

# *Holocene History of the Koholankala Lagoonal System, Southeast Sri Lanka*

— UPALI WEERAKKODY

---

The southeast coast, i.e. the coast stretching from Gurupokuna in the west to the Kirindi Oya in the east, stretches over a long and diversified tract of coastal environment. Barriers have formed in front of lagoons that are backed by a hinterland of low planation surfaces carved on Precambrian and Palaeozoic rock. Quaternary development of many landforms in the area is characterized by former bays that have more recently evolved into lagoons when barriers often crowned by dune fields, came into existence. Hence, the geomorphological analysis of these landforms should be based on the analysis of material and geomorphological mapping.

The grain size distribution of a clastic sediment is a measure of the depositing medium and the energy of the basin of deposition (Reinech and Singh 1980). Grain size characteristics and clay-silt content together, are indicative of the origin, the environment and the process of formation of landforms. Various analytical methods related to grain size distribution such as frequency curves, shape cumulative curves, histograms and various other parameters calculated from grain size distribution have been tried as environmental indicators, in many parts of the world. In case of Sri Lanka Cooray (1963) has analysed beach sands and their sorting efficiency, but his study is limited to recent beaches. Swan (1967) also studied characteristics of recent coastal sands and their depositional environments of the southwestern coast of Sri Lanka. The present paper concentrates on the Holocene history of the Koholankala lagoonal system, as revealed by the grain size analysis and the aerospace survey of landforms of the area.

## **METHODOLOGY**

The methodology used includes aerospace survey techniques, checking of landforms, laboratory analysis of material and computer analysis. The interpretation of black and white aerial photographs dating from 1981 forms the basis of the geomorphological survey of the study area (Map 1). Landsat band 4 satellite imagery and false colour composites were used. The ITC system of geomorphological survey and mapping (Verstappen 1977, van

Zuidam and van Zuidam Cancellodo 1978) was used to indicate genesis, processes, relative chronology etc. Representative samples were collected in respect of every landform in a fossilized or ancient status. There were five fossilized barriers and a fossilized spit in the area.

An analysis of the collected samples was carried out in the soil laboratory of the Department of Geography, University of Colombo. Samples weighing 30g were treated with H<sub>2</sub>O<sub>2</sub> (30%) and HCl (10%) in order to remove organic matter and carbonates, respectively. The samples were then washed and wet-sieved using a 0.062 mm sieve, the pan fractions being funnelled directly into 1 litre sedimentation cylinders. Next a peptizer (Na<sub>4</sub>P<sub>2</sub>O<sub>7</sub>·10H<sub>2</sub>O + Na<sub>2</sub>CO<sub>3</sub>) was added and the cylinders using 20 ml pipettes were placed in nickel containers. After drying, 20 ml samples were removed from the cylinders. The remaining 980 ml suspensions were shaken again and allowed to settle. After about 16 hours, 20 ml samples were again drawn from the cylinders dried and weighed. The clay (and silt+clay) content was then calculated using the formula

$$\frac{\text{observed weight (g)} - 800 \text{ (mg)}}{\text{absolute dry weight (g)}} \times 50 \times 100\%$$

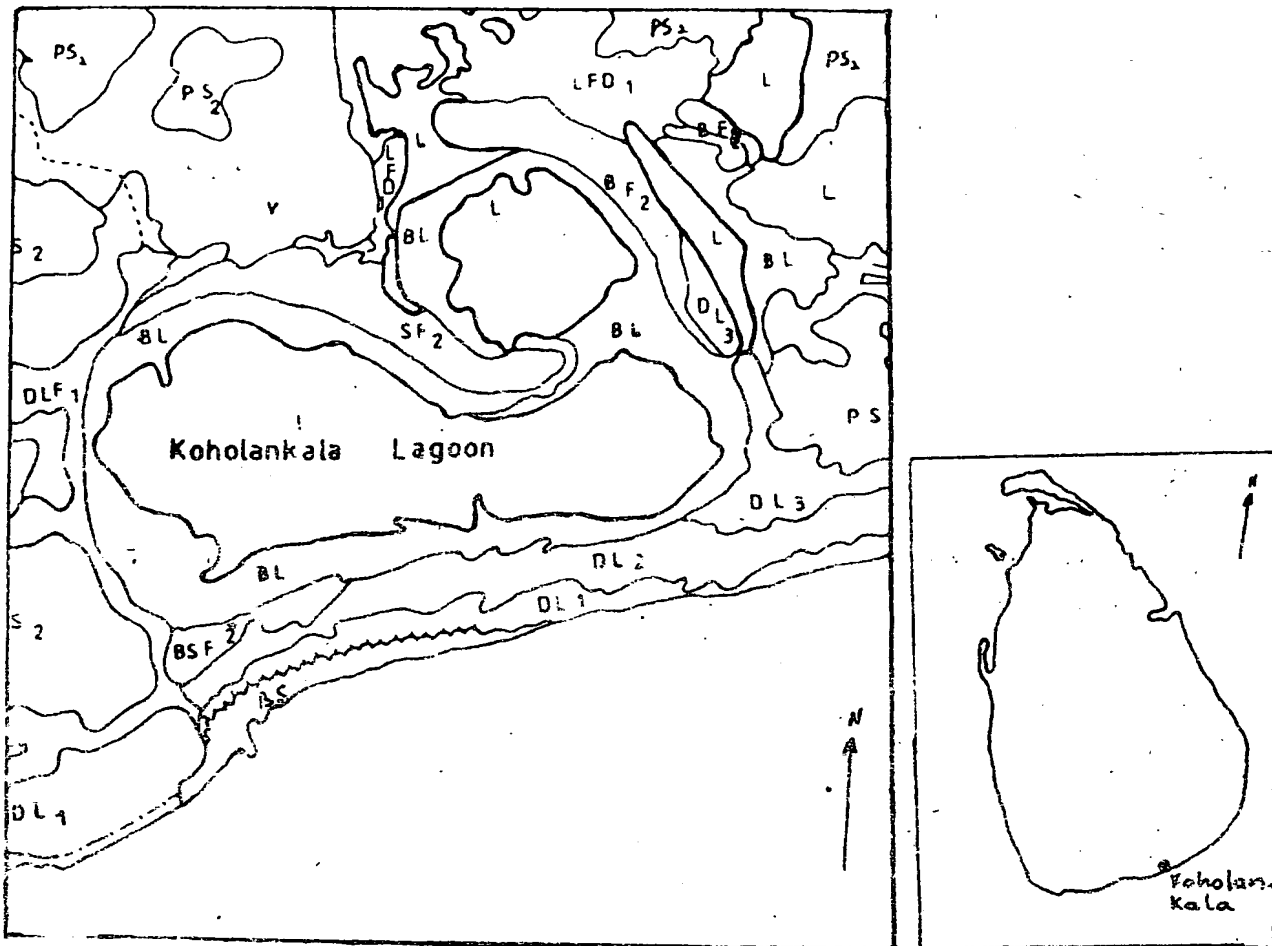
800 mg represents the weight of the peptizer per 20 ml sample. The difference in weight between clay+silt and clay is the silt content.

