

**BEACH PROFILE AND SEDIMENT DISTRIBUTION DURING SPRING  
TIDE AT UMS BEACH**

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AT UMS BEACH

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## Abstract

This study of beach profile changes and sedimentology characteristic is conducted along Universiti Malaysia Sabah (UMS) beach during spring tide. This study is to investigate how the coastal processes such as winds, waves, current and tide influence beach geomorphology. This study aim is to determine the changes of beach profile and sediment distribution patterns during spring tide from September to December. Automatic level set is used during the field work to measure the changes beach profile and sediment samples that were collected at high tide (HT), mid tide (MT), and (LT) level which then were analyzed using dry method. UMS beach do not shows much changes during four sampling date which ranges of beach gradient from  $1.55^{\circ}$  to  $4.51^{\circ}$ . Both erosion and deposition process mostly occurred at MT level and lest occurred at HT level. Besides that, sediment distribution along study area is dominated by very fine and fine sand. In addition, sedimentological characteristic can be identified as poorly sorted and more negatively skewed. However, human activity also affected the coastal processes and sediment distribution along the UMS beach. As a conclusion, the beach profile at UMS beach at first is just flat land, followed by a steep slope.



## Abstrak

Kajian perubahan profil pantai dan ciri-ciri sedimen dijalankan di pantai UMS pada air pasang perbani. Kajian ini dijalankan untuk mengetahui bagaimana tindakan proses-proses pesisir pantai seperti angin, ombak, arus dan pasang surut memberi kesan ke atas geomorfologi pantai. Kajian ini adalah bertujuan untuk melihat perubahan profil pantai dari bulan September hingga Disember serta untuk menilai taburan sedimen yang mempengaruhi aras profil pantai pada air pasang perbani. Pengukuran profil pantai ini dilakukan dengan menggunakan level automatic dan sampel pasir diambil dari kawasan HT, MT, dan LT untuk diasingkan mengikut saiz dengan menggunakan kaedah pengayakan kering. Pantai UMS tidak menunjukkan perubahan yang besar ketika empat tarikh penyempelan dijalankan di mana julat kecerunan pantai dari  $1.55^{\circ}$  ke  $4.51^{\circ}$ . Kedua-dua proses iaitu hakisan dan pemendapan berlaku dengan kadar yang tinggi pada kawasan MT dan kurang berlaku pada kawasan HT. Selain itu, taburan sedimen pada kawasan kajian didominasi oleh kumpulan pasir sangat halus dan pasir halus. Tambahan pula, ciri-ciri sedimen boleh dikategorikan sebagai penyisihan tidak sempurna dan kepencongan yang lebih negatif. Walau bagaimanapun, aktiviti-aktiviti manusia di kawasan kajian banyak mempengaruhi proses-proses pesisir pantai dan taburan sedimen sepanjang pantai UMS. Sebagai kesimpulan, profil pantai di pantai UMS merupakan pantai yang landai pada hujungnya dan diakhiri dengan pantai yang cerun.

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**LIST OF SYMBOL AND UNITS**

HT	High Tide
MT	Middle Tide
LT	Low Tide
ms <sup>-1</sup>	Minute per second
cm	Centimeter
%	Percent
s	Second
km	Kilometer
mm	Millimeter
m	Meter
g	Gram
μ	Micro
μm	Micrometer
Φ	Phi





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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Introduction**

According to Thurman and Trujillo (2004), earth surface areas are covered by 71% of ocean and 29% of land. The ocean determines that our continents end and coast act as a boundary between the land and the sea where the beach are located. Beaches are sedimentary deposits that remain at the shore due to the action of waves. Although these unconsolidated sediments would appear fragile, their persistence in the faces of variable, and often highly energetic, wave regimes indicates that they are in some balance with the processes that shape them. Their success lies in their malleability, their ability to be reshaped into a form that either reflects or dissipates wave energy and ensures their longer-term survival. Beaches, and adjacent subaqueous near shore environments, can adopt a relatively small range of long-shore and cross-shore morphologies in response to wave conditions. Beaches vary in size and shape. They can be long and straight, running for tens or hundreds of kilometers, where sediment supply has been sufficient to completely veneer the underlying topography, or they can comprise a series of pocket

beaches separated by headlands on embayed coasts with considerable inheritance from underlying bedrock.

