Geol. Soc. Malaysia, Bulletin, 7, June 1974; pp. 27–78.

Bibliography and index of the Geology of West Malaysia and Singapore — Supplement 2: 1969 — 1971

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This is the second supplement to the *Bibliography and index of the geology of West Malaysia and Singapore* compiled by the senior author and published by the Geological Society of Malaysia as their Bulletin No. 2 in 1968. An earlier supplement (Gobbett 1970) appeared in the Society's Bulletin No. 3.

The present work includes all items which have come to our attention, published or issued during 1969, 1970, or 1971, as well as earlier items previously overlooked or not before annotated. The index covers the first supplement also.

We are grateful to all those persons who have brought articles to our attention or who otherwise assisted in this compilation.

Published Works

ALLBROOK, R.F.

1970 The genesis of laterised parent material. *Newsletter geol. Soc. Malaysia* **27**, 2–4.

In Malaysia most laterised parent material (sensu Panton 1956) is shale which retains iron carried to it by circulating ground water and becomes very hard and resistant to weathering.

AW, P.C.

1970 Sungai Aring area, sheet 46, south Kelantan. *Ann. Rep. geol. Surv. Malaysia* [for 1968], 99–102, 1 geol. map. 1 : 253,440.

The strongly folded 'Aring Group' consists of argillaceous and pyroclastic rocks with minor acid to intermediate lavas and limestones. The latter have fusulines of Upper Carboniferous, Middle and Upper Permian ages. The open-folded 'Koh Fm.' is of interbedded sandstones, mudstones and conglomerates. Manganese ore caps hills in the southern part of the area.

1971 Sungai Aring area, South Kelantan. *Ann Rep. geol. Surv. Malaysia* [for 1969], 103–7, 1 geol. map approx. 1 : 250,000.

An extension of the work reported in Aw (1970). Phyllites and quartzites in the southwest of the area are tentatively assigned to the 'Koh Formation' (in part Permian), while argillaceous, cal-

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careous, and tuffaceous metasedimentary rocks along the west and northwest of the area are steeply folded and contain Permian and Triassic fossils. They are considered part of the 'Aring Group'. North to northwest trending left-lateral wrench faults occur.

AYOB, MOHAMMAD

1970a Quaternary sediments at Sungei Besi, West Malaysia. *Bull. geol. Soc. Malaysia* **3,** 53–61, 5 figs., 1 tab.

Well stratified sediments consisting of gravel, sand, mud, clay and peat crop out in several opencast pits of the Sungei Besi Tin Mines near Kuala Lumpur. They lie unconformably over limestone and granite bedrock with their base below the present sea level. Pollen analyses and carbon-14 dating indicate that most of the sediments are Pleistocene in age. Abundant plant fragments, the lack of marine fossils, and the occurrence of gravelly lenses suggest a fluvial depositional environment. The dominance of angular grains of quartz, tourmaline, and muscovite in these sediments indicate that they were derived from weathered granitic rocks nearby. The depositional history was probably related to the sea level changes during the Pleistocene.

(Author's abstract)

1970b Beach survey at Port Dickson, West Malaysia. *Geographica (J. Dep. Geogr. and geogr. Soc. Univ. Malaya)* **6,** 91–96, 2 figs., 1 tab.

Measurements taken at 3 beaches south of Port Dickson show that they include a steeper upper beach with coarser sand and a gentler —nearly flat—lower beach with finer sand. The lower beach is marked by sand ridges generally 20–50 ft. wide and ½–2 ft. high, lineated parallel to the shore. Impinging waves are generally less than 1 ft. high and have wave lengths from 20 to 100 ft. Their effect is predominantly constructive.

BEAN, J.H

1969 The iron-ore deposits of West Malaysia. *Econ. Bull. geol. Surv. Dep. W. Malaysia* **2,** xxii + 194 p., 51 figs., 63 tabs, 1 map 1:760,320.

A detailed summary of the geology and mining of all iron-ore deposits from 1903 to 1965, arranged by States. The following are or were the principal deposits: Gunong Jerai (Kedah), primary magnetite and haematite associated with schist and metaquartzite; Ipoh (Perak), primary haematite replacing limestone; Sri Medan (Johor), metasomatic replacement of andesitic agglomerate, origially by magnetite, now mainly haematite and martite; Pelepah Kanan (Johor), secondary magnetite and haematite enriched by weathering of a magnetite-bearing hornfels; Bukit Besi (Trengganu), magnetite and haematite replacing metasediments near a granite contact; Temangan (Kelantan), secondary haematite and limonite

after siderite in shale. Sri Medan and Temangan are now exhausted. Bibliography includes unpublished reports of the Geological Survey. Map shows location of the ore deposits.

BURTON, C.K.

1969 Neotectonics of the Thai-Malay Peninsula. *Bull. nat. Inst. Geol. Min Bandung,* **2,** 11–13.

Post-Jurassic movements in the peninsula are of limited significance and mainly epeirogenic in nature. The Lower Pleistocene (?) "Older Alluvium", a fluviatile-estuarine-littoral deposit, is recognized from Singapore to south Thailand and has its base as much as 46 m below sea level (Singapore) while its top is at about 70 m above sea level (Johor and Perak). Its base corresponds to the drowned Sunda Shelf and is interpreted to indicate nearly 140 m of subsidence (taking account of some 91 m of eustatic sea level decline) since Early Pleistocene. The accordant summits of the unit are, however, thought to record more recent eustatic sea level decline.

Summit elevations of the late Mesozoic Gagau Group and equivalents also show late epeirogenic activity: together with some summits of older rocks they define a surface near sea level at the south end of the peninsula and sloping upward to the north to maximum elevations of over 1300 m at Gunong Gagau (and also in the Khorat Plateau in Thailand). This tilt is taken to represent marginal warping of the Asian continent, mainly in Late Cretaceous to Early Tertiary.

Young faulting movements are limited to local small-scale faults cutting the "Older Alluvium" and possible continued activity on older wrench faults.

1970a The palaeotectonic status of the Malay Peninsula. *Palaeogeogr. Palaeoclim. Palaeocol.* **7,** 51–60, 3 figs., 1 tab.

Assumes a former connection between the Malay Peninsula and Gondwanaland. The Palaeozoic and Triassic geology of Malaya suggests the presence of a craton on the west. Burton proposes that this craton was the east coast of India which was adjacent to the Malay Peninsula during that time. It has since become separated by the opening of a Bay of Bengal sphenochasm. The evidence presented for this is slender and the form of the continental shelf between peninsular Burma and northern Sumatra is ignored.

1970b The geological environment of tin mineralization in the Malaya-Thailand Peninsula. *In* Fox, W. (ed.) *A second technical Conference on Tin,* 105–122, 2 figs., 1 tab. London: Intern. Tin Council.

The distribution of tin deposits in Malaya and south Thailand is reviewed and their relations to granitic plutons and their role in

the geological evolution of the region are discussed. While the tin deposits are disposed along batholithic belts of Carboniferous to early Jurassic age, they appear to be genetically related to late stage stocks, mainly late Jurassic to early Cretaceous. The two tin belts in Malaya are interpreted to occupy the sites of the former miogeanticline in the west and the former eugeanticline in the east. Tin in the peninsula is considered to have been recycled several times.

BURTON, C.K. and BIGNELL, J.D.

1969 Cretaceous-Tertiary events in southeast Asia. *Bull. geol. Soc. Amer.* **80,** 681–7, 1 fig., 2 tabs.

Includes the following directly relevant to Malaya. Upper Cretaceous to Lower Tertiary K/Ar dates have been obtained from some Malayan granites. A few of these, from Malacca and Johore, have been confirmed by Rb/Sr dating. However, the others probably represent periods of epeirogenic uplift. The top of the post-orogenic Gagau Group and its southern correlatives falls southwards, with an average gradient of 1 in 453, from 1380 m on Gunong Gagau to about 500 m in S. Johore. Various hilltops of older rocks lie close to this plane, which may represent an extension of the Sunda peneplain. The uplift of N Malaya probably in the late Cretaceous or early Tertiary is also evidenced by the northerly increase in metamorphic grade of the Upper Palaeozoic and Triassic outcrop and the increase in width of the Main Range granite when traced northwards.

BURTON, C.K. and JONES, C.R.

1970 Lower Palaeozoic rocks of the Malay Peninsula: discussion and reply. *Bull Amer. Ass. Pet. Geol.* **54,** 357–61.

Burton questions the palaeogeographic reconstructions and the stratigraphic nomenclature of Jones (1968). Jones points out that his interpretation is based on his own long experience with Malayan geology and his stratigraphic nomenclature conforms to the Malaysian Stratigraphic Code.

CHAND, F.

1970 Geology and mineral resources of Ulu Paka. *Ann. Rep. geol. Surv. Malaysia* [for 1968], 83–8, 1 geol. map 1:253, 440.

This area of Trengganu is formed of tightly folded metasediments, the Sungei Perlis Beds, intruded by the Loh Granite in the west and by the Jengai Granite in the centre and east. The metasediments are mainly pelitic, often carbonaceous and contain poorly preserved plant, crinoid, fenestellid, and bivalve fossils probably of Lower Carboniferous age. The Jengai Granite is biotite rich and has numerous included masses of Sungei Perlis Beds. Two small masses of granodiorite to tonalite composition and numerous

lamprophyre and quartz dykes occur. The area is important for primary tin, tungsten and iron ores.

1971 Mineral resources West Malaysia, progress for the year 1969. *Ann. Rep. geol. Surv. Malaysia* [for 1969], 14–19, 1 fig.

A summary of recent work including a mineral distribution map. Sulphide mineralization in the Sungai Aring area, Kelantan, is greater than previously thought and includes sphalerite, galena and iron sulphides. Discovery of a barite-hematite occurrence at Bukit Penchuri, Kelantan, is reported. Veins of barite in the Tasek Chini area, Pahang, intrude ferro-manganese ore.

CHONG, F.S., COOK, R.H., EVANS, G.M. and SUNTHARALINGAM, T.

1970 Geology and mineral resources of the Melaka-Mersing area. *Ann. Rep. geol. Surv. Malaysia* [for 1968], 89–94, 1 tab., 1 geol. map 1:500,000.

Tightly folded pelitic metasediments, probably Permian in age, are overlain unconformably by tuffaceous shales and sandstones, the Tenang Beds, locally with late Triassic bivalves. The central part of the area is largely composed of the Jasin Volcanics, mainly acid pyroclastic rocks, overlain unconformably by the Ulu Endau Beds of unfolded cross-bedded arenites correlated with the Tebak Fm further south. Biotite granite s.l. is probably Triassic or Jurassic in age. The area is crossed by several wrench faults striking 290°. Tin is mined in the southern part of the area and metallic sulphides are reported. Low-grade iron ore reserves at Bukit Langkap are limited.

CHONG, N.H.

1971 Occurrence of scheelite at Batu Tiga, Bukit Besi, Trengganu, West Malaysia. *Newsletter geol. Soc. Malaysia* **31**, 1–4, 4 figs.

Scheelite occurs as fine-grained disseminations in pyrrhotite and chlorite in an area being mined for cassiterite; it has not previously been reported from the Bukit Besi mining area.

CHONG, S.E.

1970 The width, depth and velocity of the Sungei Kinta, Perak. *Geographica (J. Dep. Geogr. and geogr. Soc. Univ. Malaya)* **6**, 72–83, 6 figs., 3 tabs.

