

# Lithostratigraphy of the Car Nicobar Island, Andaman and Nicobar Islands, India

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Result of field observations on the sedimentary succession in the Car Nicobar Island is presented here. Three stratigraphic sections, viz. Passa Bridge Section, Sawai Bay Section and Kakana Section, in the eastern part of the Car Nicobar Island have been measured and studied and a composite stratigraphic sequence has been compiled. Altogether, three formations have been recognized in the area. These are (in ascending order): Sawai Bay Formation (*sensu* Srinivasan & Azmi 1976), Kakana Formation and Malacca Limestone Formation. Based on lithological distinction and mappability, Kakana Formation is proposed herein. Description of formations, as to their type and reference sections, lithology, nature of contacts, lateral continuity, etc. has also been provided.

**Key-words** - Lithostratigraphy, Neogene, Kakana Formation, Car Nicobar Island, Andaman and Nicobar Islands (India).

## INTRODUCTION

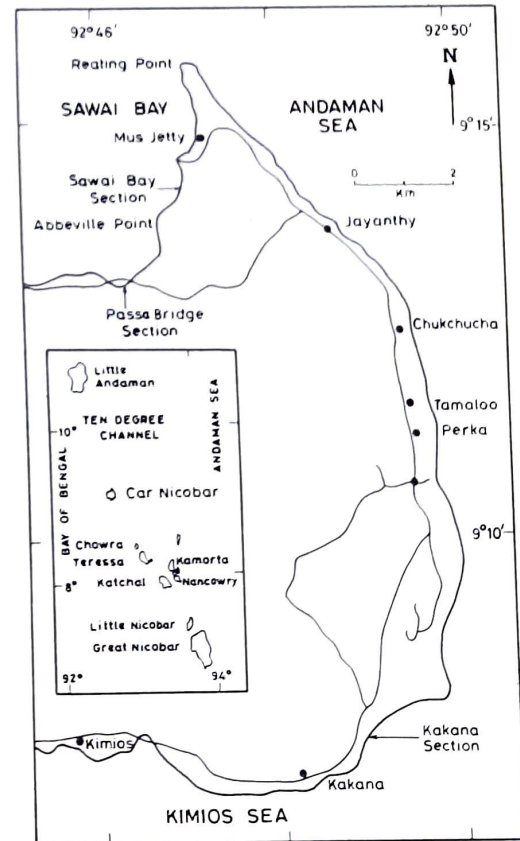
THE Andaman and Nicobar Islands in the Bay of Bengal represent projections, above sea level, of parts of submarine ridges and belong to the linear folded zone of the Arakan foothills foredeep. These islands trend almost north-south for about 850 km between  $06^{\circ} 45'$  and  $14^{\circ} 15'$  north latitudes and are divided into two groups, the Andamans and the Nicobars, which are separated from each other by the Ten Degree Channel.

The Car Nicobar Island is the northernmost island of the Nicobar group of islands and is located between  $09^{\circ} 07'$  and  $09^{\circ} 13' 45''$  north latitudes and  $92^{\circ} 43'$  and  $92^{\circ} 50'$  east longitudes (Map1). This island occupies an area of about 128 sq km, most of which is covered by thick coconut forests. It is only a narrow belt along the sea coast that is free from vegetation and where stratigraphic sections could be observed. The Car Nicobar Island is largely flat with low relief. The rock types found in this island are not much diversified and consist of mudstone and limestone only.

Significant geological information on the Nicobar Island has been published by Rink (1847), Hochstetter (1866), Ball (1870), Oldham (1885), Tipper (1911), Gee (1927), Jacob and Sastri (1951), Chatterjee (1967), Karunakaran *et al.* (1968),

Srinivasan and Sharma (1973a), Srinivasan and Azmi (1976), Srinivasan (1968), etc.

