

## **CHAPTER 1: INTRODUCTION**

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#### **1.1 Location of Study Area**

Labuan comprises one main triangular shaped island and six smaller ones. It covers an area of 82 kilometers, located to the west of mainland Sabah, situated at the north of Brunei Bay and facing the South China Sea. It is centrally located right in the middle of the Asia Pacific region (Figure 1.1).

#### **1.2 Scope**

This research project is based on field investigations and laboratory analysis of samples collected during the field study. As the Geology of Labuan Island has been thoroughly investigated by previous workers (see section 1.7), this study mainly concentrates on characterization of organic facies (based on organic petrological/geochemical parameters) of organic-rich sediments, predominantly coals/carbargillites, shales/mudstones and siltstones/sandstones.

#### **1.3 Purpose of Study**

The main objectives of the study are to:

- 1- Interpret the sedimentological features and depositional environments observed in the field and correlate them with organic facies parameters based on petrological and geochemical data,

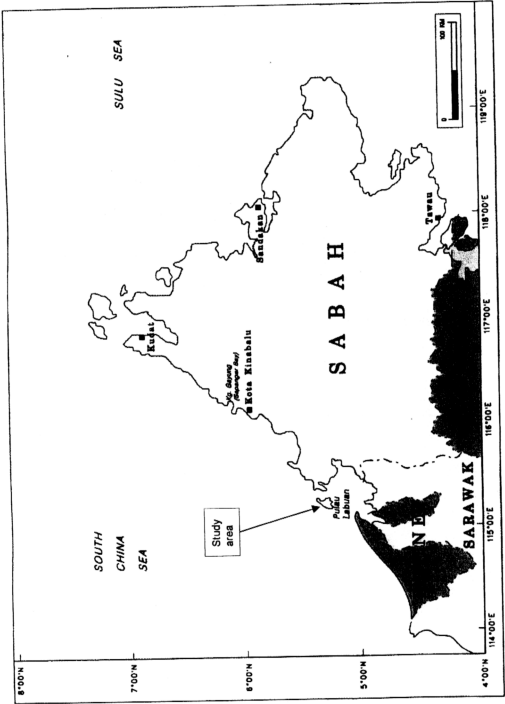


Figure 1.1: Map shows location of Labuan Island

- 2- To differentiate between the main rock units of Labuan based on organic geochemical parameters,
- 3- To identify and quantify maceral types,
- 4- Evaluate the petroleum generating potential of the different kerogen/maceral types, and
- 5- To determine the thermal maturity of the organic constituents.

#### **1.4 History of Labuan**

Coal mining started in 1846, but today the chimney in the Northern part of the island remains the only relic of its coal-mining days.

In 1963, Labuan, together with Sabah and Sarawak, became independent by joining the federation of Malaysia. Because of its strategic location on the South China Sea and by virtue of coal deposits, the British hoped to make it a refueling station for the steamships of the day as well as naval power.

Labuan town in the early days consisted of a row of Chinese brick shops and a cluster of atap houses on the outskirts. The town was named Victoria Town after the British Queen Victoria. On 16 April 1984, Labuan was proclaimed a federal Territory of Malaysia. Labuan Federal Territory comprises the main island of Labuan and the territories within 4.8 km (three nautical miles) of Labuan, including the islands of Rusukan Besar, Rusukan Kecil, Kuraman, Burong, Papan and Daat. The administration of the island was placed directly under the federal government. The federal Territory status elevated Pulau Labuan to the mainstream of national development. Labuan continues to enjoy free port status as a federal Territory. Now, as a federal Territory of Malaysia, Labuan is a dynamic town with Modern telecommunication facilities. It is now a duty free port designation and an International Offshore Financial Center and a center of attraction for shoppers and tourists.

## **1.5 Geography**

The Island of Labuan lies off the North West coast of Borneo, 8km from the Malaysian state of Sabah and 123 km from Kota Kinabalu, the state capital.

Labuan has a central position in Southeast Asia, particularly in the ASEAN region, being 1258 km from Manila, 3037 km from Bangkok, 1552 km from Kuala Lumpur, 1368 km from Singapore and 1500 km from Jakarta.

Its large safe harbour has always made it popular with seafarers. It is from this that the island derives its name, Labuan, meaning "an anchorage" in Malay.

Most of the island is flat and undulating, the highest point being 85 m. Labuan has no climatic disturbances to speak of. There are monsoons from April to June and September to December. Generally the island enjoys a healthy tropical climate. Its temperature ranges from 24C to 34C.

The national carrier, Malaysia Airlines (MAS) operates daily direct flights to Labuan from Kuala Lumpur and Kota Kinabalu. Royal Brunei Airlines also operates direct flights to Labuan.

## **1.6 Population, Language & Culture**

When the island was ceded to Queen Victoria in 1845 there were no permanent inhabitants there. Rajah James Brooke, proclaimed Governor of Sarawak in 1841, also became Labuan's first governor.