The sand fraction (0.062 mm) was dried in an oven for 24 hours at 105°C. An electric sieve shaker with 10 sieves (1.41, 1.00, 0.707, 0.500, 0.354, 0.250, 0.177, 0.125, 0.088 and 0.062 mm) was used to separate the grains according to size. Then the fraction was weighed.

The laboratory data were treated statistically using a Hewlett Packard 9816 computer. The computer programme used was PLOTGRAINS (Donker 1985) which showed a histogram and cumulative graphs of the grain size distribution. The diagrams and curves were drawn by a Hewlett Packard 9872 A electronic plotter.

### GEOMORPHOLOGY OF THE AREA

Since the Koholankala lagoonal system contains various types of fossilized landforms, **chronological criteria** were given special attention when they were classified. The landform categories distinguished are shown in Map 1.



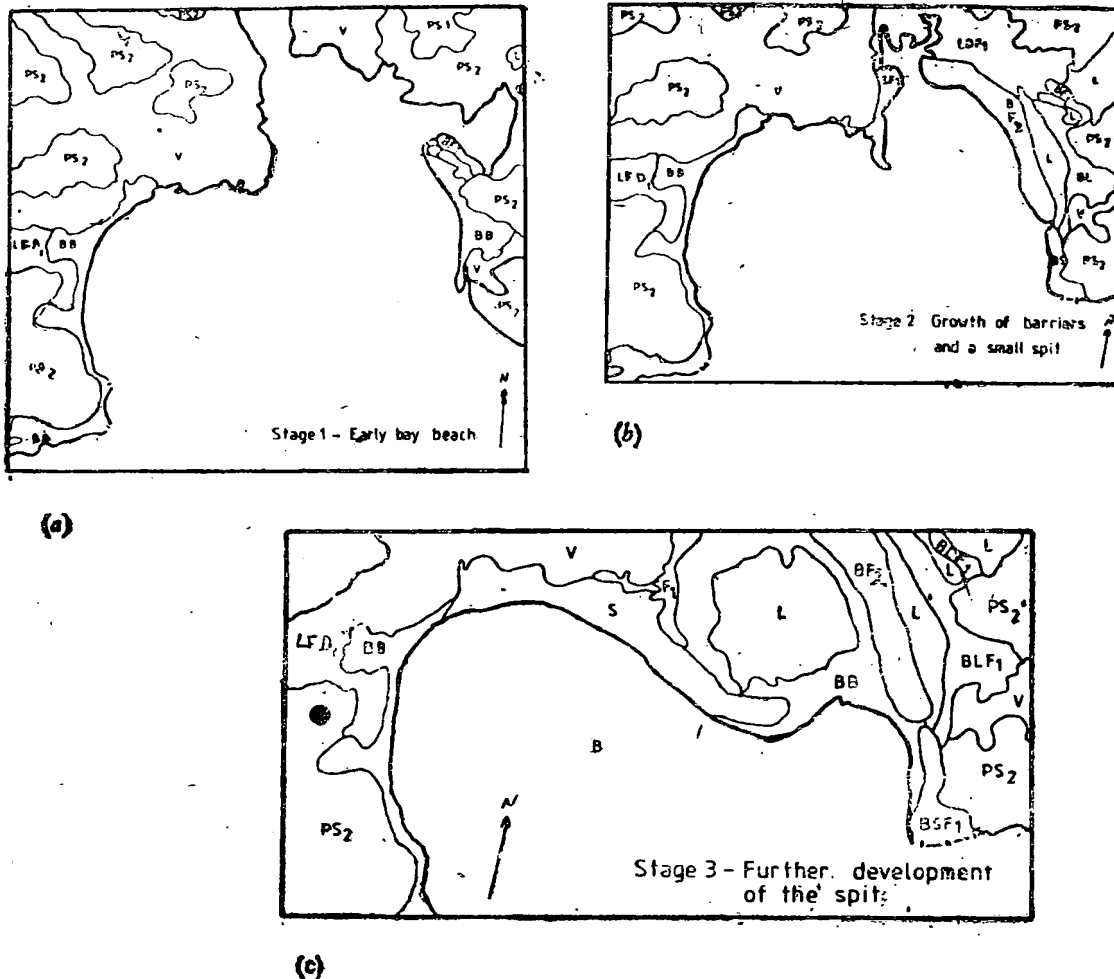
Map 1

**Map 1**—Geomorphological map of the Koholankala lagoon. PS<sub>2</sub> - Planation surface (low), V - Valley, L - Lagoon, BL - Lagoonal beach, LFD - Dried out lagoonal floor, BF<sub>1</sub> - Fossilized barrier (first generation), BF<sub>2</sub> - Fossilized barrier (second generation), DL<sub>1</sub> - Longitudinal dune (first generation), DL<sub>2</sub> - Longitudinal dune (second generation), DL<sub>3</sub> - Longitudinal dune (third generation), BS - Sea beach, BSF<sub>2</sub> - Former sea beach, SF<sub>2</sub> - Fossilized spit. Scale 1 : 20,000.

