PP 185/12/85 ISSN 0126–5539

PERSATUAN GEOLOGI MALAYSIA

WARTA GEOLOGI

NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MALAYSIA

Jil. 12, No. 2 (Vol. 12, No. 2) Mar-Apr 1986

KANDUNGAN (CONTENTS)

DIKELUARKAN DWIBULANAN
ISSUED BIMONTHLY

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(GEOLOGICAL SOCIETY OF MALAYSIA)

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Published by the Geological Society of Malaysia, Department of Geology, University of Malaya, 59100 Kuala Lumpur (Tel. 03-7577036) - 30 May, 1986.

Printed by Art Printing Works Sdn. Bhd., 29 Jalan Riong, 59100 Kuala Lumpur.

CATATAN GEOLOGI
(GEOLOGICAL NOTES)

ZON TANAH LEMAH DI ATAS BATUKAPUR DASAR (WEAK SOIL ZONE ABOVE LIMESTONE BEDROCK)

Tan Boon Kong & Ch'ng Soo Chau, Jabatan Geologi, Universiti Kebangsaan Malaysia, Bangi.

Abstrak

Catatan ini membincangkan satu aspek masalah geologi kejuruteraan di kawasan kars yang disebabkan oleh hadirnya satu zon tanah lemah di atas batukapur dasar. Ciri-ciri zon tanah lemah ini, cara pembentukannya, cara ia boleh dikenalpasti, dan juga kaedah penstabilan zon ini dibincangkan dengan menggunakan beberapa contoh dari kawasan Kuala Lumpur.

Abstract

This note discusses one aspect of engineering geologic problems in karst areas which is caused by the occurrence of a weak soil zone above the limestone bedrock. Characteristics of this weak soil zone, its mode of formation, method by which it can be identified as well as the method for stabilization of this zone are discussed using several examples from the Kuala Lumpur area.

Pengenalan

Kawasan batukapur merupakan satu kawasan yang sangat menarik perhatian para jurutera awam, memandangkan pelbagai masalah geologi dan geoteknik yang sering terdapat di kawasan ini, sepertimana yang pernah dibincangkan oleh Tan & Batchelor (1981), Ting & Ladchumanan (1974), Ting (1985), Chan & Hong (1985), Omar & Hon (1985), Sowers (1975, 1982) dan seumpamanya. Walau bagaimanapun, kebanyakan perbincangan terdahulu lebih tertumpu kepada masalah yang berkait dengan ciri-ciri jasad batuan batukapur sendiri, seperti profil batudasar yang berpuncak, rongga-rongga dan saluran bawah tanah di dalam batukapur, dan sebagainya.

Catatan ini menyentuhi pula satu aspek masalah geologi kejuruteraan yang terdapat di kawasan kars yang dinamakan sebagai masalah zon tanah lemah di atas batukapur dasar. Ini adalah satu masalah yang disebabkan oleh berlakunya satu zon atau lapisan tanah yang bersifat sangat lemah yang meliputi permukaan batukapur dasar. Sifat zon tanah lemah ini, cara pembentukannya, cara ia boleh dikenalpasti, dan juga kaedah penstabilan zon ini dibincangkan di bahagian-bahagian berikut.

Contoh-contoh yang ditunjukkan di sini diambil dari kawasan sekitaran Kuala Lumpur, kesemuanya dari tapak pembinaan bangunan tinggi. Kesan kehadiran zon tanah lemah tersebut dalam rekabentuk dan kestabilan tapak bangunan tinggi adalah satu perkara utama yang tetap diberi penelitian khas oleh para jurutera tapak.

Sifat zon tanah lemah

Zon tanah lemah yang berkenaan selalunya terletak terus di atas batu-kapur dasar. Zon ini boleh didapati pada kedalaman yang cetek, misalnya 30 m, atau pada tempat yang sangat dalam, iaitu 100 m dari permukaan tanah. Ia terdiri daripada bahan tanah yang sangat lembut, biasanya tepu atau penuh dengan air, menyebabkan ia kadangkala bersifat seperti bendalir. Butiran tanahnya boleh terdiri daripada butiran halus (tanah liat dan kelodak) atau butiran kasar (pasir). Warnanya pula pelbagai, (kuning, cokelat, kelabu dan sebagainya) bergantung kepada tanah asalnya, iaitu sama ada tanah yang terletak di atasnya ialah daripada aluvium, tanah baki formasi Bukit Kenny atau tanah tanih yang lain.

Ketebalan zon lemah ini berjulat daripada beberapa meter hingga 30 m, dan biasanya tidak seragam disesuatu tapak pembinaan. Dalam zon tanah lemah ini kadang-kadang ditemui juga rongga yang bersaiz hingga 5 m panjang.

Di kawasan Kuala Lumpur, kehadiran zon tanah lemah ini sering didapati di tapak pembinaan yang terletak berhampiran dengan sempadan batuan formasi Bukit Kenny dan Batukapur Kuala Lumpur. Ini bererti bahawa segala projek kejuruteraan yang terletak berhampiran dengan sempadan batuan tersebut, khasnya projek bangunan tinggi, haruslah berhati-hati dan dijalankan penyiasatan tapak yang mencukupi untuk menentukan taburan dan tatarajah zon tanah lemah ini selain daripada ciri-ciri geologi bawah tanah yang lain.

Cara pembentukan

Zon tanah lemah ini dipercayai dihasilkan oleh proses perluluhawaan batukapur, khasnya proses pelarutan batukapur oleh airtanah yang begitu giat di kawasan tropika. Pelarutan batukapur bukan sahaja menghasilkan profil yang berpuncak, bahkan ia juga menurunkan paras batudasar hingga segala tanah-tanih atau saki baik proses luluhawa/pelarutan yang berhampiran dengan batudasar terus ikut menurun atau menjatuh memasuki lekukan-lekukan atau lurah antara puncak. Proses penurunan atau runtuhan tanah dan saki baki proses pelarutan ini akan beransur naik di dalam tanah penutup yang asal, maka akhirnya terjadilah satu zon tanah yang terkacau teruk di antara batu-dasar dengan tanah penutup.

Dengan proses pembentukan yang sedemikian, maka boleh diumumkan bahawa ketebalan zon tanah lemah ini tidak seragam dan akan bertambah di tempat-tempat yang berdekatan dengan lekukan atau lurah di mana juga penemuan rongga dalam tanah adalah lebih biasa.

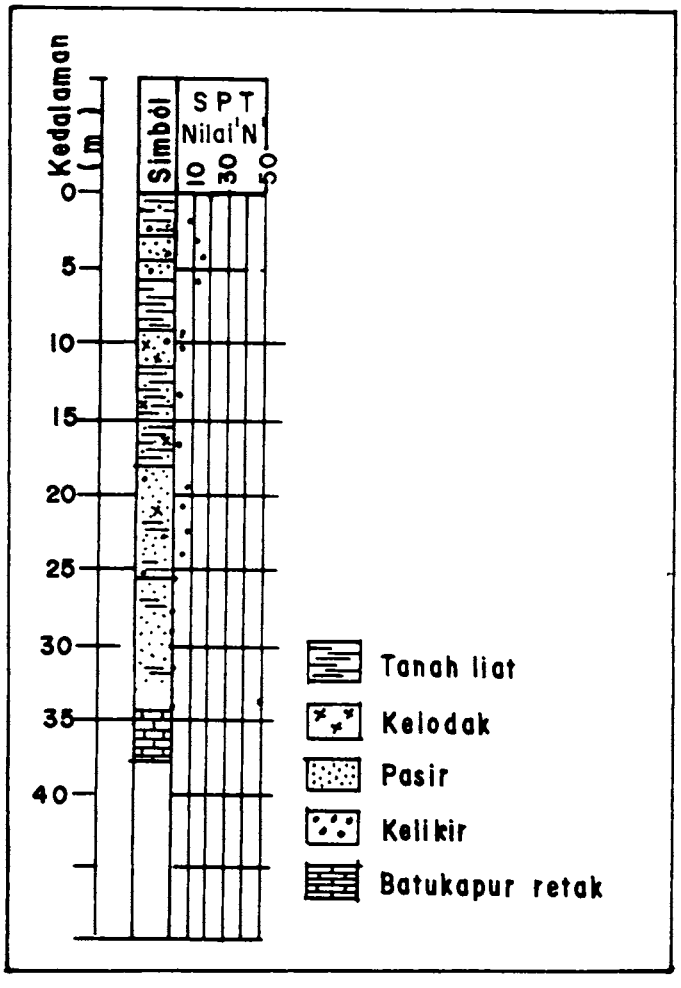
Pendek kata, zon tanah lemah ini mewakili bahan tanah atau saki baki batuan terluluhawa yang telah runtuh akibat daripada pelarutan batukapur dasar. Pelarutan ini lebih giat di sepanjang lurah (bekas kekar atau retakan di dalam batukapur) di mana resapan dan hakisan airtanah itu adalah lebih aktif dan berkesan.

Cara zon tanah lemah dikenalpasti - kaedah SPT

Cara yang paling berkesan untuk mengenalpasti zon tanah lemah tersebut ialah dengan menggunakan Ujian Penusukan Piawai (Standard Penetration Test, SPT, Sanglerat, 1972). Penggunaan kaedah SPT dalam pembezaan pelbagai jenis tanah pernah dibincangkan dahulu, contohnya Tan (1983, 1984, 1986). Dalam kajian zon tanah lemah ini, SPT memainkan peranan utama dalam mengenalpastikan

zon tersebut dengan menguji kekonsistenan atau kepadatan setempat zon ini, di mana nilai SPT adalah sangat rendah, iaitu SPT ≃ 0.

Rajah 1 hingga 4 menunjukkan empat contoh kejadian zon tanah lemah di empat tapak bangunan yang berlainan di Kuala Lumpur. Kesemua tapak ini dialasi oleh batukapur yang berpuncak. Tanah penutup asal yang terdapat berbeza-beza dan terdiri daripada aluvium dan tanah baki formasi Bukit Kenny. Contoh 2 dan 3 terletak berhampiran dengan sempadan batuan formasi Bukit Kenny dan batukapur Kuala Lumpur. Hanya empat contoh sahaja diberikan di sini. Contoh-contoh yang lain dengan butir-butir lanjut boleh diperolehi daripada Ch'ng (1984) dan juga daripada beratusan laporan penyiasatan tanah yang sedia ada di kawasan Kuala Lumpur.



Rajah 1 - Jalan Ampang

Menunjukkan aluvium di atas batukapur. SPT bagi aluvium sekitar 2-15, kebanyakan SPT < 10. Berhampiran batudasar, SPT ≃ 0, menandakan kejadian zon tanah lemah dari kedalaman 26 m - 33 m.

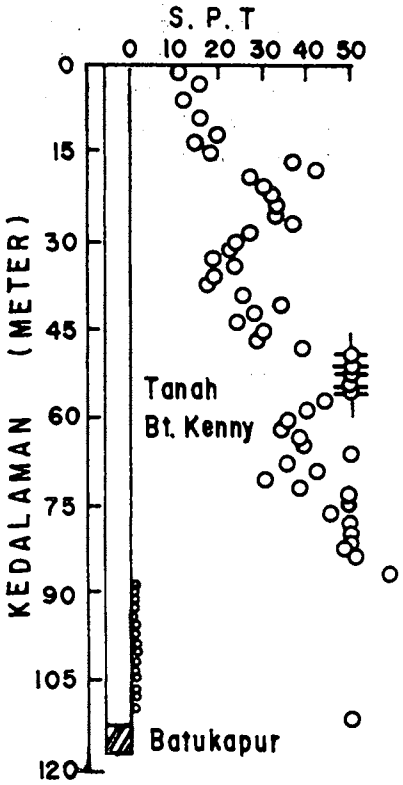


Fig. 2a.

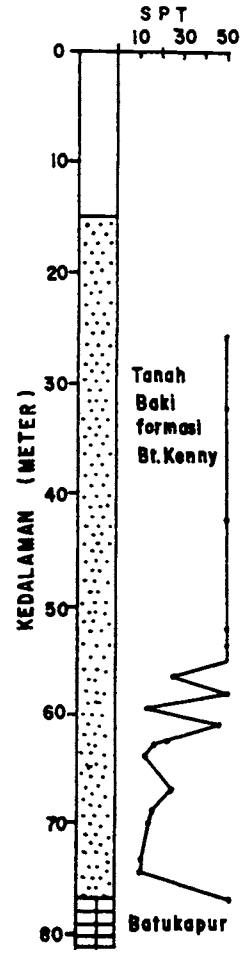


Fig. 2b.

Rajah 2a - Jalan Tun Ismail

Menunjukkan tanah baki formasi Bukit Kenny di atas batukapur. Nilai SPT bagi tanah baki formasi Bukit Kenny agak tinggi (10 - >50). Berhampiran batukapur, SPT ≃ 0, menandakan zon lemah setebal ≃ 25 m. Kedalaman zon lemah ini sekitar 100 m dari permukaan tanah.

Rajah 2b - Jalan Tun Razak

Menunjukkan tanah baki formasi Bukit Kenny di atas batukapur. Nilai SPT tanah Bukit Kenny >50. SPT berkurang menuju batudasar (SPT = 8-20 bagi zon lemah).

Satu perkara yang amat penting dan perlu ditegaskan di sini ialah hakikat bahawa zon tanah lemah ini boleh dan sering berlaku di kedalaman yang ekstrim (misalnya hingga = 100 m) dan terletak di bawah tanah baki formasi Bukit Kenny yang keras/kaku (SPT >50) - contoh 2 & 3. Penyiasatan tanah yang tidak mencukupi, misalnya penggerudian tanah yang tamat dalam tanah baki formasi Bukit Kenny tanpa mengesan kejadian zon lemah, boleh membawa akibat yang buruk kepada pendasaran dan kejayaan projek.

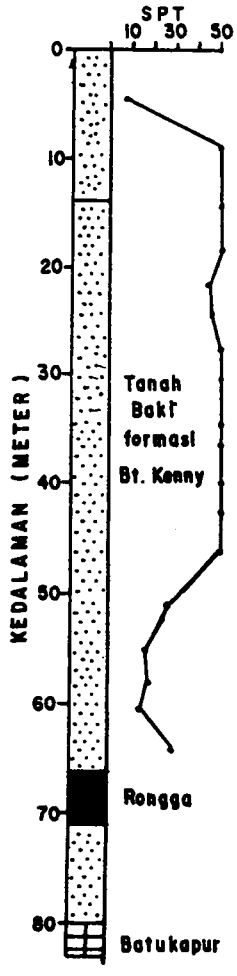


Fig. 3

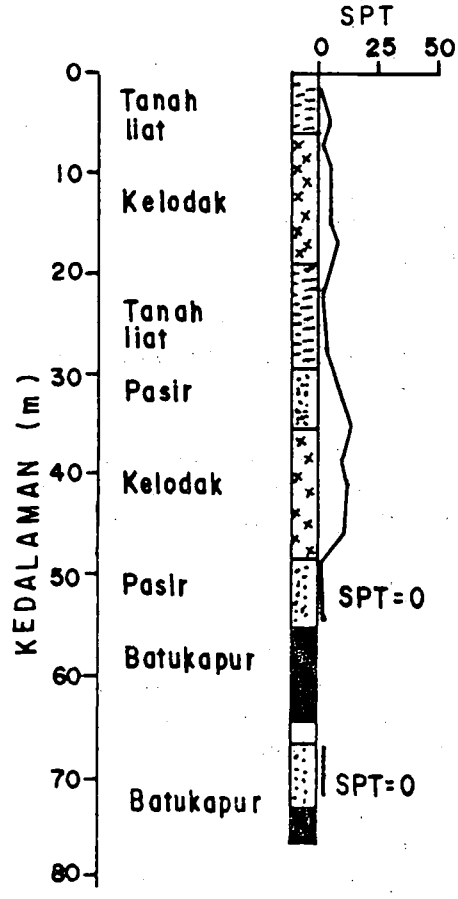


Fig. 4

Rajah 3 - Jalan Tun Razak

Menunjukkan tanah baki formasi Bukit Kenny di atas batukapur. Nilai SPT bagi tanah baki formasi Bukit Kenny kebanyakannya melebihi 50. Zon tanah lemah setebal 30 m, dan mengandungi satu rongga (dalam tanah) yang bersaiz 5 m.

Rajah 4 - Jalan Tun Razak

Menunjukkan aluvium atas batukapur. Aluvium terdiri daripada tanah liat, kelodak dan pasir dengan nilai SPT yang rendah (<10). Tanah lemah (pasir) di atas batukapur mempunyai SPT ≃ 0. Batukapur di sini mengandungi gua/rongga yang diisi oleh tanah lemah (SPT ≃ 0) juga.

Kaedah penstabilan

Setelah zon tanah lemah ini dikesan dan penyiasatan terperinci telah dilakukan terhadapnya, beberapa cara untuk mengatasi masalah zon lemah ini boleh dilakukan. Salah satu cara yang agak berkesan dan baru-baru sahaja dikenalkan di Malaysia ialah Kaedah Penurapan Jet (Jet Grouting) yang menggunakan penurapan simen bawah tekanan yang tinggi. Dalam proses ini, turap simen diinjeksi melalui lubang gerudi pada kedalaman yang tertentu supaya tanah lemah itu dapat dicampur-aduk dengan turap dan kemudian menghasilkan satu selinder tanah yang keras. Penurapan itu diulang pada keseluruhan tapak pembinaan di mana zon tanah lemah itu ditemui, dengan tujuan menggantikan zon tanah lemah itu dengan satu lapisan tanah yang agak keras.

Keberkesanan program penurapan jet itu kemudian diuji dengan melakukan Ujian Penusukan Piawai atau penggerudian semula untuk mengambil teras tanah untuk diperiksa.

Walau bagaimanapun, kaedah penurapan jet ini melibatkan perbelanjaan yang agak tinggi dan kejayaan kaedah ini masih belum dapat dipastikan memandangkan ianya baru sahaja diperkenalkan di sini.

Kesimpulan

Catatan ini telah membincangkan serba sedikit mengenai zon tanah lemah yang terdapat di atas batukapur dasar di kawasan Kuala Lumpur. Zon ini merupakan tanah yang sangat lemah yang boleh menyebabkan beberapa masalah kepada pendasaran sesuatu bangunan.

Walaupun perbincangan di sini terhad kepada kawasan Kuala Lumpur sahaja, adalah dipercayai bahawa keadaan yang serupa mungkin juga terdapat di kawasan kars yang lain, seperti di Lembah Kinta, Kedah, Perlis dan sebagainya, terutama sekali di mana terdapat batuan sedimen/metasedimen yang dialasi oleh batukapur.

Rujukan

Chan, S.F. & Hong, L.P., 1985. Pile foundations in limestone areas of Malaysia. Proc. 8th. S.E. Asian Geotechnical Conference, March 1985, Kuala Lumpur, pp. 4-17 to 4-28.

Ch'ng, S.C., 1985. Geologi Kejuruteraan Batukapur Kuala Lumpur, Malaysia. Tesis SmSn, UKM, 273 m.s.

Omar, I. & Hon, T.F., 1985. Piled foundation in limestone formation. Proc. 8th. S.E. Asian Geotechnical Conference, March 1985, Kuala Lumpur, pp. 4-45 to 4-52.

Sanglerat, G., 1972. The penetrometer and soil exploration, Elsevier Publishing Co.

Sowers, G.F., 1975. Failures in limestones of the humid sub-tropics. Journal of the Geotechnical Engineering Division, Proc. A.S.C.E., 101, GT8, pp. 771-787.

Sowers, G.F., 1982. Foundations on limestones. Technical talk delivered at Univ. of Malaya, Kuala Lumpur.

Tan, B.K. & Batchelor, B., 1981. Foundation problems in limestone areas. A case study in Kuala Lumpur, Malaysia. Proc. International Symposium on weak rock, Sept. 1981, Tokyo, pp. 1461-1463.

Tan, B.K., 1983a. Koluvium atau granit terurai; aluvium muda atau aluvium tua? - Kaedah tanpa geologi. *Warta Geologi*, Newsletter Geological Society of Malaysia, Vol. 9, n. 2, pp. 45-50.

Tan, B.K., 1983b. *In-situ* soil testing at the Bekok damsite, Johor, Peninsular Malaysia. Proc. Int. Symposium on *in-situ* testing, Paris, vol. 2, pp. 403-408.

Tan, B.K., 1984. Use of the Standard Penetration Test for Ground Interpretations - Some Examples from Peninsular Malaysia. 5th Regional Congress on Geology, Mineral & Energy Resources of Southeast Asia, April 1984, Kuala Lumpur (Abstract only, p. 34).

Tan, B.K., 1986. Use of the Standard Penetration Test for Ground Interpretations - Some Examples from Peninsular Malaysia. Proc. 5th Int. Congress, International Association of Engineering Geology, October 1986, Buenos Aires (In press).

Ting, W.H., 1985. Foundation in limestone areas of Malaysia. Special Lecture, Proc. 8th S.E. Asian Geotechnical Conference, March 1985, Kuala Lumpur, pp. 1-12.

Ting, W.H. & Ladchumanan, K., 1974. Foundations of a 17 - Storey building on a pinnacled limestone formation in Kuala Lumpur. Proc. of the Conference on Tall Buildings, Dec. 1974, Kuala Lumpur, pp. 3.20-3.25.

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Manuscript received 23 March 1986.

THE SABAH MÉLANGE - A STRATIGRAPHIC UNIT?

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Generally the stratigraphy of Sabah has not been rigidly established since the relationship between several formations as well as their boundaries still remain unknown. Several uncertainties exist particularly with reference to the location of the lower and the upper boundaries of the so-called "Chert-Spilite Formation", and its relationship with the Basement Complex and other sedimentary formations. Although some preliminary works have been done on them (Fitch, 1955; Haile and Wong, 1965), more studies have to be undertaken to give a better understanding of the Sabah stratigraphy.

Field observations indicate that every outcrop of the "Chert-Spilite Formation" is invariably associated with sheared ophilitic rocks as well as olistholiths. The ophilitic rocks outcropping at Ranau-Telupid area and at Lahat Datu-Silam area contain megablocks of chert and spilite. Similarly, the olistholiths which have been mapped as Wariu Formation present in the Kinabalu-Kota Belud area, as Ayer Formation in Dent Peninsula area and as Kuamut Formation in Darvel Bay-Segama Valley area, also contain chert and spilite. From these associations, it can be inferred that part of the ophiolite suite with its spilite and perhaps chert had been brecciated, transported and deposited together with the olistholiths. The sedimentary formations mentioned earlier, consisting of sheared breccias, blocks and megablocks of resistant or coherent rocks (including chert and spilite) embedded in highly sheared matrix of clay or phyllites could therefore be possibly identified as mélanges. The latter were believed to have been formed as a result of regional shearing and large-block submarine slumping onto a tectonically unstable and perhaps warping Basement Complex. Though Hamilton (1979) has postulated the occurrences of Tertiary mélange in Sabah based on descriptions of rocks and formations studied by various geologists, the origin of chert and spilite has not been adequately explained. The absence of type section or locality for the "Chert-Spilite Formation", particularly in Sabah and generally in Borneo, prompts that the outcrops of chert and spilite in the mélanges are broken blocks of the ophiolite suites. The "Chert-Spilite Formation", until today, has not been classified as a proper rock unit in Sabah.

Based on the above observation and reasoning, the stratigraphy of Sabah, at least part of it, should be reexamined. It is suggested here that the three sedimentary formations, viz., the Wariu Formation, the Ayer Formation and the Kuamut Formation with included chert and spilite, all having features of mélange, be grouped together as one mappable body and be termed as the "Sabah Mélange". In addition, the chert and spilite, being part of the ophiolite suite and are presently disposed chaotically in the mélange, should not be grouped and termed as the "Chert-Spilite-Formation" in the stratigraphy of Sabah.

