# Geological Evolution of South-East Asia

Second Edition

CHARLES S. HUTCHISON


Geological Society of Malaysia
2007

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This book is dedicated to the former professors at the University of Malaya. It is my privilege to have collaborated with Professors C. S. Pichamuthu, T. H. F. Klompé, N. S. Haile, K. F. G. Hosking and P. H. Stauffer. Their teaching and publications laid the foundations for our present understanding of the geology of this complex region. I also salute D. J. Gobbett for having the foresight to establish the Geological Society of Malaysia and Professor Robert Hall for his ongoing fascination with this region.

# Preface to this edition

The original edition of this book was published by Oxford University Press in 1989 as number 13 of the *Oxford monographs on geology and geophysics*. It was originally planned by me to include a section on economic deposits. However, the editor in Oxford instructed that this should be more comprehensively covered in a subsequent book. It appeared under the title 'South-East Asian oil, gas, coal and mineral deposits' in 1996 as number 36 of the *Oxford monographs on geology and geophysics*. Number 36 is still available from Oxford because it has been included in their new 'print when required' system. Number 13, unfortunately preceded this new system, and it is no longer available from Oxford.

With the permission of Oxford University Press, the 'Geological Evolution of South-East Asia' was reprinted in Kuala Lumpur, without any revision, and published by the Geological Society of Malaysia in 1996. This blue paper-back edition became well known throughout the region of South-east Asia. Unfortunately the stock has become depleted in 2007.

It is too important a book to let go. A thorough revision would be beyond my time constraints. I have revised only those sections that have become absolutely necessary because of important new data.

*Petaling Jaya* CSH
2007

ACKNOWLEDGEMENTS

I am grateful to the former President, Professor Lee Chai Peng, for support and considerable help in bringing this new edition into publication, and to Mrs Anna Lee for her friendly assistance. Many thanks are due to Dr. Ng Tham Fatt for designing the book cover.

# Preface to the original Oxford book

My involvement in South-east Asian geology began in 1957 with systematic studies on the granite and gabbro-norite of Singapore Island. Gradually, these studies were extended throughout the Malay Peninsula and into Thailand and South China. My interests broadened to the volcanic rocks, stratigraphy, structure, and economic deposits of the region.

After completing the *Geology of the Malay Peninsula* with D. J. Gobbett in 1973, it became my desire to write a book on the greater region, for no regional geology had ever been written on South-east Asia. Warren Hamilton completed his landmark *Tectonics of the Indonesian region* in 1979, paving the way for the present book.

Professor P. H. Stauffer and I made initial plans for a book under the title *South-east Asia: geology and environment*. Unfortunately, the compilation of this book had to be abandoned in 1983 when Professor Stauffer left the region.

An enquiry from the Oxford University Press for a book under my sole authorship conveniently arrived in 1984, and was readily formalized.

This is not a standard regional geology, and the selection of the title allowed me to emphasize tectonic models, but at the same time to document the stratigraphy and igneous events. I have always taught my students that every aspect of geology involves interpretation. From thin sections to hand specimens, to maps, and thence to regions there is an increasing order of interpretation. Although it has greatly benefited from and has been influenced by numerous discussions with colleagues, the mistakes are mine alone.

This book gives more of a bird's-eye view of the region, for much field and laboratory work remains before a definitive account can be written. There remains great scope for high-quality palaeomagnetic research to refine the Phanerozoic plate motions modelled in the following pages. The granites have been reasonably well dated, but there is still a lack of radiometric dates for volcanic and metamorphic formations in addition to granites in critical tectonic regions. Good structural geological analysis is also lacking, but lack of continuous outcrops will severely hamper progress.

The present volume links two major regions included in the present *Oxford Monographs on Geology and Geophysics Series*: No. 2 *Phanerozoic Earth history of Australia*, edited by J. J. Veevers (1984), and No. 3 *The Geology of China*, by Yang *et al.* (1986).

The present volume will I hope appeal to regional stratigraphers and students of the great Tethyan province. The inclusion of Tertiary oil and gas basins may result in the use of this book by exploration companies. Unfortunately, mineral deposits have been excluded due to length constraints.

This volume is the outcome of courses I have taught to my students at the University of Malaya over the past 5 years. By the time it is published, I will have closed my own books and—with regret—have left the region after 30 enjoyable years of involvement in the geology of South-east Asia. It is my earnest hope, however, that this volume will remain open on the desks of my graduates and future generations of geology students to stimulate their better understanding of this complex and fascinating region.

*Exeter* C.S.H.
1987


## ACKNOWLEDGEMENTS

The compilation of this book has benefitted from collaboration and discussions with many colleagues. In particular, I would like to single out P. H. Stauffer, I. Metcalfe, K. R. Chakraborty, and Y. G. Gatinsky. Many of their ideas have been crystallized, albeit imperfectly by me, in the pages of this book. Ian Metcalfe kindly critically read the manuscript. Thanks are due to J. K. Blake for help in compiling Table 5.1.

S. Srinivass, Ching Yu Hay, and Roslin Ismail formed my sketches into the final illustrations. Jaafar Abdullah and Lee Kok Eng gave me photographic assistance. Rujiraporn Polchai helped in compiling the index. Zaimah Ahmad Saleh and Fauziah Hanim Saidi helped with the typing at various stages. My son Timothy helped in the final stages of the manuscript. I wish to thank the editors and staff of the Oxford University Press for their help in producing this book. A debt of gratitude is expressed to the University of Malaya for facilities to carry out my research and writing throughout the years.

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# 1

# Introduction

## 1.1. GENERAL

The region described extends approximately 4330 km from latitude 26°N to 13°S, and approximately 5570 km from longitude 85°E to 135°E (Fig. 1.1). Its area, approximately 24 million km$^2$, is roughly comparable with that of Europe, and somewhat larger than that of Australia. Although geology should recognize no political boundaries, it is useful to be aware of the political subdivisions, for geological explorations have been and are largely restricted to individual countries. More often than not the international boundaries represent the limits of geological study, or changes in terminology.

The region includes all the Association of South-East Asian countries (ASEAN), namely Indonesia, Thailand, Malaysia, Singapore, and the Philippines. In addition, Myanmar and Indochina (Cambodia, Laos, and Vietnam) naturally fall into this region. For completeness, some reference will be made to Taiwan, the southern and eastern regions of China including Tibet and Hong Kong, the Assam area of India, Nepal, the Andaman and Nicobar Islands, and the northern parts of Australia and New Guinea.

About two-thirds of the region is covered by seas, in which there are thousands of islands, ranging in size from Sumatra and Borneo to those which are too small to show on the map. The interwoven network of seas, islands, and the peninsulas of mainland Asia and Australia have allowed a successful synthesis of modern oceanographic research with classical geological studies on land. Our understanding of South-east Asia has been significantly advanced as a result of international research co-ordinated and supported by the Co-ordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP), and the Intergovernmental Oceanographic Commission of UNESCO (IOC), as part of the International Decade of Ocean Exploration (IDOE). The programme came to be recognized as Studies in East Asian Tectonics and Resources (SEATAR), and a progress report was published some years ago (CCOP-IOC 1980).

The impressive amount of oceanographic work carried out in this SEATAR project has made possible the correlation of previously completed geological investigations on land with the submarine topography and its tectonic elements.

South-east Asia provides the world's most outstanding geological laboratory for the study and understanding of active plate tectonics. Deep-sea trenches, marginal seas, and island arcs abound. The region is seismically active and contains many of the world's most active volcanoes. The island arcs, and small intervening seas, are in the process of being compressed by the 8 cm per year northwards movement of cratonic Australia. The immediate effects of the arrival of Australia are to be seen in collision tectonics on the island of Timor and extinction of the volcanic arc to the north of it. As Australia continues to push northwards, the complex of island arcs and seas will be compressed further, eventually forming a major orogenic welt sutured between mainland Asia and Australia. By this time the seas will have been driven out, and the disparate islands and basins will be compressed into a Himalayan-style complex such as can now be seen between India and Tibet. The study and understanding of South-east Asia is therefore important in the development of the geological sciences, for this is a region in which a future mountain or orogenic system can be seen in the early stages of formation. Every orogen is unique, but a study of the sequence of events in the South-east Asian archipelagos and seas will help in the unraveling of older now completed orogens.

The region is also of interest in providing evidence of the relationships between tectonic evolution and economic deposits. Sedimentary basins lying between island arcs and occupying shallow shelf seas on continental margins are important for oil, gas, and coal. The volcanic island arcs are important for porphyry copper and precious metal deposits. Base metal deposits are also of some importance. Uplifted oceanic lithosphere contains chromite and nickel deposits. In the more continental parts of the region, there are spectacular granite-related tin and important tungsten

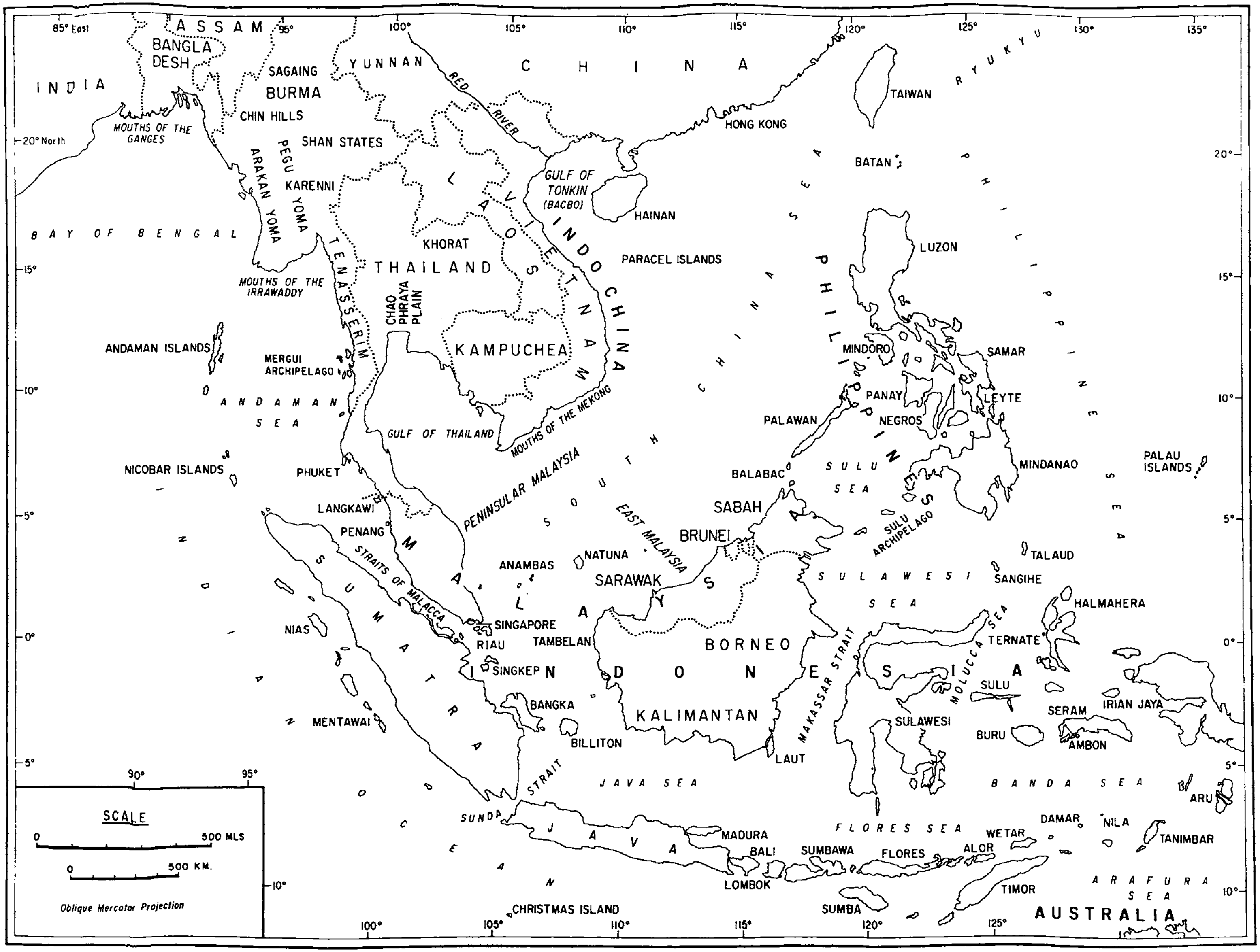


Fig. 1.1. Outline map of South-east Asia showing the countries and some of the place names. Burma is now known as Myanmar and Kampuchea as Cambodia.

deposits, and antimony and mercury are locally significant. Some of these deposits have been locally worked out.

Environmentally, the region may be divided into a stable cratonic core and an outer island arc system, which is seismically and volcanically active. Some major fault zones, such as the Red River, have high seismic risk. The volcanic arcs of Indonesia and the Philippines offer rich volcanic soils, but at the same time they are regions of high earthquake risk. The archipelagos which face the major oceans are susceptible to tsunami damage. Volcanic eruptions have frequent local effects, but they are more widely felt if the magnitude and frequency of the eruptions increase (Blong and Johnson 1986). Large-scale clearances of jungle and forest result in significant changes in microclimate, and most certainly result in soil erosion. Urbanization, especially in flat coastal plains and inland valleys, has led to severe air and water pollution, and changes in the micro-climate. Withdrawal of groundwater at excessive rates has led to regional subsidence, which in the case of Bangkok is beginning to result in disastrous flooding and structural collapses (Nutalaya and Rau 1981).

## 1.2. HISTORY OF GEOLOGICAL STUDIES

The majority of the South-east Asian countries benefited from their colonial eras in that established geological surveys, complete with experienced geologists and administrative infrastructure, were established in the territories. Only Thailand was spared the yoke of colonialism, with the drawback that systematic geological study and publication have accordingly been slow to develop.

Geological and mining activities were totally disrupted by the Japanese occupation of the whole region in the early 1940s and valuable records and manuscripts were lost for ever. Continuing insurgency in many South-east Asian countries has until recently prevented systematic geological surveys in parts of the region, and political disputes prevent a proper assessment of the oil potential of the major part of the South China Sea.

### 1.2.1. Thailand

The first useful geological description was by Hallet (1890). He was a civil engineer in search of a railway route from Moulmein to south China, and he traveled through north Thailand by elephant, describing the geological formations seen on the way.

The Royal Department of Mines and Geology was established in 1891, but little geological work was done. Its principal function was to grant tin mining leases. The second director made several trips through the country and his publications contain some descriptions of the mineral deposits (Smyth 1898).

An Anglo-French convention of 1896 secured the borders with Myanmar (then Burma) and Cambodia, and assured the continuing independence of Thailand. The southern borders with Malaysia (then called the Malay States) were long disputed, but were fixed by a treaty with Britain in 1899. In 1909 Thailand ceded to Britain its rights over the northern states of what is now Peninsular Malaysia.

The first critical geological investigation was made in 1912 by a professor from Uppsala University (Hogbom 1914). Prince Kamphaengbej, who was commissioner of the Royal State Railways, engaged Wallace M. Lee, an American geologist, to investigate the coal and oil resources of Thailand, in an attempt to find fuel for the locomotives. Lee made three investigations between 1921 and 1923, the first to the north, the second to the peninsula, and the third to the Khorat area. The reports are concise and contain useful geological summaries (Lee, W.M. 1923a, b, c). These reports form the important foundations of Thai geology. Lee subsequently summarized the reports and emphasized the oil potential of the country (Lee 1927).

In 1927–9 Wilhelm Credner, from Kiel University, visited many regions of Thailand that had not previously been described, and he published the most comprehensive description of the geology yet written (Credner 1935).

In 1934 the Ministry of Defence engaged two Swiss geologists to study the possibility of petroleum in the north, including the oil shales at Mae Sot and long-known oil seeps at Maung Fang. Accounts of the petrography and structure of the region were published (Heim and Hirschi 1939; Hirschi 1938, 1939; Hirschi and Heim 1938).

In 1941, a geological survey division was established in the Royal Department of Mines, but it was not until the end of the war in 1946 that the division could be staffed and a beginning made on a long-term geological programme. The Royal Department of Mines then asked the United States Government to assist in a reconnaissance study of the mineral deposits of the country. The survey was carried out between 1949 and 1950 and the result was the first authoritative account of the geology and mineral deposits of Thailand (Brown et al. 1951). Since 1951, geological mapping, research, and publication by the Department of Mineral Resources have flourished. The work has been carried out both by Thai geologists and in collaborative projects with the German and British geological surveys. The publications are too numerous to enumerate; and lists may be found in Workman (1978), Nutalaya *et al.* (1978) and Sethaput (1956).

However, even now, Brown et al. (1951) remains the only comprehensive account of the country. A modern definitive geology of Thailand has yet to appear, but Bunopas (1981) gives a useful recent summary.

### 1.2.2. Myanmar

In 1862 Pegu, Arakan, and Tenasserim were amalgamated to form British Burma, and the whole of Burma became incorporated in the British Indian Empire in 1886. Before the association of Burma with India there were a number of geological reports on the mineral deposits and fossil localities. Many of the reports appeared in the Journal of the Asiatic Society of Bengal. However, it was during the Indian administration that systematic surveys and published accounts flourished. These are to be found in the memoirs and records of the Geological Survey of India. The earlier records are too numerous to enumerate here, and the reader is referred to Goossens (1978a, b) for a bibliographic summary. The early work was excellently summarized in outstanding accounts by La Touche (1913) and later by Pascoe (1950, 1959, 1964). Sir Edwin Pascoe's massive 2130-page work was published after his death in 1949. He started writing in 1933 and submitted the complete manuscript in 1939. Most of it was already set in type, but at the beginning of the war in 1939 the 2.5 tons of type were broken up and remelted for munitions. After his death, the manuscript of Volume 4, which consisted of general and geographical indexes, was unfortunately never traced. This massive work is therefore not indexed, but it represents the outstanding introduction to the pre-1933 knowledge of Myanmar.

In 1923 the University of Rangoon set up a new department of geography and geology. Its staff included such famous names as L. Dudley Stamp and H. L. Chhibber. Both were active in the field and made the results of their work widely available; for example Stamp (1927). Chhibber (1934a, b) made a landmark in the geological literature by publishing his two books, one on the geology and the other on the mineral deposits of Myanmar.

Myanmar was administratively separated from India in 1937, and eventually gained independence from Britain in 1948. Since Chhibber's work. many Burmese and other geologists have contributed significantly to our understanding of the country. The publications are summarized by Goossens (1978). A notable summary of the geology and mineral deposits was published by Robertson Research (1975, 1977) at a time when it appeared that the government was opening up the country to international mining companies. Unfortunately this did not take place, and several recent surveys, maps, and reports prepared by overseas investigators have been suppressed. A geology of Burma has been recently published by Bender (1983).

### 1.2.3. Indochina (Cambodia, Laos, Vietnam)

The various provinces were unified as French Indochina in 1887, but French influence extends back to 1787. The early literature on Indochina was in French. There was only occasional research up to the end of the nineteenth century. Some of it, however, like the study of the rich flora in the coal basins of North Vietnam, was of great importance (Counillon 1914, Zeiller 1902). Before 1880, the French colonial administration showed little interest in geological research and mining development. Thus, it was that the first general work on the geology of the region (Petiton 1895) was not published until some twenty years after its completion.

The Service Géologique de L'Indochine was founded in Hanoi in 1898. Field mapping and palaeontological studies progressed rapidly, but for many years they were restricted to selected areas, most of the effort being centred on Yunnan and southern China. From 1925 onwards, emphasis was placed on the compilation of a geological map of the whole of Indochina, completed only in 1963. The publications up to 1950 are largely the fruits of the Service Géologique de L'Indochine. Individual works are too numerous to enumerate, but mention should be made of the important summaries by Fromaget (1941) and Saurin (1935, 1944). A detailed bibliography of this and the later period was compiled by Fontaine (1973). French Indochina split up into North Vietnam, South Vietnam, Laos, and Cambodia in 1956, and the newly independent countries formed their independent geological surveys. Since then, North and South Vietnam have unified and Cambodia was renamed Kampuchea before again becoming Cambodia.

The geology of North Vietnam has been extensively re-studied, with assistance from the USSR. To the extent that wartime conditions allowed, South Vietnam and Cambodia continued to perform new mapping, but little new work has been possible in Laos, and little is known still of the geology of that country. A booklet on the geology of North Vietnam was published by Tran et al. (1979), but nothing comparable has come recently from the other countries which formerly comprised Indochina. Fontaine and Workman (1978) provide the most comprehensive bibliography and most recent summary of the geology and mineral resources of these countries.

### 1.2.4. Indonesia

A very impressive geological programme of mapping, research. and publication flourished under Dutch control, which gradually spread throughout Indonesia. The last territory to be annexed was the northern part of Sumatra as late as 1907. Many significant surveys and publications were made in the latter years of the nineteenth century, but the most important works were published in the first two decades of the twentieth century. Many eminent geologists either worked in Indonesia or took part in well-organized expeditions there. The Geological Survey of the Netherlands Indies lasted from 1850 to 1950, with its headquarters in Bandung and the Bureau of Mines in Jakarta (then Batavia). During that time, the regular Survey publication was the series *Jaarboek van het Mijnwezen*, published in Batavia. In addition, several books and many articles were published in Europe on the geology of Indonesia. Virtually everything ceased in 1941 with the outbreak of war.

Many famous Dutch geologists wrote about Indonesia, and it would be impossible to do justice to all of them here. I will mention only those authors who synthesized the earlier work and built upon it in their books. The earliest and widest compilation was by Brouwer (1925). Rutten (1927, 1932) gave a series of lectures and his books brought the attention of the world to this fascinating region of South-east Asia. Umbgrove (1949) also did much to summarize the prominent features of Indonesia. However, it was by the impressive work of Van Bemmelen (1970) that the geology of Indonesia and South-east Asia became well known. The first edition of his outstanding book was published in 1949. Van Bemmelen had been a member of the Geological Survey of the Netherlands Indies since 1927, and was working on the manuscript in Bandung in 1941 when the Japanese invaded. He was interned during the war. His manuscript could not be retrieved, and the book was begun afresh after the war. Mention should also be made of the novel gravity measurements made by Vening Meinesz in the submarine K *XIII* in 1927, 1929, and 1930. Through his work, the unique nature of the deep-sea trenches of the Indonesian region was brought to the attention of the world (Vening Meinesz 1954).

The literature of the Indonesian region is rich and varied, but for most people Van Bemmelen (1970) will serve as a summary. Since the war and the independence of Indonesia, the Geological Survey of Indonesia has made great progress in better understanding this vast and complicated country. The book by Hamilton (1979), which summarizes most of the later work, is now widely known, and it interprets the region in modern plate tectonics terminology.

### 1.2.5. Philippines

The Philippines was held by Spain until 1898 and geological records of that era are generally now only of historic record. Enrique Abella-y-Casariego, the last chief of the Spanish Mining Bureau, was the ablest of the early investigators. His publications, now hard to find, are listed in Smith (1924).

In 1898 the Philippines was ceded to the United States of America. Soon after this a Mining Bureau was established. A considerable amount of information was published by the United States government, and it summarized all the useful earlier knowledge. Notably, Becker (1901) summarized all that was known to that date. The publication of Smith (1924) was a landmark in Philippine geology. He had been with the Mining Bureau since 1906, becoming chief of the division of mines in 1920. This outstanding book contains a complete bibliography of previous work of the Spanish era. Wallace E. Pratt, also of the Bureau, published extensively; for example, Pratt (1916). Filipinos began publishing; a notable example was Leopoldo A. Faustino. who joined the division of mines around 1920 and has a long list of publications (for example Faustino 1934).

The Philippine Commonwealth was established in 1934, which planned for and led to the independence of the Philippine Republic in 1946. However, no significant geological work was done around that time.

The next landmark was the publication of Corby *et al.* (1951), which contains a comprehensive account of the geology, emphasizing the oil potential. There have since been numerous publications on the geology of the Philippines, too numerous to mention, but summarized by Teves (1953, 1957), and by Aquino and Santos (1971). The most recent landmark is the publication by the Bureau of Mines (1981), summarizing the geology in book form. Volume 2 of this work is on the mineral deposits, published later (Bureau of Mines, 1986).

### 1.2.6. Peninsular Malaysia and Singapore

Peninsular Malaysia, formerly known as the Federation of Malaya, was under British rule until 1957. With independence it became Malaysia, and eventually included Sarawak and Sabah (North Borneo), which are jointly now referred to as East Malaysia. Singapore withdrew from Malaysia and is now an independent country.

The earliest and most comprehensive records of the geology of Peninsular Malaysia and Singapore were by Logan (1848). Between 1870 and 1903 Europeans began participating in the mining industry of the peninsula and several authors wrote on the tin deposits. However, until 1903 any geological work had been of a short-term and haphazard nature. It was against this background of the important tin-mining industry that the government appointed its first geologist, J. B. Scrivenor, who set up his office in Batu Gajah, in the foremost tin-mining valley of Kinta. He arrived in 1903 and devoted most of his working life to Malaysian geology. Until his retirement in 1930, most of the geological publications were written by Scrivenor, who laid the foundations of Malaysian geology. His other earlier works were admirably summarized in his two books (Scrivenor 1928, 1931). In 1913, W. R. Jones joined Scrivenor as a geological assistant. He studied the great Kinta Valley tin field and summarized its geology in Jones (1925). The early geological literature of Peninsular Malaysia and Singapore has been compiled by Gobbett (1968).

The Federation of Malaya Geological Survey continued to grow, and the headquarters moved to Ipoh, where the main laboratories are still sited. With independence in 1957, the Geological Survey of Malaysia gradually phased out its expatriate staff. The Survey headquarters moved to Kuala Lumpur, and assumed control of geological work in both Peninsular and East Malaysia. In addition to a large number memoirs and map bulletins, the Survey continues to map systematically and in detail the geology of the whole of Malaysia.

Geological work in Singapore comes under the Public Works Department, but work is usually limited to site investigations, and no systematic geological mapping is undertaken.

Establishment of a geology department in the University of Malaya in 1956 was an important landmark in the development of the geological sciences in the region. The professors – C. S. Pichamuthu, T. H. F. Klompé, N. S. Haile, K. F. G. Hosking, C. S. Hutchison, and P. H. Stauffer – have all made significant contributions to Asian geology. The Geological Society of Malaysia was founded in 1967 by the academic staff of the department, notably by D. J. Gobbett, and it continues to flourish.

As a successor to Scrivenor (1928, 1931), a book was published under the editorship of Gobbett and Hutchison (1973). It remains the authoritative summary of the geology of Peninsular Malaysia and Singapore. A revised edition is currently under preparation. The Republic of Singapore (1976) has published a summary of its own geology.

### 1.2.7. Sarawak, Sabah, and Brunei

Accounts of geological explorations in Borneo have been given by Hatton (1886), Posewitz (1892), Schmidt (1904), and Rutter (1922). The early systematic geological studies of Sarawak, Brunei, and Sabah were made primarily by oil companies and also by companies exploring for mineral deposits. But no comprehensive accounts came until a geological survey was established.

The Geological Survey Department, British Territories in Borneo, was first established in 1949, with offices in Kuching and Kota Kinabalu, then known as Jesselton. An important landmark was the publication of Reinhard and Wenk (1951). The Shell Oil Company employed these two Swiss geologists to compile a comprehensive account of the geology of North Borneo (Sabah). The field work was completed before 1942 and the results published by the Geological Survey Department in 1951.

Shell also collaborated with the Geological Survey Department in making available the only regional compilation of the whole territory, including Sarawak, Brunei and West Sabah (Liechti *et al.* 1960). Since then a large number of reconnaissance memoirs and bulletins have been produced by the Department, and later by the Geological Survey of Malaysia. Independent Brunei is dominated by the Shell Oil Company and its geology has recently been summarized in book form by James (1984). The latest book on North-west Borneo, Sarawak, Brunei and Sabah, is by Hutchison (2005).

## 1.3. THE MODERN ERA OF GEOLOGICAL CO-OPERATION

Rapid advances in the geological knowledge of Southeast Asia have been made since the early 1970s, as a result of planned international co-operation between oceanographers and land-based geologists within a programme of transect studies across peninsular Southeast Asia and its island arcs. This programme was carried out within the International Decade of Ocean Exploration, and co-ordinated by the Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asia Offshore Areas (CCOP) and the Intergovernmental Oceanographic Commission of

UNESCO (IOC) (CCOP-IOC 1974, 1980). From this programme, there has been a rapid flow of papers in international journals and books over the past decade, which has greatly improved our understanding of South-east Asia. Active offshore exploration by petroleum companies also greatly increased our knowledge of the Tertiary basins. The release of some of their data helped, for example, in the compilation of Hamilton (1979). An unnecessary reluctance by national petroleum corporations to make available regional data, has, however, greatly hindered tectonic analysts. Summaries of the Tertiary oil basin geology have been published, for example, by ASCOPE (1981). Oil companies of the region continue to release permitted information through publications of the Indonesian Petroleum Association, Jakarta, the Southeast Asia Petroleum Exploration Society, Singapore, and various regional geological societies, such as the Geological Society of Malaysia, Kuala Lumpur, which holds an annual petroleum geology seminar and publishes the papers in its bulletin series.

In 1972 the Geological Society of Malaysia began an important tradition of holding a regional conference on the geology and mineral resources of South-east Asia (GEOSEA). The proceedings have been published by various societies in the countries of the region: GEOSEA 1 (Tan 1973); GEOSEA I1 (Wiryosujono and Sudradfat 1978); GEOSEA I11 (Nutalaya 1978); GEOSEA IV (Philippines 1981); and GEOSEA V (Malaysia 1984). The full proceedings of GEOSEA V were published in 1986 and 1988 as bulletins 19 (Teh and Paramananthan, 1986) and 20 of the Geological Society of Malaysia. GEOSEA VI was held in Jakarta in July 1987. The ninth GEOSEA conference proceedings were published as Bulletin 43 of the Geological Society of Malaysia.

Volume 1 of the *Journal of Southeast Asian Earth Sciences,* published by the Pergamon Press in Oxford and edited by B. K. Tan of the University of Malaya, appeared in 1986. This journal has been superseded by the *Journal of Asian Earth Sciences*, now published by Elsevier.

The research programmes of the International Decade of Ocean Exploration Studies in East Asian tectonics and resources (SEATAR) have resulted in several special publications, for example Barber and Wiryosulono (1981), *Hayes* (1980, 1983) and Hamilton (1979). Important new work is in progress in the Philippines, the Timor area, and the South China Sea. Not all SEATAR transects have been published but those across the Banda Sea and Java to Sarawak have been published (Hutchison, 1991a, b).

Three outstanding quality maps of the region have been compiled by Gatinsky (1983), by Ray (1982) and by Pubellier et al. (2005), and the oil and gas map by ESCAP (1985).

# 2

# Late Mesozoic and Cainozoic tectonic features

## 2.1. GENERAL

The region is covered extensively by seas (Fig. 2.1). However, not all are of similar character. The 200-m water depth is a useful demarcation isobath between shallow seas that cover the continental shelf and the deeper more oceanic seas. South-east Asia has a number of marginal seas (Bostrom, 1978), where the water depth exceeds 3 km; these abyssal plains are floored by oceanic crust.

The marginal seas are separated by island or remnant arcs (Karig, 1972) made up either of volcanic or accretionary wedge material. In addition, the arcs may be complicated by the inclusion of continental fragments that have been rifted from the larger continental masses of Asia and Australia, and carried away by seafloor spreading.

The two main shelf sea regions are the Sunda Shelf, which is a submarine extension of continental South-east Asia, connecting the peninsular landmasses with Sumatra and Borneo, and the northwards extension of Australia as the Sahul Shelf, extending north to the Timor Trough. This shelf extends to link up with New Guinea via the Arafura Sea. Detached fragments of the Australian platform occur in the islands of Sumba and eastern Sulawesi (Pigram and Panggabean 1984; Hutchison 1987b). Continental fragments occupy much of the South China Sea and are assumed to have been detached from the China shelf between Hainan and Taiwan. These fragments include north-east Palawan, and several submarine banks such as the Reed Bank and Luconia Shoals (Taylor and Hayes 1983).