Schwager (1866) recorded a large number of foraminiferal species from the mudstone (Sawai



**Map 1.** Map of part of the Car Nicobar Island showing location of the sections studied.

Bay Formation) and limestone (Kakana Formation - proposed herein) of the Car Nicobar Island. Srinivasan and Sharma (1969) evaluated the status of various species described by Schwager (1866). Based on foraminiferal fauna, a number of biostratigraphic zones have been recognized in the Car Nicobar Island (Srinivasan & Sharma 1973b, Srinivasan 1977, 1988, Srinivasan & Azmi 1979, Srivastava & Goel 1982, etc.). These zones are: *Globorotalia tumida plesiotumida* Zone, *Globorotalia tumida tumida* Zone, *Sphaeroidinella dehiscens* Zone, *Globorotalia tumida flexuosa* Zone, *Globorotalia nepenthes* Zone and *Globorotalia multicamerata - Pulleniatina obliquiloculata* Zone.

Srinivasan and Sharma (1973a) and Srinivasan and Azmi (1976) recognized the following stratigraphic sequence in the Car Nicobar Island:

Srinivasan & Sharma 1973a	Srinivasan & Azmi 1976
Malacca Formation	Neill West Coast Formation
-----unconformity-----	
Sawai Bay Formation	Guitar Formation
Sawai Bay Limestone Member	
Sawai Bay Mudstone Member	Sawai Bay Formation

During 1995, the authors visited Car Nicobar Island with the objectives of studying the stratigraphic sequence developed there and to collect rock samples for siliceous microfossil studies. A lithostratigraphic account of the Car Nicobar Island is presented below:

### LITHOSTRATIGRAPHY

Three stratigraphic units (formations) are developed in the Car Nicobar Island. These are (in ascending order): Sawai Bay Formation (*sensu* Srinivasan & Azmi 1976), Kakana Formation (proposed herein) and Malacca Limestone Formation (Srinivasan & Sharma 1973a). Of these, the first two are exposed on the surface and were observed in road and cliff sections whereas the Malacca Limestone Formation does not crop out anywhere in the Car Nicobar Island except in a well adjacent to Malacca Post Office (Srinivasan & Sharma 1973a) and was not observed by the authors. The stratigraphic sequence in the Car Nicobar Island is summarized below:

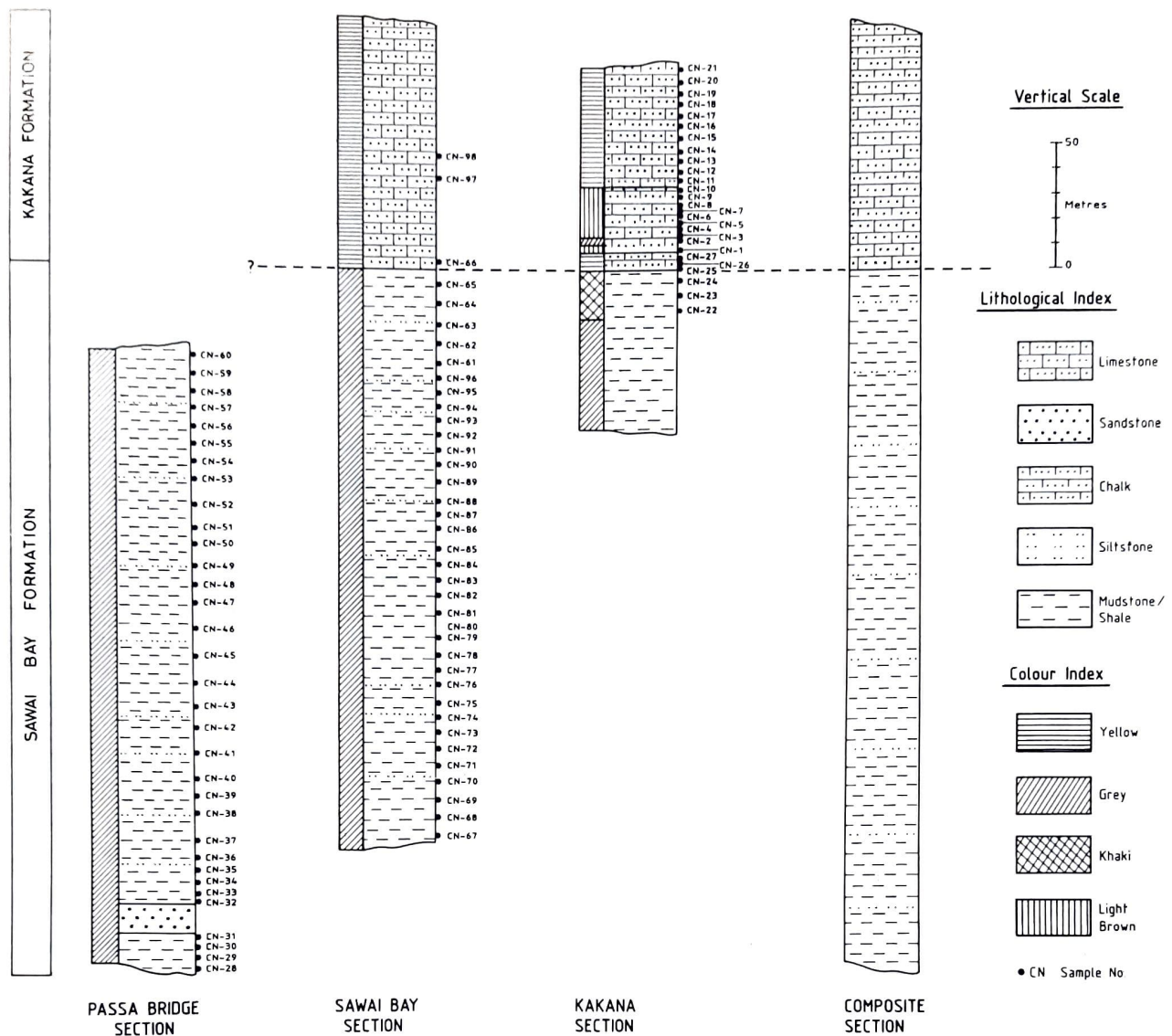
Stratigraphic unit	Lithology	Remarks
3. Malacca Limestone Formation	White, hard, compact, semicrystalline limestone with abundant larger foraminifera.	Part of the formation recorded in a well adjacent to Malacca Post Office.
-----Unconformity-----		
2. Kakana Formation	Yellow, arenaceous limestone and chalky limestone occasionally containing molluscan shell fragments.	Good sections in sea cliffs at Sawai Bay and northeast of Kakana village.
1. Sawai Bay Formation	Light grey to bluish grey, moderately hard, calcareous mudstone.	Good sections in cliffs at Sawai Bay and along the road from Passa Bridge to 12 kilometre post. Lower contact obscure.

In order to understand the stratigraphic sequence developed in the Car Nicobar Island, three sections were selected for study. These are: (i) Passa Bridge Section; (ii) Sawai Bay Section; and (iii) Kakana Section. A brief account of these sections is given below:

**Passa Bridge Section** - This section is located between Passa Bridge (at the 13 kilometre post; Lat. 09°13' 00" N; Long. 92°46' 15" E) and the 12 kilometre post along the Tee Top - Jayanthi Road in the northern part of the Car Nicobar Island (Map 1). The section exposes excellent development of calcareous mudstones alternated by silty mudstone/siltstone belonging to the Sawai Bay Formation (*sensu* Srinivasan & Azmi 1976). At Passa Bridge, the mudstone is splintery in nature (Table 1). Sample nos. CN28 to CN60 were collected from this section. The total thickness of the strata, exposed in this section, is *ca* 246 metres (Text-fig. 1).

TABLE 1

Formation	Lithology	Thickness	Samples collected
	Light grey, calcareous mudstone interbedded with thin (up to 0.5 m thick), hard siltstone	212 m	26 samples (CN35-CN60)
Sawai Bay Formation	Splintery mudstone	10 m	3 samples (CN32-CN34)
	Medium-coarse grained, friable sandstone with intercalations of mudstone	12 m	No sample collected
	Hard, compact mudstone	>12 m	4 samples (CN28-CN31)



Text-fig. 1. Lithologs of the stratigraphic sections studied in the Car Nicobar Island.