From the geomorphological map, four stages of coastal development may be identified. The former bay of Koholankala was funnel shaped (Map 2a), its narrow northern sector being a submerged denudational valley. River sediments were being deposited over this northern end of the bay as the sea-level was lowering. At a later stage an embayment barrier was formed through

the accumulation of fine material derived from the hinterland. At the same time, an incipient southward spit was formed within the bay which later developed in size and curved east-wards (Map 2 b & c). During the third stage, two headlands became connected by a long barrier chain which, at present, is covered by dunes (Map 1).

Map 2



**Map 2** (a, b & c). The evolutionary phases of the Koholankala lagoonal system: (a) Early embayment stage under a marine transgression. (b) Growth of barriers and an incipient spit in the bay. (c) Development of the spit into a huge, easterly curved one. The fourth stage is the recent beach system shown in the Map I. PS<sub>1</sub> - Planation surface (high), PS<sub>2</sub> - Planation surface (low), V - Valley, L - Lagoon, BL - Lagoonal beach, BLF<sub>1</sub> - former lagoonal beach, LFD<sub>1</sub> - Dried out lagoonal floor, BB - Bay beach, BS - Sea beach, BSF<sub>1</sub> - Former sea beach, BF<sub>1</sub> - Fossilized barrier (first generation), BF<sub>2</sub> - Fossilized barrier (second generation), SF<sub>1</sub> - Incipient spit, S - spit. Scale 1 : 40,000.

Among the landforms it was possible to identify some fossilized areas of marine origin such as former beaches, fossilized barriers, spits, former dune field etc. Three fossilized barriers, a recent barrier and a spit were selected for the grain size analysis.

### SPIT AND BARRIER MATERIAL

The material that form the Koholankala sand spit is 47 per cent silt and clay. The grain size distribution of the sand is given in figs. 1.1 and 1.2. It is evident from the high silt and clay content that the spit was formed in a very low-energy environment. The spit is also characterized by almost complete denudation, certain parts having been removed even by man (to construct a wall separating a saltern in a part of the lagoon).

Barriers are a dominant feature in the area. There are recent barriers and sub-recent barriers, and two generations of fossilized barriers are evident too. The boundary between recent and sub-recent barriers cannot always be demarcated clearly due to the presence of wind-blown sand on the top of sub-recent barriers. The unburied portion of such a sub-recent (bay mouth) barrier is located in front of the Bundala lagoon (not included in the map).

It is evident that barriers formed by wave action are often affected by wind action. The fossilized barriers analysed here are situated in the hinterland zone of the Koholankala lagoon. The grain size distribution of the samples from fossilized barriers is given in figs. 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6, while figs. 3.1 and 3.2 represent recent barriers which may be compared with the fossilized barriers.

The high content of clay and silt in the fossilized barriers and the spit (except 2.5 and 2.6) is indicative of their formation in a low-energy environment. This lies in contrast to the low content of silt and clay in the recent barrier (figs. 3.1 and 3.2). Coarse sands are scarce in the fossilized barriers as can be seen in the histogram, while the silt content is high. Although the fossilized barriers and the spit presumably have formed simultaneously, minor differences in their silt and clay contents reflect the influence of their specific locations.

