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3.7 Coastal Landforms by K.N.J Katupotha

3.7 Coastal Landforms

The action of marine processes such as waves, tsunami, tides and currents affect the 1700 km long coastline of Sri Lanka, leading to the creation of a variety of erosional and depositional landforms. The areas most severely affected by erosion are along the southwestern coast, while the northwest and northeast coasts, considered as depositional environments, are the least affected (Swan 1983; Madduma Bandara 1982 & 1987). The erosive power of waves washes away the coast, forming cliffs, caves, arches, stacks, and wave-cut platforms. Landforms such as beaches, bars, spits, and dunes are formed where the materials eroded by waves are deposited. Both erosion and deposition thus account for the distinctly different landforms around the coast of Sri Lanka.

The erosion- and deposition-dominated coasts of Sri Lanka are subdivided into 41 sectors, each with distinct physical characteristics (such as constituent matter, underlying geological structure, the actions of marine processes and wind), which distinguish them from adjacent coastal areas (Swan 1982). The underlying geological structures are basically made up of two main types of rock, viz. the sedimentary belt and the crystalline complex (Wayland 1919; Coates 1935; Deraniyagala 1958; Cooray 1967 & 1984). The sedimentary belt broadly extends as an arcuate from Puttalam on the west coast, north through Paranthan, down the east coast to Mullaittivu, and is structured and underlain by fossiliferous, high-grade limestone belonging to the Miocene age. Recent investigations reveal that the Miocene basement is expected to extend southwards along the coast up to the mouth of the Deduru Oya (Katupotha & Dias 2002). The same Miocene stratum may also underlie the numerous islands off the west coast of the Jaffna peninsula.

The Quaternary deposits (of the Pleistocene and the Holocene), covering extensive areas of the coastal belt, have a less consolidated nature, consisting for example, of Red Beds (relicts of which only exist now in patchy form), tracts of sand dunes, alluvial, lagoonal and lacustrine deposits, and mud-flats, etc. There is also a protective fringe of beach rock, which is not uniformly distributed along the entire coastline but occurring discontinuously in parts in different sectors. The Miocene belt and the Quaternary formations along the coast, mark off about one quarter of the terrain, and the rest consists of a complex of a number of rock types, crystalline in nature, formed by the metamorphosis of ancient sediments.

The crystalline rock complex, the Miocene sedimentary belt and the Quaternary formations, together with the coastal processes that prevailed from past geological ages to the present, have engraved today's familiar configuration of the coastline, the coastal landforms and the coastal ecosystems (see Table 1).

Table 1. Coastal Characteristics

Type	Total Length (km)	Percentage
Sandy without headlands	561	33
Beaches and headlands	612	36
Deltas	425	25
Limestone shorelines	68	4
Coral shorelines	34	2

Source: Swan, Bernad (1982)

Viewed in plan, the coastline in Sri Lanka combines features of bedrock-related depositional formation and water-body evolution. Much of the coastline is smooth and almost straight. There are pronounced embayments, with headlands assuming greater prominence in relation to the sizes of the bays. Along such sectors, wave action is considerable. Bays act as sand traps, resulting in comparatively little sand exchange between adjoining indentations.

Common Coastal Landforms

Based on the distinctive physical characteristics of these coastal ecosystems, the common landforms evident along the coastline of Sri Lanka fall into three classes, viz. bedrock-related and depositional landforms, as well as water bodies. The subdivisions of these three classes are shown in Table 2.

Bedrock-related Forms

Only specific locations along the coastline of Sri Lanka are made up of bedrock-related in situ materials. The low-lying and relatively flat bedrock-related shores composed of fossiliferous limestone strata on the northern flank of the Jaffna peninsula and its nearby islands have a relatively high susceptibility to chemical weathering and leaching, and are capped with Red Calcic Latosols. The sea in this area is less than 13 m deep, and is thus not affected by ocean swell over medium and long periods.

