

A review of the progress in knowledge of the geology and mineral resources of Malaysia from 1972 to early 1975¹

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Abstract: During the period under review significant progress has been made in the accumulation of knowledge of the geology and mineral resources of Malaysia by the staff of the Geological Survey, local universities, and mineral exploration companies.

The Survey intensified its geological mapping programme during this period and some 70 per cent of Peninsular Malaysia has been mapped on scales of either 1 inch to 1 mile or 1 inch to 4 miles. Good progress was made in most of the regional mapping projects in Sabah and Sarawak. However, mapping activities were temporarily suspended in those areas for which security clearance could not be obtained. The Survey also intensified its geophysical and geochemical exploration programmes. Magnetometer surveys were carried out in several places, many potential mineral deposits were investigated, and several tens of thousands of geochemical samples analyzed. The Survey was also active in the geohydrology field and significant quantities of groundwater have been discovered. Several dam sites and potential quarry sites were investigated on behalf of government and private agencies. The Survey produced several publications, including the 7th edition of the 1:500,000 geological map of Peninsular Malaysia, mineral resource potential maps for all districts in Peninsular Malaysia, and a special paper in which the Gagau Group has been formally established.

The local universities carried out geological mapping of several small areas usually on scales of 1:25,000. In economic geology the local universities were engaged in studies of ore deposits and ore textures, and the development of exploration techniques. Other interesting projects carried out by the local universities include the study of the stratigraphy of north-west Peninsular Malaysia, feldspars of Malaysian granites, and sea level changes.

INTRODUCTION

Significant progress has been made in the accumulation of knowledge and understanding of the geology and mineral resources of Malaysia during the period 1972 to early 1975. Because of security reasons, however, certain parts of the country could not be investigated. The Geological Survey of Malaysia, geology departments of local universities, and mineral exploration companies, increased their staff and intensified their activities. Several geological memoirs, reports and papers have been published. The Survey produced several maps, including the 7th edition of the 1:500,000 geological map of Peninsular Malaysia and mineral resource potential maps for all districts in Peninsular Malaysia. The first edition of the geohydrological map of Peninsular Malaysia is currently being printed and a similar map is being prepared for Sabah and Sarawak.

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GEOLOGICAL MAPPING

The Geological Survey of Malaysia intensified its geological mapping programme and at the beginning of 1975 some 70 per cent of Peninsular Malaysia had been mapped on a scale of either 1 inch to 1 mile or 1 inch to 4 miles (see Figure 1). Some areas in Sabah and Sarawak are currently being mapped on a scale of 1:50,000 (see Figure 1). In general, priority for geological mapping by the Survey is given to those areas considered to be favourable for the occurrence of economic mineral deposits, or to areas ear-marked for land development schemes.

Several small areas in Peninsular Malaysia, Sabah, and Sarawak have been mapped by graduate students of the University of Malaya and Universiti Kebangsaan Malaysia (see Figures 2, 3 & 4). In addition, general geological mapping of some areas has been carried out by staff members of the local universities.

STRATIGRAPHY

During the period under review one new stratigraphic unit, the Gagau Group (Rishworth, 1974), was formally established in Peninsular Malaysia. The Gagau Group comprises a thick sequence of terrigenous beds which are of extensive occurrence in a number of isolated areas along the eastern flank of the Malay Peninsula in the States of Kelantan, Pahang, and Johore. Fossil plant remains collected from three or more widely separated localities prove these rocks to be of Upper Jurassic to early Lower Cretaceous age.

The type area is an upland cuesta located on the boundary between Kelantan and Pahang, and Gunong Gagau (4514 feet) is its highest point. There the Group consists of two flat-lying undisturbed formations, the Badong Conglomerate and the overlying Lotong Sandstone. This sequence rests with conspicuous angular unconformity upon an eroded basement of strongly folded Permian and Triassic (?) strata cut by granite of probable Jurassic age.

During the past two years renewed interest has been shown in the geology of the Langkawi Islands. Studies made by Dr. T.E. Yancey, and a group of Japanese geologists, suggest that the popularly believed mid-Palaeozoic orogeny in northwest Peninsular Malaysia may be a fallacy.

