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Quaternary stratigraphy and prospects for placer tin deposits in the Kuantan area, Pahang

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Abstract: The Quaternary deposits in the Kuantan area are described. The deposits are divided into four lithostratigraphic units: the continental Simpang Formation (equivalent to the Old Alluvium of the Kinta Valley, Pleistocene age), Kempadang Formation (a Pleistocene marine unit), Gula Formation (a Holocene marine unit) and the continental Beruas Formation (equivalent to the Young Alluvium of the Kinta Valley).

The thickness of the unconsolidated deposits varies from a few metres in the west to more than 120 metres towards the east. Cassiterite occurs in significant concentrations in the Simpang and Kempadang Formations. Trace or minor amounts of cassiterite are found in the Gula and Beruas Formations.

Scout drill holes show that cassiterite values ranging from 0.079 kg per cu m to 0.40 kg per cu m (0.10 to 0.55 katis per cubic yard) occur at depths of 15 m to 30 m below the surface in Paya Derhaka, Kampong Belukar, Kampong Permatang Badak and Kampong Anak Ayer areas. A deep borehole at Kampong Penor in the south gave sectional values ranging from 0.3 kg per cu m (0.29 katis per cubic yard) to 0.4 kg per cu m (0.05 katis per cubic yard) between depths of 118.9 m to 122 m. The best prospects for placer tin lies between latitudes 3° 45'N to 3° 49'N and longitude 103° 15'E to the coastline, and this part of the Kuantan area appears to be the southern limit of the Pandan placer tin deposit.

INTRODUCTION

Nearly 90 percent of the tin produced from Peninsular Malaysia comes from placer deposits of Quaternary age. Of these, the bulk of the tin is obtained from the alluvial mines found along the western part of the country.

Less than ten percent of the land area in the east coast of Peninsular Malaysia is underlain by Quaternary deposits. On the East Coast tin is mined mainly in the states of Pahang, Terengganu and Johore. In order to have a better knowledge and understanding of the east coast placer deposits, a systematic study was carried out in the Kuantan area (Figure 1) by the Geological Survey of Malaysia. Besides stratigraphy, this paper gives an account of the source, distribution and prospects for placer tin in the Kuantan area.

GEOMORPHOLOGY

Geomorphologically the area is lowlying, gently undulating and covered by inland freshwater swamps. A zone of beach (sand) ridges also run parallel to the