Coast is an interface between the land and the sea; therefore, it is crucial to both human and environment. First of all, coast provides human with place to live. Presently, about two-thirds of the world's population lives within a narrow belt directly landward from the ocean edge (Komar, 1976). Additionally, coast also provides habitats for flora and fauna. It also act as an economical important to certain country due to its scenic. Meanwhile, Woodroffe (2003), points out that coast plays an important role in global transportation. Due to its contributions, it is important to know the types of coastal landforms, and understand the factors that shape them. The study that concerned with explaining the types of landforms and the factors that shape them is known as coastal geomorphology. Coastal geomorphology explains landforms by examining the form, sediments and depositional history at the modern shoreline while, the factors that shape them can be examined in plan form or in profile.

When there is a full moon or new moon, the gravitational pull of the moon and sun combined together because the spring tide shape is oval and causes the tides to be in maximum and minimum condition. So, during these times, the high tides are in a very high state while the low tides will become extremely very low. This is known as a spring high tide. Spring tides are characterized as higher tidal range which means it will happens when the phenomenon reaches the highest high tide and the lowest low tide. They only occur when the Earth, the Sun, and the Moon are in a line and it do not related with the

spring season. The gravitational force that comes from the Moon and the Sun both contributes to the tides. Spring tides occur during the full moon and the new moon. When these situations occur, the action that will happen is the beach area will be left uncovered and the coastal processes will increase while the percentage of the erosion and deposition processes also having an increasing rate.

There are four factors that influence the beach profile which are waves, currents, tides and winds. Human activities such as boating activities also can change the beach profile either directly or indirectly. This human interruption also plays an important role on the sediment transport such as the construction of jetty at the coastal area. Commonly, the construction of such structure has pronounced deleterious effects on the adjacent beaches and may even affect beaches some distance away (Komar, 1976).

## **1.2 Study Background**

Study about coastal processes and sediment transports has not been done yet at Universiti Malaysia Sabah (UMS) beach. Hoque (2006) reported that the importance of sediment transport and beach profile evaluation in the near shore zone has been widely recognized, however, the present understanding is not satisfactory. There are several studies of beach profile and sediment characteristic that have been done at Peninsular Malaysia such as Perlis, Kuantan and Kahang. The result shows that the beach ridge in Peninsular Malaysia have three main levels; 0-5 m; 9-11 m and above 15 m (Sharifah Mastura, 1987).



Researchers have done many similar research of beach profile in western countries. Hjulström (1935) derived an empirical relationship between the velocity of water flow and the movement of sediment particles in different sizes. From the research, he found that sediment is deposited when the flow decreases below the fall velocity; the larger the grain sizes are deposited before the smaller grain sizes which continue to be transport. The critical threshold for initiation of sediment motion was examined on a flat-bed surface by Shields (1936). The rate of this process depends on the characteristics of individual grains and bulk, and on physical characteristics and mechanism of the fluid (Woodroffe, 2003).

According to McCullagh (1978), the equilibrium gradient of beach depends on the sizes of materials of which it is made and the characteristics of the dominant waves. The wet sand coheres due to chemical bonds formed by moisturizing and this maintains quite steep profile. The movement of sediment is a primary control on morphodynamics and also the sedimentary processes (Woodroffe, 2003). Therefore, the beach gradient is highly proportional to the sediment size. He concluded that the generation and transformation of wave can move sediment.