During the course of systematic geological mapping in south Kelantan geologists from the Survey discovered a conformable fossiliferous sequence ranging from uppermost Permian to lowermost Triassic. This discovery is probably of consideration international interest, and at present more detailed field studies are being carried out jointly by the Survey and a team of Japanese geologists.

Several new fossil localities have been discovered by the Survey's field parties and should lead to a better understanding of the local stratigraphy.

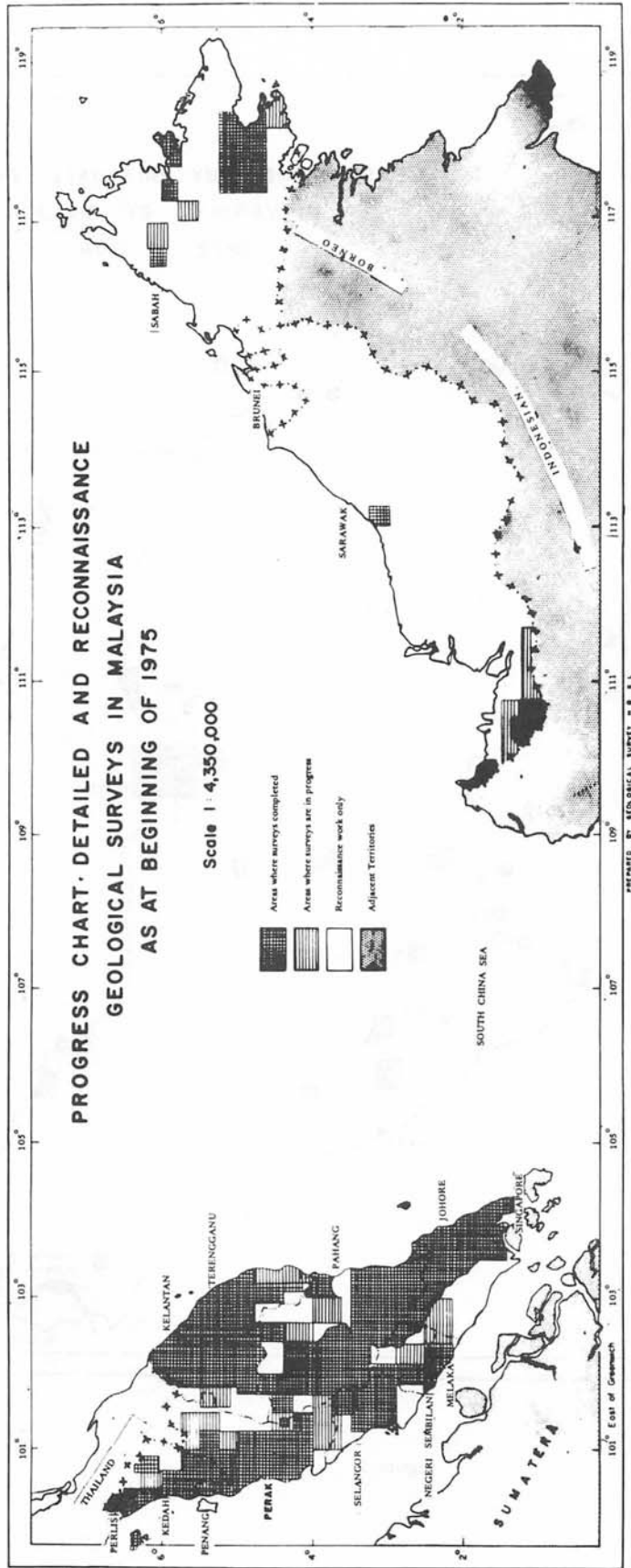


Figure 1.

