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About the Society

The Society was founded in 1967 with the aim of promoting the advancement of earth sciences particularly in Malaysia and the Southeast Asian region.

The Society has a membership of about 600 earth scientists interested in Malaysia and other Southeast Asian regions. The membership is worldwide in distribution.

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CATATAN GEOLOGI
Geological Notes

A new Earth theory for the new Millennium

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Hatton, Warrington
WA4 4DA
Cheshire, U.K.

Are you dissatisfied with Plate Tectonics because the theory does not explain every problem? Do not despair! As a change from looking down a microscope or hammering exposures, take a look at a new theory which has been devised by Professor Karsten M. Storetvedt, a geophysicist at the University of Bergen, Norway.

Working in conjunction with the late Professor S.K. Runcorn, Professor Storetvedt has, during the past 25 years, developed an alternative theory to Plate Tectonics. Noting that the rocks in Antarctica were deposited in warm water over a long period of time, Professor Storetvedt questions the validity of polar-derived tilloids in South America, South Africa, India and Australia. The glacial rocks are thought to have been deposited in a cold spell rather than prolonged polar glaciation. The Ordovician South pole was located in central Africa (for example, tilloids are reported from the late Precambrian in Nigeria and Angola) and gradually migrated — in a series of jerks — towards its present position in Antarctica. Thus in the geological past, the Earth's orientation in space was at 90 degrees to its present position. Paleo-equators from 450 million years ago through to present have moved in short-lived spasms with intervening long periods of stability. These tectonic spasms cause widespread volcanism with eruption of plateau basalts. There have been seven distinct spasms since the Precambrian, the paleo-South pole eventually reaching Antarctica about 35 million years BP at the start of processes which lead to the Quaternary Ice Age. The spasms occur when the Earth's axis is out of alignment with the astronomical (celestial) axis (see Fig. 1); when both axes coincide, the Earth is stable.

Polar magnetic curves imply relative motion of the continents and only small rotational adjustment is required to explain the known polar-wandering curves. Reorientation of continents does not occur until Alpine time. Submarine trenches occur mostly around the Pacific rim and there are no subduction sinks around Antarctica. Although several tectonic plates appear to be moving towards Antarctica, Antarctica is not under compression. Africa and Antarctica are stationary but they should be moving apart according to the spreading centres between them! The trenches are largely empty of sediments and those which are found are often flat lying and undeformed. The heat flow at ocean ridges is considered not to be excessive.

In the early Paleozoic, the continents were formally covered by the sea; much of N America was under water in the Ordovician and between then and the late Permian, the sea receded to cover only 20% before returning during the Upper Mesozoic. Today there is more dry continent exposed than at any time since the Cambrian. Water is coming to the surface of the Earth continuously during the volcanic process and the total amount of water in the Earth's system has increased, yet the continents have become drier.

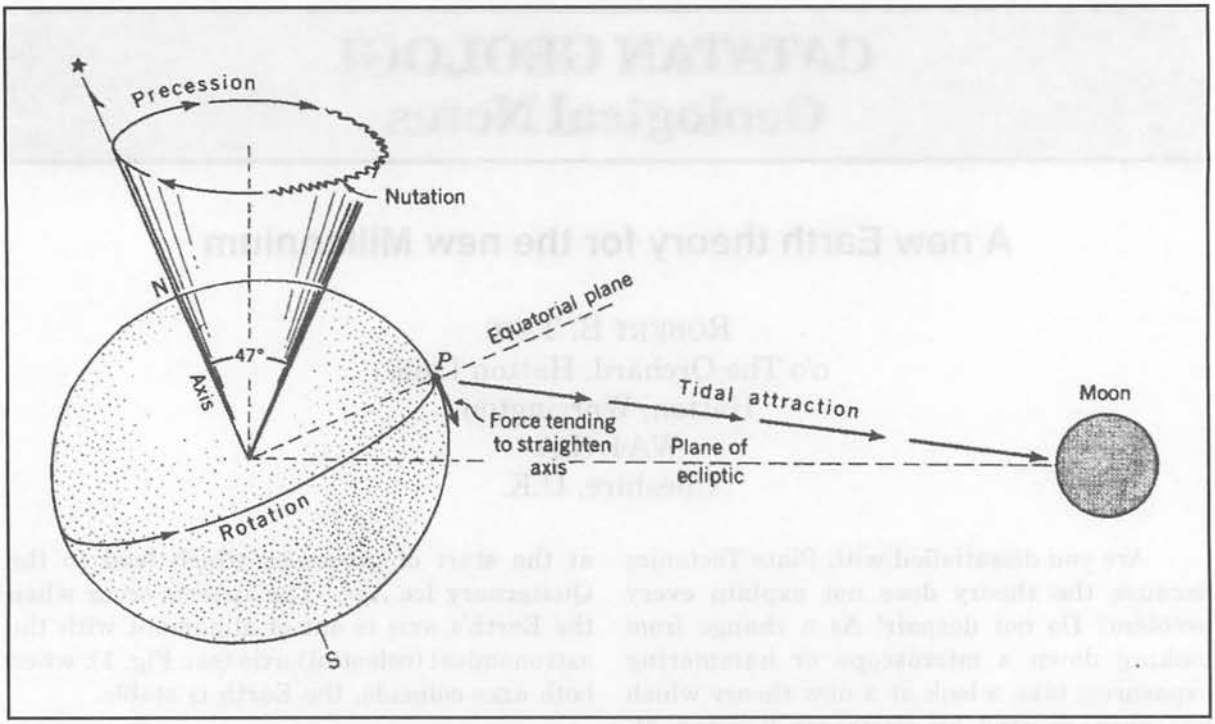

Figure 1. Spasms occur when the Earth's axis is out of alignment with the astronomical (celestial) axis.

As planet Earth cooled, a massive reorganisation of the Earth's interior has resulted in oceanisation being greater in the southern hemisphere; the oceanic basins are secondary features and the density of the core is lower than expected. The mantle under the continents is lighter than under the oceans and this is confirmed by seismic thermography. Mantle upwelling creates oceanic crust which is stable whereas the continents become unstable although continents were initially stable when the Earth was first formed.

The oceanic crust rises and falls periodically; whenever there is a rise, there is increased volcanism and when a fall increased sedimentation. Continental crust varies a great deal in thickness and basins develop where the crust is thinner. Chemical erosion explains thinning of the crust largely along the continent/ocean margins. The erosion process begins at the Earth's core and causes a phenomenon termed *oceanisation*, a theory developed by Beloussov in the Fifties. Fluids from the core have destroyed the early Pan-continental sialic crust which has broken down. As the crust becomes thinner, updoming and collapse occur in the surface layers with injection and eruption of basalt. These phenomena are apparent in the Basin and Range Province in N America , in Tibet where there is no mantle but updoming is beginning. In the Peruvian-Bolivian Altiplano — the largest inland region of drainage in South America which includes Lake Titicaca — there is collapse but as yet no basalt and in the Mediterranean where updoming took place in the Lower Cenozoic followed by a two-stage collapse, with the formation of salt basins in the Upper Cenozoic and final collapse in the Quaternary.

Many continental fragments remain in the oceanic crust provide evidence in support the oceanisation theory. Iceland sits astride the mid-Atlantic ridge MORB basalts yet the basalts contain granite pebbles and in other ridges, blocks of quartzite and thermo-metamorphic rocks have been found within oceanic basalts. The Pre-Cambrian greenstone belts in Africa represent the beginnings of oceanisation; the oceanisation process does not start fully until the Cretaceous. Prior to the Lower Cenozoic there were no deep ocean basins.

Some of the more contentious conclusions involve tectonics and include mountain building which is thought to be a recent phenomenon and is the last most important phase in Earth evolution. The Mesozoic was flatter with almost no topography and high mountains did not appear until the late Miocene. There are two great circles of tectonic activity at right angles, the Circum Pacific and the Alpine belt. In the Alpine belt, the tectonic zones young from N to S which is explained by changes in speed of rotation and the Coriolis effect (see diagram). During Alpine time, there was compression towards the equator and rotation of continents. In the Hercynian, magmatic extension was caused by deceleration; acceleration causes compression and injection/uplift of ophiolites into pods along tectonic weakness lines. Another tectonic belt lies at right angles and includes, for example, the Urals and the Rhine graben.

Magnetic reversal is caused by unstable periods created by changes in the core liquid affected by the Coriolis force and disparity in the Earth/celestial axis alignments. Magnetic anomalies in the oceans are not related to polar wandering but are formed by changes in susceptibility and induction. The planet Venus today is similar to the Earth in Archean time; however, carbon dioxide originating from the Earth's core has combined with calcium to form limestones which has enabled the Earth to cool. Venus, closer to the Sun, remains hot.

A detailed exposition of the above theory is given in Professor Storetvedt's 1997 book entitled "History of the Earth — a chain of related phenomena. The Earth is a System" published by and available from the University of Bergen Press, P.O. Box 4213, Nygardstangen, N5028 Bergen, Norway. Price US$70. As in Plate Tectonics, it helps to have an inflatable Earth globe to understand Professor Storetvedt's theory.

The above account is written from hastily compiled notes at a stimulating lecture given by Professor Storetvedt to the Geological Society of Malaysia meeting held in the University of Malaya on 30th November, 1998. The author offers his apologies for any errors which may have been inadvertently included.

Note received 19 September 1999

NEW

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CHARLES S. HUTCHISON

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50603 Kuala Lumpur, MALAYSIA

PERTEMUAN PERSATUAN
Meetings of the Society

Ceramah Teknik (Technical Talk)

Dynamic Stratigraphy & Tectonics of Peninsular Malaysia

Third Seminar — The Mesozoic of Peninsular Malaysia

Saturday, 13 May 2000

Dept. of Geology, University of Malaya

REPORT

This 3rd in the series of Seminars on the Dynamic Stratigraphy & Tectonics of Peninsular Malaysia entitled *"The Mesozoic of Peninsular Malaysia"* was held on Saturday 13th May 2000 at the Geology Department, University of Malaya.