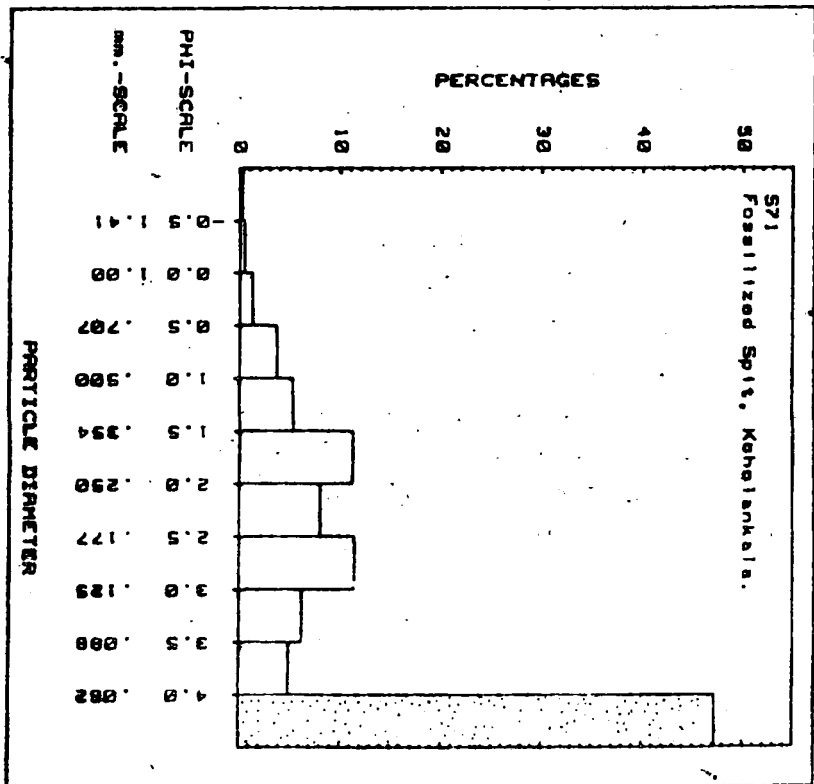
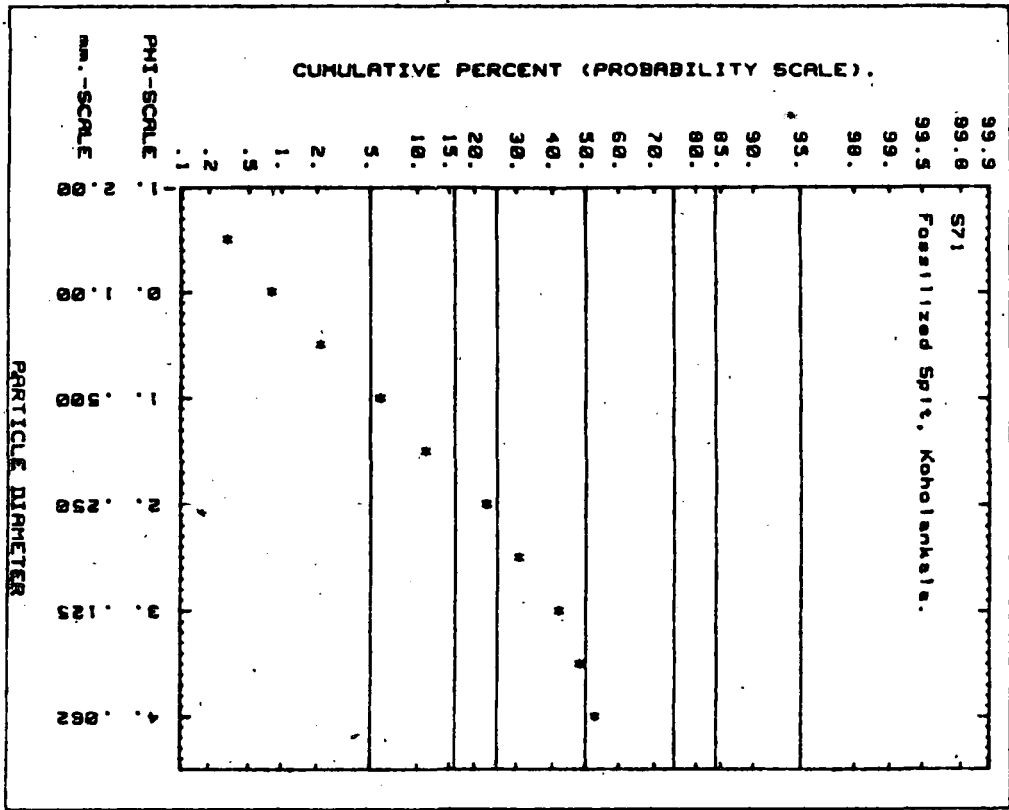
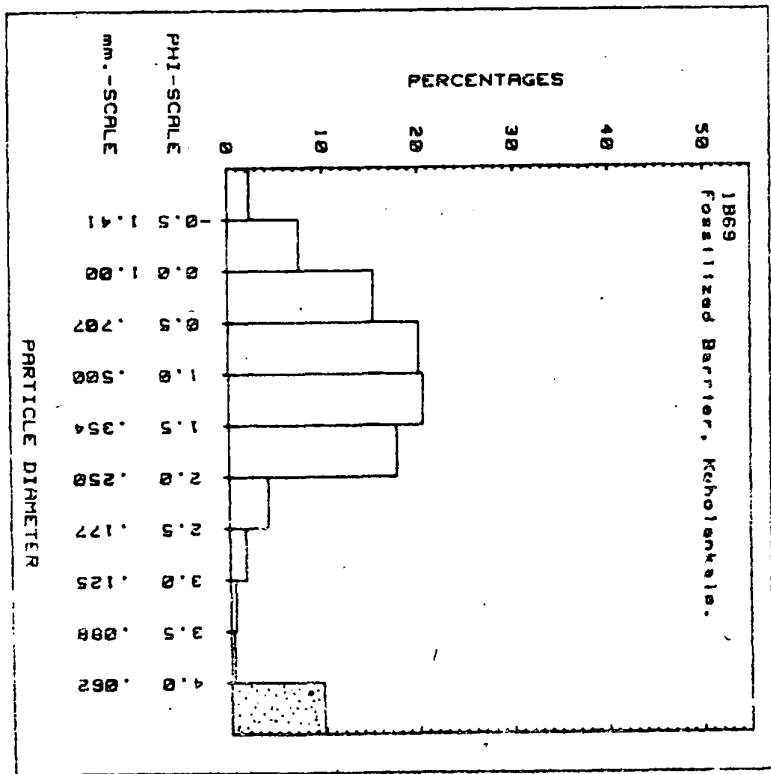