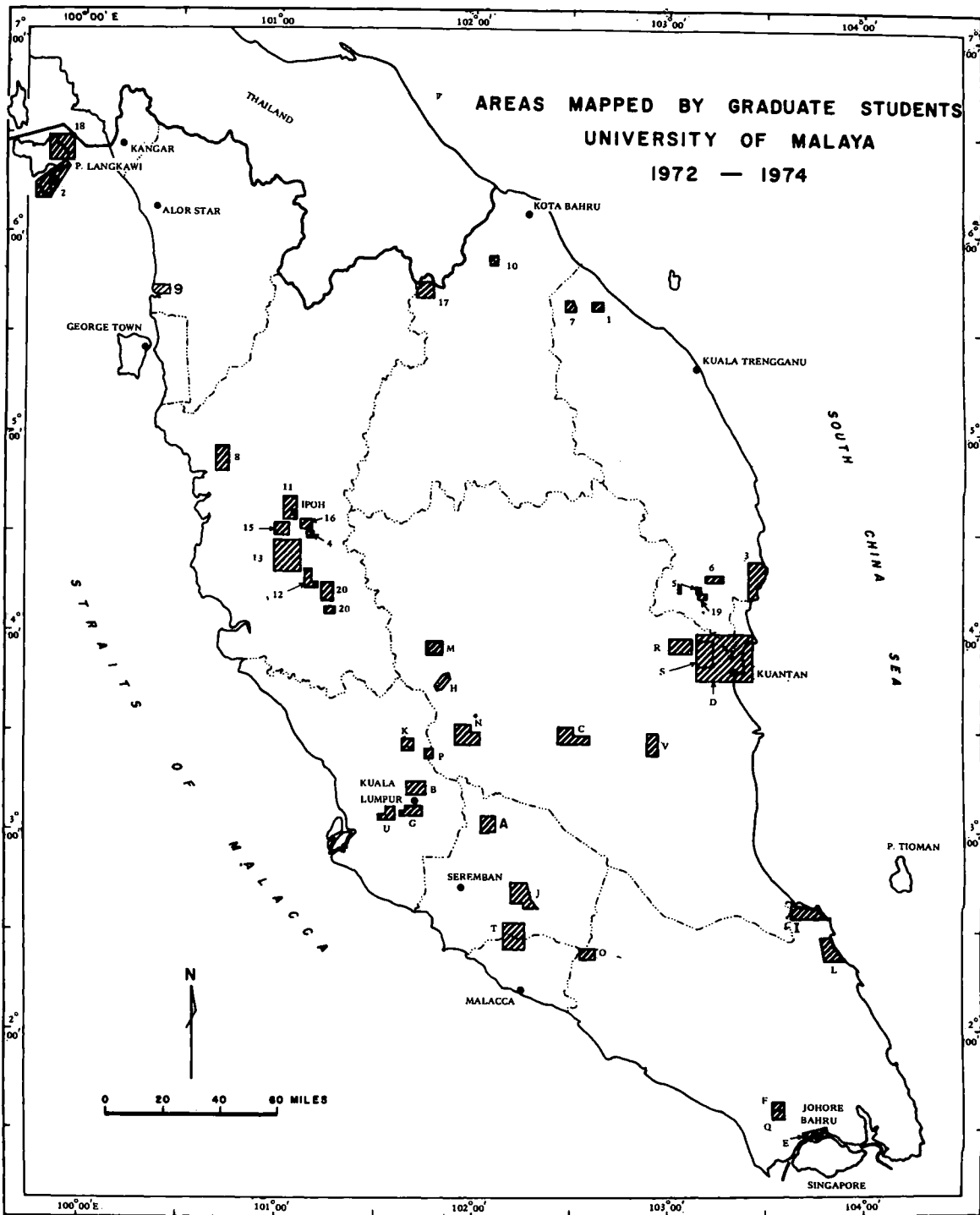


Figure 2.

