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The Geology and Geomorphology of Pulau Jarak, Pulau Sembilan and Pulau Perak

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ABSTRACT Pulau Jarak and Pulau Perak in the northern part of the Straits of Malacca constitute the outermost islands of Peninsular Malaysia. Pulau Jarak is a granitic island with a well-developed soil cover on the upper slope which falls straight into the sea with almost no coastal plain. Hence the coastline is dominated by boulders and granitic outcrop. It is fringed by an asymmetrical subsea platform which supports luxuriant coral reef development. Pulau Perak is underlain by a metamorphosed sequence of predominantly thick bedded, low-dipping arenaceous sedimentary rocks which form a broad anticline. Poor soil development is seen in Pulau Perak, being limited to areas of thick guano from ocean birds. Its subaerial morphology of steep precipitous cliffs continue into the sea to a depth of 85 meters. Luxuriant growth of corals and algae plastered the walls of these subsea cliffs.

ABSTRAK Pulau Jarak dan Pulau Perak di bahagian utara Selat Melaka merupakan pulau pulau yang terjauh dari Semenanjong Malaysia. Pulau Jarak merupakan sebuat pulau granit yang mempunyai lapisan tanah yang tebal di bahagian atas cerun yang menjunam terus ke laut tanpa kawasan pamah. Oleh itu, garisan pantainya di hadiri oleh bungkah bungkah dan singkapan granit. Ianya di kelilingi oleh pelantar marin yang taksimetri yang menyokong pertumbahan pesat terumbu karang. Pulau Perak dialasi oleh satu jujukan batuan sediment berpasir yang mempunyai lapisan yang tebal dengan kemiringan yang rendah dan membentuk satu antiklin yang terbuka. Pembentukkan tanih adalah terhad kepada kawasan yang mempunyai lapisan guano (tahi burung) dari burung burung lautan. Morfologinya yang menunjukkan cerun yang sangat tinggi berterusan ke kedalaman laut sehingga 85 meter. Petumbuhan karang dan alga meliputi dinding struktur ini.

(geology, geomorphology)

INTRODUCTION

Pulau Perak and Pulau Jarak (Figure 1) are Malaysia's most westerly islands in the Straits of Malacca and are used as baseline points in the northern part of the Straits of Malacca for the Continental Shelf Boundaries of Malaysia. The Pulau Sembilan archipelago represent an important fishing area in the State of Perak. To date little geological work has been conducted on these islands, hence little is known about them.

Pulau Jarak and Pulau Sembilan

Pulau Jarak is located about 30 miles southwest of Pulau Pangkor. It is a granitic island surrounded by waters of 25 to 40 meters deep. The seas around the

Figure 1. Map of the Nothern Straits of Malacca showing the location of Pulau Jarak and Pulau Perak. The route of SESMA1 is shown in drawn lines.