Low sea levels during the Pleistocene Great Ice Age resulted in the landmasses extending 21 thousand years ago to the 120 metre isobath (Hanebuth et al. 2000; Voris, 2000). The continental shelf, extending to the 200 metre isobath is probably wholly a result of the low sea levels and shoreface sedimentation during the past 140 thousands of years (Fig. 2.1).

## 2.2. WALLACE'S LINE AND ITS MEANING

The eminent English naturalist Alfred Russel Wallace divided South-east Asia into Oriental and Australian faunal domains by a line which became known as Wallace's Line (Fig. 2.29). West of the line, the fauna and flora have distinct Asian affinities: east and south-east of the line they have Australian or Oceanic affinities. From 1863 to 1880 Wallace drew the line between Bali and Lombok, extending between Borneo and Sulawesi (then called Celebes) and between the Philippines and Indonesia. In 1910, he revised it to lie east of Sulawesi (George 1982). Sulawesi presented difficulties to Wallace, which have even today not been resolved, for its fauna and flora seem to have affinities with both Asia and Australia. The present-day consensus is that western Sulawesi was formerly a part of South-east Asia, and the eastern part, which is largely of ophiolite, was uplifted as a result of collision of the Banggai-Sula Spur, a westwards displaced continental fragment of New Guinea. Wallace's Line, in geological terms, therefore runs through central Sulawesi (Audley-Charles 1982).

All terrains east of Wallace's Line were previously remote from South-east Asia, and have been drifting northwards since about 90 Ma when Australia separated from Antarctica and began its northwards drift which accelerated to about 8 cm $a^{-1}$. Their flora and fauna had ancestral roots in the supercontinent of Gondwanaland. The collisions of these terrains with those of South-east Asia began only about 15 Ma, and the Sahul Shelf collided with the Timor Trough at only 3 Ma (Audley-Charles 1982). As the Australian terrains approached South-east Asia, dispersal of fauna and flora across the narrowing seas that separated them caused some intermingling of the previously distinct fauna and flora. This explains the difficulties that Wallace had in drawing a definite line in the neighbourhood of Sulawesi (Fig. 2.29).

The picture is further complicated because India separated from Gondwanaland (Australia) about 120 Ma, and began its drift northwards, eventually to collide with Tibet about 50 Ma. This allowed fauna and flora of Gondwanaland origins to reach Asia and disperse into South-east Asia. There is also a possibility that other smaller landmasses of South-east Asia may have drifted away from Gondwanaland. There is a growing

# 3

# Cainozoic sedimentary basins

It is desirable to have some system of classification applicable to the thick accumulations of predominantly Tertiary strata, which have become the focus of attention for oil, gas, and coal exploration and exploitation in the region. Any mechanism which can produce a depression in the earth's crust is a potential basin-forming agent. Obviously, faulting is the main mechanism, but it is important to differentiate the kinds of faults and to consider their origin in relation to the tectonic evolution of the region.

## 3.1. BASIN CLASSIFICATION

Two attempts at classification of South-east Asian basins appeared independently in 1975 (Murphy 1975; Soeparjadi *et al.* 1975). The more detailed one by Murphy (1975) subdivides the basins into 'shelfal', 'continental margin', 'archipelagic', and 'marginal seas', but some of these are too broad to be useful. *Soeparjadi et al.* (1975) used such categories as 'outer arc', 'foreland', 'interior cratonic', and 'open shelf on continental margin'. Some of these terms are open to misinterpretation. 'Interior cratonic' rightly applies to such basins as the Sichuan 'Red' basin of the Yangzi platform and to the Khorat–Vientiane basin of Indosinia, but should not be applied to the Borneo region.

It is preferable to use terminologies related to the elements of plate tectonics. The general tectonics-based classifications of Bally and Snelson (1980), Horn (1980) and Kingston *et al.* (1983) are useful, and may be followed where appropriate. These two classifications are broadly similar despite different terminologies. One important difference is in regard to the mechanisms of rifting. Kingston *et al.* (1983) interpret the various back-arc basins of convergent plate margins as resulting from wrench faulting incorporating a component of divergence. Thus, they refer to the back-arc basins of Sumatra and the Malay basin as 'wrench or shear basins'. This is in agreement with the analysis of Wood (1985) and has been followed by Hutchison (1985, 1986a) and displayed in Figs. 3.1 and 3.2. We know that these back-arc basins have both extensional and wrench histories (Crostella 1981). The detailed code of Kingston *et al.* (1983) is difficult to apply without extensive knowledge of any particular basin, so that of Bally and Snelson (1980) is more readily applicable. They are, however, broadly complementary.

Hutchison (1985) showed that several basins peripheral to Borneo have been complicated by collision between microcontinents. He therefore created an additional category: 'basins on or peripheral to continental fragments'. This category remaiins nevertheless somewhat obscure.

A fundamental problem is whether the basins which lie behind the volcanic arc are genetically related to the arc-trench system. The 'back arc' category may be nothing more than a geographical description. From the analysis of Wood (1985) and Tapponnier *et al.* (1982), these basins are now known to have formed by wrench tectonics and widespread rifting of the South China Sea. The same problem applies to the classification of 'marginal seas'. Few, if any represent 'back-arc' ocean floor spreading (Hutchison 1986a). Many represent fragments of larger oceans trapped behind younger arc-trench systems. Others, like the South China Sea Basin, result from rifting of a continental shelf (Taylor and Hayes 1983). The use of a term to classify a basin does not, therefore, mean that we understand its origin. In many cases the terms are geographically descriptive and unrelated to genesis.

The locations of the major Tertiary basins are shown in Fig. 3.1. Their names, suggested classification, and average geothermal gradients are shown in Fig. 3.2 and listed in Table 3.1.

The fitting of geological details into various favoured models (Table 3.1) has been contrived and attempts at relating the stress fields of the faulting patterns (e.g. Wood, 1985) and basin shapes to the active plate margins have been largely unsuccessful. The fore-arc category alone remains viable, but only where the plate margin has not been reorganized throughout the basin evolution, e.g. Sibolga, Bengkalis and South Java. All others, i.e. the 'back-arc' basins, remain genetically enigmatic and defy meaningful plate tectonic classification.

# 4

# Phanerozoic tectonic framework

## 4.1. INTRODUCTION

South-east Asia represents the ultimate eastern extension of the Palaeo-Tethys (Şengör 1984; Şengör and Hsü 1984; Belov *et al.* 1986). The elimination of the Palaeo-Tethys resulted in the formation of the Late Triassic–Early Jurassic Indosinian (Cimmeride) Orogeny. The Neo-Tethys Ocean has not been totally eliminated by the Palaeogene Alpide (Himalayan) orogeny and is partly extant in the Indian Ocean. Only to the north and east of India has it been converted into suture zones in Tibet and Myanmar (Fig. 4.1).

The Cainozoic fault motions, discussed in Chapter 2, have largely moulded the present geological framework and made more difficult the unravelling of the earlier geological history and plate motions (Stauffer 1974, 1983).

The South-east Asian or *Indosinian orogenic system* (Indochinese Cimmerides of Şengör, 1984) is the least well known of the Cimmeride orogenic system and the gaps in our knowledge are attributed to many reasons, predominantly the equatorial climate leading to deep weathering and lush tropical rainforest, complex political boundaries, and a general lack of access. Nevertheless, its geological framework has emerged, though important essential details are lacking, particularly in the structural aspects. The Indosinian orogen shows great similarities to the western extensions of the Cimmeride orogenic system. The differences are unique to South-east Asia, where the Palaeo-Tethyan Ocean was widest and hence a greater separation between Gondwanaland and Asia existed.

## 4.2. ANALYSIS OF THE TECTONIC FRAMEWORK

Many attempts have been made to analyse the tectonic evolution of South-east Asia. The following are considered to be the most significant: Hutchison (1973c, 1987a), Stauffer (1974, 1983, 1985), Acharyya (1978b), Gatinsky *et al.* (1978, 1984), Şengör (1979, 1984), Ridd (1980), Bunopas (1981), Gatinsky (1981, 1986a, *b*), Mitchell (1981), Şengör and Hsü (1984), Metcalfe (1986), and Gatinsky and Hutchison (1987). Throughout this series of papers, there has developed a growing awareness that South-east Asia is composed of a number of relatively rigid Precambrian continental blocks, marginally and extensively overlain by Phanerozoic platform strata, and separated by highly deformed mobile belts composed of strongly compressed deep water strata deposited upon oceanic crust of the Palaeo-Tethys or its branches. Commonly, they are closely associated with ophiolite and mélange belts marking suture zones (Figs 4.1 and 4.2). Subduction activity within the oceans and along their margins with the continental blocks is documented by magmatic arcs; their nature and ages are summarized in Fig. 4.2. The simplified tectonic map of Şengör and Hsü is shown here as Fig. 4.1. It shows that the region represents an assemblage of terrains ('tectonic collage' of Şengör 1984[1]), welded together along narrow suture zones, and finally consolidated into the Cimmeride orogenic system in Jurassic times.

A plate boundary has long been recognized extending southwards from Yunnan as the Changning–Shuangjiang Suture (Huang *et al.* 1984), through Thailand and the Malay Peninsula. Hutchison (1975a) named it the *Uttaradit–Luang Prabang Line* in Thailand and Laos, and it extends northwards to the vicinity of Dien Bien Phu, where it appears to be represented by a major right-lateral strike-slip fault. In Peninsular Malaysia he named it the *Bentong-Raub Line* (Fig. 4.2). Unfortunately, Şengör (1984), and Şengör and Hsü (1984) did not maintain the terminology of Hutchison (1975a); their alternative nomenclature is shown in Fig. 4.1.

From the tectono-stratigraphic entity distributions, it may be concluded that this boundary was of major

1. 'Collage' is a term used exclusively for an artistic artifact, and is hardly appropriate. 'Terrain assemblage' is preferable, and means the same.

# 5

# Terrains of Cathaysian affinity

The blocks of Cathaysian affinity shown in Fig. 4.2 are: South China (6), Indosinia (7), the small microcontinent of Phu Hoat (8), the West Borneo Basement (11), and Eastern Malaya (Eastmal) (12). Sumatra (10) has mixed affinities and is included for convenience wholly in this chapter.

## 5.1. SOUTH CHINA BLOCK

The South China Block is composite, subdivided into the Yangzi Platform on the west, succeeded eastwards by the Nan-ling 'Caledonian' fold belt and then by the eastern Min-Zhe volcanic province. The major structural features of the block are illustrated in Fig. 5.1, summarized from Yang *et al.* (1986), and in the diagrammatic cross-sections (Fig. 5.2), modified after Terman *et al.* (1974). Although the Precambrian is extensively covered by Infracambrian and Phanerozoic formations, it is well exposed in the Yangzi Gorges, in the uplifted margins of the platform, and in the massifs of North Vietnam.

### 5.1.1. Yangzi Platform basement

South China is dominated geologically by the large Yangzi Platform built upon a stable predominantly Proterozoic basement, bordered on the south-west by the Trungson mobile belt, and on the south-east by the Nan-ling or Xiang-Gui 'Caledonian' fold belt. The Platform is separated on the north from the North China Block by the Qin-Ling suture and fold belt, and bordered on the west by the Longmen Shan (Fig. 5.1). The geology has been summarized by Yang *et al.* (1986).

The basement of the Yangzi Platform is heterogeneous and was consolidated by the Jinningian Orogeny (1050–850 Ma). The basement is known to be as old as Archean in the Dabie Uplift and Early Proterozoic beneath the Sichuan Basin, represented by outcrops of the Kongling Group in the Yangzi Gorge. The most mobile parts of the basement occur along the south-east margin in the Jiangnan Uplift, chiefly of Upper Proterozoic rocks. The western margin of the platform is exposed as the Kham–Yunnan Uplift, formed of Lower to Middle Proterozoic rocks (Fig. 5.2).

#### *5.1.1.1. Archean of the Dabie Uplift*

The Dabie Group is of at least 15 km thickness of amphibolite facies metamorphosed basic volcanics and sedimentary rocks including banded iron formations. The oldest radiometric date is 3120 Ma and others of 2500 and 2080 indicate Proterozoic metamorphic events. The Group is unconformably overlain by the Proterozoic Hongan Group in Hubei.

#### *5.1.1.2. Proterozoic basement of South China*

In South China, Lower Proterozoic rocks are known only from the Yangzi Platform basement (Yang *et al.* 1986; Wang and Qiao 1984). The high grade Dabie Group may include both Archean and Lower Proterozoic. It is overlain unconformably by the Susong Group, which contains marble and phosphate rock, with radiometric dates of 1850–2343 Ma.

In the interior of the Platform, the Yangzi Gorges expose the Sandouping (Kongling) Group which is directly overlain by the Sinian System. The Sandouping Group is of gneiss and amphibolite followed by schist and marble, then again by gneiss and amphibolite. Total thickness is 3 km and the metamorphic age has been dated at 1688 Ma.

In the Kham–Yunnan Uplift, the Dahongshan Group lies unconformably beneath the Middle Proterozoic Kunyang Group. It is exposed at Xinping near the Red River fault zone, and characterized by metasediments and alkaline volcanic rocks. Radiometric ages range from 1704 to 1958 Ma.

The Hekou Formation of north-east Yunnan and south-east Sichuan is of similar lithology. It is overlain by the Middle Proterozoic Huili Group.

Middle to Upper Proterozoic rocks occur widely in South China. They pass up into the non-metamorphic Infracambrian Sinian System, which forms the lower part of the platform cover of the basement.

The Sandouping Group of the Dabie Uplift is unconformably overlain by the 6 km thick non-metamorphic Shennonjia Group, predominantly of

# 6

# Gondwana affinity terrains

## 6.1. INTRODUCTION

The western part of continental South-east Asia is composed of terrains which have distinct Gondwana[1] affinities in their Upper Carboniferous and Permian successions. Such terrains are characterized ideally by:

1. Carbo–Permian diamictites (tilloids);
2. Late Permian *Glossopteris* and related flora
3. Cool or cold water Late Carboniferous to Early Permian fauna, such as the Late Carboniferous *Stepanoviella* and the Early Permian *Lytvolasma, Taeniothaerus, Monodiexodina,* and *Uraloceras.* These are in strong contrast to the Lower Permian warm water *Neoschwagerina, Dasycladaceae, Codiaceae,* and *Gymnocodiaceae* (Wang and Mu 1983).

All three together are taken to infer a definite attachment to Gondwanaland during pre-Carboniferous times. The exact time of separation of the lithospheric blocks from the Carbo–Permian glaciated continent may have been as long ago as Late Carboniferous, but the latest detachment was that of India in Early Cretaceous time, 130 Ma (Veevers 1984). Mixed affinities of diamictites, *Glossopteris* and warm water fauna may indicate that the lithospheric block was removed sufficiently far from Gondwanaland by Early Permian time so that the shelf seas became warm. Mixed affinities in Middle Eastern countries is possible because of the narrow width of the Palaeo-Tethys Ocean, across which fauna and flora could easily have dispersed. But this was impossible in South-east Asia where the Palaeo-Tethys was wide.

Some terrains contain apparently mixed Gondwana and Cathaysia flora, for example in Tibet (Li *et al.* 1984), Turkey and Saudi Arabia (Şengör 1985a), and it is not yet certain how to interpret them. The western Tethys around Turkey and Saudi Arabia can be explained by the narrow Tethys with little climate contrast across the Ocean. It may also be that there has been misidentification of fragmentary fossil leaf collections. This problem needs further research.

The several lithospheric blocks are not all defined to be of Gondwana ancestry with equal certainty, but two out of the three criteria listed above should be taken as fairly certain indications of the affinity.

The rifting from Gondwanaland is assumed to have been of Atlantic-type rifted passive margins, so that the Gondwana terrains are characterized by miogeoclinal or platform Palaeozoic successions, in places known to overlie Precambrian basement, but commonly the basement is covered and unknown in outcrop. There is a remarkable stratigraphic similarity between the terrains, from Tibet in the north, to Sinoburmalaya[2] in the south.

The lithospheric blocks are separated by suture zones one from another. The terrains are described in order from the north to south of the region.

## 6.2. THE TIBET PLATEAU

The Tibet or Qinghai–Xizang Plateau forms its own terrain, referred to as the Tethys-Himalayan tectonic domain (Huang *et al.* 1984). It is wholly of Gondwana affinity and is sutured along its northern border along the Longmuco–Yushu suture onto the Cathaysian terrain of Hoh Xil–Bayan Har, which forms the southern province of the East Kunlun region. The contact zone then bends southerly towards the east where it is known as the Jinsha Jiang–Teng Tiaohe suture, which separates the Gondwana terrain on the west, here known as the Yunlijig–Wuliang Shan, from the Cathaysian Yangzi Paraplatform on the east (Fig. 6.1).

The Tibet Plateau is separated on its southern margin from the Himalayan province by the major

1. Named in 1872 by H. B. Mendlicott, director of the Geological Survey, after *Gond*, a central India aboriginal hill tribe and *Wana*, Sanskrit for forest. Thus, *Gondwanaland*, the supercontinent of which India was part more than 130 Ma.

2. Named by Gatinsky *et al.* (1984) for an elongated terrain extending from Yunnan, through Myanmar to the Malay Peninsula. It is equivalent to *Sibumasu* of Metcalfe (1984a, 1986) and *Shan-Thai* of Bunopas (1981). Metcalfe's Sibumasu specifically includes north-west Sumatra.

# 7

# Ophiolites and sutures

There are numerous linear or arcuate belts of ophiolitic and mélange rocks in South-east Asia. They have been reviewed by Hutchison (1975a), and Wiryosujono and Tjokrosapoetro (1978). The geographic distribution of the main belts is shown in Fig. 7.1, and each is described in turn. They are divided into two categories.

- Ophiolites occurring in suture zones within the Eurasian continent, which appear to have resulted from the closure of former ocean basins.
- Ophiolites which occur along continental margins with oceans and marginal seas, which have not yet formed suture zones. The northwards motion of Australia continues to push the Indonesian–Philippine archipelago towards continental China, so that these ophiolitic belts will form future suture zones in the orogenic welt between Australia and China (Hamilton 1979).

Many ophiolites exist solely as blocks forming an integral part of a mélange formation. The subduction mélange wedge is of deformed sheared and faulted sediments, and ophiolitic blocks overlying the shallow parts of a Benioff zone. Although Hamilton (1979) holds that mélange wedges result from gravitational flow trench-wards from the outer arc ridge, the mélanges of Nias and other accretionary prisms are related to palaeo highs. Moore and Karig (1980) concluded that thrust-related shearing on the lowermost trench slope is the most likely mechanism for creating mélanges, and this thrusting facilitates the upwards movement of ophiolites when the sediment cover is still thin.

Some large ophiolitic masses have very well preserved stratigraphy extending from oceanic upper mantle, through gabbro layer, basaltic layer, to pelagic sediments, and even into fore-arc sedimentary sequences. They must be regarded as intact up-faulted or obducted masses of marginal basin lithosphere. There is therefore a spectrum from large coherent masses to the smallest clasts in a tectonic or sedimentary mélange.

The processes for coherent uplift or obduction of ophiolite have been modelled by many, including Gass (1977), and Searle and Stevens (1984). Collision of a continental massif such as Australia with an island arc such as Indonesia, followed by partial underthrusting of the depressed miogeoclinal leading edge of the continent, would provide an attractive mechanism for uplifting oceanic lithosphere. The continental edge cannot continue to subduct, and the volcanic arc is quickly extinguished, as illustrated by the Alor–Wetar–Romang sector north of Timor. The plate margin may continue to be tectonically *active*, but with a changed pattern. This model has been used for the Papuan ophiolite (Davies 1981; Davies and Jaques 1984), and it may prove attractive elsewhere. It is certainly logical to conclude that an uplifted dense ophiolitic mass needs to be isostatically supported by low density continental rocks which have been underthrust beneath it.

## 7.1. OPHIOLITIC SUTURES

### 7.1.1. Donqiao ophiolite of the Bangong–Dengqen–Nujiang suture

This suture is located about 300 km north of the Indus–Yarlung–Zangbo suture (Fig. 6.1). South of the suture, between Donqiao and Gyanco, the ophiolite outcrops are closely spaced, but spread over a width of 70 km. The array represents a single flat-lying ophiolite nappe obducted at least 180 km southwards from the suture (Chang *et al.* 1986). A cross-section across the suture zone shows, from bottom to top, a succession of Jurassic flysch and ophiolitic and Palaeozoic metasedimentary rocks (Fig. 7.2). They all stand in flat tectonic contact with each other and are overlain unconformably by Albian–Aptian redbeds and volcanic rocks (Girardeau *et al.* 1984).

The fossiliferous Jurassic flysch has undergone low-grade (sericite-chlorite) metamorphism and is folded round sub-horizontal axes and has developed a slaty $S_1$ cleavage. A sub-vertical late crenulation $S_2$ cleavage is superimposed and related to late symmetrical folds.

The ophiolite everywhere tectonically overlies the Jurassic flysch. Its basal contact is marked by tectonic

# 8

# The great Sunda–Pacific volcanic arcs

One of the world's great Cainozoic volcano-plutonic arcs characterizes the convergent plate margin of the Indian Plate against Eurasia, and the marginal seas that characterize the South-west Pacific. Together, they form a nearly continuous arc from the Andaman Sea, along the margins of Sundaland, to the northern Australian margin, then north-wards through the Philippines to Okinawa.

On the Indian side, the arc has resulted from subduction of the India–Indian Ocean–Australia Plate. Before continental India began its collision with Eurasia to form the Himalayas, there was pre-Eocene subduction of oceanic lithosphere beneath Tibet to form the Gandise arc, which abruptly terminated with the arrival of the Indian Platform at the subduction zone. The Burman Volcanic Arc was active until subduction ceased along the Indo-Burman Ranges former trench location. Southwards from Myanmar, oceanic lithosphere of the Indian Ocean continues to subduct beneath Sundaland (Fig. 2.21), and the Indonesian Volcanic Arc is continuous from Sumatra, through Java to Flores. North of Timor, there is an extinct and uplifted sector of the arc from Alor to Romang, because of the arrival of continental Australia at the subduction zone, but activity continues eastwards in the Banda Arc, though the volcanic rocks show geochemical evidence of under-thrust Australia. Most of this eastern sector will progressively extinguish as Australia pushes northwards.

On the Pacific side, the great volcanic girdle continues northwards from Halmahera and Sangihe through the Philippines, where the arcs are related to subduction of the marginal sea lithosphere of the Celebes, West Philippine Basin, and South China Sea Basin. Opposing directed subductions are in the process of active reorganization, and the volcanic arcs will change in time and place. The Taiwan sector is extinct because of the underthrust continental shelf of China, but eastwards the West Philippine Basin lithosphere subducts at the Ryukyu Trench to give the active Okinawa volcanic arc.

## 8.1. GANDISE ARC OF THE INDUS–ZANGBO–YARLUNG SYSTEM

The volcano-plutonic arc occupies southern Tibet along the Gandise–Nyainqentangtha Mountain Range (Fig. 9.1). Its eastern end turns south-east at Chayu, and in the west it extends to Ladakh in Kashmir, being 1000 km east–west and about *100 km north–*south (Geological Bureau of Xizang 1982).

The arc plutonic part comprises the huge Gandise intermediate to acid intrusive complex (Chapter 9), and the volcanic part comprises intermediate-acid volcanic rocks of the Upper Jurassic–Lower Cretaceous Sangri Group and the widespread Cretaceous–Tertiary Linzizong Formation volcanic series. The plutonic and volcanic rocks are closely associated, comprising a range from augite diorite, granodiorite and granitoids, and andesite, dacite, rhyolite, and trachyte.

The *Sangri Group* volcanic rocks are associated with a sequence of Late Jurassic to Early Cretaceous neritic carbonates and clastic sediments. It is chiefly composed of andesite, dacite, keratophyre, and a huge amount of andesitic and dacitic crystal tuff, volcanic breccia, and other pyroclastic varieties. The chemistry suggests an island-arc calc-alkaline series.

The Linzizong Formation unconformably overlies a sequence of folded Late Cretaceous red clastic rocks. Below the volcanic rocks is 50–60 m thickness of conglomerate on the Qinghai–Tibet Highway, 40 km north of Lhasa (Geological Bureau of Xizang 1982). The *Linzizong* Formation is largely of lava and tuff, intercalated with continental clastic strata. The *Linzizong Volcanic Series is* over 2500 m thick, composed mainly of andesite-dacite-rhyolite lavas and pyroclastic rocks, lying unconformably on shale of the Late Cretaceous Takena Formation (Wang 1984).

There are three major cycles, each one dominated by andesite and andesitic pyroclastic rocks in the lower part, and by dacite and rhyolitic pyroclastic rocks, and tuffaceous sandstone and conglomerate in the upper part. Cycle I is up to 966 m thick. The lower part is of a spectrum from tholeiitic, through calc-

# 9

# Granite and associated plutonic rocks

South-east Asia has an unusually strong concentration of granite batholiths, bearing witness to the various orogenic phases which have moulded the geology of the region. The granitoids are regarded as rift-, subduction-, or collision-related (Mitchell 1977, 1979). All types are important in the region, and the granites have been responsible for much of the mineral wealth of the region (Hosking 1977). In particular the tin and tungsten deposits, for which the region is renowned, are genetically related to Mesozoic S-type granites, both of the Late Triassic–Early Jurassic Indosinian Orogeny, and of the Late Yenshanian (Cretaceous) earth movements.

A general review of the granites of South-east Asia is to be found in Cobbing et al. (1992), Schwartz et al. (1995) and Hutchison (1983b), and this is expanded in this chapter to include the Himalayas and South China. The subduction-related granitoid terrains are characterized by an extended calc-alkaline series including gabbro, diorite, granodiorite, and granite of I-type; whereas the collision-related batholiths are restricted to S-type granite (Hutchison 1982c). The Late Yenshanian granites of South China and the South China Sea region are rift-related, but are distinctly not of the A-type of White and Chappell (1983); they are indistinguishable from S-type and constitute a hitherto unrecognized category of sub-alkaline crustally-derived rift-related granite of great importance to mineralization (Hutchison 1987c). The distribution of magnetite and ilmenite series granitoids is discussed by Takahashi *et al.* (1980).

## 9.1. TIBET

The granitoids of southern Tibet and Nepal form distinct belts parallel to the Indus–Yarlung–Zangbo suture (Fig. 9.1): the Gandise batholith belt north of the suture, and the Lhagoi–Kangri and Himalayan belts south of the suture (Liu 1984; Debon *et al.* 1986).

### 9.1.1. Gandise or Transhimalayan batholith system

This is the major magmatic arc of the region. It extends from Swat (Pakistan) through Ladakh and Kailas along the Gandise Range of the Lhasa Block (Valdiya 1984). It has a range of ages. The oldest group, from 82 to 113 Ma, has a mean value of about 93 Ma (Late Cretaceous). It characterizes both the north and south Zangbo units (Debon *et al.* 1986). An early basic pluton of the southern edge of the Gandise belt gave $^{39}Ar/^{40}Ar$ ages of 90–110 Ma (Albian to Cenomanian), whereas lavas from the upper unconformable series are clearly younger, 60 Ma, or Palaeocene (Maluski *et al.* 1984). The youngest group varies from 40 to 60 Ma and averages about 50 Ma (Eocene). It includes all the plutonic units in a 90 km section from Yangbajain to south of Quxu. The dating is a summary of a variety of methods and is very likely to correspond with the emplacement ages. A very young Rb-Sr date of 17 Ma is thought to be anomalous (Debon *et al.* 1984).

The initial $^{87}Sr/^{86}Sr$ ratios are characteristically low, within the range 0.7033–0.7036 (Valdaya 1984), but Jin and Xu (1984) gave a higher range of 0.7047–0.7057 for Tibet, now extended to 0.7036–0.7071, with an average of 0.705 (Debon *et al.* 1986). On the whole, the northern plutons have higher initial ratios than the main Gandise batholith.

The Gandise batholith system is composite and exhibits a spectrum, including in decreasing order of importance, adamellite, quartz monzodiorite, granodiorite, and to a lesser extent gabbro, quartz diorite, granite, quartz monzo-diorite, and monzonite. Magmatic differentiation, characterized by two superimposed stages of evolution, and hybridization processes involving both basic and acid magmas, can account for the genesis of the different plutonic units (Debon *et al.* 1986). The rocks are principally composed of microcline, plagioclase, biotite with Mg/(Mg + Fe) from 0.45 to 0.61, hornblende, magnetite, sphene, and rare ilmenite. Orthopyroxene and clinopyroxene are restricted to gabbro. The whole batholith has I-type characteristics (Liu 1984; Jin and Xu 1984; Debon *et al.* 1986). From west to east and from south to north, the system becomes younger and more acidic. Granodiorite is predominant west and granite predominant east of Qushul, while diorite commonly

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# References


Abbott, M. J. and Chamalaun, F. H. (1981). Geochronology of some Banda arc volcanics. The geology and tectonics of eastern Indonesia, Geological Research and Development Centre, Bandung, Publication 2 (ed. A. J. Barber and S. Wiryosujono), pp. 253–268.

Abdul Manaf, M. & R. H. F. Wong (1995). Seismic sequence stratigraphy of the Tertiary sediments, offshore Sarawak deepwater area, Malaysia. *Geological Society of Malaysia Bulletin*, 37, 345–361.

Abdullah Sani b. H. Hashim (1985). Discovery of an ammonoid (Agathiceras sp.) and crinoid stems in the Kenny Hill Formation of Peninsular Malaysia and its significance. Geological Society of Malaysia Newsletter **11**, 205–212.

Achache, J. and Courtillot, V. (1985). A preliminary Upper Triassic paleomagnetic pole for the Khorat Plateau (Thailand): consequences for the accretion of Indochina against Eurasia. Earth and Planetary Science Letters 73, 147–57.

Achache, J., Courtillot, V., and Besse, J. (1983). Paleomagnetic constraints on the Late Cretaceous and Cenozoic tectonics of Southeast Asia. Earth and Planetary Science Letters 63, 123–136.

Achache, J., Courtillot, V., Zhou, Y. X., Lu, L. Z., and Yuan, X. G. (1982). The paleolatitude and geographic extent of southern Tibet in Middle Cretaceous—new palaeomagnetic data. Palaeomagnetic research in Southeast and East Asia, C.C.O.P./TP **13**, Bangkok, 47–57.

Acharyya, S. K. (1978a). Stratigraphy and tectonic features of the eastern Himalaya. Tectonic geology of the Himalaya (ed. P. S. Saklani), pp. 243–267. Today and Tomorrow's Printers and Publishers, New Delhi.

Acharyya, S. K. (1978b). Mobile belts of the Burma–Malaya and the Himalaya and their implications on Gondwana and Cathaysia/Laurasia continent configurations. Geology and mineral resources of Southeast Asia (ed. Prinya Nutalaya), pp. 121–127. Asian Instit. Technology, Bangkok.

Acharyya, S. K. (1981). Late Palaeozoic Rangit pebble-slate, eastern Lesser Himalaya Lachi Formation, Sikkim Higher Himalaya India, with short notes on homotaxial formations in Nepal. *Earth's pre-Pleistocene glacial record* (ed. M. J. Hambrey and W. B. Harland), pp. 316–325. Cambridge University Press.

Achmad, Z. and Samuel, L. (1984). Stratigraphy and depositional cycles in the N.E. Kalimantan Basin. Proceedings of the Indonesian Petroleum Association 13th Annual Convention, Jakarta, 109–120.

Adams, C. G. (1965). The foraminifera and stratigraphy of the Melinau Limestone, Sarawak, and its importance in Tertiary correlation. Quarterly Journal of the Geological Society London **121**, 283–338.

Adinegoro, U. and Hartoyo, P. (1974). Paleogeography of northeast Sumatra. Proceedings of the Indonesian Petroleum Association **Third** Annual Convention, Jakarta, June 1974, 45–62.

Ahmad bin Jantan (1973). Stratigraphy of the Singa Formation (Upper Palaeozoic) in the southwestern part of the Langkawi island group, West Malaysia. *Unpubl. MSc thesis*, University of Malaya, Kuala Lumpur.

Ahmad, N. (1981). Late Palaeozoic Talchir tillites of Peninsular India. Earth's pre-Pleistocene glacial record (ed. M. J. Hambrey and W. B. Harland), pp. 326–330. Cambridge University Press.