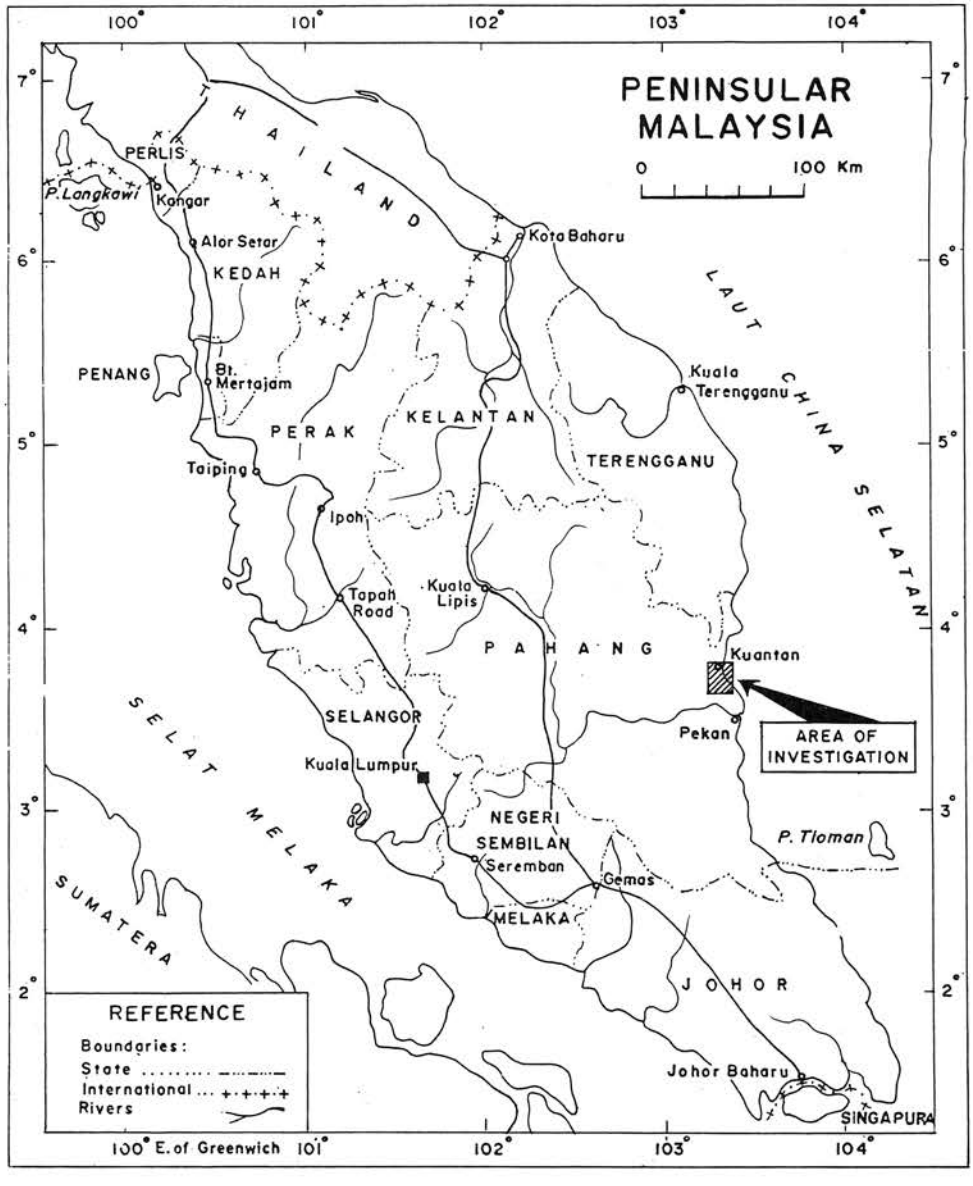


Fig. 1. Map showing the location of the area of investigation.

coastline. Sungai Kuantan including its tributaries (Sungai Belat and Sungai Soi) and Sungai Penor drain over the area to flow into the South China Sea (Figure 2).

The area appears to be a wasteland for it supports hardly any agriculture and has a dispersed habitation.

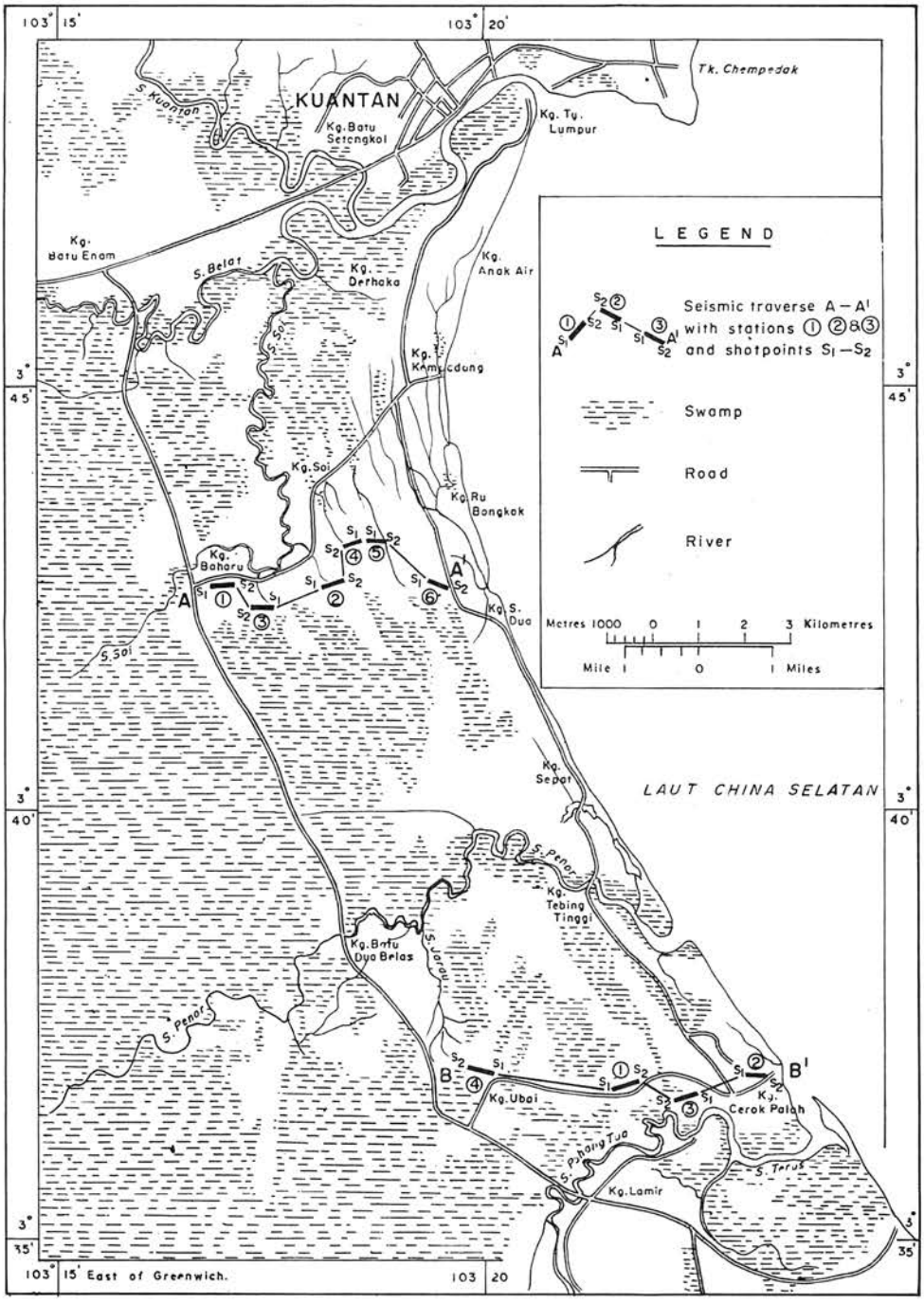


Fig. 2. Map showing the location of the seismic surveys in the Kuantan area, Pahang.