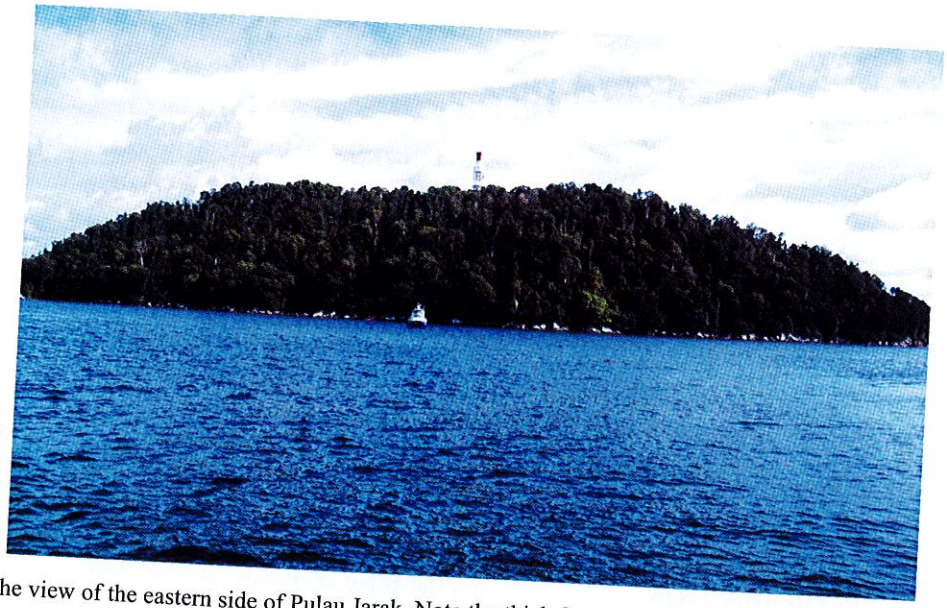

Figure 2. The view of the eastern side of Pulau Jarak. Note the thick forest cover and the boulders at the coast.

island has several interesting diving sites, especially current drift diving. There is a little beach and small coral reefs nearby. Pulau Sembilan archipelago which consists of a cluster of 9 islands is about 10 nautical miles from the mouth of Sungai Perak.

The Bedrock Lithology of Pulau Jarak and Pulau Sembilan

The islands of Pulau Jarak (Figure 2) and Pulau Sembilan archipelago in the Straits of Malacca are situated between 20 and 40 nautical miles from the

mainland of Peninsular Malaysia and are underlain by granites. In Pulau Jarak, porphyritic to coarse-grained biotite granite dominates and is characterised by bluish rounded to sub rounded quartz. The main feature of the granite is accumulation of the large pegmatitic K-feldspar associated with various types of enclave. Main enclave type is metasedimentary, fine grained surmicaceous enclave and medium grained biotite-rich enclave. Pegmatitic K-feldspar pods/irregular bodies can be up to 1 m in length. Occasionally, the flow texture forms by alignment of K-feldspar megacryst. The granite underlying the Pulau Sembilan is similar to that of Pulau Jarak but is more homogeneous.

The Geomorphology of Pulau Jarak and Pulau Sembilan

Morphologically, all these islands have steep slopes and limited coastal plains. The shorelines are either bare granite outcrops or accumulation of granite boulders. Good long beaches are only found in isolated coves of Pulau Rumbia and on the eastern side of Pulau Lalang.

The coastline of Pulau Jarak is oval shape with two headlands protruding to the NE and SW. The seawards extension of these headlands forms two submarine ridges with several pinnacles which are partly exposed at low tides and pose navigational hazards. Several elevations data will be made at different points on the islands and their coasts using GPS technologies. Using the published topographic map and satellite images, the corrected position of these islands were remapped with GIS. This position is tested against the marine transects around these islands and rocks.

The Marine geomorphology of Pulau Jarak and Pulau Sembilan

Seafloor mapping of the surrounding sea of these islands were made. Of interest were the width and morphology of the platform surrounding these islands (Figure 3). The sediment cover was also interpreted from the sonar images and groundtruthed by snorkelling and scuba-diving. Coral reefs cover most of the surrounding platform of Pulau Jarak and breaks in the slope of the platform are interpreted to be elevation differences of the surface of the