Measurement of at-a-station and downstream variations in width, depth, and velocity show that the Kinta River behaves in general similarly to other rivers studied, but compared to extra-tropical rivers, width and velocity increase more slowly and depth more quickly at a station, and width increases more slowly but velocity

more quickly downstream. Some of these differences may be caused by man-made alterations of the river's channel.

CHUNG, S.K.

1971 Geological Survey, Malaysia, general review 1969. *Ann. Rep. geol. Surv. Malaysia* [for 1969], 1–13, 2 figs., 2 tabs.

Includes a summary of recent progress in West Malaysia. Reference is made to mineral surveys and geochemistry.

CHUNG, S.K. and YIN, E.H.

1970 Regional geology: West Malaysia. Brief outline of the geology of West Malaysia. *Ann. Rep. geol. Surv. Malaysia* [for 1968], 53–67. (Reprinted, 1971, *Ann. Rep. geol. Surv. Malaysia* [for 1969], 45–59).

Includes the recognition of at least four main periods of granite intrusion as dated by K/Ar ratios, pre-Lower Trias, Upper Trias, Jurassic-Cretaceous and Lower Tertiary. Much of the mineralization is believed to be early Jurassic. Major faults are analysed into an oldest set of N-trending normal faults, an important NW-trending set of wrench faults with large sinistral displacements affecting Lower Cretaceous sediments, and a youngest set of NNE-trending wrench faults. The stratigraphy is usefully reviewed but few lithostratigraphic names are mentioned.

CHUNG, S.K. YIN, E.H. KHO, C.H. and LEE, D.T.C.

1970 Geological Survey, Malaysia, general review 1968. *Ann. Rep. geol. Surv. Malaysia* [for 1968], 1–12.

Includes a summary of recent progress in West Malaysia. Reference is made to new fossil localities, mineral surveys, engineering geology, geochemistry, and radiometric age determination.

COLEMAN, J.M., GAGLIANO, S.M. and SMITH, W.G.

1970 Sedimentation in a Malaysian high tide tropical delta. *In* Morgan, J.P. and Shaver, R.H. (eds.) *Deltaic sedimentation, modern and ancient.* Soc. Econ. Min. Paleon. Spec. Publ. **15**, 185–197, 17 figs.

The Klang and Langat Rivers have between them built a delta in the Malacca Strait. Wave energy in the Strait is generally low, and the delta has been shaped mainly by tidal currents (max. tide range 14 ft.) and the general north-westerly currents in the Strait. An intricate network of tidal channels is present along the coast and on the islands of the delta. The delta progrades by building submarine banks and ridges of mud, enlarging islands, and advancing of the coast itself. Extensive tidal flats of sand and muddy sand are encroached by mangrove, which is in turn replaced by fresh-water swamp. A C-14 date for material near the base of a

15 ft. thick peat deposit in fresh-water swamp 15 miles inland from the present edge of vegetation gave an age of 4540 ± 110 yrs. B.P. Sediments in the delta range from clean, well-sorted sands (mostly fine to very fine) in channels to muddy sands and muds on banks and tidal flats. Much of the sediment is burrowed by organisms and its lamination destroyed.

Some erroneous comments are made on the mainland bedrock geology.

COOK, R.H. and SUNTHARALINGAM, T.

1971 Geological reconnaissance area 'C', North Johore—South Pahang—concluding phase. *Ann. Rep. geol. Surv. Malaysia* [for 1969], 82–93, 1 geol. map 1 : 126,720, 3 figs., 1 tab.

Gives more details on part of the area reviewed by Chong, *et al.* (1970). Includes a mineral resources potential map, and mineralogical analyses of 45 heavy mineral concentrates.

DHILLON, D.S.

1970 An abnormal *Ammotium* from the Holocene, West Malaysia. *Micropaleont.* **16,** 59–60, 1 fig.

A single specimen of the foraminiferan *Ammotium salsum* with two apertures is described from the Muar estuary, Johore.

DOUGLAS, IAN

1970 Measurements of river erosion in West Malaysia. *Malay. Nat. J.* **23,** 78–83.

Mainly a discussion of the erosional effects of mining and land development. Some examples are cited and the data on sediment loads of West Malaysian rivers are reviewed.

ELLIOT, C.F.

1968 This should read ELLIOTT, G.F.

EYLES, R.J.

1967 Laterite at Kerdau, Pahang, Malaya. *J. trop. Geogr.* **25,** 18–23, 3 figs., 1 tab.

It is concluded that laterite being actively formed at the present time occupies valley floors. Fossil laterite on hill tops was formed in a similar way; the inversion of relief is due to resistance of the laterite to erosion and to the fact that it formed on tuffaceous sandstone rather than shale.

1970 Physiographic implications of laterite in West Malaysia. *Bull. geol. Soc. Malaysia* **3,** 1–7, 1 fig., 2 tabs.

A map of laterite-bearing soil associations is presented which illustrates the widespread but fragmentary location of laterite in the lowland areas of Malaya and the tendency for it to be most widespread in areas with relatively dry climates and argillaceous rocks.

Laterite commonly occurs in four positions in the landscape: flat alluvial land, foot slopes, gently undulating country, and hill summits. Laterites of two small sample areas are domonstrated, by measurement of soil properties (shear strength, infiltration capacity, percentage clay and aggregate stability) to be very resistant to erosion. This resistance has led to relief inversion with fossilization of laterite as summit caps in several parts of Malaya. The possibility of using these summit formations as marker levels in studies of denudation chronology is briefly discussed.

(Author's abstract)

1971 A classification of West Malaysian drainage basins. *Ann. Ass. Amer. Geogr.* **61,** 460–7, 7 figs., 4 tabs.

A representative sample of West Malaysian fourth-order drainage basins is classified into six standard groups by cluster analysis using five variables: hypsometric integral, average slope, basin relief, drainage density, and basin area. The drainage basin map so produced reflects the main features of West Malaysian geomorphology.

(Modified from author's abstract)

FOO, K.Y.

1971 Reconnaissance geological survey of area "A", southeast Pahang. *Ann. Rep. geol. Surv. Malaysia* [for 1969], 94–7, 1 geol. map 1:380,160.

Schists and phyllites ('Sawak Metasediments') and overlying ignimbritic tuffs ('Gayong Volcanics'), all probably Paleozoic, occur in the eastern part of the area, capped uncomformably by gently-folded Cretaceous (?) Lesong Sandstone. Most of the rest of the area is underlain by the 'Gemas Beds', comprising sandstones, acid tuffs, and shales, locally with Upper Middle Triassic fossils. Granite occupies a central belt, accompanied by small later intrusives, and Tertiary (?) basalt flows occur near Segamat at the southern edge of the area.

FRAULOB, K.

1934 Occurrence, investigation and evaluation of alluvial tin deposits with special reference to the Malay Peninsula. *Metall. Erz.* **31,** 395–401, 427–30, 502–11.

Not seen.

GANESAN, K.

1969 Iron-tin mineralisation in the Gunong Muntahak area, Johore. *Newsletter geol. Soc. Malaysia* **19,** 1–5, 3 figs.

Small replacement deposits of pyrometasomatic iron ore conform to the foliation of metamorphic rocks near granite contacts. They are developed along N-S trending linear structures. At Pelepah Kanan Mines a lenticular martite body contains later fine-grained cassiterite which was deposited during the formation of hypothermal stanniferous quartz-feldspar veins.

GOBBETT, D.J.

1970 Bibliography and index of the geology of West Malaysia and Singapore—supplement 1968. *Bull. geol. Soc. Malaysia* **3,** 115–23.

An annotated list of works published during 1968 and others overlooked when the original bibliography was compiled (47 items). Ten unpublished works and one unpublished map are also listed.

1971 Joint pattern and faulting in Kinta, West Malaysia. *Bull. geol. Soc. Malaysia* **4,** 39–48, 6 figs.

The Kledang Range is interpreted as a granite horst. Its faulted boundary with the Kinta Valley has been later cut and offset by many minor wrench faults with a dominant northwesterly strike produced by an approximately east-west directed compressive stress. Other observed lineations are interpreted as conjugate shear joints and/or lateral shears forming second or third order structures associated with the wrench faults and also with possibly major northwesterly striking wrench faulting postulated elsewhere in West Malaysia. Quartz dykes have widened original tension joints. Some vertical movement in northwest striking fault planes is evidenced by the contours of the sub-alluvial valley floor and the watershed which crosses the northern part of the valley.

(Author's abstract)

HAILE, N.S.

1971 Quaternary shorelines in West Malaysia and adjacent parts of the Sunda Shelf. *Quaternaria* (Rome) **15,** 333–343, 1 tab.

Reviews evidence of former relative sea levels in the Malay Peninsula, adjacent marine areas and nearby islands. A Holocene level of about +6 m is well established, and levels down to at least — 100 m are clearly shown by depths of fluviatile alluvium and erosional submarine morphology. There is no convincing evidence for former levels higher than +6 m.

HAMADA, T.

1969a Late Palaeozoic brachiopods from red beds in the Malayan Peninsula. *In* Kobayashi, T. and Toriyama, R. (eds.)

Geology and Palaeontology of southeast Asia, vol. 6, 251–64, 2 pls.

Thirteen species including three new genera and six new species are described from the Upper Devonian or Lower Carboniferous base of the Kubang Pasu Formation on Pulau Langgun, Langkawi; Gunong Hutan Haji, Perlis; and near Kg. Jelutong, north Kedah.

1969b Devonian brachipods from Kroh, Upper Perak in Malaysia (Malaya). *In* Kobayashi, T. and Toriyama, R. (eds.) *Geology and Palaeontology of southeast Asia,* vol.7, 1–13, 2 pls, 1 fig.

Two inarticulates, two plectodontids, a chonetid, a new rhynchonellid genus, and two ambocoelids of lower Middle Devonian age are described from Kampong Pahit. They occur associated with the tentaculitids *Nowakia* and *Metastyliolina* and trilobites.

HAMPTON, J.H.

1887 Tin deposits of the State of Perak, Straits Settlements. *Trans. Min. Assoc. Inst. Cornwall* **1,** 143–9, 2 maps approx. 1 : 500,000.

Tin occurs in lose deposits of supposed Tertiary age inlaid on Paleozoic bedrocks of mainly granite and limestone. Cassiterites the size of walnuts showing crystals faces are not uncommon. The tin grains show abrasion and often diminution in size away from the hills, indicating alluvial origin. The rest of the article concerns mining methods and economics.

HILL, R.D.

1968 The Singapore "deeps". *Malay. Nat. J.* **21,** 142–6, 2 figs.

The E–W elongated deeps reach –714 ft in the Singapore Straits. They are not likely to be unfilled parts of the Pleistocene Proto-Kampar valley as, in that case, the Pleistocene base level of the Sunda Shelf would have been at least 700 ft below present sea level, more than twice the figure generally accepted. It is suggested that the deeps are tectonic, being situated on a fault or faults crossing the known NW trending fault of west Singapore.

HODGKIN, E.P.

1970 Geomorphology and biological erosion of limestone coasts in Malaysia. *Bull. geol. Soc. Malaysia* **3,** 27–51, 19 figs., 1 tab.