Aldiss, D. T. and Ghazali, S. A. (1984). The regional geology and evolution of the Toba volcano-depression, Indonesia. Journal of the Geological Society London **141**, 487–500.

Alexander, J. B. (1968). The geology and mineral resources of the neighbourhood of Bentong, Pahang, and adjoining portions of Selangor and Negri Sembilan. *Memoirs of the Geological Survey Department West Malaysia* 8, Ipoh.

Allègre, C. J., et al. (1984). Structure and evolution of the Himalaya–Tibet orogenic belt. Nature **307**, 17–22.

Allen, C. R. (1962). Circum-pacific faulting in the Philippines–Taiwan region. Journal of Geophysical Research **67**, 4795–4812.

Allen, C. R., Gillespie, A. R., Han Yuan, Sieh, K. E., Zhang Buchun, and Zhu Chengnan (1984). Red

River and associated faults Yunnan Province, China: Quaternary geology, slip rates and seismic hazard. Geological Society of America Bulletin **95**, 686–700.

Allen, P. M. and Stephens, E. A. (1971). *Report on the geological survey of Hong Kong 1967–1969*. Government Press, Hong Kong.

Altermann, W. (1986). The Upper Palaeozoic pebbly mudstone facies of peninsular Thailand and western Malaysia—continental margin deposits of Palaeoeurasia. *Geologische Rundschau* **75**, 371–81.

Amiruddin and Trail, D. S. (1989). *Nangapinoh 1:250,000 Quadrangle, West Kalimantan, Geological Data Record*. Geological Research and Development Centre, Bandung.

Amos, B. J. (1975). Stratigraphy of some of the Upper Paleozoic and Mesozoic carbonates of the Eastern Highlands of Burma. *Newsletter of Stratigraphy* **4**, 49–70.

Anderson, R. N. (1980). Update of heat flow in the East and Southeast Asian seas. The tectonic and geologic evolution of Southeast Asian seas and islands, *Geophysical monograph* **23** (ed. D. E. Hayes), pp. 319–326. Geophysical Union, Washington.

Anonymous (1984). Sirikit: how one man's hunch proved true. *Oil and Gas News* **1**, (no. 2), (April 4th), Singapore, 6–7.

Aquino, B. T. and Santos, L. G. (1971). *Bibliography on Philippine geology, mining and mineral resources*. Bureau of Mines, Manila.

Archibold, N. W., Pigram, C. J., Ratnam, N., and Hakim, S. (1982). Indonesian Permian brachiopod fauna and Gondwana–Southeast Asia relationships. *Nature* **296**, 556–558.

Armitage, J. H. and Viotti, C. (1977). Stratigraphic nomenclature—southern end Malay Basin. *Proceedings of the Indonesian Petroleum Association* 6th Annual Convention, Jakarta, May 1977, 69–94.

Arpandi, D. and Patmosukismo, S. (1976). The Cibulakan Formation as one of the most prospective stratigraphic units in the northwest Java basinal area. *Proceedings of the Indonesian Petroleum Association* **1**, 181–211.

Asama, K. (1973). Lower Carboniferous Kuantan flora, Pahang, W. Malaysia. *Geology and palaeotology of Southeast Asia* **11** (ed. T. Kobayashi et al.), pp. 109–17. University of Tokyo Press.

Asama, K. (1976). *Gigantopteris* flora in Southeast Asia and its phytopalaeogeographic significance. *Geology and Palaeontology of Southeast Asia* **17** (ed. T. Kobayashi et al.), pp. 191–207. University of Tokyo Press.

Asama, K. (1984). *Gigantopteris* flora in China and Southeast Asia. *Geology and Palaeontology of Southeast Asia* **25** (ed. T. Kobayashi et al.), pp. 311–25. University of Tokyo Press.

ASCOPE (1981). *Tertiary sedimentary basins of the Gulf of Thailand and South China Sea: Stratigraphy, structure and hydrocarbon occurrences*. ASEAN Council on Petroleum, Jakarta.

Audley-Charles, M. G. (1968). The geology of Portuguese Timor. *Memoirs of the Geological Society London* **4**.

Audley-Charles, M. G. (1975). The Sumba fracture: a major discontinuity between eastern and western Indonesia. *Tectonophysics* **26**, 213–28.

Audley-Charles, M. G. (1977). Mesozoic evolution of the margins of Tethys in Indonesia and the Philippines. *Proceedings of the Indonesian Petroleum Association* 5th Annual Convention, Jakarta 1976, **2**, 25–52.

Audley-Charles, M. G. (1982). Geological history of the region of Wallace's Line. *Wallace's Line and plate tectonics* (ed. T. C. Whitmore), pp. 24–35. Oxford University Press.

Audley-Charles, M. G. (1983). Reconstruction of eastern Gondwanaland. *Nature* **306**, 48–50.

Audley-Charles, M. G., Carter, D. J., Barber, A. J., Norvick, M. S., and Tjokrosapoetro, S. (1979). Reinterpretation of the geology of Seram; implications for the Banda arcs and northern Australia. *Journal of the Geological Society London* **136**, 547–68.

Audley-Charles, M. G., Curray, J. R., and Evans, G. (1977). Location of major deltas. *Geology* **5**, 341–344.

Aung Khin and Kyaw Win (1969). Geology and hydrocarbon prospects of the Burma Tertiary geosyncline. *Union Burma Journal of Science and Technology* **2**, 53–82.

Au-Yong, Mung Heng (1974). The geology of the Bukit Bintang area, Trengganu, with some aspects of geotechnics. *Unpublished BSc thesis, University of Malaya*, Kuala Lumpur.

Azhar, Haji Hussin (1977). Geology of the Bukit Jaya area, Pahang. *Unpublished BSc thesis, University of Malaya*, Kuala Lumpur.

Bachman, S. B., Lewis, S. D., and Schweller, W. J. (1983). Evolution of a forearc basin, Luzon Central Valley, Philippines. *American Association of Petroleum Geologists Bulletin* **67**, 1143–1162.

Bai, Y.; Chen, G.; Sun, Q.; Sun, Y.; Li, Y.; Dong, Y. & Sun, D. (1987). Late Paleozoic polar wander path for the Tarim Platform and its tectonic significance. *Tectonophysics*, **139**, 145–153.

Bally, A. W. (1975). A geodynamic scenario for hydrocarbon occurrences. *Ninth World Petroleum Congress Proceedings* 1, pp. 33–44. Applied Science Publishers, London.

Bally, A. W., Bjernoulli, D., Davis, G. A. and Montadert, L. (1981). Listric normal faults. Oceanologica Acta, Colloque C3, Geology of continental margins. 26th *International Geological Congress*, Paris, 87–101.

Bally, A. W. and Snelson, S. (1980). Realms of subsidence. Facts and principles of world petroleum occurrence. *Canadian Society of Petroleum Geologists Memoirs* 6 (ed. A. D. Miall), pp. 9–94.

Bambang Setiawan and LeBel, L. M. (1987). Discovery of a new tin province, Long Laai area, east Kalimantan, Indonesia. *Tin and tungsten granites, proceedings of IGCP Project 220 meeting, Sept. 1986*, Technical Bulletin 6 (ed. C. S. Hutchison) pp. 61–82, SEATRAD Centre, Ipoh, Malaysia.

Barber, A. J. (1981). Structural interpretations of the island of Timor, eastern Indonesia. *The geology and tectonics of eastern Indonesia*, Geological Research and Development Centre, Special Publication 2 (ed. A. J. Barber and S. Wiryosujono), pp. 183–97. Bandung.

Barber, A. J. and Crow, M. J. (2005). Pre-Tertiary stratigraphy. Barber, A. J.; Crow, M. J. and Milsom, J. S. (eds.) (2005). Sumatra: geology, resources and tectonic evolution. *Geological Society of London Memoir* 31, 24–53.

Barber, A. J.; Crow, M. J. and Milsom, J. S. (eds.) (2005). Sumatra: geology, resources and tectonic evolution. *Geological Society of London Memoir* 31.

Barber, A. J. and Wiryosujono, S. (eds.) (1981). *The geology and tectonics of eastern Indonesia.* Geological Research and Development Centre, Special Publication 2. Bandung.

Barr, S. M. and MacDonald, A. S. (1978). Geochemistry and petrogenesis of Late Cenozoic alkaline basalts of Thailand. *Geological Society of Malaysia Bulletin* 10, 25–52.

Barr, S. M. and MacDonald, A. S. (1979). Palaeomagnetism, age and geochemistry of the Denchai basalt, northern Thailand. Earth and Planetary Science Letters 46, 113–24.

Barr, S. M., MacDonald, A. S., and Haile, N. S. (1978). Reconnaissance palaeomagnetic measurements on Triassic and Jurassic rocks from Thailand. *Geological Society of Malaysia Bulletin* 10, 53–62.

Barr, S. M., MacDonald, A. S., Yaowanoiyothin, W., and Panjasawatwong, Y. (1985). Occurrence of blue-schist in the Nan River mafic-ultramafic belt, northern Thailand. *Geological Society of Malaysia Newsletter* 11, 47–50.

Bashyal, R. P. (1984). Geological outline of Nepal Himalaya. Tectonics of Asia. Colloquium 5. 27th International Geology Congress Report 5, pp. 159–180. Nauka, Moscow.

Basir, J. (2000). Significance of Mesozoic Radiolarian chert in Sabah and Sarawak. Proceedings Annual Geological Conference 2000. Teh, G. H., Pereira, J. J. and Ng, T. F. (eds.). Geological Society of Malaysia, 123–130.

Basir, J.; Tahir, S.; and Samsuddin, A. R. (1985). Lower Cretaceous radiolaria from the Chert-Spilite Formation, Kudat, Sabah. *Geological Society of Malaysia Newsletter*, 11, 161–162.

Bassoullet, J. P., Colchen, M., Mascle, G., and Wang Naiwen (1984). Les ensembles sédimentaires de la zone du Tsangpo (Lhazê, Lhasa, Linzhu). (ed. J. L. Mercier and Li Guangcen) Mission Franco-Chinoise au Tibet 1980, Editions du Centre Nationale de la recherche scientifique, Paris, 133–53.

Basu, T. N. and Shrivastava, B. B. P. (1981). *Structure and tectonics of Gondwana basins of peninsular India. Gondwana Five* (ed. M. M. Cresswell and P. Vella), pp. 177–82. A. A. Balkema, Rotterdam.

Batchelor, B. C. (1979). Geological characteristics of certain coastal and offshore placers as essential guides for tin exploration in Sundaland, Southeast Asia. Geological Society Malaysia Bulletin 11, 283–313.

Baum, F., et al. (1970). *On the geology of northern Thailand.* Beiheft Geologisches Jahrbuch. 102.

Becker, G. F. (1901). Report on the geology of the Philippine islands. *U.S. Geological Survey 21st Annual Report* 3, 493–644.

Beckinsale, R. D., Suensilpong, S., Nakapungrat, S., and Walsh, J. N. (1979). Geochronology and geochemistry of granite magmatism in Thailand in relation to a plate tectonic model. *Journal of the Geological Society London* 136, 529–40.

Beddoes, L. R. (1976). The Balabac sub-basin, southwestern Sulu Sea, Philippines. *Offshore Southeast Asia Conference*, paper 15, Southeast Asian Petroleum Exploration Society.

Bell, R. M. and Jessop, R. G. C. (1974). Exploration and geology of the west Sulu Basin, Philippines. Australian Petroleum Exploration Association Journal 14, 21–28.

Belov, A. A., Gatinsky, Y. G., and Mossakovsky, A. A. (1986). A precis on pre-Alpine tectonic history of Tethyan paleo-oceans. Tectonophysics 127, 197–211.

Ben-Avraham, Zvi and Uyeda, Seiya (1973). The evolution of the China Basin and the Mesozoic paleogeography of Borneo. *Earth and Planetary Science Letters* 18, 365–76.

Bender, F. (1983). *Geology of Burma*. Gebrüder Borntraeger, Berlin.

Bergman, S. C.; Coffield, D. Q.; Talbot, J. P.; Garrard, R. A. (1996). Tertiary tectonic and magmatic evolution of western Sulawesi and the Makassar Strait, Indonesia: evidence for a Miocene continent–continent collision. Hall, R. and Blundell, D. (eds.) Tectonic evolution of Southeast Asia. *Geological Society of London, special publication*, 106, 391–429.

Bergman, S. C.; Turner, W. S.; and Krol, L. G. (1987). A reassessment of the diamondiferous Pemali Breccia, southeast Kalimantan, Indonesia: intrusive kimberlite breccia or sedimentary conglomerate? *Geological Society of America special paper* 215, 183–195.

Berrangé, J. P. and Jobbins, E. A. (1976). The geology, gemmology, mining and economic potential of the Pailin ruby and sapphire gem field, Khymer Republic. *Overseas Division Report* 35, Institute of Geological Sciences, London.

Berry, R. F. and Grady, A. E. (1981). The age of the major orogenesis in Timor. *The geology and tectonics of eastern Indonesia*, Geological Research and Development Centre Special Publication 2 (ed. A. J. Barber and S. Wiryosujono), pp. 171–81. Bandung, Indonesia.

Bhandari, L. L., Fuloria, R. C., and Sastri, V. V. (1973). Stratigraphy of Assam Valley, India. Bulletin of the American Association of Petroleum Geologists 57, 642–54.

Bhanot, V. B., Singh, V. P., Kansal, A. K., and Thakur, V. C. (1977). Early Proterozoic whole rock age for the central crystalline gneiss of the Higher Himalaya, Kumaun. *Geological Society of India Journal* 18, 90–91.

Bignell, J. D. (1972). *The geochronology of Malayan granites*. Unpublished D.Phil. thesis, Oxford University.

Bignell, J. D. and Snelling, N. J. (1977a). Geochronology of Malayan granites. Overseas geology and mineral resources 47, Institute of Geological Sciences, London.

Bignell, J. D. and Snelling, N. J. (1977b). K:Ar ages on some basic igneous rocks from Peninsular Malaysia and Thailand. *Geological Society of Malaysia Bulletin* 8, 89–93.

Blong, R. J. and Johnson, R. W. (1986). Geological hazards in the southwest Pacific and Southeast Asian region: identification, assessment, and impact. *B.M.R. Journal of Australian geology and geophysics*, Canberra 10 (No. 1), 1–I5.

Bol, A. J. and van Hoorn, B. (1980). Structural styles in western Sabah offshore. *Geological Society of Malaysia Bulletin* 12, 1–16.

Bollinger, W. and de Ruiter, P. A. C. (1976). Geology of the south central Java offshore area. *Proceedings of the 4th annual meeting of the Indonesian Petroleum Association*, Jakarta 5, 67–81.

Borax, E. and Stewart, R. D. (1966). Note on the Paleozoic stratigraphy of northeastern Thailand. *Report for ECAFE meeting in Bangkok*, 1966 mimeograph.

Bostrom, R. C. (1978). Motion of the Pacific Plate and formation of marginal basins: asymmetric flow induction. *Journal of Physics of the Earth* 26 Supplement, S103–S122.

Bowin, C., et al. (1980). Arc-continent collision in the Banda Sea region. *American Association of Petroleum Geologists Bulletin* 64, 868–915.

Bradford, E. F. (1972). The geology and mineral resources of the Gunung Jerai area, Kedah. *Geological Survey of Malaysia Memoir* 13.

Breen, N. A., Silver, E. A., and Hussong, D. M. (1986). Structural styles of an accretionary wedge south of the island of Sumba, Indonesia, revealed by SeaMARC II side scan sonar. *Geological Society of America Bulletin* 97, 1250–1261.

B.R.G.M. (1982). Geological mapping and mineral exploration in northeast Kalimantan 1979–1982. Final report. *Rapport du Bureau de Recherches géologique et minières* 82 RDM 007AO, Orléans, France.

Briais, A., Patriat, P. and Tapponnier, P. (1993). Updated interpretation of magnetic anomalies and seafloor spreading stages in the South China Sea: implications for the Tertiary tectonics of Southeast Asia. *Journal of Geophysical* Research, 98, 6299–6328.

Briais, A., Tapponnier, P. & Pautot, G. (1989). Constraints of Seabeam data on crustal fabrics and seafloor spreading in the South China Sea. *Earth and Planetary Science Letters*, 95, 307–320.

Brondijk, J. F. (1964). The Danau Formation in northwest Borneo. *British Borneo geological survey annual report for 1963*, 167–177.

Brook, M. and Snelling, N. J. (1981). K:Ar and Rb:Sr age determinations on rocks and minerals from Burma. *Isotope Geology Unit, Geochemistry and Petrology Division, Institute of Geological Sciences, London Report* 76/12.

Brouwer, H. A. (1925 ). *The geology of the Netherlands East Indies*. MacMillan & Co., New York.

Brown, G. F., et al. (1951). Geologic reconnaissance of the mineral deposits of Thailand. *U.S. Geological Survey Bulletin* **984**.

Brunnschweiler, R. O. (1966). On the geology of the Indoburman ranges. *Journal of the Geological Society of Australia* **13**, 137–94.

Brunnschweiler, R. O. (1970). Contributions to the post-Silurian geology of Burma (northern Shan States and Karen State). *Journal of the Geological Society of Australia* **17**, 59–79.

Brunnschweiler, R. O. (1974). Indoburman ranges. Mesozoic-Cenozoic orogenic belts, *Geological Society of London Special Publication* **4** (ed. A. M. Spencer), pp. 279–99.

Buffetaut, E. (1981). Éleménts pour une histoire paléo-biogéographique du sud-est asiatique: l'apport des vertébrés fossiles continentaux. *Bulletin de la Société géologique de France* 23, 587–93.

Buffetaut, E. (1982). Mesozoic vertebrates from Thailand and their paleobiological significance. *Terra Cognita* **2**, 27–34.

Buffetaut, E. and Ingavat, R. (1980). A new crocodilian from the Jurassic of Thailand, *Sunosuchus thailandicus* n. sp. (*Mesosuchia Goniopholididae*) and the paleogeographical history of South-east Asia in the Mesozoic. *Geobios* **13**, 879–889.

Buffetaut, E. and Ingavat, R. (1982). Phytosaur remains (*Reptilia Theocodontia*) from the Upper Triassic of north-eastern Thailand. *Geobios* **15**, 7–17.

Bullard, F. M. (1976). *Volcanoes of the Earth*, revised edn. University of Texas Press, Austin.

Bunopas, S. (1981). Paleogeographic history of western Thailand and adjacent parts of Southeast Asia: a plate tectonics interpretation. *Geological Survey Paper Special Issue*, **5**. Department of Mineral Resources of Thailand, Bangkok.

Bunopas, S. (1983). Paleozoic succession in Thailand. *Proceedings of a workshop on stratigraphic correlation of Thailand and Malaysia* 1, pp. 39–76. Geological Society of Thailand/Geological Society of Malaysia.

Bunopas, S.; Maranate, S. & Vella, P. (1989). Palaeozoic and Early Mesozoic rotation and drifting of Shan-Thai from Gondwana Australia. *4th International Symposium on pre-Jurassic evolution of East Asia, IGCP Project 224, Reports and abstracts*, 1, 63–64.

Bunopas, S. and Vella, P. (1978). Late Paleozoic and Mesozoic structural evolution of northern Thailand: a plate, tectonc model. *Proceedings of the Third Regional Conference on Geology and Mineral Resources of S.E. Asia* (ed. Prinya Nutalaya), pp. 133–40. Asian Institute of Technology, Bangkok.

Bunopas, S. and Vella, P. (1983). Tectonic and geologic evolution of Thailand. Proceedings of a workshop on stratigraphic correlation of Thailand and Malaysia 1, pp. 307–22. Geological Society of Thailand, Bangkok/Geological Society of Malaysia, Kuala Lumpur.

Bunopas, S., Vella, P., Pitakpaivan, K., and Sukroo, J. (1978). Preliminary paleomagnetic results from Thailand sedimentary rocks. *Geology and mineral resources of Southeast Asia* (ed. Prinya Nutalaya), pp. 25–32. Asian Institute of Technology, Bangkok.

Bureau of Mines (1976). A review of oil exploration and stratigraphy of sedimentary basins of the Philippines. *United Nations ESCAP C.C.O.P. Technical Bulletin*, Bangkok, **10**, 55–99.

Bureau of Mines (1981). *Geology and mineral resources of the Philippines* 1 (Geology). Bureau of Mines and Geo-sciences, Manila, Philippines.

Bureau of Mines (1986). *Geology and mineral resources of the Philippines* 2 (Mineral resources). Bureau of Mines and Geo-sciences, Metro Manila.

Burg, J. P., Brunel, M., Gapais, D., Chen, G. M., and Liu, G. H. (1984). Deformation of leucogranites of the crystalline Main Central Sheet in southern Tibet (China). *Journal of Structural Geology* **6**, 535–542.

Burollet, P. F. and Salle, C. (1981). Seismic reflection profiles in the Makassar Strait. *The geology and tectonics of eastern Indonesia*, Geological Research and Development Centre, Special Publication 2 (ed. A. J. Barber and S. Wiryosujono), pp. 273–6. Bandung.

Burrett, C. and Stait, B. (1984). Southeast Asia as part of Gondwanaland—rifting, drifting and collision (Abstract). *27th International Geological Congress Abstracts* 9 (part 1), 259.

Burrett, C. and Stait, B. (1985). South East Asia is a part of an Ordovician Gondwanaland—a paleobiogeographic test of a tectonic hypothesis. *Earth and Planetary Science Letters* **75**, 184–190.

Burrett, C. and Stait, B. (1986). Southeast Asia as a part of an early Palaeozoic Australian Gondwanaland. *Geological Society of Malaysia Bulletin* **19**, 103–107.

Burri, P. (1989). Hydrocarbon potential of Tertiary intermontane basins in Thailand. *Intermontance basins: geology and resources*. Proceedings of the International symposium (ed. T, Thanasuthipitak and P. Ounchanum), Chiang Mai University, Thailand, 3–12.

Burton, C. K. (1965). Wrench faulting in Malaya. Journal of Geology 73, 781–798.

Burton, C. K. (1972). The geology and mineral resources of the Baling area, Kedah and Perak. *Geological Survey of Malaysia District Memoirs* 12, Ipoh.

Burton, C. K. (1973a). Mesozoic. *Geology of the Malay Peninsula* (ed. D. J. Gobbett and C. S. Hutchison), pp. 97–141. Wiley-Interscience, New York.

Burton, C. K. (1973b). Geology and mineral resources, Johore Bahru–Kulai area, south Johore. *Geological Survey of Malaysia Map Bulletin*, 2.

Burton, C. K. (1974a). Peninsular Thailand. Mesozoic-Cenozoic orogenic belts. *Geological Society of London Special Publication*, 4 (ed. A. M. Spencer), pp. 301–325.

Burton, C. K. (1974b). The Satun Group (Nai Tak Formation and Thung Song Limestone) of Peninsular Thailand. *Sains Malaysiana* 3, 15–34.

Burton, C. K. and Bignell, J. D. (1969). Cretaceous–Tertiary events in Southeast Asia. *Geological Society of America Bulletin* 80, 681–688.

Cameron, N. R., Clarke, M. C. G., Aldiss, D. T., Aspden, J. A., and Djunuddin, A. (1980). The geological evolution of northern Sumatra. *Proceedings of the Indonesian Petroleum Association* 9th Annual convention, Jakarta, 149–187.

Cardwell, R. K. and Isacks, B. L. (1978). Geometry of subducted lithosphere beneath the Banda Sea in eastern Indonesia from seismicity and fault plane solutions. *Journal of geophysical research* 83, 2825–2838.

Cardwell, R. K. and Isacks, B. L. (1981). A review of the configuration of the lithosphere subducted beneath the eastern Indonesian and Philippine islands. *The geology and tectonics of eastern Indonesia*, Geological Research and Development Centre Special Publication 2 (ed. A. J. Barber and S. Wiryosujono), pp. 31–47. Bandung.

Cardwell, R. K., Isacks, B. L., and Karig, D. E. (1980). The spatial distribution of earthquakes, focal mechanism solutions and subducted lithosphere in the Philippine and northeastern Indonesian islands. *The tectonic and geologic evolution of Southeast Asian seas and islands*. Geophysical monograph 23 (ed. D. E. Hayes), pp. 1–35. American Geophysical Union, Washington.

Casshyap, S. M. (1979). Patterns of sedimentation in Gondwana basins. *Fourth International Gondwana symposium* 2 papers, 525–39.

C.C.O.P. (1991). Total sedimentary isopach maps offshore east Asia, 6 sheets, 1:4 000 000. Technical bulletin 23, Committee for co-ordination of Joint Prospecting for mineral resources in Asian offshore areas, Bangkok.

CCOP-IOC (1974). *Metallogenesis, hydrocarbons and tectonic patterns in eastern Asia: a programme of research*. United Nations Development Programme (C.C.O.P.), Bangkok.

CCOP-IOC (1980). Studies in east Asian tectonics and resources. A programme and review of research compiled for the 2nd SEATAR workshop, Bandung, Indonesia, 17–21 October 1978, *United Nations ESCAP, C.C.O.P. technical publ.* 7, United Nations office, Bangkok 2, Thailand.

Chakraborty, K. R. (1980). On the evolution of the nepheline to hypersthene normative alkali basaltic rocks of Kuantan, Pahang, Peninsular Malaysia. *Geological Society of Malaysia Bulletin* 12, 79–86.

Chakraborty, K. R. and Amerizal, G. D. (1984). P-T-$H_2O$ conditions of Sungei Ara granite, Penang island, Peninsular Malaysia. *Geological Society of Malaysia Bulletin* 17, 1–7.

Chakraborty, K. R. and Kamineni, D. C. (1978). Chemical characteristics and classification of Segamat volcanics. *Geological Society of Malaysia Newsletter* 4, No. 3, 85–91.

Chakraborty, K. R. and Metcalfe, I. (1983). Intrabed andalusite abundance variation as an indicator of graded beds: an example from Kuala Kemasik, Trengganu. *Geological Society of Malaysia Bulletin* 16, 159–166.

Chakraborty, K. R. and Metcalfe, I. (1984). Analysis of mesoscopic structures at Mersing and Tanjung Kempit, Johore, Peninsular Malaysia. *Geological Society of Malaysia Bulletin* 17, 357–71.

Chakraborty, K. R., Sita Ram, G., and Sharifah Barlian Aidid (1980). Rare earth element abundance patterns in alkaline basaltic lavas of Kuantan, Peninsular Malaysia. *Geological Society of Malaysia Bulletin* 13,103–111.

Chaloner, W. G. and Creber, G. T. (1988). Fossil plants as indicators of Late Palaeozoic plate positions. In Gondwana and Tethys (eds. M. G. Audley-Charles and A. Hallam). Geological Society of London special publication 37, 201–210.

Chamalaun, F. H., Grady, A. E., von der Borch, C. C., and Hartono, H. M. S. (1981). The tectonic significance of Sumba. *Geological Research and Development Centre Bulletin* 5, 1–20.

Chan, L. S.; Wang, C. Y. & Wu, X. Y. (1984). Paleomagnetic results from some Permian–Triassic rocks from southwestern China. *Geophysical Research Letters*, 11, 1157–1160.

Chand, F. (1978). The geology and mineral resources of the Ulu Paka area, Trengganu. *Geological Survey of Malaysia Memoir* 16.

Chang Chengfa and Pan Yusheng (1984). A preliminary synthesis of the tectonic evolution of the Qinghai–Xizang (Tibet) Plateau. Tectonics of Asia Colloquium 5, *27th International Geology Congress Report* 5, 190–206.

Chang Chengfa, et al. (1986). Preliminary conclusions of the Royal Society and Academia Sinica 1985 geotraverse of Tibet. *Nature* 323, 501–507.

Ch'ang Ta (1963). *The geology of China.* Joint Publications Research Service JPRS 19. [English translation of Chung-Kuo Ti-chih Hsueh, Peking 1959.]

Chaodumrong, P., Ukakimapan, Y., Snasieng, S., Janmaha, S., Pradidtan, S., and Nawee Sae Leow (1983). A review of the Tertiary sedimentary rocks of Thailand. *Proceedings of a workshop of stratigraphic correlation of Thailand and Malaysia*, pp. 159–187. Geological Society of Thailand, Bangkok/Geological Society of Malaysia, Kuala Lumpur.

Chappell, B. W. and White, A. J. R. (1974). Two contrasting granite types. *Pacific Geology* 8, 173–174.

Chen, J. C. (1975). Geochemistry of andesites from the Coastal Range, eastern Taiwan. *Geological Society of China Proceedings* 18, 73–88.

Chen Xin and Wang Zhitai (1988). Distribution of tin deposits in China and their metallogenic conditions. Tin Mineralization, with emphasis on Asian deposits (ed. C. S. Hutchison), Springer-Verlag, Heidelberg, 235–244.

Cheng, G.; Bai, Y. & Sun, Y. (1988). Palaeomagnetic study on the tectonic evolution of the Ordos block, North China. Seismological Geology, 10, 81–87.

Chhibber, H. L. (1934a). The geology of Burma. MacMillan & Co., London.

Chhibber, H. L. (1934b). *The mineral resources of Burma.* MacMillan & Co., London.

Chi, W. R., Namson, J., and Suppe, J. (1981). Stratigraphic record of plate interactions in the Coastal Range of eastern Taiwan. Geological Society of China Memoir 4.

Chiang, Kai Kim (2002). Geochemistry of the Cenozoic igneous rocks of Borneo and tectonic implications. *Ph.D. thesis, University of London*, 364p.

Chinbunchorn, N., Pradidtan, S. and Sattayarak, N. (1989). Petroleum potential of Tertiary intermontane basins in Thailand. *Intermontane basins: geology and resources.* Proceedings of the international symposium (ed. T. Thanasuthipitak and P. Ounchanum). Chinag Mai University, Thailand, 29–42.

Chonglakmani, C. (1983). The marine Mesozoic stratigraphy of Thailand. *Proceedings of a workshop on stratigraphic correlation of Thailand and Malaysia* 1, pp. 105–126. Geological Society of Thailand, Bangkok / Geological Society of Malaysia, Kuala Lumpur.

Chonglakmani, C. and Sattayarak, N. (1978). stratigraphy of the Huai Hin Lat Formation (Upper Triassic) in northeastern Thailand. *Proceedings of the 3rd regional conference on geology and mineral resources of S.E. Asia* (ed. Prinya Nutalaya), pp. 739–762. Asian Institute of Technology, Bangkok.

Clegg, E. L. G. (1941). The Cretaceous and associated rocks of Burma. Memoirs of the geological survey of India 74 (part 1), 1–101.

Clennell, M. B. (1991). The origin and tectonic significance of mélanges in eastern Sabah, Malaysia. *Journal of Southeast Asian Earth Sciences*, 6, 407–429.

Clennell, M. B. (1992). *The mélanges of Sabah, Malaysia.* Ph.D. thesis, University of London.

Clift, P. D., Lin J., and ODP Leg 184 Scientific Party. (2001). Patterns of extension and magmatism along the continent-ocean boundary, South China Margin. Wilson, R. C. L., Whitmarsh, R. B., Taylor, B. & Froitzheim, N. (eds.), Non-volcanic rifting of continental margins: a comparison of evidence from land and sea. *Geological Society of London, Special Publication*, 187, 489–510.

Clift, P. D., Lin J. & Barckhausen, U. (2002). Evidence of low flexural rigidity and low viscosity lower continental crust during continental breakup in the South China Sea. *Marine and Petroleum Geology*, 19 (No. 8), 951–970.

Cobbing, E. J. (2005). Granites. Chapter 5 in Barber, A. J.; Crow, M. J. and Milsom, J. S. (eds.) Sumatra: geology, resources and tectonic evolution. *Geological Society of London, memoir* 31, 54–62.

Cobbing, E. J., Mallick, D. I. J., Pitfield, P. E. J., and Teoh, L. H. (1986). The granites of the Southeast Asian tin belt. *Geological Society of London Journal* 143, 537–550.

Cobbing, E. J., Pitfield, P. E. J., Darbyshire, D. P. F., and Mallick, D. I. J. (1992). The granites of the South-east Asian tin belt. *British Geological Survey, Overseas Memoir* 10, London, 369p.

Collenette, P. (1965). The geology and mineral resources of the Pensiangan and upper Kinabatangan area, Sabah, Malaysia. *Borneo region Malaysia geological survey memoir* 12.