On 1 August 1848 Labuan was declared a free port and open to settlers. Brooke tried to persuade the Chinese and people from Brunei to come to Labuan but he was not successful. However, Chinese merchants from Singapore started opening up shops in the settlement. Others started farming. The population of Labuan in 1867 was about 4000, the majority being Muruts, Dusuns and Kedayans. There were also Malays from the Straits Settlements, 600 Chinese, Indian stallkeepers and 40 Europeans.

Under the Labuan Order-in-Council, dated 10th July 1946, Labuan ceased to be part of the Straits Settlements, and became part of the Colony of North Borneo. The island, meanwhile, lost its privileges as a free port. Labuan in 1946 had a population of 9,253.

In the decade that Labuan was incorporated with North Borneo as a colony in 1946 she had to pay the same tariff conditions as the other ports. Under these conditions the island did not prosper. A decision to return Labuan to the status of a free port was made and so on 1st Sept 1956 Labuan was reconstituted a free port by Ordinance.

On 31st August 1963 the state became self-governing and on 16th September of the same year it was made a state within the Federation of Malaysia. North Borneo took the name of Sabah.

Today Labuan has a population of approximately 26,500. The indigenous people that now inhabit Labuan are the Kedayans, Brunei and Kadazan.

It is not known when the Kedayans first came to Labuan. The Kedayans are a Muslim people and are probably of Sumatran or Javanese origin.

The official language is Bahasa Malaysia. However, English is widely spoken and many documents and publications are available in English.

### **1.7 Previous work**

The first recorded visit of a geologist to North Borneo was that of J. Motley to Labuan in 1852, although in 1844, Captain Sir Edward Belcher had reported on Labuan's coal during his voyage on the H.M.S. Semarang. Motley described the physiography and vegetation of Labuan, discussed its agricultural potential and recorded in detail the lithology and thickness of the stratigraphic units in the coastal section containing coal seams at Kubong Bluff. In 1899, Carl Schmidt, Professor of Geology at Basel University, visited Labuan and Klias to examine the oil and gas

seepages. In 1919 and 1920, a geological survey of the island was conducted by the Labuan Exploration Company Limited, which had acquired mineral rights in 1912. On Schmidt's recommendation to prospect the area, the Company employed G. Niethemmer as geologist. Thus began the oil exploration in the Labuan and Klias areas.

The geological surveys mapped a larger area, including Klias and the Padas Valley areas instead of just Labuan alone (Wilson, 1964). Very little further geological work was done in the area until 1935 when the oil concessions were taken over by the Royal Dutch/Shell Group. In 1947, Powell Duffryn Technical Services Limited investigated the coal deposits in the British Borneo Territories at the request of the Colonial Office. Their unpublished report includes an account of the Labuan coalfield.

In 1951, the results of previous geological work were compiled by M. Reinhard and E. Wenk and included in their work, "The geology of the colony of North Borneo" (Reinhard and Wenk, 1951). The Royal Dutch/Shell Group renewed exploration after World War II and the results of their work on Labuan are recorded in Heybroek and Crews (1954), which includes a 1: 125,000 geological map of Labuan and the Klias Peninsula. In 1960, the substance of this report was compiled and published (Liechti, 1960) together with the reports on the adjoining Crocker Range areas.

During 1960 and 1961, J. F. Brondijk, A. A. Van Der Sluys and J. Keij, geologists of the Shell Company, made sedimentological studies in the Labuan, Klias and Padas area. From June 1961 to October 1962, Wilson assisted by N.P.Y. Wong surveyed the 3,600 square mile Labuan and Padas Valley area on a reconnaissance scale in an attempt to clarify the stratigraphy and sedimentology of the Tertiary formations. The memoir resulting from their work (Wilson, 1964) is a good compilation of results of previous geological investigations and the field work focused on certain problematic areas. In 1977, Lee Chai Peng from University of Malaya provided an excellent, useful and comprehensive study of the geology and stratigraphy of Labuan Island. In 1980,

Yap Kok Thye studied the trace fossils on Labuan Island. Moligan 1992 studied the geology of BT. Kubong, north Labuan. Mazlan, B. HJ. Madon in 1994 investigated Labuan stratigraphy of the northern part of the Island. In 1997, Mazlan B. HJ. Madon studied the relation between the formations within Labuan's sedimentary sequence. The latest study of Labuan geology was made by Tongkul in 2001.

## **1.8 Exploration History in Sabah Basin**

The wealth of information described here is obtained from the PETRONAS (1999) publication practically from chapter 22.

Western and northern Sabah has been explored for more than 100 years, since the first oil seeps were reported from the Klias and Kudat peninsulas. Oil seeps were also reported from a coal mine on Labuan Island in the late 1800s. Exploration for oil started in 1897 with the drilling of the Menombok-1 well on the Klias Peninsula by the Bombay-Burma Company. Three more wells were drilled in the following year, but all were unsuccessful. Among the other pioneering companies that explored in onshore western and northern Sabah were the British Borneo Exploration Company, Burma Petroleum Syndicate, N.K.P.M. (STANVAC), Kuhara Mining Company, and the Singapore Oil Syndicate. Between 1897 and 1954, a total of 21 exploration wells were drilled in onshore Sabah. By the end of 1998, a total of 113 exploration wildcat and 79 appraisal wells have been drilled, including 23 onshore wells.

