

PERSATUAN GEOLOGI MALAYSIA

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GEOLOGICAL SOCIETY
OF MALAYSIA

DIKELUARKAN DWIBULANAN
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PERSATUAN GEOLOGI MALAYSIA Geological Society of Malaysia

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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.

Shore scleroscope hardness of the Kuala Lumpur Granite, Peninsular Malaysia

NG THAM FATT

Institut Pengajian Tinggi, Universiti Malaya

Abstract: Laboratory tests were carried out to determine the Shore scleroscope hardness of samples from the Kuala Lumpur granite, collected in the eastern part of Kuala Lumpur. The H_s mainly ranges from 85 to 100. The grain size, quartz content and dry density of the samples cannot be correlated with the H_s values, conversely, moderately significant correlation exist between H_s and other strength parameters such as dry uniaxial compressive strength, point load index and Brazil tensile strength.

INTRODUCTION

The Shore hardness (H_s) test is non-destructive and simple to perform. It would be very useful if H_s can be used to estimate the rock strength. However, information on this subject for the Malaysian Granite is scarce. This include preliminary studies by Tan and Chan (1980) and Komoo (1987). Thus, samples obtained from the Kuala Lumpur Granite in the eastern part of Kuala Lumpur were tested in the laboratory for their Shore hardness and other geotechnical properties. An attempt is made to correlate H_s and the strength, as well as the physical properties of the granite samples.

THE KUALA LUMPUR GRANITE

The Kuala Lumpur Granite is a large granitic body which is predominantly megacrystic consisting of K-feldspar megacrysts set in an allotriomorphic to hypidiomorphic groundmass. The major minerals are K-feldspar, plagioclase and quartz, while biotite, muscovite and tourmaline usually occur in minor amounts, except in the late phase differentiates where the last two minerals may be dominant.

The Kuala Lumpur Granite consists of several textural and mineralogical varieties (Ng, 1992). On that basis four main units of

granites have been distinguished in the eastern part of Kuala Lumpur (Fig. 1). Unit 1 consists of megacrystic biotite granite, while Unit 2 comprises megacrystic muscovite-biotite granite which represents the typical Kuala Lumpur Granite. Unit 3 is made up of equigranular tourmaline-muscovite granite and Unit 4 comprises mainly microgranite, aplite and pegmatites.

DESCRIPTION OF THE GRANITE SAMPLES

Most of the samples were fresh or slightly discoloured/stained, and thus belong to Grade I of the ISRM (1978a) weathering grade. Only two slightly weathered samples (Grade II, sample KL9 and KL10) were tested. Samples from all the granite units were tested except the pegmatites of Unit 4. Unit 3 and aplites of Unit 4 are grouped together in the statistical analysis due to the similarities in their texture and mineralogy.

The granite samples are principally composed of K-feldspar (11-52%), quartz (18-41%) and plagioclase (15-47%), while biotite, muscovite and tourmaline occur in subordinate amounts. The majority of the samples can be classified as monzogranite (80%), while

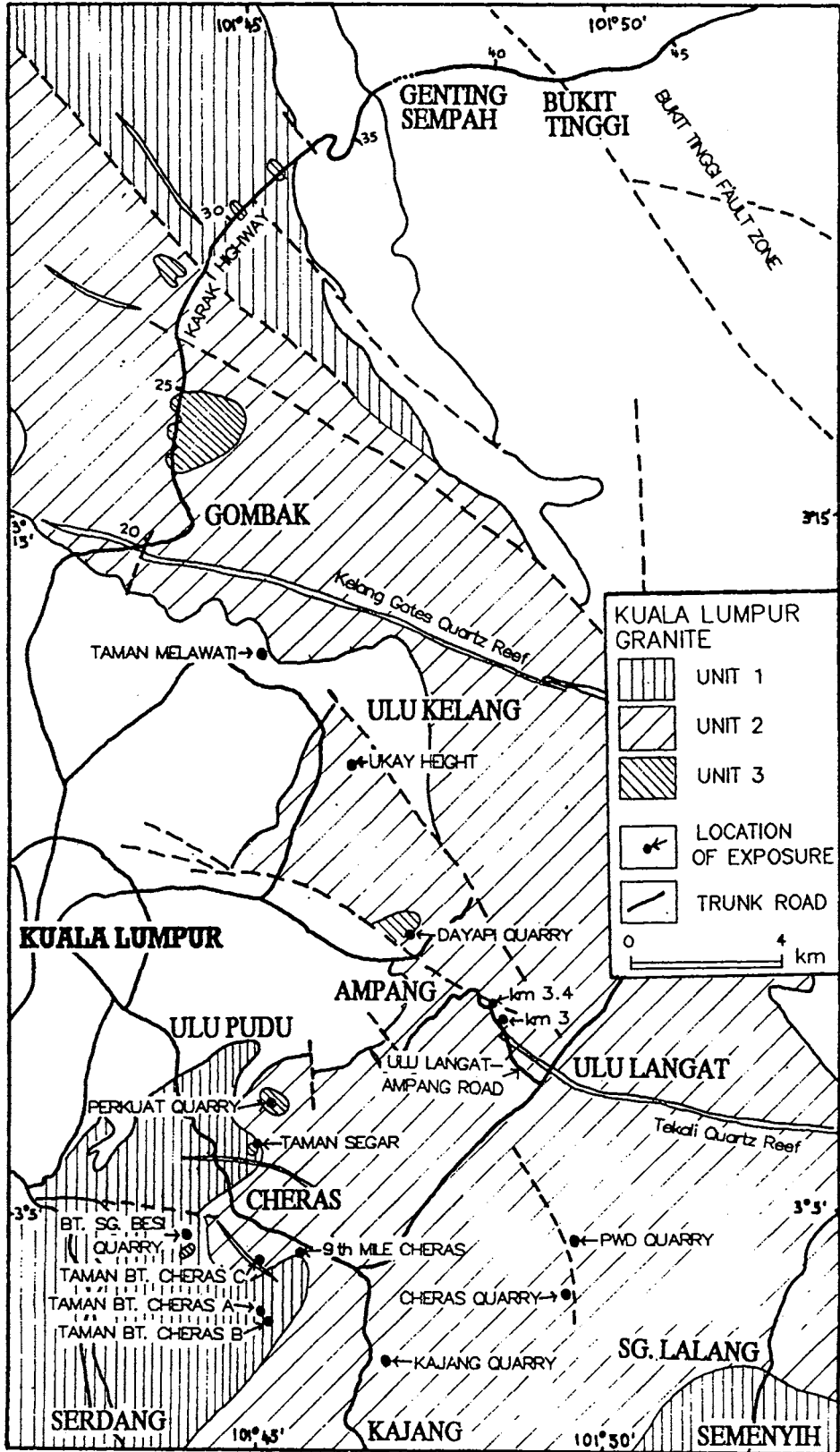


Figure 1: Sketch map showing the distribution of the various units of the Kuala Lumpur Granites in the eastern part of Kuala Lumpur. Most of the samples in this study were collected from the quarries indicated in this map, and along the Karak highway.

subordinate syenogranite (15%) occurs in Units 1 and 2, and granodiorite (5%) in Unit 3. The composition of the samples of the various units of granite obtained by point counting of stained slabs and thin sections are summarised in Table 1.

Samples of Unit 1 have the coarsest grain size, with the average diameter (d) ranging from 3.0 to 5.4 mm (mean 4.41 mm; standard deviation, s , 0.98 mm). It is followed by Unit 2 with d ranging from 1.9 to 5.35 mm (mean 3.45 mm, s 0.84 mm), while Unit 3 and aplite of Unit 4 have the finest grain size and their d is between 0.6 and 1.3 mm (mean 1.00 mm, s 0.26 mm). Units 1 and 2 are megacrystic and they contain an average of 21% and 10% of K-feldspar megacrysts respectively. The megacrysts average about 1.5 to 3 cm in length. Some of the samples are weakly sheared but competent and they have grain size finer than their undeformed protolith.

The dry density of the samples ranges from 24.7 to 25.9 kNm⁻³, but about 70% of the samples have a dry density of more than 25.5 kNm⁻³. The differences of dry density between the various granite units are not significant.

MEASUREMENT PROCEDURE

The Shore scleroscope hardness H_s was determined for cylindrical specimens (NX size) cored from block samples, as well as polished slabs. The H_s of the granite samples was determined following procedures recommended by ISRM (1978b). A Model C-2 Scleroscope was used. To ensure the reproducibility of the results, the specimens used have a minimum test surface area of 20 cm² and a minimum thickness of 2.5 cm (see Rabia and Brook, 1979 for the effects of specimen dimension on the H_s values). The test surfaces of the specimens were finely ground. All specimens were air dried. Two to three specimens were tested for each sample. A total of 50 readings were made, and the extreme values (5 lowest and 5 highest) were discounted in the calculation of the mean H_s , which is taken to represent the H_s of the specimen.

RESULTS

A total of 71 samples (Unit 1=18, Unit 2=29, Unit 3=12, Unit 4=12) were tested. The Shore scleroscope hardness (H_s) ranges from 63 to 109, but most of the samples (about 77%) have values between 85 and 100 (Table 2).