### **1.3 Study Location**

UMS is located about ten kilometers from the city of Kota Kinabalu. The latitude is N 6° 02' while its longitude is E 116° 06' and it takes about ten to twenty minutes driving from

the city. The UMS beautiful and precious beach lies on the east side of UMS and located at Sepangar Bay.

Before the Universiti Malaysia Sabah campus was built, no research has been done along its beach. The beach profile and sediment characteristic is still pure and untouched. It still maintains its originality on the sediment all along the UMS beach. The activity running along the beach just related on normal human activity such as construction of a jetty, people going on boating activity and Outdoor Development Centre (ODEC) that are developed by UMS itself.

There are a few islands located in front of UMS beach such as Gaya Island and Sepangar Island. The beach has its own specialty compared to other beaches because the originality of the beach is protected from being distracted by bad elements. This happens because it is covered from heavy wind that causes dangerous waves and erosion to the beach itself by the islands in front of the beach.



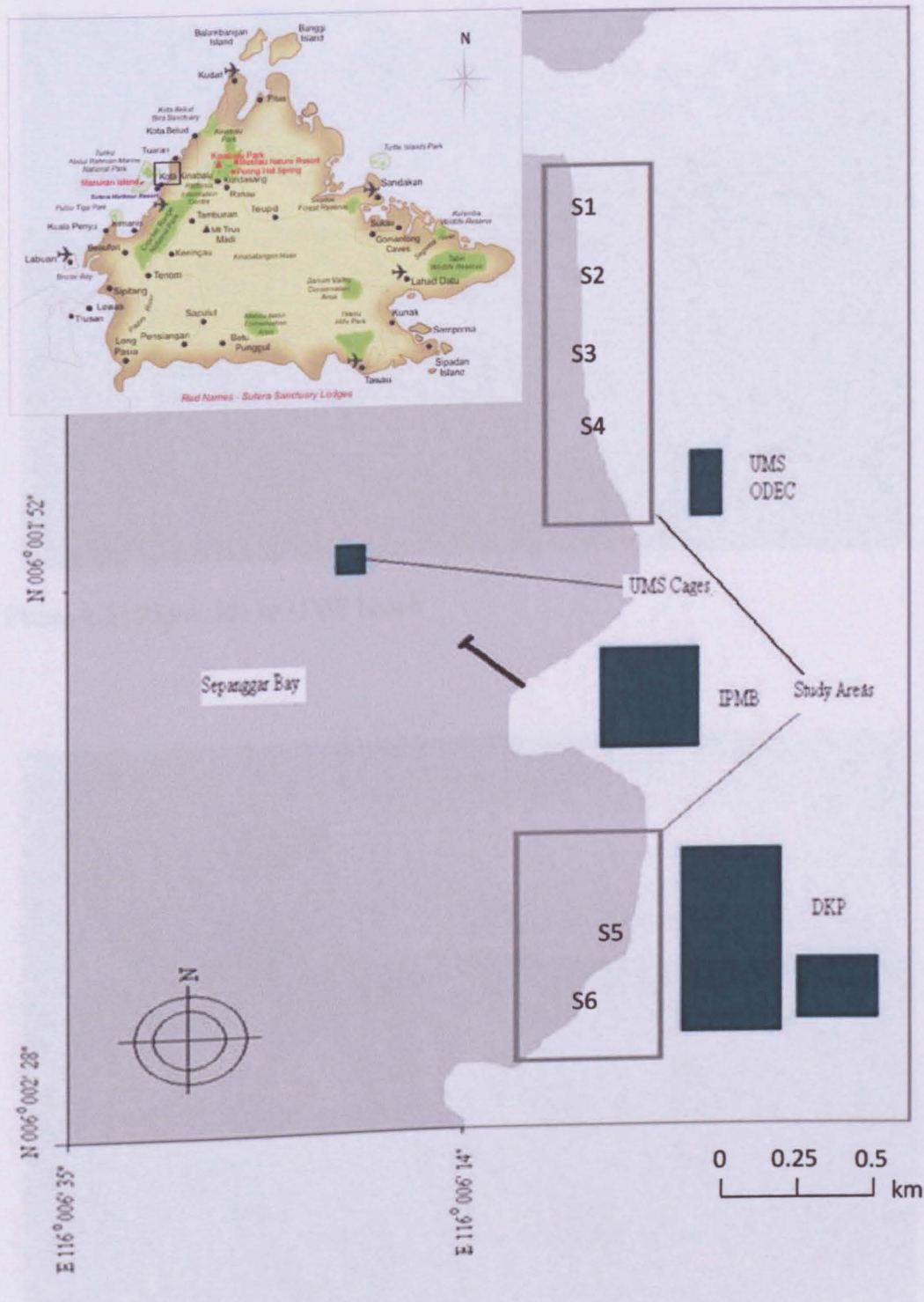


Figure 1.1: Study area