Reference

Fitch, F.H., 1955. *The geology and mineral resources of the Segama Valley and Darvel Bay area, Colony of North Borneo.* Brit. Borneo Geol. Survey, Mem. 4, 142 pp.

Haile, N.S. and Wong, N.P.Y., 1965. *The geology and mineral resources of Dent Peninsula, Sabah.* Geol. Survey Borneo Region, Malaysia, Mem. 16, 199 pp.

Hamilton, W., 1979. *Tectonics of the Indonesian region.* U.S. Geol. Survey Prof. Paper 1078, 345 pp.

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Manuscript received 7 April 1986.

PERHUBUNGAN LAIN
(OTHER COMMUNICATIONS)

P.G. Fookes: An Introduction to Weathered Rock and Residual Soils for Engineers

Consulting Engineering Geologist, Visiting Professor, Queen Mary College, London.

Introduction

This is the second lecture in the JKR (Jabatan Kerja Raya) Axle Load Study series, the first was on concrete. This lecture is the first on geotechnical aspects of road engineering and is designed to introduce the concepts and features of rock weathering (particularly in a tropical climate) and residual soils. It is not specific to Malaysia and will treat the topic on a fairly broad and worldwide scale.

Weathering

The slow breakdown of rock exposed on the earth's surface is called weathering. It ultimately leads to the formation of a fully weathered rock i.e. a soil, which because it is not formed by deposition from water (e.g. as alluvium) or from air (e.g. sand dunes), is called an *in-situ* or *'residual'* soil. Much of the ground surface of Malaysia is covered with tropical residual soils.

Weathering can be sub-divided into the following principal forms.

(a) Physical (or Mechanical) Weathering e.g. the freezing/thawing of water in joints and cracks (especially in cold climates), day/night and seasonal temperature changes (especially in hot desert climates) causes the physical breakdown of rock to smaller particles e.g. talus or gravel.

(b) Chemical Weathering the principal form of weathering in hot (or warm) humid climates. This causes the chemical breakdown of rock with the development of new minerals to form residual soils. In cold or dry climates the rate of formation is much slower so the development of a thick sequence of weathered rock leading to a thick layer of residual soil (as in Malaysia) does not happen.

(c) Biological Weathering is important particularly in the upper layers of residual soil but is generally far less significant as a form of weathering than physical or chemical weathering.

As can be seen the climate plays a very significant part in the type of weathering. Also of significance is the parent rock type, some rocks, particular igneous and metamorphic rocks (i.e. those not formed on the earth's surface) break down on chemical weathering much more than the sedimentary rocks (i.e. those formed on the earth's surface). The local agencies of erosion, e.g. running water, hill slope, also play an important part in

determining the rate of weathering and formation of the particular type of residual soil.

Figure 1 summarises the factors and processes of weathering.

Figure 2 is conceptual cross section of the earth surface from the north or south pole to the equator showing the different relative thickness of the rock weathering and residual soil formed in response to the climate. Malaysia is in the tropical rainforest zone.

Figure 3 is a world map of the distribution of weathering forms. As can be seen all the States of Malaysia are in the zone dominated by chemical weathering.

Weathered Rock

The ground surface down to the fresh rock is the weathered profile. Figure 4 shows a typical profile. It may vary in practice from a few tens of centimetres to tens even hundreds of metres. In Malaysia it is often many tens of metres especially in igneous rocks (e.g. the local granites).

Several schemes exist for sub-dividing the various stages of weathering (from fresh rock to the fully developed residual soil). Most schemes with a world wide acceptance have a six fold division. Figure 5 gives a typical scheme (after BS 5930) from weathering grade I, the fresh rock, to grade VI, the residual soil and the diagnostic features which enable the different grades to be recognised on the cut slope face, drill core or laboratory sample.

Although the engineering characteristics vary with different rock types and their discontinuities, generalised statements can be made about their characteristics related to weathering grade. Figure 6 gives the description which defines the six weathering grades and as an example, typical characteristics of road or concrete aggregate made from rock of that weathering grade. In general rock of grades I and II require blasting for excavation, III may require some blasting to loosen and help ripping, and up to these grades the material is usually considered as a rock and is amenable to rock mechanics analysis in an engineering situation. Grades IV, V and VI generally behave like a soil, for example they are generally rippable or scrapable, have significant compressibility and in grades V and VI posess plasticity. They are usually amenable to soil mechanics analysis in an engineering situation. Grades III and IV can show some properties of both rock and soil and may well be problematical for engineering investigation, design and construction.

Residual Soils

In tropical areas of abundant rainfall and with high temperatures and good drainage conditions the chemical weathering, especially in weathering grades III, IV and V, typically leads to the formation of kaolin clay minerals and hydrated iron and aluminium oxides. Resistant particles like quartz and mica remain in the soil. As weathering proceeds from grades V to VI kaolin decreases and the hydrated oxides of iron and aluminium progressively alter to iron and aluminium sesquioxides.

Because of the relatively high iron content the resulting soils are usually yellow or red coloured. Some soils may harden as a result of

cementing action to form laterite. If they are still soft when cut and then harden they are called plinithite.

Near to the borders of the tropics, with lower rainfalls and with marked wet and dry seasons and with poor drainage, montmorillonite clay mineral soils - the black 'cotton' residual soils, are formed.

The weathering of young volcanic rocks may also lead to the formation of montmorillonite soils but continues weathering of these soils leads to the formation of allophane and halloysite.

Engineering properties of residual soils vary considerably. Kaolin rich soils tend to be of low plasticity and high strength, montmorillonite allophanes and halloysites of higher plasticity and lower strength.

The soils in Peninsular Malaysia are predominantly tropical red residual soils with some true laterites types and only partly laterised soils. The true laterites may be fossil soils formed under an earlier different climate.

Engineering test results on red soils are often variable and difficult to reproduce especially tests relating to clay fraction. In an engineering laboratory soils are prepared for analysis by drying and then mixing in water with a dispersing agent. The means of drying can have a significant effect on the test results. For example plastic soils may even give results indicating they are not plastic! The dispersing agent used to defloculate the clay particles may not be efficient in the normal engineering method and it is done only once. Many red soils can then refloculate to differing amounts and give variable test results. Pedological methods of analysis (not used by engineers) which use repeated dispersions and different analytical techniques may be more appropriate for some soils.

Figure 7 and 8 give examples of the extreme behaviour of some tropical soils under various test conditions, kaolin rich soils (as probably predominant in Malaysia) generally show much more moderate behaviour.

Figure 9 is a map of the world wide distribution of residual soils and Figure 10 is of typical ranges of engineering properties of the weathered profile.

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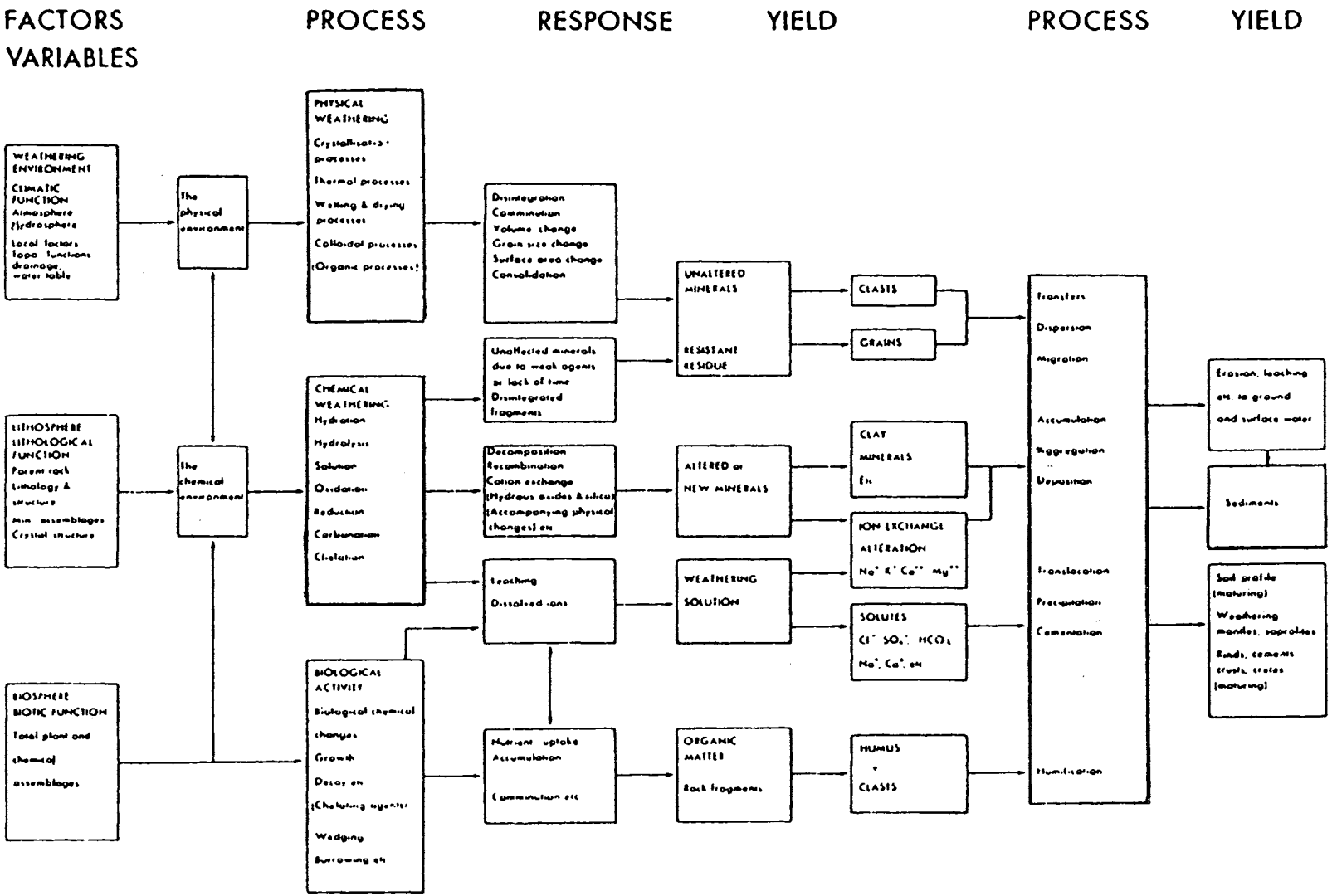
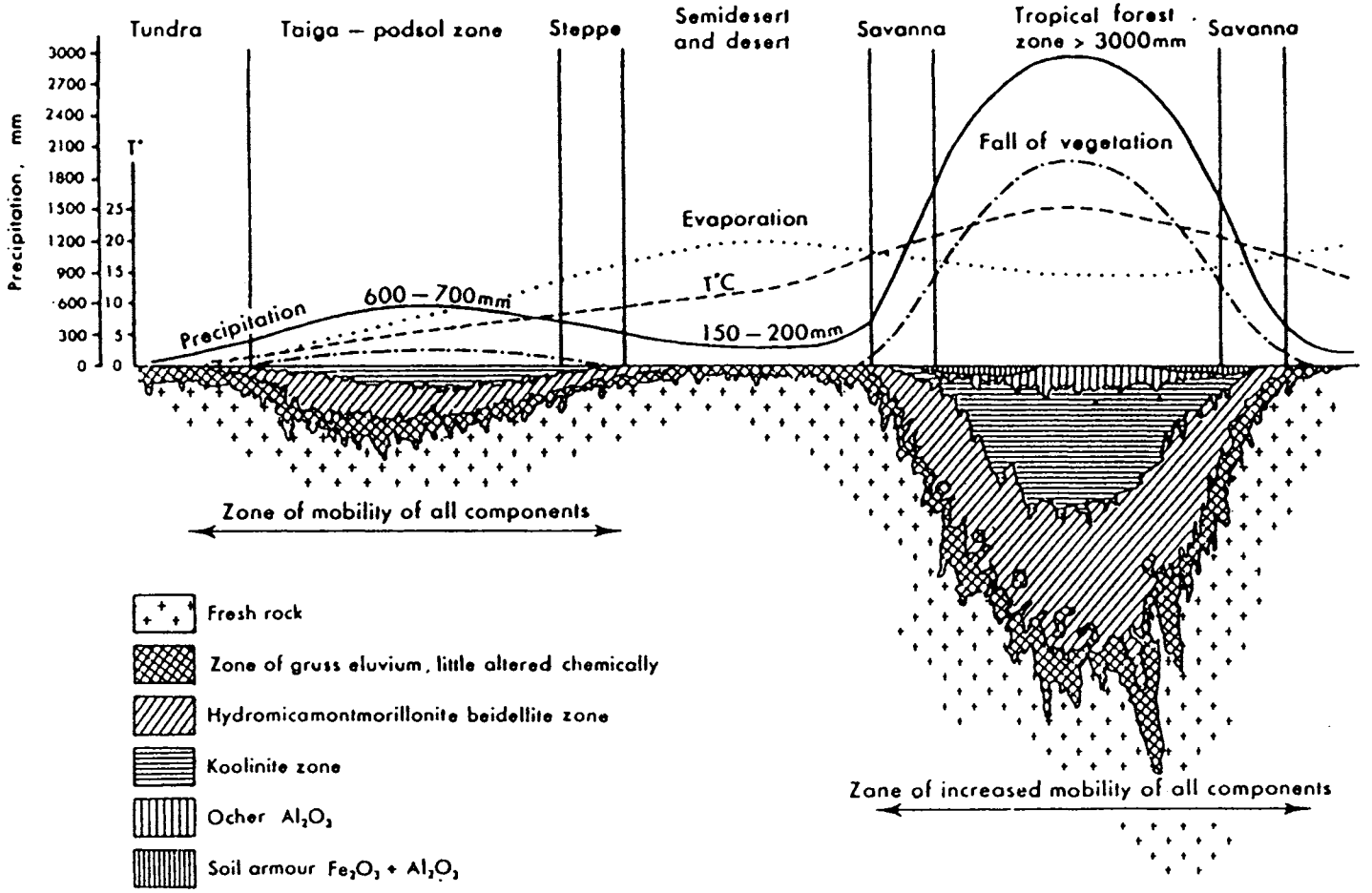
Manuscript received 28 April 1986.



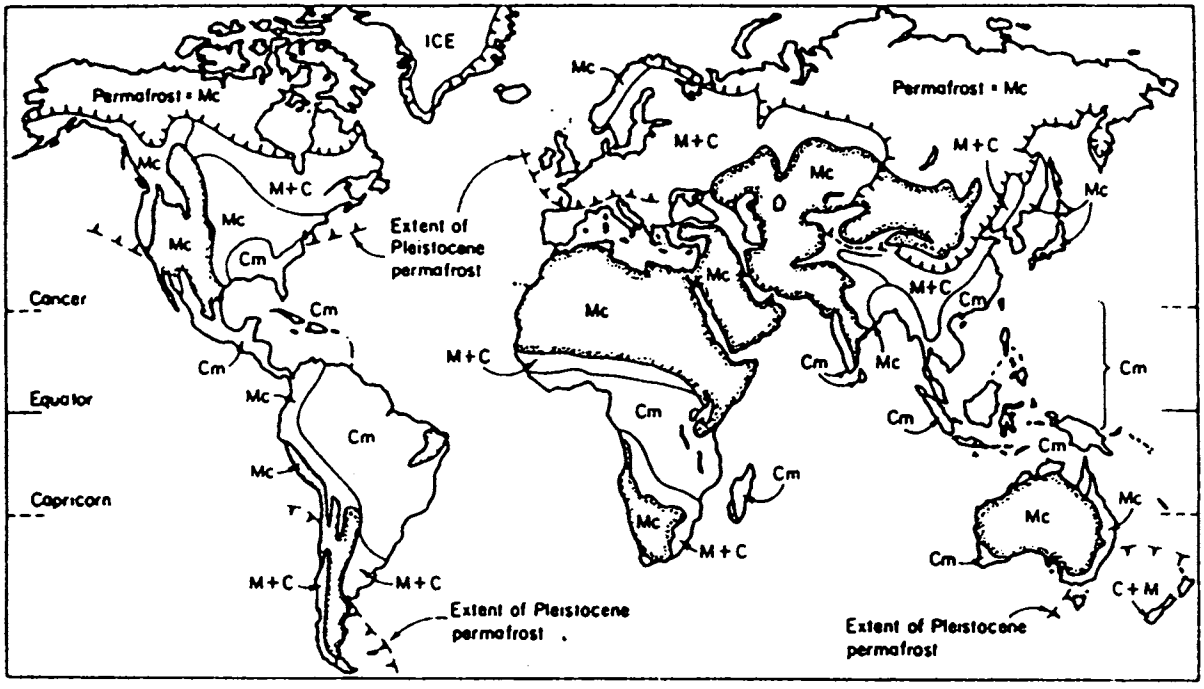
General diagram of the factors and processes of weathering.

Fig. 1



Relationships between climate and weathering mantles (after Strakhov, 1967).

Fig. 2



M = Mechanical

C = Chemical (including biological)

Mc = Mechanical weathering dominates

Cm = Chemical weathering dominates

= Boundary to semi-arid and drier zones

= Limit of seasonal widespread permafrost

= Limit of permafrost during Ice Age

Present distribution of weathering types Based on data from Washburn (1979); Meigs (1953); Flint (1957), and Strakhov (1967)

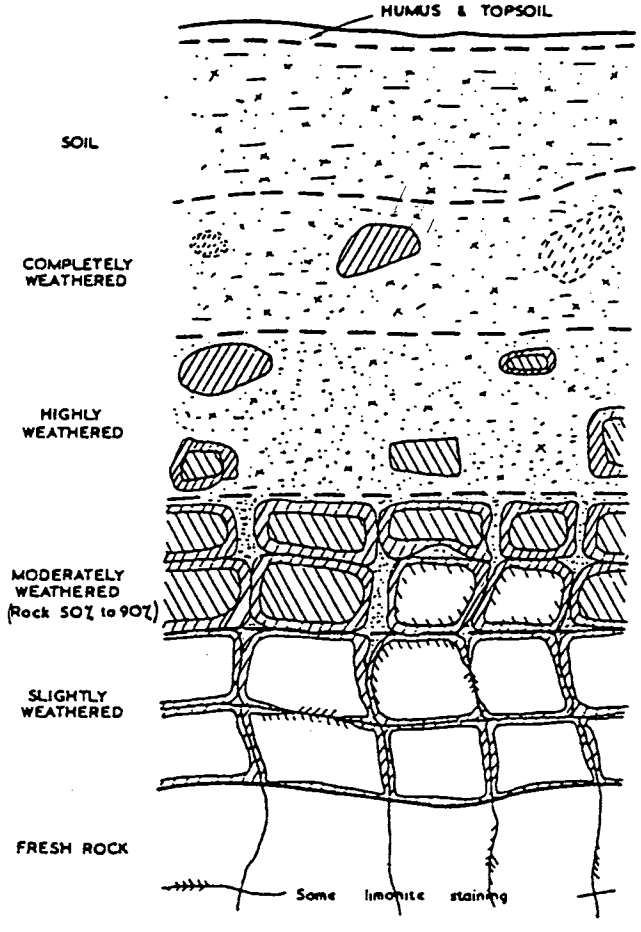


Fig. 4

Schematic Diagram of Typical Tropical Profile (from Little, 1969)

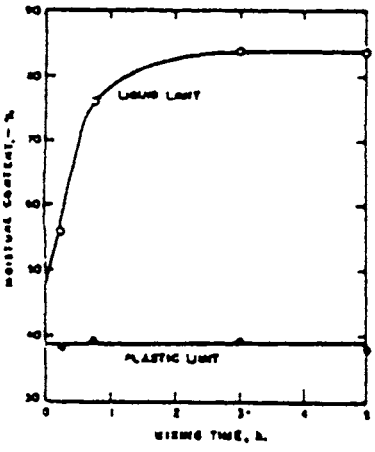
<table>
<tr><th rowspan="3">TERM</th><th rowspan="3">GRADE</th><th colspan="6">DIAGNOSTIC FEATURES</th></tr>
<tr><th colspan="3">MATERIAL</th><th colspan="3">MASS</th></tr>
<tr><th>Discolouration</th><th>Friability</th><th>Texture</th><th>Discolouration</th><th>Deterioration</th><th>Structure</th></tr>
<tr><td>FRESH</td><td>IA</td><td rowspan="2">No discolouration</td><td rowspan="4">Not friable</td><td rowspan="5">Texture preserved</td><td>No discolouration</td><td rowspan="2">No deterioration</td><td rowspan="5">Structure preserved</td></tr>
<tr><td>FAINTLY WEATHERED</td><td>IB</td><td>Discolouration restricted to surfaces of discontinuities</td></tr>
<tr><td>SLIGHTLY WEATHERED</td><td>II</td><td>Slight discolouration</td><td>Slight penetration of discolouration inwards from discontinuities</td><td>Deterioration restricted to rock adjacent to discontinuities</td></tr>
<tr><td>MODERATELY WEATHERED</td><td>III</td><td rowspan="4">Discoloured</td><td rowspan="3">Discoloured</td><td>Less than 50% deterioration</td></tr>
<tr><td>HIGHLY WEATHERED</td><td>IV</td><td>Partly friable</td><td>More than 50% deterioration</td></tr>
<tr><td>COMPLETELY WEATHERED</td><td>V</td><td rowspan="2">Friable</td><td rowspan="2">Complete deterioration</td></tr>
<tr><td>RESIDUAL SOIL</td><td>VI</td><td>Texture destroyed</td><td>Structure destroyed</td></tr>
</table>

Fig. 5

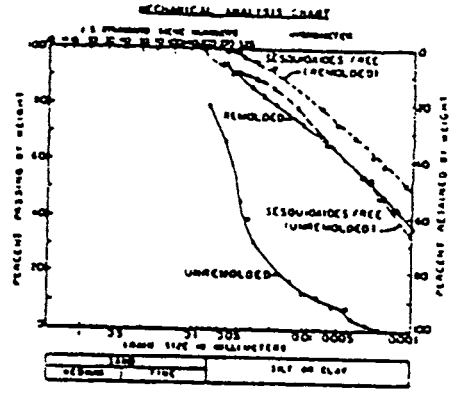
Term*	Grade*	Description*	Materials characteristics*
Fresh	1A	No visible sign of rock material weathering.	Aggregate properties not influenced by weathering. Mineral constituents of rock are fresh and sound.
Faintly weathered	1B	Discolouration on major discontinuity (e.g. joint) surfaces.	Aggregate properties not significantly influenced by weathering. Mineral constituents sound.
Slightly weathered (this grade is capable of further sub-division)	II	Discolouration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discoloured by weathering and may be somewhat weaker than in its fresh condition.	Aggregate properties may be significantly influenced by weathering. Strength and abrasion characteristics show some weakening. Some alteration of mineral constituents with microcracking.
Moderately weathered	III	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discoloured rock is present either as a continuous framework or as corestones.	Aggregate properties will be significantly influenced by weathering. Soundness characteristics markedly affected. Alteration of mineral constituents common and much microcracking.
Highly weathered	IV	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discoloured rock is present either as a discontinuous framework or as corestones.	Not generally suitable for aggregate but may be suitable for lower parts of road pavement and hardcore.
Completely weathered	V	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.	Not suitable for aggregate, or pavement but may be suitable for select fill.
Residual soil	VI	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil still has not been significantly transported.	May be suitable for random fill.