Table 1: Summary of the mineral content in various units of the Kuala Lumpur Granite. s =standard deviation.

| | | Unit 1 | Unit 2 | Unit 3 | Unit 4 |
|-----------------|--------------|----------------|----------------|----------------|----------------|
| Quartz (%) | Range | 21.4-38.5 | 20.1-41.0 | 19.4-36.5 | 18.2-36.4 |
| | Mean \pm s | 28.0 \pm 3.8 | 31.0 \pm 4.6 | 28.0 \pm 4.7 | 29.2 \pm 4.7 |
| K-Feldspar (%) | Range | 33.9-58.1 | 27.4-51.8 | 20.4-41.5 | 10.6-39.8 |
| | Mean \pm s | 41.2 \pm 5.9 | 37.0 \pm 5.4 | 35.2 \pm 7.5 | 30.0 \pm 6.9 |
| Plagioclase (%) | Range | 17.5-33.3 | 14.8-31.5 | 24.1-45.8 | 29.9-47.0 |
| | Mean \pm s | 22.9 \pm 3.3 | 24.3 \pm 3.3 | 31.3 \pm 7.1 | 35.0 \pm 3.9 |
| Biotite (%) | Range | 3.6-11.6 | 1.8-7.5 | <0.5 | <.05 |
| | Mean \pm s | 6.9 \pm 2.0 | 4.2 \pm 1.7 | | |
| Muscovite (%) | Range | <0.5 | 0.5-4.1 | 1.2-5.3 | 0.5-6.8 |
| | Mean \pm s | | 1.9 \pm 1.2 | 3.2 \pm 1.6 | 2.4 \pm 1.9 |
| Tourmaline (%) | Range | <0.5 | <0.5 | 0.5-5.9 | 0.5-7.0 |
| | Mean \pm s | | | 2.0 \pm 1.6 | 3.8 \pm 1.5 |

Table 2: Shore scleroscope hardness (H_s) of samples from the Kuala Lumpur Granite. s =standard deviation

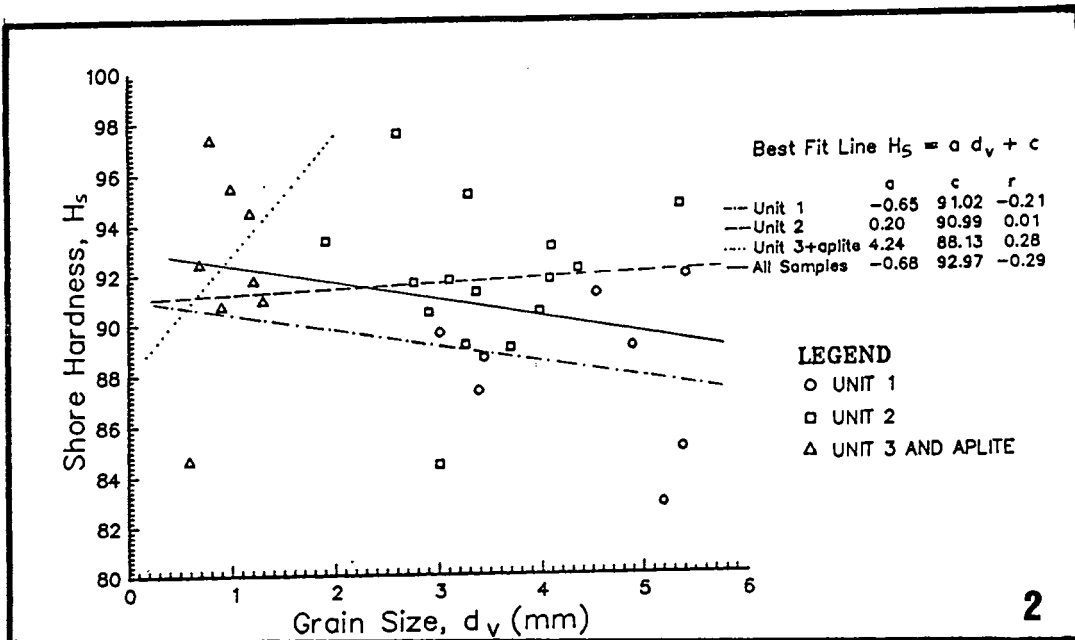
| | Sample | H_s | s | | Sample | H_s | s | | Sample | H_s | s | |
|------------------|--------|-------|------|-----------------------|--------|-------|------|-----------------|------------------|-------|-------|-----|
| UNIT 1 | KL15 | 91.1 | 7.8 | UNIT 2 | KL12 | 93.0 | 6.2 | UNIT 3 | KL1 | 92.1 | 4.9 | |
| | KL28 | 89.6 | 6.8 | | KL18 | 91.7 | 5.8 | | KL2 | 90.6 | 4.3 | |
| | KL212 | 91.7 | 6.0 | | KL19 | 95.1 | 5.8 | | KL9 | 69.1 | 10.5 | |
| | KR29 | 91.8 | 8.3 | | KL21 | 94.6 | 5.4 | | KL16 | 94.4 | 4.7 | |
| | KR30 | 62.7 | 6.3 | | KL26 | 91.6 | 4.8 | | KL29 | 92.3 | 5.4 | |
| | KL3 | 88.6 | 4.8 | | KL27 | 90.4 | 5.6 | | K128 | 98.2 | 4.9 | |
| | KL13 | 87.3 | 7.5 | | KL36 | 97.5 | 3.9 | | UNIT 3 - sheared | KL22 | 84.6 | 6.6 |
| | K211 | 95.5 | 6.6 | | KL5 | 89.0 | 6.3 | | | K803 | 101.6 | 4.2 |
| UNIT 1 - sheared | KL14 | 91.8 | 5.0 | | KL6 | 92.1 | 5.5 | K805 | | 97.2 | 4.8 | |
| | KL23 | 85.0 | 10.8 | | KL8 | 91.2 | 4.7 | KK3 | | 101.4 | 3.8 | |
| | KL24 | 89.0 | 6.0 | | KL10 | 70.6 | 7.4 | KR3191 | | 104.0 | 3.2 | |
| | KL25 | 82.8 | 10.3 | | KL32 | 90.4 | 5.3 | KR3192 | | 103.0 | 4.2 | |
| | KL201 | 94.8 | 3.4 | | KL33 | 89.1 | 5.7 | UNIT 4 - aplite | | KL11 | 91.7 | 4.7 |
| | KL202 | 96.6 | 4.4 | | K736 | 99.2 | 3.1 | | | KL17 | 97.3 | 5.0 |
| | KL210 | 97.4 | 4.4 | | K407 | 97.4 | 4.8 | | KL20 | 95.4 | 4.1 | |
| | KR295 | 94.3 | 5.2 | | K408 | 92.8 | 9.2 | | KL31 | 90.9 | 4.3 | |
| | KR3281 | 94.8 | 5.2 | K750 | 94.8 | 7.4 | K134 | | 98.8 | 4.6 | | |
| | KR3282 | 96.8 | 8.2 | K801 | 94.1 | 4.5 | K715 | | 98.2 | 5.4 | | |
| UNIT 2 - sheared | KL4 | 91.7 | 5.8 | K802 | 92.1 | 8.6 | K717 | | 99.4 | 4.4 | | |
| | KL7 | 93.3 | 4.9 | K804 | 90.4 | 11.6 | K718 | | 101.2 | 3.6 | | |
| | KL34 | 84.4 | 6.7 | K1102 | 95.6 | 6.2 | KR23 | 101.2 | 4.9 | | | |
| | K506 | 96.4 | 9.6 | UNIT 3 - microgranite | KL1103 | 99.2 | 4.9 | | | | | |
| | K614 | 97.6 | 8.7 | | K1104 | 99.6 | 3.3 | | | | | |
| | K703A | 104.8 | 2.8 | | K1105 | 99.0 | 2.7 | | | | | |
| | K703B | 108.8 | 3.3 | | | | | | | | | |
| | K739 | 100.4 | 3.5 | | | | | | | | | |

These values are slightly higher than the previously reported H_s values of Malayan granite (Tan and Chan, 1980; Komoo, 1987). As expected, the slightly weathered samples (KL9 and KL10) gave the lowest H_s values. The H_s of strongly microfractured samples are also lower. Nevertheless, no reduction is noted in the H_s values of many sheared samples where the microfractures are healed. Extremely high H_s values were obtained from several very fine-grained sheared and partially recrystallized samples (mylonites; samples K703a, K703b, KR3191, KR3192 and K803). The finer grained samples generally appear to be harder than the coarser ones. This is reflected by an increase

