Keynote Paper IV

Coastal geomorphology of the Strait of Malacca area during the past millennium

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The study of coastal geomorphological developments of the Strait of Malacca during the past millennium may give important pointers to possible shoreline development during the next millennium. For this study in

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addition to the usual tools like field observations and mapping, historical and navigational records are invaluable sources of evidence. For dating of young events such as occurring during the past 1,000 years the usual radiometric carbon 14 method may be at its limits of suitability but dating can be obtained from ceramic sherds if they occur and the sherds are also suitable for thermoluminescence dating.

Evidence from field mapping of ceramic-bearing raised beach deposits, available data from offshore geophysical survey, archaeological and historical records and radiometric carbon 14 dating has been used in Khoo (1996) to reconstruct the geomorphological evolution of the Merbok estuary area in Kedah. At the beginning of this millennium the area had a lagoon with an elongate bay mouth bar and several islets. The port city of early Kedah was sited on the beach of this lagoon. This configuration can be identified as one of the stages of an emergent coast and this stage appeared to be relatively stable for a 1,000 years or more. A dramatic fall in sea level of perhaps 2-3 m occurred within a span of perhaps 100 years from about 1300 to 1400. The shallowing of the bay led to the fall in importance of the port city in the entrepot trade between East and West but this was compensated by an increase in agricultural land area. Other port cities on the opposite side of the Malacca Strait such as Kota Kandis, Jambi and Palembang in Sumatra too suffered the same predicament as early Kedah during the same period and these former port cities are now stranded far inland. This event appears to be widespread throughout the Strait area. I shall call this 1300-1400 regressive episode as the **Merong Event** as an eye-witness account of this event has been given in no less than 15 passages in the *Hikayat Merong Mahawangsa*, also known as the *Kedah Annals* to western scholars.

After the Merong Event, from Martaban to Malacca there are geomorphological features of emergent shoreline at different stages of development, the final of which is the straightening of the coastline like the Merbok area. The present shoreline of the Takuapa area on the west coast of the Thai peninsula for example is at a stage before final straightening. In Eredia's 1,613 map of Malacca there was a well developed tombolo, an emergent coast structure, south of the city. The tombolo has since been destroyed by the more explicable activities of man. Another geomorphological legacy of the Merong Event is the wide Merbok estuary with its short drainage basin. The estuary is the only remnant of the lagoon which existed before the Merong Event. Such estuary has been called the **Merbok–type** in Khoo (1996). Another Merbok-type estuary is the present Dinding estuary with its wide mouth and short drainage basin. It was possibly the remnant of a former lagoon.

The post Merong Event geomorphological configuration of the Pangkor area has been described by Arab, Dutch and British navigators from ~ 1511 to 1822. Of special significance is in the *Kitab al-Minhaj* by Sulaiman (~ 1511) there are records in 3 folios of the area. It was recorded that in the Dingding (as spelled in the early records) area there are two large, long, barren islands and facing them is the island of Tankur Lau (also spelled as Bankur Lau in the work). In Folio 67 both large islands are referred to as the Dingding islands. Bankur Lau is obviously the present Pangkor Laut near the much larger Pangkor island. The missing island of the Dingding has merged with the mainland forming the headland opposite the present Pangkor island. This merger was probably caused by increase in sedimentation contributed in part by human activities such as tin mining and agriculture among other possible factors. This merger probably happened before 1660 and after ~1511 as Nieuhoff in his *Collection of Voyages and Travels* in 1660 published in 1745 mentioned only one island of Dingding. The change in name from Dingding to Pangkor occurred sometime before 1822 as Crawfurd (1828) wrote in 1822 that the Dingding in maritime charts should more correctly be Pangkor and Dingding referred to the mainland opposite Pangkor.

The present Bukit Jugra which is some 6 km from the coast was formerly known as Parcellar in Portuguese maps such as Eredia (1613). Nieuhoff in 1660 recorded that the cape of Barcelai is a high mountain near a point of the land. Earlier Peter Floris (a.k.a. Pieter van Elbing) in his 1611-1615 journal recorded that Pulo Parselar was a high mountain standing on a low point of ground and appeared to be an island from afar but it was firm land. This is the latest record to my knowledge of the hill being referred to as an island (pulau or pulo by Floris). The hill has been referred to as an island in all earlier Arab records such as Fulo Pasalar (Sidi Ali Selebi in the *Muhit*, 1553) and Pulau Basalar (Sulaiman in *Kitab al Minhaj*, ~1511; Sulaiman in *Umdat al Mahriyah*, ~ 1511). In Admiral Zhenghe's *Wu Pei Chih* navigation charts of the early 15th century the place is called Mi Hua Su (Cotton Island). It would appear that the island merged with the mainland sometime post Merong Event, after 1553 but before the beginning of the 17th century, a timing somewhat similar to the

merging of one of the Dingding islands with the mainland mentioned above. Increased sedimentation coupled with a small fall in sea level may have been some of the reasons.