* After Anon (1977). The description of rock masses for engineering purposes.
* For general engineering characteristics, see Fookes, Dearman & Franklin (1971)

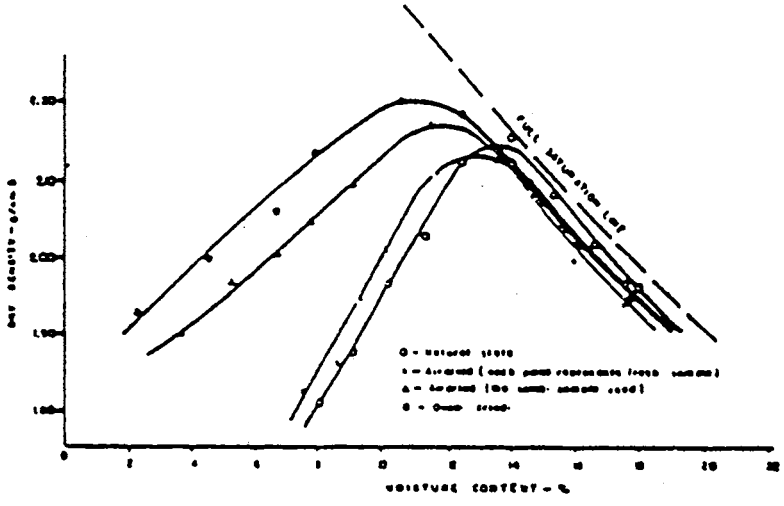
Fig. 6



Effect of Mixing Time on the Liquid Limit of a Red Clay from Kenya (from Millard, 1962; see Gidigasu, 1974)



Effect of Remolding and Sesquioxide Removal on the Grain Size of Lateritic Soil (from Townsend et al, 1971)



The Influence of Method of Sample Preparation and Laboratory Procedure on Compaction Characteristics of Lateritic Soil from Ghana (from Gidigasu, 1974)

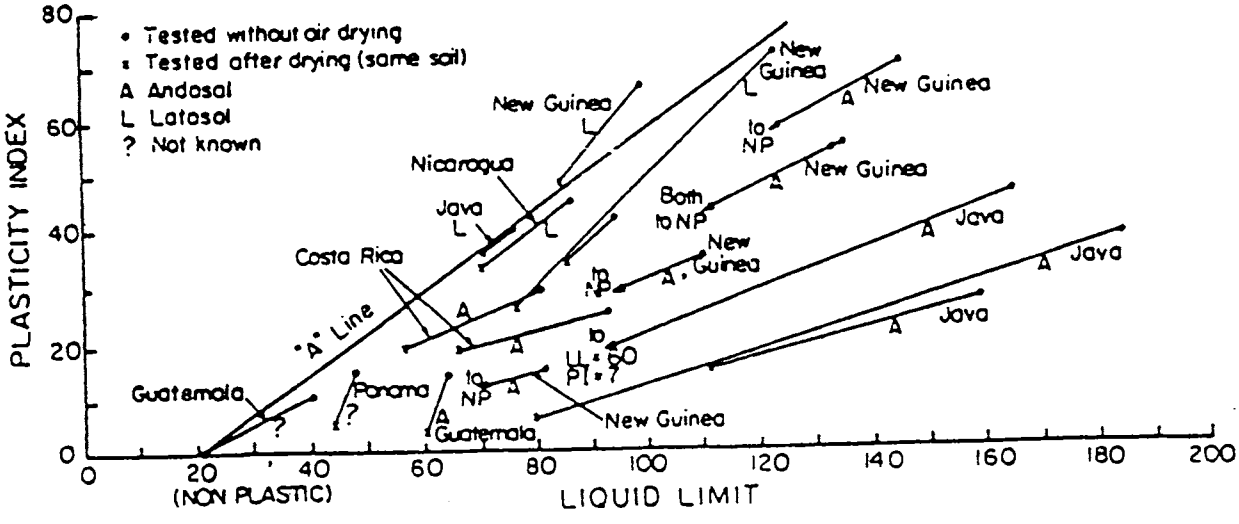
PHYSICAL PROPERTIES OF UNREMOLDED, REMOLDED AND SESQUIOXIDE-FREE LATERITIC SOIL
(from Townsend et al, 1971)

Property	Unremolded	Remolded	Sesquioxide Free
Liquid Limit (percent)	57.8	69.0	51.3
Plastic Limit (percent)	39.5	40.1	32.1
Plasticity Index (percent)	18.3	28.0	19.2
Specific Gravity	2.80	2.80	2.67
Proctor Density (kN/m^3)	13.3	13.0	13.8
Optimum Moisture Content (percent)	35.0	34.5	29.5

Fig. 7

EFFECT OF AIR DRYING ON INDEX PROPERTIES OF A HYDRATED LATERITE CLAY FROM THE HAWAIIAN ISLANDS
(after Willis, 1946, in Gidigasu, 1974)

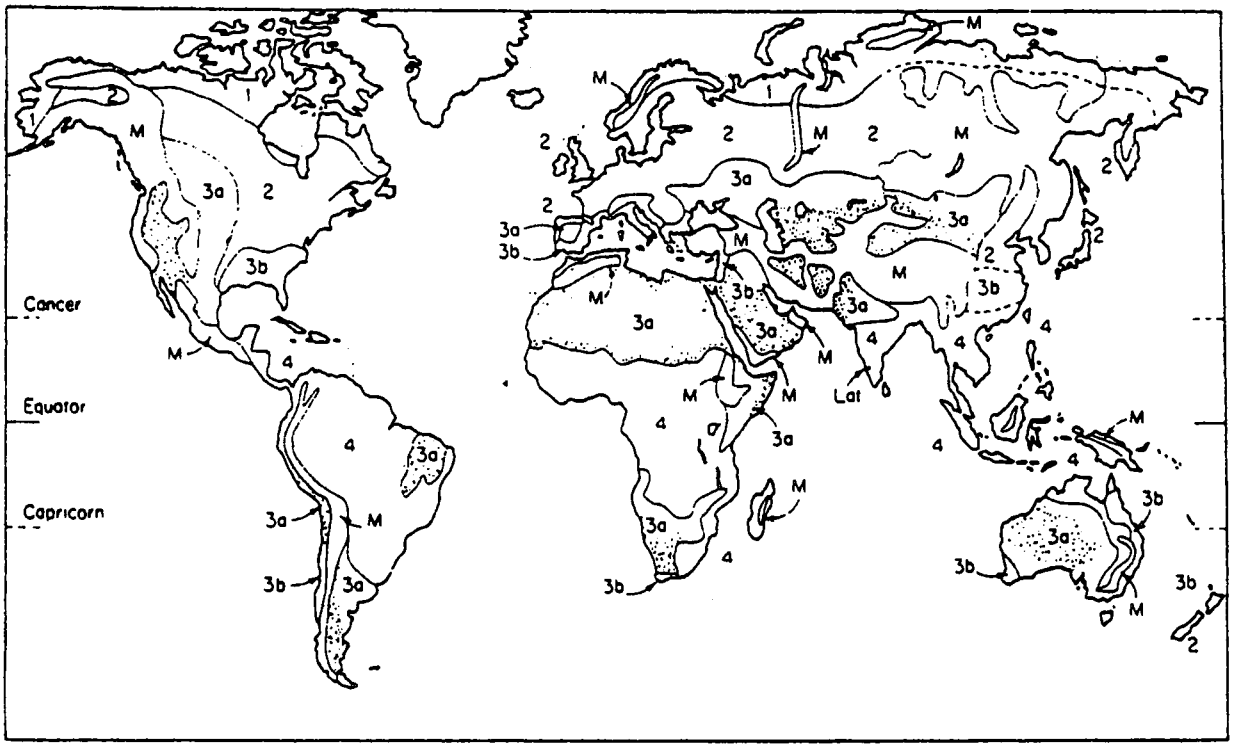
Index Properties	Wet (at Natural Moisture Content)	Moist (partial air drying)	Dry (complete air drying)	Remarks
Sand content (%)	10	42	96	Dispersion prior to hydrometer test with sodium silicate
Silt content (%) (0.05-0.005 mm)	34	17	11	
Clay content (%) (< 0.005 mm)	36	41	3	
Liquid Limit (%)	245	217	NP	Soaking in water for 7 days did not cause regain of plasticity lost due to the air drying
Plastic limit (%)	135	146	NP	
Plasticity Index (%)	110	71	NP	



Effect of Drying on the Atterberg Limits of Some Tropical Soils (from Morin and Todor, 1975)

Fig. 8

Fig. 9



1 Tundra soils (black-brown soils)

2 Taiga and Northern Forest soils (Podzols and grey-brown soils)

3a Prairie, or Steppe long-grass soils (Chernozems) to Steppe short-grass (Chestnut-brown) soils and Desert soils (red-grey)

3b Mediterranean woodland soil (red-yellow) and scrub

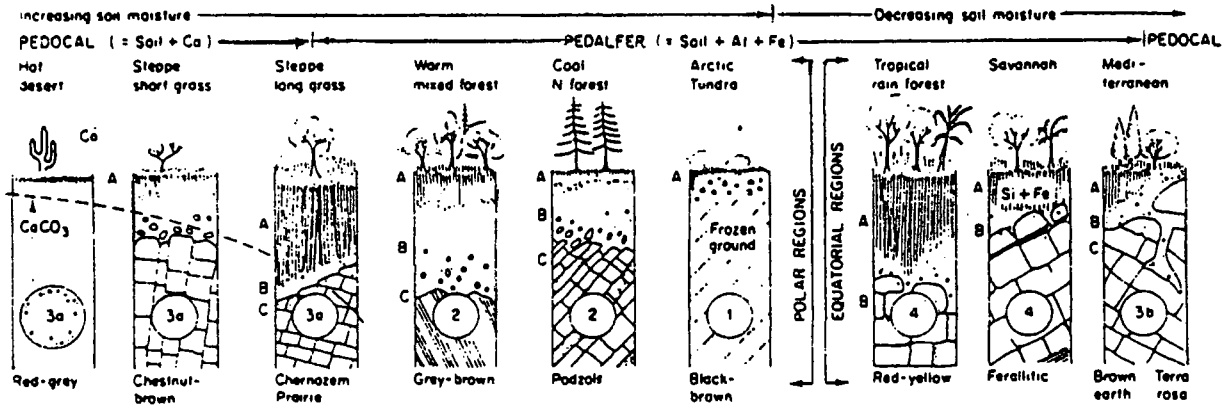
4 Savannah grass and scrub soils (ferallitic-red and yellow-and dark grey-black soils) and Tropical rain forest soils (red-yellow)

M = Mountain conditions control soil generation: mainly thin soil profiles

Lat = Type locality for Laterite (for distribution see Chapter 20)

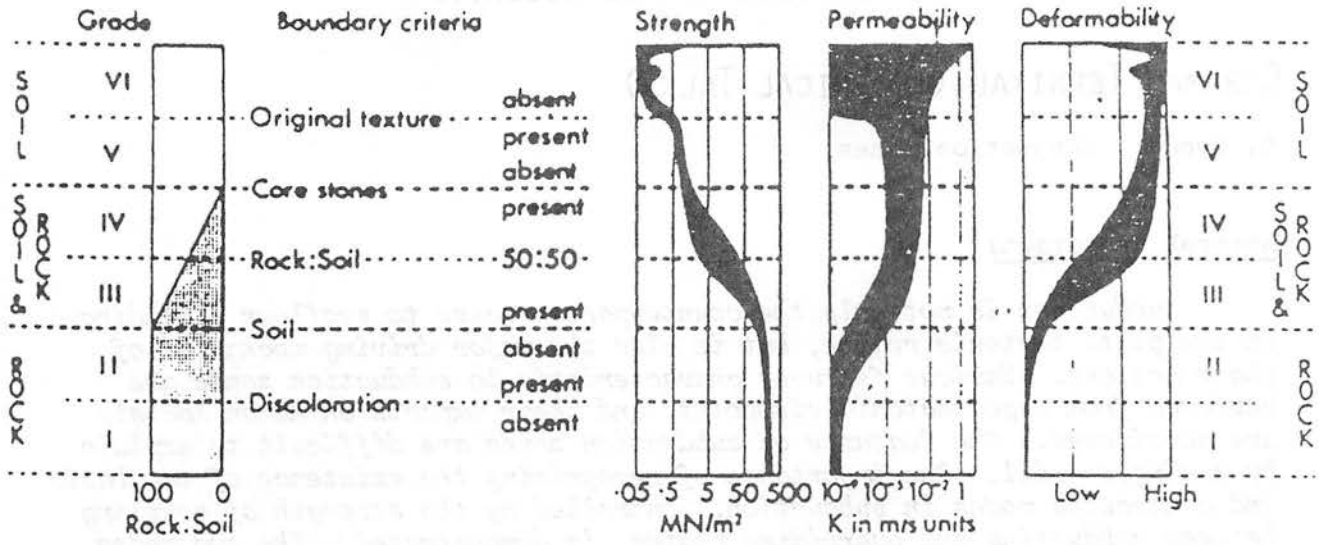
= Red-grey desert soils of (3a)

General distribution of soils. Based on data from Bridges (1970): Kellog (1950): Thornbury (1969): and Walton

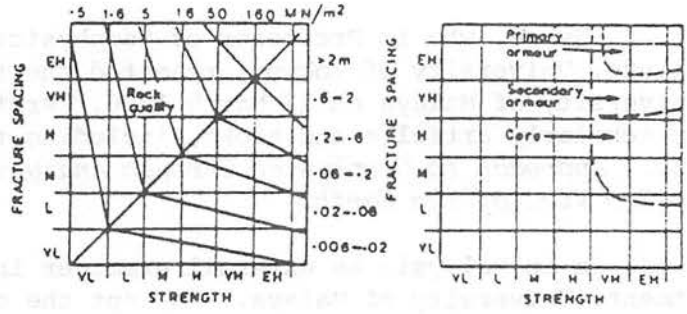


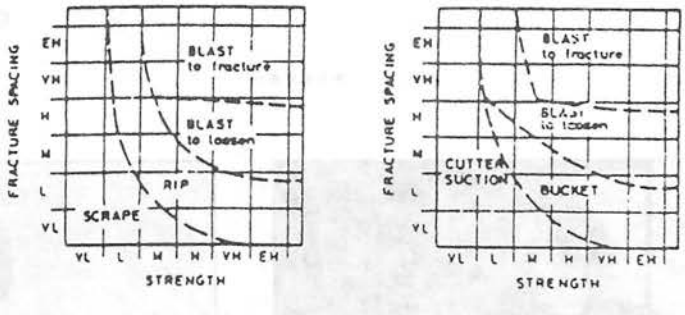
Soils of the major climatic vegetation regions. .. $CaCO_3$ found in soil profiles of warm dry regions Ca, Si, Fe = Calcite, Silica, Iron precipitate, often as a hard durable crust (*duricrust*)

Fig. 10



An idealized weathering profile and the general engineering properties of each horizon





EH EXTREMELY HIGH
VH VERY HIGH
H HIGH
M MEDIUM
L LOW
VL VERY LOW
EL EXTREMELY LOW

(Partly after Fookes, Dearman & Franklin

Simple graphical relationships between excavation and dredging of rock, and selection of breakwater stone, to the fracture spacing and unconfined compressive strength of the rock determined during site investigation

PERTEMUAN PERSATUAN
(MEETINGS OF THE SOCIETY)

CERAMAH TEKNIKAL (TECHNICAL TALKS)

S. Uyeda: Subduction Zones

Abstrak (Abstract)

Subduction is not only the counterpart process to seafloor spreading in the plate tectonic regime, but is also the major driving mechanism of plate motions. Various features characteristic to subduction zones are reviewed from a geotectonic viewpoint, and their impacts on human society are considered. The features of subduction zones are difficult to explain by a single model. The importance of recognizing the existence of two basic and contrasted modes in subduction, controlled by the strength of coupling between subducting and overriding plates, is demonstrated. The two modes are High Stress Chilean-type subduction and Low Stress Mariana-type subduction. Collision and accretion of buoyant features on seafloor, an inevitable consequence of subduction, is important in the evolution of continents.

Laporan (Report)

Prof. Dr. S. Uyeda, who is Professor of Geophysics at the Earthquake Research Institute, University of Tokyo, presented the talk at the Geology Department, University of Malaya on 17 March 1986. Professor Uyeda is the author of many scholarly articles and books, including the recent *Debate About the Earth: Approach to Geophysics Through Analysis of Continental Drift*, and *The New View of the Earth*.

Prof. Uyeda is in Malaysia as external examiner in Geology at the Geology Department, University of Malaya. He kept the crowd of 35 fully satisfied with his excellent presentation and the lively discussions that ensued.

G.H. Teh

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S. UYEDA

J. C. BRIDEN

J.C. Briden: Palaeomagnetism and tectonic displacement

Professor Briden of Leeds University, and who has recently taken up the post of Earth Sciences Director at NERC, took the opportunity of presenting this talk (on 20 March 1986) while in Malaysia as an external examiner at the Geology Department of University of Malaya.

Professor Briden reviewed the achievements and state-of-the-art of palaeomagnetism in which he is a leading figure. The role that palaeomagnetism has played in tracking the motions of the continents across the surface of the earth was clearly presented along with the palaeomagnetic signatures of continental collisions and fragmentations. Professor Briden pointed out that few significant revisions have been made to the apparent polar-wander paths of the major continental units over the last ten years, and that current research is shifting to the problems of tracking motions and rotations of smaller "displaced terrains" such as those accreted onto the western coast of Northern America. Throughout his talk Professor Briden explained the importance of petrological studies to understand the mode and history of the magnetisation of a rock and to the careful relating of that direction to any isotopic age determination. This was illustrated with several examples, many from his own research group at Leeds. One such study was a determination of the peak resetting temperature for a magnetization due to the nearby intrusion of a dyke. These temperatures were determined at different distances from dykes of varying width, and could be related to modelled temperature profiles. Professor Briden cautioned however that rarely are pure thermoremanent magnetizations measured, because generally the iron oxide grains which carry the remanence are altered during the temperature changes, and that this gives rise to a chemical remanent magnetization. During the lively debate that followed the talk it was clear that the audience was appreciative of a geophysicist who is attentive to the geological complexities of the system he works with.

C.A. Foss

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P. Bowden: Anorogenic tin granites: Classical examples from Africa.

Abstrak (Abstract)

The Nigerian anorogenic ring complexes range in age from Permo-Carboniferous centres at the Niger-Nigerian border to late Jurassic intrusions in the south which just predate the initial opening of the Bernue trough. The disposition of the ring structures was largely controlled by ancient lineaments in the polymetamorphic basement of Pan Africa age. The complexes have some mineralization features in common with a 400 km NE-SW zone of Palaeozoic pegmatites.

The majority of the ring complexes represent the roots of volcanoes with dominantly syenitic to granitic compositions. They are A-type granites of long time duration petrologically similar to, but chronologically older than, their counterparts to the north in Niger. In a few northern centres the volcanic rocks are preserved indicating an alkaline trend through hawaiite,

mugearite, trachyte to rhyolite. Some mixing of contrasting magma compositions has occurred to produce andesitic suites with disequilibrium mineral reactions.

In the Jos Plateau and other regions to the south, erosion has removed the volcanic cover exposing a multifarious array of granitic textures; varied subsolidus compositions due to rock-fluid interaction; primary uranium-niobium, zinc-tin mineralization; and placer deposits with rich concentrates of cassiterite and other resistant ore minerals, often buried in Tertiary river systems and covered by Quaternary basaltic lava flows. Cretaceous to Recent sedimentary successions which fringe the Plateau are important traps for secondary uranium mineralization.

Laporan (Report)

Prof. Peter Bowden who is with the Department of Geology, University of St. Andrews, Fife, Scotland presented the above-mentioned talk to about 15 members at the Geology Department, University of Malaya on the 7th April 1986.

It has been quite a while since we last had an authority on tin granites. As such the talk proved interesting and the discussion that followed most lively. Prof. Bowden was able to better appreciate the problem of our granites as he has just participated in a field trip from Johore Baru to Kuantan and Kuala Lumpur with a group of staff members of Geology Department, University of Malaya.

G.H. Teh

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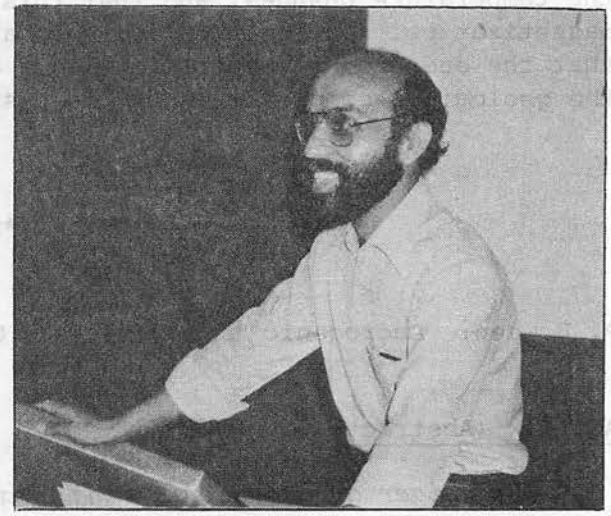
P. BOWDEN



ABDUL GHANI RAFEK

Abdul Ghani Rafek: Orientation of geological planes (joints): their indirect determination and meaning in underground construction.

Abstrak (Abstract)

In geotechnical exploration, a rock mass classification for idealisation and evaluation of prevailing geological conditions is the main aim. The importance of geological planes in determining the technical characteristics

of a rock mass are typically illustrated by the consideration given to them in Bieniawski's rock mass classification (974, 1976).

Where outcrops are scarce, indirect methods such as refraction seismic studies can be used to determine the strike directions of the main geological planes. Cuch studies were conducted by the speaker to determine the main joint directions of a rock mass. The slowness-concept was applied for the interpretation of the results. A qualitative correlation was achieved between the normals to the joint strike directions and the distribution of the slowness values. Also the intensity of jointing was shown to influence the slowness values.

In underground construction, depending on the depth below ground surface, geological planes can cause stability problems. In jointed rocks, sliding or falling of rock blocks or wedges causes instability. Stereographic projection can be used to analyse these problems. In the preliminary exploration phase indirect determination of the strike direction of joint sets can provide the input data for such analysis.

Laporan (Report)

Dr. Abdul Ghani Rafek, a lecturer with Universiti Kebangsaan Malaysia who recently obtained his Doctorate from the Ruhr-Universitaet, Bochum, West Germany, presented the talk at the Geology Department, University of Malaya on 14 April 1986.

Literature

Bieniawski, Z.T., 1974. Geomechanics classification of rock masses and its application in tunnelling. Proc. Third International Congress On Rock Mechanics, ISRM, Denver, Vol. 11A.

Bieniawski, Z.T., 1976. Rock mass classification in rock engineering. Proc. Symposium on Exploration for Rock Engineering, Johannesburg, Vol. 1.

Blum, R., 1972. Hammerschlagseismische Feldmessungen an gekluefteten Medien. Jahresbericht SFB 77.

Bock, G., 1972. Modellseismische Untersuchungen an gekluefteten Medien. Jahresbericht SFB 77.

Brueckl, E. & Fuerlinger, W., 1973. Ein Vergleich von geologischen Gefuegeaufnahmen mit seismischen Messungen. Zeitschrift fuer Geophysik. Bd. 39.

Bamford, D. & Nunn, K.R., 1979. In-situ measurement of crack anisotropie in the Carboniferous Limestone of Northwest England. Geophysical Prospecting 27.

Hoek, E. & Brown, E.T., 1980. Underground Excavation in Rock. Institution of Mining and Metallurgy, London.