The Mesozoic Era is believed to be the time period when the main geological events that resulted in the present configuration of the Malay Peninsula occurred. The Mesozoic is also the centre-stage for the *'major clash'* between the different hypotheses concerning the tectonic evolution of the peninsula. The collision between the subduction–tectonics school and the rift-graben tectonics school has managed to excite the geological community in the late 1970's and the early 1980's, locally and abroad. Much of the Mesozoic geology, however, remain unknown or uncertain to date. Good quality geological data, based on the mapping of complete sequences, is still very limited.

In this third seminar, seven research papers on the Mesozoic geology of Peninsular Malaysia were presented. Three of the papers were reviews and syntheses of current understanding of the Mesozoic geology while the other four papers were reports of new findings and interpretations.

The committee wishes to thank all speakers and co-authors for taking time to write and present their papers. My personal thanks to all committee members and helpers for organising and running the seminar and preparing the seminar handout. Thanks are also due to the Head of Geology Department, University of Malaya, Assoc. Prof. Dr. Azhar Hj. Hussin for the use of the venue.

Abdul Hadi Abd. Rahman
Chairman
GSM Sedimentology &
Stratigraphy Wroking Group

Dynamic Stratigraphy & Tectonics of Peninsular Malaysia

Third Seminar — The Mesozoic of Peninsular Malaysia

Saturday, 13 May 2000

Dept. of Geology, University of Malaya

Programme

8.45 – 9.30 am	:	Registration
9.30 – 9.40 am	:	A short welcoming speech
9.40 – 9.50 am	:	An opening speech by the Head, Geology Department, UM
9.50 – 10.10 am	:	***Paper 1:*** Tectonics of deformed and undeformed Jurassic-Cretaceous strata of Peninsular Malaysia H.D. Tjia *(Petronas PRSS)*
10.10 – 10.20 am	:	Discussion
10.20 – 10.40 am	:	***Paper 2:*** Syndepositional deformations in the Permo-Triassic and Latest Triassic to Cretaceous Central Basins of Peninsular Malaysia Mustaffa Kamal Shuib *(University of Malaya)*
10.40 – 10.50 am	:	Discussion
10.50 – 11.00 am	:	Tea Break
11.00 – 11.20 am	:	***Paper 3:*** Mesozoic mafic dykes from Eastern Belt — Part I: Textural study of the older dykes Azman Abdul Ghani *(University of Malaya)*
11.20 – 11.30 am	:	Discussion
11.30 – 11.50 am	:	***Paper 4:*** The Mesozoic of the Central Belt of the Malay Peninsular — Part I: Stratigraphy and depositional sequence Abdul Hadi A.R. & Mustaffa Kamal Shuib *(University of Malaya)*
11.50 – 12.00 noon	:	Discussion
12.00–12.20 pm	:	***Paper 5:*** The Mesozoic of the Central Belt of the Malay Peninsular — Part II: Basin configuration and tectonism Mustaffa Kamal Shuib & Abdul Hadi A.R. *(University of Malaya)*
12.20 – 12.30 pm	:	Discussion
12.30 – 12.50 pm	:	***Paper 6:*** Mesozoic mafic dykes from Eastern Belt — Part II: Geochemistry of the younger dykes Azman A. Ghani *(University of Malaya)*
12.50 – 1.00 pm	:	Discussion
1.00 – 1.20 pm	:	***Paper 7:*** The Mesozoic tectonics of Peninsular Malaysia — an overview Mustaffa Kamal Shuib *(University of Malaya)*
1.20 – 1.30 pm	:	Discussion
1.30 – 1.40 pm	:	Closing Remarks
1.40 pm	:	Lunch

Dynamic Stratigraphy & Tectonics of Peninsular Malaysia

Third Seminar — The Mesozoic of Peninsular Malaysia

Dynamic Stratigraphy & Tectonics of Peninsular Malaysia

Third Seminar — The Mesozoic of Peninsular Malaysia

Saturday, 13 May 2000

Dept. of Geology, University of Malaya

Abstracts of Papers

Tectonics of deformed and undeformed Jurassic-Cretaceous strata of Peninsular Malaysia

H.D. TJIA

Petronas Research & Scientific Services Sdn. Bhd.
Lots 3288 & 3289 Kawasan Institusi Bangi
43000 Kajang, Selangor

The Jurassic-Cretaceous (JK) strata in Peninsular Malaysia occur as folded sequences (Tembeling Group, Koh Formation, Bertangga Sandstone) but also as undeformed, slightly tilted strata (Gagau Group, Ulu Endau Formation, Panti Sandstone). In recent years, some workers have claimed that the middle-upper Triassic strata (Semantan Formation, Gemas Formation) exhibit structural styles similar to the folded JK strata. This led them to suggest that the upper Triassic-lower Jurassic Titiwangsa granitoid complex resulted from anorogenic emplacement, and that the latest major deformation in the peninsula was of Cretaceous-Tertiary age. This hypothesis does not explain: (1) the regional extent of late Triassic to early Jurassic granitoids throughout continental Southeast Asia and Sundaland; (2) the occurrence of deformed strata adjacent to some of the granitoid bodies; (3) sharply bonded, thin thermal aureoles consisting of cross-cutting contacts with country rock; (4) the absence of regional cleavage in the JK strata in contrast with its presence in the older Triassic rocks. A study of good quality, remotely-sensed images covering Peninsular Malaysia has resulted in the following conclusions: (a) the JK Koh, Tembeling and Bertangga Sandstone sequences were laid down in pull-apart depressions; (b) these depressions were developed through dextral slip motions on its major, bounding faults that trend north-south; (c) after the depressions were filled, dextral strike-slip motions continued in a transpressive regime which caused the sediment fill to be deformed into NNW-striking drag folds (These strike-slip movements persisted until middle Eocene as reset ages of cataclastics from major fault zones of the peninsula seemed to indicate); (d) the JK-strata (Gagau, Panti Sandstone) outside the influence of renewed fault movements remained essentially undisturbed; (e) the structural style of the JK-strata is favourable for the entrapment of hydrocarbons, if source material is present. This study further re-establishes the widely accepted concept that during late Triassic-early Jurassic time, Southeast Asia experienced strong tectonic deformation that was accompanied by the emplacement of the Titiwangsa and coeval granitoid complexes.

Syndepositional deformations in the Permo-Triassic and Latest Triassic to Cretaceous Central Basins of Peninsular Malaysia

MUSTAFFA KAMAL SHUIB

Department of Geology
University of Malaya
50603 Kuala Lumpur

This contribution is aimed at presenting the various syndepositional structures that are found within the central Basins and its margins, to determine the nature of the Mesozoic Central Basin of Peninsular Malaysia. Numerous direct evidences for syn-sedimentary tectonism are found within the strata of the Central Basins. These include slumps, syn-sedimentary normal and strike-slip faults, syn-sedimentary folds, and shale injection structures. The evidence that comes from these syndepositional structures is that sedimentation is continuous with transcurrent tectonism. Although shallow syndepositional structures may or may not reflects the deep seated tectonisms, many features associated with these structures points to the interpretation that the Permo-Triassic Central basin has a graven geometry that is controlled by deep seated dextral; shear zones at depth. These include its association with dextral transcurrent basin margin faults (Bentong-Raub Zone), rapid facies changes within the basin and intermediate to acid volcanics and volcaniclastics. In addition, the presence of acid volcanic would suggest that the basin must be underlained by thinned continental crust and reflects the deep seated movements that have occurred. Similarly, the syndepositional structures in the Jurassic-Cretaceous strata support the interpretation that these deposits were deposited in small fault controlled basins. Their occurrences along the Lebir fault zone are taken to indicate that these basins were developed in a transtensional setting.

Mesozoic mafic dykes from the Eastern Belt — Part I: Textural studies of the older dykes

AZMAN ABDUL GHANI

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Mesozoic mafic dykes in the Eastern Belt of Peninsular Malaysia can be divided into two based on their field occurrence. They are the older dykes which are synplutonic to their felsic host and younger dykes which post date their felsic host. Synplutonic features shown by the older dykes are recrystallisation of the dyke with the production of amphibolite or hornfelsic texture, necking of the dyke along its length, back-veining into the dyke and dismemberment of the dyke into trains of amoeboid enclaves. Inclusions of the host material in the dykes suggest that the quenched dykes' carapace were sometimes breached by host vein material which broke up into globules on penetrating the more fluid interior of the dykes. All these features suggest that the hot mafic dyke magma intruded into mobile semi solid felsic magma.

The Mesozoic of the Central Belt of Malay Peninsula — Part I: Stratigraphy and depositional sequence

ABDUL HADI ABD. RAHMAN & MUSTAFFA KAMAL SHUIB

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University of Malaya
50603 Kuala Lumpur

The Central Belt of the Malay Peninsula is a loosely defined geologic terrain which display distinct geographical and geological characteristics. The geology of the Central Belt may be defined by the north-south trending fault zones of Bentong-Raub and Lebir, the Late Palaeozoic to Mesozoic stratigraphic succession, the bounding unconformities, the north-south trending granite ranges, Mesozoic volcanism and also probably the presence of serpentinites.

The Mesozoic stratigraphy of the Malay Peninsula have been grouped into two megasequences which are bounded by regional unconformities. These megasequences are the largely Triassic Semanggol-Semantan megasequence and the Jurassic-Cretaceous Tembeling Megasequence. Based on the structural, magmatic, geochronological, palaeontological and stratigraphic data available, four time-slice sections and paleogeographic maps for the Mesozoic stratigraphic succession can be reconstructed. These are:

(i) Permian to Early Triassic section;
(ii) Middle Triassic section;
(iii) Late Triassic section;
(iv) End of Triassic to Cretaceous section.