METHODS OF INVESTIGATION

Geophysical Survey

A refraction seismic survey was carried out over the area by the Geophysical Section of the Department. Investigation were conducted at selected seismic stations along the two East-West traverses i.e. Kampong Bahru to Kampung Sungai Dua and Kampong Ubai to Kampong Cherok Paloh (Figure 2). The survey was conducted using the 12 channel ABEM Trio Seismograph with explosives as the energy source (Ho, 1982).

The seismic survey shows that in the north (Kampong Bahru to Kampong Sungai Traverse) the bedrock is irregular in relief and its depth varies from 39.6 m–152 m (130–500 feet). Along the southern traverse bedrock was not detected down to a depth of 152 m (500 feet) from the surface. In general the depth to bedrock increases eastwards and southwards.

Drilling

Initially shallow holes were drilled using the Guts and Edelman hand augers and the van der Staay suction-corer. Banka drilling was then carried out in selected areas. A total of 30 scout holes (Figure 3) were drilled using the hand-operated Bangka drill and the semi-mechanized Banka. The deepest borehole was unbottomed at about 130 metres (425 feet) from the surface in the Kampong Penor area. The details of the results of the investigation are given elsewhere (Ghani, manuscript).

STRATIGRAPHY

Four stratigraphic units have been delineated on the basis of lithology, heavy mineral content, age and to a lesser extent on palaeo-environment. These units are similar to those on the west coast of Peninsular Malaysia (Taiping-Lumut Area) and therefore the formal names used in the west coast are retained for these units. They are the continental Simpang Formation (mainly fluviatile deposits probably of Pleistocene age and equivalent to the Older Alluvium of Walker, 1955), the Kempadang Formation (an older marine formation probably of Pleistocene age), Gula Formation (a Holocene marine unit) and the continental Beruas Formation (mainly fluviatile and lacustrine deposits of Holocene age and equivalent to the Young Alluvium of Walker, 1955). These units are described briefly, and the Quaternary geology of the area is shown in Figure 4.

Simpang Formation

This unit consists of clay, silt, sand, gravel and peat deposited in a terrestrial environment before the most recent major low sea-level stand. The formation is divided into two members i.e. the Lower sand member which consists of sand and gravel and the Upper clay member which is mainly of clay. The thickness of the formation varies from a few metres to more than 100 m in the southeast.

Kempadang Formation

Clay, silt and sand deposited in a marine environment before the most recent major low sea-level stand.