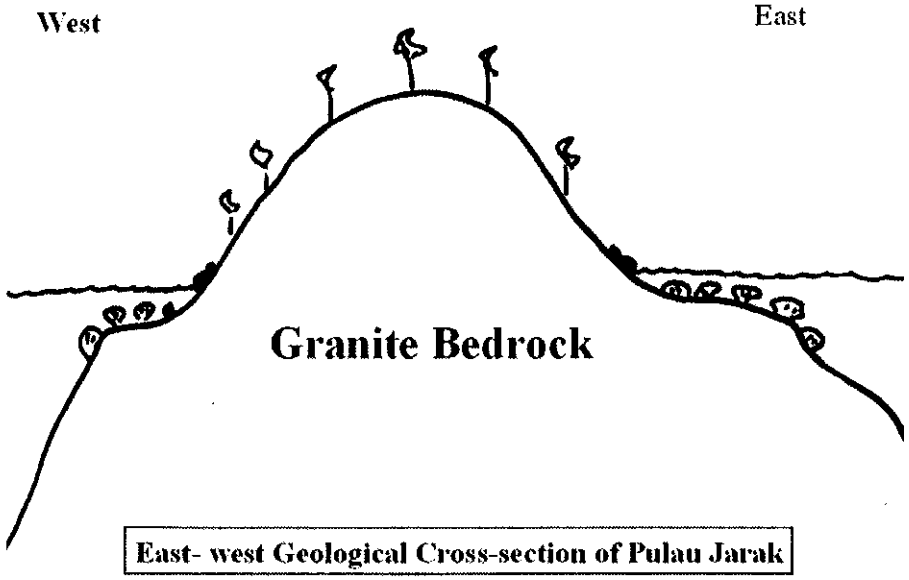

Figure 3. The east- west geological cross-section of Pulau Jarak showing the asymmetrical shape of the platform across the island.

underlying granites. To the east of Pulau Jarak a deep (200 feet) trough-like depression was mapped.

The seafloor to the east of Pulau Lalang is found to be of irregular depth forming a dissected basin topography. This appears to be the submarine extension of the southern Pulau Sembilan morphology. The horsts are dominated by granite bedrocks and boulders while most of the "graben" is covered by fine clastics. Green branching corals and a plethora of soft corals, red algae, and wisp corals are found coating the rock substrate. This surprising discovery warrants more detailed research in the future.

PULAU PERAK

Pulau Perak (Figure 4) with coordinates of 5d 40m 59.0s N, 98d 56m 17.2s E, Datum WGS84 is located almost in the center of the Straits of Malacca and is Malaysia's westernmost island. It is the closest island to south of the Andaman Sea Basin, and is 170km west of Sungai (Sg.) Petani in Kedah. Pulau Perak is located about 90km south-west of Pulau Langkawi. It is the northwestern most island in the Straits of Malacca. This 600m long and 400m wide island is surrounded by deep blue water of 85 meters depth. Along the summit, slopes and ledges, the rock surface is covered by a pearly grey deposit of guano formed from the droppings of countless numbers of sea birds which inhabit the island.

Previous work

Jones [1] visited the island in 1955 and reported that it was an isolated stack of 1800 feet by 750 feet that rised steeply to a height of 350 feet. He reported in his memoirs published in 1965 that the bedrock of Pulau Perak was indurated quartz tourmaline hornfels which was intensely veined with quartz tringers. The bedding appeared to be subhorizontal. No fossils has yet to be found in this rocks. Hence its age and stratigraphic affinity are unresolved. Jointing is common, forming a series of well defined joint planes whose erosional products produced deep gullies running from sea level to the summit. Jones also reported that was home to countless oceanic birds whose droppings especially at the summit formed a mantle 2-3 mm thick. There are no other geological report of this island. Due to its high degree of induration and the essentially arenaceous character of its lithology, Jones suggested it could possibly be correlated with the Machinchang Formation.

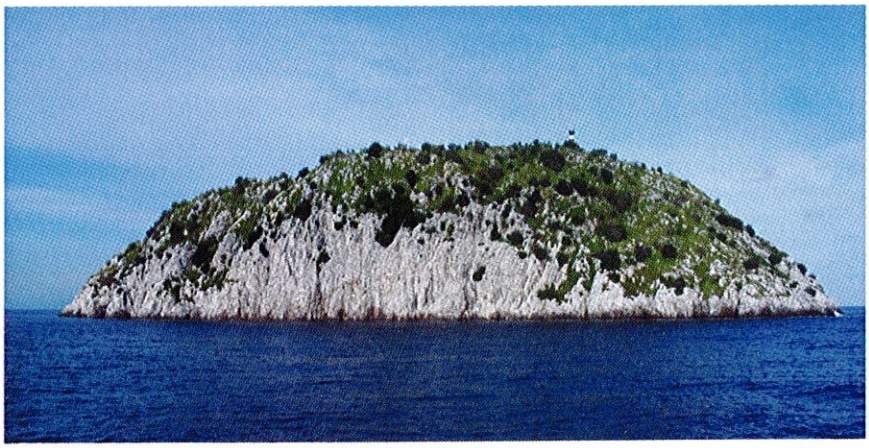

Figure 4. The view of the east side of Pulau Perak. Note the thin vegetation cover on the crest of the island and the barren precipituous slope.