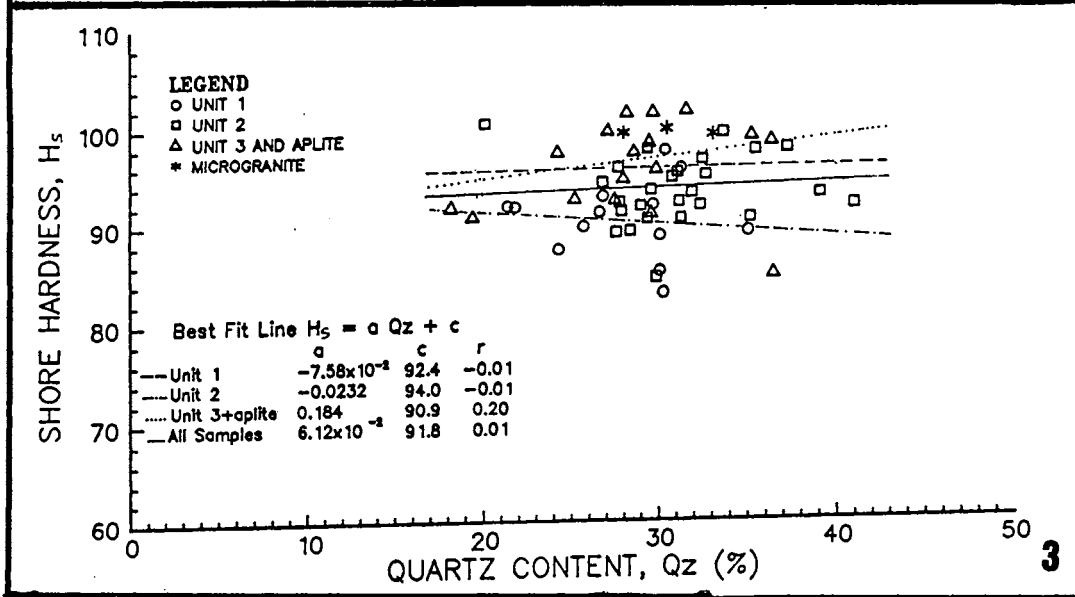
in the mean H_s values from Unit 1 (90.1 ± 8.0) to Unit 2 (94.3 ± 5.0) to Unit 3 and aplite (96.7 ± 5.0).

RELATIONSHIP BETWEEN SHORE SCLEROSCOPE HARDNESS AND PHYSICAL PROPERTIES

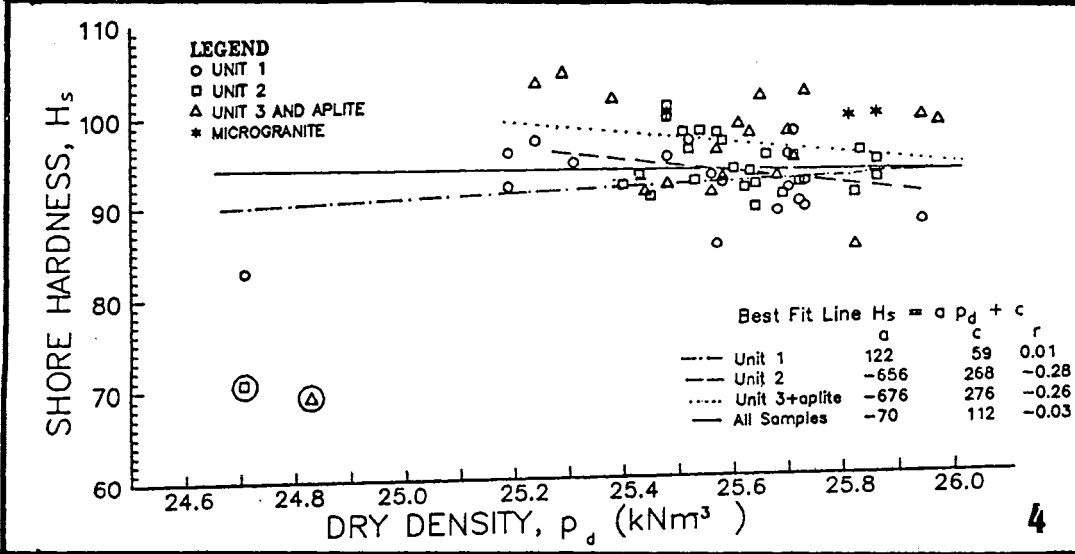
The previous sections have shown that there is a general increase in the mean Shore scleroscope hardness (H_s) values with decreasing grain size. However, the plots of grain size versus H_s is widely scattered and the statistical test (least squares regression and Student-t test) indicates a negative, but insignificant correlation (Fig. 2).



2



3



4

Figure 2: Relationship between Shore scleroscope hardness (H_s) and grain size.
Figure 3: Relationship between Shore scleroscope hardness (H_s) and quartz content.
Figure 4: Relationship between Shore scleroscope hardness (H_s) and dry density. The parameters of the best fit lines are a =slope, c =intercept, r =coefficient of correlation. Note that the two slightly weathered samples (circled) are excluded from the regression.

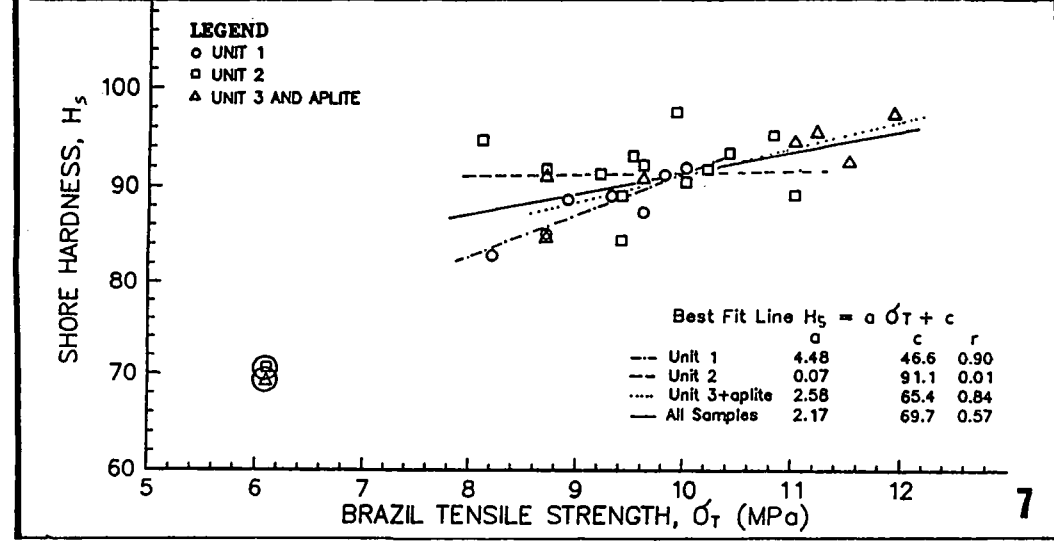
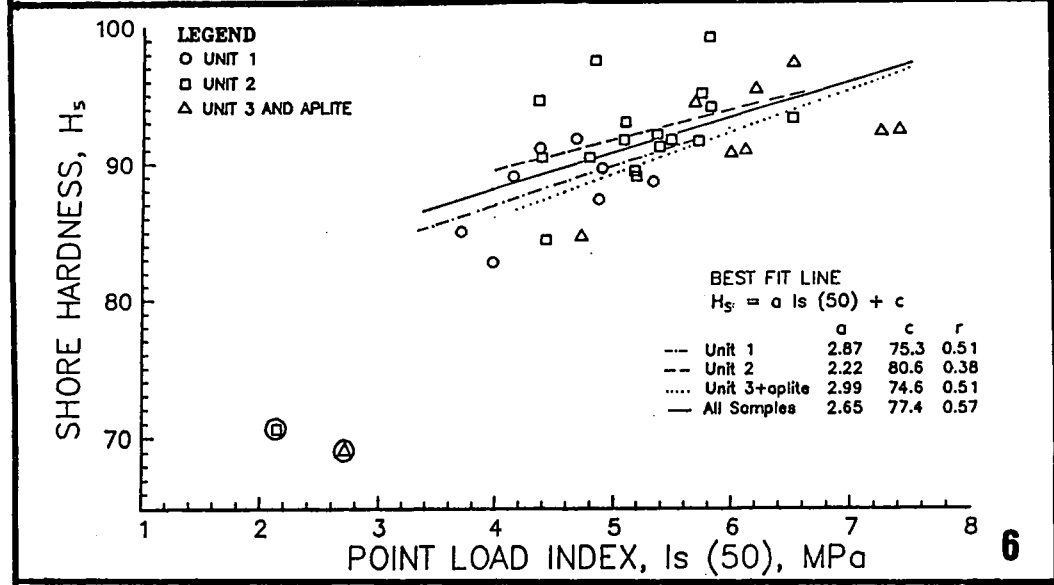
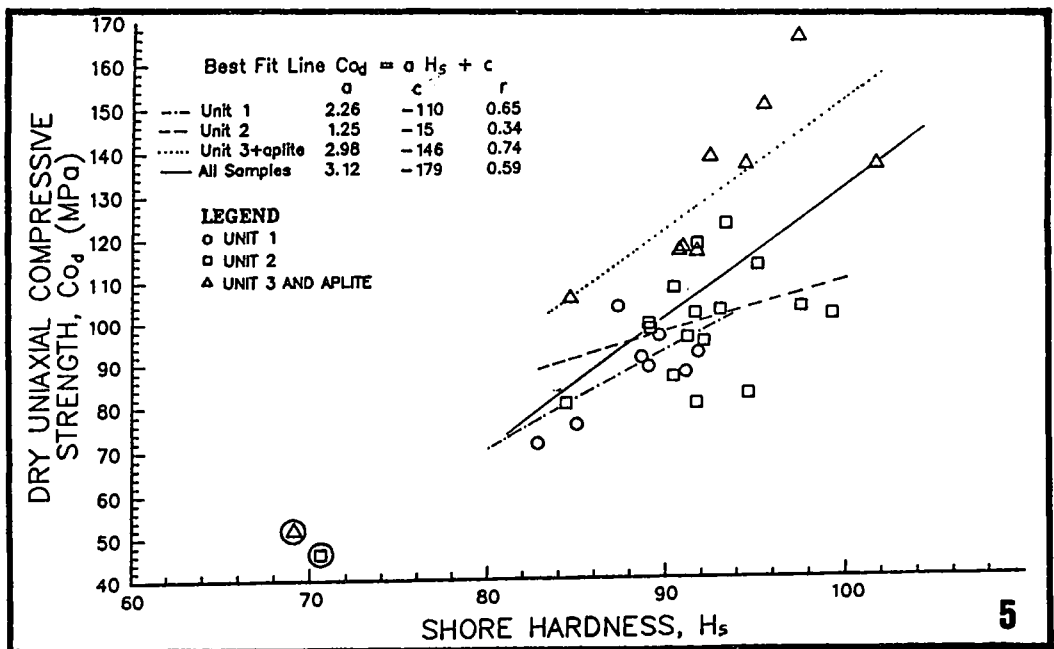