Collenette, P. (1966). The Garinono Formation, Sabah, Malaysia. *Borneo Region Malaysian Geological Survey Annual Report for* **1965**, 161–167.

Cook, R. H., Suntharalingam, T., Chong, F. S., and Evans, G. M. (1968). Geology and mineral resources of the Malacca–Mersing area. *Annual report of the geological survey of Malaysia*, 89–94.

Cooper, M. A., Herbert, R., Hill, G. S. (1989). The structural evolution of Triassic Intermontane Basins in Northeastern Thailand. *Proceedings of the International Symposium on Intermontane Basins: geology and resources*. Thanasuthipitak, T. and Ounchanum, P. (eds.), Chiang Mai University, Thailand, 231–242.

Corby, G. W., Merchant, F. E., and Taylor, E. F. (1951). Geology and oil possibilities of the Philippines. *Department of agriculture and natural resources, Technical Bulletin* **21**. Bureau of Printing, Manila.

Counillon, H. (1914). Flore fossile des gites de charbon de l'Annam. *Bulletin Service Géologique de L'Indochine* (No. **2**), 1–21.

Courtier, D. B. (1974). Geology and mineral resources of the neighbourhood of Kulim, Kedah. Geological survey of Malaysia map Bulletin, 3.

Credner, W. (1935). Siam, Das Land der Tai, J. Engelhorns Nachr., Stuttgart, Germany.

Crostella, A. (1977). Geosynclines and plate tectonics in Banda arcs, eastern Indonesia. *American Association of Petroleum Geologists Bulletin* **61**, 2063–2081.

Crostella, A. (1981). Malacca Strait wrench fault controlled Lalang and Mengkapan oil fields. *Offshore S.E. Asia conference proceedings* **2**, S.E.A.P.E.X., Singapore, 1–12.

Cummings, R. H. (1962). Limestones of the Terbat Formation, west Sarawak. *Geological Survey of the British territories in Borneo annual report* for **1961**, 36–48.

Curray, J. R. (2005). Tectonics and history of the Andaman Sea region. *Journal of Asian Earth Sciences*, **25**, 187–232.

Curray, J. R. and Moore, D. G. (1974). Sedimentary and tectonic processes in the Bengal deep-sea fan and geosyncline. *The geology of continental margins* (ed. C. A. Burke and C. L. Drake), pp. 617–237. Springer-Verlag, Berlin.

Curray, J. R., Moore, D. G., Lawver, L. A., Emmet, F. J., Raitt, R. W., Henry, M., and Kiekhefer, R. (1979). Tectonics of the Andaman Sea and Burma. Geological and geophysical investigations of continental slopes and rises, *American Association of Petroleum Geologists Memoirs* **29** (ed. J. S. Watkins, L. Montadert, and P. W. Dickerson), pp. 189–98.

Curray, J. R., Emmet, F. J., Moore, D. G., and Raitt, R. W. (1982). Structure, tectonics and, geological history of the northeastern Indian Ocean. *The ocean basins and margins: the Indian ocean* **6** (ed. A. E. M. Nairn and F. G. Stehli), pp. 399–450. Plenum Press, New York.

Daines, S. R. (1985). Structural history of the W. Natuna Basin and the tectonic evolution of the Sunda region. *Proceedings of the 14th annual convention*, **1**, 39–61, Indonesian Petroleum Association, Jakarta.

Daly, M. C.; Hooper, B. G. D.; and Smith, D. G. (1989). Tertiary plate tectonics and basin evolution in Indonesia. *Proceedings of the 6th regional conference on the geology, mineral and hydrocarbon resources of Southeast Asia (GEOSEA 6), Jakarta, July 1987*. (ed. B. Situmorang), 105–134, Indonesian Association of Geologists, Jakarta.

Darbyshire, D. P. S. (1975). K/Ar determination, of basaltic samples from Vietnam. *Unpublished report of the isotope geology unit, Institute Geological Sciences*, London, **75/2**.

Davies, H. L. (1981). The major ophiolite complex in southeastern Papua New Guinea: a review. *The geology and tectonics of eastern Indonesia*, Geological Research and Development Centre, Special Publication, 2 (ed. A. J. Barber and S. Wiryosujono), pp. 391–408. Bandung.

Davies, H. L. and Jaques, A. L. (1984). Emplacement of ophiolite on Papua New Guinea. *Ophiolites and oceanic lithosphere* (ed. I. G. Gass, S. J. Lippard, and A. W. Shelton), pp. 341–349. Geological Society, London.

Davies, P. R. (1984). Tertiary structural evolution and related hydrocarbon occurrences, North Sumatra Basin. *Proceedings Indonesian Petroleum Association* **13**th Annual Convention, Jakarta, May 1984, **1**, 19–49.

Dawson, O. T. (1978). Depositional and diagenetic fabrics of Permian limestone from Saraburi, central Thailand. *Proceedings of the third regional conference on geology and mineral resources of S.E. Asia* (ed. Prinya Nutalaya), pp. 47–60. Asian Institute of Technology, Bangkok.

De Boer, J., Odom, L. A., Ragland, P. C., Snider, F. G., and Tilford, N. R. (1980). The Bataan orogene: eastwards subduction, tectonic rotations and volcanism in the western Pacific (Philippines). *Tectonophysics* **67**, 251–282.

Debon, F. and Le Fort, P. (1982). A chemical-mineralogical classification of common plutonic rocks and associations. *Transactions of the Royal Society of Edinburgh, Earth Sciences* **73**, 135–149.

Debon, F., Le Fort, P., Sheppard, S. M. F., and Sonet, J. (1986). The four plutonic belts of the Transhimalaya–Himalaya: a chemical, mineralogical, isotopic and chronological synthesis along a Tibet–Nepal section. *Journal of Petrology* **27**, 219–50.

Debon, F., Sonet, J., Liu Guohue, Jin Chengwei, and Xu Ronghua (1984). Caractères chimico-minéralogiques et datations par Rb-Sr des trois ceintures plutoniques du Tibet méridional. *Mission Franco-Chinoise au Tibet 1980* (ed. J. L. Mercier and Li Guangcen), pp. 309–17. Éditions du centre national de la recherche scientifique, Paris.

De Broin, F., Ingavat, R., Janvier, P., and Sattayarak, N. (1982). Triassic turtle remains from northeastern Thailand. *Journal of Vertebrate Palaeontology* **2**, (No. 1), 41–6.

De Coo, J. C. M. and Lau, J. W. E. (1977). Recognition of reef facies in the Bau Limestone (Upper Jurassic–Lower Cretaceous), Sarawak. *Geological survey of Malaysia geological papers* **2**, 72–78.

De Coo, J. C. M. and Smit, O. E. (1975). The Triassic Kodiang Limestone Formation in Kedah, West Malaysia. *Geologie en Mijnbouw* **54**,169–76.

De Coster, G. L. (1975). The geology of the central and south Sumatran basins. *Proceedings of the Indonesian Petroleum Association* **Third** Annual Convention, Jakarta, June 1974, 77–110.

De Roever, W. P. (1947a). Preliminary notes on glaucophane bearing and other crystalline schists from southeast Celebes and on the origin of glaucophane bearing rocks. *Proc. Koninkl. Nederlandsche Akad. Wetensch.* **53**, 6–10, 1454–1465.

De Roever, W. P. (1947b). Igneous and metamorphic rocks in eastern central Celebes. *Geological exploration in the island of Celebes* (ed. H. A. Brouwer), 65–173. North Holland Publishing Co., Amsterdam.

Dickins, J. M. (1981). Late Palaeozoic tilloids of Bonaparte Gulf Basin, Western Australia. *Earth's pre-Pleistocene glacial record* (ed. M. J. Hambrey and W. B. Harland), 447–448. Cambridge University Press.

Dickins, J. M. (1985). Palaeobiofacies and palaeobiography of Gondwanaland from Permian to Triassic. *The Tethys: her palaeogeography and palaeobiogeography from Palaeozoic to Mesozoic (ed. K.* Nakazawa and J. M. Dickins), 83–92. Tokai University Press, Tokyo.

Dickinson, W. R. (1975). Plate tectonic evolution of sedimentary basins. Continuing education course note series **1**, Plate tectonics and hydrocarbon accumulations, 1–56. American Association of Petroleum Geologists, Tulsa.

Divis, A. F. (1980). The petrology and tectonics of Recent volcanism in the central Philippine islands. The tectonic and geologic evolution of Southeast Asian seas and islands, *Geophysical monograph,* **23** (ed. D. E. Hayes), 127–44, American Geophysical Union, Washington.

Doust, H. and Noble, R. A. (2007, in press). Petroleum systems of Indonesia. *Marine and Petroleum Geology*. doi:10.1016/j.marpetgeo. 2007.05.007.

Duarah, R., Saikia, M. M. and Bhattacharjee, C. C. (1983). Occurrence of the ophiolitic complexes along the Indoburman orogenic belt. *Geological Magazine* **120**, 175–82.

Du Bois, E. (1985). Review of principal hydrocarbon-bearing basins around the South China Sea. *Geological Society of Malaysia Bulletin* **18**, 167–209.

Enkin, R. J., Yang, Z., Chen, Y. and Courtillot, V. (1992). Paleomagnetic constraints on the geodynamic history of the major blocks of China from the Permian to the Present. *Journal of Geophysical Research*, **97**, 13953–13989.

Epting, M. (1980). Sedimentology of Miocene carbonate buildups, Central Luconia, offshore Sarawak. *Geological Society of Malaysia Bulletin* **12**, 17–30.

ESCAP (1985). *Oil and natural gas map of Asia*, **Third** revised edn. Scale 1:5 000 000. United Nations economic and social commission for Asia and the Pacific, Bangkok.

Eubank, R. T. and Makki, A. C. (1981). Structural geology of the Central Sumatra back-arc basin. Proceedings of the Indonesian Petroleum Association **10**th Annual Convention, Jakarta, 153–96.

Evans, P. (1964). The tectonic framework of Assam. Geological Society of India Journal **5**, 80–96.

Falvey, D. A. (1974). The development of continental margins in plate tectonic theory. Australian Petroleum Exploration Association Journal **14**, 95–106.

Falvey, D. A. and Middleton, M. F. (1981). Passive continental margins: evidence for a breakup deep crustal metamorphic subsidence mechanism. Oceanologica acta, Colloque C3, 26th *International Geology Congress, Paris*, 103–114.

Faustino, L. A. (1934). Taal volcano and its eruptions. *Proceedings of the 5th Pacific Science Congress* **3**, 2377–2378.

Fitch, F. H. (1951). The geology and mineral resources of the neighbourhood of Kuantan, Pahang. Geological survey department of the Federation of Malaya memoir **6**.

Fitch, T. (1972). Plate convergence, transcurrent faults and internal deformation adjacent to Southeast Asia and the western Pacific. *Journal of geophysical research* 77, 4432–4460.

Foden, J. D. (1986). The petrology of Tamboro volcano, Indonesia: a model for the 1815 eruption. *Journal of Volcanology and Geothermal Research* 27, 1–41.

Foden, J. D. and Varne, R. (1981). Petrogenetic and tectonic implications of near coeval calc-alkaline to highly alkaline volcanism on Lombok and Sumbawa islands in the eastern Sunda arc. *The geology and tectonics of eastern Indonesia* (ed. A. J. Barber and S. Wiryosujono), 135–152, Geological Research and Development Centre, Bandung.

Fontaine, H. (1973). Bibliographie des sciences de la terre pour le Vietnam, le Laos et le Cambodge. Archives géologiques du Vietnam **16**, Saigon.

Fontaine, H. (1979). Note on the geology of the Calamian islands, north Palawan, Philippines. C. C. 0. P. Newsletter **6**, (No. 2), 40–47, Bangkok.

Fontaine, H. (1986). Discovery of Lower Permian corals in Sumatra. *Geological Society of Malaysia Bulletin* **19**, 183–191.

Fontaine, H. (1990). *Ten years of CCOP research on the pre-Tertiary of East Asia*. C.C.O.P. Technical Sectariat, Bangkok, CCOP/TP. 20.

Fontaine, H., Ingavat, R., and Vachard, D. (1982). Carboniferous corals from northeast Thailand. Geological Society of Malaysia Bulletin **15**, 47–56.

Fontaine, H., Lovachalasupaporn, S., Nguyen duc Tien, and Vachard, D. (1983). New data on the Lower Carboniferous of Thailand. C.C.O.P. Newsletter **10**, 13–15, Bangkok.

Fontaine, H., Poumot, C. and Songsirikul, B. (1981). New Upper Palaeozoic formations of northeast Thailand in Devonian and Lower Carboniferous. *C.C.O.C. Newsletter* 8, (No. 4), 1–7.

Fontaine, H. and Workman, D. R. (1978). Review of the geology and mineral resources of Kampuchea, Laos and Vietnam. *Geology and mineral resources of Southeast Asia* (ed. Prinya Nutalaya), 538–603. Asian Instit. Technology, Bangkok.

Fromaget; T (1927). Études géologiques sur le nord de l'Indochine centrale. *Bulletin Service Géologique de L'Indochine* **16** (Part 2).

Fromaget, J. (1941). L'Indochine française, sa structure géologique, ses roches, ses mines et leurs relations possible avec la tectonique. *Bulletin Service Géologique de L'Indochine* **26**, (No. 2), 140p.

Fromaget, J., Saurin, E. and Fontaine, H. (1971). Geological map of Vietnam, Cambodia, Laos. Scale 1:2,000,000. National Geographic Directorate of Vietnam, Dalat.

Fuller, M., and Lin Jin-Lu (1984). Paleomagnetism of an accretionary margin: S. China and S.E. Asia. Geological Society of Malaysia: *GEOSEA V, Abstracts of Papers*, 10–11.

Fuller, M., et al. (1983). Paleomagnetism of Luzon. Hayes, D. E. (ed.) The tectonic and geologic evolution of Southeast Asian seas and islands: part 2, *Geophysical monographs* 27 (ed. D. E. Hayes), 79–94. American Geophysical Union, Washington.

Gan, A. S. (1979). The significance of a fossil find in Tanjong Malim area (sheet 76). *Geological Survey of Malaysia annual report*, 158–162.

Gansser, A. (1964). Geology of the Himalayas. John Wiley-Interscience, New York.

Gansser, A. (1966). The Indian Ocean and the Himalayas, a geological interpretation. *Eclogae Geologicae Helvetiae* **59**, 831–848.

Gansser, A. (1980). The significance of the Himalayan suture zone. Tectonophysics **62**, 37–52.

Garson, M. S., Amos, B. J., and Mitchell, A. H. G. (1976). The geology of the area around Neyaungga and Ye-ngan, southern Shan States, Burma. *Overseas memoir* 2, British Geological Survey.

Garson, M. S., Young, B., Mitchell, A. H. G., and Tait, B. A. R. (1975). The geology of the tinbelt in Peninsular Thailand around Phuket, Phangnga and Takua Pa. *Overseas memoir* 1, British Geological Survey.

Gass, I. G. (1977). Origin and emplacement of ophiolites. Volcanic processes in ore genesis. *Geological Society of London Special Publication*, 7 (ed. I. G. Gass), 72–76.

Gatinsky, Y. G. (1981). Geokinematic reconstructions of the southeast part of the Asian continent. Izvestia vuzov geol. i. razv. part **4**, **61–9**, part **5**, 10–19.

Gatinsky, Y. G. (compiler) (1983). *Geological map of Indo-China Peninsula and adjacent territories. 1:2,500,000*. All-Union scientific research institute on geology of foreign countries, Moscow.

Gatinsky, Y. G. (1986a). The lateral structural-stratigraphic analysis. Nedra, Moscow. [In Russian.]

Gatinsky, Y. G. (1986b). Geodynamics of Southeast Asia in relation to the evolution of ocean basins.

Palaeogeography, Palaeoclimatology, Palaeoecology 55, 127–144.

Gatinsky, Y. G. and Hutchison, C. S. (1984). Cathaysia, Gondwanaland and the Paleotethys in the evolution of continental Southeast Asia. *Geological Society of Malaysia*: GEOSEA V, Abstracts of Papers, Kuala Lumpur, 11–12.

Gatinsky, Y. G. and Hutchison, C. S. (1986). Cathaysia, Gondwanaland and the Paleotethys in the evolution of continental Southeast Asia. *Geological Society of Malaysia Bulletin* 20, 179–199.

Gatinsky, Y. G., Hutchison, C. S., Nguyen, Minh, N. N., and Tri, T. V. (1984). Tectonic evolution of Southeast Asia. *27th International Geology Congress Reports* 5, Colloquium 5, Tectonics of Asia, 225–240.

Gatinsky, Y. G., Kudriavtsev, G. A., and Mishina, A. V. (1972). On the 'Mesozoides' of Southeast Asia. *Moskov. Obshch. Ispytaleley Prirody Byull. Otdel Geol.* 47, 62–70. [In Russian.]

Gatinsky, Y. G., Mischina, A. V., Vinogradov, I. V., and Kovalev, A. A. (1978). The main metallogenic belts of Southeast Asia as a result of different geodynamics conditions interference. *Geology and mineral resources of Southeast Asia* (ed. Prinya Nutalaya), pp. 313–18. Asian Institute of Technology, Bangkok.

Gazdzicki, A. and Smit, O. E. (1977). Triassic foraminifers from the Malay Peninsula. *Acta Geologica Polonica* 27, 319–332.

Geological Bureau of Xizang (1982). *Tectonics of Yarlung Zangbo suture zone Xizang (Tibet)—guide to geological excursion.* Geological Bureau of Xizang/Geological Society of Xizang, China.

George, W. (1982). Wallace and his line. *Wallace's Line and plate tectonics* (ed. T. C. Whitmore), 3–8, Oxford University Press.

Ghose, N. C. (1974). Geological evolution of Chotta Nagpur granite gneiss complex. *Bulletin of the Geological, Mining and Metallurgical Society India* 47, 1–78.

Ghose, N. C. and Singh, R. N. (1980). Occurrence of blueschist facies in the ophiolite belt of the Naga Hills, east of Kiphire, N.E. India. *Geologische Rundschau* 69, 41–48.

Ginger, D. C., Ardjakusumah, W.O., Hedley, R. J. and Pothecary, J. (1993). Inversion history of the West Natuna Basin: examples from the Cumi-Cumi PSC. *Proceedings of the Indonesian Petroleum Association*, 22nd annual convention, 1, 635–658.

Girardeau, J., et al. (1984). Tectonic environment and geodynamic significance of the Neo-Cimmerian Donqiao ophiolite, Bangong–Nujiang suture zone, Tibet. *Nature* 307, 27–31.

Gobbett, D. J. (1964). The Lower Palaeozoic rocks of Kuala Lumpur, Malaysia. *Federation Museums Journal* 9, 66–79, Kuala Lumpur.

Gobbett, D. J. (1968). Bibliography and index of the geology of West Malaysia and Singapore. *Geological Society of Malaysia Bulletin* 2.

Gobbett, D. J. (1973a). Upper Paleozoic. *Geology of the Malay Peninsula* (ed. D. J. Gobbett and C. S. Hutchison), 61–95. John Wiley-Interscience, New York.

Gobbett, D. J. (1973b). Carboniferous and Permian correlations in Southeast Asia. *Geological Society of Malaysia Bulletin* 6, 131–42.

Gobbett, D. J. and Hutchison, C. S. (ed.) (1973). Geology of the Malay Peninsula: West Malaysia and Singapore. John Wiley-Interscience, New York.

Gobbett, D. J. and Tjia, H. D. (1973). Tectonic history. Geology of the Malay Peninsula (ed. D. J. Gobbett and C. S. Hutchison), 305–30, John Wiley-Interscience, New York.

Goh, S. T. (1973). Geology of the Kemaman area, Trengganu, Peninsular Malaysia. *Unpublished BSc thesis*, University of Malaya.

Golightly, J. P. (1979). Geology of Soroako nickeliferous laterite deposits. *International Laterite Symposium* (ed. D. J. I. Evans, R. S. Shoemaker, and H. Veltman), 38–56, American Institute of Mineralogy, Metallurgy and Petroleum Engineers, New York.

Goossens, P. J. (1978a). The metallogenic provinces of Burma, their definitions, geologic relationships and extensions into China, India and Thailand. *Proc. of the third regional conference on geology and mineral resources of S.E. Asia* (ed. Prinya Nutalaya), 431–92, Asian Institute of Technology, Bangkok.

Goossens, P. J. (1978b). Earth sciences bibliography of Burma, Yunnan and Andaman islands. *Proceedings of the third regional conference on geology and mineral resources of S.E. Asia* (ed. Prinya Nutalaya), 493–536, Asian Institute of Technology, Bangkok.

Goswami, D. N. D. (1960). *Geology of Assam.* Department of Publications, University of Guahati, Assam.

Gramman, F. (1974). Some palaeontological data on the Triassic and Cretaceous of the western part of Burma. *Newsletter of stratigraphy* 3, 277–90.

Green, R., Adkins, J. S., Harrington, H. J., and Unsung, M. (1979). *Bouguer gravity anomaly map* *of Indonesia with marginal text*. University of New England, Armidale, Australia.

Grubb, P. L. C. (1965). Undersaturated potassic lavas and hypabyssal intrusives in north Johore. *Geological magazine* **102**, 338–46.

Grubb, P. L. C. (1968). Geology and bauxite deposits of the Pengerang area, southeast Johore. *Geological survey of Malaysia memoir* **14**, Ipoh.

Gupta, V. T. (1973). *Indian Palaeozoic stratigraphy*. Hindustan Publishing Co., Delhi.

Gupta, V. T. (1975). *Indian Mesozoic stratigraphy*. Hindustan Publishing Co., Delhi.

Gupta, V. T. (1976). *Indian Cenozoic stratigraphy*. Hindustan Publishing Co., Delhi.

Gupta, V. T. (1977). *Indian Precambrian stratigraphy*. Hindustan Publishing Co., Delhi.

Hahn, L. (1984). The Indosinian Orogeny in Thailand and adjacent areas. *Mémoire de la Societe Géologique de France* **147**, 71–82.

Haile, N. S. (1954). The geology and mineral resources of the Strap and Sadong valleys, west Sarawak including the Klingkang coal range. *Geological Survey Department of the British Territories in Borneo Memoir* **1**, Kuching.

Haile, N. S. (1962). The geology and mineral resources of the Suai–Baram area, north Sarawak. *Geological Survey Department of the British Territories in Borneo Memoir* **13**, Kuching.

Haile, N. S. (1969). Geosynclinal theory and the organizational pattern of the Northwest Borneo Geosyncline. *Quarterly Journal of the Geological Society London* **124**, 171–94.

Haile, N. S. (1970). Notes on the geology of the Tambelan, Anambas and Bunguran (Natuna) islands, Sunda Shelf, Indonesia, including radiometric age determinations. *U.N. ECAFE C.C.O.P. Technical Bulletin* **3**, 55–90.

Haile, N. S. (1973). The recognition of former subduction zones in Southeast Asia. *Implications of continental drift to the earth sciences*, **2** (ed. D. H. Tarling and S. K. Runcorn), 885–892, Academic Press, London.

Haile, N. S. (1974). Borneo. Mesozoic–Cenozoic orogenic belts: data for orogenic studies, *Geological Society of London Special Publication* **4** (ed. A. M. Spencer), 333–47.

Haile, N. S. (1979a). Palaeomagnetic evidence for rotation and northward drift of Sumatra. *Journal of the Geological Society London* **136**, 541–545.

Haile, N. S. (1979b). Rotation of Borneo microplate completed by Miocene: palaeomagnetic evidence. *Newsletter of the Geological Society of Malaysia* **5**, 19–22.

Haile, N. S. (1980). Paleomagnetic evidence from the Ordovician and Silurian of northwest Peninsular Malaysia. *Earth and Planetary Science Letters* **48**, 233–236.

Haile, N. S., Beckinsale, R. D., Chakraborty, K. R., Abdul Hanif Hussein, and Hardjono, T. (1983). Palaeomagnetism, geochronology and petrology of the dolerite dykes and basaltic lavas from Kuantan, West Malaysia. *Geological Society of Malaysia Bulletin* **16**, 71–85.

Haile, N. S. and Bignell, J. D. (1971). Late Cretaceous age based on K/Ar dates of granitic rocks from Tambelan and Bunguran islands, Sunda Shelf, Indonesia. *Geologie en Mijnbouw* **50**, 687–90.

Haile, N. S. and Briden, J. C. (1982). Past and future palaeomagnetic research and tectonic history of East and Southeast Asia. Palaeomagnetic research in Southeast and East Asia, *C.C.O.P. Technical publication* **13**, pp. 25–46. United Nations Building, Bangkok.

Haile, N. S. and Khoo, H. P. (1980). Palaeomagnetic preliminary measurements on Upper Jurassic to Lower Cretaceous sedimentary rocks of Peninsular Malaysia. *Geological Society of Malaysia Bulletin*, **12**, 75–78.

Haile, N. S., McElhinny, M. W., and McDougall, I. (1977a). Palaeomagnetic data and radiometric ages from the Cretaceous of West Kalimantan (Borneo) and their significance in interpreting regional structure. *Journal of the Geological Society London* **133**, 133–44.

Haile, N. S., Stauffer, P. H., Krishnan, D., Lim, T. P., and Ong, G. B. (1977b). Palaeozoic redbeds and radiolarian chert: reinterpretation of their relationships in the Bentong and Raub areas of west Pahang, Peninsular Malaysia. Geological Society of Malaysia Bulletin **8**, 45–60.

Haile, N. S., Wong, N. P. Y., and Nuttall, C. P. (1965). The geology and mineral resources of Dent Peninsula, Sabah. *Geological survey of the Borneo region, Malaysia, memoir* **16**.

Haller; H. (1890). A thousand miles on an elephant. Blackwood and Sons, London.

Hambrey, M. J. and Harland, W. B. (ed.) (1981). *Earth's pre-Pleistocene glacial record*. Cambridge University Press.

Hamburger, M. W., Cardwell, R. K., and Isacks, B. L. (1983). Seismotectonics of the northern Philippine island arc. The tectonic and geologic evolution of Southeast Asian seas and islands, part 2, *Geophysical monograph* **27** (ed. D. Hayes), 1–22, American Geophysical Union, Washington.

Hamilton, W. (1979). Tectonics of the Indonesian region. *U.S. Geological Survey Professional Paper* **1078**.

Hanebuth, T., Stattegger, K., Grootes, P. M. (2000). Rapid flooding of the Sunda Shelf: a late-glacial sea-level record, *Science*, **288** (No. 5468), 1033–1035.

Haq, B. V., Hardenbol, J. and Vail, P. R. (1987). Chronology of fluctuating sea levels since the Triassic. *Science, 235, 1156–1167.*

Hariadi, N. and Soeparjadi, R. A. (1976). Exploration of the Mentawai Block, west Sumatra. *Proceedings of the Indonesian Petroleum Association* **1**, June 1975, Jakarta, 55–66.

Harris, R. A. (1991). Temporal distribution of strain in the active Banda orogen: a reconciliation of rival hypotheses. *Journal of Southeast Asian Earth Sciences*, **6**, 373–386.

Hartono, H. M. S. (1990). Late Cenozoic tectonic development of the Southeast Asia continental margin in the Banda Sea area. *Tectonophysics*, **181**, 267–276.

Hashimoto, W. and Sato, T. (1968). Contribution to the geology of Mindoro and neighbouring islands, the Philippines. *Geology and paleontology of Southeast Asia* **5** (ed. T. Kobayashi et al.), 192–220. University of Tokyo Press.

Hashimoto, W. and Sato, T. (1973). Geological structure of north Palawan and its bearing on the geological history of the Philippines. *Geology and paleontology of Southeast Asia* **13** (ed. T. Kobayashi et al.), 145–61, University of Tokyo Press.

Hatherton, T. and Dickinson, W. R. (1969). The relationship between andesitic volcanism and seismicity in Indonesia, the Lesser Antilles, and other island arcs. Journal of geophysical research **74**, 5301–5309.

Hatton, F. (1886). *North Borneo: explorations and adventures on the Equator*. Samson, Low, Marston, Searle and Rivington, London.

Hawkins, J. W. and Evans, C. A. (1983). Geology of the Zambales Range, Luzon, Philippine islands: ophiolite derived from an island arc – back arc basin pair. The tectonic and geologic evolution of Southeast Asian seas and islands, part 2, *Geophysical monographs* 27 (ed. D. E. Hayes), pp. 95–123. American Geophysical Union, Washington.

Hayes, D. E. (director) (1978). *A geophysical atlas of the East and Southeast Asian seas* (6 sheets) **MC-25**. Geological Society of America.

Hayes, D. E. (ed.) (1980). The tectonic and geologic evolution of Southeast Asian seas and islands, *Geophysical monograph* **23**. American Geophysical Union, Washington.

Hayes, D. E. (ed.) (1983). The tectonic and geologic evolution of Southeast Asian seas and islands, part 2, *Geophysical monograph*, **27**. American Geophysical Union, Washington.

Hayes, D. E. and Taylor, B. (1978). Tectonics. *A geophysical atlas of the East and Southeast Asian seas* (6 sheets) **MC-25** (director, D. E. Hayes). Geological Society of America.

Hehuwat, F. (1976). Isotopic age determinations in Indonesia: the state of the art. Proceedings of seminar on isotope geology, *Technical publication* 3, 135–57, U.N. ESCAP/C.C.O.P., Bangkok.

Heim, A. and Hirschi, H. (1939). A section of the mountain ranges of north-western Siam. *Eclogae Geologicae Helvetiae* **32**, No. 1.

Heirtzler, J. R., et al. (1978). The Argo abyssal plain. Earth and Planetary Science Letters **41**, 21–31.

Helmcke, D. (1982). On the Variscan evolution of central mainland Southeast Asia. Earth evolution sciences **4**, 309–19.

Helmcke, D. (1984). The orogenic evolution (Permian–Triassic) of central Thailand. Implications on paleogeographic models for mainland SE-Asia. *Mémoire de la Societe Géologique de France* **147**, 83–91.

Helmcke, D. (1985). The Permo–Triassic 'Paleotethys' in mainland Southeast Asia and adjacent parts of China. Geologische Rundschau **74**, 215–28.

Helmcke, D. and Lindenberg, H. G. (1983). New data on the 'Indosinian' orogeny from central Thailand. *Geologisches Rundschau* **72**, 317–28.

Herman, B. M., Anderson, R. N., and Truchan, M. (1979). Extensional tectonics in the Okinawa Trough. Geological and geophysical investigations of continental margins, *American Association of Petroleum Geologists memoir* **29** (ed. J. S. Watkins, L. Montadert, and P. W. Dickerson), 199–208.

Hermes, J. J. (1968). The Papuan geosyncline and the concept of geosynclines. Geologie en mijnbouw **47**, 81–97.

Hermes, J. J. (1974). West Irian. Mesozoic–Cenozoic orogenic belts, *Geological Society of London Special Publication* **4** (ed. A. M. Spencer), 475–90.

Hiller, K. and Elahi, M. (1984). Structural development and hydrocarbon entrapment in the Surma Basin/Bangladesh (Northwest Indo-Burman fold belt). *5th offshore Southeast Asia conference proceedings* S.E.A.P.E.X., 6.50–6.63.

Hinz, K. (1983). Reflection seismic record across the Northwest Sulu Sea Basin. Bally, A. W. (ed.). *Seismic expression of structural styles – a picture and work atlas*, 3, section 4.2.183, American Association of Petroleum Geologists, Tulsa.

Hinz, K. and Block, M (1990). Summary of geophysical data from the Sulu and Celebes seas. *Proceedings of the Ocean Drilling Program, initial reports*. (C. Rangin, E. Silver, M. T. Von Breymann et al.), chapter 5, 124.

Hinz, K.; Block, M.; Kudrass, H. R. and Meyer, H. (1991). Structural elements of the Sulu Sea, Philippines. *Geologisches Rundschau*, A127, 483–506.

Hinz, K., Fritsch, J., Kempter, E. H. K., Mohammad, A. M., Meyer, J., Mohamed, D., Vosberg, H., Weber, J. & Benavidez, J. (1989). Thrust tectonics along the north-western continental margin of Sabah/Borneo. *Geologisches Rundschau,* 78, 705–730.

