
Chapter 6

South-East Asia

South-East Asia is the least compact among the regions of the Asian continent. Out of its total land surface, estimated at four million sq.km., the mainland mass has a share of only 40 per cent. The rest is accounted for by several thousand islands of the Indonesian and Philippine archipelagoes. Thus, it is composed basically of insular and continental components. Nevertheless the orographic features on both these landforms are interrelated. This is due to the focal location of the region where the two great axes, one of latitudinal Cretaceo-Tertiary folding and the other of the longitudinal circum-Pacific series, converge. This interface has given a distinctive alignment to the major relief of the region as a whole. In brief, the basic geological structures that determine the trend of the mountains are (a) north-south and north-east in the mainland interior, (b) east-west along the Indonesian islands, and (c) north-south across the Philippines. The mountain ranges of the region are described in three geographic divisions: the continental interior, peninsular, and insular (Figure 7 and Annex E).

6.1 The Continental Interior

South-East Asia has an oceanic front in all directions except to the north. Its northerly land boundary commences as a panhandle between South and Central Asia and then on to the southern

extremity of North-East Asia. The contiguous areas constituting the continental interior include the highlands of Myanmar, Thailand, Laos, and northern Vietnam. The relief pattern is that of a longitudinal ridge and furrow in Myanmar and an undulating plateau eastwards. These are related to their structural difference: the former being a zone of tertiary folds and the latter of block-faulted massifs of greater antiquity.

The basin of the Irrawady (Elephant River), forming the heartland of Myanmar, is ringed by mountains on three sides. The western rampart, linking Patkai, Chin, and Arakan, has been dealt with in the South Asian context. The northern ramparts, Kumon, Kachin, and Namkiu of the Tertiary fold, all trend north-south parallel to the Hengduan Range and are the highest in South-East Asia; and this includes Hkakabo Raz (5,881m) in the extreme north. East of the Irrawady lies the Shan Plateau which consists of mostly block-faulted massifs of the Mesozoic age which are rich in minerals. The topography has an undulating surface carved by the tributaries of the Sittang and Salween rivers. The hills are mature and rounded and approach 2,500m only in the extreme north. The population is predominantly Shan and Karen. Southwards, the Pegu Yoma extends 435 km as an outlier range between the Irrawady and Sittang rivers. Its high-



Figure 7: South-East Asia

est peak, Popa Hill (1,519m), is an extinct volcano. The mountains of Myanmar are rich in tropical hardwood forests. Various hill tribes practise shifting cultivation on the uplands (Table 3).

The mountains of northern Thailand adjoining Myanmar and Laos are extensions of the Shan Plateau. They form a horseshoe at the headwaters of the Menam river. Those to the west are old ranges of granitic intrusions and upturned

Table 3: Highlanders of the South-East Asian Interior			
Myanmar (Region)	Thailand (Region)	Laos (Region)	Vietnam (Region)
Akha (north-east)	Akha (north)	Akha (north)	Muong (north)
Kachin (north)		Miao (east)	Mias (north)
Karen (east)	Karen (west)	Moi (north)	Hani (north)
Lahu (north-east)	Lahu (north)	Lahu (north)	Yao (north)
Lisu (north)	Lisu (north)	Lolo (west)	
Naga (north-west)	Dai/Tai (north)	Dai/Tai (south)	Dai/Tai (north)
Shan (east)	Shan (north)	Blang (north)	
Wa (north-east)	Hmong (north)	Hmong (north)	Hmong (north)
Palaung (north-east)	Yao (north)		Yi (north)

limestones. Doi Inthanon (2,595m), south of Chiang Mai, is the highest point. Evergreen forests predominate with mixed types below 1,800m and moist types above. Logging is making deep inroads in the area. The inhabitants above 1,000m are mostly Hmong who subsist on maize and poppy. Poppy growing has been controlled since the late 1970s and people have been encouraged to extract pine resin. Although there are several national parks in the Thai highlands, there is very little involvement of the local people as they are regarded as enemies of the forest (Ganjanapan 1998). The northern plateau is composed of ancient granite ridges. The plateau has a series of north-south ridges drained by four tributaries of the Menam River: from the west to east they are the Me Ping, Me Wang, Me Yom, and Me Nan. The climate is humid and precipitation ranges from 1,000-2,000 mm in summer. The winter is dry. Cultivation extends up to 1,200m upland with paddy as an important crop (Roder 1997). Swidden cultivation in secondary forest or shrub vegetation may be for two years, followed by a fallow period for as much as eight years. The eastern rim along the border of Laos is low in elevation. The natural vegetation is of the tropical monsoon rain type. The area has been the domain of more than a dozen ethnically different tribes such as the Akha, Hmong, Lisu, and Yao. They practise various forms of swidden agriculture and opium poppy is a major cash crop. For example, the Lisu cultivating at elevations ranging from 1,000 - 4,000m grow poppy after maize, while the Karen lower down (at 800- 1,200m) combine

maize and upland rice on patches that are abandoned after three to six years of cultivation (Hurni 1982). Indigenous terms, such as *raj* (swidden), *suan* (garden), and *naa* (irrigated field), indicate the diversity of land use. The mountain watersheds of northern Thailand have extremely low runoff efficiency, e.g., the recorded surface runoff is only a fifth of the precipitation received (Alford 1992). Time-series' data showing little change in sediment regimes since the 1950s provide no conclusive evidence that swidden agriculture is a major factor in land degradation.