Lithology and structure of Pulau Perak

Cliffs of close-bedded, grey and yellow, banded hornfels profusely veined by minute stringers of quartz rise steeply from the waters edge and only in a few places is a landing possible. Elsewhere, the rock shows a well-bedded character with the strata dipping at a low angle to the north-northwest in the west and easterly in the east. Jointing is common and a series of 4 well-defined joint-planes have been eroded into gullies running

from sea-level to the summit on the northeast side of the island.

The rock is fine grained and banded with layers rich in silty quartz interlaminated with ones in which tourmaline is the dominant constituent. The quartz is angular and intergrown closely with minute tourmaline crystals and minor iron oxides. The whole rock is impregnated by veins of quartz varying from hairlike stringers to veins of up to 1 inch of thickness.

The geomorphology of Pulau Perak

Pulau Perak forms a broad north-south trending anticlinal structure that is reflected by its outline. Its slopes form steep cliffs plunging almost vertically into the sea. Below the sea level, this unique morphological feature is covered with encrusting corals and algae from the sea level to depths of beyond 40 meters (Figure 5). Luxuriant marine life abound around this wall reef (Figure 6). Visibility is very good for up to more than 30 meters. Several caves formed by the intersections of bedding and joint systems are found at different elevation in Pulau Perak. One such cave occurs at sea level in the southeastern part of the island (Figure 7).

Impact of thin-soil cover on vegetation and ocean bird population

Soil formation is very limited in these arenaceous rocks of Pulau Perak. Only the presence of the guano supports sparse vegetation on Pulau Perak. Vegetation cover on Pulau Perak is about 25% of the land area and shows a maturing ecosystem compared to earlier reports that this island was a barren rock outcrop some 50 years ago. It is a breeding site to seabirds, especially the brown boobies and brown noddies. However, the population of these birds have dwindled and any future development will threaten them further.

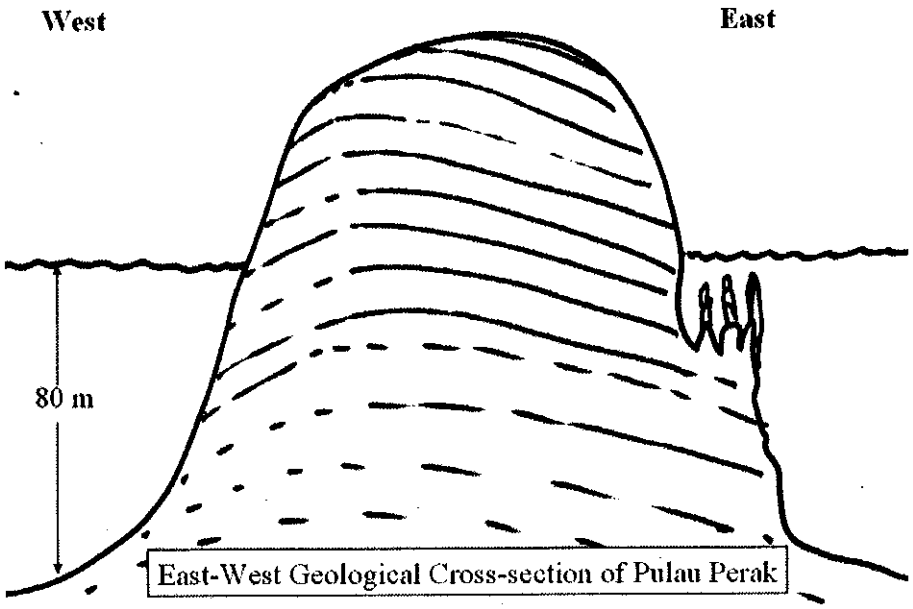

Figure 5. The NW-SE geological section of Pulau Perak showing its broad anticlinal structure and the slope that extends beneath the sea.

The scientific significance of Pulau Perak

Due to its unique morphology, luxuriant marine life, maturing ecosystem and its importance as a breeding site for the diminishing seabirds, brown boobies and brown noddies, it is proposed that Pulau Perak is gazetted as a protected area as it is a *site of scientific interest*. The only other site in Malaysia where these oceanic birds are found in Malaysia is Pulau Layang Layang, offshore Sabah.