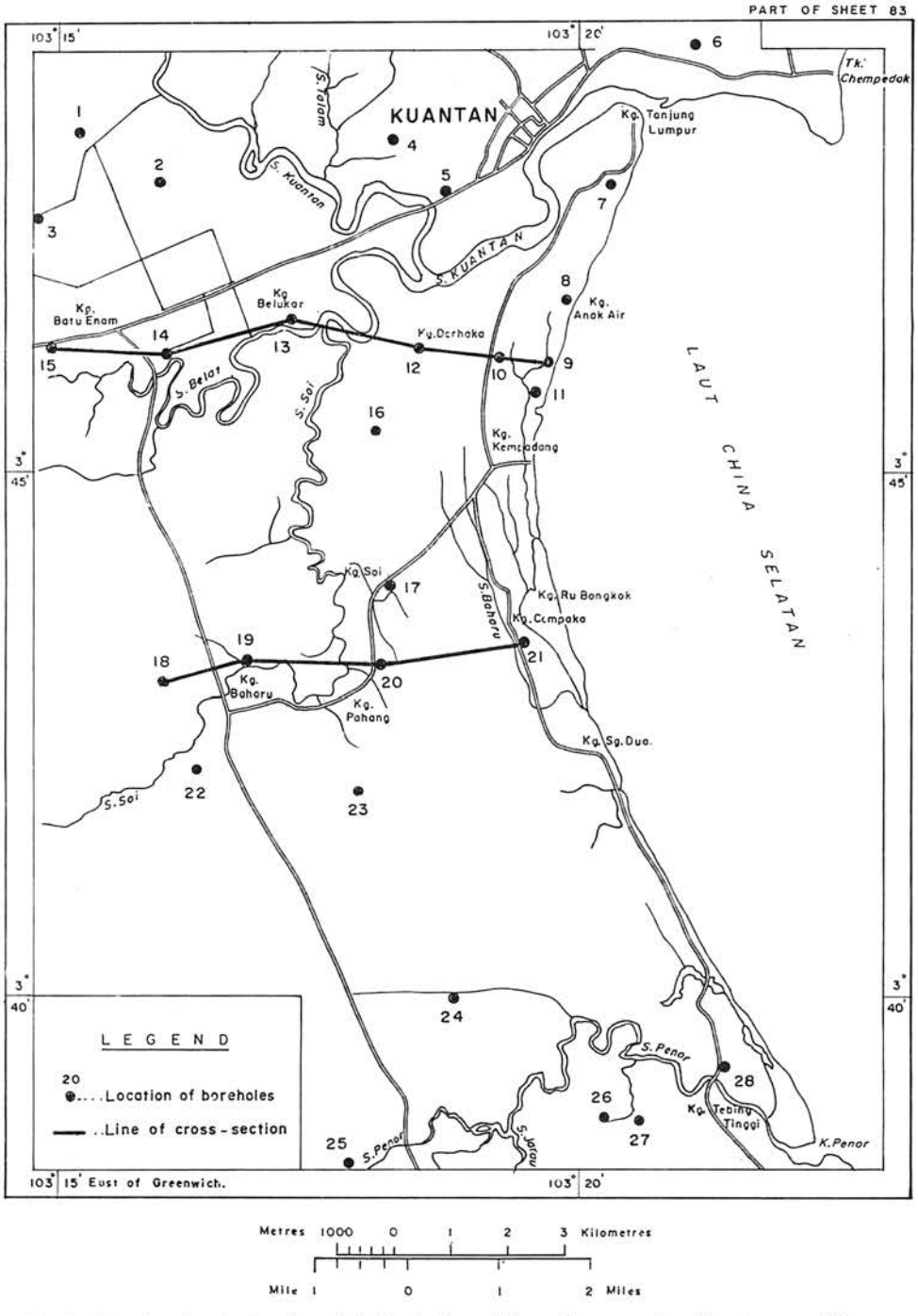


Fig. 3 Map showing the location of the boreholes and lines of cross-section, Kuantan area, Pahang.

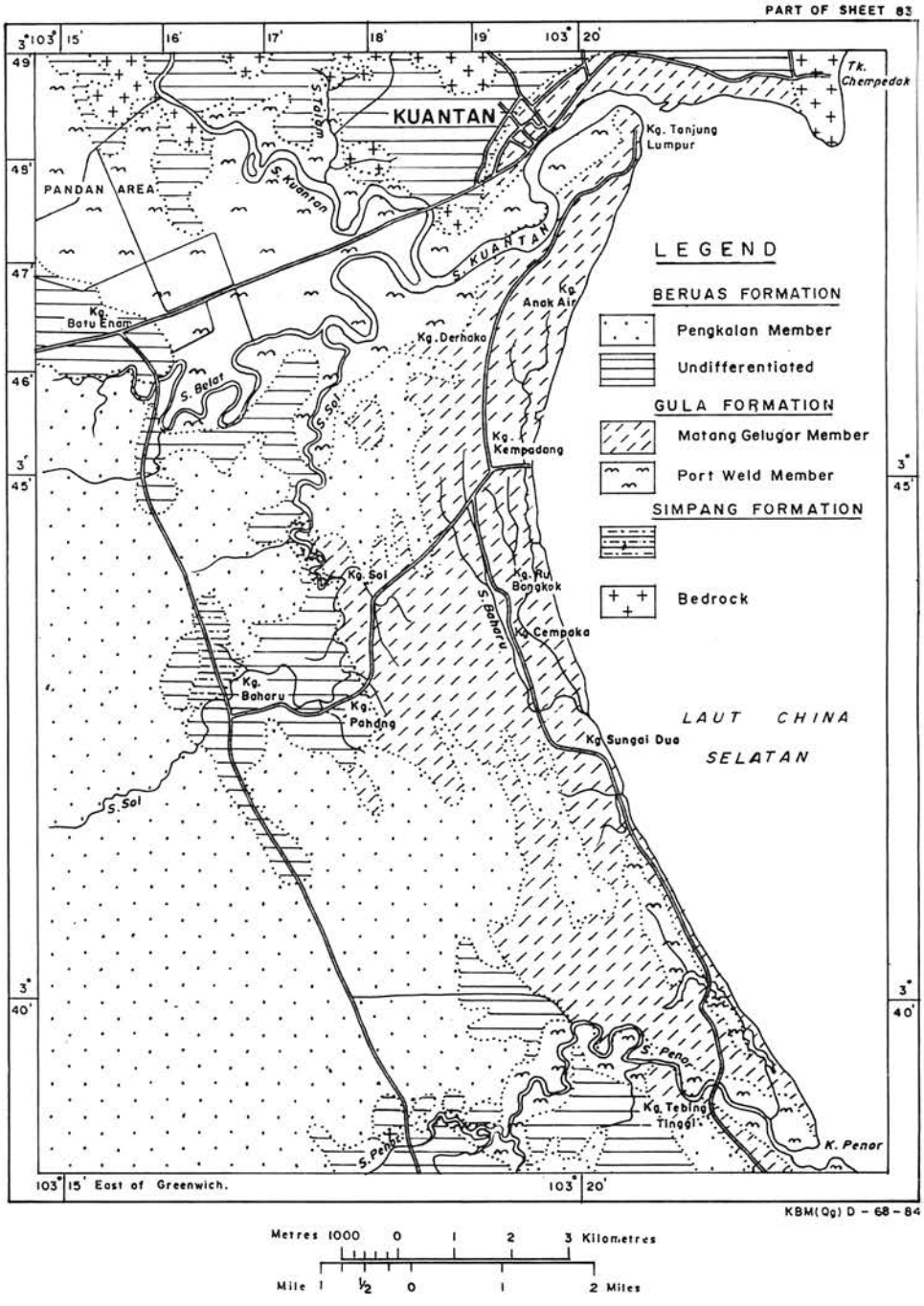


Fig. 4. Quaternary Geology Map of the Kuantan Area, Pahang.