Figure 5: Relationship between Shore scleroscope hardness (H_s) and uniaxial compressive strength.
Figure 6: Relationship between Shore scleroscope hardness (H_s) and point load index.
Figure 7: Relationship between Shore scleroscope hardness (H_s) and Brazil tensile strength. The parameters of the best fit lines are a =slope, c =intercept, r =coefficient of correlation. Note that the two slightly weathered samples (circled) are excluded from the regression.

The coefficient of correlation of the quartz content versus H_g regression is extremely low, suggesting that as far as the Kuala Lumpur Granite is concerned, quartz content has no influence on the H_g (Fig. 3). The correlation between the dry density and H_g is also not significant (Fig. 4).

RELATIONSHIP BETWEEN SHORE SCLEROSCOPE HARDNESS AND ROCK STRENGTH

Shore hardness (H_g) seems to have significant positive correlations with various measures of rock strength (dry uniaxial compressive strength, Co_d ; point load index, $Is(50)$, and Brazil tensile strength, σ_T) as evident from the various plots (Figs. 5, 6 and 7). The H_g —rock strength correlations for Unit 1 and the combination of Units 3 and 4 (aplite) are statistically moderately to highly significant; however, for Unit 2 is not significant. The correlation is also statistically significant when data of all granite units are analyzed together.

According to Deere and Miller (1966), uniaxial compressive strength (Co) can be estimated from Shore hardness by the relationship $Co=2.07H_g$. This value is lower than the value obtained using least square regression in the present study which is defined by $Co_d=3.12H_g-179$ (Fig. 5). The significance of the correlations between H_g and Co_d of the various granite units, however, are rather variable. For the Kuala Lumpur Granite, the measured H_g , thus cannot be used to give a reliable estimation of their strength values.

CONCLUSION

The values of Shore scleroscope hardness (H_g) for the samples of the Kuala Lumpur Granite range mainly from 85 to 100. There is a progressive increment in H_g values from Unit 1 which has the coarsest grain size, to Unit 2 and then to Unit 3 and aplite of Unit 4 which are the finest. However, statistical analysis shows that the H_g -grain size relationship is not significant. The correlation between the H_g

and quartz content, and between H_g and dry density is also not significant. Moderately significant correlations exist between H_g and other strength parameters (dry uniaxial compressive strength, point load index and Brazil tensile strength). In view of the moderate degree of significance, the strength of the rock materials of the Kuala Lumpur Granite cannot be estimated quantitatively from the H_g values.

ACKNOWLEDGEMENT

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Manuscript received 12 January 1993

PERTEMUAN PERSATUAN Meetings of the Society

Ceramah Teknik (Technical Talk)

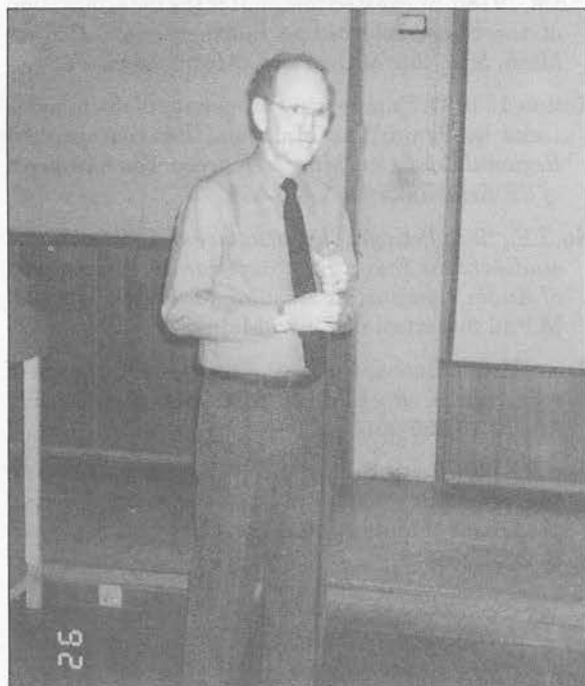
John W. Shelton : Features of Growth Faults

Laporan (Report)

A talk on "Features on growth faults" by Dr. John W. Shelton was held at the Geology Department, University of Malaya, on 27 August 1992. A relatively small audience of 11 persons from University of Malaya and Petronas PRI heard the talk.

Dr. Shelton began with 'defining growth faults' as normal faults which are active during sedimentation and are usually characterized by a listric fault shape and rotation of the hanging-wall strata towards the fault which results in 'rollover' structures. He then discussed the essential geometrical features of growth faults and compares some examples from the Mississippi Delta (US Gulf Coast), Niger Delta and Baram Delta. In most cases, the growth faults are associated with movement of ductile shale or salt under a thick pile of deltaic sediments, while in others, growth faults seem to have originated deeper in the basement. Dr. Shelton suggested that deltaic sedimentation is usually influenced by basement tectonics, as in the case of the Niger Delta which developed on a failed rift. He postulated that the W Baram Line is a significant tectonic boundary which mark the western limit of the Baram depo-centre.

Dr. John Shelton (Ph.D., Univ. Illinois) has more than 40 years of industrial and academic experiences: 10 years with Shell Oil Co. research laboratory in Houston, followed by 20 years as assistant professor and professor in Oklahoma State University, and 10 years as consultant to ERICO and Masera, a consulting firm specializing in non-exclusive research reports and digitized data (documents, logs, seismic, and maps).



Dr. Shelton's research interests have included sandstone geometry and genesis, faulting in basinal development, and descriptive basin analysis. He is an honorary member of AAPG, and had served that organization as editor and as vice-president. He is also member of SEPM, IAS, Petroleum Exploration Society of Great Britain, Tulsa Geological Society and Oklahoma City Geological Society.

Mazlan B. Hj. Madon

Dr. John W. Shelton

BERITA-BERITA PERSATUAN News of the Society

Kecahlian (Membership)

The following applications for membership were approved:

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2. Abdul Wahab Sulaiman
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State University, Baton Rouge, LA 70803,
USA.
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Kuala Lumpur.
4. Sophee Sulong
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Kuala Lumpur.
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7. Teoh Boon Chiat
Jabatan Geologi, Universiti Malaya, 59100
Kuala Lumpur.
8. Adi Mabo
Jabatan Geologi, Universiti Malaya, 59100
Kuala Lumpur.

Pertukaran Alamat (Change of Address)

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

- | | |
|--|---|
| <p>1. Ausaf-ur Rahman 20263 Times Avenue, Hayward, California 94541, USA.</p> | <p>3. Anthony K.C. Yeo 205-H Hill Top Garden, 98000 Miri, Sarawak.</p> |
| <p>2. Jasmi bin Ab. Talib Pusat Remote Sensing Negara, Kementerian Sains, Teknologi dan Alam Sekitar, No. 13, Jalan Tun Ismail, 50480 Kuala Lumpur.</p> | <p>4. Cheah Tik Wah Block 215 #12-205, Bishan Street 23, Singapore 2057.</p> |

Pertambahan Baru Perpustakaan (New Library Additions)

The Society has received the following publications:

- | | |
|---|---|
| <p>1. <i>Chronique de la Recherche Miniere</i>, no. 507, 1992.</p> <p>2. <i>Acta Micropalaeontologica Sinica</i>, vol. 8, no. 4, 1991 & vol. 9, no. 1, 1992.</p> <p>3. <i>Palaeontological abstracts</i>, vol. 6, no. 4, 1991, & vol. 7, no. 1, 1992.</p> <p>4. <i>Acta Palaeontologica Sinica</i>, vol. 30, no. 6, 1991 & vol. 31, no. 1 & 2, 1992.</p> <p>5. <i>Journal of Hebei College of Geology</i>, vol. 14, 4, 1991 & vol. 15, no. 1, 1992.</p> <p>6. <i>Minerals Yearbook</i>, vol. 1: Metals & minerals, 1989.</p> <p>7. <i>Explanatory text of the geologic map of Taiwan</i>, Sheet 35: Hualien, 1991.</p> <p>8. <i>Explanatory text of the geologic map of Taiwan</i>, Sheet 69, 70, 72: Hengchun Peninsula 1991.</p> <p>9. <i>AAPG Explorer</i>, May & June, 1992.</p> <p>10. <i>Journal of the Natural History Museum & Institute, Chiba</i>, vol. 2, no. 1, 1992.</p> | <p>11. <i>Natural History Research</i>, vol. 2, no. 1, 1992.</p> <p>12. <i>American Museum of Natural History</i>, no. 208 & 209, 1991.</p> <p>13. <i>American Museum Novitates</i>, no. 8, 3030, 1992, & 3030, 1991.</p> <p>14. <i>IMM Bulletin</i> no. 1005 & 1006, 1992.</p> <p>15. <i>The Science Reports of the Tohoku University</i>, vol. 62, nos. 1-2, 1992.</p> <p>16. <i>Contributions from the Institute of Geology & Paleontology, Tohoku Univ.</i> no. 93, 1992.</p> <p>17. <i>Bull. Centres Rech. Explor.-Prod. elf-Aquitaine</i>, vol. 16, no. 1, 1992.</p> <p>18. <i>Seatrad Centre</i>, annual report 1991.</p> <p>19. <i>IMM Section A</i>, vol. 101, Jan-April 1992.</p> <p>20. <i>Seatrad Centre: Laboratory Manual</i> no. 5, 1992.</p> <p>21. <i>Geological Survey of Japan, Bulletin</i>, vol. 43, nos. 3-5, 1992.</p> <p>22. <i>USGS Bulletin</i>, 1991: 1787-X</p> |
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BERITA-BERITA LAIN
Other News