Rafek, A.G., 1984. Ingenieurgeologische Erkundungsarbeiten mit Hilfe indirekter Erkundungsverfahren in Umfeld der Ruhr-Universitaet Bochum. Dissertation, Ruhr-Universitaet Bochum.

G.H. Teh

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Bjorn Schoon: 1) Resistivity surveying and down-hole logging using ABEM terrameters.
2) Seismic refraction methods to determine thickness of overburden, depth of weathering and bedrock quality.

Mr. Bjorn Schoon, a geophysicist with Atlas Capco, Sweden, gave the two talks on 23 April 1986 to about 20 members at the Geology Department, University of Malaya.

Mr. Schoon started off by making a brief introduction on resistivity methods and the use of the ABEM terrameter and Vertical Electrical Sounding (VES) in soil, orebody and pollution investigations.

Next Mr. Schoon spoke on the Seismic technique and introduced the terraloc together with the sextette software for vibration monitoring and use in the oil industry.

He continued with the importance of logging and drillhole inspection especially in oil prospecting, conductivity and resistivity measurements and coal exploration. He introduced the ABEM GEOLOG 1000 and the FOTOPAC interpretation package for interpretation of FOTOBOR survey results.

G.H. Teh

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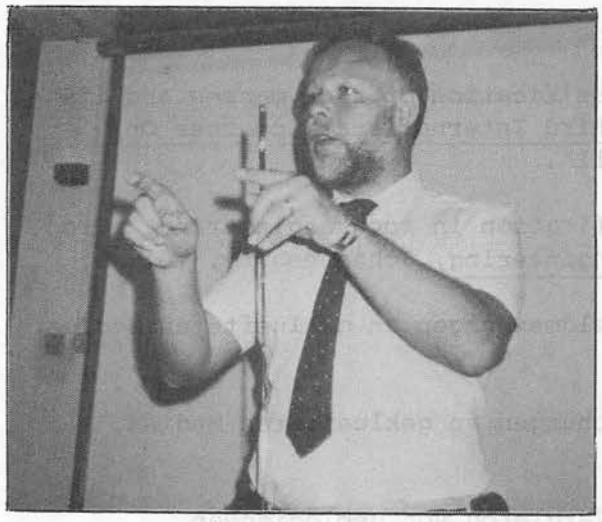

B. SCHOON

P.G. FOOKES

P.G. Fookes: An introduction to weathered rocks and residual soils for engineers

Professor Fookes's lecture was attended by about 50 engineers at J.K.R. headquarters, Kuala Lumpur on 26 April 1986. Only half a dozen members from G.S.M. attended the talk - this is rather regretable since much trouble was taken to have the talk open to G.S.M. members.

Prof. Fookes's lecture lasted about 3 hours, with about 30-minute coffee break. He began with weathering and weathered rocks (1st part of lecture), then followed with residual soils and their engineering properties.

The first part is more geological while the second part more engineering/ soil mechanics. Prof. Fookes drew heavily on his many world-wide experiences and case histories to illustrate the va ious aspects of his talk. The talk ended with some lively discussions, contributions and questions from the audience.

A copy of Prof. Fookes's lecture notes (Lecture no. 2 in the J.K.R. Axle Load Study Series) is reprinted in this issue of *Warta Geologi* with his kind permission (see '*Other Communications*').

On behalf of the Geological Society of Malaysia and its members, I would like to record our thanks to Prof. Fookes, Jabatan Kerja Raya, Rendell Palmer & Tritton, and Minconsult for kindly allowing us to attend the talk.

Tan Boon Kong

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Report on the Annual Conference '86 held at Rumah Universiti, University of Malaya, 28-29 April '86

The Annual Conference was officially opened by Prof. Dato' Dr. Asmah Haji Omar, Acting Vice Chancellor of University of Malaya. There were some anxious moments when Prof. Asmah arrived punctually at 8.30 a.m. for the opening ceremony, since at that time only about a dozen participants were present in the conference hall. Fortunately, Prof. Asmah was most understanding and gracious and even provided some light moments in her speech to calm the hearts of the organisers, and the opening ceremony went on smoothly. A copy of Prof. Asmah's opening address is reproduced here. The Society would like to record its sincere thanks to Prof. Asmah for taking time off to officiate at the opening ceremony.

Attendance picked up gradually after the opening ceremony and by the time the first keynote paper was being delivered, about 40 participants had arrived. Henceforth the technical sessions proceeded in full swing. A total of 60 people registered for the Conference, but at each particular time only about 40-50 participants were present in the hall.

A total of 29 papers were presented, including the two keynote addresses by Prof. C.S. Hutchison and Prof. H.D. Tjia. Three papers that were originally scheduled for presentation were withdrawn at the last moment. Due to the rather tight schedule that had to be maintained, Session Chairmen regrettably had to interrupt and cut-short deliberations of papers on several occasions. Otherwise, the technical sessions proceeded well with active discussions, comments and questions from the floor. Details of the technical programme and abstracts of papers presented at the Conference are listed also in this Newsletter.

The three newly elected Honorary Members of the Society, namely Prof. Prof. C.S. Hutchison, Mr. D.S. Singh and Prof. H.D. Tjia were presented with their Scrolls during lunch on 28 April. The Scroll presentation was preceeded by citation by three senior members of the Society, namely Mr. S.P. Sivam, Mr. E.H. Yin and Dr. S.S. Almashoor.

The Annual Dinner was also held at Rumah Universiti on 28th April. It was attended by about 30 people including wives of members. Food was plentiful, and many left with "doggy-bags"/"bungkus"/"ta-pao".

On behalf of the Council, I would like to thank various people for making the Annual Conference a success. First and foremost I would like to single out Dr. K.R. Chakraborty for not only coming up with the idea of an Annual Conference incorporating the disciplines of general geology, economic geology and engineering geology (thus replacing the traditional three one-day seminars on each of the above topics) but also supporting the Conference in deeds by contributing 2½ papers, hence topping the list of contributors. To all the other speakers, our sincere thanks for taking time to prepare and present papers at the Conference. Thanks also to all members of the organising committee for ideas and efforts in various aspects of the organisation work, and to Anna and the student helpers for all the help rendered in ensuring the smooth running of the Conference.

Finally, it might be appropriate and timely to add here that for those of you who could not contribute or participate at this first annual conference for one reason or another, it is perhaps not too early to think about and prepare for the next annual conference, presumably to be held in April '87 to coincide with the Society's Annual General Meeting. For those of you who contributed and participated in this Conference, we look forward to your continuous support. Now that the "baby" has been born (ever wondered why cigar-shaped souvenirs were presented to Speakers?), it is up to all members to nurture it and ensure its healthy growth in the future.

See you all next year!

Tan Boon Kong

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ANNUAL CONFERENCE '86 - PROGRAMME

MONDAY, 28TH APRIL, 1986

8.00 a.m. - 8.30 a.m.	**LATE REGISTRATION**
8.30 a.m. - 8.40 a.m.	**Welcoming address by the President**
8.40 a.m. - 9.00 a.m.	Opening Ceremony - Address by Prof. Dato' Asmah, Deputy Vice Chancellor, University of Malaya.
9.00 a.m. - 9.40 a.m.	KEYNOTE PAPER I by Honorary Member Prof. C.S. Hutchison: The Indosinian Orogeny and the problem of the Triassic basins.
	(Chairman: Prof. H.D. Tjia)
9.40 a.m. - 10.00 a.m.	MORNING TEA
	SESSION I (General Geology) Chairman: Tan Boon Kong
10.00 a.m. - 10.20 a.m.	H.D. Tjia: Disparate late Quaternary shorelines in Peninsular Malaysia: Shift of the geoid or crustal movement?

10.20 a.m. - 10.40 a.m.	S. Chandrakumar: Granitoids, enclaves and magma mixing.
10.40 a.m. - 11.00 a.m.	Hamzah Mohamed & Mohd Noor Rani: Geochemical comparison of the Cretaceous-Tertiary and Triassic granites of the Malay Peninsula.
11.00 a.m. - 11.20 a.m.	K.R. Chakraborty: Interfacial energy and spatial distribution of crystals in rocks.
	SESSION II (Geophysics) Chairman: Ibrahim Komoo
11.20 a.m. - 11.40 a.m.	Abdul Rahim Samsuddin: The role of geophysical techniques in Quaternary geology.
11.40 a.m. - 12.00 p.m.	C.A. Foss: Gravity mapping of the coastal plain of Selangor.
12.00 p.m. - 12.20 p.m.	Abdul Ghani Rafek: Depth of penetration of geophysical exploration methods as applied in shallow engineering geological investigations.
12.20 p.m. - 12.40 p.m.	John K. Raj & Preamakanthan: A case study of the seismic reflection method applied to subsurface geological mapping in the Kuala Lumpur area.
12.40 p.m. - 2.00 p.m.	LUNCH - Presentation of scrolls to new Honorary Members.
	SESSION III (Engineering Geology) Chairman: Ahmad Tajuddin
2.00 p.m. - 2.20 p.m.	Ibrahim Komoo: Engineering properties of some igneous rocks in Peninsular Malaysia.
2.20 p.m. - 2.40 p.m.	John K. Raj: The stability of slope cuts along the Kuala Lumpur-Karak Highway.
2.40 p.m. - 3.00 p.m.	Tan Boon Kong: Rock slope stabilization for hillside residential development - A case study in Kuala Lumpur.
3.00 p.m. - 3.20 p.m.	Saim Suratman: Foundation grouting of the Batu Dam, Kuala Lumpur.
3.20 p.m. - 3.40 p.m.	AFTERNOON TEA
4.00 p.m. - 6.00 p.m.	AGM, Rumah Universiti.
8.00 p.m. - 10.00 p.m.	DINNER, Rumah Universiti, University of Malaya.

TUESDAY, 29TH APRIL, 1986

9.00 a.m. - 9.40 a.m.	KEYNOTE PAPER II by Honorary Member Prof. H.D. Tjia: Structural geology of the Macincang Formation, Langkawi Islands.
	(Chairman: Prof. C.S. Hutchison)
9.40 a.m. - 10.00 a.m.	MORNING TEA
	SESSION IV (Sarawak Geology) Chairman: Azahar Hj. Hussin

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10.00 a.m. - 10.20 a.m.	Ho Chee Kwong: Stratigraphical analysis of the Sg. Arip area, Sarawak, and its regional implication.
10.20 a.m. - 10.40 a.m.	Lim Heng Gaul: Palaeoenvironment of Subis-Ulu Niah area, Sarawak.
10.40 a.m. - 11.00 a.m.	Ann Yasmin Bt. Nordin: Some sedimentological aspects of the Teres-Bakau area, Sarawak.
11.00 a.m. - 11.20 a.m.	Seitle Singh: Tertiary molasse deposition in the south-eastern Ulu Sebuyau area, West Sarawak.
	SESSION V (Hydrogeology) Chairman: Abdul Ghani Rafek
11.40 a.m. - 12.00 p.m.	Ismail Mohd Noor: Groundwater facies in Peninsular Malaysia.
12.00 p.m. - 12.20 p.m.	Daud Mohamad: A study of groundwater hydrology in the lower Sg. Kelantan basin with environmental isotopes.
12.20 p.m. - 12.40 p.m.	Ismail Mohd Noor: Recharge of deep aquifer in Kelantan, Peninsular Malaysia.
12.40 p.m. - 1.00 p.m.	Chow Weng Sum: Investigation of the presence of excessive arsenic and fluoride in well-water of Kg. Sekolah, Ulu Kepong.
1.00 p.m. - 2.00 p.m.	LUNCH
	SESSION IV (Economic Geology) Chairman: Albert Loh
2.00 p.m. - 2.20 p.m.	Teh Guan Hoe & R.W. Hutchinson: Trace element distribution patterns in cassiterites from different geological environments.
2.20 p.m. - 2.40 p.m.	Sriyanee De Silva: Some petrological aspects of some late Cenozoic Sarawak coal.
2.40 p.m. - 3.00 p.m.	Tan Teong Hing: Estuarine sediments in exploration geochemistry.
3.00 p.m. - 3.20 p.m.	AFTERNOON TEA
	SESSION VII (Miscellaneous) Chairman: Chow Weng Sum
3.20 p.m. - 3.40 p.m.	Tan Boon Kong: On the dispersion stability of the Singapore slime, and its relation to the Malaysian tin mining slime.
3.40 p.m. - 4.00 p.m.	K.R. Chakraborty: Crystallization history of basic intrusive rocks of Singapore and Linden Estate (Johore).
4.00 p.m. - 4.20 p.m.	C.A. Foss & K.R. Chakraborty: Magnetic susceptibility studies of basic igneous rocks of Malaysia.
4.20 p.m. - 4.40 p.m.	Frank Yong Siew Kee: Conservation of geological features in Peninsular Malaysia.
4.40 p.m. - 5.00 p.m.	Closing Remarks by the President.

******

UCAPAN PERASMIAN OLEH PROFESOR DATO' HAJAH ASMAH HAJI OMAR, PEMANGKU NAIB CANSELOR.

Yang Berbahagia Dr. John Kuna Raj, Presiden Persatuan Geologi Malaysia, Tuan-Tuan dan Puan-Puan sekalian,

Saya berasa besar hati kerana telah dijemput menghadiri majlis ini dan seterusnya merasmikan upacara pembukaan Persatuan Geologi Malaysia hari ini.

Saya telah difahamkan bahawa persidangan tahunan ini bertujuan memberi kesempatan kepada ahli-ahli persatuan membincangkan kajian dan perkembangan baru dalam pelbagai bidang geologi, demi kebaikan ikhtisas geologi di Malaysia. Senarai kertas kerja yang akan dibincangkan dalam masa dua hari ini merupakan pencerminan bagi kegiatan-kegiatan penyelidikan yang begitu gigih yang dilakukan oleh ahli-ahli sendiri. Ini adalah satu gejala yang sihat bukan sahaja bagi dunia ilmu, tetapi juga bagi pembangunan negara.

Sumbangan ahli-ahli geologi kepada pembangunan negara adalah satu hal yang tidak dapat dinafikan, khususnya dalam industri perlombongan, industri petroleum dalam pencarigalian petroleum dan gas, industri kejuruteraan dan pembinaan, khususnya dalam penyelidikan sumber airtanah, serta berbagai-bagai aspek yang berhubung dengan pengurusan dan pengawalan keseimbangan alam sekitar.

Sekarang ini memandang bahawa negara mengalami kemelesetan ekonomi, yang antara lain disebabkan oleh turunnya harga bijih timah, maka adalah menjadi tugas ahli-ahli geologi meneroka sumber mineral yang lain daripada bijih timah; lebih-lebih lagi apabila disedari bahawa sumber petroleum yang ada sekarang satu hari kelak akan menjadi kering atau tandus.

Dalam Al-Quran ada disebut bahawa Allah memberi kekayaan di langit dan bumi dan terserahlah kepada manusia bagaimana memanfaatkan kekayaan tersebut. Dengan berpegang kepada firman Tuhan itu, kita tahu bahawa ada banyak sekali kekayaan yang ada di bumi. Jika ada satu kawasan yang ketandusan sumber, pasti ada kawasan yang lain yang mengandungi kekayaan itu. Oleh itu dunia masih luas dan bumi masih dalam untuk digali oleh ahli geologi.

Saya difahamkan bahawa ahli-ahli geologi bukan sahaja menggali, tetapi juga melibatkan diri dalam pemulihan kawasan-kawasan bekas lombong untuk projek-projek perumahan, serta juga dalam tapak projek ampangan, bangunan tinggi dan lebuh raya. Ini semua merupakan usaha yang sungguh mendatangkan manfaat bagi negara.

Saya harap tuan-tuan dan puan-puan semua tidak akan jemu dalam menjalankan penyelidikan dan seterusnya memberi derma bakti kepada negara.

Saya juga mengharapkan forum ini dapat mencapai apa juga yang menjadi matlamatnya.

Dengan sukacitanya saya merasmikan persidangan tahunan Persatuan Geologi Malaysia.

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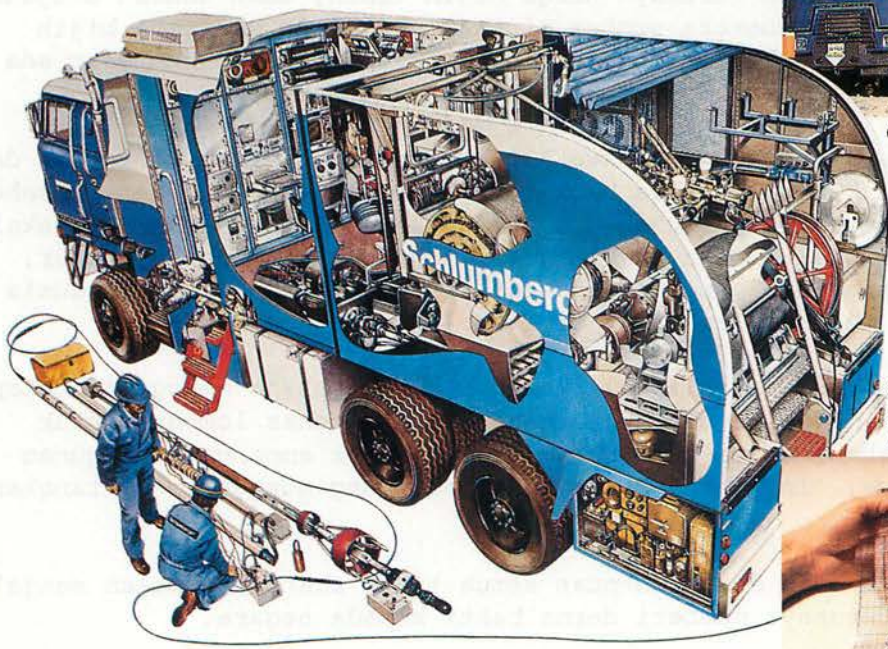

Schlumberger crew checking a logging tool.

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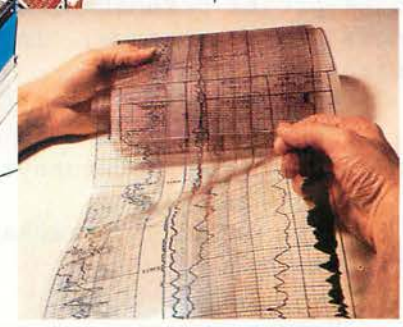

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ANNUAL CONFERENCE '86


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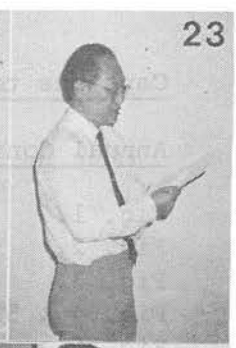
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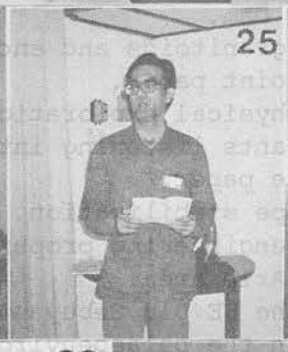
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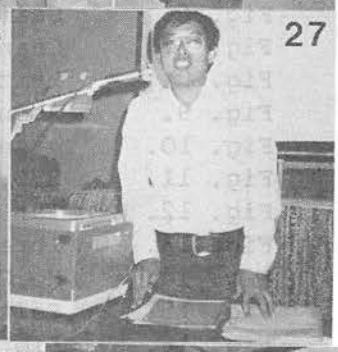
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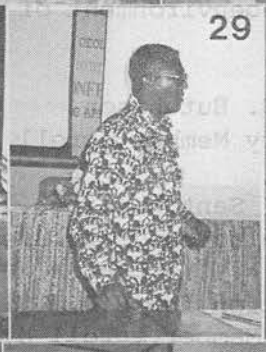
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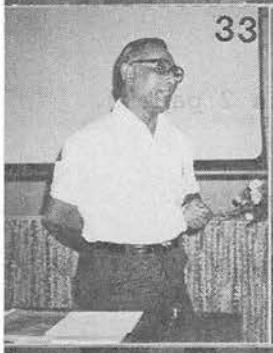
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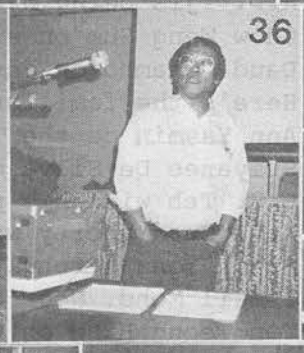
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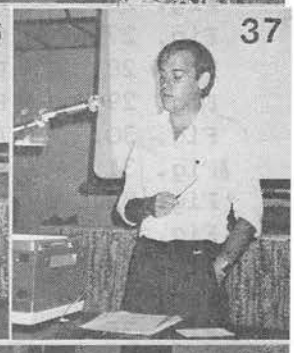
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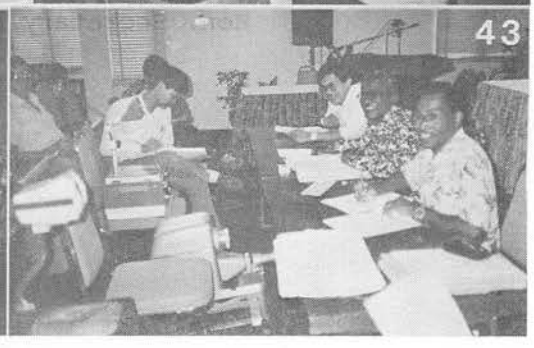
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Captions to figures

Annual Conference '86

Fig. 1. The President, J.K. Raj with his welcoming address.
Fig. 2. Prof. Dato' Asmah with her opening address.
Fig. 3. Prof. Dato' Asmah declaring open the Annual Conference '86.
Fig. 4 & 5. C.S. Hutchison with his keynote paper.
Fig. 6. Saim Suratman on the Batu Dam.
Fig. 7. Chandra Kumar talking on granitoids and enclaves.
Fig. 8. Hamzah Mohamed with his joint paper.
Fig. 9. Abdul Ghani Rafek on geophysical exploration methods.
Fig. 10. A section of the participants listening intently.
Fig. 11. H.D. Tjia with his keynote paper.
Fig. 12. Tan Boon Kong on rock slope stabilization.
Fig. 13. Ibrahim Komoo talking on engineering properties of igneous rocks.
Fig. 14. Ho Chee Kwong on the Sg. Arip area.
Fig. 15. Seitle Singh talking on the SE Ulu Sebuyau area.
Fig. 16. Lim Heng Gaul stressing on the palaeoenvironment of Subis-Ulu Niah area.
Fig. 17, 18, 19 & 20. Lunch break.
Fig. 21. S.P. Sivam with his citation for C.S. Hutchison.
Fig. 22. C.S. Hutchison receiving his Honorary Member scroll from the President.
Fig. 23. E.H. Yin reading the citation for D. Santokh Singh.
Fig. 24. Honorary Member, D. Santokh Singh being congratulated by the President.
Fig. 25. Syed Sheikh Almashoor with the citation for H.D. Tjia.
Fig. 26. H.D. Tjia being handed the Honorary Member scroll by the President.
Fig. 27. Chow Weng Sum on excessive arsenic and fluoride.
Fig. 28. Daud Mohamad on environmental isotopes.
Fig. 29. Here's the familiar participant again with one of his 2 papers.
Fig. 30. Ann Yasmin on the Teres-Bakau area.
Fig. 31. Sriyanee De Silva on late Cenozoic Sarawak coal.
Fig. 32. G.H. Teh with his paper on trace elements in cassiterites.
Fig. 33. K.R. Chakraborty with one of his 2½ papers.
Fig. 34. Frank Yong strongly advocating conservation of geological features.
Fig. 35. Ismail Mohd. Noor on groundwater facies.
Fig. 36. Tan Teong Hing on exploration geochemistry.
Fig. 37. C.A. Foss elaborating on magnetic susceptibility studies.