**Sawai Bay Section** - This section, in cliffs of the Sawai Bay coast between Abbeville Point and Mus Jetty, is located in the northern part of the Car Nicobar Island and serves as the type section for the Sawai Bay Formation (Map 1; Text - fig. 1; fig. 1). The section exposes calcareous mudstone alternated by up to 1 metre thick, hard, silty mudstone/siltstone/beds belonging to the Sawai Bay Formation (measured thickness- 233 metres). The mudstone is overlain by yellow, arenaceous, fossiliferous limestone of the Kakana Formation (measured thickness - 99 metres). The contact between the two formations is conformable (Fig. 3). Sample nos. CN61 to CN98 were collected from this section. The lithological sequence of this section is given in Table 2.

**Kakana Section** - This section is located about 1 km north-east of Kakana (Lat. 09° 07' N; Long. 92° 48' E) in the south-eastern part of the Car Nicobar Island (Map 1; Fig. 2) and serves as the type section

for the Kakana Formation. The rock sequence is exposed in a hill slope on the right side and in a cliff on the left side of Malacca - Kakana Road near 38 kilometre post. The section exposes both Sawai Bay and Kakana formations. The Sawai Bay Formation is composed of highly calcareous, grey and khaki mudstones. These are overlain by yellow, arenaceous limestone of the Kakana Formation. The contact between the two formations is conformable and is exposed about 60 metres west of the 38 kilometre post. The Sawai Bay Formation is also

TABLE 2

Formation	Lithology	Thick-ness	Samples collected
Kakana Formation	Yellow, arenaceous limestone	>99m	35 samples (CN61-CN65 & CN67-CN96)
Sawai Bay Formation	Grey mudstone interbedded with hard, silty mudstone/siltstone	233m	3 samples (CN66 & CN97-CN98)



Fig. 1. Sawai Bay Formation (mudstone) exposed in the type section.

exposed in a stream cutting between 33 and 32 kilometre posts. Sample nos. CN1 to CN27 were collected from this section. The lithological sequence of this section is given in Table 3.

TABLE 3

Formation	Lithology	Thickness	Samples collected
Kakana Formation	Light yellow, chalky, arenaceous, massive limestone (top more sandy)	30 m	11 samples (CN11-CN21)
	Buff, thinly bedded, arenaceous limestone.	10 m	4 samples (CN7-CN10)
	Buff, chalky limestone	10 m	4 samples (CN3-CN6)
	Grey limestone	3 m	1 sample (CN2)
	Buff, arenaceous limestone	3 m	1 sample (CN1)
Sawai Bay Formation	Yellow, thinly bedded, arenaceous limestone	7 m	3 samples (CN25-CN27)
	Khaki, calcareous mudstone	>10 m	3 samples (CN22-CN24)

Based on the observations on the above three sections and traverses all along the coast, a description of the three formations is given below.

### Sawai Bay Formation

(*sensu* Srinivasan & Azmi 1976)

*Derivation of name* - The formation is named after Sawai Bay, located off the northern coast of the Car Nicobar Island, where the type section of the formation is exposed (Srinivasan & Sharma 1973a).

*Type section* - Sea cliff section at Sawai Bay between Abbeville Point and Mus Jetty (Map 1; Fig. 1).

*Reference sections* - Passa Bridge Section in the northern part of Car Nicobar; Kakana Section (only upper part of the formation) in the south-eastern part of Car Nicobar (Map 1).

*Lithology* - The formation is constituted by soft to moderately hard, calcareous, light grey to bluish grey, massive mudstone alternated by bands of silty mudstone/siltstone. The total thickness of the formation is about 280 metres.

*Nature of contacts* - The lower contact of this formation is not exposed and therefore could not be observed. The formation is conformably overlain by limestone of the Kakana Formation. This contact is exposed at the Sawai Bay and Kakana sections (Text-fig. 1; Fig. 3)

*Lateral continuity* - The formation can be traced over a large part of Car Nicobar along the road, running parallel to the coast. In the interior of the island, however, it is covered with thick vegetation. This formation is also distributed in Chowra, Little Andaman and Neill Islands (Srinivasan & Azmi 1976).