Marine intertidal erosion of limestone is described at Semporna, Sabah, in uplifted Quaternary coral rock, and at Pulau Langkawi, Kedah, in crystalline Palaeozoic limestones. At Semporna, as in

coral rock elsewhere, there is a visor, an intertidal notch, and a low tide platform up to 30 m or more wide. At Langkawi intertidal notches of similar form are cut into sea cliffs which continue below sea level; there are no low tide platforms. The height of these notches approximates spring tide range where the sea is mostly calm, but increases with exposure to wave action.

At both places the surface rock is bored by endolithic algae and these are rasped by chitons and other browsing mollusks. At Langkawi the outer few cm of the rock are riddled by *Cliona, Lithophaga* and other boring organisms. Such biological erosion is the main agent in forming the notches and operates fast enough to cut ones 4 m deep during the Holocene.

Examples of possible higher level notches are discussed, but none is unequivocal. More reliable evidence of former higher sea levels is afforded by bivalve borings and oyster shell encrustations 1 m or more above living animals.

(Modified from author's abstract)

HOSKING, K.F.G.

1969 Offshore tin deposits. *Probe* (*J. Sci. Students Council, Univ. Witwatersrand*), 37–45, 6 figs.

The geology of the southeast Asian tin province is briefly reviewed and the known and probable distribution of offshore tin deposits in the region is described.

1970a Aspects of the geology of the tin fields of south-east Asia. *In* Fox, W. (ed.) *A second technical Conference on Tin*, 39–80, 7 figs., London: Intern. Tin Council.

The general geology of the tin belt stretching from Burma to Indonesia is briefly reviewed, and the tin deposits classified with examples. Primary deposits in the belt are characterized by a lack of zoning and paucity of associated porphyry dykes; in West Malaysia their development generally accords with the ideas of Bilibin. The placer deposits of the belt are considered to have formed mainly in the Quaternary as a combination of eluvial, alluvial, and in some cases marine-influenced deposits.

1970b The primary tin deposits of south-east Asia. *Minerals Science and Engineering* (Johannesberg) **2**, 24–50, 24 figs., 4 tabs.

After a brief review of the general geology of the region, the tin minerals are considered. Cassiterite, the only species commercially recovered, commonly occurs in two generations, the later typically acicular; 'pegmatite-type' bipyramidal crystals are rare, and wood-tin is unknown. Some cassiterite is magnetic, and some shows pleochroism probably due to Ta and/or Nb. Stannite, invariably

tetragonal, occurs commonly, and malayaite ('tin sphene') occurs in skarns, sometimes in such quantity as to suggest commercial recovery. Tin also occurs as an impurity in andradite and some other minerals.

Primary tin deposits of the region are classified into (1) magmatic disseminations, including pegmatites and aplites; (2) pyrometasomatic deposits; and (3) hydrothermal deposits. In pegmatites and aplites, and in pyrometasomatic deposits, the tin often appears to be a later introduction.

Most important are hydrothermal veins and vein swarms, varying greatly in size and mineralogy. These sometimes span the granite contact, may form a 'halo' in the invaded rocks, or may be confined to the granite (especially at contacts against limestone). At Sungei Lembing occur complex telescoped fault-controlled lodes; this is the only site in the region where lodes of the Cornish type are prominent.

While some of south-east Asia's tin deposits (including those of Sungei Lembing) are thought to have developed in the Carboniferous, most are considered to be genetically related to Triassic granites.

1970c Tin deposits and limestone. *Newsletter geol. Soc. Malaysia* **24,** 3–5.

The rarity of primary tin deposits in pure limestones is attributed to their plastic behaviour during fracture development and mineralisation associated with the emplacement of mesozonal granites. Impure limestone forming a brittle calc-silicate hornfels would fracture and become mineralised. However 'late' mesothermal stanniferous pipes and lodes may be developed in pure limestone which is at a higher level in the crust and thus more brittle.

1970d Curious inclusions, essentially of sphalerite, in stannite from Tekka, Perak. *Newsletter geol. Soc. Malaysia* **26,** 1–4, 4 figs.

Besides sphalerite small inclusions of chalcopyrite and ?kobellite occur. Large 'chinese character' sphalerite inclusions may be exsolution bodies, but trains of sphalerite inclusions associated with horn-like extensions of peripheral sphalerite crystals are probably relics.

1970e Chloride and oxychloride of tin on old ingots. *Newsletter geol. Soc. Malaysia* **27,** 5–7.

One of a number of ingots of 'tin-hat' money recovered by dredging from an old river bed had a thin encrustation of tin oxychloride. It is unlikely that this had been formed during burial in the reducing environment of the river mud but was more likely

due to reaction with the salted mould earth into which the ingot had been poured.

1971a The offshore tin deposits of southeast Asia. *United Nations ECAFE, CCOP tech. Bull.* **5,** 112–29, 7 figs.

The general geology and geologic evolution of the Southeast Asian tin province are briefly reviewed, together with the origin of the tin deposits, especially the placers. The known and probable distribution of offshore tin deposits is described.

1971b Bipyramidal (111) cassiterite and cassiterite with a similar habit from West Malaysia. *Newsletter geol. Soc. Malaysia* **33,** 1–5, 4 figs.

Crystals of this habit from two sites in Malaya are associated with pegmatites and show intense pleochroism, blood-red to pale greenish-yellow.

HOSKING, K.F.G. and LEOW, J.H.

1969 Stanniferous garnets. *Newsletter geol. Soc. Malaysia* **17,** 5–6.

Stanniferous garnets mentioned from Langkawi in skarn rocks devoid of cassiterite or tinbearing sulphides.

1970a A further occurrence of Malayaite in West Malaysia. *Newsletter geol. Soc. Malaysia* **22,** 4–5.

A malayaite-bearing diopside-calcite skarn rock is described from Sg. Gow, Pahang. Other occurrences of malayaite are mentioned.

1970b Unusual replacement textures in sphalerite rich material from Yam Chan Tin Mine, Temoh, Perak, West Malaysia. *Newsletter geol. Soc. Malaysia* **23,** 1–3, 1 fig.

Crystals of loellingite have their cores partly replaced by tetrahedrite and sphalerite with flat surfaces probably controlled by the (010) and (101) cleavages of loellingite. The material is cadmium rich.

HOSKING, K.F.G., LEOW, J.H., CHIN, L.S. and WONG, Y.F.

1970 The nature and significance of the Manson ore body, Ulu Ketubong, Kelantan: an interim report. *Malayan Scientist* **5,** 32–41, 7 figs., 2 tabs.

The Manson ore body, containing Fe-Cu-Pb-Zn sulphides and metallic oxides, as well as cassiterite and stannite, occurs along a limestone-tuff contact and is roughly stratiform. It is interpreted as a strongly telescoped xenothermal replacement body, the first xenothermal stanniferous deposit recorded in Southeast Asia.

HOSKING, K.F.G., LEOW, J.H. and HASER, F.E.H.

1969 A magnetite-cassiterite-polysulphide skarn vein at Bukit Besi Mine, Trengganu, West Malaysia. *Newsletter geol. Soc. Malaysia* **20,** 3–5.

A small vein in marble, mainly consisting of galena and pyrrhotite, but magnetite and cassiterite pre-dated these and other sulphides.

HOSKING, K.F.G. and LOGANATHAN, S.K.P.

1970 Traces of uranium at Bukit Takun, Selangor, West Malaysia. *Newsletter geol. Soc. Malaysia* **25,** 1–2.

Fluorescent opaline silica coating joint faces in skarn contains uranium.

HOSKING, K.F.G. and STAUFFER, P.H.

1970 Tektites from the stanniferous placers of eastern Pahang. *Newsletter geol. Soc. Malaysia* **22,** 1–4, 5 figs.

Two tektites are described and figured.

HOSKING, K.F.G. and YEAP, E.B.

1970 Scheelite from West Malaysia which fluoresces white under short-wave ultraviolet light. *Newsletter geol. Soc. Malaysia* **25,** 2–3.

Scheelite from Setapak, Selangor, showed the rare white rather than the normal blue fluorescence.

1971a A note concerning the known occurrences of malayaite ($CaO{\cdot}SnO_2{\cdot}SiO_2$). *Newsletter geol. Soc. Malaysia* **28,** 1–4, 1 locality map.

Malayaite is known from 7 localities in the Malay Peninsula, 6 of these recently discovered, and 1 locality in England. It occurs only in skarns, usually with garnets (some stanniferous), cassiterite, and nearly always scheelite; it may occur as zones in sphene crystals. Malayaite fluoresces yellow under short-wave UV light. It may weather to varlamoffite.

1971b Association of jamesonite with other sulphides at Chenderiang, Perak, West Malaysia. *Newsletter geol. Soc. Malaysia.* **30,** 1–6, 4 figs.

Jamesonite makes up over 30% of some samples and is associated with sphalerite, arsenopyrite, tourmaline, pyrite, cubanite, chalcopyrite, pyrrhotite, and supergene minerals.

1971c The mineralogical character of the Galena Lode, near Sungai Belat, Pahang. *Newsletter geol. Soc. Malaysia* **32,** 8–9, 1 tab.

The lode contains cassiterite with sphalerite and galena, and shows a close association of "high-temperature" and "low-temperature" species.

HOSKING, K.F.G., YEAP, E.B. and ANG, N.K.

1971 A dumortierite-bearing lode at the Gagak Mine, Pahang, W. Malaysia. *Newsletter geol. Soc. Malaysia* **32,** 6–7.

Dumortierite is recorded, apparently for the first time in Southeast Asia, as replacement of calcite in a cemented fault breccia, later mineralized by sulphides.

HOSKING, K.F.G., YEAP, E.B. and WONG, T.W.

1971 An occurrence of malayaite ($CaO{\cdot}SnO_2{\cdot}SiO_2$) at Rawang, Selangor, West Malaysia. *Newsletter geol. Soc. Malaysia* **29,** 4–6.

Malayaite occurs in a skarn as small euhedral crystals, together with similar grains of sphene and sometimes as rims on the latter. Flourescence of the isomorphous series sphene-malayaite is thought to be a function of the percentage of tin in the lattice.

HUTCHISON, C.S.

1969 Some notes on the Stong Metamorphic Complex, Kelantan. *Newsletter geol. Soc. Malaysia* **21,** 8–11.

The Complex is a catazonal assemblage of highly migmatised amphibolite facies schist, gneiss and marble, containing sillimanite, cordierite, diopside and phlogopite.

1970 The tectonic framework of the southern Malay peninsula (abstr.). *Abstr. geol. Soc. Amer.* 1970, vol. 2, No. 7, 584 only.

The Malayan Orogen contains a rock sequence from Upper Cambrian to Cenozoic and now exposes a distinct and characteristic catazone, mesozone and epizone. The metamorphic facies series is of Low Pressure type indicating an orogenic high geothermal gradient.

The catazone, generally of Lower Palaeozoic rocks, is sporadically exposed through the mesozone in a narrow belt extending north-south along the east-central axis of the peninsula. Foliated and migmatitic granite is associated with cordierite amphibolite facies metasediments. Gold mineralization is present. K–Ar Lower Triassic dates probably indicate the time of uplift of the catazone as gneiss domes.

The mesozone outcrops extensively. Large subconcordant granite batholiths occur in greenschist facies Palaeozoic metasediments and metavolcanics. Tin is abundant. Rb–Sr dates indicate that the granite to the east of the catazone belt is Upper Carboniferous while that forming the Main Range to the west is generally Middle Triassic.