Exceptional raised Holocene beach deposits in the region lie within 3.0 m of the high water mark. Marine processes have cut inter-tidal shore platforms backed by low-sea cliffs and caves. Likewise, karstic landforms, such as swallow holes, dolines and larger depressions, exhibit solution labyrinths, confining underground reservoirs of freshwater with possible submarine springs into limestone shores at Keerimalai on the Jaffna peninsula (Cooray 1956; Seneviratne 1992). Along the mainland shores of Portugal Bay, as in the vicinity of Kudremalai Point, limestone cliffs are higher, exceeding 15 m in places with caves (Katz 1975).

Table 2. Classification of Coastal Landforms In Sri Lanka

Extension	Form	Landform			
		Dry Land		Wet Land	
		Bedrock Related	Depositional		
Coastal Belt	Marine	Headland Sea cliff Caves Blow holes Shore platforms Swallow holes Dolines Labyrinths Submarine springs	Beaches Barrier islands Barrier spits Beach ridges	Inter tidal level Sand bars Beach-rock shoals Tidal flats	Spring tidal level Mud flats
	Marine and fluvial		Cheniers		
	Aeolian		Dunes Dune ridges/rocks Hill top dunes		
				Biogenic	
	Marine and biogenic			Mangrove low swamps Salt low marshes	Mangrove high swamps Salt high marshes
	Marine, fluvial and biogenic			Mangrove low swamps Brackish low marsh	Mangrove high swamps Brackish high marsh
	Fluvial		Natural levees Alluvial flats		
Water Bodies	Estuaries, lagoons, tidal creek, streams, channels, lakes and ponds				

Source: Swan (1982), Katupotha (1988).

High and steep crystalline rocky coastlines occur where denudation has been moderate due to the resistance of the structure, e.g., at Rumassalakanda, Godawaya, Patanagala, and the near vertical cliffs at Trincomalee (Fig.1). These are attributable to lithological control over form, exercised by the rocks of three of the major geological provinces: tightly jointed granites, highly metamorphosed biotite gneisses, and quartzites, respectively (Swan 1982). These areas are subjected to differential weathering patterns during episodes of sub-aerial denudation and partial planation.

Figure 1. Crystalline Rocky Structures in Pigeon Island at Trincomalee (Eastern Coast)

Figure 2. Exposed rock surfaces (granitic tors)at Badungala, 69 km on the Colombo - Galle road (West Coast).

Figure 3. Severe coastal erosion destroys the coconut trees at Beruwala Beach (West Coast).

Likewise, biogenically assisted weathering and rain action have promoted the development of solution pits and solution fretwork on exposed rock surfaces (granitic tors), which may penetrate deep into the rock, while vertical ribs and gutters may develop in the wet zone on the steep flanks of such outcrops. Such weathering effects are best evidenced in the wet zone, as at Badungala, 69 km south on the Colombo-Galle road (Fig. 2), and at Kaluwella in Galle.

Similarly, soft erodible material retreats readily in the face of wave action in the laterite or clayey residues that persist in the Beruwala, Kapparatota, Pallikkuwada and Ussangoda areas (Figs.3 & 4). Furthermore, as the jointed structures reach down to the sea, the joints may be widened considerably where contact with marine processes is most frequent. Where local conditions are amenable, waves and surging waters enter these widened joints and shoot through blowholes high into the air. The blowhole (locally known as '*hu-mmanaya*') at Kudawella, west of Tangalla (Fig. 5), is an excellent example. Shore platforms are relatively more common in metasediments than in other crystalline types. Examples are evident at the Veragala Islet east of Weligama Bay, and below Swami

Rock, Trincomalee, where multiple platforms are found at supra-tidal, inter-tidal and sub-tidal levels.

Coastal margins dominated by Holocene coral deposits are found in a few tracts: especially along the south and southwest coast between Kosgoda and Balapitiya (Fig. 6), between Akurala to Narigama, in the areas of Mihiripenna and Kahawa, as well as between Nambimulla and Matara (Fig. 7). They presently lie above the high water mark (Katupotha 1988a & 1988b). Similar coastal margins are found at points along the east coast, at Kalkudah, Elephant Point at Kayankernim Pannnichchankeni, Periyapupau and Koddikkadu (Swan 1982). Most of these inland coral deposits and the coral reef patches submerged nearshore are mined for lime burning (Fig. 8).