Hinz, K. and Schlüter, H. U. (1983). Geology of the Dangerous grounds, South China Sea, and the continental margin off S.W. Palawan: results of Sonne cruises SO-23 and SO-27. *Bundesanstalt fur Geowissenschaften und Rohstoffe* 5701.

Hirn, A., et al. (1984). Crustal structure and variability of the Himalayan border of Tibet. *Nature* 307, 23–25.

Hirschi, H. (1938). Zur petrographie von Nordwest Siam (Gebiet zwichen Lampang und Raheng). *Schweizer mineralogische petrographisch Mitteilungen* 18, 490–511.

Hirschi, H. (1939). Zur petrographie von Nordwest Siam (Gebiet westlich von Raheng). *Schweizer mineralogisch petrographisch Mitteilungen* 19, 200–221.

Hirschi, H. and Heim, A. (1938). Zur geologie und petrographie von Nord-Siam. Schweizer mineralogisch petrographisch Mitteilungen 18 (2).

Ho, C. S. (1986). A synthesis of the geological evolution of Taiwan. *Tectonophysics* 125, 1–16.

Ho, C. S. and Lee Chinnan (1963). *Chapters on geology of Taiwan. Economic minerals of Taiwan* 1, pp. 3–57. Geological Survey of Taiwan.

Ho, K. F. (1978). Stratigraphic framework for oil exploration in Sarawak. *Geological Society of Malaysia Bulletin* 10, 1–13.

Hobson, G. V. (1941). A geological survey in parts of Karenni and southern Shan States. *Geological Survey of India memoir* 74, part 2.

Högbom, C. J. (1914). Contributions to the geology and morphology of Siam. *Uppsala Univ. Geol. Instit. Bull.*, 12.

Holcombe, C. J. (1977a). How rigid are the lithospheric plates? Fault and shear rotations in Southeast Asia. *Journal of the Geological Society London* 134, 325–342.

Holcombe, C. J. (1977b). Earthquake foci distribution in the Sunda arc and the rotation of the back arc area. *Tectonophysics* 43, 169–80.

Holloway, N. H. (1981). The North Palawan Block, Philippines: its relation to the Asian mainland and its role in the evolution of the South China Sea. *Geological Society of Malaysia Bulletin* 14, 19–58.

Holt, R.A. (1998). *The Gravity Field of Sundaland – acquisition, assessment and interpretation*. Ph. D. thesis, Birbeck College and University College, University of London.

Horn, M. K. (1980). The habitat of oil and gas on continental margins. *Southeast Asia Petroleum Exploration Society Proceedings* 5, 23–62.

Hosking, K. F. G. (1977). Known relationships between the 'hard rock' tin deposits and the granites of Southeast Asia. *Geological Society of Malaysia Bulletin* 9, 141–57.

Hsieh, C. Y. (1963). Major geotectonic features of southeast China. Scientia Sinica 12, 1871–1887.

Huang Jiqing (1984). New researches on the tectonic characteristics of China. Tectonics of Asia, Colloquium 5, 27th International Geology Congress Reports 5, 13–28.

Huang Jiqing, Chen Guoming, and Chen Bingwei (1984). Preliminary analysis of the Tethys–Himalayan tectonic domain. *Acta geologica Sinica* 58, 1–17.

Huang, K. & Opdyke, N. D. (1991). Paleomagnetic results from the Upper Carboniferous of the Shan-Thai–Malay block of western Yunnan, China. *Tectonophysics*, 192, 333–344.

Huchon, P., Barrier, E., De Bremaecker, J. C., and Angelier, J. (1986). Collision and stress trajectories in Taiwan: a finite element model. *Tectonophysics* 125, 179–191.

Huchon, P., Nguyen. T. N. H. & Chamot-Rooke, N. (2001). Propagation of continent break-up in the south-western South China Sea. Wilson, R. C. L.; Beslier, M.-O.; Whitmarsh, R.B.; Froitzheim, N. and Taylor, B. (eds.). *Non-volcanic rifting of continental margins: a comparison of evidence from land and sea*. Geological Society of London, Special Publication 187, 31–50.

Hutchison, C. S. (1972). Alpine-type chromite *in* North Borneo, with special reference to Darvel Bay. *American mineralogist* 57, 835–56.

Hutchison, C. S. (1973a). Plutonic activity. *Geology of the Malay Peninsula* (ed. D. J. Gobbett and C. S. Hutchison), 215–52, John Wiley-Interscience, New York.

Hutchison, C. S. (1973b). Metamorphism. *Geology of the Malay Peninsula* (ed. D. J. Gobbett and C. S. Hutchison), 253–303, John Wiley-Interscience, New York.

Hutchison, C. S. (1973c). Tectonic evolution of Sundaland: a Phanerozoic synthesis. *Geological Society of Malaysia Bulletin* 6, 61–86.

Hutchison, C. S. (1975a). Ophiolite in Southeast Asia. *Geological Society of America Bulletin* **86**, 797–806.

Hutchison, C. S. (1975b). Correlation of Indonesian active volcanic geochemistry with Benioff zone depth. Geologie en Mijnbouw 54, 157–68.

Hutchison, C. S. (1976). Indonesian active volcanic arc: K, Sr and Rb variation with depth to the Benioff zone. *Geology* 4, 407–408.

Hutchison, C. S. (1977). Granite emplacement and tectonic subdivision of Peninsular Malaysia. *Geological Society of Malaysia Bulletin* **9**, 187–207.

Hutchison, C. S. (1978a). Southeast Asian tin granitoids of contrasting tectonic setting. Journal of the Physics of the Earth **26**, supplement, S221–S232.

Hutchison, C. S. (1978b). Ophiolite metamorphism in northeast Borneo. Lithos 11, 195–208.

Hutchison, C. S. (1982a). Southeast Asia. The Ocean basins and margins: The Indian Ocean (ed. A. E. M. Nairn and F. G. Stehli), **6**, 451–512, Plenum Press, New York.

Hutchison, C. S. (1982b). Indonesia. Andesites: orogenic andesites and related rocks (ed. R. S. Thorpe), 207–224, John Wiley & Sons, England.

Hutchison, C. S. (1982c). The various granitoid series and their relationship to W and Sn mineralization. Tungsten Geology, Jiangxi, China (ed. J. V. Hepworth and Zhang Yuhong), 87–114, ESCAP/RMRDC, Bandung, Indonesia.

Hutchison, C. S. (1982d). Pre-Tertiary basement of Borneo: what and where? *Geological Society of Malaysia Newsletter* 8, 295–297.

Hutchison, C. S. (1983a). *Economic deposits and their tectonic settings.* The MacMillan Press, London and Basingstoke.

Hutchison, C. S. (1983b). Multiple Mesozoic Sn-W-Sb granitoids of Southeast Asia. Roddick, J. A. (ed.) Circum-Pacific plutonic terranes. *Geological Society of America memoir* **159**, 35–60.

Hutchison, C. S. (1984). Is there a satisfactory classification for Southeast Asian Tertiary basins? *Offshore S.E. Asia conference proceedings* 5, S.E.A.P.E.X., Singapore, 6.64–6.76.

Hutchison, C. S. (1985). A re-assessment of the evidence that the S.E. Asian shear basins resulted from the India–Tibet collision. *Geological Society of Malaysia Petroleum and Geology seminar'85*, Kuala Lumpur, Dec. 1985.

Hutchison, C. S. (1986a). Tertiary basins of S.E. Asia—their disparate tectonic origins and eustatic stratigraphic similarities. *Geological Society of Malaysia Bulletin* **19**, 109–22.

Hutchison, C. S. (1986b). Formation of marginal seas in Southeast Asia by rifting of the Chinese and Australian continental margins and implications for the Borneo region. Geological Society of Malaysia Bulletin 20, 201–220.

Hutchison, C. S. (1987a). Tectonic settings of tin-tungsten granites in Southeast Asia. Proceedings of IGCP project 220 conference, *Technical Bulletin* 6 (ed. C. S. Hutchison), pp. 1–24. SEATRAD Centre, Ipoh, Malaysia.

Hutchison, C. S. (1987b). Continental growth and collision, and mineral prospection in Southeast Asia. Impact of Science on Society **145**, 33–44. UNESCO, Paris.

Hutchison, C. S., 1988: The tin metallogenic provinces of S.E. Asia and China: a Gondwanaland inheritance. Hutchison, C. S. (editor). *Geology of Tin Deposits in Asia and the Pacific,* Springer-Verlag, Heidelberg, 225–234.

Hutchison, C. S. (1989a). The Palaeo-Tethyan realm and Indosinian orogenic system of Southeast Asia. *Tectonic evolution of the Tethyan regions,* Proc. NATO-ASI Advanced Study Institute, Istanbul, 1985 (ed. A. M. C. Şengör). Kluwer Academic Publishers, Dordrecht, Boston, London), 585–643.

Hutchison, C. S., 1989b: Displaced terranes in the Southwest Pacific. Ben Avraham, Z. (editor). *The Evolution of the Pacific Ocean Margins.* Oxford Monographs on Geology and Geophysics, **8**, Oxford University Press, New York, 161–175.

Hutchison, C. S. (1989c). *Geological evolution of South-east Asia.* Oxford monographs on geology and geophysics, 13, Oxford University Press, 368p.

Hutchison, C. S. (editor, part author and co-ordinator), (1991a): *Studies in East Asian Tectonics and Resources (SEATAR) Crustal Transect IV: Banda Sea.* Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas (Bangkok) and Intergovernmental

Oceanographic Commission (Paris), C.C.O.P./TP 25, 30 pages +2 map sheets.

Hutchison, C. S. (editor and co-ordinator), (1991b): *Studies in East Asian Tectonics and Resources (SEATAR) Crustal Transect VII Jawa – Kalimantan – Sarawak – South China Sea.* Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas (Bangkok) and Intergovernmental Oceanographic Commission (Paris), C.C.O.P./TP 26, 66 pages + 2map sheets.

Hutchison, C. S. (1992a). The Southeast Sulu Sea, a Neogene marginal basin with outcropping extensions in Sabah. *Geological Society of Malaysia Bulletin*, 32, 89–108.

Hutchison, C. S. (1992b). The Eocene unconformity in Southeast Asia and East Sundaland. *Geological Society of Malaysia Bulletin*, 32, 69–88.

Hutchison, C. S. (1993). Gondwanaland and Cathaysian blocks, Palaeotethys sutures and Cenozoic tectonics in South-east Asia. *Geologisches Rundschau*, 82, 388–405.

Hutchison, C. S. 1994. Mélange on the Jerudong Line, Brunei Darussalam, and its regional significance. *Geological Society of Malaysia Bulletin*, 36, 157–161.

Hutchison, C. S. (1996a). *South-East Asian Oil, Gas, Coal and Mineral Deposits.* Oxford Monographs on geology and geophysics, 36, Clarendon Press, Oxford.

Hutchison, C. S. (1996b). The 'Rajang accretionary prism' and 'Lupar Line' problem of Borneo. Hall, R. & Blundell, D. (eds.). *Tectonic Evolution of Southeast Asia.* Geol. Soc. of London Special Publication 106, 247–261.

Hutchison, C. S. (2004). Marginal basin evolution: the southern South China Sea. *Marine and Petroleum Geology*, 21, 1129–1148.

Hutchison, C. S. (2005a) *Geology of North-West Borneo (Sarawak, Brunei and Sabah).* Elsevier, Amsterdam.

Hutchison, C. S. (2005b). The geological framework. Chapter 1 in Avijit Gupta (ed.) *The physical geography of Southeast Asia.* Oxford University Press, 3–23.

Hutchison, C. S. and Chakraborty, K. R. (1979). Tin: a mantle or crustal source? *Geological Society of Malaysia Bulletin*, 11, 71–79.

Hutchison, C. S. and Dhonau, T. J. (1969). Deformation of an Alpine ultramafic association in Darvel Bay, East Sabah, Malaysia. *Geologie en Mijnbouw* 48, 481–93.

Hutchison, C. S. and Dhonau, T. J. (1971). An Alpine association of metabasites and ultrabasic rocks in Darvel Bay, East Sabah, Malaysia. *Overseas geology and mineral resources* 10, 289–308.

Hutchison, C. S. and Jezek, P. A. (1978). Banda arc of eastern Indonesia: petrography, mineralogy and chemistry of the volcanic rocks. *Proceedings of the third regional conference on geology and mineral resources of S.E. Asia* (ed. Prinya Nutalaya), pp. 607–19. Asian Institute of Technology, Bangkok.

Hutchison, C. S. and Taylor, D. (1978). Metallogenesis in S.E. Asia. *Journal of the Geological Society London* 135, 407–428.

Hutchison, C. S. and Tungah Surat (1991). Sabah serpentinite sandstone and conglomerate. *Geological Society of Malaysia Newsletter*, 17, 59–64.

Ichikawa, K., Ishii, K., and Hada, S. (1966). On the remarkable unconformity at the Jengka Pass, Pahang, Malaya. *Journal of Geoscience*, Osaka City University 9, 123–130.

Igo, H., Rajah, S. S., and Kobayashi, F. (1979). Permian *Fusulinaceans* from the Sungei Sedili area, Johore, Malaysia. *Geology and paleontology of S.E. Asia* 20 (ed. T. Kobayashi et al.), 95–118.

Ingavat, R. (1984). On the correlation of the Permian foraminiferal faunas of the western central and eastern provinces of Thailand. Mémoire de la Societé Géologique de France 147, 93–100.

Ingavat, R. and Janvier, P. (1981). *Cyclotosaurus* cf. *Posthumus* Fraas (*Capitosauridae*, *Stereospondyli*) from the Huai Hin Lat Formation (Upper Triassic), Northeast Thailand. *Geobios* 14, 711–725.

Ingham, F. T. and Bradford, E. F. (1960). The geology and mineral resources of the Kinta Valley, Perak. *Federation of Malaya geological survey district memoir* 9.

Irving, E. (1977). Drift of the major continental blocks since the Devonian. *Nature* 270, 304–309.

Ishihara, S. (1977). The magnetite-series and ilmenite-series granitic rocks. Mining Geology 27, 293–305.

Ishihara, S. and Mochizuki, T. (1980). Uranium and thorium contents of Mesozoic granites from Peninsular Thailand. *Bulletin of the geological survey Japan* 31, 369–376.

Ishihara, S., Sawata, H., Arpornsuwan, S., Busaracome, P., and Bungbrakearti, N. (1979). The magnetite-series and ilmenite-series granitoids and their bearing on tin mineralization, particularly in the Malay Peninsula region. Geological Society of Malaysia Bulletin 11, 103–110.

Ishii, K. and Nogami, Y. (1966). Discovery of Triassic conodonts from the so-called Paleozoic limestone in Kedah Malaya. *Journal of Geoscience*, Osaka City University 9, 93–98.

Iwai, J. (1973). Dolomitic limestone of the Phu Kradung Formation, Mesozoic Khorat Group, Thailand. Geology and paleontology of S.E. Asia 12 (ed. T. Kobayashi et al.), 173–178.

Jaafar bin Ahmad (1976). The geology and mineral resources of the Karak and Temerloh areas, Pahang. *Geological survey of Malaysia district memoir* **15**.

Jacobson, G. (1970). Gunong Kinabalu area, Sabah, Malaysia. Geological survey of Malaysia report **8**.

Jacobson, R. S., Shot, G. G. Jr, Kieckhefer, R. M., and Purdy, G. M. (1979). Seismic refraction and reflection studies in the Timor–Aru Trough system and Australian continental shelf. Geological and geophysical investigations of continental margins. *American Association of Petroleum Geologists memoir* **29** (ed. J. S. Watkins, L. Montadert and P. W. Dickerson), 209–222.

Jain, A. K. and Balasubramanian, E. (1981). Late Palaeozoic diamictites of the eastern Himalayan Gondwana belt, India. *Earth's pre-Pleistocene glacial records* (ed. M. J. Hambrey and W. B. Harland), 308–15, Cambridge University Press.

James, D. M. D. (ed.) (1984). *The geology and hydrocarbon resources of Negara Brunei Darusslam.* Brunei Museum and Brunei Shell Petroleum Co.

Jangpangi, B. S. (1978). Stratigraphy and structure of Bhutan Himalaya. Tectonic geology of the Himalaya (ed. P. S. Saklani), 221–242, Today and Tomorrow's Printers and Publishers, Delhi.

Jarrard, R. D. and Sasajima, S. (1980). Paleomagnetic synthesis for Southeast Asia: constraints on plate motions. Hayes, D. E. (ed.) The tectonic and geologic evolution of Southeast Asian seas and islands, *Geophysical monograph* **23** (ed. D. E. Hayes), 293–316, American Geophysical Union, Washington.

Jarvis, G. T. and McKenzie, D. F. (1980). Sedimentary basin formation with finite extension rates. *Earth and Planetary Science Letters* **48**, 42–52.

Jennings, J. R. and Lee, C. P. (1985). Preliminary note on the occurrence of Carboniferous-age coals and in-situ plant fossils in eastern Peninsular Malaysia. *Newsletter of the geological society of Malaysia* **11**, 117–121.

Jezek, P. A. and Hutchison, C. S. (1978). Banda arc of eastern Indonesia: petrography and geochemistry of the volcanic rocks. *Bulletin of Volcanology* **41**, 586–608.

Jezek, P. A., Whitford, D. J., and Gill, J. B. (1981). Geochemistry of Recent lavas from the Sangihe–Sulawesi arc, Indonesia. *The geology and tectonics of eastern Indonesia* (ed. A. J. Barber and S. Wiryosujino), 383–9, Geological research and development centre, Bandung.

Jin Chengwei and Xu Ronghua (1984). Les granitoids de la partie centrale de l'Himalaya et du Gandise au Xizang (Tibet) méridional. Mission Franco-Cbinoise au Tibet 1980 (ed. J. L. Mercier and Li Guangcen), 289–308, Editions du centre national de la recherche scientifique, Paris.

Johnson, B. D., Powell, C. McA., and Veevers, J. J. (1976). Spreading history of the eastern Indian Ocean and greater India's northward flight from Antarctica and Australia. *Geological Society of America Bulletin* **87**, 1560–1566.

Johnston, C. R. (1981). A review of Timor tectonics with implications for the development of the Banda arc. The geology and tectonics of eastern Indonesia (ed. A. J. Barber and S. Wiryosujono), 199–216, Geological Research and Development Centre, Bandung.

Jones, C. R. (1970a). The geology and mineral resources of the Grik area, upper Perak. *Geological survey of West Malaysia district memoir* **11**.

Jones, C. R. (1970b). On a Lower Devonian fauna from Pahang, West Malaysia. *Geological Society of Malaysia bulletin* **3**, 63–75.

Jones, C. R. (1973). Lower Paleozoic. *Geology of the Malay Peninsula* (ed. D. J. Gobbett and C. S. Hutchison), 25–60, John Wiley-Interscience, New York.

Jones, C. R. (1981). Geology and mineral resources of Perlis, north Kedah and the Langkawi islands. *Geological survey of Malaysia memoir* **17**.

Jones, C. R., Gobbett, D. J., and Kobayashi, T. (1966). Summary of fossil record in Malaya and Singapore 1900–1965. *Geology and palaeontology of S.E. Asia* **2** (ed. T. Kobayashi et al.), 309–59.

Jones, M. T., Reed, B. L., Doe, B. R., and Lanphere, M. A. (1977). Age of tin mineralization and plumbotectonics, Belitung, Indonesia. *Economic Geology* **72**, 745–52.

Jones, W. R. (1925). The tin deposits of the Kinta district. Mining Magazine **32**, 26–31, **33**, 83–89.

Kamineni, D. C. and Chakraborty, K. R. (1975). Trace element characteristics of Segamat volcanics. Newsletter of the geological society of Malaysia **4**, 115–122.

Karig, D. E. (1971). Origin and development of marginal basins in the western Pacific. *Journal of geophysical research* **76**, 2542–2561.

Karig, D. E. (1972). Remnant arcs. *Geological society of America bulletin 83,* 1057–1068.

Karig, D. E. (1973). Plate convergence between the Philippines and the Ryukyu islands. *Marine geology* 14, 153–168.

Karig, D. E., Lawrence, M. B., Moore, G. F., and Curray, J. R. (1980). Structural framework of the fore-arc basin, N.W. Sumatra. *Journal of the geological society London* 137, 77–91.

Kastowo and Leo, G. W. (1973). *Geologic map of the Padang quadrangle, Sumatra, 1:250, 000*. Geological survey of Indonesia, Bandung.

Kat, Nguyen-Dinh (1972). Types and positions of abyssal fractures in north Vietnam. *International geology review* 14, 937–46.

Katili, J. A. (1974a). Sumatra. Mesozoic-Cenozoic orogenic belts, *Geological Society of London special publication* 4 (ed. A. M. Spencer), 317–331.

Katili, J. A. (1974b). Volcanism and plate tectonics in Indonesian island arc. *Tectonophysics* 26, 165–88.

Katili, J. A. (1978). Past and present geotectonic position of Sulawesi, Indonesia. *Tectonophysics* 45, 289–322.

Katili, J. A. (1984). Tectonic framework, resources, occurrences and related problems in Southeast Asia. *Southeast Asia: tectonic framework, earth resources and regional geological programs,* International Union geological sciences publication 13 (ed. J. A. Katili and J. A. Reinemund), 18–68.

Keppie, J. D. (1977). Plate tectonic interpretation of Palaeozoic world maps. *Nova Scotia department of mines paper* 77–3.

Khalid bin Ngah (1973). Brief geology of the Seremban area sheet 103. *Geological survey of Malaysia annual report for 1972,* 86–93.

Khin Zaw, U. (1990). Geological, petrological and geochemical characteristics of granitoid rocks of Burma; with special reference to the associated W-Sn mineralization and their tectonic setting. *Journal of Southeast Asian Earth Sciences*, 4, 293–335.

Khin Zaw, U., Aung Pwa, and Thet Aung Zan (1984). Lead-zinc mineralization at Theingon Mine, Bawsaing, Southern Shan State, Burma: a Mississippi Valley-type deposit? *Geological Society of Malaysia Bulletin* 17, 283–306.

Kho, C. H. (1968). Bintulu area, Central Sarawak, East Malaysia. *Geological Survey Malaysia Borneo Region, Report* 5.

Khoan, P. and Isaev, E. N. (1977). The relations between the deep structure of the earth's crust and the surface structures of the territory of the Socialist Republic of Vietnam. *Zeitschrift der geologishen Wissenschaffen.* 5, 321–328.

Khoo, Han Peng (1977). Geology of the Sungei Tekai area. *Geological survey of Malaysia annual report for 1977,* 93–103.

Khoo, Han Peng (1983). Mesozoic stratigraphy in Peninsular Malaysia. *Proceedings of a workshop on stratigraphic correlation of Thailand and Malaysia*: vol. 1, 370–83, Geological society of Thailand, Bangkok/Geological Society of Malaysia, Kuala Lumpur.

Khoo, K. K. (1973). Geology of the central part of sheet 104, Kuala Pilah, Negeri Sembilan. *Geological survey of Malaysia annual report*, 133–43.

Khoo, T. T. and Tan, B. K. (1983). Geological evolution of Peninsular Malaysia. *Proceedings of a workshop on stratigraphic correlation of Thailand and Malaysia* 1, 253–90, Geological Society of Thailand, Bangkok/Geological Society of Malaysia, Kuala Lumpur.

Kieckhefer, R. M., Moore, G. F., Emmel, F. J., and Sugiarta, W. (1981). Crustal structure of the Sunda forearc region west of central Sumatra from gravity data. *Journal of geophysical research* 86, 7003–7012.

Kingston, D. R., Dishroon, C. P., and Williams, P. A. (1983). Global basin classification system. *American association of petroleum geologists bulletin* 67, 2175–2193.

Kirk, H. J. C. (1957). The geology and mineral resources of the Upper Rajang and adjacent areas. *Geological Survey Department for the British Territories in Borneo, Memoir* 8.

Kirk, H. J. C. (1962). The geology and mineral resources of the Semporna Peninsula, North Borneo. *British Borneo Geological Survey Memoir* 14.

Kirk, H. J. C. (1968). The igneous rocks of Sarawak and Sabah. *Geological survey of Borneo region Malaysia bulletin* 5.

Kizaki, K. (1978). Tectonics of the Ryukyu island arc. *Journal of Physics of the Earth* 26 Supplement, S301–S307.

Kizaki, K. (1986). Geology and tectonics of the Ryukyu islands. Tectonophysics 125, 193–207.

Klemme, H. D. (1975). Giant oil fields related to their geologic setting: a possible guide to their exploration. *Bulletin of Canadian petroleum Geology* 23, 30–66.

Klompé, T. H. F. (1956). The structural importance of the Sula Spur (Indonesia). Proceedings of the 8th Pacific Science Congress 2a, 869–89.

Klompé, T. H. F. (1962). Igneous and structural features of Thailand. *Geologie en mijnbouw* 41, 290–302.

Klootwijk, C. T. and Radhakrishnamurthy, C. (1981). Phanerozoic palaeomagnetism of the Indian Plate and the India–Asia collision. *Palaeoreconstruction of the continents, Geodynamics Series* 2, 93–105.

Knight, M. D., Walker, G. L. P., Ellwood, B. B., and Diehl, J. F. (1986). Stratigraphy, paleomagnetism, and magnetic fabric of the Toba Tuffs, constraints on the sources and eruptive styles. *Journal Geophysical Research* 91, 10355–10382,

Knittel, U. (1979). Petrography and origin of the syenite from Cordon, Isabela. *Geological Society of the Philippines Journal* 33, 34–43.

Kobayashi, T. (1968). The Cretaceous non-marine *pelecypods* from the Nam Phung dam site in the northeastern part of the Khorat Plateau, Thailand, with a note on the *Trigonioididae*. *Geology and palaeontology of S.E. Asia* 4 (ed. T. Kobayashi et al.), 109–38.

Kobayashi, T., Torijama, R., and Hashimoto, W. (eds.) (1984). *Geology and palaeontology of S.E. Asia* 25.

Koch, K. E. (1973). Geology of the region Sri Sawat Thong Pha Phun–Sangklaburi (Kanchanaburi Province/Thailand). *Geological Society of Malaysia Bulletin* 6, 177–85.

Koesoemadinata, R. P. (1978). Sedimentary framework of Tertiary coal basins of Indonesia. *Third regional conference on geology and mineral resources of S.E. Asia* (ed. Prinya Nutalaya), pp. 621–40. Asian Institute of Technology, Bangkok.

Koning, T. (1985). Petroleum geology of the Ombilin intermontaine basin, West Sumatra. *Proceedings of the Indonesian Petroleum Association* **14**th annual convention, Jakarta, Oct. 1985 **1**, 117–137.

Kon'no, E. (1964). Some Permian plants from Thailand. *Geology and paleontology of S.E. Asia* **1** (ed. T. Kobayashi et al.), 89–111.

Kon'no, E. (1972). Some Late Triassic plants from the southwestern border of Sarawak, East Malaysia. *Geology and paleontology of S.E. Asia* **10** (ed. T. Kobayashi et al.), 125–78.

Kon'no, E. and Asama, K. (1970). Some Permian plants from the Jengka Pass, Pahang, West Malaysia. *Geology and paleontology of S.E. Asia* **8** (ed. T. Kobayashi et al.), 97–132.

Kon'no, E. and Asama, K. (1973). Mesozoic plants from Khorat, Thailand. *Geology and paleontology of south-east Asia* 12 (ed. T. Kobayashi et al.), 149–72.

Kon'no, E., Asama, K., and Rajah, S. S. (1971). The Late Permian Linggiu flora from the Gunung Blumut area, Johore, Malaysia. *Geology and paleontology of S.E. Asia* **9** (ed. T. Kobayashi et al.), 1–85.

Koopmans, B. N. (1965). Structural evidence for a Paleozoic orogeny in Northwest Malaya. *Geological magazine* 102, 501–20.

Koopmans, B. N. (1968). The Tembeling Formation lithostratigraphic description (West Malaysia). *Geological Society of Malaysia Bulletin* 1, 23–43.

Kosaka, H. and Wakita, K. (1978). Some geologic features of the Mamut porphyry copper deposit, Sabah, Malaysia. Economic geology 73, 618–627.

Krähenbuhl, R. (1991). Magmatism, mineralization and tectonics of the Main Range, Malaysian Peninsula: consequences of the plate tectonic model of Southeast Asia based on Rb-Sr, K-Ar and fission track data. Geological Society of Malaysia Bulletin, 29, 1–100.

Kroenke, L. W. and Scott, R. (1978). Old questions answered and new ones asked. Geotimes 23, 20–23.

Kudrass, H. R. and Schlüter, H. U. (1983). Report on geophysical and geological offshore surveys in the Malacca Strait (1976). *Exploration for offshore placers and construction materials* C.C.O.P./TP 12, Bangkok, 115–154.

Kudrass, H. R., Wiedicke, M., Cepek, P., Kreuzer, H. and Muller, P. (1986). Mesozoic and Cainozoic rocks dredged from the South China Sea (Reed Bank area) and Sulu Sea and their significance for plate-tectonic reconstructions. *Marine and Petroleum Geology*, 3, 19–30.

Kumar, S. C. (1981). Gabbroic rocks from the southern Malaya Peninsula and their relation to similar rocks of other orogenic zones. *Geological Society of Malaysia Bulletin* **14**, 75–100.

Kundig, E. (1956). Geology and ophiolite problems of east Celebes. *Verh. Konink. Nederlandsch Geol. Mijnbouw Genoot.*, geol. ser. **16**, 210–235.

Kuno, H. (1962). *Catalogue of the active volcanoes of the world including solfatara fields: Japan, Taiwan and the Marianas*. **11**. International Association of Volcanology, Rome.

Kuno, H. (1966). Lateral variation of the basalt magma type across continental margins and island arcs. *Bulletin of Volcanology* **29**, 195–222.

La Brecque, J. L., Kent, D. V., and Cande, S. C. (1977). Revised magnetic polarity time scale for Late Cretaceous and Cenozoic time. *Geology* 5, 330–335.

La Touche, T. H. D. (1913). Geology of the northern Shan States. *Memoirs of the geological survey of India* 39, 1–379.

Lane, H. R., Muller, K. J., and Ziegler, W. (1979). Devonian and Carboniferous conodonts from Perak, Malaysia. *Geologica et palaeontologica* 13, 213–222.

Lapouille, A., Haryono, H., Larue, M., Pramuwijowo, S. and Lardy, M. (1985). Age and origin of the seafloor of the Banda Sea (eastern Indonesia). *Oceanologica Acta*, 8, 379–389.

Lasserre, M., Cheymol, J., Petot, J., and Saurin, E. (1970). Geologie, chimie et géochronologie du granite de Tasal (Cambodge occidental). *Bur. de récherches geol. et min. Bull.* 4, 5–13.

Lasserre, M., Lacombe, P. and Saurin, E. (1968). Étude pétrographique, chimique et géochronologique du granite de Bo Kham (Cambodge oriental). Compte Rendu de Académie des Sciences **267**, 2073–2075.

Lasserre, M., Saurin, E. and Dumas, J. P. (1972). Age Permien obtenue par le méthode a l'argon sur deux amphiboles extraites de granodiorites de la région de Sanakham (Laos). Compte Rendu Sommaire des Séances de la Societé géologique de France 972 (3), 65–67.

Le Dain, A. Y., Tapponnier, P., and Molnar, P. (1984). Active faulting and tectonics of Burma and surrounding regions. *Journal of geophysical research* 89, 453–72.

Le Pichon, X. & Sibuet, J. C. (1981). Passive margins: a model of formation. *Journ. of Geophysical Research,* 86 (B5), 3708–3720.

Le Van Khy (1986). The structure of the Mekong Trough. *International Geology Review* 28, 87–95.

Lee, C., Lee, H., Lio, H., Lio, G., and Yeh, S. (1963). Preliminary study of paleomagnetism of some Mesozoic and Cenozoic redbeds of south China. *Acta geol. Sinica* 43, 261–264.

Lee, C. P. (1977). The geology of Labuan island, Sabah, East Malaysia. *Unpublished BSc thesis, University of Malaya*, Kuala Lumpur.

Lee, C. P. (1983). Stratigraphy of the Tarutao and Machinchang formations. *Proceedings of a workshop on stratigraphic correlation of Thailand and Malaysia* 1, 20–38, Geological society of Thailand, Bangkok/Geological society of Malaysia, Kuala Lumpur.