The Middle to Upper Permian paleogeography consist of a warm shallow marine environment with widespread volcanic activities and volcanic islands which display close resemblance to some areas in Japan today. The Early Triassic rock distribution to indicate that along the margin of the Central Belt, sedimentation was strongly influenced by steep slopes that could have developed during basin extension.

The Middle Triassic paleogeography is characterised by the 'flysch' Semantan Formation, which indicate the domination of deep water environment with pronounced volcanism.

The Late Triassic times witness a gradual change from a deep marine environment to shallow water conditions, which is reflected in the increase in the proportion of conglomerates, limestones lenses and tuff beds.

The Indosinian Orogeny of Southeast Asia marks the end of Late Triassic marine, flysch-type sedimentation and the beginning of the predominantly continental Jurassic-Cretaceous sedimentation. However, the evidences available indicate that this orogeny is not of mountain building proportion. The Jurassic-Cretaceous paleogeography begins with a shallow marine environment, which swiftly gave way to the continental regime of the Tembeling times.

The Mesozoic of the Central Belt of Malay Peninsula — Part II: Basin configuration and tectonism

MUSTAFFA KAMAL SHUIB & ABDUL HADI ABD. RAHMAN

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The Central Basins infillings are divided into 2 megasequences. They are the Permo-Triassic Semanggol-Semantan Megasequence and the overlying Latest Triassic to Cretaceous Tembeling Megasequence. These infillings can further be divided into 3 depositional sequences. The first two is predominantly marine and the third predominantly continental. They represent a complete transgressive-regressive cycle that marks the opening and closing of the Permo-Triassic basin and the initiation of the Latest Triassic to Cretaceous intermontane basins.

The first depositional sequence (Permian-Early Triassic) consists of continental sediments at its base that grades into shallow marine and then to deeper marine at the top. The sequence marks the opening of the basin. The second sequence (Middle Triassic to Late Triassic) begins with deep marine turbidites and volcaniclastics that grades into shallow marine sediments to the top. It marks the rifting of the basin and then followed by the initiation of the gradual closure of the basin.

From the sedimentological and structural characteristics, the Permo-Triassic basin can be considered to have a graben-like configuration. The graben have a roughly N-S trend. The nature of the margin fault zones with steeply dipping faults that have downthrown side into the basin and exhibiting dextral transpressive and transtensive character suggest that the basin is a strike-slip control basin.

The third sequence (Latest Triassic to Cretaceous) marks the closure of the basin and the initiation of new successor basins. The basins although small, are characterized by a wide variety of depositional facies, from fluviatile to deltaic to lacustrine facies. Facies changes can be abrupt. Locally, acid extrusive rocks are found. These suggest a syn-sedimentary tectonic control on the deposition.

The overall synclinal nature and asymmetric character of the basin together with their occurrences along the Lebir Fault Zone may be taken to indicate that these small Latest Triassic to Cretaceous basins are also strike-slip fault control inter-montane basins.

Mesozoic mafic dykes from the Eastern Belt — Part II: Geochemistry of the younger dykes

AZMAN ABDUL GHANI

Department of Geology
University of Malaya
50603 Kuala Lumpur

Mafic to intermediate Carboniferous dykes are common throughout the Eastern Belt of Peninsular Malaysia. They are mainly dolerite, containing mainly plagioclase, clinopyroxene, quartz and opaque phases. They plot in the basalt-trachybasalt-basaltic and andesite-basaltic trachyandesite fields in a total alkali silica diagram (TAS diagram). The SiO_2 content of the dykes are between 46.4 to 58.68% (mean 50.97%) and are both quartz and olivine normative. They evolved from saturated (Ol-Di-Hy) to over saturated (Di-Hy-Q) basaltic magmas ranging in composition from olivine tholeiite to quartz tholeiite. The geochemical data indicate that the dykes magma is tholeiite, and similar to the magma formed in a continental within plate tectonic setting.

The Mesozoic tectonics of Peninsular Malaysia — an overview

MUSTAFFA KAMAL SHUIB
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In contrast to the established and popularly accepted tectonic models of steady state subduction and allochthonous terrane accretion, the overall features of the Palaeozoic and Mesozoic of Peninsular Malaysia are consistent with the extensional opening of a narrow seaway, with or without an oceanic crust, and the ensuing dextral transcurrent amalgamation of the 2 detached blocks.

The Bentong-Raub Zone which is supposed to be an oceanic suture zone; base on the presence of the small bodies of serpentinites, contain no records of oceanic crust. It is highly likely the zone represent just a narrow ocean or seaway. The distinct faunal difference between the 2 provinces suggests that although a narrow sea separated them, they were also located at different palaeolatitudes; the western province to the south and the eastern province further to the north. But by Late Permian time they could have amalgamated by dextral transcurrent movements into a single block. In addition the structures found within the Bentong-Raub Zone exhibit none of the typical characteristics of collision suture zone but typical of transcurrent tectonics.

The bulk of the Permo-Triassic Central basin sediments are shallow to deep-water clastics and volcaniclastics exhibiting rapid facies changes deposited in a rapidly subsiding basin. It has a graben configuration. The acid nature of the tuffs suggests that the sediments were not deposited on oceanic crust. It developed at the late stage of the dextral transcurrent amalgamation by pull-apart mechanisms.

Mantle upwelling would have thinned the crust beneath the Central Basin. This would supply enough heat to metamorphose part of the central basin infillings into what is now the Taku schist. It also would provide enough heat to cause adiabatic decompression so that the Late Permian (255 Ma) granites could intrude into plane of weakness in the uplifted Eastern Belt.

Continued dextral transcurrent movements would eventually lead to the inversion of the Central Basin resulting in widespread uplift along with the intrusions of Late Triassic granites along major strike-slip faults zones.

Further transcurrent movements would eventually uplift and faulted into half grabens which were eventually filled with predominantly Upper Jurassic to Cretaceous continental sediments, that were eventually deformed by sinistral transcurrent movements along the Lebir fault zone.

PETER HOBBS

Measurement of shrinkage limit

PETER HOBBS

Laporan (Report)

Dr. Peter Hobbs of the British Geological Survey presented the above technical talk on Monday 15th May 2000 at the Geology Department, University of Malaya at 5.30 pm.

Abstrak (Abstract)

Introduction

Structural damage due to subsidence, as a direct result of the swelling and shrinkage of clay soils, is estimated to cost the equivalent of 1.8 billion Malaysian Ringgit annually in Britain. Research at the British Geological Survey (BGS) has involved the gathering of shrinkage and swelling data for a variety of British sedimentary soil formation. As part of this work, a new shrinkage limit test methodology has been developed.

Shrinkage limit

Traditional methods of measuring the volumetric shrinkage of clay soils have utilised Archimedes' principle requiring immersion of the specimen in a vessel of mercury. These are two such methods, described in American Society for Testing & Materials (ASTM, D427) and British Standards (BS1377: 1990, Test 6.3). These tests permit the use of undisturbed, remoulded, or compacted specimens, and are distinct from the linear shrinkage test (BS1377: 1990, Test 6.5) which permits only remoulded samples to be tested. The mercury immersion methods have fallen into disuse in many countries due to health issues. Mercury is a significant health hazard in both liquid and vapour forms. Use of these tests with tropical residual clay soils and fissured over-consolidated clay soils is also problematic due principally to entry of mercury droplets into the specimen, and hence incorrect weight and volume measurements. Despite this, the shrinkage limit remains a fundamental soil parameter of which more use should be made.

BGS research

As part of the BGS' work a new test apparatus has been developed to measure the shrinkage limit of a 100 x 100 mm cylindrical specimen. This utilises a laser rangefinder to measure a pseudo-volume and an electronic balance to measure weight, without the need to handle the specimen. Many results have now been obtained with a prototype hand-operated apparatus, including tests on two tropical residual clay soils from Java (results to be reported in Unsat2000, Singapore). Research has also been carried out with the apparatus at Leeds University, UK by M.Sc students A.A. Kadir and D. Marchese. These data have shown interesting comparative results for de-structured and compacted specimens. A fully automatic version of the apparatus, entitled *SHRINKIT*, is under construction at BGS. It is hoped to publish papers in Geotechnique in the near future. To date, the results have highlighted structural differences between sedimentary clay soils of different plasticities and residual clay soils.

Whilst it is not anticipated that *SHRINKIT* will replace the ASTM or BS test equipment, it does have the ability to research shrinkage, and possibly swelling, in an environmentally controlled and safe manner. It is particularly suited to highly structured or weak soils where preparation and handling are difficult. Each *SHRINKIT* test requires between 2 and 4 weeks to complete, depending on the sample and the controlled drying rate. However, the large specimen is more representative of the soil structure than the small BS, or very small ASTM, specimens.

"Malam Geologis Muda III/Young Geologist Nite III"

Wednesday, 24th May 2000
Dept. of Geology, University of Malaya

High resolution seismic refrection method for geotechnical engineering purposes

WONG TING KUN

S.I. Practice — a review

MOHD. JOHARY KAAMARUDIN

Soil and rock description for civil engineering purposes: overview on current practice in Malaysia and the need for geological institutions involvement

ABD. RASID JAAPAR

Excavatability assessment of weathered rock mass — case studies from Ijok, Selangor and Kemaman, Terengganu

TAJUL ANUAR JAMALUDDIN AND MOGANA SUNDARAM

Laporan (Report)

The above "malam" saw 4 "young" speakers sharing their views and experiences in engineering geology/geophysics.

Mr. Wong presented some case studies of the seismic refraction method for site investigations. Sdr. Mohd. Johary gave a personal review of the site investigation practice vis-a-vis engineers versus geologists. Sdr. Rasid commented on the common problems of soil and rock descriptions in S.I., and the need for more input by the various professional bodies. Sdr. Dr. Tajul gave a couple of interesting case studies on the assessments of excavatability of weathered rocks.