The first offshore well in the Sabah Basin was Hankin-1, drilled by Sabah Shell/Pecten (SSPC) in 1958 from a fixed platform. Shell drilled several more offshore structures during the 1960s, including the Barton structure. In the mid and late 1960s, Esso and Oceanic Exploration began exploring in offshore western Sabah. Between 1958 and late 1976 (when the Concession Period ended), a total of 53 offshore wells were drilled (37 by SSPC, 15 by Esso, 1 by Oceanic), with a peak of 18 wells drilled in



1972. These efforts resulted in several oil discoveries, which are currently on production: the Tembungo Field by Esso, and the Barton, Erb West, South Furious, Samarang, and St Joseph fields by SSPC other oil and gas discoveries were Erb South (SSPC) and Kinarut (Esso) respectively.

Exploration in the Sabah Basin under Production Sharing Contracts (PSCs) during the 5-year period from 1977 to 1981 resulted in 4 oil discoveries by Shell: Ketam, Lokan, SE Collins, and SW Emerald. There were also 2 gas discoveries: Samarang Kecil (Esso) and Glayzer (SSP). A total of 46 wells were drilled during that period. When the PSC expired, exploration activity continued in the retained development and production areas.

The Tembungo Field was relinquished prematurely by Esso in 1986, and is now operated by Carigali (Mazlan et al. 1999). The Samarang Field PSC was originally held by SSPC, Pecten, and PETRONAS Carigali from 1991 to 1995. A new PSC arrangement was awarded in 1995 to Carigali as the sole contractor and operator. This PSC also includes the Erb South, SE Collins, Lokan, SW Emerald, Glayzer, Kinarut, Samarang Kecil fields in offshore Sabah, and the Asam. Paya Field in onshore Sarawak. The Erb West Field was relinquished by SSPC in 1996 and is now included in the new Samarang Field PSC. The St Joseph, South Furious, Barton, and Ketam fields now fall under a new North Sabah PSC, which was awarded to SSPC (as operator), Sabah Shell SelaLan (SSS) and Carigali in 1996.

The original Concession Area in northern Sabah, which was held by Oceanic Exploration, was expanded to incorporate areas relinquished by SSPC and Esso. In 1980 a new PSC was awarded to British Petroleum (BP), Carigali, and Oceanic Exploration. The joint operators were Carigali and BP, then known as Carigali-BP (CBP). A total of 2998 line-km 2D seismic data were acquired, and 8 wells were drilled, resulting in an oil discovery at Tiga Papan. In 1984, Overseas Petroleum Investment Company (OPIC)

assumed operatorship of the area, and drilled 2 wells without success. Some 557 line-km 2D seismic data were acquired, before the area was relinquished in 1986 (Mazlan, 1999).

Following the promulgation of the 1985 PSC terms, the open exploration areas in offshore western Sabah were re-blocked as SB1, SB2, SB3, and SB4. All these blocks are in water depths of 200 m or less, except for SB1, which contains a strip of deepwater area. Block SB1 was awarded to Sabah Shell, Pecten (later to Sabah Shell Selatan or SSS), and Carigali in 1987. A total of 14,604 line-km 2D and 82,662 line-km 3D seismic data were acquired, and 13 exploration wells were drilled. This resulted in the discovery of the Kinabalu oil field and the Kebabangan gas accumulation. Block SBI was relinquished in 1997 but the Kinabalu Field was retained as a production area, and is now producing.

Block SB2 was awarded to Tenneco, Occidental, and Carigali in 1988. British Gas became the operator of this block after acquiring Occidental's and Tenneco's interests. In 1992 British Gas assumed 100% equity in the area. Approximately 7000 line-km of 2D seismic data were acquired. Five wells were drilled, but only 2 found minor oil and gas shows. The acreage was relinquished in 1997. In 1983 Block SB3, which includes parts of the Klias Peninsula, was awarded to a consortium that comprised Phoenix, Enron, Kufpec, Monument Resources, and Carigali. A total of 4575 line-km of 2D seismic data were acquired, and 2 onshore wells were drilled without success. The operatorship of the block changed from Phoenix to Enron and to Monument Resources, before it was relinquished in- 1995. Enron drilled South Lokan-1 and Gava-1 wells. Block SB4 is an expanded Carigali-BP-Oceanic-OPIC acreage that includes a narrow strip of the offshore area around the Kudat Peninsula. The block was awarded to Hall-Houston (as operator), Ensearch, Global, and Carigali in 1991. A total of 1594 line-km 2D and 4276 line-km 3D seismic data were acquired. Three wells were

drilled, with a gas discovery at Titik Terang-1. The PSCs for blocks G and J were awarded under the 1993 Deepwater Terms to SSPC (operator), SSS, and Carigali in 1995 and 1997, respectively. Block H was awarded to Esso (as operator) and Carigali in 1997, while Block K was awarded to Murphy Oil and Carigali in early 1999.