The epizone comprises extensive unmetamorphic late orogenic Mesozoic sediments and shelf-facies Palaeozoic rocks of the extreme west of the peninsula. Post orogenic intrusions of granite are late Cretaceous and are related to widespread faulting and shearing.

K–Ar granite dates generally indicate the age of epeirogenic uplift which strongly controlled the late orogenic sedimentation. Faulting accompanied by diabase dyke intrusion and basalt extrusion apparently ranging in age from late Cretaceous to Quaternary. The shape and outcrop pattern of the peninsula is fault controlled.
(Author's abstract)

1971a Meditations on metamorphism. *Bull. geol. Soc. Malaysia* **4**, 1–13, 7 figs.

Dynamothermal metamorphism is produced by load pressure rather than tectonic pressure. Contact metamorphism should be used to denote metamorphism of rocks by intrusions at high levels in the crust where there would be no other type of metamorphism. Thermal metamorphism should refer to an increase of dynamothermal metamorphism around a deepseated pluton. Thus the Malayan mesozonal granites had produced thermal aureoles rather contact aureoles. Malaya has probably been an area of abnormally high geothermal gradient which may have resulted from the extensive and long sustained volcanic and plutonic activity the region has undergone.

1971b The Benta Migmatite Complex: petrology of two important localities. *Bull. geol. Soc. Malaysia* **4**, 49–70, 9 figs., 2 tabs.

Gneiss, monzonite and migmatite are well exposed in the Sungei Lipis and the nearby P.W.D. quarry at Benta, Pahang. The petrography and chemistry of these rocks are described and their petrogenesis discussed. They are of deep seated origin and suffered Abukuma type metamorphism. Some K–metasomatism gave rapakiwi microcline porphyroblasts in foliated gneiss. Anatexis of the gneiss produced monzonite.

HUTCHISON, C.S. and SNELLING, N.J.

1971 Age determination of the Bukit Paloh Adamellite. *Bull. geol. Soc. Malaysia* **4**, 97–100, 1 fig., 1 tab.

K–Ar and Rb–Sr age determinations on this adamellite from near Sungei Lembing, Pahang give widely discordant results indicating

a complicated tectonic history but suggesing it was emplaced into Viséan strata during Upper Carboniferous time.

IGO, H., YIN, E.H. and KOIKE, T.

This should read IGO, H., KOIKE, T. and YIN, E.H.

IWAI, J.

1971 Reconnaissance of Mesozoic stratigraphy in central Pahang, Malaysia. Part 1. The Jenka Pass to Maran. *In*: Kobayashi, T. and Toriyama, R. (eds.) *Geology and palaeontology of southeast Asia,* vol. 9, 147–159, 4 pls., 4 figs. Univ Tokyo Press.

Road sections show two formations resting unconformably on late Palaeozoic strata. Basal conglomerate, sandstone, mudstone, shale and tuff occur in the western half of the area and constitute the Jenka Pass Formation, characterised by the tuff and a yellowish to light grey colour. In the eastern half of the area, conglomerate, coarse to fine sandstone, mudstone and shale are characterised by their unsorted nature and red colour. These rocks are equated with the Tembeling Formation. Both of these formations are gently folded and frequently cut by small faults. Their junction is probably faulted.

(Modified from author's abstract)

JONES, C.R.

1970a On a Lower Devonian fauna from Pahang, West Malaysia. *Bull. geol. Soc. Malaysia* **3,** 63–75, 1 pl., 1 fig., 1 tab.

A fauna of reticulate sponges, inarticulate brachiopods, phyllocarid crustaceans and graptolites is described from the upper part of the 'Foothills formation' of west Pahang. The graptolites include *Monograptus* cf. *praehercynicus* Jaegar of Lower Devonian (Gedinnian) age. This is the first sound evidence that the bulk of the Foothills formation is Lower Palaeozoic in age.

1970b The geology and mineral resources of the Grik area, Upper Perak. *Mem. geol. Surv. Dep. W. Malaysia* **11,** xxviii + 144 p., 22 pl., 15 figs., 13 tabs., 1 geol. map 1:63,360 and 3 horizontal geol. sections.

This area in the upper Perak River valley is underlain by a central belt of metasedimentary and metavolcanic rocks, flanked by the granitic masses of the Bintang Hills on the west and the Main Range on the east. The pre-granite sequence is of Lower Palaeozoic age and is all referred to the Baling formation of Burton (1965MSd). This sequence includes interfingering arenaceous, argillaceous, calcareous and pyroclastic beds with rapid lateral and vertical variation. The lower portion is dominantly of quartzite, the upper portion dominantly of shale and limestone, and

the pyroclastics, which are rhyolitic and rhyodacitic crystal tuffs, occur mainly in the middle of the sequence. These tuffs are named the Grik pyroclastic member and are the first documented Lower Palaeozoic volcanic rocks in Malaya. Carbonaceous beds in the upper portion of the pre-granite sequence have yielded graptolites and shelly fossils giving a Lower Silurian (Llandovery) age. The thickness of the whole sequence is estimated at a maximum of 15,000 ft., the tuffs accounting for about 6000 ft.

Post-granite sediments include only the Quaternary alluvium in the river valleys, and a single occurrence of tilted, semi-consolidated basin deposits (mainly sand and gravel) of possible late Tertiary or Quaternary age near Lawin.

The granitic rocks, thought to be Mesozoic, are mainly coarse-grained adamellite, with minor late phase differentiates. There is also a single small body of serpentinite which cuts the Lower Palaeozoic rocks and is considered to be possibly mid-Palaeozoic.

The pre-granite rocks are folded into broad north-south folds, which have later been refolded. All the pre-granite rocks have been metamorphosed to varying degrees and form phyllites, quartzites, marbles, and metatuffs in many places, and hornfelses near the granite contact.

The only significant mineral resource in the area is placer tin ore derived from mineralization along the granite contacts.

(Modified from author's abstract)

JONES, C.R. and SCRUTTON, C.T.

1971 Palaeozoic corals from Perak,Malaya, Malaysia: discussion. *Overseas Geol. Miner. Resour.* **10,** 392–3.

Quepora-bearing limestone is interstratified with graptolite shales now considered Middle Landrovery and not Ordovician as previously thought. An adjacent limestone with tabulate corals is associated with shales bearing Lower Devonian dacryoconarid tentaculites.

JONES, M.P. and GHANI, M.M.

1970 The mineralogy of the Sungai Besi decomposed stanniferous granite. *In* Fox, W. (ed.) *A second technical conference on tin,* 549–55, 3 tab. London: Intern. Tin Council.

A detailed, quantitative mineralogical assessment of a decomposed stanniferous granite and associated quartz veins is reported. The granite consists of quartz, clay minerals, remnants of decomposed feldspar, mica and tourmaline with small amounts of tin, iron, manganese and titanium oxides. The cassiterite content is about 0.01 percent. Over 90% of the cassiterite is in the — 2 mm + 50 μm size fraction, although this makes up only 45% of the

granite. Samples of the narrow quartz veins which make up about 0.1% of the Sungei Besi deposit contain almost 14% cassiterite, generally coarser than 2 mm.

(Modified from author's abstract)

KATILI, J.A.

1970 Large transcurrent faults in Southeast Asia with special reference to Indonesia. *Geol. Rundsch.* **59,** 581–600, 4 figs.

Mentions and figures a sinistral transcurrent fault (after Burton 1965) along the axis of the Malay Peninsula.

KAWAMURA, B. and YAMADA, N.

1970 Sand waves in the Malacca Strait. *J. Geogr.* (Tokyo) **79,** 266–279, 18 figs., 1 tab. (In Japanese with English summary).

A Joint Hydrographic Survey team in 1969 recorded sand waves on the sea bottom in the Malacca Straits and around Singapore. These waves are mostly 5 to 15 m high, but the largest one noted reached a height of 20 m, with a width of 267 m. The waves are classified into morphological types, the distribution of these is noted, and sample profiles are presented.

KOBAYASHI, T.

1964 Should now read 1964a.

1964b On the orogenies of the Burmese-Malayan geosyncline. *Proc. XXII Int. geol. Congr. India* 1964 **11,** 123–131.

Briefly reviews the stratigraphy, especially Palaeozoic, of Malaya and parts of Thailand, Burma, South China, and Laos, concluding that a major geosyncline existed throughout the Palaeozoic and and early Mesozoic, that the major orogeny was in Jurassic, and that orogenic activity has shown migration outward from the continental side.

KOBAYASHI, T. and HAMADA, T.

1970 A cyclopygid-bearing Ordovician faunule discovered in Malaya with a note on the Cyclopygidae. *In* Kobayashi, T. and Toriyama, R. (eds.) *Geology and palaeontology of southeast Asia,* vol. 8, 1–18, 2 pls., 4 figs. Univ. Tokyo Press.

A poorly preserved trilobite fauna from Ulu Sungei Tambak, west of Baling, Kedah, is described. It includes *Ogygiocaris*?, *Isotelus, Microparia,* and *Tambakia* (n. gen.) associated with cryptolithid and odontopleurid trilobite fragments, an orbiculoid brachiopod and biserial graptolites.

1971a Agnostid trilobites in a Devonian formation in West Malaysia. *Proc. Japan Acad.* **47**, 396–400, 1 pl.

A new genus, *Pseudotrinodus*, is described from mudstone near Kroh, Perak, where it is associated with a trilobite-brachiopod-tentaculitid fauna of Lower to Middle Devonian age. In spite of the presence of intramarginal cephalic sutures and at least three thoracic segements, *Pseudotrinodus* is thought to be an agnostid, relict of an otherwise Cambrian and Ordovician group.

1971b Silurian trilobites from the Langkawi Islands, West Malaysia, with notes on the Dalminitidae and Raphiophoridae. *In*: Kobayashi, T. and Toriyama, R. (eds.) *Geology and palaeontology of southeast Asia*, vol. 9, 87–134, 6 pls., 4 figs., 4 tabs. Univ. Tokyo Press.

A rich trilobite fauna from the basal part of the upper member of the Setul Limestone on Pulau Langgon is described. It is of late Llandovery or early Wenlock age and is distinct from other Silurian trilobite faunas in southeast Asia, most of which are probably younger. The fauna is dominated by a new dalmanitinid genus and species, *Prodontochile igoi*, and includes another new dalmanitinid genus *Langgonia* (3 new spp.), a new proetid genus, *Malayaproteus* (2 new spp.), new species of the genera *Sphaeroxochus*, *Calymene*, and *Lonchodomas* (new sub-genus) and indeterminate species of the genera *Cheirurus*, *Octobronteus*, and *Aristoharpes*. The genus *Dalmanitina*, its distribution in Asia, and also the family Raphiophoridae are briefly reviewed.

KON'NO, E.

1970 The *Gigantopteris-Lobatannularia* flora and the Dipteridaceae flora, newly found in Malaysia, and their comparisons with those in other districts of East Asia. *Fossils* **19**, 2–13, 3 figs. (In Japanese).

Not seen.

KON'NO, E. and ASAMA, K.

1970 Some Permian plants from the Jenka Pass, Pahang, West Malaysia. *In* Kobayashi, T. and Toriyama, R. (eds.) *Geology and palaeontology of southeast Asia*, vol. 8, 97–132, 8 pls., 7 figs. Univ. Tokyo Press.