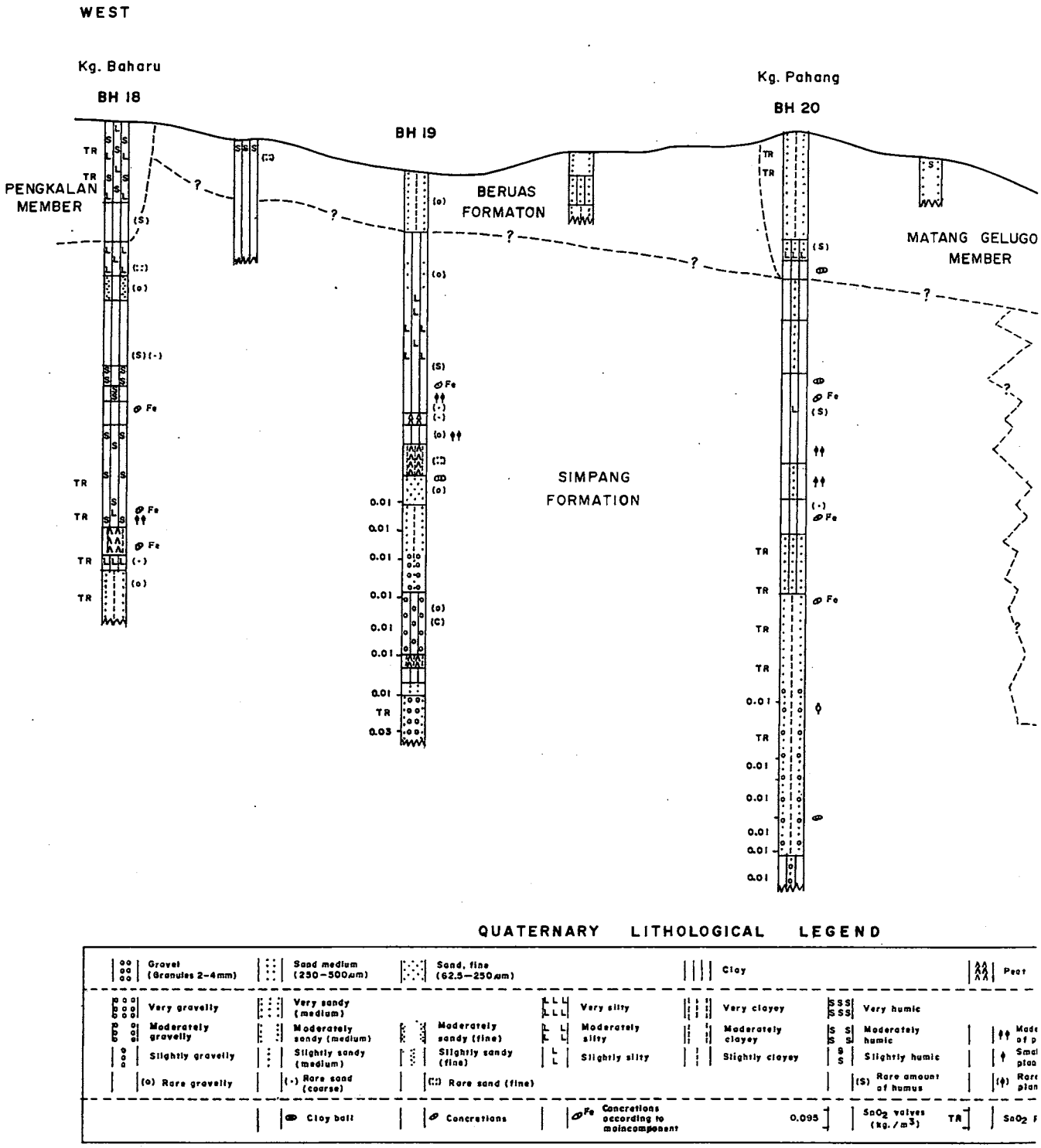
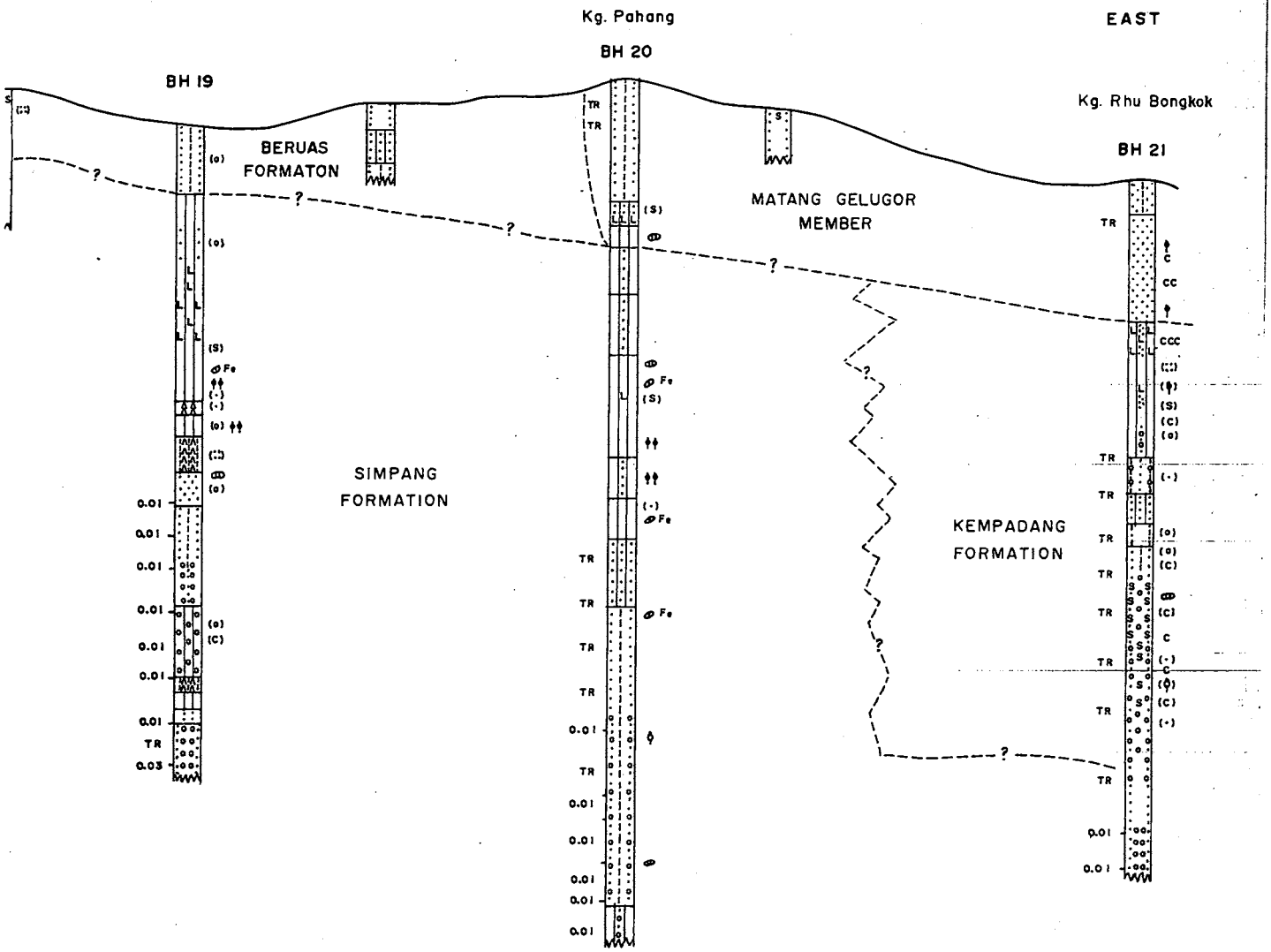