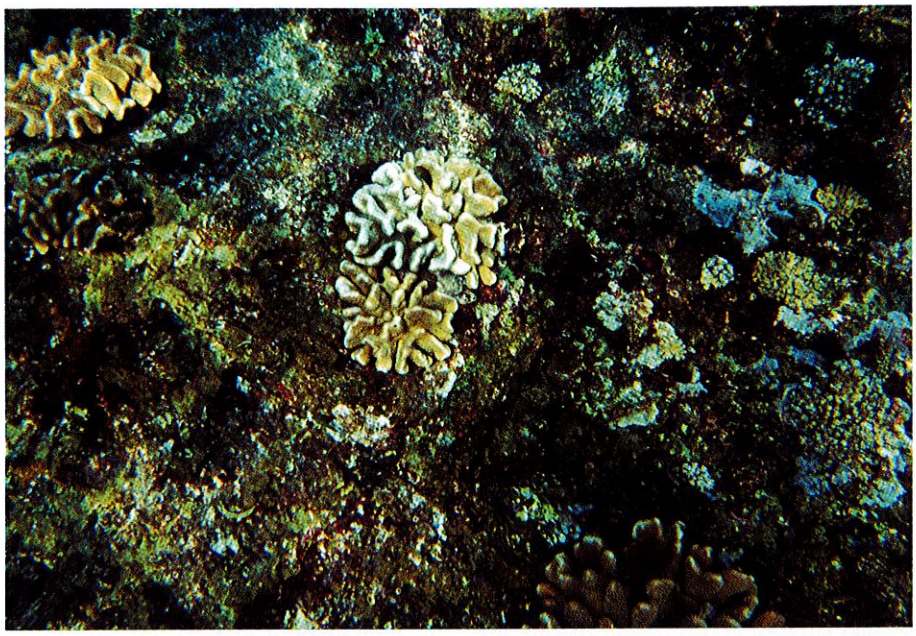

Figure 6. Coral and algae covering the wall of Pulau Perak.

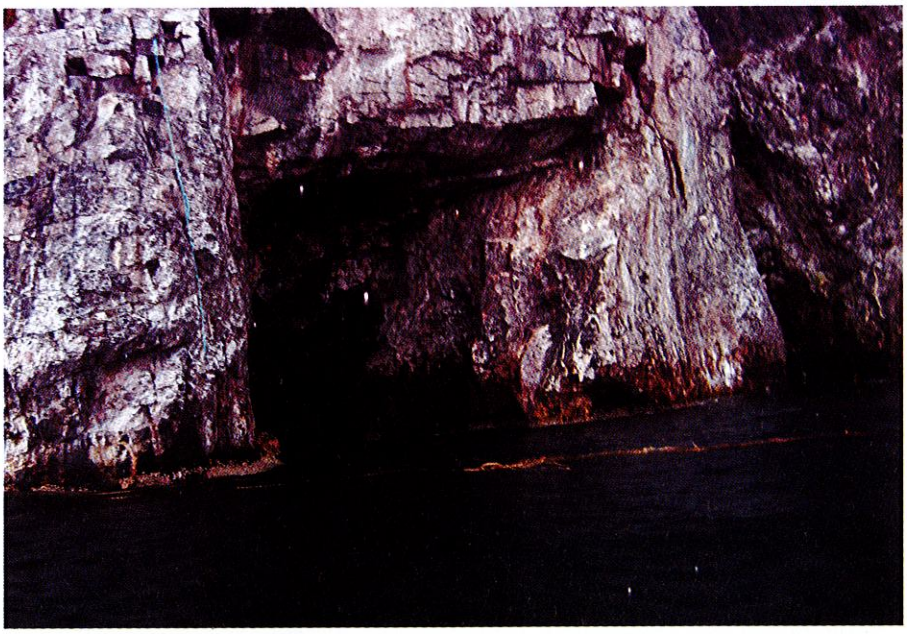

Figure 7. A cave at sea level which is formed by the intersection of bedding and joint planes.

REFERENCE

1. Jones C.R., 1965. The Geology and Mineralisation of Langkawi and North Kedah. Geological Survey of Malaysia Memoir.