Abstracts of presentations submitted are enclosed herein.

Tan Boon Kong
Chairman
Working Group on Engineering Geology & Hydrology
19th July, 2000

Malam Geologis Muda III/Young Geologist Nite III

Soil and rock description for civil engineering purposes: overview on current practice in Malaysia and the need for geological institutions involvement

ABD. RASID JAAPAR

Abstrack Panjang (Extended Abstract)

Introduction

The engineering usage of 'rock' and 'soil' differs from geological usage of 'rock' and 'soil'. The value of an engineering rock or soil description is often increased if the materials encountered are placed in the context of the geological structure of the area around the site and for big scale projects. Rock and soil descriptions for civil engineering applications are typically carried out in three main locations:

i. in the field, at a natural or man-made exposure.
ii. in the field, on core or sample obtained from a ground investigation drilling rig.
iii. in the laboratory, on pieces of core or samples before or after the testing were carried out.

The main purpose of soil and rock description for civil engineering purposes is to give an indication of the likely engineering properties of the material. A complete description should comprise a simple soil or rock name, qualified discontinuities and other characteristics as appropriate.

The philosophy of description

Soil and rock description is to a certain degree subjective. In order to minimise the subjective element a systematic examination should be carried out using a standard terminology, whether the material be in natural exposure, trial pit face or samples recovered from a borehole. The use of a standardised scheme of description ensures that:

i. all factors are considered and examined in a logical sequence.
ii. no essential information is omitted.
iii. no matter who describes the sample, the same basic description is given using all terms in an identical way.
iv. the description conveys an accurate mental image to the reader.
v. any potential user can quickly extract the relevant information.

The description of individual samples from a borehole, each sample being described in isolation and in completely factual terms, noting any disturbance or obvious loss of material caused by sampling. Any two geologists of sufficient and comparable experience should produce almost identical descriptions of each sample with only minor differences resulting from, for example, judgement of the proportion of secondary constituents.

Conclusions and recommendations

Guide for soil and rock description in Malaysian practice was not seriously look into by any engineering, geoscience or government organisations. Therefore, there is an urgency need for any geological institutions such as IGM, GSM etc. involvement as they are the right and capable organisation. This task can be carry out based on the following steps:

- IGM/GSM shall set up a steering committee on soil and rock description consists of practitioners, researchers and academicians.
- Upon completion, IGM/GSM shall publish "Guide to Soil and Rock Description in Malaysian Practice" and submit to relevant authority such as SIRIM, CIDB, BEM, IEM, MSIA etc.
- The guide has to be included in Engineering Geology or Soil Mechanics courses in university.

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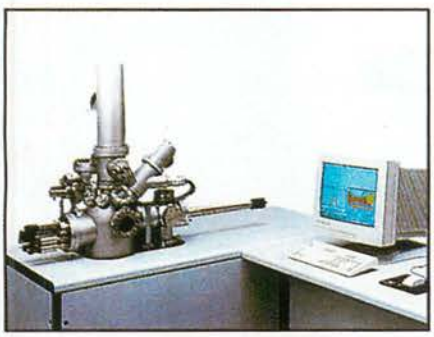

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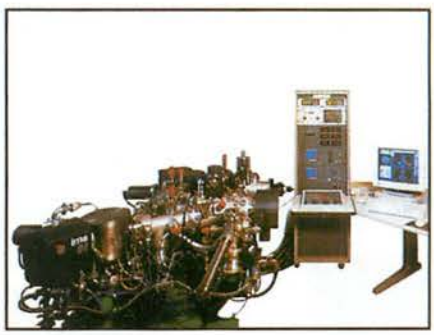

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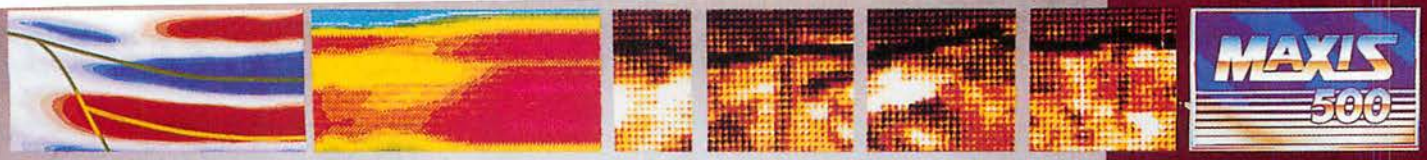

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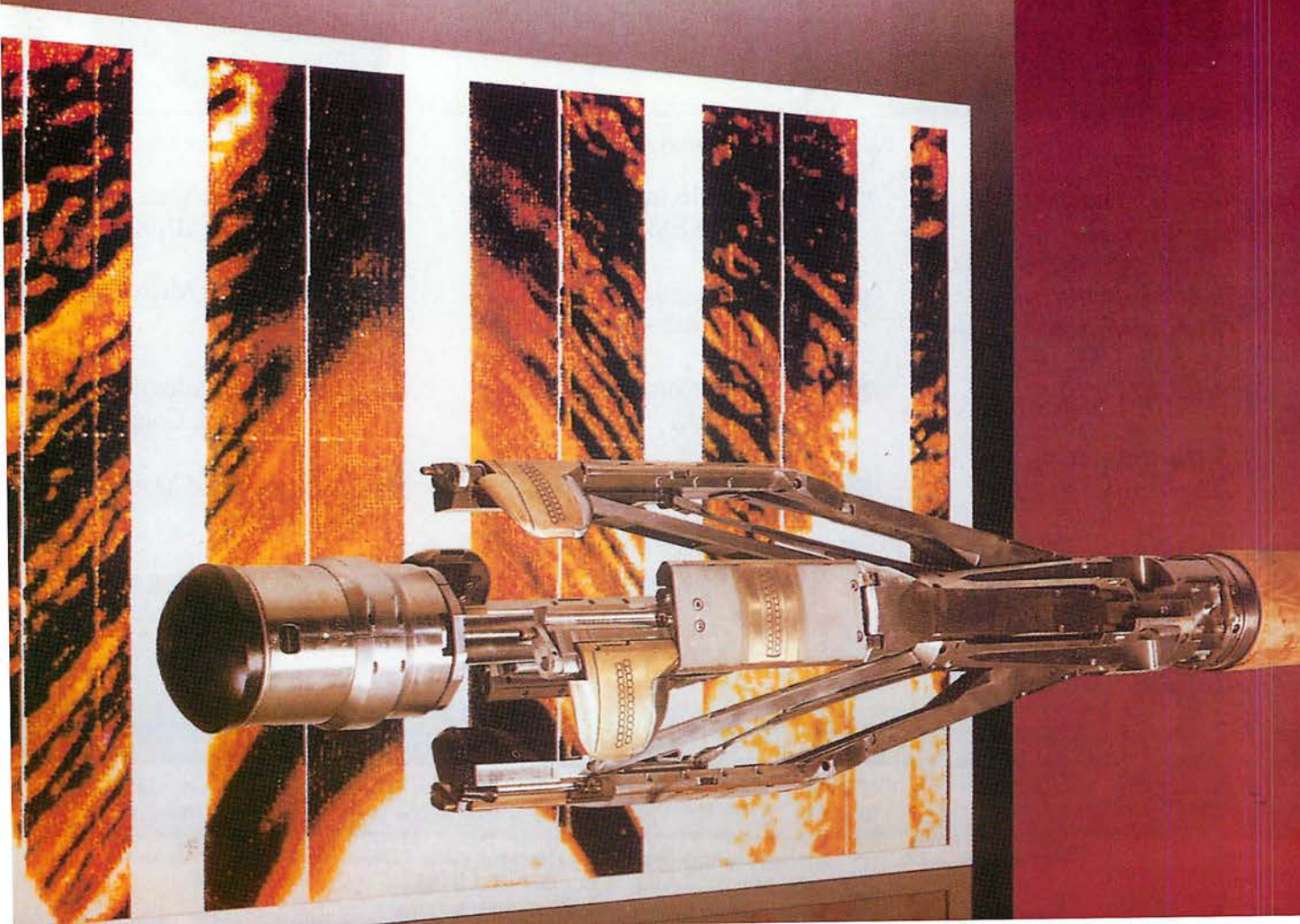

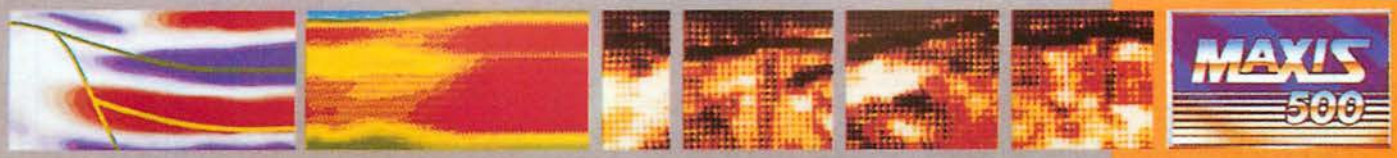

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Excavatability assessment of weathered rock mass — case studies from Ijok, Selangor and Kemaman, Terengganu

TAJUL ANUAR JAMALUDDIN AND MOGANA SUNDARAM

Abstrack Panjang (Extended Abstract)

The ease with which the ground can be excavated (i.e. its excavatability) must be assessed, preferably prior to the earthworks, so that civil engineering works can be realistically planned and priced. Excavatability usually becomes a disputable issue during the earthworks when the engineers or client and the contractor do not reach mutual agreement regarding the boundary between "rock" and "soil", especially when dealing with weathered rock masses. Due to insufficient geological information about the nature of the project site, the party involved may underestimate the presence of hard rock mass, thus the costs and work schedule.