1993 AAPG

International Conference & Exhibition

The Hague, The Netherlands

October 17-20, 1993

Sponsors:

American Association of Petroleum Geologists (AAPG)

European Association of Petroleum Geoscientists and Engineers (EAPG)

Geological Survey of the Netherlands (RGD)

Host Societies:

Royal Geological & Mining Society of the Netherlands (KNGMG)

Petroleum Geological Circle (PGK)

THEME: New Views on Old World Oil –
Technology Leads the Way

PROPOSED TECHNICAL SESSIONS

Regional Themes:

Oil and Gas in The Netherlands

Exploration in Mature Areas

West Africa: Discoveries and Exploration
Potential

Oil and Gas Basins in the Former Soviet
Union

Oil and Gas in Central Europe

Structure and Prospects of Alpine Basins and
Foredeeps

Southern Permian Basin: Advances in Reservoir
Geology and Exploration Potential

Technology Themes:

Impact of 3D Seismic

Prediction, Uncertainties and Modelling

Hydrocarbon Habitat and Geochemistry

New Developments in Stratigraphy and
Sedimentology

Remote Sensing

Benefits from Horizontal Drilling

Reservoir Anatomy

PROPOSED FIELD TRIPS

Southern Permian Basin in Germany, 2 days
Carbonates in the Ardennes in Belgium, 2
days

Carbonates in the Dolomites, 5 days

Siliciclastics in the Pyrenees, 5 days

Coastal Deposits in Belgium and The
Netherlands, 5 days

Hydrocarbon Geology of the Carpathian
Foothills, 5 days

EXHIBITION

The Hague will also be the location of the
largest scientific and technical trade fair AAPG
has ever staged outside North America. Over
150 companies will occupy 1800 sq.m. (20,000
sq.ft.) of display space in the Congress Centre's
Statenhal. Lunch will be served daily to all
participants in the exhibits hall's cafe.

The exhibition will feature:

- Computer Mapping and GIS
- Geophysical Data Processing,
Interpretation and Equipment
- Geologic/Geophysical Workstations
- Advanced Well Testing and Services
- Geological Data, Publications, and
"Turnkey" Regional Studies

- Geochemical, Gravity, Remote Sensing, and Global Positioning Equipment and Services

CONFERENCE VENUE

The Netherlands Congress Centre features beautiful theatres for concurrent technical sessions, and an 8,000 sq.m. exhibit hall for the exhibition, poster sessions, and conference luncheons everyday. Easily accessible by public transportation from all conference hotels, it will serve the conference's expansion well since the 1991 AAPG conference in London.

HOTEL ACCOMMODATIONS

Special AAPG conference rates will be available from a variety of hotels which will fit into everyone's budget. The beautiful Kurhaus Hotel in Scheveningen, only five minutes from the Centre, is the headquarters hotel for the conference.

For more information, contact the AAPG Convention Department by fax, 918-584-2274, or mail this form to AAPG, P.O. Box 979, Tulsa, OK 74101-0979 USA.

International Marine Minerals Society

MEETING ANNOUNCEMENT and CALL FOR PAPERS

The 24th annual Underwater Mining Institute will be held on November 7-9, 1993 at the Aspen Lodge, Estes Park, Colorado. Presentations for this year's UMI are currently being sought for two sessions. The first session will focus exclusively on how studies of marine massive sulfide deposits can benefit the exploration and development of land-based sulfide mines. Participation both by mining-industry professionals and marine researchers will be welcome. For the second session the organizers are seeking high-quality papers of timely interest to the exploration and development of marine minerals worldwide.

Individuals interested in becoming members of the Society and those who wish to attend the 1993 UMI and/or present papers should address inquiries to the following:

*Ms. Karynne Chong Morgan
UMI Conference Coordinator
811 Olomehani Street
Honolulu, HI 96813-5513*

Tel: (808) 522-5611

Fax: (808) 522-5618

Internet: morgan@uhunix.uhcc.hawaii.edu

CompuServe: MMTTC, 70673, 534

MINERAL RESOURCES OF RUSSIA

The International Exhibition and Seminar "Mineral Resources of Russia" will be held in November from 9 to 13, 1993, in St. Petersburg.

The Exhibition and the Seminar are organized by Russian Federation Committee on Geology & Exploitation of Natural Resources, A.P. Karpinsky All-Russia Geological Research Institute (VSEGEI), Russian Research Institute on Geology and Mineral Resources of the World Ocean (VNIIOkeangeologiya), Russian Petroleum Research Institute of Geological Prospecting (VNIGRI).

THE FOLLOWING MATERIALS WILL BE WIDELY REPRESENTED AT THE EXHIBITION:

- materials on different mineral deposits, offered for development by joint ventures, joint stock companies or leasing;
- materials on technogenic deposits (from small to giant ones), offered for development to foreign and Russian investors.

Of special interest for participants from Russia and CIS will be proposals and technologies of western firms pertaining to environmental protection during mining of minerals, supply of equipment on leasing basis.

DURING THE EXHIBITION AND THE SEMINAR:

- tenders will be held on different economic minerals from ornamental stones and building materials to metals and energy carriers (fuels);
- the commercial center for concluding single transactions or future deals for exhibited raw materials will be in operation;
- the participants will be acquainted with the Russian mining legislation, taxation regime, capital repatriation terms, and transfer of rights to land its mineral resources to joint ventures;

- leading specialists will make presentations on the state of economic mineral prospecting and exploration in Russia (uranium, gold, platinum, non-ferrous and rare-earth metals, coal and petroleum on shelf and in the continental part of the country).

Heads of mining and petroleum producing enterprises and geological surveys of Russia and CIS countries, interested in foreign capital investments, new technologies of prospecting, exploration, production and dressing of economic minerals will participate in the Exhibition and Seminar.

The Exhibition will be visited by specialists and businessmen from all over Russia and CIS countries, as well as foreign companies.

The Organizing Committee envisages different forms of participation:

- I form - presentation of models, exhibits, maps, demonstration of software and video advertisement at individual booth and office;
- II form - participation in the scientific part of the Seminar;
- III form - participants having no booth or office have the right to consult the information and legal centre, to participate in all events of the Exhibition, to carry out sale-purchase transactions.

If you are interested in participation in the Exhibition and the Seminar, please send your enquires to:

mail: 199004, St. Petersburg, P.O. Box 215, "MINERALS"

telex: 614026 sprst su;

phone: (812) 355-79-52; 218-92-24; 355-72-01

fax: (812) 355-79-52

Chairman of the Organizing Committee,
Director of A.P. Karpinsky All-Russia Geological Research Institute,
Academician of the Russian Academy of Sciences

GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATIONS

BULLETIN OF THE GEOLOGICAL SOCIETY OF MALAYSIA
 WARTA GEOLOGI - NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MALAYSIA

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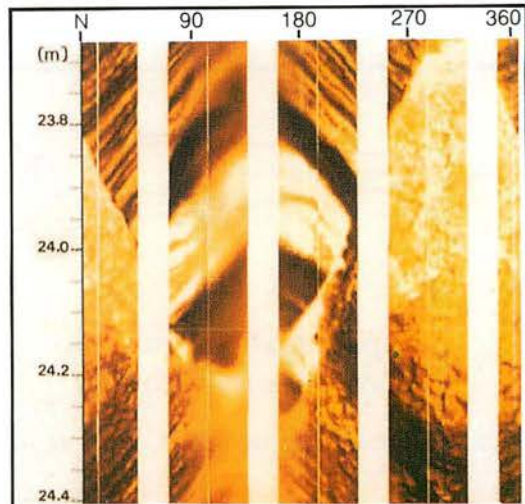
Fullbore Micro Imager*

Formation imaging using microelectrical arrays has benefited the oil industry since its introduction in the mid-80s. The FMI*, Fullbore Formation MicroImager tool, is the latest-generation electrical imaging device. It belongs to the family of imaging services provided by the MAXIS 500* system with its digital telemetry capability.