Figure 4. Southern swells hit the *in situ* weathered rocky structures at Ussangoda (Southern Coast) area carving micro landforms.

Figure 5. Blowhole in the rocky coast at Kudawella,Tangalla (Southern Coast).

Figure 6. Holocene emerged coral patches are located in many places between Kosgoda and Hikkaduwa (Southwest Coast)

Figure 7. Coral rubbles have been embedded during the formation of Holocene beach rock reef patches at Polhena area (Southern Coast)

Figure 8. Sea coral mining is major cause for the severe coastal erosion along the Southern Coast (Rekawa Beach)

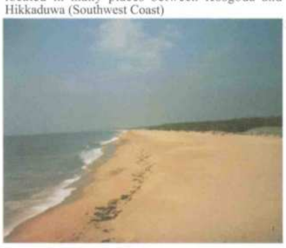

Figure 9. Wide beach in Godawaya area (westward side of the Walawe Ganga, Southern Coast)

Figure 10. An aerial view of the sand spits at Deduru Oya River Mouth.

Figure 11. Vegetated sand dunes are a significant feature along the Southeast Coast (Talgasmandiya, Hambantota).

Figure 12. Well developed sand dunes on Panama coastal area, Batticaloa (Eastern Coast).

Depositional Forms

Beaches, sandbars and spits, and dunes accumulate the material eroded by waves as well as wind action. Besides, mud flats, mangrove swamps and brackish marshes develop along the coast due to tidal flow and biogenic process, and appear as depositional landforms.

Beaches and Spits

Most beaches on the island are sandy, although beaches with pebbles, cobbles and boulders sometimes are found along bedrock-related coast backed by lagoons, swamps and ill-drained terrains, as well between headlands or the outfalls of rivers. Most beaches in the island commonly consist of two elements: an outer, seaward-sloping swash zone washed by waves, as well as a landward platform above it, referred to as the berm. Some beaches lack berms because of an insufficient tidal range, and a relatively low-wave energy. They are often only a few metres across where wave energy is perennially low. On such coasts, contemporary beaches with berms are about 40 m to 50 m wide on average. In contrast, where there are no berms, beaches are only about 10 m to 15 m across (Swan 1982). Such features are usually asymmetrical in profile, especially to the north between the Kalu Ganga and the Deduru Oya, at Udappu and Kandakuliya, the area between Tangalla and Hambantota (Fig. 9), to the beach north of the outfall of the Batticaloa Lagoon and the beach road in Trincomalee. A series of low beach ridges and intervening depressions in those areas develop during the off-seasons of monsoons.

Cheniers are beaches where coast erosion has destroyed barrier beaches, and there has been an encroachment of the sea into the zones of fluvio-marine and organic accumulation beyond. Examples of cheniers are found at Akurala and Kapparatota (east of Weligama). Cheniers are also common in low-energy environments; for example, they abound in deltas, such as that of the Aruvi Aru, where they have been produced largely by wavelets.

Examples of boulder beaches are found along the northerly shores of Galle Buck (Colombo), and at the Koddikaddu Aru Heads on the northeast coast. Likewise, pocket beaches are also abundant along sectors where bedrock coasts are found. These are sand bodies deposited at the ends of the small embayments cut into in situ materials, and are underlain by bedrock mainly between Dondra and Tangalla.

Sandy spits are connected to the land at one end and free at their distal end. Well-developed sand spits are found in front of the Gin, Kalu, Kelani, Maha Oya and Deduru Oya estuaries on the southwest and west coasts (Fig.10), and at the islands of Dutch Bay and Portugal Bay, as well as the Aruvi Aru estuary on the northwestern coast. Similarly, a large number of sand spits have formed around the Jaffna Lagoon and its environs, as well as in the Kokkilai Lagoon and Vakaneri on the northeast coast. Along the southeast and south coasts, similar features have developed in the Batticaloa Lagoon, between Akkaraipattu and Tirukkovil, in Kallar, in front of the Menik Ganga, between the Bundala and Kalametiya Lagoon, and in the Nilwala Ganga estuary. Likewise, beach cusps, which have horns or promontories, have developed in the direction of the beach face at Kirinda, Maha Lewaya, and Hambantota. Texturally, they are coarser than the surfaces of the bays in between. Other cusps are due to the differential erosion of the berm. The horns are finer textured than the surfaces of the intervening embayments, as noted at the Kalu Ganga estuary and the Karagan Lewaya.