A description of the Jenka flora, comprising 24 species belonging to the genera *Paratrizygia*, *Annularia*, *Lobatannularia*, *Neuropteridium*, *Neuropteris*, *Pecopteris*, *Bicoemplectopteris*, *Cathaysiopteris*, *Protoblechnum*, *Taeniopteris*, *Coraites*, *Cordaianthus*, and *Trigonocarpus*. This flora is associated with a marine fauna. It compares closely with the northern Cathaysia flora of the Lower

Upper Shihhotse Series (Upper Permian), and with the Linggiu flora (Kon'no *et. al.* 1970), but contrasts with the Lower Permian Djambi flora of Sumatra.

KON'NO, E., ASAMA, K. and RAJAH, S.S.

1970 The late Permain Linggiu flora from the Gunong Blumut area, Johore, Malaysia. *Bull. Nat. Sci. Mus., Tokyo* **13**, 491–580, 17 pls., 18 figs., 2 tabs. (Reprinted, 1971, *in* Kobabayashi, T. and Toriyama, R. (eds.) *Geology and palaentology of Southeast Asia,* vol.9, 1–85. Univ. Tokyo Press).

The sedimentary rocks of the area include a Middle Permian Dohol Formation of pelites with some coarser clastics, tuff and lava, and a fusuline-bearing Semanggol Limestone Member. The Linggiu Formation overlies this, probably uncomformably, and is a clastic sequence, locally rhythmically beded and including chert, tuff and lava. It probably interfingers with the Sedili Volcanic Formation, mainly tuffs of rhyolitic to andesitic composition. These beds are isoclinally folded and strike N to NW. The Lower Cretaceous Tebak Formation lies unconformably on the older rocks.

A flora from the Linggiu Formation is described and figured. It consists of 41 spp (35 leaf spp) characterised by advanced members of Gigantopteridaceae, Sphenophyllaceae and Lobatannulariaceae, and the absence of Glossopteris floral elements. Ferns with Marattiacean affiinities are an important constituent of the flora. It is clearly closely related to the north Cathaysian Gigantopteris-Lobatannularia flora of early late Permian age and in this it contrasts with the older Djambi flora of Sumatra. It is similar to but probably slightly younger than the Jenka flora (Kon'no and Asama 1970).

KUDRYAVTSEV, G.A., GATINSKY, Yu.G., MISHINA, A.V. and STROGANOV, A.N.

1968 Nekotoryye cherty tektoniki Burmyi Malakkskogo poluostrova (Some tectonic features of Burma and the Malacca peninsula) *Geotektonika* **4**, 99–113, (English translation in *Geotectonics* **4**, 254–60, 1969).

Geosynclinal deposition occurred during the entire Palaeozoic and the Triassic and was concluded by an orogeny in the late Triassic. A belt of granitoid massifs lies between this orogen and the Cenozoic orogen of western Burma. This belt consists of binary leucocratic stanniferous granite with pegmatitic and aplitic veins and is considered a major structural feature of southeast Asia. It may be correlated with the granitoids of the Chukotsk-Cathaysia volcanic belt.

LEOW, J.H., HOSKING, K.F.G and TEH, G.H.

1969 Aspects of the mineralogy of the NE–SW trending veins at Tekka, Perak. *Newsletter geol. Soc. Malaysia* **21**, 2–8, 6 figs., 1 tab.

Mineral paragenesis of these hydrothermal polymetallic sulphide veins is disussed. Loellingite was early partly replaced by arsenopyrite. Primary cassiterite was partly replaced by stannite formed contemporaneously with sphalerite. Other sulphides include enargite and kobellite. Supergene alteration of stannite to varlamoffite has also occurred.

MORGAN, R.P.C.

1970 An analysis of basin asymmetry in the Klang Basin, Selangor. *Bull geol. Soc. Malaysia* **3**, 17–26, 3 figs., 3 tabs.

An analysis of the fourth order topographic basins within the drainage system of the Sungei Klang reveals that a number of them are asymmetrical. Basin asymmetry appears to be a reflection of structural control since the direction of maximum asymmetry follows certain preferred alignments, of which 30°, 105°, and 140° are the most important. A distribution analysis using the nearest neighbour test indicates that those asymmetrical basins which follow the 105° direction have a tendency towards agglomeration. They are therefore distinctive compared with the basins aligned in other directions which are distributed randomly. It is suggested that the randomly distributed basins have been superimposed and that their alignment partially reflects the geological conditions of rocks since removed by denudation, and that the basins aligned along 105° are the result of subsequent adjustments of the drainage to the present geological conditions.

(Author's abstract)

MORIYAMA, J., TAKIMOTO, K. and MINATO, T.

1968 Rare metal minerals in Malaya. *In* Takimoto, K. (ed.) Geology and mineral resources in Thailand and Malaya, *Kyoto Univ. Cent. Southeast Asian Stud., Rep. Res. Southeast Asia, Nat. Sci., Ser. N*–3, 129–34, locality map, 2 tabs.

Samples from the amang dumps at 22 dressing plants, mostly in Perak and Selangor, were analyzed by X-ray powder diffraction and XRF analysis. Iron, yttrium and tungsten were generally present in addition to tin, and the minerals ilmenite, monazite, and xenotime were commonly detected, in addition to ubiquitous cassiterite. A few samples revealed zirconium, niobium, or manganese, and the following minerals were also less commonly detected: rutile, magnetite, haematite, columbite, zircon, wolframite, quartz, and garnet.

NEWBERRY, J.

1970 Engineering geology in the investigation and construction of the Batang Padang hydro-electric scheme, Malaysia. *Q. Jl. Engng. Geol.* **3,** 151–81, 4 pls., 11 figs., 7 tabs.

The Batang Padang hydro-electric scheme in West Malaysia is located in an area of tropically-weathered granite. Major factors in the siting, design and construction of the engineering structures, which include three dams, twelve miles of tunnel and a power station 900 ft underground, were the nature of the residual soil mantle and the structure of the underlying rock.

Site investigation included over 10,000 ft of cored borings. No major geological impediments to the scheme were encountered. Because of the deep weathering, earth-fill dams were the most suitable. The pressure tunnels were left unlined, as they were mainly in competent granite with tight joints.

Exploration of the power station site through an exploratory adit and bore holes confirmed that the cavern could be excavated in rock suitable for permanent support by bolts, gunite and mesh. In the event some of this rock proved 'defective' and led to exfoliation of the walls, requiring more guniting than had been expected. But in the project as a whole, rock tightness led to a major reduction in the scale of grouting. A major geological problem was tunnelling through residual soil below water table. This led to flow slides necessitating tunnel diversions.

(Modified from author's abstract)

NEWELL, R.A.

1971 Characteristics of the stanniferous alluvium in the southern Kinta valley, West Malaysia. *Bull. geol. Soc. Malaysia* **4,** 15–37, 12 figs., 3 tabs.

The Kinta Valley is a large alluviated tract in Perak, flanked by granite ranges and underlain by marble with minor clastic metsediments. The Kinta River has a transitional sinuosity of about 1.3 and a gradient of about 5 ft/mi, while the bedrock surface slopes southward at about 10 ft/mi, the alluvium reaching thicknesses in excess of 100 ft in the southern part of the valley.

Alluvial sections were studied in 38 tin mines near Kampar. The deposits include 'granite wash' (partly eluvial); stratified sand, silt, and clay; peat and peaty sediments; and mine tailings. Multiple (up to 4) graded depositional sequences were characteristic. The sections at 3 mines are described in detail.

Size distribution and heavy mineral content were determined for 139 samples from 27 mines. Content of heavy minerals averaged 0.59% (range: 0.05% to 3.2%). Scatterplots showed that high content of heavy minerals is associated with coarse mean size and with low or negative skewness, but the relationships are not simple, and no single parameter is a good index to heavy mineral concentrations.

Many characteristics of the deposits strongly suggest fluvial origin; in the main they probably represent channel and topstratum deposits of a river of low to transitional sinuosity.

(Modified from author's abstract)

NG, C.N.

1970 Paleozoic fossil locality in Negri Sembilan. *Newsletter geol. Soc. Malaysia* **27**, 7–8, 1 locality map.

Casts and moulds of brachiopods, rugose corals, fusulinids and plants, probably Upper Carboniferous or Permian in age, are recorded from the Sg. Jelei, 20½ miles from Tampin.

NG, W.K. and ONG, H.P.

1971 Determination of tin by atomic absorption after concentration with calcium carbonate. *Ann. Rep. geol. Surv. Malaysia* [*for* 1969], 108–12, 1 fig., 3 tabs.

Tin was successfully concentrated by calcium carbonate co-precipitation. The precipitates were dissolved in 50 ml of 1M hydrochloric acid and measured with a Tetron AA4 atomic absorption spectrophotometer at 2863.3A° tin lines using an air-acetylene flame. No difference was detected for hydrochloric acid concentration below 1 Molar. Calcium concentration ranging from 0.2–2.0 percentage could be tolerated.

(Author's abstract)

NG, W.K. and YONG, S.K.

1971 Rapid semi-quantitative mineral analysis to improve efficiency in processing alluvial tin-ores from West Malaysia. *Ann. Rep. geol. Surv. Malaysia* [for 1969], 128–55, 4 pls., 7 figs., 2 tabs.

A rapid semi-quantitative method of mineral analysis is described, involving magnetic separation by the Frantz isodynamic separator, chemical treatment by acids, gravity separation by heavy liquids, and mineral identification and estimation by microsopic methods. The method is said to be quick, reliable, cheap, and relatively simple in application. Descriptions are given of alluvial minerals from West Malaysia, with notes on their identification.

OLANDER, H.C.

1969 *Petroleum exploration in West Malaysia—1969.* 12 p., 3 figs. Kuala Lumpur: Geological Society of Malaysia.

Discusses the methods and problems involved in drilling the sea bed.

OLOFIN, E.A. and MORGAN, R.P.C.

1971 Mass movements in the University of Malaya campus, January 1971. *Newsletter geol. Soc. Malaysia* **29,** 1–4, 1 fig., 1 tab.

Several earthflows characterised by slumping occurred on man-made slopes after heavy rain. One is described in detail and the soil properties given.

PILLAI, S.P.

1971 Mineralogical study of some magnetic cassiterite from Perak, Malaysia. *Trans. Inst. Min. Metall., Lond.* **80,** sect. B, (Bull. No. 771), B18–26, 11 tabs.

Earlier work on the paramagnetism of cassiterite is critically reviewed. Magnetic cassiterite has a wide range of magnetic susceptibility related to its composition in addition to magnetic impurities. Tantalum is present and distributed uniformly in all the cassiterite grains studied. Micro-inclusions of magnetite in some cassiterite, or the presence of iron in the crystal structure, account for the observed magnetic properties. Pseudobrookite and magnetic niobian rutile are formed in some grains when magnetic cassiterite concentrate is heated to 850°C. The latter may be the cause of the paramagnetism found in some cassiterite.

(Modified from author's abstract)

RAJAH, S.S.

1969a Younger Mesozoic sedimentary rocks, State of Johore, West Malaysia. *Bull. Amer. Ass. Petrol. Geol.* **53,** 2187–94, 1 fig.

Flat-lying to gently dipping arenaceous rocks of molasse facies crop out extensively in Johore. Their maximum thickness exceeds 1000 ft. They rest unconformably on older rocks, in part Permian, and contain fossil plants probably of Lower Cretaceous age. The name Tebak Formation is proposed for all these outcrops. It is correlated with the Gagau Group of northeast Malaya.