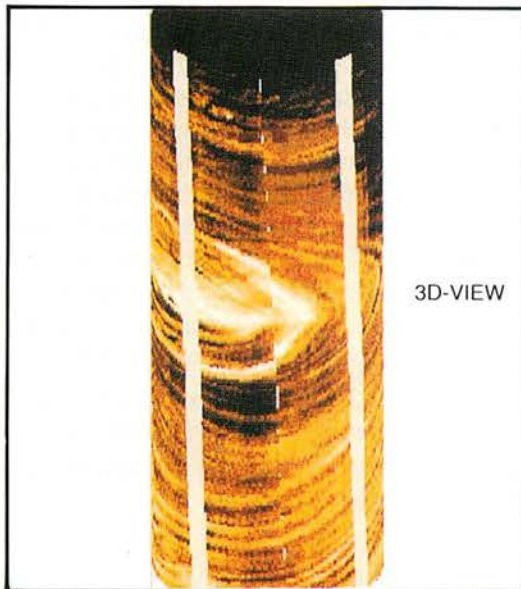
The FMI log, in conductive muds, provides electrical images almost insensitive to borehole conditions and offers quantitative information, in particular for analysis of fractures.

The FMI tool combines high-resolution measurements with almost fullbore coverage in standard diameter boreholes, thus assuring that virtually no features are missed along the borehole wall. Fully processed images and dip data are provided in real time on the MAXIS 500 imaging system.

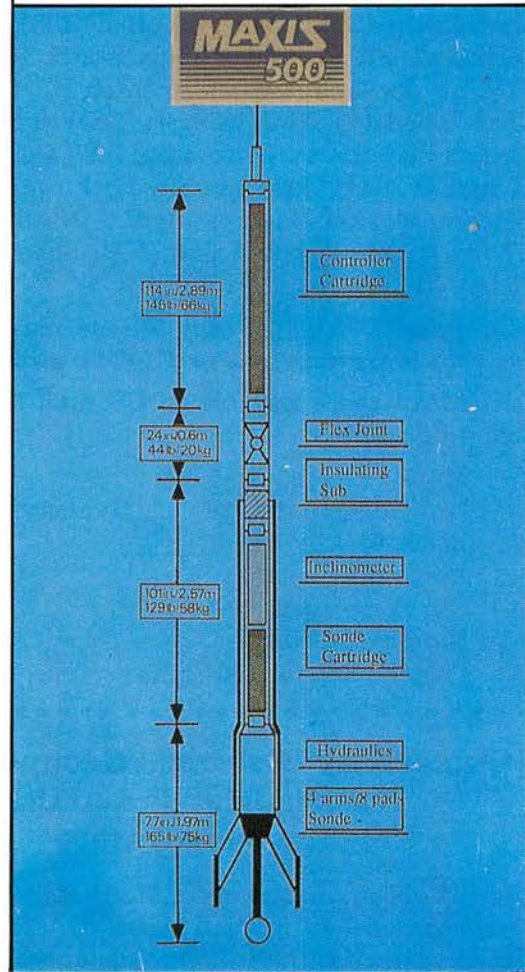
The tool's multiple logging modes allow wellsite customization of results to satisfy client needs without compromising efficiency.



Fault without associated drag



"Bullseye" structure



BERITA-BERITA LAIN
Other News



**Aspects of Nonmarine
Cretaceous Geology**

(eds. by Niall J. Mateer & Chen Pei-ji)

This book is a proceedings of the Ürümqi Symposium on Nonmarine Cretaceous Correlation (IGCP 245 project) in 1987, and includes 21 articles by Pier Binda, Eric Buffetaut, E.V. Bugdaeva, Kenneth Carpenter, P.J. Chen, John Congleton, Philip Currie, David Eberth, Romeo Flores, Dan Grigorescu, Z.W. Gu, V.A. Krassilov, B.P. Liu, Martin Lockley, Niall Mateer, Masaki Matsukawa, E.V. Nesterova, Thomas Rich, Ashok Sahni, Y.B. Shen, and Robin Whatley from 11 countries.

Price: \$35.00 per copy (Please add \$4.00 per copy for surface mail or \$7.00 for airmail.)

Make check payable in US fund to the following address:

Mr. Ma Zhongang
Nanjing Institute of Geology and
Palaeontology
Academia Sinica
Chi-Ming-Ssu 1
Nanjing 210008
People's Republic of China

**Quaternary Biological Groups of
the Nansha Islands and the
Neighbouring Waters**

The book is edited by the Multidisciplinary Oceanographic Expedition Team of Academia Sinica to the Nansha Islands and published by the Zhongshan University Publishing House. It

is an important monograph, which includes 11 papers written by 16 Chinese well-known stratigraphic palaeontologists from Nanjing Institute of Geology & Palaeontology, and South China Sea Institute of Oceanology, Academia Sinica. Dealt with in this book are spore-pollen, calcareous-nannoplankton (coccolithus), dinoflagellate-cysts, foraminifers, ostracodes, radiolarian, diatoms, gastropods, bivalves & bryozoans, all of which were collected from near 200 submarine surface deposits (at water depth of 30–3,096 m). 14 drill holes (at water depth of 30–4,230 m, with the cores 20–514 cm), reef flats and lagoon surface deposits on 14 coral reefs. Half of genera and species of the organisms mentioned above were described and the provincial characteristics, time-space distribution, evolutionary regularity, ecological habit, climate and sedimentary facies were discussed herein. This project was carried out over a 5-year period. This book is useful reference source for those studying the Quaternary sedimentary facies and biota and the technicians and teachers working in the departments of production, education and scientific research.

552 pages, 15 x 23 cm, 102 plates, 113 figures and tables, price \$50 (including postage and handing). Copies are available by remitting money to:

Prof. Lu
Nanjing Institute of Geology and
Palaeontology
Academia Sinica
Chi-Ming-Ssu 1
Nanjing 210008
People's Republic of China

KALENDAR (CALENDAR)

1993

► April 1993

◆◆◆ April 1-3

FRACTALS AND DYNAMICS SYSTEMS IN GEOSCIENCES (International Meeting), Frankfurt/Main, Germany (Jörn H. Kruhl, Geology-Paleontology Institute, JW Goethe-University, Senckenberganlage 32, D-6000 Frankfurt/Main, Germany. Phone: 0049-69-7982695)

◆◆◆ April 1-30

COMPUTER SIMULATED MINERAL EXPLORATION (22nd Workshop), Fontainebleau, France. (L. Zanone, Ecole des Mines de Paris, CGGM-IGM, 35, rue Saint-Honoré, 77305 Fontainebleau Cedex, France. Phone: (33 1) 64 69 49 30; telefax: (33 1) 64 69 47 01; telex: 694 736F)

◆◆◆ April 4-8

REMOTE SENSING AND GLOBAL ENVIRONMENTAL CHANGE (25th International Symposium), Graz, Austria. (Dorothy M. Humphrey, ERIM, P.O. Box 134001, Ann Arbor, MI 43113-4001, USA. Phone: (313) 994-1200, ext. 2290; telefax: (313) 994-5123)

◆◆◆ April 5-8

GLOBAL WARMING, int'l. mtg., Chicago. (Sinyan Shen, Natural Resource Management Division, SUPCON International, One Heritage Plaza, Woodridge, III. 60517-0275. Phone: 708/910-1551; 419/372-8207. Fax: 708/910-1561)

◆◆◆ April 17-20

INTEGRATED METHODS IN EXPLORATION AND DISCOVERY (International Conference), Denver, Colorado, USA. (SEG Conference '93, P.O. Box 571, Golden, CO 80402, USA. Telefax: (303) 279-3118)

◆◆◆ April 21-25

GEOSCIENCE EDUCATION AND TRAINING (International Conference), Southampton, UK. (Mrs. Esther Johnson, GEOED Conference Secretariat, Department of Geology, University of Southampton, Southampton S09 5NH, UK. Phone: (0703) 593049; telefax: (0703) 593052; telex: 47662 SOTONU G)

◆◆◆ April 19-23

REMOTE SENSING, int'l mtg., Enschede, The Netherlands, by international Institute for Aerospace Survey and Earth Sciences, and others. (Myriam Fahner, Box 6, 7500 AA Enschede, The Netherlands. Phone: 31-53-874 255. Fax: 31-53-874 436) Deadline for manuscripts: March 11.

◆◆◆ April 25-28

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (Annual Meeting), New Orleans, Louisiana, USA. (Convention Department, AAPG, Box 979, Tulsa, OK 74101, USA. Phone: (918) 584-2555; telefax: (918) 584-0469)

► May 1993

◆◆◆ May 5-8

PROTECTING THE EARTH - CHALLENGES TO SCIENCE AND TECHNOLOGY (1st International Fair and Congress), Köln, Germany. (Alfred-Wegener-Stiftung zur Forderung der Geowissenschaften, Wissenschaftszentrum Ahrstraße 45, Postfach 20 14 48, D-5300 Bonn 2, Germany. Phone: 02 28/302-260; telefax: 02 28/302-270; telex: 885 420 wzd).