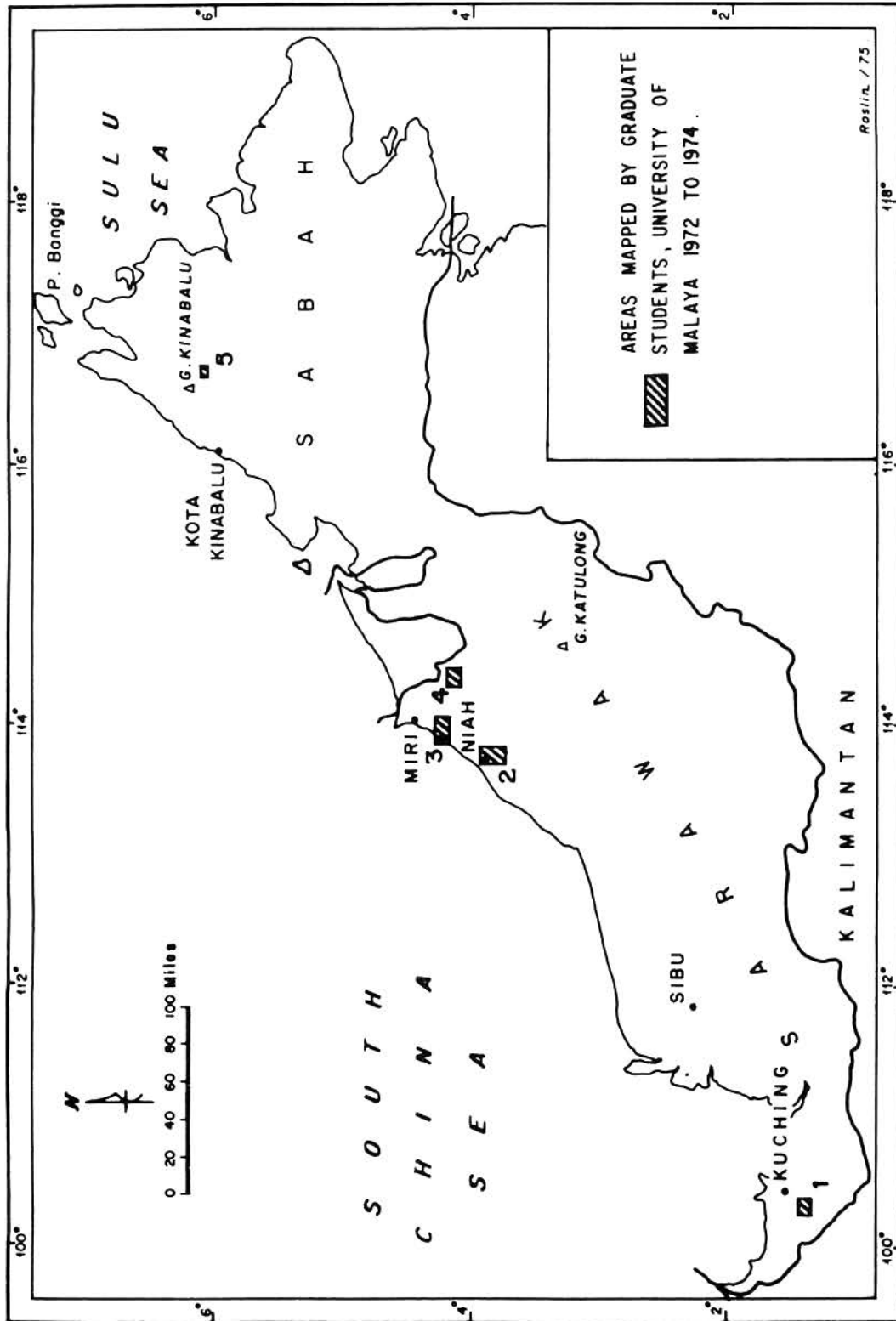


Figure 3

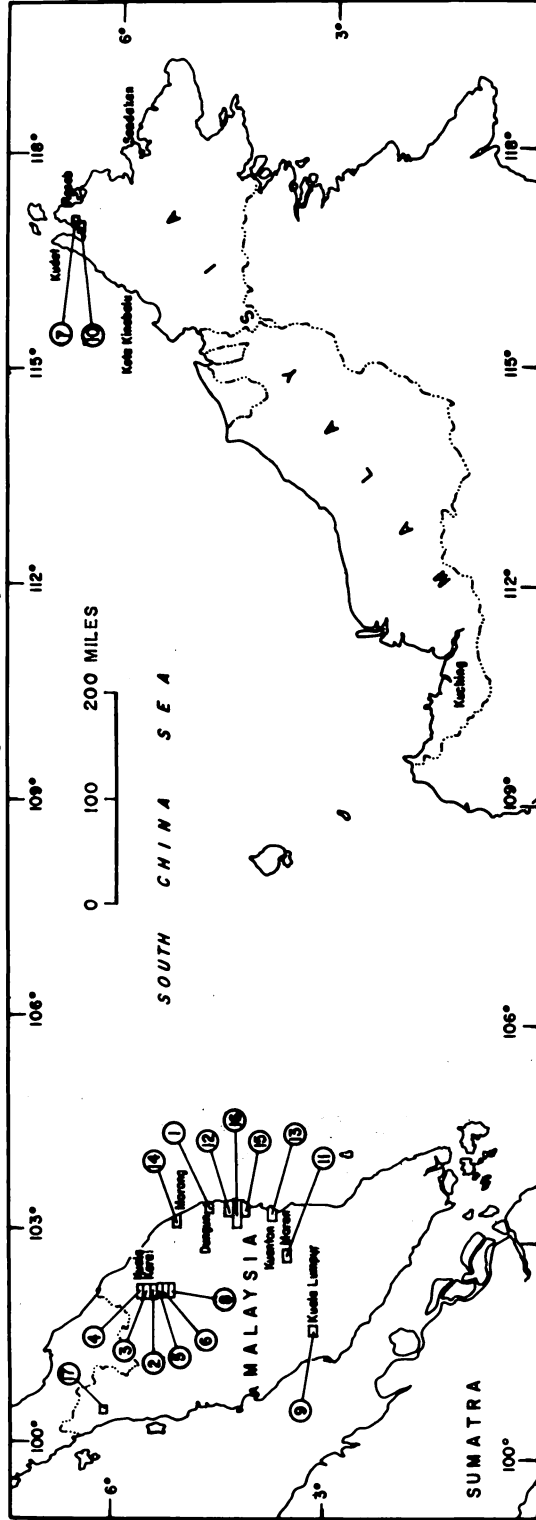
Names of persons who studied areas marked in Figure 2

- | | |
|-------------------|---------------------|
| 1. M H Au-yong | A. Abd. Hamid |
| 2. T Wan Fuad | B. A L Chua |
| 3. S T Goh | C. Y C Chow |
| 4. Harbajan Singh | D. Abd. Hanif |
| 5. L S Goh | E. Kumar Kuttan |
| 6. K H Lim | F. R S S Koe |
| 7. W C Loy | G. P S Leong |
| 8. K H Lai | H. G B Ong |
| 9. A K Rao | I. W H Mah |
| 10. Nik Azman | J. Mohd Yussof |
| 11. A C Ooi | K. K H Lean |
| 12. T H Ong | L. S C Lee |
| 13. H K Too | M. T P Lee |
| 14. K W Tong | N. D Krishnan |
| 15. B K Tan | O. Y K Lim |
| 16. L C Wong | P. G C Yeoh |
| 17. P K Wong | Q. C C Voon |
| 18. W S Chow | R. J T Tan |
| 19. K K Cheang | S. C M Ong |
| | T. Shaharin Ibrahim |
| | U. Siti Zauyah |
| | V. S K Teoh |

Names of persons who studied areas marked in Figure 3

- | | |
|---------------------|---------------|