Lee, C. S. (1980). Two new Permian ammonoid faunas from Malaysia. *Geology and palaeontology of S.E. Asia* 21 (ed. T. Kobayashi et al.), 63–72.

Lee, C. S. and McCabe, R. (1986). The Banda–Celebes–Sulu Basins: a trapped piece of Cretaceous–Eocene oceanic crust? *Nature*, 322, 51–54.

Lee, D. T. C. (1988). Gunung Pock area, Semporna Peninsula, Sabah, Malaysia. *Geological Survey of Malaysia, report* 6.

Lee Soon Chong (1972). Geology of the Mersing area, Johore. *Unpublished BSc thesis, University of Malaya*, Kuala Lumpur.

Lee, W. M. (1923a). *Reconnaissance geological report of the district of Payap and Maharastra, northern Siam.* Department of State Railways, Bangkok.

Lee, W. M. (1923b). *Reconnaissance geological report of the provinces of Puket, Surashtradhani, Nakom Sridhamaraj and Patani in Siamese Malaya.* Department of State Railways, Bangkok.

Lee, W. M. (1923c). *Reconnaissance geological report of the Khorat region, province of Nakhorn Ratchasima, Udon, Roi-et and Ubon, Siam.* Manuscript in files of Thai geological survey department, Department of Mineral Resources, Bangkok.

Lee, W. M. (1927). Outline of the geology of Siam with reference to petroleum. *American association of petroleum Geologists bulletin* 11, 407–415.

Leloup, P. H., Lasassin, R., Tapponnier, P., Schärer, U., Zhong, D., Liu, X., Zhang, L., Ji, S., Trinh, P. T. (1995). The Ailao Shan–Red River shear zone (Yunnan, China), Tertiary transform boundary of Indochina. *Tectonophysics*, 251, 3–84.

Leong, K. M. (1971). Progress report: East Malaysia. Upper Segama Valley–Darvel Bay area (Memoir 4 revised). *Geological survey of Malaysia annual report for 1969* 186–189.

Leong, K. M. (1974). The geology and mineral resources of the Upper Segama Valley and Darvel Bay area, Sabah, Malaysia. *Geological Survey of Borneo Region Malaysia Memoir* 4 (revised).

Leong, K. M. and Azlina Anuar (1999). Northeast Sabah Basin. Chapter 23 in *The Petroleum Geology and Resources of Malaysia.* Petroliam Nasional Berhad (PETRONAS), Kuala Lumpur, 545–569.

Letouzey, J. and Kimura, M. (1986). The Okinawa Trough: genesis of a back-arc basin developing along a continental margin. *Tectonophysics* **125**, 299–230.

Levell, B. K. and Kasumajaya, Awang (1985). Slumping at the Late Miocene shelf-edge offshore west Sabah: a view of a turbidite basin margin. *Geological Society Malaysia bulletin* 18, 1–29.

Lewis, S. D. and Hayes, D. E. (1983). The tectonics of northward propagating subduction along eastern Luzon, Philippine islands. Hayes, D. E. (ed.) The tectonic and geologic evolution of Southeast Asian seas and islands, part 2. *Geophysical monograph* 27 (ed. D. E. Hayes), 57–78, American Geophysical Union, Washington.

Li Desheng (1984). Geologic evolution of petroliferous basins on continental shelf of China. *American* *association of petroleum Geologists bulletin* 68, 993–1003.

Li Xingxue, Wi Yiming, and Fu Zaibin (1984). Preliminary study on a mixed Permian flora from Xiagangjian of Gerze district, Xizang, and its palaeogeographic significance. *International symposium on Himalayan geology*, Abstracts (supplement), 3–4.

Li, Y., McWilliams, M., Cox, A., Sharps, R., Li, Y. et al. (1988). Late Permian palaeomagnetic pole from dikes of the Tarim craton, China. *Geology*, 16, 275–278.

Li, Y. X., Ali, J. R., Chan. L. S. and Lee, C. M. (2005). New and revised set of Cretaceous palaeomagnetic poles from Hong Kong: implications for the development of southeast China. *Journal of Asian Earth Sciences*, 24, 481–493.

Liechti, P., Roe, F. W., and Haile, N. S. (1960). The geology of Sarawak, Brunei and the western part of North Borneo. *Geological survey department for the British territories in Borneo bulletin* 3.

Lietz, J. K. and Kabir, J. (1982). Prospects and constraints of oil exploration in Bangladesh. *Proceedings of the Offshore Southeast Asia '82 conference*, Southeast Asia petroleum exploration Soc., Singapore, 1–6.

Liew, T. C. (1983). Petrogenesis of the Peninsular Malaysian granitoid batholiths. *Unpublished PhD thesis,* Australian National University, Canberra.

Liew, T. C. and McCulloch, M. T. (1985). Genesis of granitoid batholiths of Peninsular Malaysia and implications for models of crustal evolution: evidence from Nd-Sr isotopic and U-Pb zircon study. *Geochimica et cosmochimica acta* 49, 587–600.

Liew, T. C. and Page, R. W. (1985). U-Pb zircon dating of granitoid plutons from the west coast province of Peninsular Malaysia. *Journal of the Geological Society London* 142, 515–526.

Lim, P. L. and Tjia, H. D. (1979). The Genting thrust belt at Genting Sempah, Selangor. *Sains Malaysiana* 8, 125–146.

Lim Peng Siong (1981). Wullersdorf area, Sabah, Malaysia. *Geological Survey of Malaysia Report* 15.

Lin Baoyu (1984). Les strates du Permien inférieur et la faune corallienne de part et d'autre du Yarlung Zangbo dans la région centre-sud du Tibet (Version résumée). *Mission Franco-Chinoise au Tibet 1980*, Editions du Centre national de la recherche scientifique, Paris, 77–107.

Lin, J. (1987a). Late Carboniferous paleogeographic reconstruction. *11th International congress of Carboniferous stratigraphy and geology, Abstracts*, 283.

Lin, J. (1987b). The apparent polar wander path for the South China Block and its geological significance. *Scientia Geologica Sinica*, 4, 306–315.

Lin, J. & Fuller, M. (1990). Palaeomagnetism, North China and South China collision and the Tan-Lu Fault. *Philosophical Transaction of the Royal Society of London*, A331, 589–598.

Lin, J. L., Fuller, M., and Zhang, W. Y. (1983). Position of South China Block on Cambrian world map (abstract). E. O. S. trans. Amer. Geophysical Union 64, p. 320.

Lin, J. L., Fuller, M., and Zhang, W. Y. (1985). Preliminary Phanerozoic polar wander paths for the north and south China blocks. Nature 313, 444–449.

Liou, J. G. (1979). Zeolite facies metamorphism of basaltic rocks from east Taiwan ophiolite. American mineralogist 64, 1–14.

Liou, J. G. and Ernst, W. G. (1979). Oceanic ridge metamorphism of the east Taiwan ophiolite. *Contributions to mineralogy and petrology* 68, 335–348.

Liu, C. and Liu, H. (1965). Some paleomagneiic studies of the Sinian System of China. *Acta Geophysica Sinica* 1, 77–79.

Liu, Guohiu (1984). Les charactéristiques et la genèse des ceintures granitiques au Sud du Tibet. *Mission Franco-Chinoise au Tibet 1980* (ed. J. L. Mercier and Li Guangcen), 255–88. Éditions du centre national de la recherche scientifique, Paris.

Lofting, M. J. W., Crostella, A. and Halse, J. W. (1975). Exploration results and future prospects in the northern Australian region. *Ninth world petroleum congress proceedings* 3, 65–81, (exploration and transportation). Applied Science Publishers, London.

Logan, J. R. (1848). Sketch of the physical geography and geology of the Malay Peninsula. *Journal of the Indian Archipelago* 2, 83–138.

Loke, M. H., Lee, C. Y., and Van Klinken, G. (1983). Interpretation of regional gravity and magnetic data in Peninsular Malaysia. *Geological Society of Malaysia Bulletin* 16, 1–21.

Lovatt Smith, P. F., Stokes, R. B., Bristow, C., and Carter, A. (1996).Mid-Cretaceous inversion in the northern Khorat Plateau of Lao PDR and Thailand. Hall, R. and Blundell, D. (eds.) *Tectonic evolution of Southeast Asia*. Geological Society of London, special publication 106, 233–247.

Loveman, M. H. (1919). A connecting link between the geology of the northern Shan State and Yunnan. *Journal of Geology*, 27, 204–221.

Ludwig, W. J., Kumar, N., and Houtz, R. E. (1979). Profiler-Sonobuoy measurements in the South

China Sea Basin. Journal of Geophysical Research 84, 3505–3518.

Luong Hong Huoc (1981). On the presence of Ordovician and Silurian graptolite zones in Vietnam. *Proceedings of the fourth regional conference on the geology of Southeast Asia*, Geological Society of the Philippines, Manila, 341–346.

Lyon-Caen, H. and Molnar, P. (1983). Constraints on the structure of Himalaya from the analysis of gravity anomalies and flexural models of the lithosphere. Journal of geophysical research 88, 8171–8191.

MacDonald, A. S. and Barr, S. M. (1978). Tectonic significance of a Late Carboniferous volcanic arc in northern Thailand. Geology and mineral resources of S.E. Asia: GEOSEA III (ed. Prinya Nutalaya), 151–6, Asian Institute of Technology, Bangkok.

MacDonald, A. S. and Barr, S. M. (1984). The Nan River mafic-ultramafic belt, northern Thailand: geochemistry and tectonic significance. *Geological Society of Malaysia Bulletin* 17, 209–224.

MacDonald, S. (1967). The geology and mineral resources of north Kelantan and north Trengganu. Geological survey of West Malaysia district memoir 10.

Mah Weng Hong (1972). The geology of the area southeast of Endau, Johore, Malaysia. Unpublished BSc thesis, University of Malaya, Kuala Lumpur.

Malaysia (1973). *Geological map of West Malaysia, 1:500,000* (2 sheets). Geological Survey of Malaysia, Ipoh.

Malaysia (1984). *Fifth regional congress on geology, mineral and energy resources of S.E. Asia*: GEOSEA V, Abstracts of Papers. Geological Society of Malaysia, Kuala Lumpur.

Malod, J. A. and Kemal, B. M. (1996). The Sumatra margin: oblique subduction and later displacement of the accretionary prism. Hall, R. and Blundell, D. (eds.) *Tectonic Evolution of Southeast Asia*. Geological Society of London, special publication 106, 19–28.

Maluski, H., Proust, F., and Xiao Xuchang (1984). Âge du magmatism calco-analcin Transhimalayen du Tibet méridional, premiers résultats obtenus par la méthode $^{39}Ar$-$^{40}Ar$. Mission Franco-Chinoise au Tibet 1980 (ed. J. L. Mercier and Li Guangcen), pp. 335–339. Éditions du Centre National de la recherche scientifique, Paris.

Mammericks, J., Fisher, R. L., Emmel, F. J., and Smith, S. M. (1977). *Bathymetry of the East and Southeast Asian seas*. Geological Society of America map MC-17.

Maranate, S. and Vella, P. (1986). Paleomagnetism of the Khorat Group, Mesozoic, Northeast Thailand. *Journal of Southeast Asian Earth Sciences* 1, 23–31.

Marauchi, S., et al. (1973). Structure of the Sulu Sea and the Celebes Sea. *Journal of Geophysical Research* 78, 3437–3447.

Marks, E., Sujatmiko, Samuel, L., Dhanutirto, H., Ismoyowati, T., and Sidik, B. B. (1982). Cenozoic stratigraphic nomenclature in East Kutai Basin, Kalimantan. *Proceedings of the Indonesian Petroleum Association* 11th annual convention, Jakarta, 147–179.

Martin, M. and Ingavat, R. (1982). First record of an Upper Triassic Ceratodontid (*Dipnoi Ceratodontiformes*) in Thailand and its palaeogeographic significance. *Geobios* 15, 111–114.

Mascle, A. and Biscarrat, P. A. (1979). The Sulu Sea: a marginal basin in Southeast Asia. Geological and geophysical investigations of continental margins, *American association of petroleum Geologists* memoirs 29 (ed. J. S. Watkins, L. Montadert, and P. J. Dickerson), pp. 373–381.

Mattauer, M., et al. (1985). Tectonics of the Qinling Belt: build-up and evolution of eastern Asia. *Nature* 317, 496–500.

Maung Thein (1973). A preliminary synthesis of the geological evolution of Burma with reference to the tectonic development of Southeast Asia. *Geological Society of Malaysia Bulletin* 6, 87–116.

Maung Thein and Ba Than Haq (1969). The pre-Paleozoic and Paleozoic Stratigraphy of Burma: a brief review. *Union of Burma Journal of Science and Technology, Rangoon* 2, 275–287.

Mazlan b. Hj. M. (1999a). North Luconia Province. *The Petroleum Geology and Resources of Malaysia.* Petroliam Nasional Berhad (Petronas), Kuala Lumpur, chapter 19, 443–454.

Mazlan b. Hj. M. (1999b). Geological Setting of Sarawak. *The Petroleum Geology and Resources of Malaysia*. Petroliam Nasional Berhad (Petronas), 275–290.

Mazlan, b. Hj. Madon and Abolins, P. (1999) Balingian Province. *The Petroleum Geology and Resources of Malaysia*. Petroliam Nasional Berhad (PETRONAS), Kuala Lumpur, 345–367.

Mazlan, b. Hj. Madon, Abolins, P., Mohammad Jamaal b. Hoesni, and Mansor b. Ahmad. (1999). Malay Basin. Chapter 8 in *The Petroleum Geology and Resources of Malaysia*. Petroliam Nasional Berhad (PETRONAS), Kuala Lumpur, 173–*217*.

Mazlan b. Hj. Madon and Azlina Anuar. (1999) Penyu Basin. Chapter 9 in *The Petroleum Geology* *and Resources of Malaysia*. Petroliam Nasional Berhad (PETRONAS), Kuala Lumpur, 221–233.

Mazlan b. Hj. Madon, Leong K. M. and Azlina Anuar (1999). Sabah Basin. Chapter 22 in *The Petroleum Geology and Resources of Malaysia*. Petroliam Nasional Berhad (PETRONAS), Kuala Lumpur, 501–542.

Mazlan b. Hj. Madon and Mansor b. Ahmad (1999) Basins in the Straits of Melaka. Chapter 10 in *The Petroleum Geology and Resources of Malaysia*. Petroliam Nasional Berhad (PETRONAS), Kuala Lumpur, 237–249.

Mazlan, b. Hj. Madon and Redzuan b. Abu Hassan. (1999) West Luconia Province. Chapter 18 in *The Petroleum Geology and Resources of Malaysia*. Petroliam Nasional Berhad (PETRONAS), Kuala Lumpur, 429–439.

McCabe, R., Almasco, J., and Diegor, W. (1982). Geologic and paleomagnetic evidence for a possible Miocene collision in western Panay, central Philippines. *Palaeomagnetic research in Southeast and East Asia* C.C.O.P./TP 13, 76–86.

McCaffrey, R., Silver, E. A., and Raitt, R. W. (1980). Crustal structure of the Molucca Sea collision zone, Indonesia. The tectonic and geologic evolution of Southeast Asian seas and islands, *Geophysical monograph* 23 (ed. D. E. Hayes), 161–77, American Geophysical Union, Washington.

McElhinny, M. W. and Embleton, B. J. J. (1976). Precambrian and early Paleozoic paleomagnetism in Australia. *Philosophical Transactions of the Royal Society*, series A 280, 419–430.

McElhinny, M. W., Embleton, B. J., Ma, X. H., and Zhang, Z. K. (1981). Fragmentation of Asia in the Permian. *Nature* **293**, 212–216.

McElhinny, M. W., Giddings, J. W., and Embleton, B. J. J. (1974a). Paleomagnetic results and Late Precambrian glaciations. *Nature* **248**, 557–561.

McElhinny, M. W., Haile, N. S., and Crawford, A. S. (1974b). Palaeomagnetic evidence shows Malay Peninsula was not part of Gondwanaland. *Nature* 252, 641–645.

McFadden, P. L., Ma, X. H., McElhinny, M. W. and Zhang, Z. K. (1988). Permo–Triassic magnetostratigraphy in China: northern Tarim. *Earth and Planetary Science Letters,* 87, 152–160.

McKenzie, D. P. (1978). Some remarks on the development of sedimentary basins. *Earth and planetary science letters*, 40, 25–32.

McWilliams, M. T. (1977). Late Precambrian paleomagnetism of Australia and Africa. *Unpublished PhD thesis,* Australian National University Canberra.

Mehra, P. K. (1980). Tectonic significance of the young mineral dates and the rates of cooling and uplift in the Himalaya. *Tectonophysics* **62**, 205–217.

Mercier, J. L., et al. (1984). La collision Indie–Asie coté Tibet. *Mission Franco-Chinoise au Tibet 1980* (ed. J. L. Mercier and Li Guangcen), 1–13, Éditions du centre national de la recherche scientifique, Paris.

Mertosono, S. and Nayoan, G. A. S. (1975). The Tertiary basinal area of central Sumatra. *Proceedings of the Indonesian petroleum association* third convention, Jakarta, June, 1974, 63–76.

Metcalfe, I. (1979). Carboniferous conodonts from Perak, Malaysia. *Newsletter of the Geological Society Malaysia* 5, 35–39.

Metcalfe, I. (1981a). Permian and Early Triassic conodonts from northwest Peninsular Malaysia. *Geological Society of Malaysia Bulletin* 14, 119–126.

Metcalfe, I. (1981b). A Late Wolfcampian (Early Permian) conodont fauna from Perak, Peninsular Malaysia. *Newsletter of the Geological Society of Malaysia* 7, 76–79.

Metcalfe, I. (1983a). Southeast Asia. *The Carboniferous of the world: I China, Korea, Japan and S.E. Asia*, I.U.G.S. publication 16 (ed. Carlos Martinez Diaz), 213–43, Instit. geol. y minero., Spain.

Metcalfe, I. (1983b). conodont faunas, age and correlation of the Alas Formation (Carboniferous), Sumatra. *Geological magazine* 120, 579–586.

Metcalfe, I. (1983c). Devonian conodonts from Batu Gajah, Perak, Peninsular Malaysia. *Newsletter of the geological society Malaysia* 9, 152–154.

Metcalfe, I. (1984a). Stratigraphy, palaeontology and palaeography of the Carboniferous of Southeast Asia. Mémoire de la Societé géologique de France 147, 107–118.

Metcalfe, I. (1984b). The Permian–Triassic boundary in northwest Malaya. *Geological Society of Malaysia newsletter* 10 (4), 139–147.

Metcalfe, I. (1986). Late Palaeozoic palaeogeography of Southeast Asia: some stratigraphical, palaeontological and palaeomagnetic constraints. *Geological society of Malaysia bulletin* 19,153–64.

Metcalfe, I. (1988). Origin and assembly of Southeast Asian continental terranes. In Gondwana and Tethys (ed. M. G. Audley-Charles and A. Hallam), *Geological Society of London special publication*, 37, 101–118.

Metcalfe, I. (1990). Stratigraphic and tectonic implications of Triassic conodonts from northwest

Peninsular Malaysia. *Geological Magazine*, 127, 567–578.

Metcalfe, I. (1996). Pre-Cretaceous evolution of SE Asian terranes. Hall, R. and Blundell, D. (eds.), Tectonic evolution of Southeast Asia. *Geological Society of London Special Publication* 106, 97–122.

Metcalfe, I. (2000). The Bentong–Raub Suture Zone. *Journal of Asian Earth Sciences*, 18, 691–712.

Metcalfe, I., Idris, M., and Tan, J. T. (1980). Stratigraphy and paleontology of the Carboniferous sediments in the Panching area, Pahang, West Malaysia. *Geological society of Malaysia bulletin* 13, 1–26.

Metcalfe, I., Koike, T., Rafek, M. B., and Haile, N. S. (1979). Triassic conodonts from Sumatra. *Palaeontology* 22, 737–46.

Metcalfe, I., Sivam, S. P., and Stauffer, P. H. (1982). Stratigraphy and sedimentology of Middle Triassic rocks exposed near Lanchang, Pahang, Peninsular Malaysia. *Geological society of Malaysia bulletin* 15, 19–30.

Meyerhoff, A. A. and Willums, J. D. (1976). Petroleum geology and industry of the People's Republic of China. *United Nations ESCAP, C.C.O.P. technical bulletin* 10, 103–212.

Mitchell, A. H. G. (1977). Tectonic settings for emplacement of Southeast Asian tin granites. Geological society of Malaysia bulletin 9, 123–40.

Mitchell, A. H. G. (1979). Rift-, subduction- and collision-related tin belts. Geological society of Malaysia bulletin 11, 81–102.

Mitchell, A. H. G. (1981). Phanerozoic plate boundaries in mainland S.E. Asia, the Himalayas and Tibet. *Journal of the geological society London* 138, 109–122.

Mitchell, A. H. G. (1984). Post-Permian events in the Zangbo 'suture' zone, Tibet. *Journal of the geological society London* 141, 129–36.

Mitchell, A. H. G. (1989). The Shan Plateau and western Burma: Mesozoic Plate boundaries and correlation with Tibet. *Tectonic evolution of the Tethyan regions*, NATO ASI series, (ed. A. M. C. Şengör), Kluwer Academic Publishers, Dordrecht, Boston, London, 567–583.

Mitchell, A. H. G., Hernandez, F., and Dela Cruz, A. P. (1986). Cenozoic evolution of the Philippine Archipelago. *Journal of Southeast Asian Earth Sciences* 1, 3–22.

Mitchell, A. H. G. and Leach, T. M. (1991). *Epithermal gold in the Philippines: island arc metallogenesis, geothermal systems and geology*. Academic Press, London, 457p.

Mitchell, A. H. G., Marshall, T. R., Skinner, A. C., Baker, M. D., Amos, B. J., and Bateson, J. H. (1977). Geology and exploration geochemistry of the Yadanatheingi and Kyaukme-Longtawkno area, northern Shan states, Burma. *Overseas geology and mineral resources* 51.

Mitchell, A. H. G. and McKerrow, W. S. (1975). Analogous evolution of the Burma orogen and the Scottish Caledonides. *Bulletin of the geological society of America* 86, 305–315.

Mohammad Daud Hashim (1986), Structural geology of Tanjong Siang, Tanjong Balau and Tanjong Lompat, east of Johore, Malaysia. Unpublished BSc thesis, University of Malaya, Kuala Lumpur.

Mohammad Yamin b. Ali and Abolins, P. (1999) Central Luconia Province. *The Petroleum Geology and Resources of Malaysia*. Petroliam Nasional Berhad (PETRONAS), Kuala Lumpur, 371–392.

Mohd Idrus, b. I., Abdul R. E., Abdul Manaf, M., Sahalan A. A. & Mahendran, B. (1995). The geology of Sarawak deepwater and surrounding areas. *Proceedings of the AAPG-GSM International Conference 1994,* Bulletin of the Geological Society of Malaysia, 37. 165–178.

Molnar, P. and Tapponnier, P. (1975). Cenozoic tectonics of Asia: effects of a continental collision. *Science* 189, 419–426.

Moore, G. F., Curray, J. R., Moore, D. G., and Karig, D. E. (1980). Variations in geologic structure along the Sunda fore-arc, northeastern Indian Ocean. The tectonic and geologic evolution of Southeast Asian seas and islands, *Geophysical monograph* 23 (ed. D. E. Hayes), pp. 145–160. Geophysical Union, Washington.

Moore, G. F. and Karig, D. E. (1980). Structural geology of Nias island, Indonesia: implications for subduction and tectonics. *American Journal of Science* 280, 193–223.

Moore, G. F. and Silver, E. A. (1983). Collision processes in the northern Molucca Sea. The tectonic and geologic evolution of Southeast Asian seas and islands, part 2, *Geophysical monograph* 27 (ed. D. E. Hayes), pp. 360–72. American Geophysical Union, Washington.

Morgunov, Y. G. (1970). Basic features of tectonics of north Vietnam. *International geology review* 12, 1333–1345.

Morley, C. K. (2002). A tectonic model for the Tertiary evolution of strike-slip faults and rift basins in SE Asia. *Tectonophysics*, 347, 189–215.

Morley, C. K. (2007). Variations in Late Cenozoic–Recent strike-slip and oblique-extensional geometries within Indochina: the influence of pre-existing fabrics. *Journal of Structural Geology*, 29, 36–58.

Morris, J. D., Jezek, P. A., Hart, S. R., and Gill, J. B. (1983). The Halmahera island arc, Molucca Sea collision zone, Indonesia: a geochemical survey. The tectonic and geologic evolution of Southeast Asian seas and islands, part 2. *Geophysical monograph* **27** (ed. D. E. Hayes), pp. 373–87. American Geophysical Union, Washington.

Moss, S. J. (1998) Embaluh Group turbidites in Kalimantan: evolution of a remnant oceanic basin in Borneo during the Late Cretaceous and Palaeogene. *Journal of the Geological Society of London*, **155**, 509–524.

Murphy, R. W. (1975). Tertiary basins of Southeast Asia. *Southeast Asia petroleum exploration society proceedings* **2**, 1–36.

Myint Lwin Thein (1973). The Lower Paleozoic stratigraphy of western part of the southern Shan State, Burma. *Geological society of Malaysia bulletin* **6**, 143–163.

Nakapungrat, S. (1982). Geochronology and geochemistry of the Thong Lang granite complex, Central Thailand. *unpublished Ph.D. thesis, University of London*, 336p.

Neumann van Padang, M. (1951). *Catalogue of the active volcanoes of the world including solfatara fields*, part **I**, Indonesia. International Volcanology Association, Naples.

Neumann van Padang, M. (1953). *Catalogue of the active volcanoes of the world including solfatara fields*, part **II**, Philippine islands and Cochin China. International Volcanological Association, Naples.

Newton-Smith, J. (1967). Bidu-Bidu Hills area, Sabah, East Malaysia. *Geological survey of Malaysia Report* 4, Kuching.

Nguyen Thanh Giang (1982). Palaeomagnetic studies of Cenozoic basalts in Vietnam. *Palaeomagnetic Research in Southeast and East Asia*, C.C.O.P./TP **13**, 58–63.

Nguyen Vatt Phuc (1981). Graptolite faunas in Vietnam. *Proceedings of the fourth regional conference on the geology of Southeast Asia*, pp. 347–354. Geological society of the Philippines, Manila.

Nichols, G. and Hall, R. (1999). History of the Celebes Sea Basin based on its stratigraphic and sedimentological record. *Journal of Asian Earth Sciences*, 17 (1), 47–59.

Nichols, G. and Uttamo, W. (2005). Sedimentation in a humid, interior, extensional basin: the Cenozoic Li Basin, northern Thailand. *Journal of the Geological Society of London*, **162**, 333–347.

Nicolas, A., et al. (1981). The Xigaze ophio*lite* (Tibet): a peculiar oceanic lithosphere. *Nature* **294**, 414–417.

Ninkovich, D. (1976). Late Cenozoic clockwise rotation of Sumatra. *Earth and Planetary science letters* 29, 269–75.

Ninkovich, D., Shackelton, N. J., Abel-Monem, A. A., Obradovich, J. D., and Izett, G. (1978). K:Ar age of the Late Pleistocene eruption of Toba, north Sumatra. Nature **276**, 574–577.

Nishimura, S., Abe, E., Yokoyama, T., Sugiyarta, and Dharma, A. (1978a). Danau Toba—the outline of Lake Toba, north Sumatera, Indonesia. Studies of physical geology on the Sunda island arc (ed. S. Sasajima), pp. 54–62. University Press, Kyoto.

Nishimura, S., Sasajima, S., Hirooka, K., Thio, K. H., and Hehuwat, F. (1978b). Radiometric ages of volcanic products in Sunda arc. Studies of physical geology on the Sunda island arc (ed. S. Sasajima), 34–37, University Press, Kyoto.

Nishimura, S. and Suparka, S. (1986). Tectonic development of east Indonesia. Journal of Southeast Asian Earth Sciences **1**, 45–57.

Nishimura, S., et al. (1981). Physical geology of the Sumba, Sumbawa and Flores islands. The geology and tectonics of eastern Indonesia, Geological research and development centre, Bandung, Special Publication **2** (ed. A. J. Barber and S. Wiryosujono), pp. 105–113.

Nissen, S. S.; Hayes, D. E.; Buhl, P.; Diebold, J.; Bochu, Y., Weijun, Z. & Yongqin, C. (1995). Deep penetration seismic soundings across the northern margin of the South China Sea. *Journ. of Geophysical Research*, **100** (B11), 22407–22433.

Nur, A. and Ben Avraham, Zvi (1977). Lost Pacifica continent. Nature **270**, 41–43.

Nutalaya, Prinya (ed.) (1978). Geology and mineral resources of Southeast Asia: GEOSEA III. Asian Institute of Technology, Bangkok.

Nutalaya Prinya (ed.) (1983). Stratigraphic correlation of Thailand and Malaysia **1**, technical papers. Geological Society of Thailand, Bangkok/Geological Society of Malaysia, Kuala Lumpur.

Nutalaya Prinya, Petchvarun, V., and Saengsuwan, C. (1978). Bibliography of geology and mineral resources of Thailand (Thai language). Prinya Nutalaya (ed.), Geology and mineral resources of

Southeast Asia (ed. Prinya Nutalaya), 823–843, Asian Institute of Technology, Bangkok.

Nutalaya Prinya and Rau, J. L. (1981). Bangkok: the sinking metropolis. Episodes **4**, 3–8.

Oba, N., Tomita, K., Yamamoto, M., Istidjab, M., Sudradjat, A., and Suhanda, T. (1986). Geological significance of granitic fragments found in pumice flow 1883 eruption at the Krakatau Group, Indonesia. Geological society of Malaysia bulletin **19**, 51–68.

Opdyke, N. D., Huang, K., Xu, G., Zhang, W. Y., and Kent, D. V. (1986). Paleomagnetic results from the Triassic of the Yangtze Platform. *Journal of Geophysical Research*, **91**, 9553–9568.

O'Sullivan, T., Pegum, D., and Tarigan, J. (1985). Seram oil search, past discoveries and future oil potential. Proceedings of the Indonesian Petroleum Association **14**th annual convention, Jakarta **1**, 3–20.

Otofuji, Y., Sasajima, S., Nishimura, S., Dharma, A., and Hehuwat, F. (1982). Paleomagnetic evidence for clockwise rotation of the northern arm of Sulawesi, Indonesia. (abstract). C.C.O.P. paleomagnetism workshop, Kuala Lumpur, March 1982.

Ozawa, T. (1976). Late Viséan Eostaffella (Fusulinian Foraminifers) from West Malaysia. Geology and palaeontology of S.E. Asia **17** (ed. T. Kobayashi et al.), 117–128.

Ozima, M., Kaneoka, I. and Ujiee, H. (1977). $^{40}$Ar:$^{39}$Ar age of rocks, and the development mode of the Philippine Sea. Nature **267**, 816–818.

Packam, G. H. (1990). Plate motions and Southeast Asia: some tectonic consequences for basin development. *SEAPEX Proceedings*, Singapore, **9**, 55–68.

Packham, G. H. (1993). Plate tectonics and development of sedimentary basins of the dextral regime in western Southeast Asia. *Journal of Southeast Asian Earth Sciences*, 8, 497–511.

Page, B. G. N., et al. (1979). A review of the main structural and magmatic features of northern Sumatra. Journal of the geological society London **136**, 569–79.

Page, B. N. and Suppe, J. (1981). The Pliocene Lichi mélange of Taiwan: its plate-tectonic and olistrostromal. origin. American Journal of Science **281**, 193–227.

Page, R. W. (1976). Geochronology of igneous and metamorphic rocks in the New Guinea highlands. Geology and geophysics bulletin **162**.

Parker, E. S. and Gealey, W. K. (1985). Plate tectonic evolution of the western Pacific–Indian Ocean region. Energy **10**, 249–61.

Parsons, B. and Sclater, J. G. (1977). An analysis of the variation of ocean floor bathymetry and heat flow with age. Journal of Geophysical Research **82,** 803–827.

Pascoe, E. H., Sir (1950). A manual of the geology of India and Burma, **1**, third edn. Government of India Press, Calcutta.