Most interestingly in the *Kitab al Minhaj* of Sulaiman (~1511) Folio 77 it is mentioned that the islands of Pulau Sanbilan (Pulau Sembilan near Pangkor) were at the northern head of a bay just as Pulau Basalar were at the southern head of the same bay. This would imply that the coastline of the part of Selangor between Sabak Bernam and Bukit Jugra was a bay concave to the east and the further implication that the coastline had accreted westward at a relatively rapid rate to the situation as obtain today. Indeed the coastal stretch between these two points are covered by young marine sediments. The development of mud flats and mud islands such as the Ketam-Carey group mark the forefront of the accretion boundary. Increased erosion of the hinterland and sedimentation perhaps aided by slight fall of sea level could eventuate the system. The same kind of coastal development with a coast festooned by mud islands and mud flats especially exposed at low tide occur on the Sumatran coast and the shoreline is building eastward toward the peninsula.

The role of human activities in changing the coastal geomorphology is textbook knowledge. A rather unique human activity changing the coastal geomorphology occurred at Pulau Upeh, near Malacca and Teluk Pelandok, near Cape Rachado. At these two places I have found evidence of extensive laterite cutting with remnant rectangular cavities still to be seen on laterite bedrock. The Upeh site was worked by the Portuguese throughout their occupation of Malacca from 1511 to 1641 as mentioned in records such as Cardon (1934). The laterite cutting at Teluk Pelandok has been mentioned in Khoo (1997) and the occurrences of ceramics dating from the mid 18th century near the site suggest that possibly the Dutch worked on the site to obtain laterite blocks for structures such as the St John Fort and repairs to the Portuguese fort existing then. The extensive laterite cutting at these two sites had caused the sea to denude further inland. To some extent the present bay at Teluk Pelandok is not a naturally formed bay but partly caused by taking away of voluminous lateritic material. The headlands with their naturally occurring outcrops of laterite, which could not be cut, were left as small islets way out from the present coastline.

At the Teluk Pelandok locality is a bed of ferricreted (iron oxide cemented) beach deposit with well cemented pebbles of quartz, laterite, wood fragments (a sample even with 2 copper nails), glass and about 10 pieces of ceramic sherds. Among the ceramic sherds are pieces similar to those found in the environ of the mid 18th century Dutch fort at Kuala Linggi and a piece of Chinese ceramic with sapphire-blue glaze appears to date from the mid 18th century as well. The development of this ferricreted beach deposit would require at least a slightly lower sea level after the mid 18th century and subsequent rise in sea level has exposed the by now ferricreted beach deposit. The lowering can be no more than 50 cm and there is no evidence to date the time of the subsequent rise, here called the **Pelandok Event,** more precisely. But the significance of the ferricreted beach deposit is that it shows that a minor fall and rise of sea level occurred.

From the limited data available it will be tempting to make a prognosis of the coastal geomorphology of the Malacca Strait area into the next millennium. It would be necessary to understand the reasons for the events and developments which occurred during the last millennium to forecast the *feng-shui* of the area in the next millennium. The Merong Event with its rapid fall in sea level, the post Merong progressive build-out of the coastal zone westward from the peninsula and eastward from Sumatra and the Pelandok Event suggest to me a cycle of uplift for the peninsula and the adjacent Sumatra which began with the Merong Event and subsided by the Pelandok Event. During the initial phase of an orogenic uplift the initial phase is rapid followed by a longer phase of slower uplift. The Merong Event marked the initial phase of uplift which witnessed a rapid fall in sea level. The longer period of post Merong uplift provided for the increase in sedimentation to the coastal areas where the geomorphology of the accretion boundary at various stages of development can still be seen. The mud flats and mud islands of Ketam-Carey in Selangor and Port Weld-Trong in Perak represent a stage before final straightening of the coastline like the coastal area of Muar-Kesang in Johor. If the cycle has been terminated by the advent of the Pelandok Event then we may witness stability of the coastline and maybe the onset of erosion as a result of the cessation of uplift, however, small. A more dreaded *if* will be the Pelandok Event heralded the beginning of a longer cycle of erosion of the coastline after the cessation of uplift. If the uplift cycle has not been completed, with the Pelandok Event being a minor reversal, then the island clusters such as Ketam-Carey will merge with the mainland. There will then be continued build-out onto the Malacca Strait from both the peninsula and Sumatra considerably narrowing the

Strait. Further research will be able to gather in more golden threads of evidence which can be woven to evolve a prognosis with an accuracy, detail and beauty as exquisite as the *kain songket.*