| 1. K S Loi | 4. Yogeswaran |
| 2. P Jagasthasparan | 5. P S Lim |
| 3. Polit Hamzah | |

Kawasan Kawasan Penyelidikan Geologi
 Jabatan Geologi,
 Universiti Kebangsaan Malaysia.



1. Tjia Hong Djin ————— Dungun

Tahun 73/74

- 6. Abd. Rahim Samsuddin ————— Pahi, Kuala Kerai
- 7. Basir Jasin ————— Macang, Kuala Kerai
- 8. Abd. Rashid Abd. Mohid ————— Sungai Nai, Kuala Kerai
- 9. Nasiman Sapari ————— Kuala Kerai, Kelantan

Tahun 74/75

- 6. Aziz Husein ————— Manik Ural, Kuala Kerai
- 7. Rashid Ahmad ————— Rosob, Sabah
- 8. Aziz Sidek ————— Manek Ura, Kuala Kerai
- 9. Mahzan Bakar ————— Kuala Lumpur utara
- 10. Mohd. Zahari Bakar ————— Marasimsim - Silimpodon, Sabah

Tahun 75/76

- 11. Hamzah Mohammad ————— Maran
- 12. Hamzah Yunus ————— Pakar
- 13. Ibrahim Komoo ————— Kuantan
- 14. Ismail Abu Bakar ————— Marang
- 15. Kassim Buhiran ————— Telok Kalong
- 16. Mohd. Mat Tan ————— Kijal
- 17. Syed Shiekh Almasheer ————— Gunung Jerai

Figure 4.