1969b A brief note on ignimbrite in Johore. *Newsletter geol. Soc. Malaysia* **20,** 1–2.

Rhyolitic welded tuffs are widespread in Johore. They are generally massive, well-jointed, and sometimes stratified. Their mineralogy and texture are described.

1970a Geology of the Gunong Blumut area. *Ann. Rep. geol. Surv. Malaysia* [for 1968], 79–83, 1 geol. map 1:253,440.

The Dohol Fm. is mainly of unfossiliferous metasediments but contains the Sumalayang Limestone Member with fusulines of

Middle Permian age. The Linggiu Fm. of arenites of flysch type is probably contemporaneous with the Sedili Volcanic Fm., a thick sequence of acid to intermediate lavas, ignimbrites and pyroclastic rocks. The Linggiu flora dates the Fm. as Upper Permian (Kon'no *et. al.* 1970).

The Lower Cretaceous Tebak Fm. is composed of crag-forming sandstones, for the most part flat-lying unconformably over the older sediments and the Blumut Granite. The Layang-Layang Fm. of clays and sands contains plants fossils probably of Pliocene to Pleistocene age. It resembles the 'Older Alluvium' of other parts of Johore. Three main granite intrusions are recognized. The Tengkil Granite is a fine to medium grained pink alkali granite. The Blumut Granite is mainly coarse-grained pink biotite granite, and the Lenggor Granite is typically a grey fine to medium grained adamellite. Similar folding characterises the older sediments and a number of faults run between WNW and N, at least one of which has a sinistral displacement. The area includes five small tin fields, and xenotime, wolframite, and Cu, Pb, and Zn sulphides are reported.

1970b Limestone occurrences in Johore. *Bull. geol. Soc. Malaysia* **3,** 131–3, 1 fig.

Small fossiliferous limestone outcrops are recorded from Sungei Sedili and Sungei Lenggor. The former contains Permian foraminifera; the later crinoids, corals and bryozoans probably also Permian.

RIDD, M.F.

1971a Faults in South-East Asia, and the Andaman rhombochasm. *Nature, Lond.* **229,** 51–2, 2 figs.

A net southeasterly movement of the Malay Peninsula between the southeast-trending wrench faults of axial Sumatra and the Thai-Burma fault belt may be associated with the opening of the Andaman basin.

1971b South-East Asia as a part of Gondwanaland. *Nature Lond.* **234,** 531–3, 2 figs.

Proposes that mainland southeast Asia and western Indonesia represent a fragment of Gondwanaland which formerly fitted between India on the west and Australia on the east. The evidence adduced for this includes that used by Burton (1970a) in his similar reconstruction, plus reports of *Glossopteris* from Thailand. The proposed fit, here made on the continental slopes, is geometrically good, but the facies and palaeoclimate contrasts of the areas involved are ignored.

RODOLFO, K.S.

1969 Bathymetry and marine geology of the Andaman Basin, and tectonic implications for southeast Asia. *Bull geol. Soc. Amer.* **80,** 1203–30, 1 pl., 16 figs.

A detailed geophysical and geological study of the Andaman Basin. Of relevance to West Malaysia are the following: Only a very thin mantle of Cenozoic sediments covers the 250 km wide continental shelf on the west side of the Malay Peninsula north of Sumatra, except in the Sumatra Shelf Basin, where over 1 km has accumulated. The Andaman-Nicobar ridge, mainly of Palaeogene sediments, is interpreted to have formed adjacent to the Malay Peninsula and to have been drifted to its present position by rifting movements starting in Miocene. The Andaman Basin is therefore a rhombochasm. The tectonic pattern of the whole region is interpreted as reflecting south-southeastward movement of southeast Asia.

SAKAGAMI, S.

1968 Study on the Upper Palaeozoic *Bryozoa* of Japan and the Thai-Malaya districts. *Atti. Soc. It. Sc. Nat. e Museo Civ. St. Nat. Milano* **108,** 295–7.

The bryozoa of Japan and Thai-Malaya are related at generic level, although there are only three species in common out of 181 spp. known from Japan and 87 spp. known from Thai-Malaya.

1970 On the Palaeozoic bryozoa of Japan and Thai-Malayan districts. *J. Paleont.* **44,** 680–92, 2 figs., 2 tabs.

Reviews the occurrence of bryozoa of Japan, Thailand, and Malaya. Bryozoa are known from the Viséan of Sg. Lembing, Pahang, and from the Permian of Pulau Jong, Langkawi and Bt. Mata Ayer, Perlis.

SANTOKH SINGH, D,

1970 Mineral resources West Malaysia. *Ann. Rep. geol. Surv. Malaysia* [for 1968], 13–25, 2 figs., 1 tab.

A summary of recent work including a mineral distribution map. In Ulu Sokor, Kelantan, gold and silver mineralisation is associated with base metal sulphides, and gold and silver-bearing quartz lodes occur in andesitic and rhyolitic lavas. In Ulu Paka, Trengganu, pyrometasomatism and pneumatolytic-hydrothermal activity associated with granite intrusions formed deposits of tin, tungsten and iron in two NNW-trending belts. Samples of Trengganu beach sand contained commercial ilmenite and zircon. Gold and silver are recorded from P.C.C.L. Mine in Pahang. Detrital minerals in the Temengor and Ringat valleys, Upper Perak, contain economic cassiterite and also gold and columbite.

SHU, Y.K.

1969 Some NW trending faults in the Kuala Lumpur and other areas. *Newsletter geol. Soc. Malaysia* **17,** 1–5, 1 map.

The southern end of the Main Range is cut by sinistral wrench faults trending 310°–320° with associated tension fractures at 280°–290°, often filled with quartz dykes. The largest wrench fault system, the Bukit Tinggi Fault Zone, lies in a broad zone of mylonite, and flaser and sheared granite. Similar wrench fault systems are noted from other parts of Malaya.

1970 Geology of the Jelebu District, new series map sheet 95. *Ann. Rep. geol. Surv. Malaysia* [for 1968], 94–9, 1 geol. map 1:250,000.

In the eastern part of the area is the Silurian to Devonian Karak Fm. consisting mainly of conglomerates interbedded with quartzites. Four mainly fault-bounded granitic masses are described. An enstatite-bearing quartz monzonite occurs around Gunong Nuang in the NW of the area.

1971 The geology of new series map sheet 95, Jelebu District, Negri Sembilan. *Ann. Rep. geol. Surv. Malaysia* [for 1969], 72–81, 1 geol. map 1:250,000, 3 figs.

A more detailed review of the geology outlined in Shu (1970), giving a stratigraphic column and more structural data. NW–SE sinistral wrench faults and N–S normal faults dominate the structural pattern.

SIVAM, S.P.

1971a Differences between the Old Alluvium and weathered granite in Perak, West Malaysia. *Newsletter geol. Soc. Malaysia* **32,** 1–2.

Old Alluvium can be identified by the presence of non-granitic phenoclasts, rounding of clasts, inclusion of wood and peat, bedding structures, and characteristic lack of micas. Presence of quartz veins proves material is weathered bedrock.

1971b Evidence for the non-marine origin of the tin-bearing alluvium in the north Kinta Valley, Malaysia. *Newsletter geol. Soc. Malaysia* **32,** 3–6.

Contrary to some published opinions, fossils, sedimentary characteristics, and paleodrainage patterns all point to a fluviatile origin.

SMILEY, C.J.

1969 Preliminary notes on the Mesozoic flora from Maran, Pahang. *Newsletter geol. Soc. Malaysia* **16,** 1–2.

The flora, from the middle of the Tembeling Fm., is almost identical with the Gagau flora, both probably being early Cretaceous in age.

1970a Later Mesozoic flora from Maran, Pahang, West Malaysia. Part 1: geologic considerations. *Bull. geol. Soc. Malaysia* **3,** 77–88, 2 figs., 1 tab.

Plant megafossils from two horizons in the middle part of the Tembeling Formation at Maran closely resemble plants from Gunong Panti in southern Johore and from Ulu Endau respectively. The composite Maran flora is nearly identical with the Gagau flora, probably of Lower Cretaceous (Neocomian) age.

1970b Later Mesozoic flora from Maran, Pahang, West Malaysia. Part 2: taxonomic considerations. *Bull. geol. Soc. Malaysia* **3,** 89–113, 5 pls.

Species of *Equisetites, Gleichenoides, Otozamites, Ptilophyllum, Zamites, Frenelopsis, Conites, ?Pelourdea, ?Nageiopsis,* and *Carpolithes* compose the flora discussed by Smiley (1970a).

SMITH, J.M.

1970 Mineral investigations in the Ulu Sokor area. *Ann. Rep. geol. Surv. Malaysia* [for 1968], 102–5, 1 geol. map 1:45,000.

This part of Kelantan is underlain mainly by interbedded phyllites, tuffs and limestone. Manson's Lode is the most important mineral deposit in the area. It strikes 65° and is an elongated, manto-type deposit. The massive sulphide ore is mainly argentiferous galena, sphalerite, pyrite, chalcopyrite and pyrrhotite and occurs within or at the boundaries of gently dipping limestone beds. Sulphide, gold and silver ores are reported from other localities in the area.

STAUFFER P.H.

1969 Tin mineralisation and faults in the Kuala Lumpur region. *Newsletter geol. Soc. Malaysia* **20,** 5–7, 1 map.

From published maps it appears that tin mineralisation in this area is related to fault zones, especially those trending WNW which may have sinistrally offset primary tin lodes to a cumulative total of about 70 km.

1971 Quaternary voloanic ash at Ampang, Kuala Lumpur, West Malaysia. *Newsletter geol. Soc. Malaysia* **33,** 5–8, 1 fig.

The ash is white, fine-grained and rhyolitic, and occurs as a distinct layer 0.45 m thick in a sequence of alluvium and peat exposed by tin mining. It is correlated with ash previously reported from Perak and Pahang.

SUZUKA, T. and MINATO, T.

1966 Aspects of some iron and tin deposits in the western district in Malaya. *Kyoto Univ. Cent. southeast Asian Stud., Rep. Res. South-east Asia, Nat. Sci. Ser.*, vol. 4, no. 2, 87–99.

Not seen.

1968 Iron ore deposits in Malaya. *In* Takimoto, K. (ed.) Geology and mineral resources in Thailand and Malaya. *Kyoto Univ. Cent. southeast Asian Stud., Rep. Res. Southeast Asia, Nat. Sci. ser.*, N–3, 77–108, 27 pls., 21 figs.

After a general review of iron mining in Malaya, detailed observations are given on the Simpang Rengam, Jorak, and Lenga mines in Johore, and the Perak mine near Ipoh. At Simpang Rengam, magnetite, haematite, and goethite form the ore, which occurs in a complex bedrock geology of sedimentary, volcanic and acid igneous rocks. At Jorak and Lenga, the ore consists of haematite boulders, with some magnetite at Lenga. At Jorak the bedrock is Triassic volcanics and granite, while no bedrock is exposed at Lenga. In the Perak mine, haematite replaces limestone-dolomite of Gunong Rapat; secondary boulder ore of haematite also occurs. All of these deposits are thought to be formed by contact metasomatism or hydrothermal action related to the emplacement of granites.

SWAN, S.B.St.C.

1968 Coastal classification with reference to the east coast of Malaya. *Z. Geomorph., supplementband* **7,** 114–32, 6 photos, 5 figs., 1 tab.