Pascoe, E. H., Sir (1959). A manual of the geology of India and Burma, **2**, third edn. Government of India Press, Calcutta.

Pascoe, E. H., Sir (1964). A manual of the geology of India and Burma, **3**, third edn. Government of India Press, Calcutta.

Paul, D. D. and Lian, H. M. (1975). Offshore Tertiary basins of Southeast Asia, Bay of Bengal to South China Sea. Ninth World petroleum congress proceedings 3, Exploration and transportation, 107–21, Applied Science Publishers, London.

Pautot, G., et al. (1986). Spreading direction in the central South China Sea. Nature **321**, 150–154.

Pearce, J. A., Harris, N. G. W., and Tindle, A. G. (1984). Trace element discrimination diagrams for the tectonic interpretation of granitic rocks. Journal of Petrology 25, 956–983.

Peccerillo, A. and Taylor, S. R. (1976). Geochemistry of Eocene calc-alkaline volcanic rocks from the Kastamonu area, northern Turkey. Contributions to mineralogy and petrology 58, 63–81.

Petiton, A. (1895). Géologie de L'Indochine. Imprimerie Nationale, Paris.

PETRONAS (1999). *The Petroleum Geology and Resources of Malaysia.* Petroliam Nasional Berhad (Petronas), Kuala Lumpur, 665p.

Pham Dinh Long (1981). An attempt at Devonian stratigraphic division of northeastern Vietnam. Proceedings of the fourth regional conference on the geology of Southeast Asia, 371–375, Geological Society of the Philippines, Manila.

Phan Cu Tien (1981). The limits of the natural division in the Late Paleozoic in north Vietnam. *Proceedings of the fourth regional conference on the geology of Southeast Asia*, 377–381, Geological Society of the Philippines, Manila.

Philippines (1981). *Proceedings, fourth regional conference on the geology of Southeast Asia.* Geological society of the Philippines, Manila.

Pichamuthu, C. S. (1967). The Precambrian of India. *The Precambrian*, **3** (ed. K. Rankama), 1–96, John Wiley-Interscience, New York.

Pichamuthu, C. S. (1974). On the banded iron formations of Precambrian age in India. *Journal of the geological society India* 17, 1–16.

Pigram, C. J., Challinor, A. B., Hasibuam, F., Rusmana, E., and Hartono, U. (1982a). Lithostratigraphy of the Misool Archipelago, Irian Jaya, Indonesia. Geologie en mijnbouw **61**, 265–79.

Pigram, C. J. and Panggabean, H. (1984). Rifting of the northern margin of the Australian continent and the origin of some microcontinents in eastern Indonesia. Tectonophysics **107**, 331–353.

Pigram, C. J., Robinson, G. P., and Tobing, S. L. (1982b). Late Cainozoic origin for the Bintuni Basin and adjacent Lengguru fold belt, Irian Jaya. *Proceedings of the Indonesian Petroleum Association* 11th annual convention, Jakarta, 109–126.

Pimm, A. C. (1965). Serian area, west Sarawak, Malaysia. *Geological survey of the Borneo Region Malaysia report* **3**.

Pimm, A. C. (1967). Bau mining district, west Sarawak, East Malaysia. Part II: Kronkong. *Geological survey of the Borneo Region Malaysia bulletin* 7.

Piyasin, S. (1975). Review of the Ratburi Group. *Proceedings of the conference on the geology of Thailand, Special publication* 1(1), 65–100, Department of Geological Sciences, Chiang Mai University.

Posavec, M., Taylor, D., Van Leeuwen, T., and Spector, A. (1973). Tectonic controls of volcanism and complex movements along the Sumatran Fault System. Geological society of Malaysia bulletin **6**, 43–60.

Posewitz, T. (1892). *Borneo: its geology and mineral resources*. Verbreitung der Nutzbaren Mineralien, Berlin. (Translated by F. H. Hatch.)

Powell, C. McA. (1979). A speculative tectonic history of Pakistan and surroundings: some constraints from the Indian Ocean. Geodynamics of Pakistan (ed. A. Farah and K. De Jong), 5–24, Geological Survey of Pakistan, Quetta.

Powell, D. E. (1976). The geological evolution of the continental margin off northwest Australia. Australian petroleum exploration association Journal **16**, 13–23.

Powell, D. E. and Mills, S. J. (1978). Geological evolution and hydrocarbon prospects of contrasting continental margin types, southwest (sic!) Australia [should be northwest]. Regional conference on the geology and mineral resources of S.E. Asia (ed. S. Wiryosujono and A. Sudradjat), 77–101, Indonesian association of geologists, Jakarta.

Pozzi, J. P., Westphal, M., Zhou, Y. X., Xing, L. S., and Chen, X. X. (1982). Position of the Lhasa Block, south Tibet, during the Late Cretaceous. *Nature* **297**, 319–321.

Pratt, W. E. (1916). Occurrence of petroleum in the Philippines. *Economic geology* **11**, 246–264.

Priem, H. N. A., et al. (1978). Isotopic evidence for a Middle to Late Pliocene age of the cordierite granite on Ambon, Indonesia. *Geologie en mijnbouw* 57, 441–443.

Priem, H. N. A., Boelrijk, N. A. I. M., Bon, E. H., Hebeda, E. H., Verdurman, E. A. T., and Verschure, R. H. (1975). Isotope geochronology in the Indonesian tin belt. *Geologie en mijnbouw* 54, 61–70.

Prouteau, G., Maury, R. C., Pubellier, M., Cotton, J. and Bellon, H. (2001). Le magmatisme post-collisional du Nord-Ouest de Bornéo, produit de la fusion d'un fragment de croûte océanique ancré dans le manteau supérieur. *Bulletin Societé Géologique de France*, 172 (3), 319–332.

Pubellier, M., Rangin, C., Le Pichon, X. and DOTSEA working group. (2005). DOTSEA: a synthesis of deep marine data in Southeast Asia. *Mémoire de la Société géologique de France*, n.s., 176

Pupilli, M. (1973). Geological evolution of South China Sea area, tentative reconstruction from borderland geology and well data. *Proceedings of the Indonesian petroleum association* 2nd annual convention, Jakarta, June, 223–241.

Raj, J. K. (1982). A reappraisal of the Bok Bak fault zone. *Newsletter of the geological society of Malaysia* **8**, 35–41.

Raj, J. K. (1983). Negative lineaments in the granitic bedrock areas of N. W. Peninsular Malaysia. *Geological society of Malaysia bulletin* **16**, 61–70.

Rajah, S. S. (1969). Younger Mesozoic sedimentary rocks, state of Johore, West Malaysia. *Bulletin of the American Association of Petroleum geologists* 53, 2187–2189.

Rajah, S. S. (1987a). Geology and mineral resources of the Gunung Belumut area, Johore, Peninsular Malaysia. *Geological survey of Malaysia, district memoir* **19**.

Rajah, S. S. (1987b). Geology and mineral resources of the Ulu Lebir area, Trengganu. *Geological survey of Malaysia, Map bulletin* **6**.

Rajah, S. S. and Yin, E. H. (1980). Summary of the geology of the Central Belt, Peninsular Malaysia. *Geology and palaeontology of S.E. Asia* **21** (ed. T. Kobayashi et al.), 319–342.

Raju, A. T. R. (1968) Geological evolution of Assam and Cambay Tertiary basins of India. American Association of Petroleum geologists **52**, 2422–2437.

Rangin, C. (1989). The Sulu Sea, a back-arc basin setting within a Neogene collision zone. *Tectonophysics*, 161, 119–141.

Rangin, C., Bellon, H., Bernard, F., Letouzey, J., Muller, C. and Sanudin, T. (1990). Neogene arc-continent collision in Sabah, northern Borneo (Malaysia). Geodynamic evolution of the Eurasian margin (I. Angelier, ed.) *Tectonophysics*, 183, 305–319.

Rangin, C., Klein, M., Roques, D., Le Pichon, X., Trong, Le Van (1995). The Red River fault system in Tonkin Gulf, Vietnam. *Tectonophysics*, 243 (3–4), 209–222.

Ranneft, T. S. M. (1979). Segmentation of island arcs and application to petroleum geology. *Journal of petroleum geology* 1, 35–53.

Rao, P. C. (1984). Sedimentology of some Permo–Triassic carbonates of Malaysia. *Geological society of Malaysia*: GEOSEA V, abstracts of papers, p. 28.

Rao, Y. S. N. (1980). Geology of the eastern margin of the Indian subcontinent. *Proceedings of the Southeast Asia petroleum exploration society*, Singapore 5, 161–78.

Ray, D. K. (1982). *Tectonic map of South and East Asia*: I:5,000,000. Commission for Geological Map of the World, Paris.

Réhault, J. P., Malod, J. A., Larue, M., Burhanuddin, S. and Sarmili, L. (1991). A new sketch of the central North Banda Sea, Eastern Indonesia. *Journal of Southeast Asian Earth Sciences*, 6, 329–334.

Réhault, J. P., Villeneuve, M., Honthaas, C., Bellon, H., Malod, J. A., Cornee, J. J., Butterlin, J., Sarmili, L. and Burhanuddin, S. (1995). New geological samplings along a transect across the south east Banda Sea Basin (Indonesia). *Tectonic evolution of S.E. Asia*. Dec. meeting Abstract volume Geological Society of London, p. 49.

Reinhard, M. and Wenk, E. (1951). Geology of the colony of North Borneo. *Geological survey department for the British territories in Borneo bulletin* 1.

Republic of Singapore (1976). *Geology of the Republic of Singapore*. Public Works Department, Singapore.

Reynolds, C. D., Havryluk, I., Bastaman, S., and Atmowidjojo, S. (1973). The exploration of the nickel laterite deposits in Irian Barat, Indonesia. *Geological society of Malaysia bulletin* 6, 309–323.

Rice-Oxley. E. D. (1991). Palaeoenvironments of the Lower Miocene to Pliocene sediments in offshore N. W. Sabah area. *Geological Society of Malaysia Bulletin*, 28, 165–194.

Richardson, A. N. and Blundell, D. J. (1996). Continental collision in the Banda arc. Hall, R. and Blundell, D. (eds.) *Tectonic evolution of Southeast Asia*. Geological Society of London, special publication 106, 47–60.

Richardson, J. A. (1939). The geology and mineral resources of the neighbourhood of Raub, Pahang, Federated Malay States, with an account of the geology of the Raub Australian Gold Mine. *Geological survey department memoir* 3.

Ridd, M. F. (1971). Southeast Asia as part of Gondwanaland. Nature 234, 531–533.

Ridd, M. F. (1978). Thailand. *The Phanerozoic geology of the world*, II, The Mesozoic (ed. M. Moullande and A. E. M. Nairn), pp. 145–63. Elsevier, Amsterdam.

Ridd, M. F. (1980). Possible Palaeozoic drift of SE Asia and Triassic collision with China. *Journal of the geological society London* 137, 635–640.

Rigby, J. F. and Shah, S. C. (1981). The flora from the Permian nonmarine sequences in India and Australia: a comparison. *Gondwana Five* (ed. M. W. Crosswell and P. Vella), 39–41, A. A. Balkema, Rotterdam.

Rijks, E. J. H. (1981). Baram Delta geology and hydrocarbon occurrence. *Geological society of Malaysia bulletin* 14, 1–18.

Rishworth, D. E. H. (1974). The Upper Mesozoic terrigenous Gagau Group of Peninsular Malaysia. *Geological survey of Malaysia special paper* 1.

Robertson Research (1975). *Burma—an appraisal of mineral resources* 1, report, 2, atlas. Robertson Research (Australia) Pty. Ltd.

Robertson Research (1977). Burma, 1:2,000,000, Southeast Asia geological map series. Robertson Research International, United Kingdom.

Robinson, K. (open file). The Tertiary development of Borneo. U.S. geological survey.

Rock, N. M. S., Syah, H. H., Davis, A. E., Hutchison, D., Styles, M. T., and Rahayu, Lena (1982). Permian to Recent volcanism in northern Sumatra, Indonesia: a preliminary study of its distribution, chemistry and peculiarities. *Bulletin of volcanology* 45, 127–152.

Roger, F., Leloup, P. H., Jolivet, M., Lacassin, R., Trinh, P. T., Brunel, M., Seward, D. (2000). Long and complex thermal history of the Song Chay metamorphic dome (Northern Vietnam) by multi-system geochronology. *Tectonophysics*, 321 (4), 449–466.

Rose, R. (1983). Miocene carbonate rocks of Sibolga basin, Northwest Sumatra. *Proceedings of the*

*Indonesian Petroleum Association* 12th annual convention, Jakarta, 107–125.

Rose, R. and Hartono, P. (1978). Geological evolution of the Tertiary Kutei–Melawi basin, Kalimantan, Indonesia. *Proceedings of the annual convention of the Indonesian petroleum association*, 7th, Jakarta, 225–237.

Ru, Ke and Pigott, J. D. (1986). Episodic rifting and subsidence in the South China Sea. *American Association of Petroleum Geologists Bulletin* 70, 1136–1155.

Rutherford, K. J. and Qureshi, M. K. (1981). *Geothermal gradient map of Southeast Asia*, 2nd edn. Southeast Asia petroleum exploration society, Singapore/Indonesian petroleum association, Jakarta.

Rutland, R. W. R. (1968). A tectonic study of the Philippine Fault zone. *Quarterly Journal of the geological society London* 123, 293–325.

Rutten, L. M. R. (1927). *Voordrachten over de geologie van nederlandsch oost-Indie.* Bij J. B. Wolters U. M. Groningen, Den Haag.

Rutten, L. M. R. (1932). *De geologie van nederlandsch Indie.* N. V. Boek en Uitgevers-Mij. v/h W. P. van Stockum and Zoon, Den Haag.

Rutten, M. G. (1940). On Devonian limestones with *Clathrodictyon* cf. *spatiosum* and *Heliolites porosus* from eastern Borneo. *Nederlandsche Akademie van wetenschappen Proceedings* 43, 3–6.

Rutter, O. (1922). British North Borneo. *An account of its history, resources and native tribes.* Constable and Co., London.

Ryall, P. J. C. (1982). Some thoughts on the crustal structure of Peninsular Malaysia—results of a gravity traverse. *Geological society of Malaysia bulletin* 15, 9–18.

Ryall, P. J. C. and Beattie, D. (1996). A gravity high in Darvel Bay. *Geological Society of Malaysia Bulletin*, 39, 113–122.

Salun, S. A., Gatinsky, Y. G., and Stroganova, S. A. (1974). Experiment in characterization of synclinal suture zones, as in certain structures in East Asia. *International geology review* 17, 1266–1274.

Sandal, S. T. (ed.) (1996). *The geology and hydrocarbon resources of Negara Brunei Darussalam.* Brunei Shell Petroleum Company, Seria; and Brunei Museum, Bandar Sri Begawan. 243p.

Sanderson, G. A. (1966). Presence of Carboniferous in west Sarawak. *American association of petroleum Geologists bulletin* 50, 578–80.

Sano, S. (1978). Gravity anomalies associated with island arcs. *Geology and mineral resources of S.E. Asia* (ed. Prinya Nutalaya), pp. 173–176. Asian Institute of Technology, Bangkok.

Sarkar, S. N., Saha, A. K., and Miller, J. A. (1969). Geochronology of Precambrian rocks of Singhbhum and adjoining regions, eastern India. Geological magazine 106, 75–84.

Sasajima, S. and Maenaka, K. (1987). A paleomagnetic aspect on the assemblage of East Asian fragmented continents. *IGCP Project 224. Pre-Jurassic geological evolution of eastern continental margin of Asia, Report* 2, 139–150.

Sasajima, S., Nishida, J., Maenaka, K., Chak, L. S., and Yokoyama, T. (1982). Paleomagnetic research of Jurassic acid igneous rocks and Cretaceous red bed in Hong Kong. C.C.O.P. palaeomagnetism conference, Kuala Lumpur, March 1982.

Sasajima, S., Otofuji, Y., Hirooka, Supraka, Suwijanto, and Hehuwat, F. (1978). Paleomagnetic studies on Sumatra island on the possibility of Sumatra being part of Gondwanaland. Rock magnetism and paleogeophysics 5, 104–110.

Sastri, V. V., Sinha, R. N., Gurcharan Singh, and Murti, K. V. S. (1973). Stratigraphy and tectonics of sedimentary basins on east coast of Peninsular India. *Bulletin of the American Association of Petroleum Geologists* 57, 655–678.

Sattayarak, N. (1983). Review of the continental Mesozoic stratigraphy of Thailand. *Stratigraphical correlation of Thailand and Malaysia* 1, technical papers, 127–148, Geological society of Thailand, Bangkok/Geological society of Malaysia, Kuala Lumpur.

Sattayarak, N., Srilulwong, S. and Pum-im, S. (1989). Petroleum potential of the Triassic pre-Khorat Intermontane basin in Northeast Thailand. *Proceedings of the International Symposium on Intermontane Basins: geology and resources.* Thanasuthipitak, T. and Ounchanum, P. (eds.), Chiang Mai University, Thailand, 43–58.

Saurin, E. (1935). Éudes géologiques sur l'Indochine du sud est (Sud Annam, Cochinchine, Cambodge-Oriental). Bulletin service géologique de L'Indochine, Hanoi 22.

Saurin, E. (1944). *Éudes géologiques sur le Centre Annam meridional.* Bulletin service géologique de L'Indochine, Hanoi 27.

Saurin, E. (1959). Les inclusions exogènes des dacites de Bien-Hoa et le substratum de la basse vallée du Donnau. Compte Rendu sommaire des séances de la société géologique de France 7, 169–70.

Savage, H. E. F. (1937). The geology of the neighbourhood of Sungei Siput, Perak, Federated Malay States, with an account of the mineral deposits.

Geological survey department Federated Malay States memoir **1**.

Saxena, S. P. and Rao, P. N. (1975). Does the Almora nappe exist? Himalayan geology 5, 169–84.

Schmidt, C. (1904). Ueber die geologie von Nordwest Borneo and eine daselbst entstandene 'Neue Insel'. Gerlands beitrage zur geophysik 7 (1).

Schmidtke, E. A., Fuller, M. D. and Haston, R. B. (1990). Paleomagnetic data from Sarawak, Malaysia (Borneo) and the Late Mesozoic and Cenozoic tectonics of Sundaland. *Tectonics*, 9, 123–140.

Schwartz, M. O., Rajah, S. S., Askury, A. K., Putthapiban, P. and Djaswadi, S. (1995). The Southeast Asian tin belt. Earth Science reviews, **38**, 95–293.

Schweller, W. J. and Karig, D. E. (1979). Constraints on the origin and emplacement of the Zambales ophiolite, Luzon, Philippines (abstract). Geological society of America abstracts with programs **11**, 512–513.

Schweller, W. J., Karig, D. E., and Bachman, S. B. (1983). Original setting and emplacement history of the Zambales ophiolite, Luzon, Philippines, from stratigraphic evidence. Hayes, D. E. (ed.) The tectonic and geologic evolution of Southeast Asian seas and islands, part 2. *Geophysical monograph* 27 (ed. D. E. Hayes), 124–38, American Geophysical Union, Washington.

Schweller, W. J., Roth, P. H., Karig, D. E., and Bachman, S. B. (1984). Sedimentation history and biostratigraphy of ophiolite-related Tertiary sediments, Luzon, Philippines. *Geological society of America bulletin* 95, 1333–1342.

Sclater, J. G. and Christie, P. A. F. (1980). Continental stretching: an explanation of the post Mid Cretaceous subsidence of the central North Sea Basin. Journal of geophysical research 85, 3711–3739.

Sclater, J. G. and Fisher, R. L. (1974). Evolution of the East Central Indian Ocean, with emphasis on the tectonic setting of the Ninetyeast Ridge. *Geological society of America Bulletin* 85, 683–702.

Scotese, C. R., Bambach, R. K., Barton, C., Van der Voo, R., and Ziegler, A. M. (1979). Paleozoic base maps. *Journal of Geology* 87, 217–277.

Scrivenor, J. B. (1928). *The geology of the Malayan ore deposits*. MacMillan Press, London.

Scrivenor, J. B. (1931). *The geology of Malaya*. MacMillan Press, London.

Searle, D. L. and Ba Than Haq (1964). The Mogok Belt of Burma and its relationship to the Himalayan orogeny. *Proceedings of the 22nd International geology congress*, Delhi **11**, 132–161.

Searle, M. P. and Stevens, R. K. (1984). Obduction processes in ancient, modern and future ophiolites. Ophiolites and oceanic lithosphere (ed. I. G. Gass, S. J. Lippard, and A. W. Shelton), 303–319, Geol. Soc. London.

Seeber, L. and Gornitz, V. (1983). River profiles along the Himalaya Arc as indicators of active tectonics. Tectonophysics 92, 335–367.

Sen, S. N. and Chattopadhyay (1978). The ophiolite belt of northeastern India and associated mineralization. *Proceedings of the third regional conference on geology and mineral resources of S.E. Asia* (ed. Prinya Nutalaya), 281–284, Asian Institute of Technology, Bangkok.

Şengör, A. M. C. (1984). The Cimmeride orogenic system and the tectonics of Eurasia. *Geological society of America special paper* **195**.

Şengör, A. M. C. (1985a). Die Alpiden and die Kimmeriden: die Verdoppelte Geschichte der Tethys. *Geologische rundschau* 74 (2), 181–113.

Şengör, A. M. C. (1985b). East Asian tectonic collage. *Nature* 318 (6041), 16–17.

Şengör, A. M. C. and Hsü, K. J. (1984). The Cimmerides of eastern Asia: history of the eastern end of the Palaeo-Tethys. Mémoire de la societé géologique de France **147**, 139–167.

Seno, T. (1977). The instantaneous rotation vector of the Philippine Sea Plate relative to the Eurasian Plate. *Tectonophysics* 42, 209–226.

Seno, T. and Kurita, K. (1978). Focal mechanisms and tectonics in the Taiwan–Philippine region. *Journal of the physics of the Earth* 26 (supplement), S249–S263.

Sethaput, V. (1956). Lexique stratigraphique international, 111, Asia, fasc. 6c: Thailand. Centre national de la récherche scientifique, Paris, 35–57.

Shackleton, R. M. (1981). Structure of southern Tibet: report on a traverse from Lhasa to Kathmandu organized by Academia Sinica. Journal of structural geology 3, 97–105.

Shi Lin, Chen Jichen, Zhang Weili, and Fan Yuchun (1988). Tectonic zoning and genetic types of tin-bearing granites in western Yunnan and their relationship with tin deposits. Tin mineralization, with emphasis on Asian deposits (ed. C. S. Hutchison), Springer-Verlag, Heidelberg, 245–252.

Shih, T. C. (1980). Marine magnetic anomalies from the western Philippine Sea: implications for the evolution of marginal basins. The tectonic and geologic evolution of Southeast Asian seas and islands, *Geophysical monograph* 23 (ed. D. E. Hayes), 49–75, American Geophysical Union, Washington.

Shipboard Scientific Party (2000). Site 1143. In Wang, P.; Prell, W. L.; Blum, P. et al. Proc. ODP, Init. Repts., **184**, 1–103. [CD-R] available from: Ocean Drilling Program, Texas A&M University, College Station, Texas 77845-9547, U.S.A.

Sikumbang, N. (1984). The geology and tectonics of the Meratus Range, Southeast Kalimantan, Indonesia. *Geological Society of Malaysia* GEOSEA V, Abstracts of Papers, 31.

Silver, E. A. et al. (1989a). Origins of marginal basins. *Nature*, **338**, 380–381.

Silver, E. A. et al. (1989b). Leg 124 researchers drill marginal basins. *Geotimes*, May **1989**, 15–17.

Silver, E. A., Gill, J. B., Schwartz, D., Prasetyo, H., and Duncan, R. A. (1985). Evidence for a submerged and displaced continental borderland, north Banda Sea, Indonesia. Geology **13**, 687–691.

Silver, E. A., McCaffrey, R., and Joyodiwiryo, Y. (1981). Gravity results and emplacement geometry of the Sulawesi ultramafic belt, Indonesia. *The geology and tectonics of eastern Indonesia*, *Special publication* 2 (ed. A. J. Barber and S. Wiryosujono), 313–19, Geological Research and Development Centre, Bandung.

Silver, E. A. and Moore, J. C. (1978). The Molucca Sea collision zone, Indonesia. *Journal of geophysical research* 83, 1681–1691.

Silver, E. A. and Moore, J. C. (1981). The Molucca Sea collision zone, Indonesia. Barber, A. J. and Wiryosujono, S. (eds.). *The geology and tectonics of eastern Indonesia*, Geol. research and development centre, Bandung, 327–340.

Silver, E. A., Reed, D., McCaffrey, R., and Joyodiwiryo, Y. (1983). Back arc thrusting in the eastern Sunda arc, Indonesia: a consequence of arc-continent collision *Journal of Geophysical Research* 88, 7429–7448.

Situmorang, B. (1976). The Makassar Trough: regional geology and hydrocarbon prospects. *C.C.O.P. proceedings of the thirteenth session*, Kuala Lumpur, ESCAP, Bangkok 306–321.

Situmorang, B., Harbury, N. A. and Audley-Charles, M. G. (1987). Tectonic inversion in the Sunda forearc: evidence from Simeulue. Indonesian Petroleum Association Proceedings, 16th annual convention, Jakarta, **1**, 57–64.

Situmorang, B. and Yulihanto, B. (1985). The role of strike slip faulting in structural development of the North Sumatra Basin. *Proceedings of the Indonesian Petroleum Association* 14th annual convention, Jakarta, 21–38.

Sivam, S. P. (1969). Quaternary alluvial deposits in the north Kinta. Valley. Unpublished MSc thesis, University of Malaya, Kuala Lumpur.

Smiley, C. J. (1970). Later Mesozoic flora from Maran, Pahang, West Malaysia: part I. geologic considerations. *Geological society of Malaysia bulletin* 3, 77–88.

Smith, A. G., Hurley, A. M., and Briden, J. C. (1981). *Phanerozoic paleocontinental world maps*. Cambridge University Press, England.

Smith, W. D. (1924). Geology and mineral resources of the Philippine islands. Bureau of printing, Manila.

Smyth, H. W. (1898). Five years in Siam, 2 volumes. Charles Scribner's Sons, New York.

Soe-Win, U. (1968). The application of geology to the mining of jade. *Union of Burma Journal of science and technology* 1, 445–456.

Soeparjadi, R. A., Nayoan, G. A. S., Beddoes, L. R., and James, W. V. (1975). Exploration play concepts in Indonesia. *Ninth world petroleum congress proceedings* 3, exploration and transportation, pp. 51–64. Applied Science Publishers, London.

Soeparjadi, R. A., Valachi, L. Z., and Sosromihardjo, S. (1985). Oil and gas developments in Far East 1984. *American association of Petroleum Geologists Bulletin* 69,1780–1855.

Soeria Atmadja, R., Golightly, J. P., and Wahyu, B. N. (1974). Mafic and ultramafic rock associations in the east arc of Sulawesi. *Proceedings of the Institute of Technology, Bandung* **8** (2), 67–85.

Stamp, L. D. (1927). The geology of the oil fields of Burma. *Bulletin of the American association of petroleum geologists* 11, 557–580.

Staritskiy, Y. G., Maymin, Y. S., and Trofimov, V. A. (1973). Tectonic development of north Vietnam. *International geology review* **15**, 1381–1390.

Stauffer, P. H. (1968). Studies in the Crocker Formation, Sabah. *Borneo region of Malaysia geological survey bulletin* 8, 1–13.

Stauffer, P. H. (1973a). Cenozoic. Geology of the Malay Peninsula (ed. D. J. Gobbett and C. S. Hutchison), 143–176, John Wiley-Interscience, New York.

Stauffer, P. H. (1973b). Kenny Hill Formation. Geology of the Malay Peninsula (ed. D. J. Gobbett and C. S. Hutchison), 87–91, John Wiley-Interscience, New York.

Stauffer, P. H. (1974). Malaya and Southeast Asia in the pattern of continental drift. *Geological society of Malaysia bulletin* 7, 89–138.

Stauffer, P. H. (1976). Cross-bedding in sandstone of probable Carboniferous age at Tanjung Gelang, Pahang. *Newsletter of the geological society of Malaysia* 2, 9–13.

Stauffer, P. H. (1978). Anatomy of the Australasian tektite strewnfield and probable site of its source crater. *Proceedings of the third regional conference on the geology and mineral resources of S.E. Asia* (ed. Prinya Nutalaya), 285–9, Asian Institute of Technology, Bangkok.

Stauffer, P. H. (1983). Unraveling the mosaic of Paleozoic crustal blocks in Southeast Asia. *Geologische Rundschau* 72, 1061–1080.

Stauffer, P. H. (1985). Continental terranes in Southeast Asia: pieces of which puzzle? Tectonostratigraphic terranes of the Circum-Pacific region, *Circum-Pacific council for energy and mineral resources, earth science series* 1 (ed. D. G. Howell), pp. 529–39.

Stauffer, P. H. and Lee Chai Peng (1986). Late Paleozoic glacial marine facies in Southeast Asia and its implications. *Geological society of Malaysia bulletin* 20 363–397.

Stauffer, P. H. and Mantajit, J. (1981). Late Paleozoic tilloids of Malaya, Thailand and Burma. *Earth's pre-Pleistocene glacial record* (ed. M. J. Hambrey and W. B. Harland), 331–337, Cambridge University Press, England.

Stauffer, P. H., Nishimura, S., and Batchelor, B. C. (1980). Volcanic ash in Malaya from a catastrophic eruption of Toba, Sumatra 30,000 years ago. *Physical geol. of Indonesian island arcs* (ed. S. Nishimura), 156–164, Kyoto University Press.

Stein, S. and Okal, E. A. (1978). Seismicity and tectonics of the Ninetyeast Ridge area: evidence for internal deformation in the Indian Plate. *Journal of geophysical research* 83, 2233–2244.

Stephenson, B. and Aspden J. A. (1982). *Simplified geological map of northern Sumatra,* 1:1,500,000. Directorate of overseas surveys, British geological survey.

Stephenson, D. and Marshall, T. R. (1984). The petrology and mineralogy of Mt Popa volcano and the nature of the Late-Cainozoic Burma volcanic arc. *Journal of the geological society London* 141, 747–762.

Stöcklin, J. (1980). Geology of Nepal and its regional frame. *Journal of the geological society London* 137, 1–34.

Stokes, R. B. (1975). Pre-Ratburi Group Paleozoic rocks. *Proceedings of the conference on the geology of Thailand*, Department of geology, Chiang Mai University special publication 1 (ed. R. B. Stokes and C. Tantisukrit), 21–64.

Stratigraphic table of China (1963). *A regional stratigraphic table of China (Draft).* Joint Publications research service, U.S. Department of Commerce, JPRS:18. [English translation of 'Chung-kuo Chu-yu Ti-ts'eng Piao', Peking (1958).]

Suensilpong, S., Putthapiban, P., and Mantajit, N. (1983). Some aspects of tin granite and its relationship to tectonic setting. Circum-Pacific plutonic terranes, *Geological society of America memoir* 159 (ed. J. A. Roddick), 77–85.

Suess, E. (1893). Are great ocean depths permanent? *Natural Sciences* 2, 180–187.

Sugiyama, T. and Toriyama, R. (1981). Coral and fusuline faunas from the Kabin Buri area, east central Thailand. *Geology and paleontology of S.E. Asia* 22 (ed. T. Kobayashi et al.), 2–22.

Sukamto, R. (1978). The structure of Sulawesi in the light of plate tectonics. *Proceedings of the regional conference on the geology and mineral resources of S.E. Asia*, Jakarta 1975. Indonesian association of geologists, 124–141.

Sukamto, R., Apandi, T., Supriatna, S., and Yasin, A. (1981). The geology and tectonics of Halmahera island and surrounding areas. *The geology and tectonics of eastern Indonesia,* Geological Research and Development Centre, special publication (ed. A. J. Barber and S. Wiryosujono), pp. 349–362. Bandung.

Sumarso and Ismoyowati, T. (1976). Contribution to the stratigraphy of the Jiwo Hills and their southern surroundings (Central Java). *Proceedings of the fourth meeting of the Indonesian petroleum association*, Jakarta, June 1975 2, 19–26.