Methods and costs of rock excavations vary greatly from digging, scrapping, ripping, hard ripping, blasting to loosened and blasting to fracture; depending on the geotechnical properties of the rock mass and the type, size and condition of the excavating equipment used. It is widely accepted that the most important geotechnical properties governs the excavatability of rock mass are ***discontinuity*** and ***strength of rock materials***.

A number of systems have been developed for assessing various aspects of rock excavatability (e.g. Weaver, 1975; Kirstein, 1982; Scoble and Muftouglu, 1984). Machine manufacturer such as Caterpillar Tractor Company also suggest procedures for assessing rippability. Franklin *et al.* (1971) published a "size-strength" graph which related discontinuity spacing and rock strength to the method of excavation required. The graph was subdivided into areas of digging or scrapping, ripping, blasting to loosen, and blasting to fracture on the basis of research carried out in the United Kingdom between 1968 and 1970. The same graph was published by Fookes *et al.* (1971) who emphasized that it was at the development stage. A complete revision of the graphical method has been carried out by Pettifer and Fookes (1994), based on a total of 120 published and original case studies from all over the world. This updated 'excavatability graph" (Fig. 1), which was adopted in the present case studies, stresses the limits of ripping using different sizes of tractor.

In Case Study 1 (Ijok, Selangor), a geologist was called to give an independent professional report to clarify that the rock mass encountered at the site is really a hard rock and to recommend on the suitable method of excavation. The project site was formally a gentle hill with thick (10–20 m) residual soils and HW-CW metasedimentary rocks of the Kenny Hill Formation.

As the excavation becomes deeper into the core of the hill, the materials becomes harder and can no longer be excavated by using a conventional digging method. The rock mass contains 4 sets of discontinuity which give an average Volumetric Joint Count, J_v = 8.73/m, and average Discontinuity Spacing Index, I_f = 0.46. The material strength varies between weak to strong rock (Is_{50} = 0.65 MPa to 4.38 MPa), with an average of medium strong rock (Is_{50} = 2.09 MPa). Plot on the "excavatability graph" clearly indicates that the excavation of the rock mass requires D8 series tractor or higher. Blasting was recommended to loosen and to expedite the rock excavation works.

Almost a similar problem happened in Case Study II (Kemaman, Terengganu). The same method of works was applied by the geologist to assess the excavatability of the rock mass. The project site is a hill made up of massive, slightly metamorphosed, indurated rhyolite. The diggable residual soils and highly weathered rock masses have been removed, leaving behind the slightly to moderately weathered rocks in the hill. The rocks mass contains 4 sets of discontinuity (average J_v = 2.97 and I_f = 1.4) and the rock material is medium strong to very strong (average Is_{50} = 2.6). Results clearly indicate "blasting" method is required to excavate the rock mass. Due to the existing surrounding infrastructures and human activities, controlled blasting method was recommended to minimise flyrock, noise and ground vibrations.

In conclusion, excavatability assessment is a straightforward method of work but requires a skilled geologist who is familiar with rock mass characterization in the field. By

knowing the degree of excavatability of the rock mass beforehand, a comprehensive earthwork program can be planned with more accurate and realistic work schedule, logistics and costing. This can avoid unnecessary argument between the contractor and the client/engineer. The Malaysian experience however, shows that geologists are only consulted when the rock mass cannot be excavated by the equipment specified in the contract or unable to classify the earth material as soil or rock for excavatability purpose. Excavatability of a rock mass can be assessed during the SI stage. Combination of geological mapping, detailed logging of rock core samples (e.g. RQD, fracture frequency, joint characteristics) and laboratory testing (point load strength) should be sufficient for this purpose.

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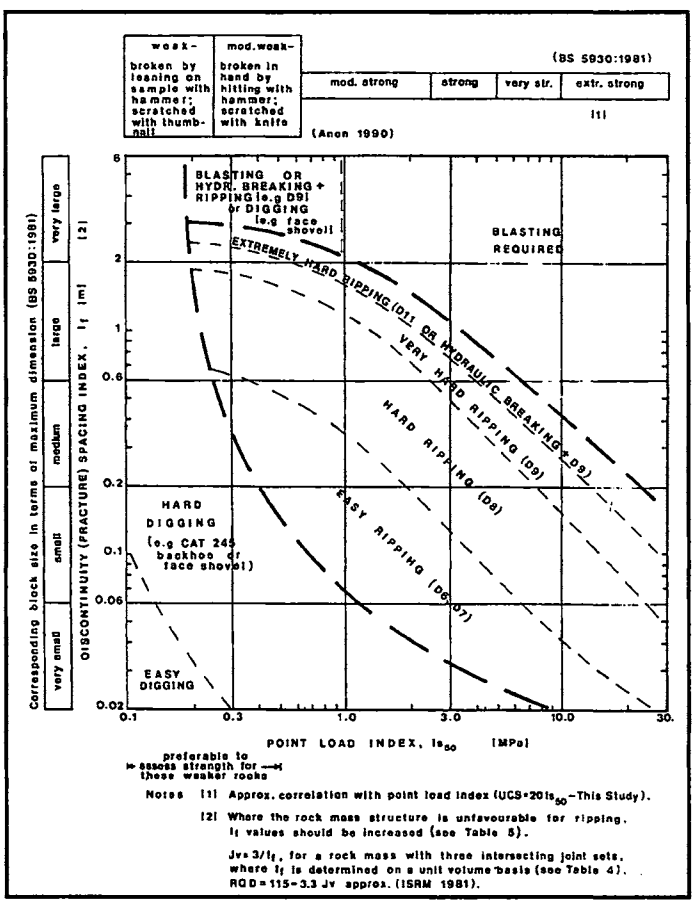

Figure 1. Revised excavatability graph (after Pettifer and Fookes, 1994).

Laporan Seminar Setengah Hari "Penggunaan Geofizik dalam Kajian Geoteknik"

Anjuran Kumpulan Geofizik Persatuan Geologi Malaysia

Satu Seminar Setengah Hari telah dianjurkan oleh Kumpulan Geofizik, Persatuan Geologi Malaysia pada 12hb Jun 2000 di Jabatan Mineral & Geosains, Ipoh, Perak.

Seminar ini telah dirasmikan oleh En. Chu Ling Heng, Timbalan Ketua Pengarah Jabatan Mineral dan Geosains Malaysia. Seramai 58 orang peserta yang terdiri daripada kalangan ahli akademik dan pelajar-pelajar institut pengajian tinggi, kontraktor, syarikat swasta, institusi penyelidikan dan jabatan kerajaan termasuklah pegawai-pengawai Jabatan Mineral dan Geosains (JMG) telah mendaftar dan hadir dalam seminar tersebut. Sebanyak lapan kertas kerja telah dibentangkan oleh ahli-ahli geofizik dan jurutera yang mencakupi aspek penggunaan teknik-teknik geofizik dalam kajian kejuruteraan dan potensi kebergunaannya dalam industri pembinaan negara. Salinan kertas kerja boleh diperolehi daripada Persatuan Geologi Malaysia.

Senarai Kertas Kerja adalah seperti berikut:

1. *En. Jamaludin Othman(JMG):* Issues in engineering and environmental Geophysics
2. *En Khairul Anuar Mohd. Nayan (UKM):* Aplikasi geofizik dalam kejuruteraan geoteknik: Kajian dari kaca mata jurutera awam
3. *Dr. Mohd Nawawi (USM):* Perbandingan Pemodelan Komputer dan Kerja lapangan untuk model blok kubus menggunakan kaedah pengimejan Elektrik 2-D
4. *En Abd. Rasid Jaapar (Soil Centralab):* Application of land and underwater seismic refraction survey for Highway project: case study
5. *Dr. Mohd Nawawi (USM):* Mengesan batu tongkol (boulder) menggunakan kaedah pengimejan geoelektrik 2-D untuk kajian tanah di Sg. Nibong Pulau Pinang
6. *En Azhari Ahmad (JMG):* Sumbangan pemetaan geofizik marin dalam kajian geoteknik
7. *En Abdul Kahar bin Embi (PPM):* Perbandingan kajian geologi subpermukan menggunakan teknik seismik pembiasan dan resistiviti pengimejan di cadangan lebuhraya Kuala Kangsar-Grik (Fasa 2)
8. *En Teo Hak Jing (USM):* Survei pembiasan seismik untuk cadangan pembinaan asrama pelajar di Universiti Sains Malaysia

Seminar ini telah berjalan lancar seperti yang dijadualkan dan telah mendapat sambutan yang menggalakkan daripada peserta. Beberapa cadangan berikut telah dikemukakan kepada jawatankuasa penganjur untuk tindakan selanjutnya.

a) Mengumpul dan menerbitkan semua 'case histories' kajian geofizik yang berkaitan dengan geoteknik di Malaysia.

b) Mencadangkan pembinaan homepage — 'Case Studies in Geophysics' dan senarai 'Local Expertise'.

c) Bagi seminar-seminar yang berikutnya jawatankuasa dicadangkan untuk menjemput peserta-peserta yang terdiri daripada kalangan jurutera 'Board of Engineer', DEB, para kontraktor dan juga peyertaan dibuka kepada umum.

Abdul Rahim Samsudin

Seminar Setengah Hari
"Penggunaan Geofizik dalam Kajian Geoteknik"

DLIS and archival of interpreted petrophysical data

PETER BOLES

Laporan (Report)

Dr. Peter Boles, Senior Research Engineer of Paradigm Geophysical based in Brisbane Australia, gave the above talk to Malaysia Chapters of the SPE & SPWLA and the Petroleum Group of Geological Society of Malaysia on Monday 19th June 2000 at 9th Floor Twin Tower 1, Kuala Lumpur City Centre at 12.00 noon.

