
- + 02 Technical Officers

# Project Background

- Project proposal – 2011
- Project Approval – 2012 (total IAEA support 190,000 Euro)
- Fellowship nominations – late 2012
- Specifications for equipment – late 2012
- Project Planning - late2012/early 2013

# Activities

- IAEA Expert Visits
- Survey Planning – Scientific visits by local counterparts
- Initial field Survey
- Equipment supply – Fellowships
- Further field surveys
- Laboratory work
- Data analysis, compilation and reporting

# Action Plan

- Beach sand (monazite) survey – early 2013 early 2014
- Car-borne Gamma Ray survey –in selected areas - late 2013
- Car-borne gamma ray surveys around selected known locations
- Laboratory work late 2013- 2014
- Submission of Report I – Late 2014

# Present Status

- Nominations for fellowships & scientific visits submitted
- Specifications for equipment submitted (Rs. 12,000,000 allocated for sharing XRFS cost)
- IAEA Expert Mr. Peter Woods visited GSMB & AEA for local infrastructure assessment
- Mineral sand (monazite) survey in progress
- Placements for fellowships are being sought

# Planned Technical Support from IAEA

- Expert (IAEA) visits
- Car-borne gamma ray spectrometer (30,000 Euro)
- XRF Spectrometer (50,000 Euro from IAEA & cost shared with GSMB)
- Scientific visits
- Fellowships

Thank you