The varied morphology of the east coast of Malaya is due to its complex evolution. The classification given is empirical and noncyclic. Over 90% of the coast is prograded by terrestrial and marine Quaternary deposits although the width of the coastal plain is variable, due partly to variation in size of the drainage basins. Most of the retrograded coast consists of a relatively narrow belt of residual terrain backed by late Quaternary deposits. Progradation of the coast has been by outward growth (marine deposits and mangrove) locally, but more commonly by outward and inward growth (the formation of spits and bars seaward and

the infilling of lagoons landward by fluviatile deposits and by vegetation.). At present some parts of the coast show either intermittent or simultaneous advance and retreat.

1970a Analysis of residual terrain, Johor, Malaya. *Ann Ass. Amer. Geogr.* **60,** 124–33, 11 figs., 5 tabs.

Analysis of slope measurements made in Johore, Malaya, indicates the existence of a variety of slope forms. Slope length is found to vary with relative relief, and slope angle does the same for the first few hundred feet, after which there is no significant change in steepnsss despite increase of relief. Lithology exerts a decisive influence on relative relief and slope form. Terrain is finely dissected.

(Author's abstract)

1970b Relationships between regolith, lithology and slope in a humid tropical region: Johor, Malaya. *Trans. Inst. Brit. Geogr.* **51,** 189–200, 4 figs., 8 tabs.

Statistical analyses of soil samples from the eluviated A horizon of the upper layer of the regolith in terrain with a local relief of 65 m in Johore, Malaya, show that textural variations are related primarily to rock type. Catenary variations are related more to position on the profile than to form of slope element or slope steepness, a decrease in the clay-silt content being noted down the slope profile.

(Author's abstract)

1970c Piedmont slope studies in a humid tropical region, Johor, Southern Malaya. *Z. Geomorph., supplementband* **10,** 30–39, 6 figs., 1 tab.

At a number of sites in Johore, chiefly in areas of granitic or quartzitic bedrock, piedmont slopes occur between hill slopes and clay flats. These piedmont slopes are from 5 to 900 m wide and have inclinations of 1° to 9°, with an average of 4.25°. The slopes are partly composed of colluvial material but are essentially residual erosional features. They are thought to form by inward weathering and backwearing of steep slopes, and are themselves lowered by sheet wash erosion and lateral physical and chemical eluviation. They are initially undissected, but later succumb to dissection by gullying and local base level changes. These piedmont slopes are the humid tropical equivalent of the pediments of drier environments.

(Modified from author's abstract)

1970d Land surface mapping, Johor, West Malaysia. *J. trop. Geogr.* **31,** 91–103, 12 figs., 4 tabs.

Using criteria of slope angle and curvature and position in landscape, landforms are classified and mapped in Johore State from

1:63,360 topographic maps. A simplified landform map and an average slope map of Johore are given, as well as a larger scale landform map of the Muar area.

TAKIMOTO, K., MORIYAMA, J., MINATO, T., et al.

1968 Studies on tin ores from Malaya. *In* Takimoto, K. (ed.) Geology and mineral resources in Thailand and Malaya. *Kyoto Univ. Cent. southeast Asian Stud., Rep. Res., South-east Asia, Nat. Sci. ser.*, N–3, 109–28, 3 pls., 11 figs., 8 tabs.

Samples of mine concentrates from twenty localities in both west coast and east coast tin belts were analyzed by magnetic separator, heavy liquids, X-ray diffraction, XRF, ultraviolet light, and electron probe. The minor elements and minor minerals found are shown in tables.

TAKIMOTO, K. and SUZUKA, T.

1968 General statement on geology and ore deposits in Thailand and Malaya. *In* Takimoto, K. (ed.) Geology and minerial resources in Thailand and Malaya. *Kyoto Univ. Cent. Southeast Asian Stud., Rep. Res. South-east Asia, Nat. Sci. ser.*, N–3, 1–6, 3 tabs.

A brief review is given of the geology of Thailand and Malaya and of mining activities in these two areas.

TAMURA, M.

1970 Pteriacea from Malayan Triassic. *In* Kobayashi, T., and Toriyama, R. (eds.) *Geology and palaeontology of southeast Asia,* vol. 8, 133–149, 2 pls., 8 figs., 4 tabs. Univ. Tokyo Press.

Species of *Pteria, Cassianella, Hoernesia,* and *Bakevellia* are described from Chegar Perah, Kuala Lipis, Temerloh and Fort Iskandar, Pahang. Although the Temerloh faunas may be somewhat younger, the remainder show Middle Triassic rather than Upper Triassic affinites. The distribution of Pteriacea in southeast Asia is reviewed.

TAN, B.K. and SIVAM, S.P.

1971 A fossil "Portuguese Man-of-War" (Velellidae) from the Paleozoic of the Raub area, Pahang, West Malaysia. *Newsletter geol. Soc. Malaysia* **33,** 8–12, 3 figs.

Well preserved imprints of the jellyfish occur in metasedimentary rocks of probable Carboniferous age along the Cheroh River.

TAYLOR, D.

1971 An outline of the geology of the Bukit Ibam orebody, Rompin, Pahang. *Bull. geol. Soc. Malaysia* **4**, 71–89, 10 figs.

The Bukit Ibam iron ore lies within a sheath of sheared and chloritized rocks between a hangingwall (east) of deeply weathered unmetamorphosed acid volcanics and a footwall of siliceous pyritic hornfels. A granodiorite body lies a short distance into the footwall. The ore comprises an upper secondarily enriched zone of high-grade haematite-magnetite ore and an underlying magnetite, in magnesium silicate gangue. Massive liomonite ore formed a distinct zone along the hangingwall and, with haematite, formed a mantle of secondary boulder ore. Copper, zinc and bismuth were present in minor amounts. The orebody may have originated contemporaneously with the volcanic series as an exhalative—sedimentary deposit over an intrusive at shallow depth. Subsequent folding and fracturing with further rise of the granodiorite to close below the ore caused considerable thermal metamorphosim of the footwall rocks and shearing and recrystallization of the ore zone, with some redistribution of the copper and sulphur. The high grade ore was formed subsequently by supergene processes which upgraded the iron content by removal of magnesium, silicon and sulphur and oxidation of magnetite to haematite and pyrite and of chlorite to limestone.

(Modified from author's abstract)

THOMAS, H.D., and SCRUTTON, C.T.

1969 Palaeozoic corals from Perak, Malaya, Malaysia. *Overseas Geol. Miner. Resour.* **10**, 164–71, 2 pls., 1 fig.

Quepora sp. of Upper Ordovician age and *Heliolites barrandei*, *Favosites allani* and *Favosites* sp. of Middle Silurian to Lower Devonian age are described from two tin mines near Kanthan, Kinta.

TJIA, H.D.

1969a Sunda-Land bauxites: related to Late Cenozoic sea level? *Newsletter geol. Soc. Malaysia* **18**, 1–2.

Summit elevations of about 60m of bauxite in Johore and the Riau Islands are comparable to the maximum Quaternary sea level and occupy a gentle erosion surface. Bauxitization could have occurred during the Quaternary.

1969b Regional implications of the Lebir fault zone. *Newsletter geol Soc. Malaysia* **19**, 6–7.

Field work in the Lebir valley, Kelantan, has established that the fault zone is a sinistral wrench system, 2–3 km wide and containing a number of parallel shears. The importance of NW and NNW

trending sinistral wrench faults in Malaya indicate the counter-clockwise movement of NNW–SSE elongated crustal slabs.

1970a Quaternary shorelines of the Sunda Land, southeast Asia. *Geol. en Mijnb.* **49,** 135–44, 3 figs., 2 tabs.

Includes a list of raised and submerged shorelines of West Malaysia and correlates these with the classical Quaternary shorelines of the Mediterranean.

1970b Monsoon-control of the eastern shoreline of Malaya. *Bull. geol. Soc. Malaysia* **3,** 9–15, 5 figs., 1 tab.

Monsoon-controlled currents along the eastern shoreline of Malaya are predominantly southward throughout the year for the tract between latitude 3°N to 5°N, whereas the other coastal stretches are subjected to mainly north-northwestward currents. These dominant current senses affect the directional displacements of lower stream courses. Beach ridges tend to develop on the downcurrent sides of river outlets as the result of the longshore current directions during the wet monsoon when the streams are transporting the bulk of their annual load.

The step-like (in plan) protuberances of the eastern shoreline mainly reflect the *en echelon* arrangement of resistant rock bodies. These asymmetrical headlands may maintain their shapes if the shorter sides face into the current, but the 'risers' (defined in the text) will gradually become smooth shorelines through sedimentation if they occur on the leeward sides of headlands.

(Author's abstract)

1971 Lineament pattern on Penang Island, West Malaysia. *J. trop. Geog.* **32,** 56–61, 4 figs.

Topographic lineaments on Penang Island are analyzed as to direction. Five important directions are seen: N to N10°E; N35°E; N70°E; N100°E; and N150°E. These are all interpreted in terms of an E–W compressive stress. Lateral offsets of up to 4 km are suggested for some of the lineaments thought to represent shear fractures (directions N70°E, first order; N35°E and N150°E, second order). Some evidence for vertical offset is also cited.

TRIVEDI, B.S., and CHATURVEDI, S.K.

1961 On two new genera of fungi from Tertiary coal beds of Malaya. *Curr. Sci.* **30,** 112–3, 6 figs.

Fungal hyphae are figured and compared with living fungi.

TRIVEDI, B.S., and VERMA, C.L.

1969 A notes on mega and microspore remains from the Tertiary coal of Malaya. *Curr. Sci.* **38,** 546–7, 6 figs.

Spores of a fungus, *Brachysporium;* a bryophyte, *Sphagnum;* a pteridophyte, *Anemia;* a gymnosperm, *Podocarpus;* an angiosperm, *Quercus* and a megaspore are described.

TSCHANG, H.L.

1961 The pseudokarren and exfoliation forms of granite on Pulau Ubin, Singapore. *Z. Geomorph.* **5,** 302–12, 14 pls., 5 figs.

Describes weathering forms developed on bare surfaces of granite. Down-slope oriented grooves (pseudokarren) on steep to vertical surfaces are interpreted as formed mainly by the mechanical action of rain wash. Splitting off of concentric curved sheets (exfoliation), usually less than 3 cm thick, is attributed to chemical weathering.

1962 Some geomorphological observations in the region of Tampin, southern Malaya. *Z. Geomorph.* **6,** 253–9, 14 pls., 3 figs.

Describes and illustrates weathering forms on granite outcrops and boulders, including pseudokarren and exfoliation forms like those on Pulau Ubin (see Tschang 1961), 'water eyes' (weathering pans), and split rocks.

1966 Geomorphological observations on weathering forms in Hong Kong and some other humid regions of SE Asia. *Chung Chi J.* (Hong Kong) **5,** 206–26, 6 pls., 1 tab.

Describes and discusses a variety of weathering forms, with some examples from Malaya and Singapore.

WEST, G., and DUMBLETON, M.J.

1970 The mineralogy of tropical weathering illustrated by some West Malaysian soils. *Quart. J. engineer. Geol.* **3,** 25–40, 2 figs., 6 tabs.

The mineralogy of the processes leading to the formation of soils by the tropical weathering and leaching of rocks is reviewed, and illustrated by the results of an investigation into the formation, mineralogy and plasticity properties of some soils formed on basalt, granite, shale and sandstone in West Malaysia.