Annual Dinner '86

Fig. 38, 39, 40, 41 & 42. Members, their wives and friends in a most relaxed mood over dinner.

Annual General Meeting '86

Fig. 43. The President, J.K. Raj chairing the AGM 1986 flanked by the Hon. Secretary and Hon. Treasurer.

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The Indosinian orogeny and the problem of the Triassic basins

Charles S. Hutchison
Dept. of Geology, University of Malaya, Kuala Lumpur

All the major suture zones of South and East Asia, Qinling, Red River-Song Ma, Nan-Uttaradit, and Bentong-Raub, characteristically are associated with Triassic basins. Although debate continues, both the Qinling and the Red River-Song Ma are now interpreted as Devonian-Early Carboniferous (Late Caledonian) sutures that amalgamated the Chinese blocks with Indosinia to form an East Asian Cathaysian Continent. These sutures represent zones of crustal weakness. In the Qinling, the Triassic is represented by thick platform limestones overlain by molasse. The Late Triassic-Early Jurassic (Indosinian) folding thus affected a thin-skinned but clearly continental crust. The Triassic basins of North Vietnam are likewise of molasse underlain by platform limestones and some have important rhyolitic activity. The molasse character is indicated by important coal deposits.

The Semantan-Gemas basin has important differences from the East Asian Continent basins. Permian-Early Triassic volcanic island arc rocks are overlain by a thick Late Triassic (Carnian-Noriam) flysch. Truly molasse sediments became important in the Jurassic, and slightly earlier in Singapore. The close association of the Semantan-Gemas flysch with ignimbritic rhyolite is highly characteristic.

In northern Thailand, the Nan-Uttaradit suture is less compressed than at Bentong-Raub, but there appear to be two flysch basins on either side of the suture - the Lampang and Nam Pat basins. The former continues as the Phong Saly depression west of the Luang Prabang and Dien Bien Phu line, which appears to be the northwards continuation of the Nan-Uttaradit suture.

Doubt has been cast on the interpretation of the Lampang Group as a flysch and allodapic limestones farther east have been taken to indicate that the orogeny was pre-Triassic. A re-study of the Lampang Group is necessary before useful comment can be made on this development.

In Peninsular Malaysia, the Late Triassic-Early Jurassic compressive orogeny has been so severe that the 200-220 Ma old Main Range granites, which were generated from an underlying unexposed continental 1,500 to 1,700 Ma old Proterozoic basement, have risen up into an overlying deep water sedimentary sequence (Hawthornden and Schist Series). In the Genting area the overlying country rocks of the Main Range batholith include important mélanged turbidite units which have been strongly deformed and displaced by a series of eastwards dipping thrust.

The Semantan-Gemas Triassic basin is therefore interpreted as the final deepening of the residual Palaeotethys Ocean before its extinction by collision of the Gondwana continental block of Sinoburmalaya to the west with the East Asian Continent on the east. The spectacular collision was the Indosinian Orogeny, which caused eastwards subduction of the Sinoburmalaya Proterozoic basement and overlying platform strata beneath the island arc which fringed the western miogeoclinal margin of the East Asian Continent. The underthrusting of the continental lithosphere caused crustal thickening in the Main Range area (gravity low) resulting in the spectacular S-type granite batholith, and also caused compression and folding of the Semantan-Gemas strata. A rifting model for the Semantan-Gemas basin is contradictory to the geological information.

The Indosinian orogenic collision would be expected to give a jolt across the whole East Asian Continent and to reactivate the older sutures such as the Qinling and Red River-Song Ma to form shear basins of intermontane character filled with molasse strata.

By analogy, the Early Tertiary collision of India with Eurasia and its continuing underthrusting beneath Tibet has again caused reactivation of the Qinling and Red River-Song Ma suture zones. Both are presently active earthquake strike slip zones characterized by Tertiary grabens.

The Indian collision must have had important reactivation along the older weakness zones in Peninsular Malaysia, but these effects have not yet been fully recognized and documented.

******

Disparate Late Quaternary shorelines in Peninsular Malaysia: Shift of the geoid or crustal movement?

H.D. Tjia
Jabatan Geologi, Universiti Kebangsaan Malaysia, Bangi

About two scores of radiometrically dated shoreline indicators of Late Pleistocene age from the Strait of Malacca and its eastern coastal plain define a sea level curve similar to those constructed for other regions. In Sundaland, which is tectonically stable, about four scores of sea level indicators suggest sea level in the past 6,000 years had reached a maximum of some 5 m above the present level and since then sea level had descended through a series of 2-m high fluctuations to its present position.

Several dated shoreline indicators of the Early Holocene and Late Pleistocene are at elevations several metres higher than those predicted by the constructed sea level curves. In addition, recently a few normal faults with decimetre-range throws have been recorded from Peninsular Malaysia. Together, these evidences suggest that shortly prior to the mid-Holocene either vertical crustal uplift or a shift (probably eastward) of the geoid of the order of a few metres had occurred in the Peninsula.

******

Granitoids, enclaves and magma mixing

S. Chandra Kumar
Maktab Sains MARA, Kuantan

Detailed study of the petrology of Pulau Ubin in the Southern Malay Peninsula has unravelled convincing evidence of the operation of magma mixing in the genesis of certain granitoids. Important features exposed on Pulau Ubin include synplutonic dykes, enclave dykes and the immensely important, newly discovered "globular rock". All these features, in particular the extremely enclave-rich globular rock, demonstrate that the enclave-granitoid association represents a stage in the mixing of magmas of contrasted composition arrested before completion. In this context enclaves represent quenched globules of basic magma within comingled granitoid magma. Enclave formation is a vital stage in the magma mixing process since it greatly increases the area of interface between the comingling magmas.

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Geochemical comparison of the Cretaceous-Tertiary and Triassic granites of the Malay Peninsula

(Pembandingan geokimia granit Trias dan Kapur-Tersier di Semenanjung Malaysia)

Hamzah Mohamad & Mohamad Noor Rani
Jabatan Geologi, Universiti Kebangsaan Malaysia, Bangi

Eighty samples of granites from 13 localities, 50 of Triassic age and 30 of Cretaceous-Tertiary, have been analysed by XRF for ten major and four trace elements. A geochemical comparison of the two types of granites shows that there are no obvious differences in SiO_2, Al_2O_3, MgO, Na_2O, TiO_2, P_2O_5 and H_2O^- content. On the other hand, FeO, Fe(total), MnO, K_2O and H_2O^+ are relatively higher in the Triassic granites, while Fe_2O_3 and CaO are lower, compared to the other type. Rb and Nb are higher in proportion in the Triassic granites, while Sr and Ba are higher in the Cretaceous-Tertiary. Geochemically, the Triassic granites closely resemble the S-type granites of Chappel and White (1974), and ilmenite-series granites of Ishihara *et al.* (1979). It is suggested here that the significant geochemical parameters to distinguish between the two groups of granites are the FeO, K_2O, Rb, Sr, Ba and Nb contents of the rocks.

Lapan puluh sampel granit dari 13 tempat, 50 berusia Trias dan 30 berusia Kapur-Tersier, telah dianalisis sepuluh unsur major dan empat unsur kesannya dengan XRF. Pembandingan geokimia kedua jenis granit ini menunjukkan tidak terdapat perbezaan nyata kandungan SiO_2, Al_2O_3, MgO, Na_2O, TiO_2, P_2O_5, dan H_2O^-. Sebaliknya FeO, Fe (jumlah), MnO, K_2O dan H_2O^+ secara relatif lebih tinggi kandungannya di dalam granit Trias, sementara kandungan Fe_2O_3 dan CaO rendah, jika dibandingkan dengan granit yang sejenis lagi. Rb and Nb tinggi kandungannya di dalam granit Trias, sementara Sr dan Ba pula tinggi kandungannya di dalam granit Kapur-Tersier. Secara geokimia, granit Trias amat menyerupai granit jenis-S Chappel dan White (1974), dan menyerupai juga granit seri-ilmenit Ishihara *et al.* (1979). Dicadangkan di sini bahawa parameter-parameter geokimia yang bererti dalam membezakan kedua-dua kumpulan granit ini ialah kandungan FeO, K_2O, Rb, Sr, Ba dan Nb batuan-batuan tersebut.

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Interfacial energy and spatial distribution of crystals in rocks

K.R. Chakraborty
Dept. of Geology, University of Malaya, Kuala Lumpur.

Grain transition probability studies show that spatial distributions of crystals are not random in most rocks. Nonrandomness lead to preferred crystal association giving rise to higher frequency of like- or unlike-crystal contacts than the expected values. Interfacial energy may be a controlling factor for such preferred crystal association.

Energies associated with the different types of crystal contacts are different, consequently the crystals would be distributed in a pattern that minimizes the high energy contacts in order to minimize the total free energy of the rock. A segregation pattern would tend to develop if the average energy of the like crystal contacts are less than that of the unlike crystal contacts, while an ordered pattern would form for the opposite condition. A preferred association, however, reduces the entropy of the system, thereby raising the free energy. A stable distribution pattern thus probably reflects the net effects of interfacial energy and the configurational entropy.

******

The role of geophysical techniques in Quaternary geology

Abdul Rahim Haji Samsudin
Jabatan Geologi, Universiti Kebangsaan Malaysia, Bangi

In the investigation of Quaternary deposits, geophysical techniques offer considerable advantage over conventional drilling techniques although for most people the methods still retain a 'black box' image. The following paper aims to provide an understanding of the techniques as well as their potential use in the investigation of the Quaternary deposits. Problems associated with the techniques are also discussed.

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Gravity mapping of the coastal plain of Selangor

C.A. Foss
Dept. of Geology, University of Malaya, Kuala Lumpur

Gravity mapping "sees through" the extensive alluvial cover of the coastal plains and allows delineation of those bedrock features which involve rocks of different densities. From Klang to Kuala Selangor the gravity field is dominated by a regional variation which is a continuation of that associated with the main-range granite to the east. Superimposed on this is a local negative anomaly to the southwest of Batang Berjuntai. South of Klang this regional variation is not seen, but there are large (> 10 milligal) anomalies. To the east of Morib is a northeast trending negative anomaly, interpreted as a sedimentary trough which is fault bounded on its western margin. To the north and west of Banting is a broad complex positive anomaly interpreted as due to an igneous complex.

******

Depth of penetration of geophysical exploration methods as applied in shallow engineering geological investigations

Abdul Ghani Rafek
Jabatan Geologi, Universiti Kebangsaan Malaysia, Bangi

This note discusses the depth of penetration of seismic refraction surveys and d.c. geoelectrical soundings. Field examples from studies carried out in the vicinity of the Ruhr-Universitaet, Bochum, Federal Republic of Germany are presented to illustrate the variation of a defined depth of penetration for both these methods.

For seismic refraction surveys it was found that the ratio of the depth of penetration to the length of the profile, a certain depth factor varies between 1/2 to 1/10. This illustrates the difficulty of estimating the depth of penetration before conducting seismic refraction surveys and shows the dependence of the depth of penetration, in addition to the length of the seismic profile, on the p-wave velocity of each subsurface layer and the layer's thickness.

Similarly for d.c. geoelectrical soundings, the depth factor, a ratio of depth penetration to the spacing of current electrodes, varies between 1/3 to 1/8. The main factors influencing the depth of penetration are the number of subsurface layers, their specific resistivity and their individual thicknesses, in addition to the spacing of the current electrodes.

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A case study of the seismic reflection method applied to subsurface geological mapping in the Kuala Lumpur area

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The larger part of the city of Kuala Lumpur is developed over unconsolidated, alluvial sediments of a variable thickness that mainly overlie a marble bedrock. The bedrock has been subjected to extensive solution and possesses a very irregular upper surface that often shows relief differences of up to 30 m over short lateral distances. Determination of the depth to bedrock is thus an important prerequisite for foundation design and presently involves the drilling of variably spaced boreholes. Preliminary results of the seismic reflection method, applied to a small area in the city, show that the method can be successfully used to delineate sites of shallow, and deep, subsurface outcrops of the marble bedrock. It should be noted however, that several factors including signal source, background noise, side reflections, diffractions and multiples, influence this application of the seismic reflection method and much care has to be exercised in the interpretation of the seismograms.

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Engineering properties of some igneous rocks in Peninsular Malaysia

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The engineering properties of more than 100 samples of igneous rocks from 10 different areas in Peninsular Malaysia have been investigated. Rock types include several granitic rocks, rhyolite, andesite, dolerite, basalt and gabbro. The engineering properties investigated were porosity, dry density, Shore's hardness value, point load strength index, uniaxial compressive and tensile strengths, and the stress-strain behaviour.

This paper will discuss results of the investigation, and illustrate the correlation of some important properties which can be used during exploration work. Some of the rock mass properties will also be discussed.

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Lebih 100 buah sampel batuan igneus yang mewakili 10 kawasan di Semenanjung Malaysia telah dikaji sifat kejuruteraannya. Jenis batuan termasuk beberapa jenis granit, riolit, andesit, dolerit, basalt dan gabro. Di antara sifat kejuruteraan yang diselidiki termasuk sifat keliangan, ketumpatan kering, nilai kekerasan Shore, indeks kekuatan beban titik, kekuatan mampatan sepaksi dan tensi, dan kelakuan tegasan-keterikan.

Kertas kerja ini akan membincangkan sifat di atas, dan menghuraikan beberapa perkaitan sifat kejuruteraan yang sesuai terutama untuk tujuan penerokaan. Sebahagian daripada sifat jasad batuan juga akan dibincang.

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The stability of slope cuts along the Kuala Lumpur-Karak Highway

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The Kuala Lumpur-Karak Highway, constructed between the years 1975 and 1978, connects the East and West Coasts of Peninsular Malaysia and forms the most important land transport route across the Main Range. The Highway cuts across a generally hilly to mountainous terrain, developed over a variety of bedrock types, and has thus necessitated the excavation of several deep slope cuts. These slope cuts have been excavated in a variety of earth materials and often expose deep weathering profiles developed over different bedrock types. The stability of these slope cuts is however, open to question for several of them have been affected by failures of different types and sizes. These failures are described in this paper and their causes recognized and discussed. Conclusions are finally reached on the near-future stability of the slope cuts along the Kuala Lumpur-Karak Highway.

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Rock slope stabilization for hillside residential development - A case study in Kuala Lumpur

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A certain residential development scheme sited on hilly, granitic terrain in Kuala Lumpur involved the cutting back of hill slopes for the construction of access roads, houses and condominiums. Excavations in some cases include blasting of the rock slopes, resulting in conditions where the stability has become of major concern.

This paper presents the results of an engineering geologic investigation on the stability of the relevant rock slopes, focussing on the causes of instability and some possible remedial measures that can be undertaken. The causes of instability include poor blasting practices resulting in excessive overbreaks and overhangs, unfavourable joint orientations, faulting and severe weathering of some portions of the rock. Possible remedial measures include rock bolting, scaling and cleaning, controlled blasting to reduce height of rock face as well as to remove major overhangs, and rock buttress.

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Foundation grouting of Batu Dam, Kuala Lumpur

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Batu Dam, located approximately 20 km north of Kuala Lumpur is a multizoned earthfill dam. The dam is founded on schist with the foliation dipping downstream. The grouting works consist of blanket and curtain grouting ranging in depth from 6.5 m to 40 m. One row curtain grouting was designed for the right abutment and a three row curtain grouting for the river valley, left abutment and spillway area. The conditions encountered necessitated minor changing of the hole layout.

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Structural geology of the Macincang Formation, Langkawi Islands

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A recent field study determined that in general, beds of the Macincang Formation have not been overturned despite the fact that at least two phases of deformation affected the rocks. This is interpreted as indicating that the Langkawi islands represent a transitional boundary between the mobile region in the east (including a narrow belt along the east side of the island group) and the, since Early Palaeozoic stable area in the west. The Macincang beds were compressed to form listric faults and large open folds striking north and northeast. Indicators of palaeocurrents and palaeoslope suggest that the original western and eastern edges of the Macincang sedimentary basin are located close to Tanjung Cincin and Kuala Kubang Badak, respectively. A group of rocks with different lithologic and structural character compared to the ordinary Macincang clastics is interpreted to represent pre-Macincang rocks. At Teluk Datai and near Tanjung Buta, these rocks are separated from overlying Macincang beds by a low-angle lag fault and a paraconformity. The reverse motion on the lag fault indicates tectonic transport towards southwest.

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Stratigraphic analysis of the Sungai Arip area and its regional implications

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The Sg. Arip area is located south of the Tatau Horst and north of the main area of Belaga Formation in central Sarawak. The area has a tectonic trend that deviates from the regional strike of the Northwest Borneo Geosyncline. The regional strike is gently arcuate, convex to the south, whereas, the Sungai Arip area has an arcuate trend which is shown by the easterly pitching Arip-Pelugau Anticline.

Four lithostratigraphic units are present in the area, namely, the Bawang Member of the Belaga Formation, Tatau Formation, Buan Formation and Nyalau Formation. Detail fieldwork shows that the Bawang Member was inadequately defined and there is a need to redefine the Member.

The oldest rock unit in the area is the Bawang Member. This is a turbidite unit that was deposited in the Eocene. It suffered folding and faulting in the Late Eocene. The Late Eocene Tatau Formation is unconformable on the Bawang Member. The lowermost part of the Tatau Formation is composed of argillite with globigerinid marl which was probably deposited in open marine environment. It was later uplifted and volcanic rocks was extruded subaerially. Lying on top of the volcanics are conglomerate and sandstone which are probably near shore deposits. The uppermost part of the Tatau Formation is represented by a shallow marine calcareous unit. The transition from the volcanics to the calcareous unit shows that the basin was rapidly subsiding. A major folding phase took place in the Early Oligocene which gave rise to the Arip-Pelugau Anticline. The Kelawit Fault which is a left lateral wrench fault was probably activated at this time. The Buan Formation was deposited in the Oligocene after the folding phase in the deeper part of the basin. In Late Oligocene, a regression took place and caused the lower part of the Nyalau Formation to be deposited in a shallow sea to near shore environment. The Kelawit Fault was rejuvenated during the Miocene where the northern fault block was uplifted. No sediments of Late Miocene age are found in the study area except the Tunggal Tutong Conglomerates which are believed to be of Late Pliocene to Pleistocene age. Presumably the area was uplifted during the Late Miocene causing sedimentation to cease.

Igneous intrusion at Piring Hill is believed to post-date the first movement of the Kelawit Fault in Oligocene. In Quaternary, alluvial sediments were deposited here and there in the lowland.

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Palaeoenvironment of the Subis-Ulu Niah area, Sarawak

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The Subis-Ulu Niah area is mainly underlain by the Setap and the Nyalau Formation which are dated to be from Late-Oligocene to Early-Miocene. The Subis member of the Tangap Formation is found to the north of the mapped area. The sedimentary rocks of the Subis-Ulu Niah area were deposited in a shallow marine environment.

The Nyalau Formation predominantly consists of silty fine sandstone whereby laminations and intense bioturbation are the two most prominent sedimentary features. Other lithologies include massive fine sandstone, nodular mudstones and silty mudstone. Lenticular beds are common too. These lithofacies indicate a near shore low energy environment with tidal influence. Palaeontological evidence with respect to foraminifera and trace fossils support this interpretation.

The Setap Formation consists predominantly of mudstone (shale), subordinate siltstone and sideritic concretions. These concretions form extensive continuous bands imparting pseudobedding characteristics. Evidence from trace fossils, foraminifera and its relations to the laterally equivalent Nyalau Formation and the Subis member support that the Setap Formation in the mapped area was formed within a lagoonal setting whereby the water depth is about 60-100 m. The silty bands in the mudstone (shale) indicate that the depositional environment was calm, affected only by occasional storm. The bioturbation features preserved in the concretions indicates a non-euxinic condition.

The Subis limestone consists predominantly of large benthonic foraminifera, coralline red algae and hermatypic corals. The lithologies range from wackestone to grainstone. The Subis limestone is interpreted to have been formed as a shallow water biohermal mass, in a warm tropical sea.

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Some sedimentological studies in the Teres-Pakau Area, Sarawak.

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3 lithostratigraphic units are present in the area. The Balingian Formation is overlain by the Begrih Formation with an angular unconformity. These two formations are in turn, unconformably overlain by the Quaternary deposits.

The Balingian Formation is of Upper Miocene (?) age and are characterised by the occurrence of rootlet dominated mudstone facies, lenticular bedding facies, nodular mudstone facies and trough and planar cross bedded sandstone facies. These are interpreted to be associated with alluvial meandering channels, levee deposits, overbanks deposits, tidal flat and marine channels.

The Begrih Formation is characterized by extraformational orthoconglomerate, pebbly sandstone facies, laminated shale facies, massive siltstone facies and trough cross-bedded sandstone facies. These facies are interpreted to be associated with alluvial braided channels, estuarines and pebbly to sandy beachface deposits. The microfossils of *Cyclogyra multiplex* found, indicated a Pliocene age to the Begrih Formation. Other microfauna found were *Triloculina sp., Amphisorus sp., Globigerine sp., Globobulimina sp., Sorites sp.* etc.

The evidence for tectonic activity at the end of the Miocene time is the presence of an angular unconformity and the sudden change in clastic sedimentary facies. Detailed study on the heavy minerals indicate an assortment of zircons, hornblende and tourmaline as the major heavies present and a variety of others in lesser amounts.

The variation in the distribution of the heavy minerals in the area is summarised below:

1. The Balingian Formation is characterized by minor amounts of zircons, pyrites and opaque minerals. Zircons are mainly anhedral and cloudy.

2. The Begrih Formation is characterized by much euhedral zircons with substantial amounts of subhedral to anhedral zircons (notably well-rounded ones), varied colours of the zircons (colourless, pink and yellow), hornblende, tourmaline, ilmenite, magnetite, pyrite and the opaques.

3. The Quaternary sediments are characterized by mainly euhedral zircons and minor amounts of subhedral and anhedral zircons. The zircons are usually clouded and are mainly pink and colourless. The most abundant heavy minerals are ilmenite, siderite, biotite and magnetite. Leucoxene, pyrite, goethite and copper occur in minor amounts.

4. There is very little variety and amount of heavy minerals in Late Miocene times. (Balingian Formation)

5. There is an increase in variety and abundance of heavy minerals in Early Pliocene times but later showed slight decrease. (Begrih Formation)

6. There is a sharp contrast in the heavy mineral assemblages of the Quaternary sediments.

7. There is an increase in the variety of mineral species from the Upper Miocene period to the Quaternary period.

Implication

The presence of the various heavy minerals in the area (and also the lack of it) reflect the various provenance of sediments and their structural relief at that time.

The lack of heavy minerals in the Balingian Formation suggests a subdued relief of the hinterland and this probably accounted for the peneplanation of the area.

The sudden appearance of heavy mineral varieties and abundance in the Begrih Formation indicate uplift and new source rocks in the hinterland. The heavy mineral assemblage suggests a provenance from the Lower Rajang areas, mainly the Pirong Hill areas and the adjacent formation, namely the Buan, Tatau, Belaga and the Nyalau Formation which had been gently to intensely folded due to the progressive tectonism in the area.

The global trangressive phase which occurred then had brought the shoreline rather close to the source areas and this accounted for the many euhedral zircons found.

The heavy mineral assemblage of the Quaternary sediments suggests that mainly erosional processes were operating in the area and had eroded much of the older Balingian and the Begrih sediments. This resulted in an increase in the heavy mineral varieties found within the Quaternary sediments.