Behind the contemporary shorelines, raised beaches have been formed widely (Swan 1964; Katupotha 1988). They are found mainly between 3 m to 10 m above the Mean Sea Level (MSL), and in most cases are due to sea-level changes. Where progradation had been extensive, protracted and at a fairly uniform rate, they occur as broad sand plains rather than as marked ridges and swales. Typical examples are found on the Hikkaduwa coast, between Panadura and the Colombo Fort, west of the Katunayake Airport, between Maha Oya and Toduwawa, as well as east of Mundal Lake on the southwest and west coasts.

Coastal Dunes

Windblown accumulations of sand heaps occur as well-developed dunes in both the dry and intermediate zones, but in the wet zone they appear as incipient dunes. Dunes develop due to both seasonally high-wave and perennially low-wave energy as well as winds (Swan 1979 & 1982). The best dune development is along the northeast coast between Mullaittivu and Point Pedro, between Elephant Pass and Chavakachcheri, across Mannar Island as well as the Pooneryn peninsula.

Incipient dunes occur on the wet-zone coast at Koggala, and form as a patch over 30-m wide, behind a 50m-wide beach lying within the shelter of a fringing reef. Similarly, at Matara, Akurala, Uswetikeiyawa, Pamunugama and Ambakandawila, they occur behind narrow sheltered beaches. Well-developed dunes may be seen on the Kalpitiya peninsula on the west coast, and along the southeast coast from Hambantota to Sangamankanda Point (Figs. 11 & 12). Similarly, highly weathered reddened dunes have formed along the northwest, north and northeast coasts. Unlike many of the less-weathered younger dunes, which are largely active, the older dunes are usually fixed by dense monsoon scrub forest.

Transverse primary (foredune ridges) and secondary transgressive (mostly longitudinal, sometimes parabolic) sets of dunes are associated with stable beaches along tropical coasts (Davies 1972; Swan 1982). Many of these dunes shift, possibly through human and animal interference. Unique examples are seen on the south side of Mannar Island, on the southern shores of Pooneryn peninsula in a low-wave energy environment, and on the exposed southern portion of the Kalpitiya peninsula. A variant of the trangressive type, such as rocky headlands, low inselbergs and rock knobs, are commonly found along the southeast coast where transgression has taken place along the axes of dunes onto the bedrock relief. Hilltop dunes have resulted from such longitudinal transgression (see also Jenings 1967). The absolute height of these dunes may reach 30 m above sea level.

Beach Rocks

Shoals of beach rock in Sri Lanka are cemented predominately by biogenic carbonate sands, quartz grains and different types of heavy minerals, such as ilmenite, monazite, garnet, etc. The reef-like characteristics of beach rocks act as a barrier to the movement of sediment across the beach.

Figure 13. A beach rock reef patch at Chilaw (Northwestern coast)

Along the present coastline of Sri Lanka, many beach rocks are exposed as reef-like patches and extended reefs. For example, well-developed beach rocks along the northwest and west coast have been seen in the areas west of Mannar Island, on the Vankalai and Silavatturai reefs, at Karativu Island, at Kalpitiya peninsula and at Chilaw (Fig 13) . Likewise, beach rocks can be seen along the west coast between Negombo and Mt Lavinia at Kalutara between Bentota and Balapitiya and south coast at Galle, at Ahangama and some patches at Tangalla. Similarly, along the southeast and east coasts, shoals of beach rock have developed in the areas of the Little and Great Basses, at Komari, Tirukkovil between Kalmunai and Batticaloa, and at Pulmoddai.