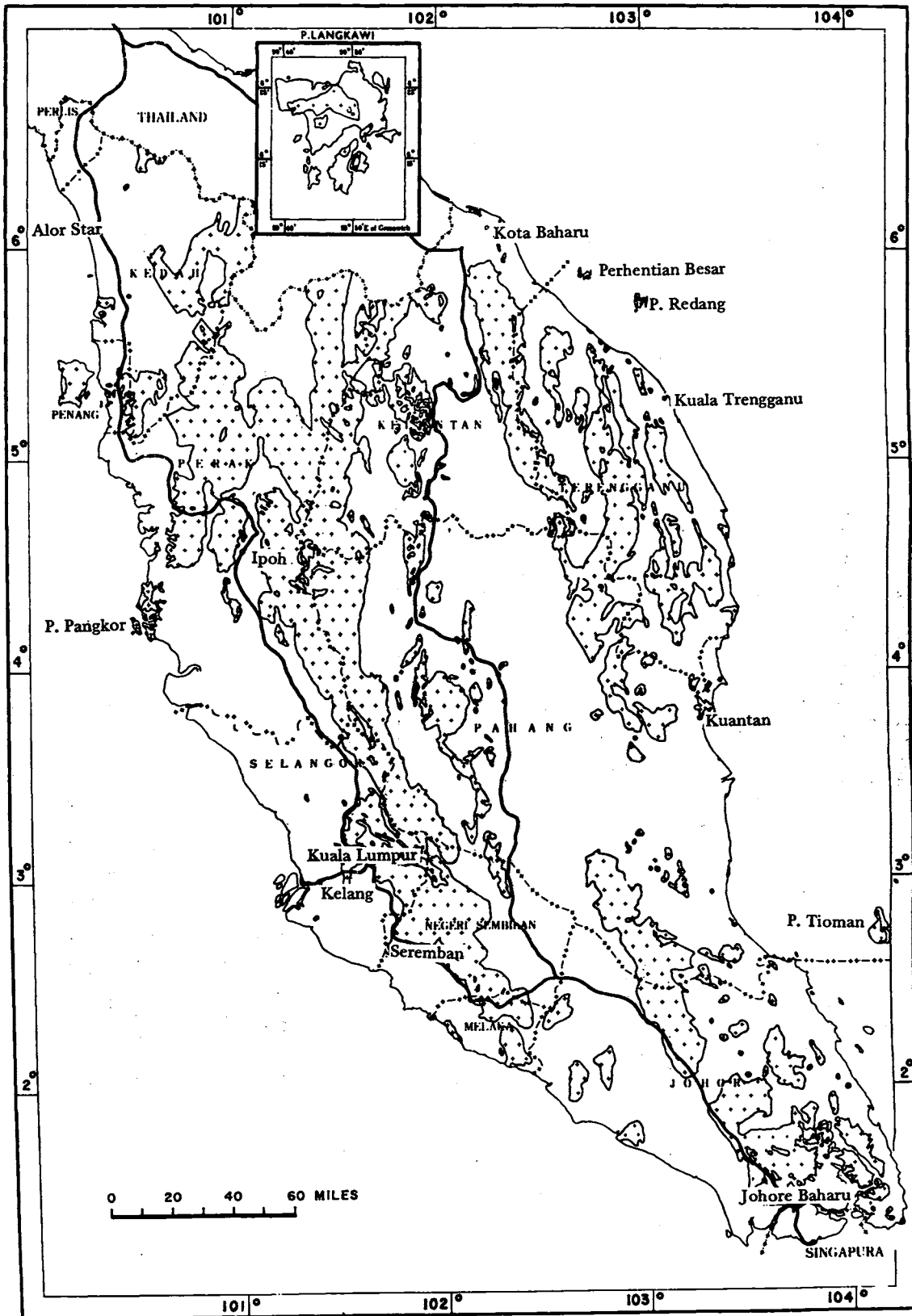


Figure 5.