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Tertiary molasse deposition in the South-Eastern Ulu Sebuyau area, West Sarawak

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The South-eastern Ulu Sebuyau area is located in the 2nd division of Sarawak and is underlain by Tertiary post-orogenic molasse sediments, namely the Silantek Formation and Plateau Sandstone.

The Plateau Sandstone overlies the Silantek Formation conformably in the type locality but with a local angular unconformity in the study area. This unconformity is attributed to a period of uplift, tilting, erosion and non-deposition.

The Silantek Formation ranges from Eocene to probably mid-Oligocene in age. The lithology is mainly conglomerates, arenaceous and argillaceous strata. It can be divided into the Lower and Middle beds based on lithology and stratigraphical relationships. A brackish to fluvial environment of deposition is indicated by this formation.

The Plateau Sandstone is thought to be of mid-Oligocene to Miocene? in age. It consists of thickly bedded to massive sandstone beds with gentle dips. Subordinate shale, mudstone and coal also outcrop here interbedded with the sandstone beds. This formation forms escarpment features which appear to be sandstone ridges. The source of the detritus is believed to be from the north-west region. Fossils are scarce except for plant fragments. Deposition was mainly in a fluviatile environment.

Structurally the area is not complex. Faulting is rare and mild folding has produced gentle anticlines. Uplift of the adjacent areas has most probably controlled the molasse sedimentation here.

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Groundwater facies in Peninsular Malaysia

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The groundwater in Malaysia can be divided into several water-types or facies. The classification of groundwater into facies is based on the analysis of major anions and cations contents of the water. The concentration of the ions are expressed in milliequivalent per litre and under normal conditions the total anions will be approximately equal to the cations. The trend of facies change can be presented in the form of Duror diagram. Generally, it was found that the water changes from calcium bicarbonate type in the interior towards sodium chloride type in the coastal area. However, in some coastal areas where reverse ion-exchange has taken place the chloride facies is of calcium chloride type. Chemically, the groundwater in most areas is within the acceptable limit for drinking or agricultural purposes. Biologically, the shallow groundwater may be contaminated with pathogens as evidence from the high E. Coli count in some well waters.

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A study of groundwater hydrology in the Lower Kelantan River Basin with environmental isotopes

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A study of groundwater hydrology with environmental isotope of the Lower Kelantan Basin is presented. The hydrological problems of major interest here are to study the origin and mechanism of recharge, inter-relation among the aquifers and relation of river water with the wells located near the Kelantan River. The results show that the stable isotopes content of the groundwater in the area vary within a narrow range while tritium data confirm that water from the lower aquifer zone comprises of old water component and most samples from the upper aquifer zone are young water. Carbon-14 investigation was carried out from a few selected deep wells and their ages were found to be in the range of about 2,000 to 11,000 years. The isotopic data demonstrates that the first aquifer is replenished by local recharge through precipitation while the lower aquifer zone seems to be recharged by other source of groundwater originating from the upper aquifer zone. As a whole, the aquifers apparently are inter-connected and regionally they may be considered to represent a single system.

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Recharge of deep aquifer in Kelantan, Malaysia

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The Kelantan Coastal Alluvial plain has a thickness varying from a few metres in the interior to over 200 m near the coast. It consists of several layers of sand/gravel and clay. Generally the alluvium can be regarded to consist of two aquifers; the top shallow aquifer and the lower deep aquifer. However, due to hydraulic connection between the two, the whole alluvial sediments can be regarded as one groundwater system. The general flow pattern of the system is north to northeast. The hydraulic conductivities of the aquifers range between 50 to 250 m/day. Recharge to the top aquifer occurs directly from rainfall, particularly during the northeast monsoon season. The effective recharge to the top aquifer normally takes place a few hours after the beginning of the rain. The fast response of the top aquifer is mainly due to the unconfined condition of the aquifer. Initial tritium study of water in the aquifer shows that the water from the top aquifer has high tritium count and this indicates that it is a fairly young water. The tritium content of the groundwater is similar to the average tritium content of the rain in the area. However, the water from the main Kelantan River also shows similar tritium content. There is a possibility that the river water may be partly responsible for the recharge of the top aquifer.

The lower aquifer which has a vast reservoir of groundwater, generally, has a lower tritium content - an indication of older water than the water of the top aquifer. The hydraulic conductivities of the lower aquifer are generally higher than those of the top aquifer. This means that the flow velocity of the lower groundwater is faster or at least equal to that of the upper aquifer.

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Investigation on the presence of excessive arsenic and fluoride in well-water in Kg. Sekolah, Ulu Kepong

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Some residents in Kg. Sekolah, Ulu Kepong were found to have mottled teeth and subsequent analyses of well water in the area showed the presence of excessive arsenic and fluoride in some wells.

Analyses of river water and drain water, including effluents from some factories and the sewage exidation pond nearby indicated that it was not possible to identify any likely source of contamination by surface runoff.

Chemical analyses carried out in the soil showed a remarkable correlationship between the total and adhered arsenic and fluoride contents of the soil and the content of arsenic and fluoride in the groundwater. Semi quantitative mineral examination of heavy concentrates in the soil showed the presence of excessive fluorite and limonite in some places.

Leaching from the fluorite as well as that of the fluoride-enriched soil leads to excessive fluoride in the groundwater. High total and adhered arsenic content in the soil could result from the breakdown of pyrites and arsenopyrites in the soil. Leaching from the pyrites and arsenopyrites as well as from the arsenic-enriched soil could lead to the presence of excessive arsenic in the groundwater. The breakdown of pyrites and arsenopyrites results in the formation of secondary minerals like limonite and scorodite in the soil.

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Trace element distribution patterns in cassiterites from different geologic environments

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Cassiterites from different geologic environments besides possessing certain distinct to subtle differences in crystallography, physical and optical properties also show interesting differences in minor and trace element contents.

Ionprobe analysis scans through 250 elements revealed distinct trace element distribution patterns for cassiterites from different geologic environments, in particular rare earth elements distribution patterns.

Additional quantitative microprobe analysis of 28 selected minor and trace elements in the cassiterites also showed distinctive trace element distribution patterns.

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Some petrographical implications of the coal from the Mukah-Balingian area

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The younger basin in the south Mukah-Balingian area contains coal seams which are distinctive in outcrop, and therefore used as stratigraphic markers. They represent autochthonous and allochthonous deposits of accumulated plant debris and peat. The environment of formation lay within or close to a landmass.

Interpretation of the palaeo-environment is based on both sedimentalogical and coal analysis. The petrographic analysis of coal, based on its micro-lithotype composition and association, supported the sedimentological evidence for a poralic-fluvial environment of formation. Most of the coal originated autochthonously from the humification of peat formed in swamps.

The coal from the two formations differed mainly in turns of rank. The older Balingian coal is bituminous (*steinkohle*) and is ranked as high volatile A (ATSM rank) while the younger 'Begrih-Liang' coals range from sub-bituminous B to high volatile B (ATSM rank). The rank of the coals were determined by measuring the reflectance of vitrinite.

Petrographic analysis showed the Balingian coals be banded microscopically in which bands of vitrite alternate with clarite v. The morphology of the individual maceral groups were indistinguishable. The presence of vitrinite, resinite and liptodetrinite indicate that the swamp was either inundated or had a high ground water level. Vitrite and clarite v suggest forest-peat litter. Also, the exinite-poor clarite are said to originate from angiosperm forests.

The 'Begrih-Liang' coal, although being of two varieties, the brown coal (*braunkohle*) and bituminous coal (*steinkohle*), contain similar microlithotype compositions and associations. The morphology of the individual maceral groups could be distinguished such as telinite and telocollinite (vitrinite group), resinite and ontinite (exinite group) and fusinite and selerotinite (inertinite group). Pyrite and clay minerals are also present. The interpretation of the 'Begrih-Liang' coal suggest a similar antochthonous mode of formation. Hence, it is suggested that the depositional milieux had not changed since the Upper Miocene.

The Balingian coal and the 'Begrih-Liang' coals were buried to a depth of at least 2,000 m (discounting anomalous geothermal gradients). This suggests that the 'Begrih-Liang' Formation at one time, was at least 5,000 m thick. The present thickness of 3,000 m suggests considerable uplift/epeirogenesis since the Pliocene-Pleistocene boundary. The younger formation coal only straddles the 'oil window' and therefore could be ruled out as being the source of an oil seep in the area of study. The source of the oil seep would most likely be the Balingian coals.

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Estuarine sediments in exploration geochemistry

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Estuarine sediments can be used to target areas of mineralization in the hinterland. Geochemical anomalies invariably occur in estuaries draining from areas with proven mineral deposits. Relatively high geochemical contrasts between mineralized and unmineralized drainage basins are expressed in sediment samples as well as in their heavy fractions. These observations are based on the analyses of sediment samples collected from estuaries present in the Tawau-Semporna peninsula in Sabah.

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On the dispersion stability of the Singapore slime, and its relation to the Malaysian tin mining slime

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This short presentation gives some data on the physical, chemical and mineralogical properties of the Singapore slime, in an attempt to account for its dispersion stability. For further details on the Singapore slime, the two publications listed below can be referred to.

The dispersion stability of the Singapore slime can be attributed to its high clay content, in particular the very significant presence of surface-active montmorillonite. The pore fluid chemistry also shows a predominance of Na^+ over other cations, a condition which is conducive to the dispersion of the clay particles. Measured values of the Zeta-potential range from -35 to -57 mV, indicating that the Singapore slime has moderate to very good dispersion stability.

In comparison, preliminary studies of the Malaysian tin mining slime in the Kuala Lumpur area shows the lack of surface-active montmorillonite, and the predominance of soluble Mg^{2+} over other cations. These major differences would have great implications especially with regard to the applicability of possible chemical treatment methods for the two slimes.

References

1) R.N. Yong, B.K. Tan, C.S. Kim, C.K. Chen & J. Sellapah, 1985. Characterization studies of the Singapore clay slurry (Slime). Geotechnical Engineering, Journal of the Southeast Asian Geotechnical Society, Vol. 16, no. 2, Dec. 1985, pp. 139-166.

2) R.N. Yong, C.K. Chen, J. Sellapah & C.S. Kim, 1985. Stabilization of clay slurry at Tampines, Singapore. Proc. 3rd International Geotechnical Seminar on Soil Improvement Methods, Singapore, 27-29 Nov. 1985, pp. 113-125.

*The author is grateful to Prof. R.N. Yong, William Scott Professor of Civil Engineering & Applied Mechanics and Director, Geotechnical Research Centre (GRC), McGill University, Montreal, Canada, for the opportunity and financial support to work on the Singapore Slime Project during his recent sabbatical leave at GRC.

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Crystallization history of basic intrusive rocks of Singapore and Linden Estate (Johore)

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The basic intrusive bodies at Singapore and Linden Estate (Johore) comprise a consanguineous suite of rocks ranging in composition from allivalite to tonalite, noritic and eucritic rocks being the most dominant members. The crystallization sequence appears to be:

Olivine + Plagioclase $\longrightarrow$ Calcic pyroxene $\longrightarrow$ Orthopyroxene (+ Pigeonite) $\longrightarrow$ Amphibole + Fe-Ti-oxide $\longrightarrow$ Biotite + Quartz.

Separation of early formed minerals has produced different types of cumulate rocks with variable intercumulus phases. Amphibole and other late crystallizing minerals do not occur as cumulus phase. The observed sequence suggests crystallization at shallow depth under progressively increasing P_{H_2O}, and is comparable to the low pressure experimental results of crystallization of calc-alkaline magmas (high alumina basalt).

The occurrence of an orthopyroxene-cumulate rock having orthopyroxene as the only cumulus phase is problematic and implies some complexities in the crystallization history.

Crystallization relationship of the pyroxenes appear to be complex. Inverted pigeonite sporadically occurs with apparently primary orthopyroxene while orthopyroxene and calcic clinopyroxene show cotectic relationship for the major part of the crystallization sequence suggesting a phase geometry where calcic clinopyroxene-pigeonite boundary surface terminates against that of calcic clinopyroxene-orthopyroxene. The cessation of pyroxene crystallization is coincident with the precipitation of amphibole.

The presence of primary cummingtcnite is a unique feature. It is not ubiquitous but precedes hornblende. The magmatic crystallization of cummingtonite is probably conditioned by very low Ca-activity coupled with high a_{H_2O} as well as relatively high a_{SiO_2}/a_{H_2O} ratio.

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Magnetic susceptability studies of basic igneous rocks of Peninsular Malaysia

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Magnetic susceptability values of the basic igneous rocks of Peninsular Malaysia range from 10^{-4} to 10^{-1} SI. Values of 10^{-4} to 10^{-3} SI for the gabbroic rocks of Singapore and southern Johore are unusually low for this rock type and indicate that the opaque phase present is ilmenite. The Singapore dolerite dykes have an identical low susceptability, but the hybrid rocks of Pulau Ubin mostly have high susceptabilities of 10^{-2} to 10^{-1} SI. The extrusive rocks of Segamat have susceptabilities in excess of 10^{-2} SI, except for those which are oxidised, which mostly have susceptabilities in the range 10^{-2} to 10^{-1} SI. The dolerite dykes at Kuantan have susceptabilities of 10^{-2} to 10^{-1} SI, identical to values for olivine nephelinites which are found in the same area. Alkaline olivine basalts associated with the nephelinites have a bimodal susceptability distribution with peaks at 10^{-2} and 10^{-3} SI. Amongst these similar looking rocks at Kuantan only the lower susceptability group of alkaline olivine basalts can be positively discriminated on grounds of magnetic susceptability.

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Conservation of geological features in Peninsular Malaysia

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Inanimate nature geological conservation is the protection from destruction of physical formation and geological phenomena of outstanding scientific geologic value representing the different stages of the earth's geologic history and its transformation through ongoing geological processes.

Conservation takes into account the need for a proper and the most economical exploitation of the country's geologic resource in order to prevent undue waste of this depletive and non-renewable resource.

Various types of geological features may be conserved for the science and study of geology. These features are type sections/localities/areas of geological formations, fossil localities, karstic limestone hills and caves, rock forms, coastline, hot springs, coral reefs and historical man-made mining structures.

In view of land and economic development, the selection of a geological feature for conservation must be pragmatic. The feature should significantly represent one or more aspects of geology and does not duplicate the geology of other features conserved. These features occurring in a state of Peninsular Malaysia may be conserved in a State Park (land and marine), Nature Reserve, Nature Monument and Geological Site (of special scientific interest). Geological Site is a new category of conservation area in this country, proposed in this study.

Geological features are studied in various earth science disciplines by various universities in the country. A CODE FOR GEOLOGICAL FIELDWORK is proposed for adoption to conserve geological localities for future fieldstudy from vandalistic "hammer-happy" fieldworkers and from indiscriminate wasteful collecting.

Geological features in Peninsular Malaysia that are worthy for conservation are evaluated.

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ANNUAL GENERAL MEETING

The 20th Annual General Meeting of the GSM was held at the Rumah Universiti, University of Malaya, Kuala Lumpur at 4.00 p.m. on Monday 28th April 1986.

The meeting was attended by 23 members. The minutes of the 19th AGM was passed without any amendments and discussion.

President's Report

In his Presidential Report, Dr. J.K. Raj said that 1985/86 was another eventful year for the Society. Many technical talks which were well attended were held. The 1985 Petroleum Geology Seminar was another success. Dr. Raj also added that 1985/86 also saw the appointment of three prominent geologists as Honorary Members. Publications of the Society continued to be published regularly. He added that the Sub-Committee on Professional Geologists Act has produced a Draft of the Proposed Act. A Protem Committee has to be appointed to proceed with the next step. The President took the opportunity to thank all those who help the Society during the past year and hoped that they will continue to support the Society. The report was accepted.

Honorary Secretary's Report

Dr. S. Paramananthan, the Hon. Secretary in his report outlined the major activities of the GSM in the last year. Members from the floor expressed concern with the large amount of stock of publications carried by the Society. The report was accepted.

Editor's Report

Dr. G.H. Teh, the Editor, outlined the progress on the publications. He informed members that Vol. I of Geosea (Bull 19) is being bound and will be ready for sale by mid-June. Vol. II (Bull 20) will be ready by August. Dr. Teh added that to date only $19,600/= in adverts has been collected. Members suggested that Council consider reducing the price of the two volumes (GEOSEA) from the recommended $40/= for members. Council was also asked to look into having Abstracts in Bahasa Malaysia in all future publications. The Editor's report was accepted.

Honorary Treasurer's and Honorary Auditor's Report

Mr. Chow Weng Sum, the Hon. Treasurer, presented both the reports. He pointed out that although there was a significant drop in excess of income over expenditure, this was partly due to the payment of some publications published in 1984 being paid in 1985. The Society was still financially sound. Both the reports were accepted.

Election of Honorary Auditor

Mr. Peter Chew was then elected to be the Hon. Auditor for 1986/87.

Other Business

a) Professional Geologists Act

The President traced the history of this matter. The Sub-Committee

has now prepared a draft Act. The next step would be to appoint a Protem Committee the members of which would automatically be Professional Geologists. After a lot of discussions the floor agreed that the incoming Council draw up a list of members to serve on the Protem Committee and then circulate to Members for approval.

b) GEOSEA Conference

To a query from the floor, the Chairman confirmed that this will be held in Bandung in 1987. No details were however available.

New Council (1986/87)

The Chairman then announced the new Council:

President:	J.K. Raj (U.M.)
Vice President:	Ahmad Said (Petronas)
Hon. Secretary:	S. Paramananthan (U.P.M.)
Hon. Asst. Secretary:	Ibrahim Komoo (U.K.M.)
Hon. Treasurer:	Chow Weng Sum (Geol. Sur. Malaysia)
Hon. Editor:	Teh Guan Hoe (U.M.)
Councillors (2 years):	Wan Fuad Wan Hassan (U.K.M.)
	Koh Tuck Wai (Petronas)
	Idris Mohamad (U.M.)
	Khee Koh Kean (Esso)
(1 year):	Azhar Hj. Hussin (U.M.)
	Albert Loh (MMC)
	Ahmad Tajuddin Ibrahim (U.M.)
	Vacant

Hon. Secretary

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PERSATUAN GEOLOGI MALAYSIA
(GEOLOGICAL SOCIETY OF MALAYSIA)

Minutes of the 19th Annual General Meeting held at the Hotel Dayang, Petaling Jaya at 2.30 p.m. on 13th April 1985.

The meeting was called to order by the President, Mr. Leong Khee Meng.

Present:	Leong Khee Meng (Chairman)	Syed Sheikh Almashoor
	Albert Loh	Michael Leong
	Chow Weng Sum	J.K. Raj
	Ian Metcalfe	Yin Ee Heng
	Hamzah Mohamad	Gan Ah Sai
	Koh Tuck Wai	S. Paramananthan (Secretary)
	Choo Mun Keong	Andrew Spykerman
	T.T. Khoo	Azhar Hj. Hussin
	Mohamad Shah Abdullah	B.K. Tan

Absent with apologies: C.S. Hutchison (overseas)
G.H. Teh (overseas)
Idris Mohamad (outstation)
K.R. Chakraborty

1. Confirmation of the Minutes of the Previous AGM

The minutes of the 18th AGM were confirmed on the proposal of Mr. Andrew Spykerman and seconded by Mr. Choo Mun Keong.

2. Matters Arising

There were no queries or comments from the floor.

3. President's Report

Mr. Leong Khee Meng presented his report for 1984/85. He reported that the Council set three priorities during this term of office. These were for (i) Council to work as a cohesive unit; (ii) the Society to be on a financially sound basis and (iii) publications to be released more regularly. In general the Council had managed to achieve most of these goals. The President also highlighted some of the achievements of the Society.

The Sub-Committee set up to study the proposal on establishing the Institute of Professional Geologists Malaysia had made its recommendations and the in-coming Council would have to look into this. Also special attention should be made on the relationship between the Professional Members of GSM vis-a-vis the Institute. Being a Professional Member may not automatically enable membership in the Institute.

For the first time a prominent geologist has been recommended for an award by the Agung. We are hopeful that this nomination will be successful.

Council also decided that Honorary Member should be given a Certificate and Mr. S.K. Chung would be the first recipient.

During the current term no Young Geoscientist Award was made as no suitable nomination was received.

The President also suggested that the in-coming Council look into the possibility of getting a permanent room somewhere.

The President thanked all Council Members and Members who have helped the Society. In particular he wished to thank Dr. S. Paramananthan who took the role of Honorary Secretary and Editor. Also he thanked all donors and the University especially the Head of Geology Department, University of Malaya.

Mr. Mohamad Shah suggested that with a view to cut down expenses the Society should consider publishing the WARTA quarterly and also to reduce the pages by not publishing things already published in earlier issues.

Dr. T.T. Khoo responded that money is never enough but if the WARTA is published quarterly the authors have a longer wait or the issues may become thicker and hence the cost may be the same.

Dr. Metcalfe commented that looking at the Financial Statement the Society was still healthy.

Mr. Mohamad Shah also suggested that the new Council should consider buying a permanent site.

Dr. Khoo added that if the Society buys a property then the achievements such as publications will suffer as the Society would be financially tight. Other bodies such as IKM/IEM have buildings due to the Act which guarantees income from membership.

Mr. Hamzah Mohamad suggested that some talks could be held at UKM.

The President said that the Council has tried to do this and suggested that the new Council look into this.

The President's Statement was then accepted on the proposal of Dr. T.T. Khoo who also proposed a vote of thanks to the President and the Council. It was seconded by Mr. Choo Mun Keong.

4. Presidential Address

Mr. Leong then gave an informal Presidential Address on the topic "Malaysian Geologists in the Corporate Orbit". He asked why were there very few geologists (local) as directors of mining companies, etc. In Indonesia a geologist was appointed as Director Public Affairs and another as Director of Corporate Affairs of PERTAMINA but why not in Malaysia. Even Tan Sri Raja Mohar during the Petroleum Geology Seminar remarked that the geologists are little known. The factors that hinder us, Mr. Leong said was because geologists are individuals and never agree and hence seldom work as a team. Geologists lack diplomacy and are never exact however they are risk takers. Mr. Leong with the use of view-graphs illustrated the qualities required of being a director and also the pyramid structure of corporations. He concluded that if geologists want to make it to the top they should not be technocrats alone. He concluded that geologists can make it to the top if they try.

5. Honorary Secretary's Report

The Honorary Secretary's Report was presented by Dr. S. Paramananthan. The Report outlined the major activities of the Society and also the state of membership and publications of the Society.

Dr. Azhar Hj. Hussin proposed the Report to be accepted. This was seconded by Mr. Koh Tuck Wai.

6. Editor's Report

Dr. S. Paramananthan, Acting Editor presented his Report where he outlined the state of the publications. He said that the GEOSEA V papers will be published as Bulletin nos. 18 & 19 and these should be ready by September 1985. He also touched on the progress of the other publications.

Dr. Metcalfe proposed that a vote of thanks and appreciation to Dr. S. Paramananthan be recorded for the work he is doing in his capacity as Acting Editor. This was seconded by Dr. J.K. Raj and accepted by the floor.

7. Honorary Treasurer's and Honorary Auditor's Reports

Both these Reports were presented by the Honorary Treasurer, Mr. Gan Ah Sai. Mr. Gan clarified that although the excess of income over expediture shown in the statement is very high, this is not really so as a number of bills were paid in early 1985.

Mr. Choo Mun Keong said that in future the Financial Statement should also carry an item for committed expenditure and this would be more realistic.

Both the reports were accepted on the proposal of Dr. T.T. Khoo and seconded by Mr. Choo Mun Keong.

Mr. Koh Tuck Wai proposed that a vote of thanks be recorded for the work of Mrs. Anna Lee and Mr. Peter Chew. This was seconded by Dr. T.T. Khoo and accepted by the floor.