*Former equivalent stratigraphic unit* - Sawai Bay Mudstone Member of the Sawai Bay Formation (Srinivasan & Sharma 1973a).

*Remarks* - Based on benthic foraminiferal assemblage, Srinivasan and Azmi (1976) suggested a lower bathyal environment of deposition. Srinivasan and Sharma (1973a) assigned a Middle Pliocene age to this formation. Srinivasan and Azmi (1976), however, modified this dating and assigned it an age ranging from Late Miocene to Middle Pliocene.



Fig. 2. Kakana Formation (limestone) exposed in the type section.

### **Kakana Formation** (proposed herein)

*Derivation of name* - The formation is named after Kakana village (Lat.  $09^{\circ} 07' N$ ; Long.  $93^{\circ} 48' E$ ), to the north-east of which the type section of this formation is located.

*Type section* - Cliff section about 1 km north-east of Kakana village (Map 1; Fig. 2).

*Reference section* - Sawai Bay Section, off the northern coast of the Car Nicobar Island (Text-fig.1).

*Lithology* - The formation is constituted by a monotonous sequence of hard, yellow, thickly bedded to massive, arenaceous limestone, often containing molluscan shell fragments. The sandy contents in the limestone greatly vary from place to place, to the extent that in a section near Mus Jetty it becomes more or less coarse grained calcareous sandstone. The total thickness of this formation is over 100 metres.

*Nature of contacts* - This formation overlies the Sawai Bay Formation with a conformable contact (Text-fig. 1; Fig. 3). The formation is unconformably over-



Fig. 3. Contact of the Sawai Bay and Kakana formations in Sawai Bay Section.

lain by the Malacca Limestone Formation (Srinivasan & Sharma 1973a).

*Lateral continuity* - The Kakana Formation is developed only in the eastern half of the Car Nicobar Island. Srinivasan and Azmi (1976) opined correspondence of this sequence with the Guitar Formation (Chatterjee 1967) of the Guitar Island and the Melville Limestone (Karunakaran *et al.* 1968) of the Havelock Island.

*Former equivalent stratigraphic unit* - Sawai Bay Limestone Member of the Sawai Bay Formation (Srinivasan & Sharma 1973a).

*Remarks* - Based on foraminiferal evidence, Srinivasan and Sharma (1973a) assigned a Middle Pliocene age to this formation.

### Malacca Limestone Formation (Srinivasan & Sharma 1973a)

*Derivation of name* - The formation is named after Malacca village (Lat. 09° 10' 35" N; Long. 92° 49' 20" E) where its type section is located.

*Type section* - Well section adjacent to the Malacca Post Office.

*Lithology* - The formation is composed of white, hard, compact, semicrystalline limestone with abundant larger foraminifera.

*Nature of contacts* - Malacca Limestone Formation overlies the Sawai Bay Formation with unconformable contact (Srinivasan & Sharma 1973a).

*Lateral continuity* - The formation does not crop out anywhere in the Car Nicobar Island except in a well adjacent to the Malacca Post Office.

*Remarks* - On the basis of larger foraminifera, Srinivasan and Sharma (1973a) assigned a Pliocene age to this formation.

## DISCUSSION

Data compiled from the three measured sections, viz. Passa Bridge Section, Sawai Bay Section and Kakana Section, and traverses undertaken along the coast indicate that the Sawai Bay Formation, made up of grey, moderately hard, calcareous, massive mudstone, constitute the oldest stratigraphic unit in the Car Nicobar Island. This formation is conformably overlain by the Kakana Formation which is composed of hard, yellow, thickly bedded to massive, arenaceous limestone. On the basis of its lithological distinction and mapability, this unit has been proposed here as a formation. The next overlying and youngest stratigraphic unit is the Malacca Limestone Forma-

tion. It is made up of white, hard, compact and semicrystalline limestone and can be observed only in a well adjacent to Malacca village.

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