PETROLOGY AND AGES OF PLUTONS

Field and laboratory studies of plutonic and volcanic rocks in Malaysia have been carried out by Survey geologists and members of the staff at the local universities. Recent detailed studies on the Bukit Ulu Lalat pluton and country rocks have provided useful data, and similar studies in the future should provide a better understanding of the mode and level of emplacement of the plutons that crop out in the central belt of the peninsula.

Laboratory studies using X-ray and optical methods, of K-feldspars in granitic rocks from Peninsular Malaysia have been made by Hutchison. According to Hutchison the results obtained indicate that the Main Range granites were emplaced at deeper levels than the East Coast granites. The latter, according to him, are emplaced at high levels since they usually contain orthoclase and have contact metamorphic aureoles bordering them. The Main Range granites are found by him to contain maximum microcline suggesting slow cooling and hence emplacement at deeper levels (see Figure 5). It must be pointed out, however, that bordering the Main Range granites there are sporadic occurrences of andalusite-bearing metamorphic rocks which are considered to form parts of contact metamorphic aureoles. This feature is well illustrated in roof pendants and contact aureoles in the State of Negri Sembilan.

More radiometric data have been made available since the geochronological studies of Malaysian granites was first initiated by the Survey with the assistance of the Institute of Geological Sciences, United Kingdom. During the last year or two several age determinations have been made. These new data reinforce the conclusion that in Peninsular Malaysia the granitic intrusions were emplaced during several periods between late Palaeozoic and Tertiary and the associated tin mineralization is not time dependant. (Singh and Jaafar, 1974). Furthermore, the age distribution pattern of the various granitic masses is at present not clear.

STRUCTURAL GEOLOGY

The structural geology and deformation history of certain areas in the eastern part of Peninsular Malaysia and Sabah have been interpreted by staff of local universities. Several major faults and mylonitic zones, and their significance in engineering geological studies and economic geology, have been recognized by Survey geologists. These studies strongly suggest that deformation of rocks in many parts of Malaysia is more complex than had been previously realized.

QUATERNARY GEOLOGY

Evidence of higher Quaternary, sea levels have been recorded and dated at several areas in Peninsular Malaysia by staff members of the University of Malaya and Universiti Kebangsaan Malaysia. Samples of shelly material obtained from raised deposits are being dated and results obtained should lead to a better understanding of the Quaternary geology of Malaysia.

ECONOMIC GEOLOGY

Intensive petroleum exploration and development were undertaken in the offshore areas, and several new hydrocarbon finds were disclosed. In Sarawak exploration for coal deposits was revived. Development work on the Mamut copper deposit in Sabah was continued with the view to commence production by mid-1975.

In April 1973, PERNAS (Perbadanan Nasional Berhad); a national mining corporation, entered into agreement with the State Governments of Penang, Perak, Selangor, and the Federal Government, in order to undertake prospecting for tin in the offshore areas. Prospecting operations in the shallow marine areas off Bukit Segeri, Teluk Mengkadu, and Lumut (all localities in Perak) commenced in late 1973. Preliminary results indicate that the marine sediments contain significant tin values. PERNAS also investigated the Johore River estuary, but with disappointing results. Another offshore mineral survey in the South China Sea was carried out by the Geological Survey with the assistance of the Netherlands Government and CCOP. The data collected are currently being processed and samples analyzed.

Reconnaissance prospecting of beach sand deposits along the Kelantan – Trengganu coastline, and at Pasir Hitam (Pulau Langkawi) has been carried out. No significant deposits of detrital ore minerals were disclosed. Several mineral prospects were investigated in detail and additional work has been programmed for 1975.

Mineral exploration activities were intensified, particularly in south Trengganu and southeast Pahang, and geochemical stream-sediment sampling was continued in several areas considered favourable for the occurrence of tin and base-metals. Several small, but promising, tin, tungsten, and base-metal anomalies were disclosed.

Several clay deposits in Sarawak, Pahang, and Trengganu were investigated by drilling, and both their quantity and quality assessed. Similar investigations were undertaken for other industrial minerals and construction materials in various states throughout the country. Maps showing clay (including kaolin), limestone, and silica sand deposits in Peninsular Malaysia have been compiled.

