The Holocene history of the West Coast of Peninsular Malaysia

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A study of selected borehole samples, as well as reviews of borehole logs and published literature, shows that the Holocene of the West Coast of Peninsular Malaysia was characterized by depositional and erosional phases related to fluctuations of mean sea-level. Rising, and still-stands, of sea-level were marked by deposition of sediments in a variety of shallow marine and coastal environments, whilst falling sea-level was marked by exposure and erosion of these sediments. On a broad scale, two separate phases of rising, and falling, sea-level can be distinguished as can be two separate phases of still-stands of high sea-level.

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At the end of the late Pleistocene, corresponding with the peak of the Wurm Glaciation in the Northern Hemisphere, there was a world-wide low sea-level, some 40 to 60 m below present-day mean sea-level. During this time, the (present-day) coastal plains of the West Coast of Peninsular Malaysia were non-existent and a larger part of the (present-day) Strait of Malacca was sub-aerially exposed. Several northwestward flowing rivers (draining into the Andaman Sea) were present in this sub-aerially exposed Strait; their catchment areas encompassing a larger part of north and central Sumatra, as well as the western part of Peninsular Malaysia. Drainage divides of these catchment areas coincided with present-day drainage divides, except in the southeast where a major sub-continental drainage divide extended through Singapore Island, Pulau Sentosa, St. John's Island, Pulau Batam, Pulau Bintang and the islands of the Riouw and Lingga Archipelagoes before continuing into central Sumatra.

At the beginning of the Holocene, there was a world-wide rise of mean sea-level (following melting of the Wurm glaciers) and this led to the gradual southeastward encroachment of the Andaman Sea into the then sub-aerially exposed Strait of Malacca. Under the present-day coastal plains of the West Coast of Peninsular Malaysia, this first marine transgression is marked in most areas by a sequence (termed the Lower Clays) of soft, dark grey, silty clays with shells and shell fragments that were deposited under mainly sub-tidal conditions. This sequence of silty clays overlies thin peat, or peaty clay, layers as well as light-grey, silty to sandy clays deposited under supra-tidal conditions. In places, these sediments infill valleys incised into, a variety of weathered bedrock, or dense, Pleistocene alluvial sands and gravels with stiff clay interbeds. The Lower Clays decrease in thickness away from the present-day coastline, as well as towards the southeast end of the West Coast and are absent in the eastern part of Singapore Island.

Deposition of the Lower Clays continued with the world-wide rise of sea-level until about 5,500 to 4,000 yrs BP when a mean sea-level, some 3 to 4 m above present-day mean sea-level was attained. In places, raised beach ridges mark this high mean sea-level. As sea-level rose, the then sub-aerially exposed Strait of Malacca was gradually drowned by the Andaman Sea, whilst to the east and southwest of the Malay Peninsula, there was a concommitant rise in sea-level of the South China Sea. At the peak of this sea-level rise about 4,500 yrs BP, the sub-continental drainage divide from Singapore Island through Pulau Sentosa and St. John's Island to the Riouw and Lingga Archipelagoes was first breached leading to establishment of the present-day Strait of Malacca. At this breach, initial movement of sea-water was from the west towards the east, leading to the development of a plunge pool (the present-day Singapore Deep).

From the about 4,000 to 3,000 yrs BP, there was a gradual drop in mean sea-level and this is reflected in places by erosion, exposure and weathering of the upper part of the Lower Clays. From about 3,000 to 2,000 yrs BP, there was another rise in mean sea-level to some 2 m above present-day sea-level. This second high sea-level is marked by raised beach ridges in a number of places, whilst the marine transgression is marked by a sequence (the Upper Clays) of soft, dark grey, silty clays with shells and shell fragments that were deposited under mainly sub-tidal conditions. The Upper Clays also sometimes overlie beach sands as well as thin peaty clay layers. From about 2,500 yrs BP, there has been a gradual drop of mean sea-level to its present-day level, and this is mainly marked by erosion, exposure and weathering of the upper part of the Upper Clays.