8. Election of Honorary Auditor

Mr. Gan Ah Sai informed the Members present that Mr. Peter Chew has agreed again to continue as GSM's Hon. Auditor for the coming year 1985/86. Mr. Gan Ah Sai then proposed a motion to appoint Mr. Peter Chew as Hon. Auditor and this was seconded by Dr. S. Paramananthan and accepted by the floor. Dr. Param also informed the Members that the Society will be presenting Mr. Peter Chew with a pewter plaque in recognition of his contribution to the Society.

9. Other Business

Mr. Choo Mun Keong wanted an up-date on the Proposed Institute of Professional Geologists. Mr. Koh Tuck Wai said in addition to those already mentioned by the President the Sub-Committee proposed that the in-coming Council look into (i) Constitution; (ii) areas to be covered by the Act and (iii) Membership of the Board.

He added if these can be tackled quickly it may be possible for the Act to be tabled in 1985.

Mr. Choo suggested that Council look into the possibility of this Report being included in the WARTA for Members to comment.

10. Announcement of New Council (1985/86)

The Chairman announced the new Council for 1985/86. He added however that few Members had already resigned (due to being overseas) and that in accordance with the Constitution only the Council could fill these vacancies.

President	:	Dr. John Kuna Raj (Universiti Malaya)
Vice-President	:	Dr. S. Paramananthan (Universiti Pertanian)
Honorary Secretary	:	Mr. Mohd. Ali Hasan (Universiti Malaya)
Honorary Asst. Secretary	:	Mr. Koh Tuck Wai (Petronas Carigali)
Honorary Treasurer	:	Mr. Chow Weng Sum (Geological Survey)
Editor	:	Dr. Teh Guan Hoe (Universiti Malaya)
Councillors (2-year)	:	Dr. Abdullah Hasbi Hj. Hassan (SEATRAD Centre)
		Mr. Ahmad Said (Petronas)
		Dr. Azhar Hj. Hussin (Universiti Malaya)
		Mr. Albert Loh (MMC)
(1-year)	:	Dr. Abdul Hamid Mohamad (Universiti Kebangsaan)
		Dr. Hamzah Mohamad (Universiti Kebangsaan)
		Mr. Michael Leong (Petronas)
		Mr. Yin Ee Heng (Geological Survey)
Immediate Past President	:	Mr. Leong Khee Meng (Petronas)

Dr. J.K. Raj then took over the Chairmanship of the meeting. He thanked Mr. Leong Khee Meng and all the other Members of the Council for the good work they have done and hoped that the in-coming Council could also keep on the good work.

Dr. Raj also informed Members that due to the meeting of ASCOPE the Society may not be able to hold the Petroleum Geology Seminar this year. If that was the case then financially we would be tight and the activities would have to be curtailed. Members however felt we should have the Seminar probably after the ASCOPE meeting so that participants from ASCOPE can also attend the Seminar of the Society.

There being no other business the meeting adjourned at 4.30 p.m.

11 May 1985.

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PRESIDENT'S REPORT 1985/86

The past year 1985/86 has proved to be another eventful and successful year for the Society, though it was intially anticipated that it would have been a lean one in terms of activities. Several activities were organized and were well attended by members of the Society. This was particularly true of the many technical talks that were organized. These talks covered a broad range of topics of geological interest and were presented by several eminent geologists including Prof. Skinner of Yale University, Prof. Uyeda of Tokyo University and Prof. Briden of Leeds University. A total of some 19 talks were organized and proved extremely beneficial to members who heard of current ideas and developments on a wide range of geological topics. In acceptance of a proposal made at last year's AGM furthermore, the venues for talks hosted by the Society were moved around and included the Departments of Geology, both in the University of Malaya and in Universiti Kebangsaan Malaysia. In order to encourage the participation of undergraduates in geological research, the Society hosted a Graduates Evening at which two recent graduates of the University of Malaya presented results of their fourth year project reports. It should also be noted that this year's AGM is being held in conjunction with a two-day Conference organized by the Society. This Conference provides an opportunity for local and other geoscientists to present results of their research activities and it is hoped that such a Conference will be an annual affair.

The Petroleum Geology Seminar 1985 was again held successfully and very well supported by the Petroleum Industry. This Seminar is one of the more important activities of the Society and aims at promoting the dissemination of knowledge and experience on various aspects of petroleum geology. In this respect the support of industry, governmental agencies and academia is acknowledged and appreciated and it is hoped that this support will continue. The 1985 Seminar was very well attended with a total of some 200 participants who listened to 18 presented papers. The successful organization of this year's Seminar is particularly gratifying in view of the committment of Industry to other Petroleum Conferences and grateful thanks are extended to the Organizing Committee headed by Mr. Michael Leong. In connection with this year's Seminar furthermore, a Special Bulletin on Petroleum Geology was able to be published by the Society. This Bulletin contains papers presented at past Petroleum Geology Seminars and its publication underlines the Society efforts in promoting the dissemination of knowledge and experience in Petroleum Geology. It should be noted that the Society also hopes to publish in another special Bulletin the papers presented at this year's Petroleum Geology Seminar as soon as formal approval from PETRONAS for release of the submitted papers is received.

The past year has also seen the election of three senior Members of the Society to Honorary Membership. These Honorary Members comprising Mr. Santokh Singh, Prof. Hutchison and Prof. Tjia were considered by Council as being all meritorious of election to Honorary Membership and in view of their contemporary stature it was decided to honour all of them simultaneously. All of them have contributed significantly towards the unravelling of Malaysian geology and have played definitive and involved roles in activities and publications of the Society. I take this opportunity to congratulate all three of them and trust that they will continue to provide their unabated support to the Society.

Publications of the Society have continued on an even keel with regular issues of the Newsletter and Bulletin. The long awaited Bulletins containing the proceedings of GEOSEA V have also finally seen the light of day with the first volume, i.e. Bulletin 19 having been printed while the second volume, i.e. Bulletin 20 will be printed by the end of July. Order forms for the purchase of these two volumes have been circulated to members and other interested parties. It is to be noted that these two volumes are being offered for sale to members at a price of M$40.00 (for both) as the Society intends to recover part of the costs of publication.

With reference to the Professional Geologists Act, it is to be noted that the Sub-Committee looking after this matter has come-up with a rough draft of the proposed Act. In view of the Society's committed role in only helping to set-up the procedural framework for the formulation of the Act, however, Council has decided that a separate Society be set-up to push forward by itself for the final formulation and implementation of the Act. A draft Constitution has already been drawn-up for this Society that is to be known as the Malaysian Institute of Geologists, though no pro-tem Committee has been set-up. In view of the difficulty of naming this pro-tem Committee, Council has decided to seek the views of members during this AGM. At this point, I would like to extend my thanks to the Sub-Committee headed by Mr. Koh Tuck Wai who have spent a lot of time and effort in drawing-up the drafts of the proposed Act and the Constitution of the proposed Institute. Mr. Chin Lik Suan is also thanked for his effort and assistance in these matters.

In closing I take this opportunity to thank all fellow members of Council who have generously contributed of their time to ensure the successful management of the Society over the past year. I also take this opoortunity to thank the Heads of the Departments of Geology of both the University of Malaya and the Universiti Kebangsaan Malaysia for their support of Society's activities. I finally express my thanks to all individuals and organizations who have provided invaluable support and contributions to the Society's activities over the past year.

21 April 1986

HONORARY SECRETARY'S REPORT

(April 1985 - March 1986)

1. Council

The Council of the Geological Society of Malaysia (GSM) for the 1985/86 term was as follows:-

President:	Dr. J.K. Raj (University of Malaya)
Vice-President:	Dr. S. Paramananthan (Universiti Pertanian Malaysia) (resigned 13/4/85)
	Mr. Yin Ee Heng (Geological Survey Malaysia) (from 13/4/85)
Honorary Secretary:	Mr. Mohd. Ali Hasan (University of Malaya) (resigned 13/4/85)
	Dr. S. Paramananthan (Universiti Pertanian Malaysia) (from 13/4/85)
Honorary Asst. Secretary:	Mr. Koh Tuck Wai (Petronas-Carigali)
Honorary Treasurer:	Mr. Chow Weng Sum (Geological Survey Malaysia)
Editor:	Dr. Teh Guan Hoe (University of Malaya)
	(Dr. S. Paramananthan acted from Nov., 1984 to August, 1985)
Councillors (1985-1987):	Dr. Abdullah Hasbi Hj. Hassan (SEATRAD Centre) (resigned w.e.f. 7/3/86)
	Mr. Ahmad Said (Petronas)
	Dr. Azhar Hussin (University of Malaya)
	Mr. Albert Loh (MMC)
Councillors (1985-1986):	Dr. Abdul Hamid Mohamad (Universiti Kebangsaan Malaysia) (resigned w.e.f. 13/4/85)
	Dr. Hamzah Mohamad (Universiti Kebangsaan Malaysia)
	Mr. Michael Leong (Petronas)
	Mr. Yin Ee Heng (Geological Survey Malaysia) (resigned 13/4/85)
	Dr. Idris Mohamad (University of Malaya) (w.e.f. 13/4/85)
	Dr. Wan Fuad (w.e.f. 13/4/85)
Immediate Past President:	Mr. Leong Khee Meng

2. Resignations

Due to the number of resignations which took place as a result of various circumstances, some changes in the Council were made at the first meeting of the Council held on 13/4/85.

These changes were:

i) Dr. S. Paramananthan resigned as Vice-President to become Honorary Secretary to replace Encik Mohamad Ali Hasan.
ii) Mr. Yin Ee Heng was appointed Vice-President.
iii) Dr. Abdul Hamid Mohamad resigned as Councillor and Dr. Idris Mohamad was appointed to replace him.
iv) Dr. Wan Fuad Wan Hassan was appointed to replace Mr. Yin who was appointed Vice President.

Dr. Hasbi resigned from Council w.e.f. 7/3/86.

3. Council Meetings

The GSM Council 1985/86 met twelve (12) times over the last year. Meetings were normally held on the first Friday of every month. As required the Council established a number of Sub-Committees such as the Nominations Committee, Young Geoscientists Publication Award etc.

4. Membership

The total membership of the Society as of 31st March 1986 was 399. A breakdown of the membership is given in Table 1.

5. Activities of the GSM

The GSM continued to remain active during the year. Once again a very successful Petroleum Geology Seminar was held in December 1985. The activities of the GSM for the period from April 1985 to March 1986 are listed in Table 2.

6. Publications

The sales of the Publications of the Society during the year have been rather slow. The Society still continues to carry a large amount of the stock. In an effort to reduce this, a number of 'package deals' were offered for sale but yet this did not improve sales. The stock as of 31st March 1986 and sales in 1985/86 are given in Table 3.

7. Regional Representatives

The following members were reappointed as the GSM's Regional Representatives:

a) Mr. Aw Peck Chin (Ipoh)
b) Mr. Victor Hon (Sarawak)
c) Mr. Lim Peng Siong (Sabah)
d) Mr. Loke Meng Heng (P. Pinang)

8. Amendments to the Constitution

The Amendments of Article V. Section 2 regarding the election of office bearers were approved by the Registrar of Societies. These changes will therefore be implemented for the election of the Council for 1986/87. A copy of the revised Constitution of the GSM is being printed and will be circulated to members shortly.

9. Young Geoscientists Award

The winner for this year was Mr. Lye Yue Hong. His award was based on the publication of his undergraduate research work in Bulletin 17.

10. Matters Arising from the AGM

a) Institute of Professional Geologists

The Sub-Committee has finalised the draft of the Constitution for the Institute and this will be circulated to members shortly. The outgoing Council hopes that the Institute can be a reality by 1986 or 1987.

11. <u>Summary</u>

In general, the GSM has had a relatively active and successful year. The Council would like to take this opportunity to thank all sponsors/organisers who assisted in the seminars/talks etc. Thanks are also due to the many donors who have continued to support the Society with financial assistance.

The Society wishes also to place on record the appreciation and thanks for the support given by many organisations (in particular, the Department of Geology, University of Malaya) and individuals without whose support the Society could not carry out its activities successfully. Last but not least, thanks are also due to all members of the GSM who have continued to support the activities of the Society.

Dr. S. Paramananthan
Honorary Secretary

31st March, 1986.

Table 1: Membership of the Society

Country	Full	Full/ Professional	Life/ Professional	Life	Institutional	Associate	Student	Honorary
Malaysia	172	24	4	6	10	13	15	3
Africa					1			
Australia	20	5	1		2			
Canada	4							
Europe	23			2	8		1	1
Hong Kong	2							
Indonesia	5							1
Japan	11							1
New Zealand	2							
Singapore	16				6		1	
Taiwan	1							
Thailand	6			1	1			1
United Arab Emirates	1							
U.S.A.	24	1		1	1		1	
Total	287	30	5	10	29	13	18	7

Table 2: Activities of the Geological Society of Malaysia (April 1985 - March 1986)

	Date	Activity	Organisers/Speakers	Place
Technical Talks				
1.	12 June 1985	Environmental trace element geochemistry of the Kelang Basin	Bruce Nelson (Univ. of Virginia)	Universiti Malaya
2.	13 July 1985	A geostatistical study of global and local reserves in an Indonesian Primary tin deposit	Prof. A.J. Sinclair (Univ. of British Columbia Canada)	SEATRAD Centre
	15 July 1985	- Do -	- Do -	Univ. Malaya
3.	15 July 1985	Changing patterns of mineralization through geologic time	Prof. Brian J. Skinner (Yale University, U.S.A.)	Universiti Malaya
4.	16 July 1985	Environments and styles of mineralization in massive sulfide deposits	Prof. Brian J. Skinner (Yale University, U.S.A.)	Universiti Malaya
5.	29 July 1985	Recent advances in the C^{14} dating techniques	Dr. Michael Barbetti (Sidney Univ., Australia)	Universiti Malaya
6.	29 August 1985	Petang Siswazah a) Stratigraphy of Mantannani Islands, Sabah. b) Stratigraphy of the Suan Lamba area, Sabah.	Kok Keng Hung (Universiti Malaya) Chush Teong Ban (Universiti Malaya)	Universiti Malaya Universiti Malaya
7.	30 September 1985	Shuttle Imaging radar (SIR-B) in resource survey	John Ford (California Institute of Technology, U.S.A.)	Kuching
8.	18 October 1985	Models for Epithermal Gold Deposits	D.J. Kirwin (Townsville, Australia)	Universiti Malaya
9.	26 October 1985	a) Perbandingan Fasies Formasi Bt. Kenny dan Formasi Bt. Dinding b) Contact Metamorphism and Matrix recrystallization of the Setul Limestone, Langkawi.	Hamzah Mohamad (UKM, Bangi) Khoo Teng Tiong (Univ. Malaya)	UKM, Bangi UKM, Bangi
10.	31 October 1985	Pegmatitic tin occurrences in Africa	Dr. Oleg Von Knorring (Univ. of Leeds)	Universiti Malaya
11.	27 November 1985	Did the flowering plants (angiosperms) first evolve in Malaya? - A geological look at the problem.	Prof. M.G. Audley-Charles (Univ. College, London)	UKM, Bangi.
12.	11 December 1985	Habitat of onshore oil accumulations in Southern England.	Dr. Bruce Sellwood (Univ. of Reading)	Universiti Malaya.
13.	12 December 1985	Carbonate platform and platform-collapse facies in the Mesozoic Tethys	Dr. Bruce Sellwood (Univ. of Reading)	Universiti Malaya
14.	15 January 1986	Melange and subduction in the Outer Zone of Southwest Japan	Dr. Shigeki Hada (Kochi Univ., Japan)	Universiti Malaya
15.	21 February 1986	Africa to Europe Motions and the Tectonics of the Alpine - Mediterranean Region	Dr. Alan Smith (University of Cambridge)	Universiti Malaya
16.	17 March 1986	On Subduction Zones	Prof. S. Uyeda (Japan)	Universiti Malaya
17.	20 March 1986	Palaeomagnetism and Tectonic Displacement	Prof. J.C. Briden (Univ. of Leeds)	Universiti Malaya

Table 3: Stock of Publications

Bulletin No.	Sales 1985/86	Stock Remaining
1	17	187
2	20	500
3	18	535
4	18	499
5	18	242
6	19	873
7	18	642
8	18	241
9	15	165
10	15	160
11	14	421
12	16	282
13	16	189
14	18	280
15	20	220
16	59	222
17	714*	286
18	700*	300
Field Guide 1	19	207
Abstracts (Bulletin 6)	2	38
Stratigraphic Correlation	36	692

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* Inclusive of free copies to members

EDITOR'S REPORT

The Society's *Warta Geologi* made its regular appearance in 1985 while *Bulletin 18*, a special volume on Petroleum Geology, was brought out in time for the Petroleum Geology Seminar '85.

Bulletin 18 besides having coloured illustrations also introduced coloured advertisements in the Society's Bulletin Series for the first time.

The Society's newsletter, the *Warta Geologi*, also went colour in the Jan-Feb 1986 issue with an advertisement from Schlumberger Overseas S.A.

The GEOSEA V PROCEEDINGS (*Bulletin 19* and *20*) are in the final stages of publication. Volume I will be available in April/May 1986 and Volume II in July/August 1986. Members will be charged a nominal sum for the 2 volumes and it is hoped that members will come forward readily to help the Society offset the publication costs for these 2 voluminous PROCEEDINGS containing 95 articles and over 1,000 pages in total.

The Editor appreciates the good work of the Acting Editor and the Editorial Advisory Board and those who unselfishly chipped in with valuable assistance. The Society is also grateful to the authors for their worthy contributions and the many advertisers and donors who came forward in the year with valuable financial assistance towards the Society's Publication Fund.

HONORARY TREASURER'S REPORT, 1985

The excess of income over expenditure for the year 1985 is M$39,067.70. This value represents a drop in the excess of income over expenditure for 1985 when compared with 1984 though it should be pointed out that publication costs were high due to the payment for the printing of Bulletins 16 & 17 in 1985. There has been in 1985 a substantial increase in income derived from subscriptions, advertisements in publications and sales of publications. Increase in income from subscriptions has been due to the increase in membership fees while the increase in advertisements in publications has been due to a drive by Council to offset publications costs. Increase in the sales of publications has finally resulted in part from Council's attempt to reduce present stocks of publications by offering special package deals for earlier published Bulletins. In comparison with 1984 furthermore, there is a decrease in the interests for fixed deposits, though it should be noted that this is due to the absence of maturation of some fixed deposits which have been placed for 15 months maturation periods as compared to 3 & 6 months maturation periods for 1984. On the whole the Society remains in a financially sound situation with a total of M$174,570.88 placed in fixed deposits.

I wish to thank all donors and all members of the Society who have supported the Society's activities for the year.

Last but not least, I also take this opportunity to thank the Society Honorary Auditor, Mr. Peter Chew for sacrificing much of his precious time in providing excellent services to the Society and also for agreeing to continue as the Society's auditor for yet another year.

(CHOW WENG SUM)
Honorary Treasurer

24th April, 1986.

REPORT OF THE AUDITORS TO THE MEMBERS OF THE GEOLOGICAL SOCIETY OF MALAYSIA

To Members of the Geological Society of Malaysia

We have obtained all the information and explanations necessary for the purpose of this audit and in our opinion the accounts for the year ended 31st December 1985 give a true and fair view of the state of the Society's financial affairs.

CERTIFIED PUBLIC ACCOUNTANTS
AUDITORS

Date: 21 April 1986
Kuala Lumpur

PERSATUAN GEOLOGI MALAYSIA
(GEOLOGICAL SOCIETY OF MALAYSIA)

INCOME AND EXPENDITURE ACCOUNT FOR
THE YEAR ENDED 31 DECEMBER 1985

INCOME	1984	1985	
Entrance fee	$ 550.00	$ 515.56	
Subscriptions	15,269.59	22,774.09	
Fixed deposits interest	12,223.87	10,368.84	
Advertisements	1,500.00	3,200.00	
Sales of publications	4,385.71	10,158.01	
Professional Membership	300.00	50.00	
Petroleum Geology Seminar 1984	39,929.79	30,799.85	
Xerox	224.15	3,534.47	
Rockcon/Border Workshop	23.00	-	
Economic Geology Seminar/GEOSEA V	-	2,585.69	
Advertisements: Bulletin 18	-	8,000.00	
	$74,406.11		$91,986.51
LESS EXPENDITURE			
Bank charges	$ 489.75	$ 486.60	
Depreciation on office equipment	2,409.00	2,409.00	
Honorarium	3,111.00	4,071.00	
Postage	3,337.22	4,467.86	
Printing & Stationary:			
Misc. $ 2,071.10	650.80		
Newsletters 6,259.50	7,939.50		
Bulletin 16 9,800.00	-		
Bulletin 17 17,000.00		35,130.60	
Refreshments	101.50	820.60	
Subscription to Professional bodies	-	100.00	
Sundry expenses	460.60	1,294.10	
Annual General Meeting	348.00	520.00	
Telephone expenses	400.50	465.90	
Speakers' Account	1,341.55	2,387.95	
Geoscience Education Project	522.65	-	
Annual Dinner	-	765.20	
	$21,112.07		$52,918.81
EXCESS OF INCOME OVER EXPENDITURE	$53,294.04		$39,067.70

PERSATUAN GEOLOGI MALAYSIA
(GEOLOGICAL SOCIETY OF MALAYSIA)

BALANCE SHEET AS AT 31 DECEMBER 1985

FIXED ASSETS	1984	1985	
Office equipment	$ 24,099.02	$ 24,099.02	
Less: Accumulated depreciation	13,792.00	16,201.00	
	$ 10,307.02		$ 7,898.02
CURRENT ASSETS			
Fixed deposits	$105,386.82	$174,570.88	
Expenses prepaid:			
Telephone deposit	300.00	300.00	
Cash at bank	90,761.81	66,309.51*	
Petty cash	-	160.28	
	$196,448.63	$241,340.67	
LESS CURRENT LIABILITIES			
Subscriptions in advance	$ 396.00	-	
Petty cash	200.52	-	
Geosea V	6,532.65	-	
Donations/Advertisements: Bull. 21/22		1,000.00	
	$ 7,129.17	$ 1,000.00	
	$189,319.46		$240,340.67
	$199,626.48		$248,238.69
Represented by			
CAPITAL FUND			
Balance as at 1.1.85	$100,538.06	$152,345.33	
Add: excess of income over expenditure	53,294.04	39,067.70	
	$153,832.10		$191,413.03
Student Loan Fund	10,101.91		10,101,91
Petroleum Geology Seminar 1985	33,684.05		44,563.34
Young Geoscientist Award	2,008.42		2,160.41
	$199,626.48		$248,238.69

*Committed expenditures:

a) Petroleum Geology Seminar '85 - $15,091.82
b) Bulletin 18 14,000.00
c) Transfer to fixed deposits - 20,000.00
d) Warta Geologi - 1,800.00

BERITA-BERITA PERSATUAN
(NEWS OF THE SOCIETY)

PROGRESS OF SOCIETY'S PUBLICATIONS

Bulletin 19, GEOSEA V PROCEEDINGS Vol. I.

Printing is completed. The Volume I of a 2-volume set will be available in mid-June. It has a meaty 652 pages.

Bulletin 20, GEOSEA V PROCEEDINGS Vol. II.

Typesetting is in its final stages.

Bulletin 21

With 3 additional papers from the Annual Conference '86 this volume has now 6 papers under consideration.

Bulletin 22 - Special Issue on Petroleum Geology Vol. 2.