Suntharalingam, T. (1968). Upper Paleozoic stratigraphy of the area west of Kampar, Perak. Geological society of Malaysia bulletin 1, 1–15.

Suppe, J. (1981). Mechanics of mountain building and metamorphism in Taiwan. *Geological society of China memoir* 4.

Suppe, J., Liou, J. G., and Ernst, W. G. (1981). Paleogeographic origins of the Miocene east Taiwan ophiolite. *American Journal of Science* 281, 228–246.

Takahashi, M., Aramaki, S., and Ishihara, S. (1980). Magnetite-series/ilmenite-series vs. I-type/S-type granitoids. Granitic magmatism and related mineralization, *Mining geology* special issue 8 (ed. S. Ishihara and S. Takenouchi), 13–28. Tokyo.

Tamesis, E. V., Manlac, E. V., Reyes, C. A., and Ote, L. M. (1973). Late Tertiary geologic history of the continental shelf of northwestern Palawan, Philippines. *Geological society of Malaysia bulletin* 6, 165–176.

Tamura, M. and Hon, V. (1977). Upper Jurassic bivalves from the Kedadom Formation of Sarawak, Malaysia. *Geology and paleontology of S.E. Asia* **18** (ed. T. Kobayashi et al.), 33–47.

Tan, B. K. (editor) (1973). Regional conference on the geology of Southeast Asia, Proceedings. *Geol. soc. Malaysia bull.* **6**, Kuala Lumpur.

Tan, B. K. (1984). The tectonic framework and evolution of the Central Belt and its margins, Peninsular Malaysia. *Geological society of Malaysia bulletin* 17, 307–322.

Tan, D. N. K. (1979). Lupar Valley, west Sarawak, Malaysia. *Geological survey of Malaysia report* **13**.

Tan, D. N. K. (compiler) (1982). *Geological map of Sarawak*, 1:500,000, first edn. Geological Survey of Malaysia, Kuching.

Tan, D. N. K. (1986). Palaeogeographic development of west Sarawak. *Geological society of Malaysia bulletin* 19, 39–49.

Tan, D. N. K., Abdul Hadi b. Abd. Rahman, Azlina Anuar, Boniface Bait, and Chow Kok Tho (1999) West Baram Delta. *The Petroleum Geology and Resources of Malaysia*. Petroliam Nasional Berhad (PETRONAS), Kuala Lumpur, 293–341.

Tang Zhi (1982). Tectonic features of oil and gas basins in eastern part of China. *American association of petroleum Geologists bulletin* 66, 509–521.

Tantisukrit, C. (1978). Review of the metallic mineral deposits of Thailand. *Geology and mineral resources of Southeast Asia* (ed. Prinya Nutalaya), 783–793, Asian Institute of Technology, Bangkok.

Tantiwanit, W., Raksaskulwong, L. and Mantajit, N. (1983). The Upper Paleozoic pebbly rocks in southern Thailand. *Proceedings of a workshop on the stratigraphic correlation of Thailand and Malaysia* 1, 96–104, Geological society of Thailand, Bangkok/Geological Society of Malaysia, Kuala Lumpur.

Tapponnier, P., Peltzer, G., and Armijo, R. (1986). On the mechanics of the collision between India and Asia. In Collision tectonics (ed. M. P. Coward and A. C. Ries), 115–57, Geological Society of London special publication **19**.

Tapponnier, P., Peltzer, G., Le Dain, A. Y., Armijo, R., and Cobbold, P. (1982). Propagating extrusion tectonics in Asia, new insights from simple experiments with plasticene. *Geology* 10, 611–616.

Tarling, D. H. (1981). Models for fragmentation of Gondwana. *Gondwana Five* (ed. M. M. Cresswell and P. Vella), 261–266, A. A. Balkema, Rotterdam.

Tate, R. B. (1976). Paleo-environment studies in Brunei. *Proceedings of the Southeast Asia petroleum exploration society* 3, 102–124.

Tate, R. B. (1991). Cross-border correlation of geological formations in Sarawak and Kalimantan. *Geological Society of Malaysia Bulletin*, 28, 63–95.

Tate, R. B. and Hon, V. (1991). The oldest rocks in Borneo: a note on the Tuang Formation, West Sarawak, and its importance in relation to the presence of "basement" in West Borneo. *Newsletter of the Geological Society of Malaysia*, 17, (5), 221–224.

Taylor, B. and Hayes, D. E. (1980). The tectonic evolution of the South China Sea Basin. The tectonic and geologic evolution of Southeast Asian seas and islands, *Geophysical monograph* **23** (ed. D. E. Hayes), 89–104, American Geophysical Union, Washington.

Taylor, B. and Hayes, D. E. (1983). Origin and history of the South China Sea Basin. The tectonic and geologic evolution of Southeast Asian seas and islands, part 2, *Geophysical monograph* **27** (ed. D. E. Hayes), 23–56, American Geophysical Union, Washington.

Taylor, D. (1971). An outline of the geology of the Bukit Ibam orebody, Rompin, Pahang. *Geological Society of Malaysia bulletin* 4, 71–89.

Taylor, D. and Toh Swee Cheng (1981). Regional mineral exploration, Pahang Tenggara—a case history of base metal exploration project in the Malay Peninsula. *Asia Mining*, 1981 meeting, 1–12.

Teggin, D. E. (1975). The granites of Northern Thailand. *unpublished Ph.D. thesis*, University of Manchester.

Teh, G. H. and Paramananthan, S. (editors) (1986). Fifth Regional Congress on geology, mineral and energy resources of Southeast Asia-GEOSEA V, Proceedings, Vol. 1, *Geological Society of Malaysia bulletin* **19**.

Terman, M. J., Bowers, W. E., Soleimani, G., and Ching, C. W. (1974). *Tectonic map of China and Mongolia*, 2 sheets. Geological society of America.

Teves, J. S. (1953). *Bibliography of Philippine geology, mining and mineral resources*. Bureau of Printing, Bureau of Mines, Manila.

Teves, J. S. (1957). *Lexique stratigraphique international*, **III**, Asie, Fasc. 5, Centre national de la réchérche scientifique, Paris.

Thakur, V. G. (1984). Tectonics of the Himalaya and Karakoram conjugation area (Indus–Tsangpo suture zone). Tectonics of Asia colloquium 5, *27th International geology congress reports* 5, 137–150.

Thanasuthipitak, T. (1978). Geology of Uttaradit area and its implications on tectonic history of Thailand. *Proceedings of the third regional conference on geology and mineral resources of S.E. Asia* (ed. Prinya Nutalaya), 187–97, Asian Institute of Technology, Bangkok.

Thomas, J. S., Nestvold, E. O., and Crostella, A. (1978). Exploration of part of the northwest shelf of Australia (a case history). *Proceedings of the Offshore Southeast Asia conference*, Paper **6**. S.E. Asia petroleum exploration society, Singapore.

Thompson, M. L. (1936). Lower Permian fusulinids from Sumatra. *Journal of Paleontology* **10**, 587–92.

Tjia, H. D. (1978). Structural geology of Peninsular Malaysia. (Ed. Prinya Nutalaya) *Proceedings of the third regional conference on the geology and mineral resources of S.E. Asia*, 673–82, Asian Institute of Technology, Bangkok.

Tjia, H. D. (1979). Westward tectonic transport of Kenny Hill rocks at Bukit Pantai, Kuala Lumpur. *Sains Malaysiana* 8, 153–61.

Tjia, H. D. (1981). Examples of young tectonism in eastern Indonesia. *The geology and tectonics of eastern Indonesia*, Geological Research and Development Centre special publication **2** (ed. A. J. Barber and S. Wiryosujono), pp. 89–104. Bandung.

Tjia, H. D. (1986). Structural geology of the Machinchang Formation, Langkawi islands (abs). *Newsletter of the geological society of Malaysia* **12** (2), p. 91.

Toriyama, R. (1984). Summary of the Fusuline faunas in Thailand and Malaysia. *Geology and palaeontology of S.E. Asia* **25** (ed. T. Kobayashi et al.), 137–46.

Toriyama, R., Pitakpaivan, K., and Ungavat, R. (1978). The paleogeographic characteristics of Fusuline faunas of the Rat Buri Group in Thailand and its equivalent in Malaysia. *Proceedings of the third regional conference on geology and mineral resources of S.E. Asia* (ed. Prinya Nutalaya), 107–111, Asian Institute of Technology, Bangkok.

Towner, R. R. (1981). Late Paleozoic tillites of the Canning Basin, Western Australia. *Earth's pre-Pleistocene glacial record* (ed. M. J. Hambrey and W. B. Harland), 449–452, Cambridge University Press, England.

Trail, D. S., Heryanto, R., and Williams, P. R. (1984). Paleogeography and tectonic development of the Tertiary basins in Kalimantan Barat. GEOSEA V: abstracts of papers, *Geological society of Malaysia*, Kuala Lumpur, 35–36.

Tran Van Tri, Tran Kim Thach, and Truong Cam Bao (1979). *Geology of Vietnam (North Part)*. General Department of Geology, Research Institute of Geology and Mineral resources, Hanoi.

Travena, A. S. and Clark, R. A. (1986). Diagenesis of sandstone reservoirs of Pattani Basin, Gulf of Thailand. American Association of Petroleum Geologists Bulletin, **70**, 299–308.

Trung, H., Bao, N. X., My, B. P., and Tinh, T. H. (1979). Peculiarities of the intrusive magmatic formation distribution in southern Vietnam. Dia Chat Va Khoang San Vietnam, Hanoi. [In Vietnamese.]

Umbgrove, J. H. F. (1949). Structural history of the East Indies. Cambridge University Press, England.

Vail, P. R. and Mitchum, R. M., Jr. (1979). Global cycles of relative change of sea level from seismic stratigraphy. Geological and geophysical investigations of continental margins. American association of petroleum geologists memoir **29**, 469–72.

Valdiya, K. S. (1969). Stromatolites of the Lesser Himalayan carbonate formations and the Vindhyans. Journal of the geological society India **10**, 1–25.

Valdiya, K. S. (1984). Tectonics of the folded fringe of the Indian platform. Tectonics of Asia. Colloquium 5. *27th international geology congress reports* 5, 110–137.

Van Bemmelen, R. W. (1970). *The geology of Indonesia*, 1A; *General geology of Indonesia and adjacent archipelagoes*, 2; *Economic geology*, 1B; *Portfolio and index*, 2nd edn. Martinus Nijhoff, The Hague.

Van de Graaff, W. J. E. (1981). Early Permian Lyons Formation, Carnarvon Basin, Western Australia. *Earth's pre-Pleistocene glacial record* (ed. M. J. Hambrey and W. B. Harland), 453–458, Cambridge University Press, England.

Van Gool, M., Huson, W. J., Prawirasasra, R. and Owen, T. R. (1987). Heat flow and seismic observations in the northwestern Banda Arc. *Journal of Geophysical Research*, **92**, 2581–2586.

Van Hattum, M. W. A., Hall, R., Pickard, A. L. and Nichols, G. J. (2006). Southeast Asian sediments not from Asia: provenance and geochronology of North Borneo sandstones. *Geology*, **34** (no. 7), 589–592.

Van Leeuwen, T. M. (1981). The geology of southwest Sulawesi with special reference to the Biru area. *The geology and tectonics of eastern Indonesia*. Geological Research and Development Centre, special publication 2 (ed. A. J. Barber and S. Wiryosujono), 277–304, Bandung.

Varne, R. and Foden, J. D. (1986). Geochemical and isotopic systematics of eastern Sunda arc volcanics: implications for mantle sources and mantle mixing processes. *Origins of Arcs* (ed. F. C. Wazel), 159–189, Elsevier, Amsterdam.

Veevers, J. J. (1982). Western and northwestern margin of Australia. *The Ocean basins and margins: The Indian Ocean*, **6** (ed. A. E. M. Nairn and F. G. Stehli), 513–44, Plenum Press, New York.

Veevers, J. J. (ed.) (1984). *Phanerozoic earth history of Australia*, Oxford geological sciences series **2**. Clarendon Press, Oxford.

Vening Meinesz, F. A. (1954). Indonesian archipelago—a geophysical study. *Geological society of America bulletin* **65**, 143–64.

Verbeek, R. D. M. (1905). Geologische beschrijving van Ambon. Jaarboek van het mijnwezen Nederlandsche Oost-Indie wetensch. ged. **34**, 1–308.

Verdier, A. C., Oki, T., and Suardy, A. (1980). Geology of the Handil Field (East Kalimantan, Indonesia). Southeast Asia petroleum exploration society proceedings **5**, 124–50.

Verma, R. K., Mukhopadhyay, M. J., and Ahluwalia, M. S. (1976). Earthquake mechanisms and tectonic features of northern Burma. *Tectonophysics* **32**, 387–99.

Vincelette, R. R. (1973). Reef exploration in Irian Jaya, Indonesia. *Proceedings of the Indonesian petroleum association* 2nd convention, Jakarta, 243–77.

Visser, W. A. and Hermes, J. J. (1962). *Geological results of the exploration for oil in Netherlands New Guinea*. Koninkl. Nederlands geol. mijnbouw Genoot. verb. geol. **20**, special number.

Vogt, E. T. and Flower, M. F. J. (1989). Genesis of the Kinabalu (Sabah) granitoids at a subduction-collisional junction. *Contributions to Mineralogy and Petrology*, **103**, 493–509.

Von Braun, E. and Jordon, R. (1976) The stratigraphy and paleontology of the Mesozoic sequence in the Mae Sot area in western Thailand. *Geologisches jahrbuch* **21**, 5–51.

Voris, H. K. (2000). Maps of Pleistocene sea levels in Southeast Asia: shorelines, river systems and time durations. *Journal of Biogeography*, **27**, 1153–1167.

Vozenin-Serra, C. (1986). Two Gymnospermous woods from the Lower Permian of Jambi, Sumatra. Fontaine, H. (ed.) *The Permian of Southeast Asia*, C.C.O.P. technical bulletin TP **18**, 168–171, Bangkok.

Vozenin-Serra, C. (1989). Lower Permian continental flora of Sumatra. Henri Fontaine and Suudi Gafoer (eds.) *The pre-Tertiary fossils of Sumatra and their environments*. C.C.O.P. Technical bulletin TP **19**, 53–57, Bangkok.

Wakita, K. & Metcalfe, I. (2005). Ocean plate stratigraphy in East and Southeast Asia. *Journal of Asian Earth Sciences*, **24**, 679–702.

Wan Ismail wan Yusoff (1984). Heat flow study in the Malay Basin. *Combined proceedings of joint ASCOPE-CCOP workshops* **1** and **2**, 1981, Jakarta, CCOP, Bangkok, 77–87.

Wang Hongzhen and Qiao Xiufu (1984). Proterozoic stratigraphy and tectonic framework of China. *Geological magazine* **121**, 599–614.

Wang, L. K., Zhao, B., Zhu, W. F., and Li, T. J. (1980). Characteristics and melting experiments of granites in southern China. *Mining geology* special issue 8, 29–38.

Wang, N. and Bassoullet, J. P. (1984). Les systèmes du Jurassic et du Crétacé dans la region de Lhasa au Tibet. *Mission Franco-Chinoise au Tibet 1980* (ed. J. L. Mercier and Li Guangcen), 155–166, Éditions du centre national de la recherche scientifique, Paris.

Wang, P. L., Lan, C. Y., Yem, N. T., Lo, C. H., Lee, T. Y., Chung, S. L. (1998). Thermochronological evidence for the movement of the Ailao Shan–Red River shear zone: a perspective from Vietnam. *Geology*, **26**, 887–890.

Wang Songshan (1984). Caractéristiques de la série volcanique de Linzizong dans le secteur oriental de l'arc de Gandise. *Mission Franco-Chinois au Tibet 1980* (ed. J. L. Mercier and Li Guangcen), 319–333, Éditions du centre national de la recherche scientifique, Paris.

Wang, T., Teng, H., Li, C., and Yeh, S. (1960). *Acta geophysica Sinica* **9**, 125–138.

Wang Xibin, Cao Yougong, and Zhen Haixiang (1981a). *Geological map of middle section of ophiolite suite along the Yarlung Zangbo (Tsangpo) River, Tibet*. Geological Bureau of Xizang, China.

Wang, Y., Lu, S., Gao, Z., Lin, W., and Ma, G. (1981). Sinian tillites of China. *Earth's pre-Pleistocene glacial record* (ed. M. J. Hambrey and W. B. Harland), 386–401, Cambridge University Press, England.

Wang, Yu-Jing and Mu Xi-nan (1983). Upper Carboniferous and Lower Permian strata in the Gondwana-Tethys province of Xizang (Tibet). *Palaeontologia Cathayana* 1, 411–419.

Watanabe, T., Langseth, M. G., and Anderson, R. N. (1977). Heatflow in back-arc basins of the western Pacific. C. III. *Island arcs, deep sea trenches and back-arc basins, Maurice Ewing Series* 1 (ed. M. Talwani and W. Pitman), 137–161, American Geophysical Union, Washington.

Waterhouse, J. B. (1982). An Early Permian cool-water fauna from pebbly mudstones in south Thailand. *Geological magazine* 119, 337–354.

Waterhouse, J. B. (1983). A Late Permian *Lyttoniid* fauna from northwest Thailand. *Department of Geology, University of Queensland papers* 10 (3).

Watts, A. B., Bodine, J. H., and Bowin, C. O. (1978). Free air gravity field. *A geophysical atlas of the East and Southeast Asian seas*, MC-25 (director D. E. Hayes). Geological society of America.

Wee Heng Tian and Taylor, D. (1974). A major unconformity exposed in Sungei Siput, Pahang. *Geological society of Malaysia bulletin* 7, 79–88.

Weissel, J. K. (1980). Evidence for Eocene oceanic crust in the Celebes Basin. Hayes, D. E. (ed.) The tectonic and geologic evolution of Southeast Asian seas and islands, *Geophysical monograph* 23 (ed. D. E. Hayes), 37–47, American Geophysical Union, Washington.

Weissel, J. K. and Anderson, R. N. (1978). Is there a Caroline Plate? *Earth and planetary science letters* 41,143–158.

Wheller, G. E., Varne, R., Foden, J. D., and Abbott, M. J. (1987). Geochemistry of Quaternary volcanism in the Sunda-Banda Arc, Indonesia, and three-component genesis of island arc basaltic magmas. Geochemistry of eruptive magmas and tectonic controls on petrogenesis (ed. S. D. Weaver and R. W. Johnson), *Journal of Volcanology and geothermal research*, 32, 137–160.

White, A. J. R. and Chappell, B. W. (1983). Granitoid types and their distribution in the Lachlan Foldbelt, southeastern Australia. Circum-Pacific plutonic terranes, *Geological society of America memoir* 159 (ed. J. A. Roddick), 21–34.

White, J. M., Jr and Wing, R. S. (1978). Structural development of the South China Sea with particular reference to Indonesia. *Proceedings of the 7th annual convention Indonesian petroleum association*, Jakarta, 159–164.

Whitford, D. J. (1975). Strontium isotopic studies of the volcanic rocks of the Sunda arc, Indonesia, and their petrogenetic implications. *Geochimica et cosmochimica acta* 39, 1287–1302.

Whitford, D. J., Compston, W., Nicholls, I. A., and Abbott, M. J. (1977). Geochemistry of Late Cenozoic lavas from eastern Indonesia: role of subducted sediments in petrogenesis. *Geology* 5, 571–575.

Whitford, D. J. and Jezek, P. A. (1979). Origin of Late Cenozoic lavas from the Banda Sea, Indonesia: trace element and Sr isotope evidence. Contributions to mineralogy and petrology **68**, 141–50.

Whitford, D. J. and Nicholls, I. A. (1976). Potassium variation in lavas across the Sunda arc in Java and Bali. *Volcanism in Australasia* (ed. R. W. Johnson), 63–75, Elsevier, Amsterdam.

Wielchowsky, C. C. and Young, J. D. (1985). Regional facies variations in Permian rocks of the Phetchabun fold and thrust belt, Thailand. *Conference on geological and mineral resources development of northeast Thailand*, 41–55, Khon Kaen University, Thailand.

Wikarno, Suyatna, D. A. D. and Sukardi, S. (1988). Granitoids of Sumatra and the tin islands. *Tin mineralization with emphasis on Asian deposits* (ed. C. S. Hutchison). Springer-Verlag, Heidelberg, 571–589.

Wilford, G. E. (1955). Salt springs in the Kelabit Highlands. *British territories in Borneo geological survey annual report for 1955*, 89–93.

Wilford, G. E. (1961). The geology and mineral resources of Brunei and adjacent parts of Sarawak. *British Borneo geological survey memoir* 10.

Wilford, G. E. (compiler) (1967). *Geological map of Sabah, East Malaysia* 1:500,000, 2nd edn. Geological Survey of the Borneo Region, Malaysia.

Wilford, G. E., Collenette, P. and Kirk, H. J. C. (1967). Radio-carbon determinations on specimens from Sabah. *Geological Survey, Borneo Region Malaysia, Annual Report for 1966*, 83–85.

Wilford, G. E. and Kho, C. H. (1965). Penrissen area, west Sarawak, Malaysia. *Geological survey of the Borneo region of Malaysia report* 2.

Williams, P. R. and Harahap, B. H. (1987). Preliminary geochemical and age data for postsubduction intrusive rocks, northwest Borneo. *Australian Journal of Earth Sciences* 34, 405–415.

Williams, P. R., Johnston, C. R., Almond, R. A., and Simamora, W. H. (1984). Late Cretaceous to Early Tertiary structural elements of West Kalimantan. *Tectonophysics* 148, 279–297.

Williams, P. R., Supriatna, S., and Harahap, B. (1986). Cretaceous mélange in west Kalimantan and its tectonic implications. *Geological society of Malaysia bulletin* 19, 69–78.

Williams, P. R., Supriatna, S., Trail, D. S., and Heryanto, R. (1984). Tertiary basins of west Kalimantan, associated igneous activity and structural setting. *Proceedings of the Indonesian Petroleum Association* 13th annual convention, Jakarta, 151–160.

Wilson, R. A. M. (1964). The geology and mineral resources of the Labuan and Padas Valley area, Sabah, Malaysia. Geological survey of the Borneo region of Malaysia memoir 17.

Winkel, R., Ingavat, R., and Helmcke, D. (1983). Facies and stratigraphy of the lower Lower-Middle Permian strata of the Petchabun fold-belt in central Thailand. *Proceedings of a workshop on the stratigraphic correlation of Thailand and Malaysia* 1, technical papers, 293–304, Geological society of Thailand, Bangkok/Geological society of Malaysia, Kuala Lumpur.

Wiryosujono, S. and Hainim, J. A. (1978). Cainozoic sedimentation in Buton island, southeast Sulawesi. *Proceedings of the regional conference on geology and mineral resources of S.E. Asia*, Jakarta 1975 (ed. S. Wiryosujono and A. Sudradjat), 109–119, Geological association of Indonesia.

Wiryosujono, S. and Sudradjat, A. (ed.) (1978). *Proceedings of the regional conference on the geology and mineral resources of S.E. Asia*, Jakarta 1975. Indonesian Association of Geologists.

Wiryosujono, S. and Tjokrosapoetro, S. (1978). Ophiolites in eastern Indonesia. *Proceedings of the third regional conference on the geology and mineral resources of S.E. Asia* (ed. Prinya Nutalaya), 641–52, Asian Institute of Technology, Bangkok.

Wolfe, J. A. and Self, S. (1983). Structural lineaments and Neogene volcanism in southwestern Luzon. The tectonic and geologic evolution of Southeast Asian seas and islands, part 2. *Geophysical monograph* 27 (ed. D. E. Hayes), 157–172, American Geophysical Union, Washington.

Wolfenden, E. B. (1960). The geology and mineral resources of the lower Rajang Valley and adjoining areas, Sarawak. *Geological survey department for the British territories in Borneo memoir* 11.

Wolfenden, E. B. (1965). Bau mining distict, west Sarawak, Malaysia, Part I: Bau. *Geological survey of the Borneo region of Malaysia bulletin* 7.

Wolfenden, E. B. (1976). The information problems of the mining and petroleum geologist working in (or on) South-East Asia. Sources of geological information for SE Asia. *Geological society of London miscellaneous papers* 9, 1–4.

Wolfenden, E. B. and Haile, N. S. (1963). Sematan and Lundu area, west Sarawak. *Geological survey department for British territories in Borneo report* 1.

Woollands, M. A. and Haw, D. (1976). Tertiary stratigraphy and sedimentation in the Gulf of Thailand. *Proceedings of the offshore S.E. Asia conference* Feb. 1976, 1–22, South East Asia petroleum exploration society, Singapore.

Wong, P. K., Faud Hassan, and Yancey, T. E. (1973). Newly recognized structural and stratigraphical features in the eastern part of the Langkawi islands, West Malaysia. Newsletter of the geological society of Malaysia 43, 5–10.

Wongwanich, T., Wyatt, D., Stait, B., and Burrett, C. (1983). The Ordovician System in southern Thailand and northern Malaysia. *Proceedings of a workshop on stratigraphic correlation of Thailand and Malaysia* 1, technical papers, 77–95, Geological society of Thailand, Bangkok/ Geological society of Malaysia, Kuala Lumpur.

Wood, B. G. M. (1985). The mechanics of progressive deformation in crustal plates—a working model for Southeast Asia. *Geological society of Malaysia bulletin* 18, 55–99.

Wood, C. (1983). Continental rift jumps. Tectonophysics 94, 529–540.

Wopfner, H. and Jin, X. (1993). Baoshan and Tengchong blocks of western Yunnan (China) in the late Paleozoic mosaic of the eastern Tethys. *Gondwana dispersion and Asian asccretion; International Geological Correlation Program Project 321*, 3rd international symposium, Department of Geology, University of Malaya, Kuala Lumpur, 47–49.

Workman, D. R. (1977). Geology of Laos, Cambodia, South Vietnam and the eastern part of Thailand. *Overseas geology and mineral resources* 50, 134p, Institute of geological sciences, London.

Workman, D. R. (1978). Bibliography of the geology and mineral resources of Thailand, 1951–1977. *Proceedings of the third regional conference on geology and mineral resources of Southeast Asia* (ed. Prinya Nutalaya), 805–821, Asian Institute of Technology, Bangkok. [English, French, German languages.]

Workman, D. R., Addison, R., Bennett, J. D., and Burnett, A. D. (1986). Present understanding of the pre-Cenozoic stratigraphy of Hong Kong. *Geological society of Malaysia bulletin* 19, 173–181.

Wu, F. T. (1978). Recent tectonics of Taiwan. *Journal of the physics of the Earth* 26 Supplement, S265–S299.

Xia K. Y. & Zhou D. (1993). The geophysical characteristics and evolution of northern and southern margins of the South China Sea. *Geological Society of Malaysia Bulletin,* 33, 223–240.

Xiao Xuchang and Gao Yanlin (1984). Tectonic evolution of the Tethys Himalayas of China. Tectonics of Asia, colloquium 5, *27th international geology congress reports* 5, 181–189.

Xing Yusheng, Ding Qixiu, Luo Huilin, He Tinggui, and Wang Yangeng (1984). The Sinian–Cambrian boundary of China and its related problems. *Geological magazine* 121, 155–170.

Xu Keqin, et al. (1980). Investigation on the time and spatial distribution of the granitic rocks of Southeastern China, their petrographic evolution, petrogenetic types, and metallogenic relations. *Journal of Nanjing University, special issue on geological science* 1–56.

Xu Keqin, Hu Shouci, Sun Minzhi, Zhang Jingrong, Ye Jun, and Li Huiping (1982). Regional factors controlling the formation of tungsten deposits in south China. *Tungsten geology, Jiangxi, China* (ed. J. V. Hepworth and Zhang Yu Hong), 473–88, ESCAP/RMRDC, Bandung, Indonesia.

Xu Keqin and Zhu Jinchu (1986). Tin-tungsten-bearing granites in south China and their metallogenic relations. *Geological society of Malaysia bulletin* 20, 579–599.

Xu Rong-Hua, Schärer, U., and Allègre, C. J. (1985). Magmatism and metamorphism in the Lhasa Block (Tibet): a geochronological study. *Journal of geology* 93, 41–57.

Yanagida, J. and Aw Peck Chin (1979). Upper Carboniferous, Upper Permian and Triassic brachiopods from Kelantan, Malaysia. Geology and paleontology of S.E. Asia 20 (ed. T. Kobayashi et al.), 119–141.

Yancey, T. E. (1972a). Carboniferous fossils from the 'Raub Group' near Cheroh village, western Pahang, West Malaysia. *Geological society of Malaysia newsletter* 34, 5–9.

Yancey, T. E. (1972b). Devonian fossils from Pulau Rebak Besar, Langkawi islands, West Malaysia. *Geological society of Malaysia newsletter* 37, 10–12.

Yancey, T. E. and Alif, S. A. (1977). Upper Mesozoic strata near Padang, West Sumatra. Geological society of Malaysia bulletin 8, 61–74.

Yang Zunyi, Cheng Yuqi, and Wang Hongzhen (1986). *The geology of China*, Oxford monographs on geology and geophysics 3. Clarendon Press, Oxford.

Yang, Z. Y. and Besse, J. (2001). New Mesozoic apparent polar wander path for south China: tectonic consequences. *Journal of Geophysical Research*, 106, 8493–8520.

Yap, L. S. (1976). Geology of the Tanjong Gelang area, Pahang. *Unpublished BSc thesis, University of Malaya*, Kuala Lumpur.

Yaw, B. S. (1977). Geology of the Pulau Redang area, Trengganu. *Unpublished BSc thesis, University of Malaya*, Kuala Lumpur.

Yeap, C. H. (1966). Geology of the Sungai Lembing area, Pahang, West Malaysia. *Unpublished BSc thesis, University of Malaya*, Kuala Lumpur.

Yeoh, G. C. (1974). The geology of the Genting highlands area, Selangor–Pahang, with some aspects of geotechnics. *Unpublished BSc thesis, University of Malaya*, Kuala Lumpur.

Yeow, Y. H. (1971). Geology and bauxite deposits of the Pengerang area, southeast Johore. *Unpublished BSc thesis, University of Malaya*, Kuala Lumpur.

Yin, E. H. (1965). Progress report on geological survey work done in the area of sheet 45 in south Kelantan. Geological Survey Federation of Malaya Professional Paper E65–26, 20–4.

Yin, E. H. and Shu, Y. K. (1973). Geological map of Peninsular Malaysia, scale 1:2,000,000. Geological Survey of Malaysia, Kuala Lumpur.

Yokohama, T. and Dharma, A. (1982). Magnetostratigraphy of the Toba Tuffs in Sumatra, Indonesia. *Palaeomagnetic research in Southeast and East Asia*, C.C.O.P./TP 13, 201–211.

Zeiller, R. (1903). Sur la flore des gîtes de charbon du Tonkin. *Étude des gîtes mineraux de la France*, Imprinterie Nationale, Paris, 328p.

Zhai, Y. J.; Zhang, Z. K.; Li, Y. A.; Li, Q.; Li, Y. P. et al. (1988). A study of Upper Carboniferous palaeomagnetism for the Tarim Block. *Geosciences*, 2, 43–56.

Zhang, Z. M., Liou, J. G., and Coleman, R. G. (1984). An outline of the plate tectonics of China. *Geological Society of America bulletin* 95, 295–312.

Zhao, X. & Coe, R. S. (1987). Palaeomagnetic constraints on the collision and rotation of North and South China. *Nature*, 327, 141–142.

Zhou Jiazin (1985). The timing of calc-alkaline magmatism in parts of the Alpine-Himalayan collision zone and its relevance to the interpretation of Caledonian magmatism. *Journal of the geological society London* 142, 309–317.

Zhou Xinmin and Chen Tuhua (1981). Composition and evolution of Cenozoic basaltic rocks in south-eastern coastal provinces of China. *Collected Oceanic works*, Beijing 4, 99–110.

Ziao, Zuchang and Gao Yanlin (1984). Tectonic evolution of the Tethys Himalayas of China. Tectonics of Asia, colloquium 5, 27th International geology congress reports 5, 181–9.

Zillman, N. J. and Paten, R. J. (1975). Exploration and petroleum prospects Bula Basin, Seram, Indonesia. *Proceedings of the Indonesian petroleum association fourth annual convention*, Jakarta, 129–4.