During the period under review several ground magnetometric investigations were undertaken in the states of Trengganu, Johore, and Negri Sembilan. Exploratory drilling will be undertaken in the more promising anomaly areas. Ground magnetometer work should prove particularly useful in the search for complex tin-iron deposits and mapping of elongate ultrabasic bodies that crop out close to the eastern margin of the Main Range granite.

The Geochemical Division of the Survey carried out 86, 156 geochemical analyses and its Mineral Examination Division made 17,582 mineral identifications during 1972–74 period.

Staff members and senior students at the University of Malaya made several studies on tin, tungsten, and sulphide minerals and deposits, and the development of various exploration techniques and evaluation methods. Several field and laboratory studies have

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been made on ore minerals in order to better understand the characteristics of Malaysian ore deposits and minerals. Exploration techniques being developed include the possibility of using fluorine as a path-finder element in the search for primary tin deposits, biogeochemical techniques, criteria for recognizing tin-bearing and tin-barren granites, and thermoluminescence of carbonate rocks adjacent to ore deposits.

In connection with the Natural Resources Evaluation Programme being undertaken by the Economic Planning Unit of the Prime Minister's Department, mineral resource potential maps for every state in Peninsular Malaysia were prepared.

GEOHYDROLOGY

The Geological Survey in cooperation with the German Geohydrological Mission and the Public Works Department carried out detailed geohydrological investigations in order to locate additional sources of groundwater in the Kota Bharu, Kubang Krian, and Tumpat areas in Kelantan. Similar investigations will be undertaken in the states of Trengganu, Pahang, Perlis, and Sarawak. Investigations in the Kota Bharu area have disclosed significant new quantities of groundwater so vital for the economic development of this township.

ENGINEERING GEOLOGY

Several quarry sites were investigated by the Survey on behalf of government agencies and State Economic Development Corporations; in addition, investigations relating to highway alignment, foundation problems, landslides and rockfalls were also carried out. Some slope stability studies have been made by senior students of the University of Malaya.

Major dam-site studies in North Perak, Pahang, Selangor, and Trengganu were made by the Survey. In connection with the Kuala Lumpur Flood Mitigation Scheme preliminary investigations commenced at the existing Klang Gates Dam and the proposed Batu Dam. The Survey assisted the MUDA authority in order to remedy the leakage at the Pedu Dam. A small rock mechanics laboratory was established at the Geological Survey, Ipoh, to provide data to consultants engaged for the Temengor Dam and other geological engineering studies.

RESEARCH PROJECTS

Detailed studies on tropical weathering have been undertaken by staff of the local universities. The results obtained from these studies may have significant engineering applications. The Geophysics Department of the Universiti Sains Malaysia was engaged in physical oceanography research in the coastal areas of Sabah. The research includes the study of general sea and swell conditions, tides, longshore and onshore-offshore currents.

SCIENTIFIC EQUIPMENT

Several items of sophisticated laboratory equipment for geological research have been acquired. Rock mechanics laboratories have been established in the Survey and local

universities. The University of Malaya purchased a scanning electron microscope and equipment for palaeomagnetic studies; the Universiti Kebangsaan Malaysia will be purchasing an electron probe soon. Many new items of geophysical equipment have been acquired by the University of Science Malaysia recently, and the Agricultural University received a well-equipped soil physics laboratory from the Belgian Government. The acquisition of this new equipment will be of considerable assistance to geologists in Malaysia and should facilitate research studies of Malaysian geology and mineral resources.

CONFERENCES AND MEETINGS

The 9th Session of the ECAFE (now ESCAP) Regional Conference on Geology and Mineral Resources Development was hosted by the Government of Malaysia in 1973 and the 4th World Technical Tin Conference was hosted by the Malaysian Government in 1974. In addition several discussion meetings and seminars were organized by the Geological Society of Malaysia. The United States Information Services and the U.S. Embassy in Kuala Lumpur organized and financed a one-day ERTS seminar. Drs. J.H. Boeckel and N.M. Short, NASA Scientists, delivered several stimulating lectures.

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The following short notes are a selection of geological notes from Volume 1 of the *Warta Geologi*, the bimonthly newsletter of the Society, which was and still is available only to the members of the Society.