**Photo 1.1:** Right side of UMS beach

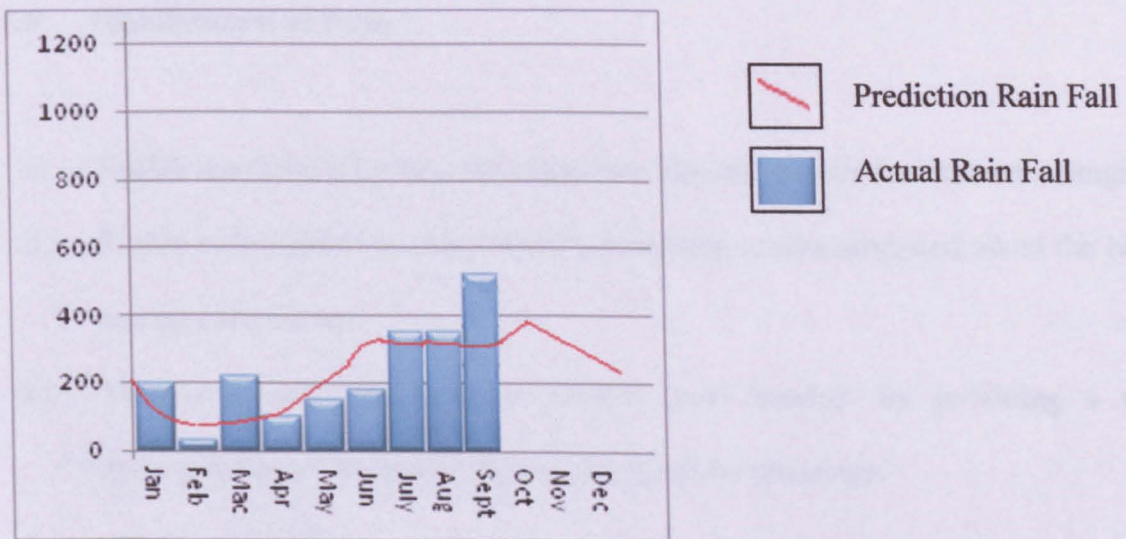


**Photo 1.2:** Left side of UMS beach



#### 1.4. Secondary Data

In addition, wind becomes the major factor that gives great influence for the changes on the beach profile. Secondary data that is taken from Malaysia Meteorological Department can estimate the winds at certain places by referring to the annual prediction and actual rainfall. Figure 1.4 shows annual rain fall for Kota Kinabalu.



**Figure 1.2:** Annual rain fall at Kota Kinabalu

### **1.5 Objectives of study**

- i. To determine the variation of beach profile during spring tide at UMS Beach,
- ii. To determine the sedimentological characteristics of beach,
- iii. To identify physical processes that influences the variation of beach profile and sediment characteristics.

### **1.6 Significances of study**

- i. Enable scientists to better understand how fast and why the beaches are changing.
- ii. Enable policymaker to make better information recommendation about the beach management issues.
- iii. Monitoring data will help to protect local beaches by providing a clear understanding of the beach erosion and accretion processes.

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