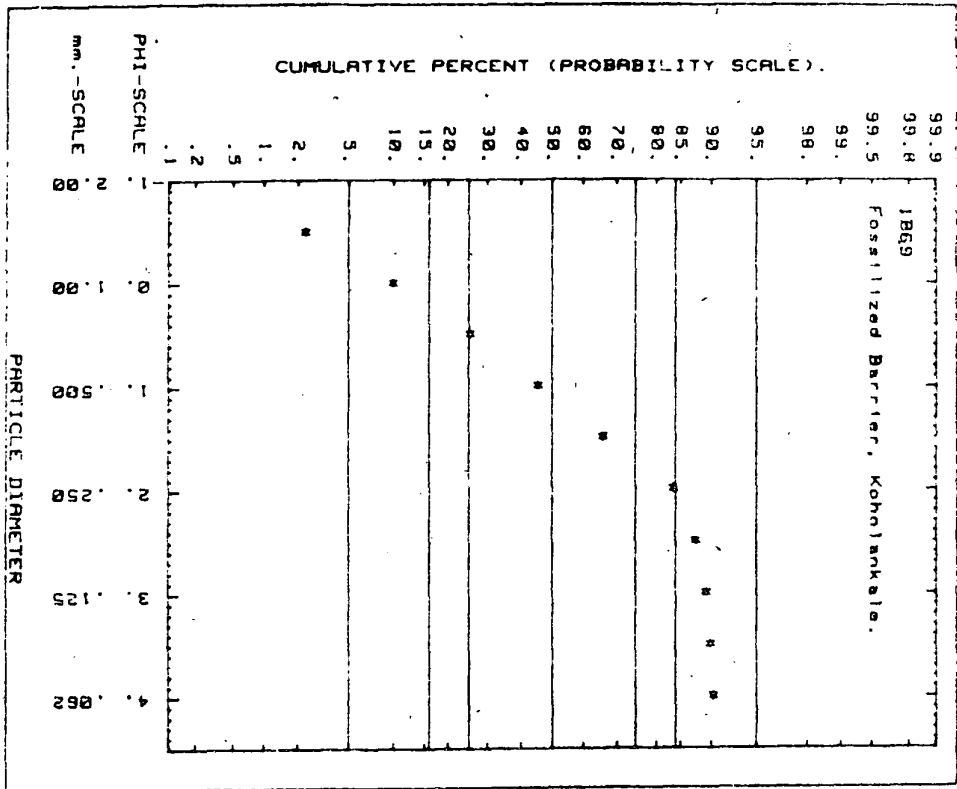
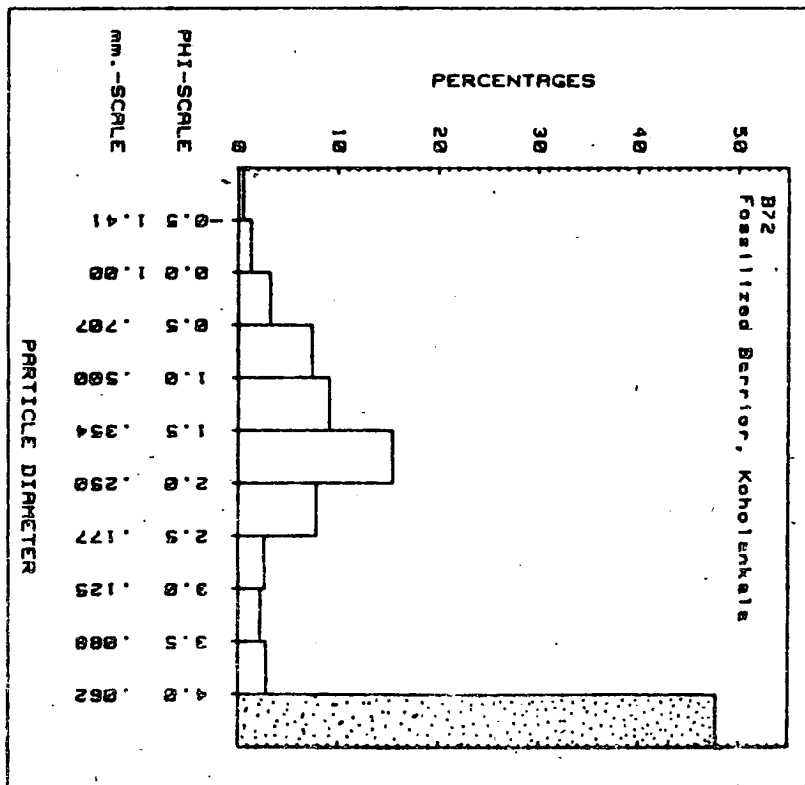
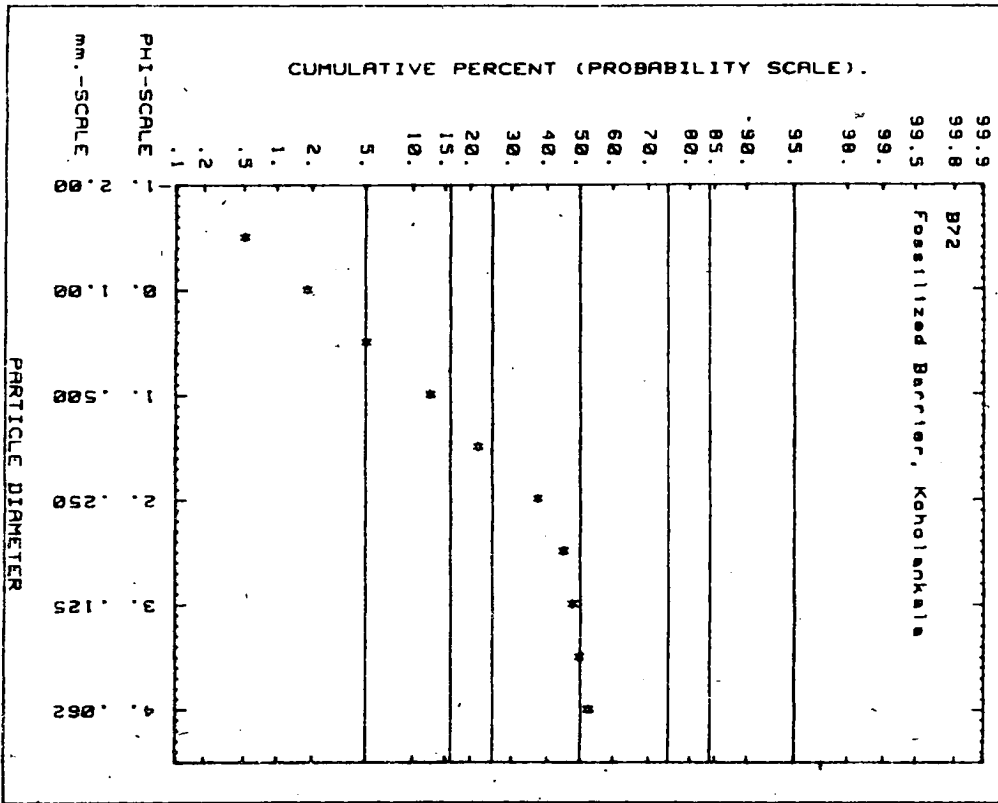