It is shown that hydrolysis followed by differential solution can account for the formation of the samples studied. Kaolinite was always present and generally the dominant clay mineral, although it gave place to gibbsite under severe weathering, and illite was also present in some of the less weathered soils on granite and shale. Quartz was prominent in soils on granite and sedimentary rocks, which are rich in this mineral. Iron oxide generally occurred, usually as goethite in the soils but as hematite in the nodules which

were generally present in the soils selected for study, although gibbsite (hydrated alluminium oxide) was the main constituent of the nodules in one case. The observed mineralogical composition and clay content of the soils are consistent with the range of plasticity properties observed. The activity of some soils was reduced by the presence of gibbsite or goethite in the clay-sized fraction.

(Author's abstract)

WONG, P.P.

1969 Surface configuration of Singapore Island: a quantitative description. *J. trop. Geog.* **29**, 64–74.

Morphological units are mapped over Singapore Island, and given numerical description using indices based on hypsometric data, slope data, and hill frequency (as a measure of degree of dissection). The indices reflect the underlying rocks, igneous rocks having the highest relief; Old Alluvium (Pleistocene?) being the most dissected, though of low relief; and the older sedimentaries being intermediate.

WONG, Y.C.

1970 A study on some alluvial xenotime of West Malaysia and its economic significance. *Ann. Rep. geol. Surv. Malaysia* [for 1968], 105–9.

Xenotime forms up to 1.4% of *amang* from Perak, Negeri Sembilan, Melaka, Selangor and Johore. It would be economic to recover this from large mines and has recently been in great demand for its yttrium.

1971 The analysis of rare earths in monazite by X-ray spectrometry. *Ann. Rep. geol. Surv. Malaysia* [for 1969], 113–5, 1 fig., 2 tabs.

Five monazite samples were analyzed for rare earth elements by X-ray spectrometry. Total rare earths compare well with chemical analyses. The results indicate the feasibility of this method for determining these elements in monazites.

YANAGIDA, J. and SAKAGAMI, S.

1971 Lower Carboniferous brachiopods from Sungei Lembing district, NW of Kuantan, Malaysia with a brief note on the bryozoans in association with brachiopods. *Mem. Fac. Sci. Kyushu Univ. Ser. D, Geology*, **21**, 75–91, 3 pls., 3 figs.

Seven species of Lower Carboniferous brachiopods, *Punctospirifer* sp. (? sp. nov.), *Antiquatonia* sp., *Setigerites* sp., *Linoproductus* sp., *Streptorhynchus* cf. *S. ruginosum* (Hall et Clarke), *Pugnax* cf. *P. asiaticus* Muir-Wood and *Camarotoechia*? sp. are described

from siltstones of the Lower Carboniferous Calcareous Series of east Pahang, Malaysia. This brachiopod species assemblage has a strong afinity with the Middle Viséan fauna of the Russion Central Asia and the Upper Meramecian to Lower Chesterian ones of Central North America. Palaeontological notes on some bryozoans which have occurred associated with the brachiopods are also given as an Appendix.

(Author's abstract)

YAP, F.L.

1971 The Lenggong, Bruas, and Batu Gajah Districts. *Ann. Rep. geol. Surv. Malaysia* [for 1969], 97–103, 1 geol. map approx. 1 : 240,000.

Much of the Lenggong area is underlain by well-jointed and locally sheared, biotite-rich porphyritic granite to granodiorite, with some inclusions of hornfels. Near Lenggong town occurs a larger body of marble and hornfels.

In the Bruas-Batu Gajah Districts the southern end of the Bintang Range consists of biotite-rich porphyritic adamellite, with minor granite and granodiorite, and is flanked by alluvial sediments.

In both areas cassiterite occurs widely in small amounts.

YOSHIZUMI, E., TANIGUCHI, K., and IRIE, T.

1968a Geophysical prospecting: reconnaissance survey in Thailand and Malaya. *In* Takimoto, K. (ed.) Geology and mineral resources in Thailand and Malaya. *Kyoto Univ. Cent. Southeast Asian Stud., Rep. Res. Southeast Asia, Nat. Sci. ser.* N–3, 135–48, 12 pls.

A general discussion of the applicability of various geophysical methods to prospecting for tin and iron in Malaya, and fluorite and manganese in Thailand.

1968b Geophysical prospecting: results of the survey in Malaya. *Ibid,* 149–60, 14 figs.

Magnetic surveys were carried out at 4 known iron-ore localities in Malaya. Surveys were on a grid with spacing 20 to 40 meters. Some known deposits showed clearly in the magnetic readings, and anomalies outside mined areas suggest additional deposits. But some known deposits give only weak anomalies.

SUBJECT INDEX

This index also covers published items listed in the first Supplement (Gobbett 1970).

Volcanic ash: ALEXANDER 1968; STAUFFER 1971
Volcanic rocks
Triassic: PIMM 1967

Weathering
and bauxite formation: GRUBB 1968
forms: TSCHANG 1961, 1962, 1966
of granites: DOUGLAS 1967b, 1968; NOSSIN and LEVELT 1967
and soil formation: WEST and DUMBLETON 1970

Xenotime
from *amang*: WONG, Y.C. 1970

Zircon
in beach sand: SANTOKH SINGH 1970

Appendix I: Unpublished Works

ABDUL JAMIL ALI
1967MS *Geology of Batu Kikir and Kg. Petaseh (in the districts of Bahau and Kuala Klawang), Negri Sembilan, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

ANG, N.K.
1971MS *The geology and mineralisation of the Gagak and Gagak Creek area, Sungai Lembing, Pahang, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

BRADFORD, E.F.
1965MS *The geology and mineral resources of the Gunong Jerai area, Kedah, Malaya.* Ph.D. thesis, University of London.

CHAN, S.C.
1970MS *Geology of the Sungei Besi area with special reference to its primary tin mineralisation.* Honours thesis, Department of Geology, University of Malaya.

CHIN, L.S.
1969MS *Geology and mineral resources of the Sungei Ketubong area, Kelantan.* Honours thesis, Department of Geology, University of Malaya.

CHONG, F.S. and EVANS, G.M.
1969MS *The geology and mineral potential of north Johore and south Pahang—Area B.* Ipoh: Geol. Surv. Malaysia.

CHONG, N.H.
1970MS *The geology and mineralisation of Batu Tiga old pit, Bukit Besi, Trengganu, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

CHOY, K.W.

1969MS *Geology of the western Kuala Lumpur area, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

CHU, L.H.

1971MS *The geology, mineralisation and geochemical studies of the Bukit Payong area, Rompin, Pahang, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

CHUNG, S.K.

1959MS *The geology of south central Pahang.* Ipoh: Geol. Surv. Malaysia.

1962MS Should now read 1962MSa.

1962MSb *Operation Col (Sheet 79 & 88). Brief account of the geology and mineral resources of central Pahang.* Ipoh: Geol. Surv. Malaysia.

COOK, R.H. and SUNTHARALINGAM, T.

1969MS *The geology and mineral potential of north Johore and south Pahang —Area C.* Ipoh: Geol. Surv. Malaysia.

FOO, K.Y.

1968MS *The geology and mineral resources of the Kuala Kangsar—Taiping area.* Ipoh: Geol. Surv. Malaysia.

GAN, A.S.

1969MS *Geology and mineralisation of the Ulu Langat area, Selangor, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

JOGINDER SINGH

1970MS *A study of the distribution of tin and related elements in certain superficial deposits of North Pahang, West Malaysia.* M.Sc. thesis, Department of Geology, University of Malaya.

KHOO, H.P.

1969MS *Mineralisation at Pelapah Kanan, Kota Tinggi, Johore, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

KHOO, K.K.

1970MS *The geology and mineral resources of the Hong Kong—Killinghall opencasts, Puchong, Selangor.* Honours thesis, Department of Geology, University of Malaya.

KHOO, T.T.

1967MS *A petrological study of the Sungai Ruan area, Raub, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

KWAN, T.S.

1971MS *The geology and mineral resources of the Kledang Range area in the vicinity of Ipoh, Perak, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

LEE, A.K.

1970MS *Geology of the Kerdau-Mentakab-Temerloh area, central Pahang, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

LEE, C.Y.

1971MS *Geology, mineralization and some geochemical aspects of the Chenderiang area, Perak, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

LEE, K.W.M.

1971MS *The geology, mineralization and geochemical studies of the Bukit Lentor area, Trengganu, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

LEONG, L.S.

1970MS *Geology and mineralisation of the Western Hill area, Batu Tiga, Bukit Besi, Trengganu, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

LIM, T.H.

1971MS *Geology, mineralisation and geochemical studies of the western Gambang area, Pahang, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

LOGANATHAN, S.K.P.

1970MS *Geology and geochemical study of the Templer Park area, Selangor, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

LOH, C.H.

1971MS *Geology and geochemical studies of the Bukit Tulis area, Ulu Paka, Trengganu, West Malaysia.* Honours thesis, Department of Geology, University of Malaya.

NG, C.N.

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Appendix II: Geological Maps

These maps were published or prepared by the Geological Survey of Malaysia.

A. GENERAL GEOLOGICAL MAPS

1970Ma Malaysia Barat geological map, 1968 edition. Compiled by E.H. Yin and F. Chand, 1: 2,000,000.

B. MINERAL DISTRIBUTION MAPS

1969M Malaysia Barat, showing the locations of principle iron-ore deposits. Compiled by J.H. Bean, 1: 760,320.

D. GEOLOGICAL SHEETS, 1: 63,360, AND HORIZONTAL SECTIONS

1970Mb Old Series sheet 2J/9 (Grik). Compiled by C.R. Jones. One sheet in colour.

1970Mc Geological sections across old series sheet 2J/9 (Grik). Compiled by C.R. Jones. Three sections in colour: horizontal scale 1: 63,360, vertical scale 1 inch to 2,000 feet.

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Newly published: PROCEEDINGS, REGIONAL CONFERENCE ON THE GEOLOGY OF SOUTHEAST ASIA ed. by B.K. Tan. Bulletin 6. (1973). 342 p. Price: £4.00/US$10.00 (Hardbound).

GEOLOGICAL MAP OF THE MALAY PENINSULA (1: 1,000,000, coloured) compiled by D.J. Gobbett. March 1972. Price: £1.00/US$2.50 (folded flat; rolled extra at cost).

Field guide for a 7 day, one thousand mile geological excursion in Central and South Malaysia (West Malaysia and Singapore) by C.S. Hutchison. Field Guide No. 1 (1973) Price £1.00/US$2.50.

Also available: BULLETIN SERIES 1968—Bulletins 1, 3, and 4 are collections of papers on Malaysian geology; Bulletin 2 is an annotated Bibliography and Index of the Geology of West Malaysia and Singapore through 1967 (a Supplement for 1968 appears in Bulletin 3).

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Bulletin 2 (1968): 152 p. £2.00/US$5.00
also in hard cover at £3.00/US$7.50
Bulletin 3 (1970): 146 p. £2.00/US$5.00
Bulletin 4 (1971): 100 p. £2.00/US$5.00

Abstracts of papers: Regional Conference on the Geology of Southeast Asia, Kuala Lumpur. March 20—25 1972. 64 p. 8 figs., tables, many extended abstracts. February 1972. Price: £1.20/US$3.00.

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