The 14C dating of exposed coral reef patches (in growth position), cemented with beach rocks, range within 5980±70 to 5100±70 yr BP and 2560±60 to 2250±70 yr BP age groups. These age groups indicate that the post-glacial transgression culminated in between the mid- and late-Holocene epochs.

Water Bodies

The coastline of Sri Lanka is indented by outlets, inlets, entrances or outfalls where the 103 rivers, estuaries and lakes meet the sea, and exchange freshwater and seawater (Irrigation Department 1974). Bays and lagoons also indent the coastline with large mouths. On the southeast coast, between Panama and Pottuvil, outlets lie at the southern ends of the beach systems, sheltered by nearby headlands from the constructive southerly swell. Yet they are exposed to northeasterly influences such as the rough seas, wet weather and beach recession associated with the northeast monsoon. Along exposed sandy shores that lack headlands, the locations of the outfalls vary according to local conditions and the direction of the longshore drift. As the outfall periodically shifts, adjacent shores are often unstable (Swan 1982).

Estuaries and Deltas

Both estuaries and deltas are sedimentary accumulations. The estuaries are affected by the twice-daily tides carrying larger volumes of water. Similarly, deltas are formed mainly by sub-aerial processes along coastal zones, and consist of disaggregated materials. These materials, which are readily dispersed by currents and waves, develop best in sheltered waters, e.g., as in the delta of the Aruvi Aru, which has wide deposits of alluvium. The deltas include sand spits and barrier islands at their margins.

Mantai was an important port in early historical times, but today is completely deposited with sediment. This occurs along low-wave energy tracts, for example, as along the mainland shores in the shelter of the Kalpitiya and Karativu sand barriers, and within Palk Bay. Sedimentation also develops within lagoons, such as in the deltas of the Kanakarayan Aru in the Jaffna Lagoon. Along exposed coasts, the only shelter from larger disruptive waves occurs within estuaries, lagoons and lakes. The largest estuarine delta in the island is the lower Mahaweli Ganga flood

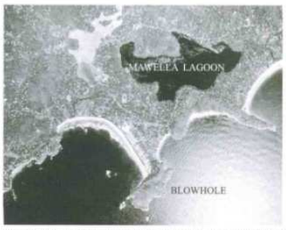

Figure 14. Aerial view of the Mawella lagoon behind the headland-bay (pocket beach) in Tangalla Coastal area (Southern Coast).

Figure 15. Salt marsh vegetation in the Kalpitiya peninsula (Westernbank of the Puttalam lagoon)

Figure 16. Destruction of mangrove vegetation at western bank of the Negombo lagoon (Pamunugama)

plain. In some instances, as in the Batticaloa-Kalmunai deltaic system, several rivers contribute materials to form the complex.

The barrier beaches and spits prevent seaward expansion of the delta. These sedimented zones are vertical alternations of fluvio-organic and marine deposits, including the remains of marine organisms, and are also caused by the presence of distributory channels. Examples occur in the lower Nilawala and Gin Ganga basins. Further aggradation by fluvial processes eventually eliminates larger distributory channels, as in the lower Kelani, Kalu and Bentota Ganga basins. Tidal deltas may form where tidal currents pass through narrow openings and channels across low submarine ridges and rises. Examples are evident on either side of Adam's Bridge, between Palk Bay and the Gulf of Mannar, and also between the Puttalam Lagoon and Dutch Bay.

Lagoons and Coastal Lakes

The majority of the coastal lagoons and lakes are attributable to the effects of the Holocene transgression, at the height of which the island's coasts were far more indented than today. Coastal smoothing followed this event. Lesser transgressions may have occurred since, developing barrier beaches and spits that form lagoons and lakes behind them, e.g., along the southern and southwestern coasts (Fig. 14). However, not all lagoons are necessarily related to submersion. Some are exclusively the outcome of spit growth and of barrier beach development, such as the lagoons and lakes along the northwestern, northeastern and southeastern coasts. Salterns and salt marshes cover most of the lagoonal coasts in these areas (Fig. 15). There are also lagoons that may be only regarded as such in a broad sense. These include bodies of water formed when the sea broke through one-time