Fig. 1.1 & 1.2 — Grain size distribution of fossilized spit, Koholankala. Silt/clay content is shown by the shaded column.

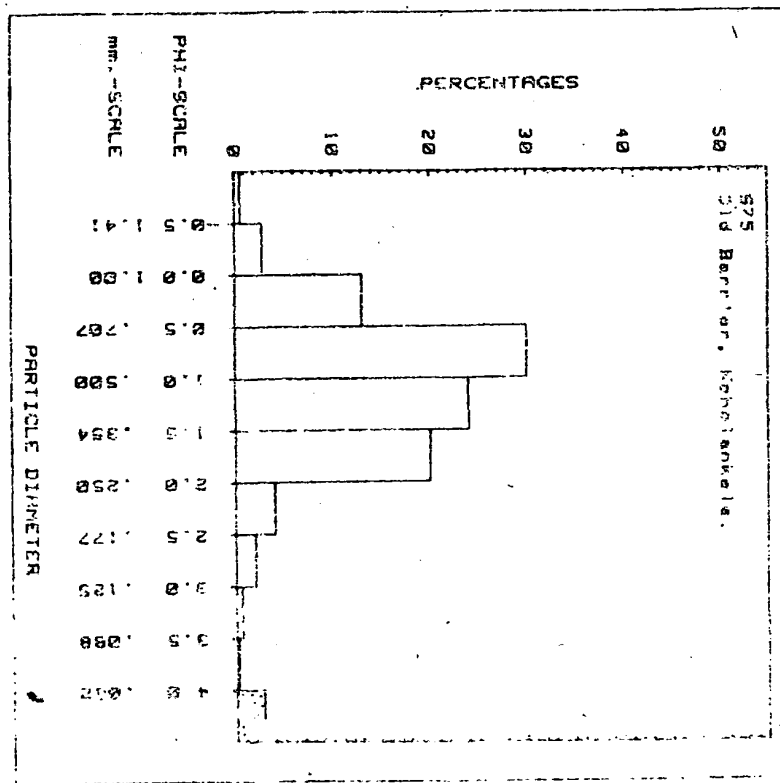
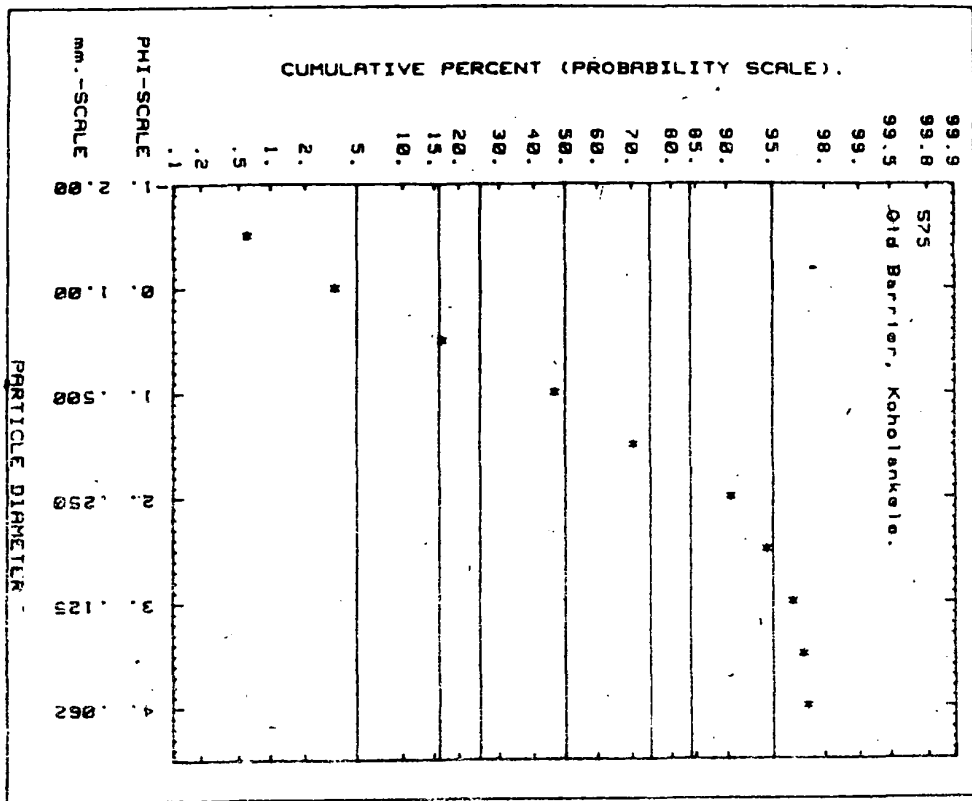


Figs. 2.1 & 2.2 — Grain size distribution of fossilized barrier, Koholankala. Silt/clay content is shown by the shaded column.