Abstrak (Abstract)

DLIS is the API standard for the recording of well log data. Today, the API has defined Version 2.0 of the standard, but 100% of the industry still uses Version 1.0 for the recording of acquisition wireline and LWD data, and for the recording of processed or interpreted petrophysical data. With this, there are issues of weaknesses in the recording of acquisition data to be defined and improved by the various data acquisition companies, and issues of how to best record the interpreted data or results into the physical format of DLIS.

The proposed presentation will outline DLIS and data archival issues that affect the day to day workflow of the well log analyst or petrophysicist using the various commercial software packages available to them.

Firstly, an overview of historical DLIS problems will be presented as they do affect the well log analyst from the data loading point in their workflow. Secondly, some recommendations on good practices will be made to minimize problems in loading DLIS into interpretation software. Thirdly, the issue of auditing of the workflow of the well log analyst with regard to archival of their results into DLIS will be discussed. Today, the industry has no clear guidelines for the third subject. With this in mind, the efforts of POSC to help produce guidelines will be presented along with some details of a pilot project sponsored by a major European oil company and two service companies. Feedback from the Kuala Lumpur talk on this third subject will be transmitted to POSC and other interested groups.

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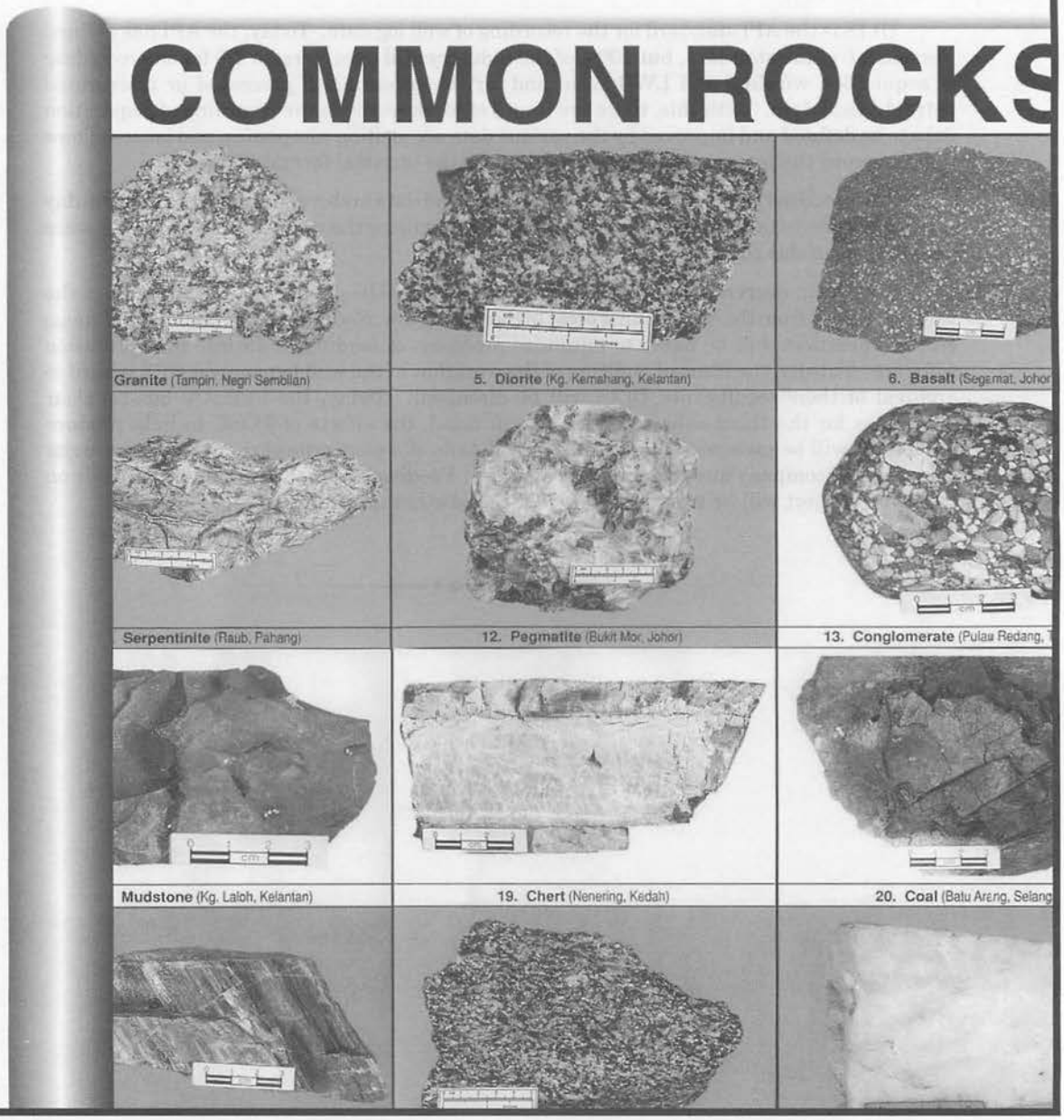

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BERITA-BERITA PERSATUAN
News of the Society

KEAHLIAN (Membership)

The following applications for membership were approved:

Full Members

1. Malliga Palaniapan
   L & M Instrumentation Sdn. Bhd., 6 Persiaran kerjaya (Jln. Glenmarie), Seksyen U1, 40150 Shah Alam.
2. Mahat Hj Sibon
   Jabatan Mineral dan Geosains Malaysia Sabah, Jalan Penampang, P.O. Box 2042, 88999 Kota Kinabalu.

Associate Member

1. Azman Kassim
   Fakulti Kejuruteraan Awam, UTM, 81310 UTM, Skudai, Johor.

GSM

PETUKARAN ALAMAT (Change of Address)

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

1. Mogana Sundram
   16 Headland Street, Sunnybank, 4109 QLD, Australia.
2. Malliga Palaniapan
   A-15-6, Menara Komanwel A, Vista Komanwel, Bukit Jalil, 55770 Kuala Lumpur.
3. Yb. Che Ghani Ambak
   3905, Kampong Bukit Chendering, 21080 Kuala Terengganu.
4. Mike Friederich
   BHP Minerals, BRI Building, 6th Floor, Jl. Jend. Sudirman No. 37, Balikpapan 76112, East Kalimantan, Indonesia.

GSM

CURRENT ADDRESSES WANTED

The GSM is seeking the address of the following member. Anyone knowing the new address please inform the Society.

1. En. Zainal Abidin Jamaluddin
   Jabatan Geologi, Universiti Kebangsaan
   Malaysia, 43600 Bangi, Selangor D.E.

PERTAMBAHAN BAHARU PERPUSTAKAAN (New Library Additions)

The Society has received the following publications:

1. Geoscience Journal, vol. 4, no. 1, 2000.
2. American Museum of Natural History, Bulletin nos. 249 & 251, 2000.
3. AAPG Explorer, May, 2000.
4. Proceedings of the SOPAC 28th Session, 1999.
5. Institute of Geoscience, The University of Tsukuba, no. 25, 1999.
6. Bulletin de la Societe belge de la Geologie, vol. 105, delen 3 & 4, 1996 & vol. 106, 1999.
7. Monthly statistics on mining industry in Malaysia, Dec 1999.
8. American Museum Novitates, nos. 3290 & 3292, 2000.
9. USGS Professional paper: 1999: nos. 1613; 2000: 1619.
10. USGS Circular: 2000, no. 1193.

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GEOLOGICAL SOCIETY OF MALAYSIA

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Editor: G.H. Teh

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Bulletin 2 (Dec 1968). 152 p. Bibliography and Index of the Geology of West Malaysia and Singapore by D.J. Gobbett. Price: RM10.00 - Softcover, M$15.00.

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Bulletin 19 (Apr 1986) **& 20** (Aug 1986). GEOSEA V Proceedings Vols. I & II, Fifth Regional Congress on Geology, Mineral and Energy Resources of Southeast Asia, Kuala Lumpur, 9-13 April 1984. Edited by G.H. Teh & S. Paramananthan. Price for both Bulletins 19 & 20: Members – RM50.00, Non-Members – RM125.00.

Bulletin 21 (Dec 1987). 271 p. Special Issue on Petroleum Geology Vol. II. Edited by G.H. Teh. Price: RM40.00.

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Bulletin 34 (Dec 1993). 181 p. Bibliography and Index — Publications of the Geological Society of Malaysia 1967-1993. Compiled by T.F. Ng. Edited by G.H. Teh. Price: RM30.00.

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Field Guide 1 (1973). A 7-day one thousand mile, geological excursion in Central and South Malaya (West Malaysia and Singapore). 40 p. by C.S. Hutchison. Price: RM5.00. **Out of stock.**

Abstracts of papers (1972). Regional Conference on the Geology of Southeast Asia, Kuala Lumpur, 1972. 64 p. 8 figs, 3 tables, many extended abstracts. Edited by N.S. Haile. Price: RM6.00.

Proceedings of the Workshop on Stratigraphic Correlation of Thailand and Malaysia Vol. 1. (1983). Technical Papers. 383 p. Price: RM25.00 (Members: RM12.00).