◆◆◆ May 5-8

GEOTECHNICA '93 (International Symposium), Cologne, Germany. (Hans Teetz, Cologne International Trade Fairs Inc., 21st Floor, 666 Fifth Ave., New York, NY 10103-0165, USA. Phone: (212) 974-8836; telefax: (212) 974-8838)

◆◆◆ May 15-21

ENVIRONMENTAL HYDROLOGY AND HYDROGEOLOGY (2nd USA/CIS Joint Conference), Arlington, Virginia, USA. (Americal Institute of Hydrology, 3416 University Avenue, SE, Minneapolis, MN 55414-3328, USA. Phone: (612) 379-1030; telefax: (612) 379-0169)

◆◆◆ May 17-19

GEOLOGICAL ASSOCIATION OF CANADA/ MINERALOGICAL ASSOCIATION OF CANADA (Joint Annual Meeting), Edmonton, Alberta, Canada. (J.W. Kramers, Alberta Geological Survey, P.O. Box 8330, Station F, Edmonton, Alberta T6H 5X2, Canada. Phone: (403) 438-7644; telefax: (403) 438-3644)

◆◆◆ May 25–June 15

BASIN TECTONIC AND HYDROCARBON ACCUMULATION (International Conference), Nanjing, China. Professor Shi Yangshen, Department of Earth Sciences, Nanjing University, Nanjing, China. Phone: 86-25-634651, ext. 2890; telefax: 86-25-302728; telex: 34151 PRCNU CH. Or David Howell, U.S. Geological Survey, 345 Middlefield Road, MS 902, Menlo Park, CA 94025, USA. Phone: (415) 354-5430; telefax: (415) 354-3224

◆◆◆ May 31–June 2

APPLIED MINERALOGY, int'l. mtg., Perth, Western Australia. (Jim Graham, ICAM '93, Private Bag, P.O. Wembley 6014, Australia. Phone: 619/387-0371)

▶ June 1993

◆◆◆ June 1–5

GEOTECHNICAL ENGINEERING (International Meeting), St. Louis, Missouri, USA. (Norma R. Fleming, 119 ME Annex, University of Missouri, Rolla, MO 65401-0249. Phone: (314) 341-6061; (800) 752-5057. telefax: (314) 341-4992)

◆◆◆ June 7–16

SUBCOMMISSION ON CARBONIFEROUS STRATIGRAPHY 1993 FIELD AND GENERAL MEETING (International Symposium), Liège, Belgium, and field excursions to Belgium, Germany, and the Pyrenees in France. (Dr. M. Streeel, Paléontologie, Université de Liège, 7 Place du Vingt-Août, B-4000 Liège, Belgium)

◆◆◆ June 20–27

ZEOLITES (International Meeting), Boise, Idaho, USA. Sponsored by International Committee on Natural Zeolites. (F.A. Mumpton, Dept. of Earth Sciences, State University of New York, Brockport, 14420. Phone: 716/395-2635; 716/637-2324. Fax: 716/395-2416)

◆◆◆ June 21–25

ROCK ENGINEERING (Meeting and Workshop), Lisbon, Portugal. Sponsored by the International Society for Rock Mechanics. (Luis Ribeiro e Sousa, Portuguese Society for Geotechnique, Laboratório Nacional de Engenharia Civil, Av. do Brasil, 101, 1799 Lisboa Codex Portugal. Phone: 848 21 31; telefax: 89 76 60)

◆◆◆ June 28–July 2

INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS: HYDROGEOLOGY

OF HARD ROCKS (24th IAH Congress), Oslo, Norway. (Geological Survey of Norway, P.O. Box 3813, Ullevål Hageby, N-0805 Oslo, Norway. Phone: 47-2-950895)

▶ July 1993

◆◆◆ July

ENVIRONMENTAL CONTEXT OF HUMAN EVOLUTION (International Scientific Congress and Exhibition), The Netherlands and Indonesia. (Dr. Hans Beijer, Geological Survey of The Netherlands, P.O. Box 157, NL-2000 AD Haarlem, The Netherlands. Telefax: 31 23 351614)

◆◆◆ July 5–8

ROCK FRAGMENTATION BY BLASTING (4th International Symposium), Vienna, Austria. (Dr. H.P. Rossmannith, Institute of Mechanics, Technical University Vienna, Wiedner Hauptstraße 8–10/325, A-1040 Vienna, Austria. Phone: (222) 588 01 5514 or 5519; telefax: (222) 587 5863)

◆◆◆ July 5–9

FLUVIAL SEDIMENTOLOGY (5th International Conference), Brisbane, Australia. (Continuing Professional Education, The University of Queensland, Queensland 4072, Australia. Phone: 61 7 365 7100; telefax: 61 7 365 7099; telex: UNIVQLD AA40315)

◆◆◆ July 5–16

VERY LOW GRADE METAMORPHISM: MECHANISMS AND GEOLOGICAL APPLICATIONS (IGCP Project 294 Thematic Meeting and Field Excursions), Xi'an, People's Republic of China. (Dr. Wu Hanquan, Xi'an Institute of Geology and Mineral Resources, 116 Easy Youyi Road, Xi'an 710054, People's Republic of China)

◆◆◆ July 17–24

GEOLOGICAL AND LANDSCAPE CONSERVATION, int'l. mtg., Great Malvern, U.K. (Margaret Phillips, The Company, St. John's innovation Centre, Cowley Road, Cambridge CB4 4WS. Phone: (0223) 421124. Fax: (0223) 421158)

◆◆◆ July 18–23

CLAY CONFERENCE (10th International Conference in conjunction with Commission VII of the International Soil Science Society), Adelaide, South Australia. (Dr. Tony Eggleton, Geology Department, ANU, GPO Box 4, Canberra, ACT 2601, Australia)

◆◆◆ July 25-30

ORIGIN OF PARENTAL ANORTHOSITE MAGMAS, TECTONIC AND METAMORPHIC PROCESSES IN THE EVOLUTION OF ANORTHOSSITES (Conference), Kadalaksha, Kola Peninsula, Russia. Sponsored by International Geological Correlation Programme Project 290. (Michael Higgins, Sciences de la Terre, Université du Québec à Chicoutimi, Chicoutimi, Québec G7H 2B1, Canada. Phone: (418) 545-5012)

▶ August 1993

◆◆◆ August

INTRAPLATE VOLCANISM: THE POLYNESIAN PLUME PROVINCE (International Workshop), Tahiti, French Polynesia. (Workshop Tahiti 1993, C. Dupuy, Centre Géologique et Géophysique, Case 060, Université de Montpellier II, place E. Bataillon, 34095 Montpellier Cedex 5, France. Phone: (33) 67-634-983; telefax: (33) 67-523-908)

◆◆◆ August 1-6

GEOCHEMISTRY OF THE EARTH SURFACE (3rd International Symposium), University Park, Pennsylvania, USA. (Lee Kump, Department of Geosciences, Pennsylvania State University, 210 Deike Bldg., University Park, PA 16802, USA. Phone: (814) 863-1274; telefax: (814) 865-3191)

◆◆◆ August 4-7

PALEOZOIC MICROVERTEBRATES (IGCP Project-328) (2nd International Symposium), Berlin, Germany. In conjunction with the birthday anniversary of Professor Walter Gross. (Dr. S. Turner, Queensland Museum, P.O. Box 3300, South Brisbane, Qld 4101, Australia. Telefax: 617 846 1918. Or Prof. H. Jaeger, Museum für Naturkunde, Invalidenstr. 43, 00-104 Berlin, Germany)

◆◆◆ August 8-12

STRATIGRAPHIC RECORD OF GLOBAL CHANGES: CLIMATE, SEA LEVEL, AND LIFE (SEPM Meeting), University Park, Pennsylvania, USA. (Mike Arthur, Department of Geosciences, Pennsylvania State University, University Park, PA, 16802, USA. Phone: (814) 865-6711)

◆◆◆ August 11-15

GEOSCIENCE IN URBAN DEVELOPMENT (International Conference), Beijing, China. (Professor Wang Sijing, Chairman LANDPLAN IV, Institute of Geology, Academia Sinica, P.O.

Box 634, Beijing 100029, China. Phone: 86-1-2027766; telefax: 86-1-4919140; telefax: 22474 ASCHI CN c/o Institute of Geology)

◆◆◆ August 15-19

CARBONIFEROUS TO JURASSIC PANGEA: A GLOBAL VIEW OF ENVIRONMENTS AND RESOURCES (International Symposium), Calgary, Alberta, Canada. (Dr. Benoit Beauchamp or Dr. Ashton Embry, Geological Survey of Canada, 3303 33rd St. NW, Calgary, Alberta T2L 2A7, Canada. Phone: (403) 292-7190; telefax: (403) 292-4961)

◆◆◆ August 23-29

GEOMORPHOLOGY (3rd International Conference), Hamilton, Ontario, Canada. (3rd International Geomorphology Conference, Department of Geography, McMaster University, Hamilton, Ontario L8S 4K1, Canada. Phone: (416) 525-9140, ext. 4535; telefax: (416) 546-0463; E-mail: GEOMORPH)

◆◆◆ August 23-29

COASTAL SEDIMENTOLOGY (Meeting), Hamilton, Ontario, Canada. (William F. Tanner, Dept. of Geology B-160, Florida State University, Tallahassee, FL 32306, USA) Phone: 904/644-3208)

◆◆◆ August 28-September 15

LANDSLIDES (International Meeting and Workshop), Czech and Slovak Federal Republic. (ICFL-C.S. Landslides '93, c/o NOVOSAD IG/EG, I. Sekaniny 1801, CS-70800 Ostrava 4, Czechoslovakia. Phone: (42-69) 473028; telefax: (42-2) 381848)