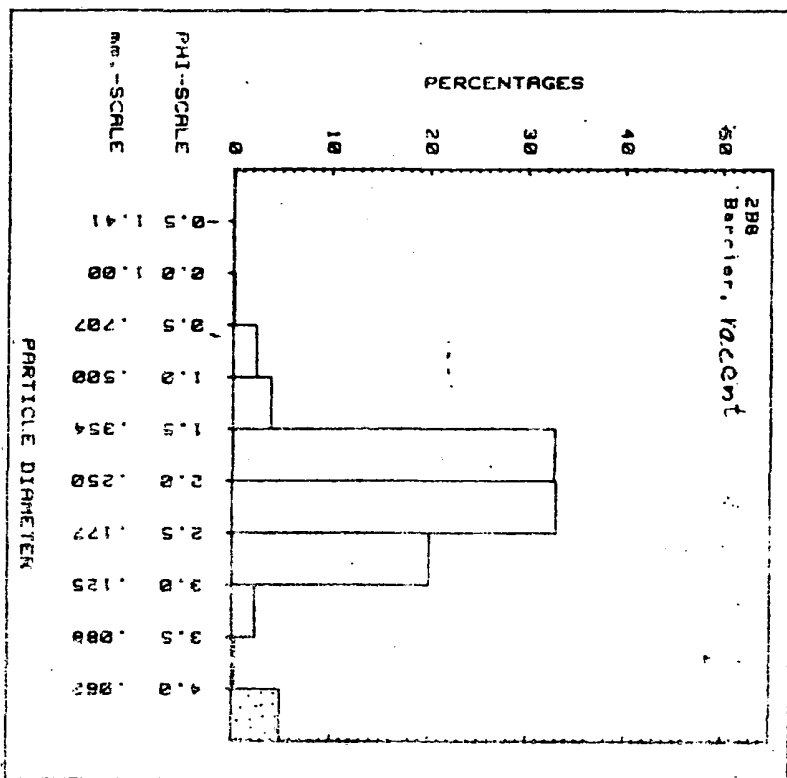
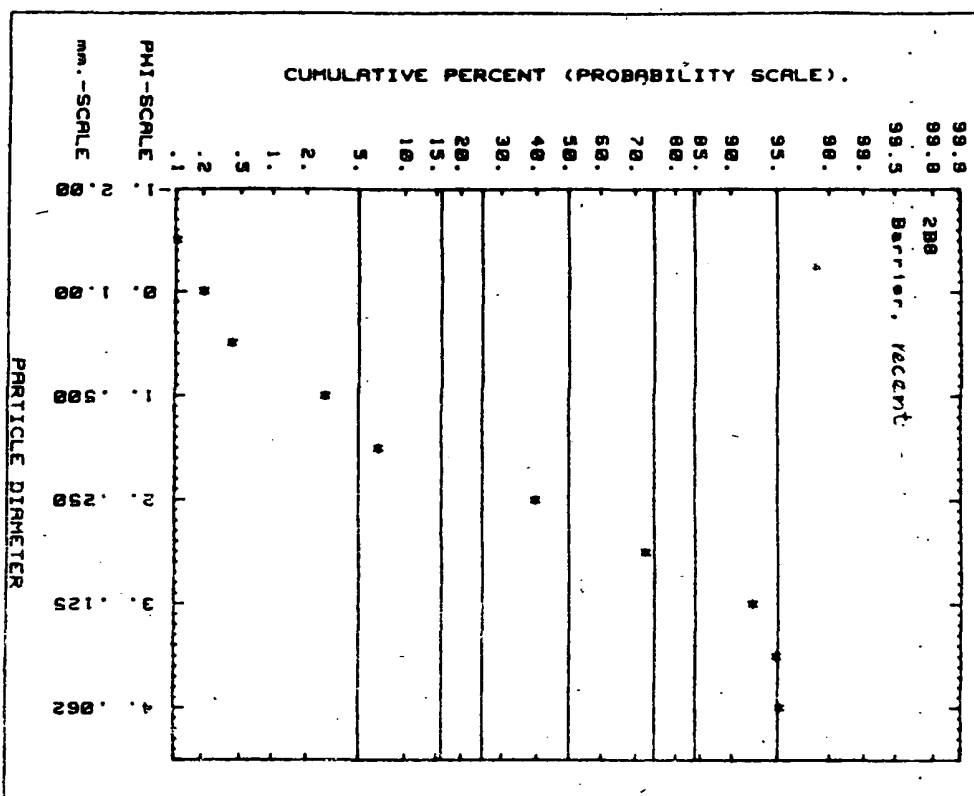


Figs. 2.3 & 2.4 — Grain size distribution of the other fossilized barrier, Koholankala. Silt/clay content is shown by the shaded column.





Figs. 2.5 & 2.6 — Grain size distribution of the subrecent barrier, Koholankala. Particle content is shown by shaded column.



Figs. 3.1 & 3.2 — Grain size distribution of the recent barrier. Koholankala. Clay/silt content is shown by the shaded column.

**References:**

- COORAY, P. G. (1963): 'Size and Sorting in Some Recent Coastal Sands from Ceylon' in *The Indian Minerologist*, 4
- DONKER, N. H. W. (1985): *Documentation Programme Enteri and Programme Plotgrains* (unpublished), ITC, Enschede, The Netherlands
- REINECH, H. E. & SINGH, I. B. (1980), 'Depositional Sedimentary Environments' 2nd Review. Springer Verlag, New York.
- VAN ZUIDAM R. A. & VAN ZUIDAM CANCELLODO F. I. (1978): *Terrain Classification Analysis*, Vol. VI. ITC, The Netherlands.
- VERSTAPPEN, H.Th. (1977): 'Remote Sensing in Geomorphology.' Elsevier Sci. Pub. Co., Amsterdam

## OUR CONTRIBUTORS

- ABEYWARDANE, H. A. P.** : *B.A., Ph.D. (Cey.), Additional Secretary, Ministry of Cultural Affairs*
- BANDARANAYAKA, ABHAYA** : *M.A., Ph.D. (Sri J'Pura), Dip. in Social Science (UNE., Aust.), Senior Lecturer in Philosophy and Psychology, University of Sri Jayawardenepura*
- de SILVA, M. P.** : *B.Sc. (Cey.), Ph.D. (Aachen), Lecturer, Department of Botany, University of Ruhuna*
- de SILVA, M. U.** : *B.A., M.A., Ph.D. (Vidya'), Senior Lecturer, Department of History and Sociology, University of Ruhuna*
- GOONEWARDENE, I. M. R.** : *M.B.B.S. (Cey.), M.S. (Col.), M.R.C.O.G. (Gt.Br.), Senior Lecturer, Department of Obstetrics & Gynaecology, University of Ruhuna*
- LIYANAGE, HEMACHANDRA D.** : *B.Sc. Agr. (Per.), Asst. Lecturer in Agronomy, University of Ruhuna*
- RANAWELLA, SIRIMAL** : *B.A. (Cey.), Ph.D. (Lond.), Professor of History and Sociology, University of Ruhuna*
- SIRISENA, L. A. W.** : *M.B.B.S. (Cey.), M.R.C.O.G. (Gt. Brit.), M.S. (Cey.), Consultant Obstetrician, Galle*
- VITHARANA, V.** : *M.A., Ph.D. (Lond.), Ph.D. (Cey.), Professor of Sinhala, University of Ruhuna*
- WEERAKKODY, UPALI** : *B.A. (Vidyod.), Diploma in Geomor Survey, M.Sc. (Netherlands), Lecturer, Department of Geography, University of Ruhuna*

# *An offer to the Public and Private Sectors*

- \* Long Term Finance for Projects.
- \* Share Participation.
- \* Project Development Assistance.