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2000

July 3–7

GEOLOGICAL SOCIETY OF AUSTRALIA (Biennial Meeting), 15TH AUSTRALIAN GEOLOGICAL CONVENTION (Theme: Understanding Planet Earth — Searching for a sustainable future), University of Technology, Sydney, Australia. (Contact: Misha Frankel, Geological Society of Australia, Suite 706, 301 George Street, Sydney, NSW, Australia. Tel: +61 2 92902194; Fax: +61 2 9290 2198; E-mail: 15thagc@gsa.org.au; Website: www.science.uts.edu.au/agc/agchome.html)

July 3–7

18TH COLLOQUIUM OF AFRICAN GEOLOGY (Hosted and organized by the Austrian Geological Society and the Austrian Mineralogical Society), Graz, Austria. (Contact: Institut für Geologie und Paläontologie, Karl-Franzens-Universität Graz, Heinrichstraße 26, A-8010 Graz, Austria. Tel: +43-316-380-5587; Fax: +43-316-380-9870; E-mail: cag18@bimn22.kfunigraz.ac.at)

July 9–12

INTERNATIONAL CONFERENCE ON CATASTROPHIC EVENTS AND MASS EXTINCTIONS: IMPACTS AND BEYOND, Vienna, Austria. Sponsored by: University of Vienna, Lunar and Planetary Institute, European Science Foundation IMPACT Program, Federal Ministry of Science and Transport, Austria, and the Geological Survey of Austria. (Contact: Elizabeth Wagganer, Impact 2000 Conference, Lunar and Planetary Institute, 3600 Bay Area Boulevard, Houston TX 77058-1113. Tel: (281)486-2177; E-mail: wagganer@lpi.jsc.nasa.gov; Website: http://cass.jsc.nasa.gov/meetings/impact2000/)

July 11–15

APC-2000, COMBINED AUSTRALIAN PALAEONTOLOGICAL CONVENTION; 3RD INTERNATIONAL SYMPOSIUM ON THE SILURIAN SYSTEM; AND 2ND AUSTRALIAN CONODONT SYMPOSIUM, New South Wales, Australia. (Contact: George Wilson, Department of Earth and Planetary Sciences, Macquarie University, Sydney, NSW 2109, Australia. Website: http://www.es.mq.edu.au/MUCEP/auscos/auscos.htm)

July 12–14

GEOFLUID-III 2000 (The third international conference on fluid evolution, migration and interaction in sedimentary basins and orogenic belts), Barcelona, Spain. (Organized by the University of Barcelona and Instituto Jaume Almera. Website: www.ub.es/geoquimi/geofluids)

July 16–22

APPLIED MINERALOGY — ICAM 2000 (6th International Congress), Gottingen & Hannover, Germany. (Contact: ICAM 2000 Office, P.O. Box 510153, D-30631 Hannover, GERMANY. Tel: +49-511 643 2298; Fax: +49-511 643 3685; E-mail: ICAM2000@bgr.de; Website: www.bgr.de/ICAM2000; abstract deadline: September 1, 1999)

July 16–22

"GEO-INFORMATION FOR ALL" (19th International Congress of the International Society for Photogrammetry and Remote Sensing), Amsterdam, The Netherlands. (Contact: Prof. K.J. Beek, P.O. Box 6, 7500 AA Enschede, The Netherlands. Tel: +31 (0) 53 4874214; Fax: +31 (0) 53 4874200; E-mail: beek@itc.nl)

July 18–23

INTERNATIONAL ASSOCIATION OF VOLCANOLOGY AND CHEMISTRY OF THE EARTH INTERIOR (IAVCEI) GENERAL ASSEMBLY 2000, Bandung, Indonesia. (Contact: Secretariat, Volcanological Survey of Indonesia, Jalan Diponegoro 57, Bandung 40122, Indonesia. Tel: +62-22 772606; Fax: +62-22 702761; E-mail: iavcei@vsi.dpe.go.id; Website: http://www.vsi.dpe.go.id/iavcei.html; abstract deadline: February 29, 2000)

July 31 – August 4

JOINT WORLD CONGRESS ON GROUNDWATER, Forteleza, Brazil. (Contact: ABAS, Ceara Chapter, Avienda Santos Dumont, 7700 Papicu, Fortaleza, CEP 60 150-163, Brazil. Tel: +55 85 265 1288; Fax: +55 85 265 2212)

August 6–17

31ST INTERNATIONAL GEOLOGICAL CONGRESS, Geology and Sustainable Development: Challenges for the Third Millennium, Rio de Janeiro, Brazil. (Contact: 31st IGC Secretariat Bureau, Av. Pasteur, 404-ANEXO 31 IGC, Urca, Rio de Janeiro RJ, CEP 22.290-240 Brazil. Tel: +55 21 295 5847; Fax: +55 21 295 8094; E-mail: 3ligc@cristal.cprm.gov.br; Website: www.3ligc.org. To request current Circular, send e-mail to mailto:address@3ligc.org)

September 3–8

GOLDSCHMIDT 2000 (International Conference), Oxford, UK. (Contact: P. Beattie, Cambridge Publications, Publications House, P.O. Box 27, Cambridge UK CB1 4GL. Tel: +44-1223 333438; Fax: +44-1223 333438; E-mail: Gold2000@campublic.co.uk; Website: http://www.campublic.co.uk/science/conference/Gold2000/)

September 11–15

8TH INTERNATIONAL NANNOPLANKTON ASSOCIATION CONFERENCE, Bremen, Germany. (Contact: Prof. Helmut Willems, FB-5-Geowissenschaften, Universität Bremen, Postfach 330 440, 28334 Bremen, Germany. Tel: +49 421 21 82 198; Fax: +49 421 21 84 451; E-mail: willems@micropal.uni-bremen.de; Website: http://uni.bremen.de/-micropal/ina8.html)

September 17–21

7TH INTERNATIONAL CONFERENCE ON PALEOCEANOGRAPHY, Sapporo, Japan. (Contact: Prof. Helmut Weissert, Geological Institute, ETH-Zurich, CH-8092 Zurich Switzerland. Tel: +41 (0)1 632 37 15; Fax: +41 (0)1 632 10 30; E-mail: helmi@erdw.ethz.ch; Website: http://www.iijnet.or.jp/jtb-cs/icp7/)

September 17–26

KARST'2000: 6TH INTERNATIONAL SYMPOSIUM AND FIELD SEMINAR ON PRESENT STATE AND FUTURE TRENDS OF KARST STUDIES, Marmaris, Turquie. (Contact: Hacettepe University, International Research and Application Centre for Karst Water Resources (UKAM), Beytepe Campus, 06532 Ankara, Turquie. Fax: 90 312 299 213; E-mail: ukam@naim.jeo.edu.tr)

September 25–29

12TH INTERNATIONAL SYMPOSIUM ON PLACER AND WEATHERED ROCK DEPOSITS, Moscow, Russia. Pre-congress and post-congress workshops and field excursions. Abstract deadline: May 1, 2000. (Contact: Prof. Patyk-Kara N.G., Secretary General, IGEM RAS, 35. Staromonetny Per., 109017 Moscow. Tel: 7 (095) 230-8427; Fax: 7 (095) 230-2179; E-mail; rkv2000@igem.ru; Website: http://www.igem.ru/symp/rkv2000/)

October

INTERNATIONAL MILLENNIUM CONGRESS ON GEOENGINEERING, Melbourne, Australia. (More information soon)

October 11–13

RISK ANALYSIS 2000, Second International Conference on Computer Simulation in Risk Analysis and Hazard Mitigation, Bologna, Italy. Organised by Wessex Institute of Technology (WTT), Ashurst Lodge, Ashurst, Southampton SO40 7AA, UK. (Contact: Karen Savage, RISK 2000/1479. Tel: +44(0)238 029 3223; Fax: +44(0)238 029 2853; E-mail: ksavage@wessex.ac.uk; Website: www.wessex.ac.uk/conferences/2000)

October 15–18 (Provisional)

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (International Meeting), Bali, Indonesia. (Contact: AAPG Conventions Dept., P.O. Box 979, Tulsa, OK 74101-0979, USA. Tel: 1 918 560 2679; Fax: 1 918 560 2684)

October 23–27

9TH INTERNATIONAL CORAL REEF SYMPOSIUM, Bali, Indonesia. (Contact: Secretariat of the International Coral Reef Symposium, c/o COREMAP, Jl. Raden Saleh 43, Jakarta 10330, Indonesia. Tel: +62 21 314 30 80; Fax: +62 21 327 958; E-mail: coremap@indosat.net.id; Website: http://www.coremap.or.id)

October 23–27

INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS (30th Annual Meeting), Cape Town, South Africa.

November 13–16

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Reno, Nevada, USA. (Contact: GSA Meetings Dept., P.O. Box 9140, Boulder, CO 80301-9140, USA. Tel: +1 303 447 2020; Fax: +1 303 447 1133; E-mail: meetings@geosociety.org; WWW: http://www.geosociety.org/meetings/index.htm)

November 19–24

GEOTECHNICAL AND GEOLOGICAL ENGINEERING — GEOENG 2000 (International Conference), Melbourne, Australia. (Contact: GeoEng2000, ICMS Pty. Ltd., 84 Queensbridge Street, Southbank, Vic 3006, Australia. Tel: +61 3 9682 0244; Fax: +61 3 9682 0288); E-mail: geoeng2000@icms.com.au; Website: http://civil-www.eng.monash.edu.au/discipl/mgg/geo2000.htm)

December 3–6

DEEP WATER RESERVOIRS OF THE WORLD (Gulf Coast Section of Society of Economic Paleontologists and Mineralogists Foundation Research Conference), Houston, Texas. (Contact: GCSSEPM Foundation, 165 Pineburst Rd., West Hartland, Conn. 06091-0065. Tel: 800/436-1424; Fax: 860/738-3542; E-mail: gcssepm@mail.snet.net; Website: http://www.gcssepm.org)

December 11–16

INTERNATIONAL SYMPOSIUM AND FIELD WORKSHOP ON GEODYNAMIC EVOLUTION OF HIMALAYA-KARAKORAM-EASTERN SYNTAXIS (INDO-BURMA RANGE)-ANDAMAN NICOBAR ISLAND ARC AND ADJOINING REGION, Lucknow, India. (Contact: Prof. A.K. Sinha, Director/Dr. Anil Chandra, Organizing Secretary, Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226 001, India. Tel: 0091-0522-333620/32491/323206/325822/325945; Fax: 0091-0522-381948/374528; E-mail: bsip@bsip.sirnetd.ernet.in)