▶ September 1993

◆◆◆ September 5-11

NUCLEAR-WASTE MANAGEMENT, int'l mtg., Prague, Czech and Slovak Federal Republic, by American Society of Mechanical Engineers, Czech and Slovak Mechanical Engineering Society, and the Czech and Slovak Nuclear Society. (Radovan Kohout, Ontario Hydro (H11 A2), 700 University Ave., Toronto, Ontario M5G 1X6. Phone: 416/592-5384. Fax: 416/592-4485)

◆◆◆ September 6-8

STRUCTURES AND TECTONICS AT DIFFERENT LITHOSPHERIC LEVELS (International Conference), Graz, Austria. (Wolfgang Unzog, Department of Geology, University of Graz, Heinrichstrasse 26, A-8010 Graz, Austria. Phone: 43 316 380 5584; telefax: 43 316 38 28 85)

◆◆◆ September 8-13

JURASSIC GEOLOGY (Arkel International Symposium), London, UK. (Dr. Stewart Brown, Conference Secretary, Petroleum Science and Technology Institute, 25 Ravelston Terrace, Edinburgh EH4 3EX, UK. Phone: 031 451 5231; telefax: 031 451 5232)

◆◆◆ September 8-17

LAYERING IN IGNEOUS COMPLEXES - WAGER AND BROWN 25th ANNIVERSARY COMMEMORATIVE MEETING (Symposium), Johannesburg, South Africa. (Professor R. Grant Cawthorn, Department of Geology, University of the Witwatersrand, P.O. Wits 2050, Republic of South Africa. Phone: 11 716 2711 or 2608; telefax: 11 339 1697 or 430 1926)

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AFRICAN GEOLOGY (16th International Colloquium), Ezulwini, Swaziland. (The Chairman or Secretary, Organizing Committee, 16th Colloquium of African Geology, P.O. Box 9, Mbabane, Swaziland. Phone: 42411; telefax: 45215; telex: 2301 WD; telegram: GSM)

◆◆◆ September 21-23

ANDEAN GEODYNAMICS (2nd International Symposium), Oxford, UK. Sponsored by University of Oxford and Institut Francais de Recherche Scientifique pour le Développement en Coopération (Orstom). (Pierre Soler, ISAG 93, Orstom, CS1, 213 rue Lafayette, 75480 Paris Cedex 10, France. Telefax: 33 1 48 03 08 28)

◆◆◆ September 25-October 1

INTERNATIONAL ASSOCIATION OF VOLCANOLOGY AND CHEMISTRY OF THE EARTH'S INTERIOR (Meeting), Canberra, Australia. (IAVCEI ACTS, GPO Box 2200, Canberra ACT 2601, Australia. Phone: 61 6 257-3299. Fax: 61 6 257-3256)

◆◆◆ September 27-30

ENVIRONMENTAL BIOGEOCHEMISTRY (11th International Symposium), Salamanca, Spain. (Dr. J.F. Gallardo Lancho, I.E.T./CSIC, Aptdo. 257, Salamanca 37071, Espana, Spain. Phone: (923) 219606; telefax: (923) 219609)

◆◆◆ September 27-29

GLOBAL BOUNDARY EVENTS (Interdisciplinary Conference of IGCP Project 293, Geochemical Marker Events in the Phanerozoic), Kielce, Poland. (Barbara Studencka, Muzeum Ziemi PAN, Al. Na Skarpie

20/26, 00-488 Warszawa, Poland. Phone: (4822) 217-391; telefax: (4822) 297-497. Or Helmut H.J. Geldsetzer, Geological Survey of Canada, 3303-33rd St. NW, Calgary, Alberta T2L 2A7, Canada. Phone: (403) 292-7155; telefax: (403) 292-5377)

◆◆◆ September 28-October 1

ENVIRONMENTAL POLLUTION (International Conference), Barcelona, Spain. (ICEP Conference Office, ICTR Secretariat, 11-12 Pall Mall, London SW1Y 5LU, UK. Phone: 44 71 930-6825; telefax: 44 71 976-1587; telex: 925312 REICO)

▶ October 1993

◆◆◆ October 4-9

BASIN INVERSION (International Conference), Oxford, UK. (James G. Buchanan, British Gas Exploration and Production Limited, 100 Thames Valley Park Drive, Reading, Berkshire RG6 IPT, UK. Phone: 0734-353222; telefax: 0734-353484; telex: 846231)

◆◆◆ October 10-15

INTERNATIONAL ASSOCIATION FOR MATHEMATICAL GEOLOGY (Silver Anniversary Meeting), Prague, Czechoslovakia. (John C. Davis, Kansas Geological Survey, University of Kansas, Lawrence, KS 66047, USA. Phone: (913) 864-3955; telefax: (913) 864-5317; E-mail: john_davis.moore_@msmail.kgs.ukans.edu. Europe, Africa, and Asia: Jan Harff, Institute for Baltic Sea Research, Seestr. 15, 0-2530 Warnemuende, Germany. Phone: 49 381 58 261; telefax: 49 381 58.336; E-mail: harff@geologie.io-warnemuende.dbp.de)

◆◆◆ October 11-24

INTERGEMS '93 (2nd International Symposium on Precious and Decorative Stones), Prague, Czechoslovakia. Sponsored by Czech and Slovak Geological Services and Museums. (Secretariat INTERGEMS, Malostranske nam. 19, CS-11821 Praha 1, Czechoslovakia. Phone: 535 357; telefax: 533 564)

◆◆◆ October 17-20

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS (International Meeting), The Hague, The Netherlands. (AAPG, Box 979, Tulsa, OK 74101, USA. Phone: (918) 584-2555; telefax: (918) 584-0469)

◆◆◆ October 18–23

NEW DEVELOPMENTS IN GEOTHERMAL MEASUREMENTS IN BOREHOLES (Meeting), Klein Koris, Germany. (Prof. E. Hurtig, GFZ Potsdam, Telegrafenberg A45, 0-1561 Potsdam, Germany. Phone: 49 331 310 347; telefax: 49 331 310 610; E-mail: gth@gfz-potsdam.dbp.de)

◆◆◆ October 25–28

GEOLOGICAL SOCIETY OF AMERICA (Annual Meeting), Boston, Massachusetts, USA. (Vanessa George, GSA, P.O. Box 9140, Boulder, CO 80301, USA. Phone: (303) 447-2020)

▶ November 1993

◆◆◆ November 15–30

LOW TEMPERATURE METAMORPHISM: PROCESSES, PRODUCTS AND ECONOMIC SIGNIFICANCE (IGCP Project 294 Thematic Meeting), Santiago, Chile. (Professor M. Vergara, Universidad de Chile, Departamento de geologia y Geofisica, Casilla 13518-Correo 21 Santiago, Chile. Telefax: 56 2-6963050)

1994

◆◆◆ June 6–10

EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS (56th Annual Meeting and Exhibition), Austria Center, Vienna, Austria. (Evert Van der Gaag, Business Manager, European Association of Exploration Geophysicists, Utrechtseweg 62, NL-3704 HE Zeist, the Netherlands. Phone: (03404) 56997; telefax (03404) 62640; telex:33480)

1995

◆◆◆ May 29–June 2

EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS (57th Annual Meeting and Exhibition), Glasgow, UK. (Evert van der Gaag, European Association of Exploration Geophysicists, Utrechtseweg 62, NL-3704 HE Zeist, The Netherlands. Phone: (03404) 56997; telefax: (03404) 62640; telex: 33480)

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Sep-Okt 1988

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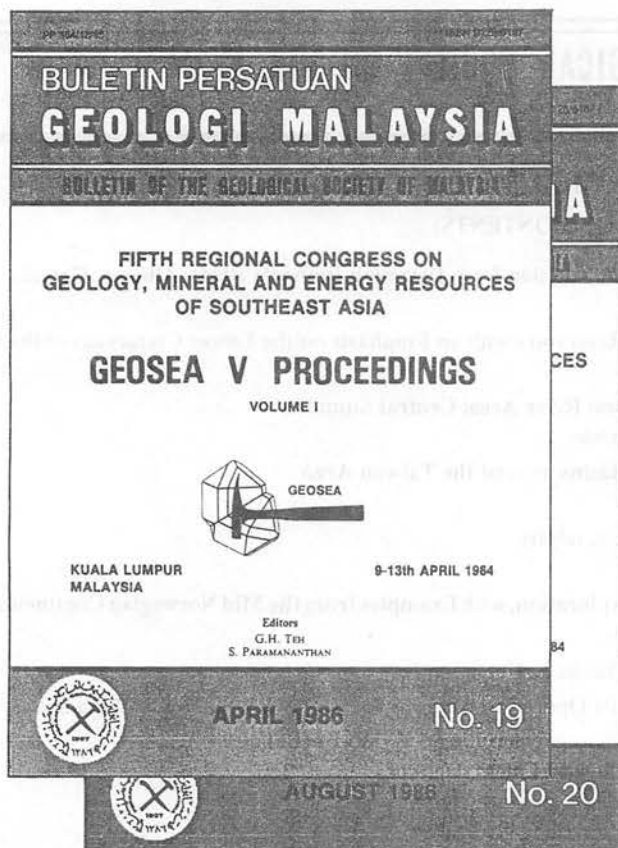
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