*and above all*

- \* The Back-up Services  
of a Resourceful,  
Innovative and Helpful  
National Bank as a Partner  
in your Project.

## **NATIONAL DEVELOPMENT BANK OF SRI LANKA**

P. O. Box 1826, 6th Floor, Ceylinco House,  
Janadhipathi Mawatha, Colombo 1.

Telephones: 23966-7, 36276-8, Telex: 21399 NDB CE

# PEOPLE'S BANK

in the

forefront with the

nation.

# PEOPLE'S BANK

Head Office, Colombo 2, Phone: 27841-9

**අනුග්‍රහය**

**රාජ්‍ය උකස් හා ආයෝජන බැංකුව**

නැ: පෙ: අංකය 156,  
91, හෝර්ටන් පෙදෙස,  
කොළඹ-07.

නිවහල් නව ලොවකට පිය නැගීමේ ජාතියේ උදර අධිෂ්ඨානය සහ අරමුණ සපුරාලීමට මංජාන ජාතික ඉතිරිකිරීමේ බැංකුව ඔබේ ජීවන ගමනට අත්වැලක් කරගන්න.

තැන්පත් කරුවන්ට වැඩිම වාසි හා මුදල් ඉතිරිකිරීමට වැඩිම පහසුකම් සලසන්නේ ජාතික ඉතිරිකිරීමේ බැංකුවයි.

**\* ස්ථිර තැන්පතු.**

ඔබේ ස්ථිර තැන්පතුවලට මාස්පතා හෝ කල්පිරීමෙන් පසු වැඩිම බැංකු පොලිය ලැබෙන්නේ අපෙනි.

**\* කිලිණ ගිණුම් ක්‍රමය.**

වසර 10 කින් කල්පිරෙන අප කිලිණ ගිණුම් ක්‍රමය ඔබේ ආයෝජනය මෙන් හය ගුණයකටත් වඩා විශාල කිලිණ මුදල් වසර අභයකදී ඔබට පිරිනමනු ඇත.

ඔබේ නමින් මෙන්ම, ඔබ දුරුවන් ටෙක්නොවනද් අදාළ කිලිණ ගිණුමක් අරඹන්න.

**\* ඉතිරිකිරීමේ වාසනාපත්.**

සෑම මාසික දිනුම් ඇදීමකදීම ඔබට බද්දෙන් නිදහස් තැගි 32 ක් දිනා ගැනීමේ වාසනාව ගෙන එයි. පළමුවන තැගි රු. 10,000/-, දෙවන තැගි රු. 5,000/- හා රු. 500/- බැගින් සැතසිලි තැගි 30 යි.

**\* උපයනවිට ඉතිරි කිරීම.**

ඔබේ සේවා ස්ථානයේ සිටම මුදලත්, කාලයත් ඉතිරිකර ගැනීමේ පහසුව මේ ක්‍රමයෙන් සැලසේ. ඔබ කළයුත්තේ මාසික ඉතුරුම් මුදල පඩිපඩින් අඩුකර ගන්නා ලෙස සේවා ස්ථානයේදී දැන්වීම පවතී.

**\* විශ්‍රාම වැටුප් ක්‍රමය.**

මෙම සමාජ සුභ සාධන ක්‍රමය ස්වයං-රැකියාවල හා රැකියාවල නියුතු අයට හා පවුලේ සැමට ජීවිත කාලයටම මාස 54 කින් ස්ථිර මාසික ආදායමක් ලබාදෙයි.

ඔබේ ඉතුරුම් තැන්පත් කිරීමට පෙර අපෙන් විමසන්න.

**ජාතික ඉතිරිකිරීමේ බැංකුව,**

255, ගාලුපාර, කොළඹ 3. දුරකථනය: 20101



# අනුග්‍රහය

**රාජ්‍ය ඉස්කාලාර සංස්ථාව**

කැ: පෙ: 1756,  
111, නොර්ස් කැනල් පාර,  
කොළඹ-10.

## ORDER FORM

The Librarian,  
University of Ruhuna,  
Matara, Sri Lanka.

- Please supply ..... copy/copies of the 'Rōhaṇa' No. 2—1987.
- Please enrol me as a subscriber for ..... numbers of the 'Rōhaṇa' commencing from No. 1—1985, or No. —19

I enclose a cheque/draft/bank order/money order for Rs./£/\$.....  
being payment in full.

Please mail copies to:

Name:

Address:

Date:

Signature

**National Digitization Project**

**National Science Foundation**

Institute : University of Ruhuna

1. Place of Scanning : University of Ruhuna, Wellamadama, Matara

2. Date Scanned : ..2017/12/19.....

3. Name of Digitizing Company : Sanje (Private) Ltd, No 435/16, Kottawa Rd,  
Hokandara North, Arangala, Hokandara

4. Scanning Officer

Name : ..Chamata Kanishk.....

Signature : .......

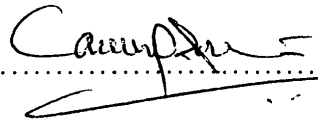
Certification of Scanning

*I hereby certify that the scanning of this document was carried out under my supervision, according to the norms and standards of digital scanning accurately, also keeping with the originality of the original document to be accepted in a court of law.*

Certifying Officer

Designation : ..Senior Assistant Librarian.....

Name : ..Kusala Fernando.....

Signature : .......

Date : ..2017/12/19.....

*"This document/publication was digitized under National Digitization Project of the National Science Foundation, Sri Lanka"*