Table 3. Genetic Classification of Coastal Lagoons and Lakes of Sri Lanka

A. Due to drowning	• Drowning of flat continental shelf leaving an archipelago off the mainland (a lagoon, in the broadest sense): Kayts lagoon.
	• Blind estuary: marine inundation of abandoned river course: Valaichchenai.
	• Residual water body in a once drowned and then largely sedimented food plain: Dedduwa Lake, Bentota Ganga valley, Hikkaduwa Ganga
B. Due to spit/barrier beach formation	• Ribbon lakes due to the addition of an outer barrier to an existing barrier/spit coast: east Jaffna peninsula
	• Lakes/lagoons enclosed during complex spit growth: within Kalpitiya peninsula.
	• Water bodies cut off from open sea by spit growth: Puttalam lagoon, Negombo lagoon, Mundel lake, Kalutara lagoon
	• Water bodies isolated by multiple barrier development: Beira lakes.
	• Water bodies isolated during delta growth: in Aruvi delta.
C. Due to spit/barrier destruction	• Water body, attributable to the destruction of former sand barrier by advancing sea, leaving rampart of littoral sandstone between open sea, lagoon and the sheltered shore: Beruwala, Colombo south (Fig. 9).
D. Due to drowning and barrier development	• Bays, isolated by bay mouth barriers: Hambantota *lewayas*, Tambalagam Bay.
	• Water bodies isolated by complex spit/barrier systems which have smoothened a lowlying shoreline rendered irregular by drowning: Batticaloa and Jaffna lagoon systems.

sand barriers, destroying them but not their consolidated, cemented foundations. Such lagoons are found where ramparts of beach rock stand offshore paralleling the shoreline, with the sheltered water leeward. The term 'lagoon' becomes even looser when applied to the sheltered waters between the islands and the Jaffna peninsula.

Mangrove Swamps

Mangrove swamps are also a significant habitat in terms of coastal landforms, and act as an open ecosystem. These swamps exchange matter and energy within the system and play an important role with regard to microscopic and mesocopic fauna, and for the coastal inhabitants. Plant species extend as fringes as well as patches in the swamps located along the sea coast, estuaries, lagoon and lake margins of Sri Lanka. The sand spits, beaches and beach ridges of headland-bay-beaches protect most of the swamps. They have developed as a result of a lowering of sea levels in the Late Holocene period (Katupotha 1988a & 1988b).

The micro relief of mangrove swamps produces food and shelter, and provides nursery grounds for birds, fish, reptiles and other crustaceans. Although mangrove swamps help to preserve the natural balance, they have been damaged by the development of human settlements, industrial activity, tourism, aquaculture, and land reclamation (Figure 16). Similarly, many mangrove species have also been degraded by: (a) the changes in freshwater run-off, salinity regime, and tidal flow patterns; (b) the excessive siltation and discharge of toxic substances; and (c) the flowing of polluted water into lagoons, lakes, estuaries and tidal creeks. The depletion and degradation of mangroves have directly and indirectly influenced the livelihood of people, as well as the survival of wildlife.

A simplified genetic classification of Sri Lanka's lagoons and lakes is shown in Table 3. The morphology of lagoons is closely related to their mode of origin and to the processes that modify them. Many lagoons have rivers or streams discharging into them, and it is at such places that deltas develop. Those related to multiple barriers have sand beaches along their banks. The orientation of such beaches is sometimes attributable to events and forces that acted upon them before the lagoon was formed. In other cases their orientation is due to wind and wavelet action related to seasonal winds.

The average salinity of lagoonal waters is less than that of seawater because of dilution. Salinities at upper levels of the lagoon are generally low due to precipitation and fluvial inputs. Values increase with depth due to the influx of tidal water. Because of the small tidal range in Sri Lanka, the tidal cycle has only a slight effect on salinity variations. Seasonal climatic differences are more important. Bottom salinities usually peak during the onshore monsoon when invasion of seawater is greatest. Surface salinities are low during rainy months, but increase during drier periods (see also, Arudpragasm & Jayasinghe 1980). Wet-zone lagoons are less saline than those of the dry zone, where during the dry season entrances generally close, and intense evaporation results in a build-up of salinity. Where little or no freshwater enters lagoons during the dry season, salt may crystallize, as in some of the '*lewayas*' of the Hambantota, Puttalam and Mannar districts.