Fig. 5 Cross-section from Kampung Baharu – Kampung Rhu Bangkok (Horizontal scale 1:50,000; Vertical scale 1:



QUATERNARY LITHOLOGICAL LEGEND

Sand medium (250–500 µm)	Sand, fine (62.5–250 µm)		Clay			Peat					
Very sandy (medium)		Very silty	Very clayey	Very humic					ccc	Abundand shells	
Moderately sandy (medium)	Moderately sandy (fine)	Moderately silty	Moderately clayey	Moderately humic		Moderate amount of plant remains			cc	Moderate amount of shells	
Slightly sandy (medium)	Slightly sandy (fine)	Slightly silty	Slightly clayey	Slightly humic		Small amount of plan remains			c	Small amount of shells	
(-) Rare sand (coarse)	(::) Rare sand (fine)			(S) Rare amount of humus		(ϕ) Rare amount of plant remains			(C)	Rare amount of shells	
Clay ball	Concretions	Concretions according to maincomponent	0.095	SnO_2 values (kg./m³)	TR	SnO_2 present in trace amount					

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Fig. 5 Cross-section from Kampung Baharu – Kampung Rhu Bangkok (Horizontal scale 1:50,000; Vertical scale 1:400).

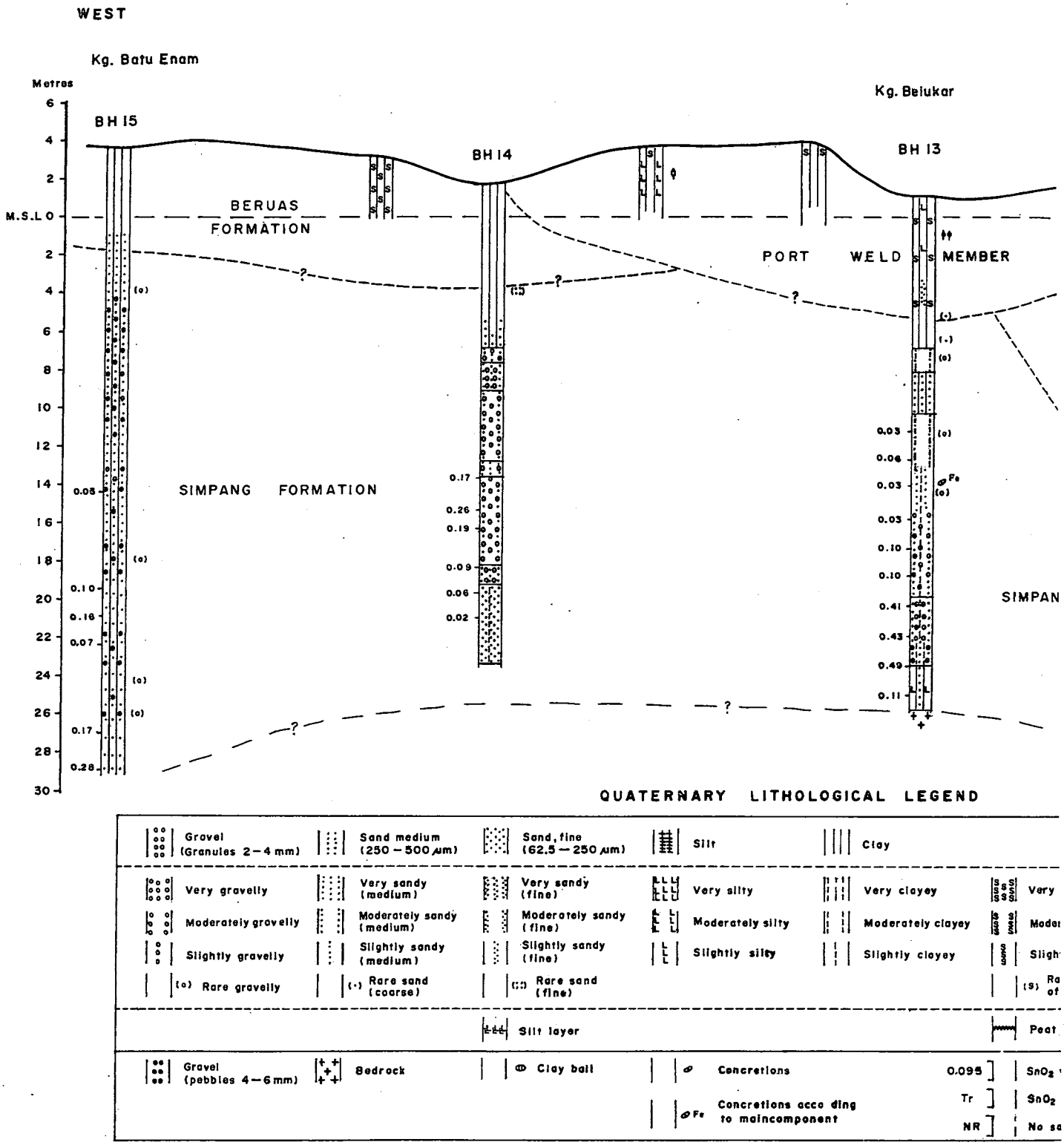
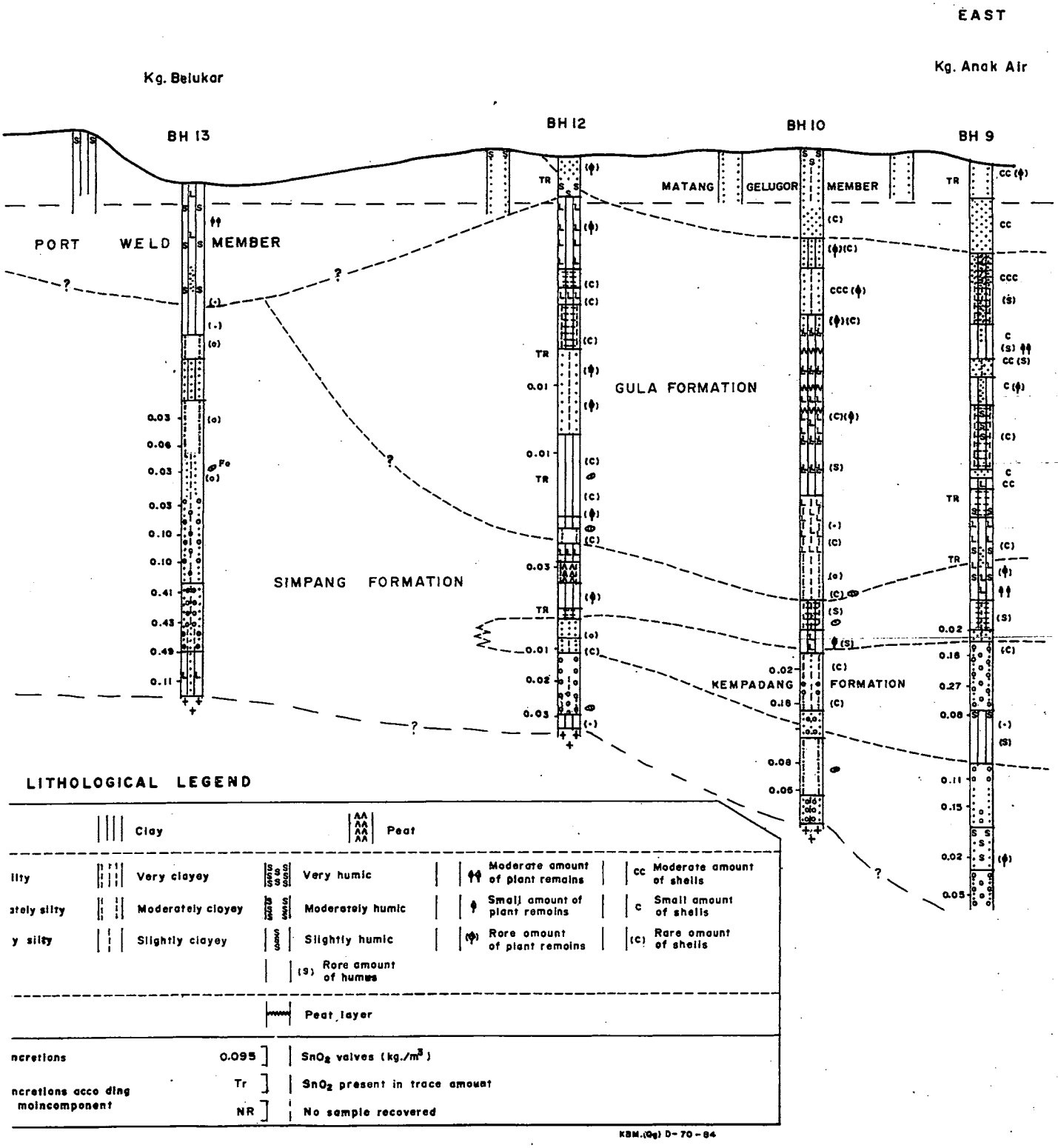