December 15–19

AMERICAN GEOPHYSICAL UNION (FALL MEETING), San Francisco, California, USA. (Contact: AGU Meetings Department, 2000 Florida Avenue, NW, Washington, DC 20009 USA. Tel: +1 202 462 6990; Fax: +1 202 328 0566; E-mail: meetinginfo@kosmos.agu.org; Website: http://www/agu.org)

2001

May 11–21

MID-PALAEOZOIC BIO- AND GEODYNAMICS: THE NORTH GONDWANA-LAURUSSIA INTERACTION, Joint meeting of the 'International Geological Correlation Program (IGCP) 421' and the 'Subcommission on Devonian Stratigraphy (SDS)' hosted by the 'Senckenbergische Naturforschende Gesellschaft', Frankfurt am Main at the 'Forschungsinstitut und Naturmuseum Senkenberg' Frankfurt am Main, Germany. (Contact: G. Plodowski, Forschungsinstitut Senckenberg, Senckenberganlage 25. D-60325 Frankfurt am Main. Tel: ++49-69-97075127; Fax: ++49-69-97075137; E-mail: gplodows@sngkw.uni-frankfurt.de)

June 3–6

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (Annual Meeting), Denver, Colorado, USA. (Contact: AAPG Conventions Department, P.O. Box 979, 1444 S. Boulder Ave., Tulsa, OK 74101-0979, USA. Tel: +1 918 560 2679; Fax: +1 918 560 2684; E-mail: dkeim@aapg.org)

June 11–16

63RD EAGE CONFERENCE & TECHNICAL EXHIBITION, Amsterdam, The Netherlands. (Contact: EAGE Conference Dept., P.O. Box 59, 3990 DB Houten, The Netherlands. Tel: +31 30 6354055; Fax: +31 30 6343524)

July 30 – August

INTERNATIONAL ASSOCIATION OF ENGINEERING GEOLOGY AND THE ENVIRONMENT (IAEG), "Engineering Geological Problems of Urban Areas" (International Symposium), Ekaterinburg, Russia. (Contact: Secretariat, "EngGeolCity-2001, UralTISIZ 79, Bazhov str., Ekaterinburg, Russia 620075. Tel: +7 3432 559772; Fax: +7 3432 550043; E-mail: UralTIS@etel.ru)

August 23–28

INTERNATIONAL CONFERENCE ON GEOMORPHOLOGY (5th), Tokyo, Japan. (Contact: Prof. K. Kashiwaya, Dept. of Earth Sciences, Kanazawa University, Kanazawa, 920-1192 Japan. E-mail: kashi@kenroku.kanazawa-u.ac.jp)

September 6–12

IAMG2001 (THE ANNUAL CONFERENCE OF THE INTERNATIONAL ASSOCIATION FOR MATHEMATICAL GEOLOGY), Cancún, Mexico. (Contact: IAMG2001 Conference Secretariat, c/o Jorgina A. Ross, Kansas Geological Survey, 1930 Constant Avenue, Lawrence, KS 66047-3724, USA. Tel: +785-864-3965; Fax: +785-864-5317; E-mail: aspiazu@kgs.ukansedu; Website: http://www.kgs.ukans.edu/Conferences/IAMG/index.html)

November 5–8

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Boston, Massachusetts, USA. (Contact: GSA Meetings Dept., P.O. Box 9140, Boulder, CO 80301-9140, USA; Tel: +1 303 447 2020; Fax: +1 303 447 1133; E-mail: meetings@geosociety.org; WWW: http://www.geosociety.org/meetings/index.htm)

2002

INTERNATIONAL ASSOCIATION ON THE GENESIS OF ORE DEPOSITS (11th International Symposium), South Africa. (Contact: Dr. Erik Hammerbeck, Geological Survey, Department of Mineral and Energy Affairs, 280 Pretoria Street, Private Bag X112, Silverton, Pretoria 0001, South Africa. Tel: +012 841 1130; Fax: +012 841 1203; E-mail: ehammerb@geoscience.org.za)

April 7–10

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (Annual Meeting), Houston, Texas, USA. (Contact: AAPG Conventions Department, P.O. Box 979, 1444 S. Boulder Ave., Tulsa, OK 74101-0979, USA. Tel: +1 918 560 2679; Fax: +1 918 560 2684; E-mail: dkeim@aapg.org)

July 7–12

16TH INTERNATIONAL SEDIMENTOLOGICAL CONGRESS, Auckland Park, Gauteng, South Africa. (Contact: Bruce Cairncross, Department of Geology, Rand Africans University, P.O. Box 524, Auckland Park, 2006, South Africa. Tel: +27 11 489 23 13; Fax: +27 11 489 23 09; E-mail: bc@na.rau.ac.za; Website: http://general.rau.ac.za/geology/announcement.htm)

September 16–20

INTERNATIONAL ASSOCIATION OF ENGINEERING GEOLOGY AND THE ENVIRONMENT (IAEG), "Engineering Geology for Developing Countries" (9th International Congress), Durban, South Africa. (Contact: The Technical Committee, 9th IAEG Congress, P.O. Box 1283, Westville 3630, South Africa)

October 28–31

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Denver, Colorado, USA. (Contact: GSA Meetings Dept., P.O. Box 9140, Boulder, CO 80301-9140, USA; Tel: +1 303 447 2020; Fax: +1 303 447 1133; E-mail: meetings@geosociety.org; WWW: http://www.geosociety.org/meetings/index.htm)

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HUTCHISON, C.S., 1989. *Geological Evolution of South-east Asia*. Clarendon Press, Oxford. 368p.

SUNTHARALINGAM, T., 1968. Upper Paleozoic stratigraphy of the area west of Kampar, Perak. *Geol. Soc. Malaysia Bull. 1*, 1-15.

TAYLOR, B., AND HAYES, D.E., 1980. The tectonic evolution of the South China Sea basin. *In:* D.E. Hayes (Ed.), The Tectonic and Geologic Evolution of Southeast Asian Sea and Islands, Part 2. *Am. Geophy. Union Monograph 23*, 89-104.

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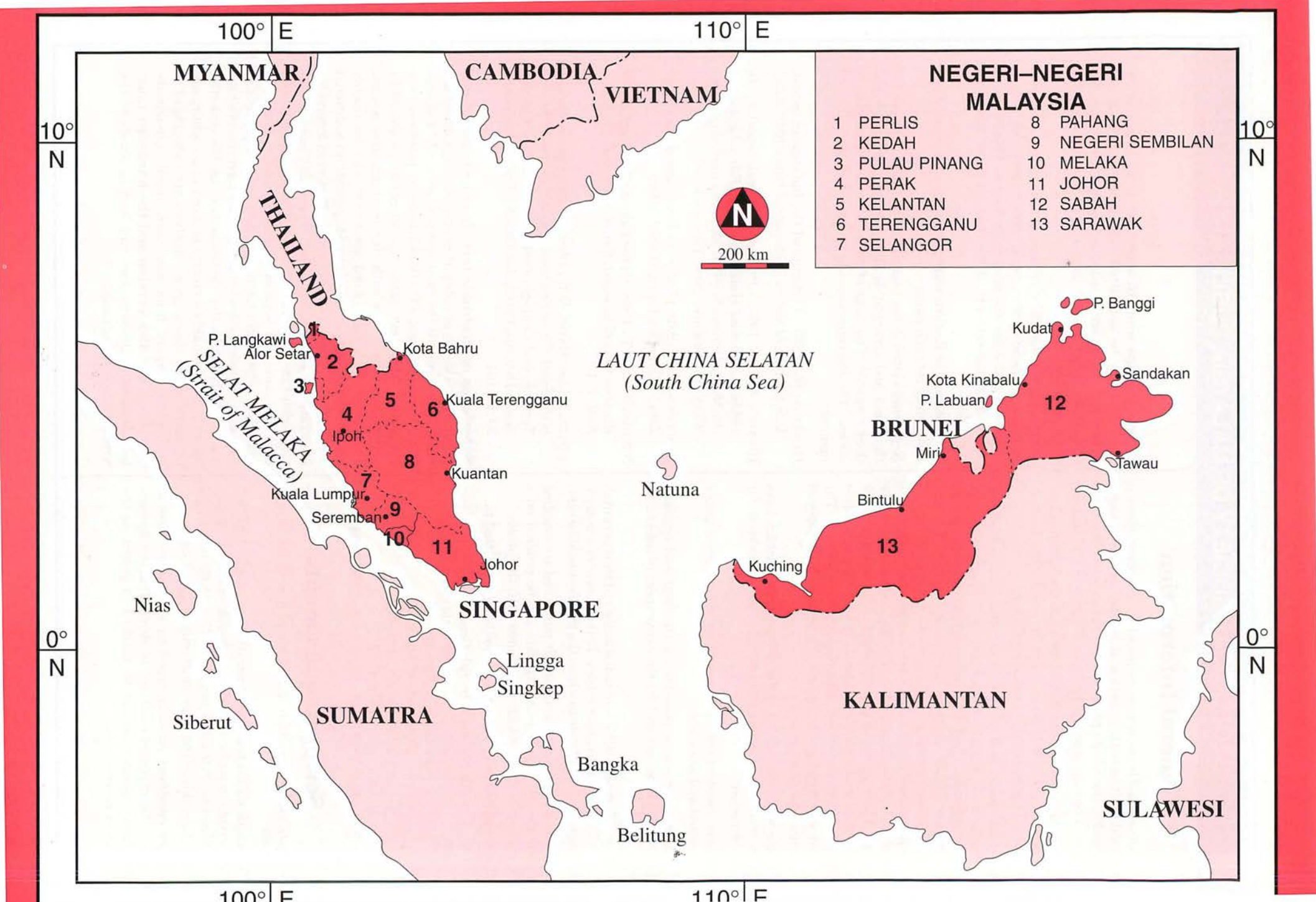
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