Tsunamis

A tsunami caused by tectonic activity is a phenomenon that can suddenly affect the morphology of coastal landforms, as in the case with the great tsunami of 26 December 2004. In the Indian Ocean, shallow earthquakes occur where an oceanic plate begins its descent, at the outer margin of the island arcs, while deep-focus earthquakes occur at the inner margins of the islands arcs. Accordingly, the descending plate has reached depths of 600 km to 700 km. In this context, Sri Lanka is located in isolation, away from the boundaries of the Indo-Australian Plate, and was considered a volcanic- and earthquake-free zone or stable landmass. However, Table 4 shows significant earthquakes that have shaken the stable landmass of Sri Lanka.

Table 4. Historically Significant Earthquakes in Sri Lanka

Date	Region	Max.Intensity/ Magnitude	Lat/Longitude
14 April 1615	Colombo area	8.0	
09 February 1823	Colombo area,	5.7	07°00'N, 80°00'E
January 1882	Trincomalee area	6.3	08°36'N, 81°20'E
10 September 1938	Gulf of Mannar	5.8	07°50'N, 79°00'E
30 September 1973	Off the eastern coast of Sri Lanka	5.9	07°10'N, 84°30'E
06 December 1993	Gulf of Mannar (Felt in Colombo)	5.2 (4.7)	06°49'N, 78°18'E

Source: International Centre for Disaster-Mitigation Engineering (INCEDE) 1994; Gunasekara 2000; Rao at el 1984; Chandra 1977 & USGS.

A number of smaller earthquakes, between 2.5 and 4.5 in magnitude, have also been reported in and around Sri Lanka. Likewise, powerful earthquakes in the Tamil Nadu area in India also sometimes cause tremors in Sri Lanka. If there had been marine thrust and reverse faults, at those times, tsunamis could have hit the coast of Sri Lanka to change regional coastal configuration.

The 26 December 2004 tsunami hit 13 coastal districts out of the 25 districts in Sri Lanka, and deadly tsunami waves triggered flash floods, resulting in surges of seawater spreading swiftly into inland areas, sometimes up to 1 km or more. The waves inundated large extents of agricultural lands and livestock and property, also damaging irrigation canals and polluting water bodies.

Figure 17. Tsunami rubble at Pereliya, Hikkaduwa (Southwest coast of Sri Lanka)

The December tsunami waves in Sri Lanka carried sand from the beaches and ocean floor, and deposited it in buildings, on top of boulders, and on the ground (Figs.16 & 17). Tsunami sand deposits were found at all affected sites in eastern and southern Sri Lanka. Although tsunamis are capable of eroding the land, erosion in Sri Lanka was mainly concentrated in a relatively narrow zone near the coast. For example, at Mankerni, there was evidence that a grassy area eroded about 1 metre vertically in a zone about 20 to 30 metres wide near the coast. The sand eroded was transported both onshore and offshore. The sand transported onshore formed a recognizable tsunami sand deposit. Tsunami sand deposits at Mankerni started about 50 m inland, and decreased in thickness, from about 10 centimetre total thickness, to about 2 cm thickness by about 150 m inland. In other locations where the tsunami's impact was more severe, both the width of the erosion zone and the tsunami deposits were larger (Figs. 18 &19).

Figure 18. Pre Tsunami Images showing part of Jaffna region
(IRS-P6 AWiFS IMAGE of 20 Feb 2004)

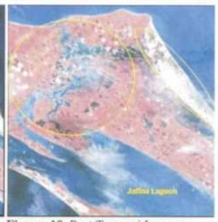

Figure 19. Post Tsunami Images showing part of Jaffna region
(IRS-P6 AWiFS IMAGE of 01 Jan 2005)

Source : National Remote Sensing Agency - India

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