Fig. 6 Cross-section from Kampung Batu Anam – Kampung Anak Air (Horizontal scale 1:50,000;



n – Kampung Anak Air (Horizontal scale 1:50,000; Vertical scale 1:400).

Gula Formation

This formation is made up of mainly grey to greenish-grey to estuarine clay and subordinate sand deposited after the most recent major low sea-level stand. The term Matang Gelugor Member was introduced on the west coast for the subordinate sand occurring as beach ridges along the coastal areas. The term Port Weld Member (also from the west coast) encompasses clay and silt deposited in a mangrove environment.

Beruas Formation

This unit consists of clay, silt, sand, gravel and peat deposited in a terrestrial environment after the most recent major low sea-level stand. The term Pengkalan Member was introduced on the west coast for peat with minor intercalations of clay and silt deposited in a paludal environment.

PROSPECTING RESULTS OF PRIVATE COMPANIES

The prospecting results of mining companies show that the values for cassiterite range from trace to 0.08 kg. per cu m (0.10 katis per cubic yard) in Sungai Pandan and the other areas. In the Sungai Pandan area, the average depth of alluvium is about 16.8 m (55 feet) and the average value for cassiterite is 0.1 kg. per cu m (0.13 katis per cubic yard). A Minerals Investigation Drilling Report (MIDU Report 7/55) states that the cassiterite in the Sungai Pandan area is fine and rounded which indicates transport. A similar report (D211) on the prospecting carried out in the Gambang area states that cassiterite was not transported eastwards along the present Sungai Belat valley. This report also states that possible concentrations of tin might occur west of the present coastline.

The prospecting results indicate that the overburden thickens southwards and eastwards. The cassiterite content in the paydirt layers also increases with depth.

RESULTS OF THE PRESENT INVESTIGATION

In summary, the present investigation demonstrated that:

i) The thickness of the unconsolidated deposits increases southwards and eastwards. Refraction seismic surveys indicate the thickness of the unconsolidated deposits to vary from 39.6 m (130 feet) in the north to more than 152 m (500 feet) in the south. This is confirmed by drilling where in the Sungai Pandan area the average thickness of the overburden is 16.8 (55 feet) and it increases to more than 130 m (425 feet) in the Penor area.

ii) Cassiterite in significant quantities occurs in the sand or gravelly sand layers of the Simpang and Kempadang Formations (Figures 5 and 6). It is either absent or found only in trace amounts in the overlying Beruas and Gula Formations.

iii) Borehole results show that cassiterite values ranging from 0.079 kg per cu m to 0.4 kg per cu m (0.10–0.55 katis per cubic yard) occur between depths of 15 m

to 30 m below the surface at Kampong Permatang Badak (borehole 2), Kampong Belukar (borehole 13), Kampong Derhaka (borehole 12) and Kampong Anak Air (boreholes 8 and 9). In areas towards the south only trace to small amounts of cassiterite have been recorded (Figure 6). However, an unbottomed borehole (BH 28) at Kampong Penor gave cassiterite values ranging from 0.23 kg per cu m (0.29) katis per cubic yard) to 0.40 kg per cu m (0.50 katis per cubic yard) between depths of 118.9 m to 122 m.

iv) The grain size of the cassiterite is generally fine. In the Kampong Permatang Badak—Kampong Belukar—Kampong Anak Air areas more than 60 percent of the cassiterite is coarser than the 200 mesh fraction (British Standard Size—BSS). Further south in the Kampong Bahru—Kampong Pahang—Kampong Rhu Bangkok areas there appears to be nearly equal amounts of coarse (+ 200 mesh BSS or + 75 microns) and fine cassiterite (− 200 mesh BSS). However, towards southeast in the Sungei Penor area at least 60 percent or more of the cassiterite is in the range of − 200 mesh.

v) Because of the absence of any major past or present river system there is no evidence to show that the cassiterite came from the well known Gambang tin field, which is located west of the Kuantan area. The Sungei Kuantan which flows through known tin mineralized areas in the north appears most likely to be the source. This river also flowed further south of its present course to the South China Sea. The rich pockets of cassiterite south of Sungai Kuantan is probably the southern limit of the Pandan tin field.

CONCLUSION

The present investigation, supplemented by the prospecting results of the various mining companies, indicates that the best prospect for placer tin lies between latitudes 3°45′N to 3°49′N and longitude 103°15′E to the coastline. The thickness of overburden is about 15 metres in this area compared to about a few metres towards the north in the Pandan area. It is recommended that further close spaced drilling be carried out to determine the economic potential of the deep seated placer tin deposit in the area.

Further scout drilling is necessary to ascertain the possible source(s) of the tin in the Sungai Penor area and the explanation for the high tin values for example in borehole 28.

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