There are now 9 papers being considered for this volume. One each from CPC, GSI and Schlumberger, and 6 papers (5 from SHELL and 1 from ESSO) awaiting PETRONAS' approval. The Editor has written to Mr. Leong Khee Meng, who is PETRONAS' Exploration Manager, requesting his help to facilitate an early clearance of the papers so that we can get the volume out before the GSM Petroleum Geology Seminar '86. It is hoped that Mr. Leong, who is the Society's Immediate Past President, will help expediate the **release** of the papers concerned.

FIRST 20 ADVANCE ORDERS FOR GEOSEA V PROCEEDINGS

Since the call for advance orders for the GEOSEA V PROCEEDINGS in mid-April, we have received 60 orders so far. We are pleased to announce the first 20 advance orders received - our appreciation for their valuable support and hope other members and organisations will follow the example set by the first 20.

1. Tan Teong Hing - UKM, Bangi.
2. C.S. Hutchison - UM, Kuala Lumpur.
3. S. Sandrasagaram - UM, Kuala Lumpur.
4. Khoo Han Peng - Geological Survey Malaysia, Ipoh.
5. Geological Survey Malaysia Library - Ipoh.
6. Mohamed Shah b. Abdullah - Shah Alam.
7. A. Aziz b. Hussin - UTM, Kuala Lumpur.
8. Huzaidi b. Hashim - Cement Industries Malaysia, Perlia.
9. C.P. Lee - University of Liverpool.
10. J.A. Richardson - Western Australia.
11. John M. Cleara - Perth, Australia.
12. P. Loganathan - Geological Survey Malaysia, Seremban.
13. Syed Sheikh Almashoor - UKM, Bangi.

14. H. Sawata - Chiba-shi, Japan.
15. Ho Kok Kett - Dengkil, Selangor.
16. Che Aziz b. Ali - UKM, Bangi.
17. Kamal Roslan b. Mohamed - UKM, Bangi.
18. Shu Yeoh Khoon - Geological Survey Malaysia.
19. Au Yong Mun Heng - Petaling Jaya.
20. C.R. Pietersz - Victoria, Australia.

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KEAHLIAN (MEMBERSHIP)

The following applications for membership were approved:

Full Members

Howard John Smith, Gearhart Geodata Services Ltd., 118 Tagore Lane, Singapore 2678.
Kamaludin bin Hassan, Geological Survey Lab., P.O. Box 1015, 30820 Ipoh, Perak.
Rohaiyah Ismail, Sarawak Shell Berhad, 98100 Lutong, Sarawak.
Brian David Outlaw, Britoil (Alpha) Ltd., Setiabudi Building 1, A2, 4-6, Jl. H.R. Rasuna Said, Jakarta Selatan.
Uyop Said, Jabatan Geologi, Universiti Kebangsaan Malaysia, Bangi.
Kamal Roslan Mohamed, Jabatan Geologi, Universiti Kebangsaan Malaysia, Bangi.

Institutional Member

Petrofina S.A. Far East Exploration Office, 138, Cecil Street # 12-01, Cecil Cecil Court, Singapore 0106.
Phillips Petroleum Co. Far East, 51 Goldhill Plaze # 19-01 Newton Road, Singapore 1130.

Associate Member

Dr. Ting Wen Hui, 18, Jln. 20/10, Damansara Kim, 47400 Petaling Jaya.

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PERTUKARAN ALAMAT (CHANGE OF ADDRESS)

The following members have informed the Society of their new addresses:

Frederick Newcomb, 5 Baker Court, Rancho Mirage, CA 92270, U.S.A.
Juhari Bin Mat Akhir, Department of Environmental Science, University of Stirling, Stirling FK9 4LA, Scotland.
Che Aziz Bin Ali, Jabatan Geologi, Fakulti Sains Fizis Dan Gunaan, Universiti Kebangsaan Malaysia, 43600 UKM Bangi.
Chue Hang Cheong, 188 Lorong Maarof, 59000 Kuala Lumpur.
T.R. Sweatman, c/o Stephen Eric Consultants Pte. Ltd., 10 Anson Road # 16-23, International Plaza, Singapore 0207.
Choo Mun Keong, 36, Jalan SS21/1, Damansara Utama, 47400 Petaling Jaya.
N.C. Tallis, Phillips Petroleum Company, 6330 W. Loop South, Bellaire, Texas 77401, Phillips Building, Houston.
Jasvir Singh, No. 63 Jalan 8/1, Section 8, Shah Alam 50000, Selangor.
Robert B. Tate, c/o New House Farm, Hatton, Warrington, Cheshire, United Kingdom.

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PERTAMBAHAN BARU PERPUSTAKAAN (NEW LIBRARY ADDITIONS)

The following publications were added to the Library:

1. Bulletin Centres de Recherches Exploration - Production Elf Aquitain, Vol. 7 (nos 1 & 2), 1983 and Vol. 8 (nos. 1 & 2), 1984, Vol. 9 (nos. 1 & 2), 1985.
2. National Geophysical Research Institute, Hyderabad, Annual Report 1984-1985.
3. Journal of the Faculty of Science, The University of Tokyo, Vol. 21, no. 2, 1985.
4. Oklahoma Geology Notes, Vol. 45, nos. 4-6, 1985.
5. Landplan II: Role of geology in planning and development of urban centres in Southeast Asia. Edited by B.K. Tan and J.L. Rau, 1986.
6. Memoirs of the Ehime University, Vol. X, no. 2, 1985.
7. National Library Singapore, adult reference collections. Accessions list, Dec. 1985 and Jan-Mar & April 1986.
8. Bulletin of the American Museum of Natural History, Vol. 181, article 2, 1985.
9. American Museum Novitates, nos. 2829, 2831, 2832, 1985.
10. Bulletins of the Geological Survey of India, no. 48, 1982.
11. Commonwealth Science Council, Newsletter, Jan-Feb, & Mar-April 1986.
12. Institution of Mining & Metallurgy, Transactions. Section A, vol. 95, 1986.
13. Scripta Geologica, no. 78, 1985.
14. Seatrad Bulletin, Vol. VI, no. 4, 1985.
15. AAPG Explorer, Feb & March 1986.
16. AGID News, no. 46, 1986.
17. The Journal of the Geological Society of Korea, vol. 21, no. 4, 1985.
18. Chronique de la recherche miniere, no. 482, 1986.
19. Bulletin of the Institution of Mining and Metallurgy, no. 951, 1986.
20. Institute of Geoscience, The University of Tsukuba, Annual Report, no. 11, 1985.
21. Episodes, Vol. 9, no. 1, 1986.
22. Bulletin of the Chinese Academy of Geological Sciences, no. 11, 1985.
23. The University of Kansas, Paleontological contributions, Paper 117, 1986.
24. Bulletin of Statistics Relating to the Mining Industry of Malaysia, 1983.
25. Report and statistics relating to the Mining industry in Malaysia, 1982.
26. Geological Literature of USSR. Bibliographical year book for 1981 year, Vol. I & II, 1985.
27. Geophysical Research Bulletin, Vol. 24, no. 1, 1986.

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BERITA-BERITA LAIN
(OTHER NEWS)

CAMPUS ROUND-UP - GEOLOGY DEPARTMENT, UNIVERSITY OF MALAYA

The months of March and April 1986 appeared to be a most busy and eventful time at the Geology Department, University of Malaya. First of all there was the final examinations and the visits made by both the external examiners for Geology and Applied Geology, namely Prof. S. Uyeda and Prof. J. Briden (see section on Technical Talks in this issue).

On April 1st, Assoc. Prof. S.P. Sivam was appointed the new Head of the Geology Department by the Vice-Chancellor, replacing Prof. B.K. Tan. Congratulations are also in order for Dr. John Kuna Raj (President of Geological Society of Malaysia) on being promoted to Associate Professor.

As one of the first duties as Head, Assoc. Prof. S.P. Sivam received a cheque for M$10,000 from Encik Yusuf Hashim on behalf of SHELL in a simple ceremony at the department. The grant is SHELL's annual contribution to the financing of the department's students working on their theses field areas in Sabah and Sarawak. The company has made about M$50,000 in annual grants to the university since 1980.

S.P. Sivam receiving the cheque from Yusuf Hashim of SHELL.

G.H. Teh

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EMPLOYMENT CORNER

Malaysian Geologist seeks a geological position with a firm in or around Kuala Lumpur, preferably in the petroleum or engineering/geotechnical industry. Other types of employment, especially management also happy to consider. Married, male, 38 with B.Sc (Hons), University of Malaya 1974. Experience as mud logging geologist April 1974 - November 1980, Advanced Drilling Technology (ADT) Engineer December 1980 - December 1981, Petroleum

Geologist January 1982 - April 1983 and later briefly as Consultant Geologist and Sales Representative. Sitting for final paper of Association of Business Executives (ABE) diploma in June 1986. Resume on request. Code ECOO1, *Warta Geologi.*

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THESES TITLES 1985/86 UNIVERSITY OF MALAYA

1. The geology and gravity survey of Kuala Kelawang-Durian Tipus area, Jelebu, Negeri Sembilan by Abd. Rahim Nurdin, 1986. 85 pp.

2. Palaeontology and biostratigraphy of Bukit Panching, Kuantan, Pahang, Malaysia by Azlan Mohd. Sabirin, 1986. 71 pp.

3. Geologi Struktur Tanjung Sedili Besar dan Tanjung Tebal, Kuala Sedili, Kota Tinggi, Johor by Azahab Hassan, 1986. 76 pp.

4. The geology of the South Mukah-Balingian Area, Sarawak by Sriyanee de Silva, 1986. 136 pp.

5. Stratigraphy, Sedimentology and Palaeontology of the Teres-Bakau area, Mukah, Third Division, Sarawak by Ann Yasmin Nordin, 1986. 112 pp.

6. The geology and metamorphism of the Kedah Peak area, Kedah by Salahuddin Aminy b. Jamaluddin, 1986. 60 pp.

7. Geologi am kawasan Bahau, Negeri Sembilan by Othman Ali Mahmud, 1986. 66 pp.

8. Geologi am kawasan Paloh, Keluang, Johor by Zamani Jantan, 1986. 65 pp.

9. Structural geology of Tanjong Siang, Tanjong Balau and Tanjong Lompat, East of Johore, Malaysia by Mohd. Daud Hashim, 1986. 87pp.

10. The general geology of the Simpang Rengam area, Kluang, Johore by Azman Abd. Aziz, 1986. 77 pp.

11. Geologi am kawasan Keruak, Ulu Besut, Terengganu by Badrul Hisam Ismail, 1986. 79 pp.

12. Petrografi dan geokimia bagi kawasan Bukit Rambutan, Besut, Terengganu by Sirattal'Aini Abdul Hamid, 1986. 69 pp.

13. The general geology of the South-Eastern Ulu Sebuyau area, West Sarawak, East Malaysia by Seitle Singh Dhillion, 1986. 125 pp.

14. Geology of an area south of Bahau by Yeap Kok Loo, 1986. 59 pp.

15. Geologi kawasan Kemaman, Negeri Terengganu by Lim Thiam Chang, 1986. 55 pp.

16. The geology and biostratigraphy of Pulau Langgun, Langkawi, Kedah by Zulraini Mohd. Dahlim, 1986. 97 pp.

17. Geologi kawasan Bukit Tujoh, Bukit Sembilan dan Chegar Perah, Lipis, Pahang by Norisman Ismail, 1986. 66 pp.

18. The general geology of Kepayang-Singkalan area, West Sarawak, East Malaysia by Chai Ted Seng, 1986. 116 pp.

19. Sedimentologi, stratigrafi dan struktur bagi kawasan Raub, Pahang by Mohd. Zuhar Haron, 1986. 80 pp.

20. Petrographic studies of Gunung Sumalayang Limestone, in the Sungai Sedili Area, Johore, West Malaysia by Mahidah Ab. Wahab, 1986. 47 pp.

21. The geology of Terbat area, Sarawak, Malaysia by Mohd. Shukri Abdullah Sani, 1986. 90 pp.

22. Geologi dan paleontologi kawasan Sg. Chiku, Gua Musang, Kelantan by Abd. Nasir Janaro, 1986. 76 pp.

23. Geology of eastern Pengerang and Tanjung Penawar, Southeast Johore by Razu Shawari, 1986. 68 pp.

24. Sedimentologi, stratigrafi dan struktur kawasan Sg. Rek-Sg. Sam, Kuala Krai, Kelantan by Mohd. Razali Che Kob, 1986. 128 pp.

25. Stratigraphy, sedimentology and structural geology of Stapang-Bukit Singalang area, Central Sarawak by Lancelot Sering, 1986. 94 pp.

26. General geology of South-west Langkawi, Kedah, Malaysia by Soo Meng Fook, 1986. 70 pp.

27. Stratigraphy, sedimentology and structure of the Sungai Arip area, Third Division, Sarawak by Ho Chee Kwong, 1986. 98 pp.

28. Geologi dan geomorfologi bagi kawasan Kampung Seledang, Setiu, Terengganu by Omar Salleh, 1986. 79 pp.

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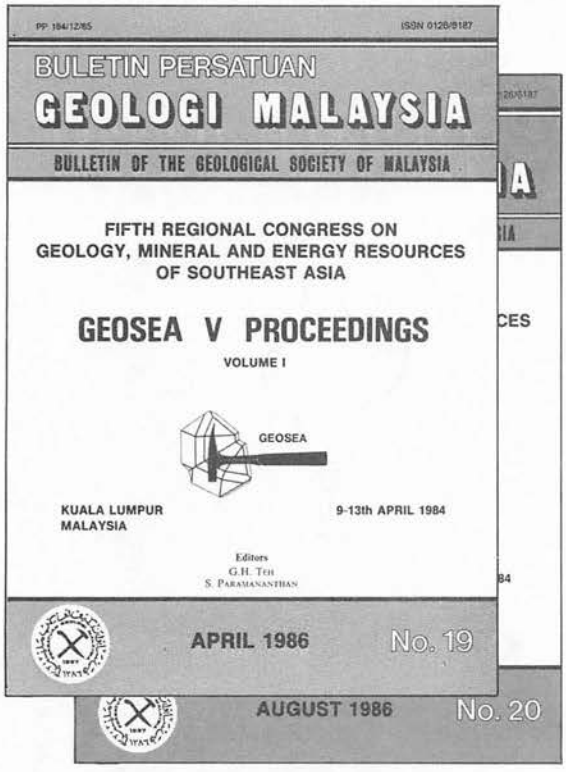
GEOLOGICAL SOCIETY OF MALAYSIA

GEOSEA V PROCEEDINGS

VOLUMES I & II

(Bulletin Geological Society of Malaysia Nos. 19 & 20)



Some of the articles appearing include:-

Massive sulphide deposits and their possible significance to other ores—R.W. Hutchinson; **Palaeogeographic development of west Sarawak**—Denis N.K. Tan; **Geological evolution of the Southern Philippines**—C.K. Burton; **Southeast Asia as a part of an early Palaeozoic Australian Gondwanaland**—C. Burrett & B. Stait; **Tertiary basins of S.E. Asia—their disparate tectonic origins and eustatic stratigraphical similarities**—C.S. Hutchison; **Late Palaeozoic palaeogeography of Southeast Asia: some stratigraphical, palaeontological and palaeomagnetic constraints**—I. Metcalfe; **The REE geochemistry of Lingshan W-Sn-bearing granites and their applications to petrogenesis of the granites**—Yuan Zhongxing *et al.*; **Chromite deposits of Papua New Guinea**—P.M. Afenya; **Recent advances in exploration modelling for tin deposits and their application to the SE Asian environment**—R.G. Taylor & P.J. Pollard; **Some thoughts on the development of the alluvial tinfields of the Malay-Thai Peninsula**—D. Taylor; **Base metal exploration in Sabah**—David T.C. Lee & H.S. Weber; **The nature and potential of gold mineralisation in Kelantan**—L.H. Chu & D. Santokh Singh; **Quaternary deposits of Thailand**—P. Dheeradilok & W. Kaewyana; **Soil landscapes in Peninsular Malaysia**—S. Paramananthan & S. Zauyah; **Aspects of the geochemistry of Malaysian cassiterites**—W. Fuad Hassan; **Geological evolution of the Indonesian Archipelago**—H.M.S. Hartono & S. Tjokrosapoetro; **The nature, distribution and genesis of certain authigenic minerals in the stanniferous alluvial deposits of S.E. Asia**—K.F.G. Hosking; **Global tectonics and resources**—W.S. Fyfe; **Tin/tungsten-bearing granites in S. China and their metallogenetic relations**—Xu Keqin & Zhu Jinchu; **Hydrogeological activities in Peninsular Malaysia and Sarawak**—F.S. Chong & Denis N.K. Tan; **Status of uranium exploration in Peninsular Malaysia**—L.H. Chu & F. Chand; **Directions of geologic transport in Peninsular Malaysia**—H.D. Tjia; **Cathaysia, Gondwanaland and the Palaeotethys in the evolution of Continental S.E. Asia**—Y.G. Gatinsky & C.S. Hutchison; **Marginal sea formation by rifting of the Chinese and Australian Continental Margins and implications for Borneo**—C.S. Hutchison; **Mesozoic and Cenozoic regional tectonics and metallogenesis in Mainland S.E. Asia**—A.H.G. Mitchell; **Coal potential and exploration in Sarawak**—S.P. Chen; **The succession of vertebrate faunas in the continental Mesozoic of Thailand**—E. Buffetaut & R. Ingavat; **Regional controls of hydrothermal ore localization in northern Thailand**—P. Asnachinda & S. Chantaramee; **Late Palaeozoic glacial marine facies in S.E. Asia and its implications**—P.H. Stauffer & C.P. Lee. **Cretaceous melange in West Kalimantan and its tectonic implications**—P.R. Williams *et al.*; **Recent advances in the knowledge of geology, mineral and energy resources of Singapore since 1981**—Ansafur Rahman & P.P. Wong; **The integration of remote sensing, terrain evaluation and engineering geology in Southeast Asia**—Beaumont, T.E. & Hunt, T.; **Recent advances in the knowledge of geology and mineral resources of Vietnam since 1981**—Le Thai Xinh & Nguyen Xuan An.

This 2-volume GEOSEA V PROCEEDINGS of about 500 pages each contains 95 articles presented at the Fifth Regional Congress on Geology, Mineral and Energy Resources of Southeast Asia held in Kuala Lumpur, April 1984.

To: Hon. Assist. Secretary
Geological Society of Malaysia,
c/o Department of Geology,
University of Malaya,
59100 Kuala Lumpur, MALAYSIA.

Date: .....

Order for GEOSEA V PROCEEDINGS

I wish to place an order for ..... set(s) of the GEOSEA V PROCEEDINGS which will be in 2 volumes of about 500 pages each. Volume I will be available in April/May 1986 and Volume II in July/August 1986.

Both Volumes	**Price**
Members	M$50.00 (US$21.90)
Non-members	M$125.00 (US$53.20)

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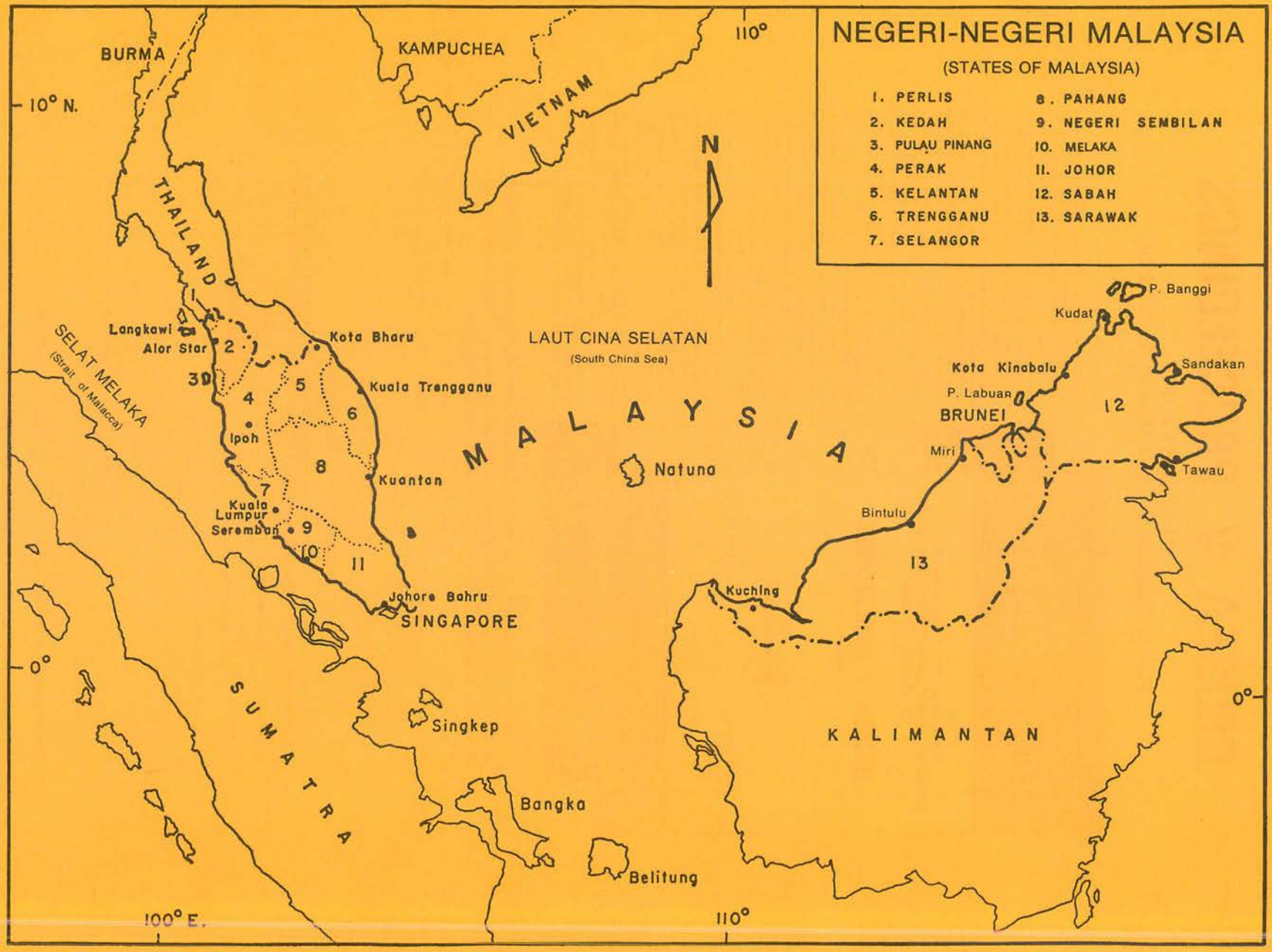
NEGERI-NEGERI MALAYSIA
(STATES OF MALAYSIA)
1. PERLIS
2. KEDAH
3. PULAU PINANG
4. PERAK
5. KELANTAN
6. TRENGGANU
7. SELANGOR
8. PAHANG
9. NEGERI SEMBILAN
10. MELAKA
11. JOHOR
12. SABAH
13. SARAWAK
BURMA
KAMPUCHEA
VIETNAM
THAILAND
10° N.
110°
N
LAUT CINA SELATAN
(South China Sea)
MALAYSIA
SELAT MELAKA
(Strait of Malacca)
Langkawi
Alor Star
Kota Bharu
Kuala Trengganu
Ipoh
Kuantan
Kuala Lumpur
Seremban
Johore Bahru
SINGAPORE
Natuna
P. Banggi
Kudat
Kota Kinabalu
Sandakan
P. Labuan
BRUNEI
Miri
Tawau
Bintulu
Kuching
KALIMANTAN
SUMATRA
Singkep
Bangka
Belitung
0°
100° E.
110°