The northern part of Laos, along the eastern flank of the Mekong River, is mostly rugged highlands of sandstone and limestone. West of Luang Prabang, the relief form is made up of parallel ranges aligned south-west/north-east. Eastwards, the Xiang Khoang Plateau forms a compact block with a radial drainage pattern. Some of the highest peaks in Laos occur in this area—including the Phou Bea (2,820m) near the Plain of Jars. The general elevation of the plateau is 1,200m compared to 2,000m in the northern mountains. Towards the south, the Annamite chain is rugged and densely forested. The local tribes include the Miao in the east, the Moi at higher elevations above 900m, the Lolo in the north-west, and the Thai at lower elevations (below 1,000m). Ray, a local version of shifting cultivation is common in these highlands.

Vietnam's border with Laos and China in the extreme north is marked by a series of ranges.

They are all aligned north-west/south-east, maintaining their trend in Yunnan from where they descend. Most of these are low ranges, approaching 3,000m on the central range between the Red (*Songkoi*) and Black (*Songbo*) rivers. The rock formation is mainly igneous overlain by limestones and sandstones. Fluvial erosion has created varied shapes on heavy limestone formations. With a tropical monsoon climate and an average annual rainfall of 1,500mm, forests are an intermixture of deciduous and evergreen species. Much of these have been reduced to secondary types due to overexploitation through burning and clearing. The montagnards include the Hmong, Muong, Hani, and Yi.

6.2 Peninsular

The mountains of South-East Asia grouped as peninsular fall into two types. The first type, as in Indo-China, is aligned along the coastal area of the peninsula. The second type forms the spine of the peninsula along the Tenasserim-Malaysia stretch. The first type includes the Truong San along the east coast and the Chuor Phnum Kravanh along the south-west coast of Indo-China. The former, 'La Chaîne Annamitique' in French, extends southwards from Tonkin to the Mekong delta as a rugged highland. The chain is less of a continuous range than a series of plateaus. The high point, Ngoc Linh (2,598m), is in the central section. Both its northern and southern extremities exceed 2,400m in elevation. The highland rises precipitously from the east and descends gently towards the Mekong Valley. The composition is mainly of sandstones and limestones with some exposures of ancient crystalline rocks in the north. These highlands receive more than 2,000mm of rain annually and support tropical evergreen forests. In the extreme south, the basalt highlands have some large rubber estates.

Chuor Phnum Kravanh or simply Kravanh was formerly called the Cardamom Mountains. It extends about 160 km along the south coast of Cambodia with a south-east/north-west axis. Its eastern extension, Chuor Phnum Damrei, for-

merly called Elephant Mountains, is aligned north-south. The highest point, Phnum Aoral (2,929m), is located at the convergence of these two ranges in the north-east. Their western slopes receive nearly 5,000 mm of rain annually from the south-west monsoon. In contrast, the eastern slopes receive half of that. The indigenous people speak mainly Mon-Khmer. Commercial crops include cardamom and pepper.

The second type of peninsular range traverses south along the Myanmar-Thailand border all the way to Selangor in Malaysia. It commences with the Dawna Range east of Yangon with the high point, Mawkhi (2,080m), being on the Myanmar side. Further south, the range is called the Bilaktaung Range and it terminates short of the Kra Isthmus. Here also, the highest peak, Myinmoletkat (2,072m), lies west of the border. Despite its low elevation, the range acts as an effective climatic barrier. The western slopes receive nearly 3,000 mm of rain, while it is about 1,500mm on the east side.

The Thai section of the Malay Peninsula has some elevated ranges exceeding 1,000m between the Kra Isthmus and Songkhla area. Southwards, the highlands of Malaysia commence at Bukit Bubus (1,145m) on the country's northern border. Peninsular Malaysia has several north-south trending ranges with granitoid topographic highs flanked by limestone, quartzite, and shale. Of these, the Banjaran Titiwangsa, including the Cameron Highlands, extends south to Selangor. Gunung Tahan (2,187m), the highest peak in Malaysia, lies on an eastern spur of the main range. The ranges are under dense tropical rain forests which are home to small groups of indigenous people (*Orang Asli*) of the Negrito type. These include the Jahai, Jakun, Semai, and Temiar.

6.3 Insular

The insular component of South-East Asia consists of archipelagoes that rim the continent between the Indian and Pacific Oceans. The geographical alignment is determined by major

structural arcs traversing the region. The islands are dominated by rugged mountain backbones, many of which have volcanic cones. Those on the west, such as Sumatra, Borneo, and Java, that rest on the continental shelf have fairly extensive coastal lowlands fringed by shallow seas. Eastwards, the islands rise abruptly from deep seas like the isolated peaks of submerged mountain ranges and, in many cases, have virtually no coastal plain. The description of the mountains of insular South-East Asia is given in three groups: Borneo, The Philippines, and Indonesia.

South-East Asia is a region in which the land divides but the sea unites (Fisher 1964, p 662). This is seen in The Philippines as a country of 7,000 islands and in Indonesia, a country of 3,000 islands, while the singular block of Borneo is shared by Indonesia, Malaysia, and Brunei. Borneo is not only the largest island in the region, it also has the highest peak (Gunung Kinabalu - 4,094m) outside the continental interior (Box 3). Borneo's highland backbone is aligned like a trident pointing to the south-west. It commences in Sabah with Crocker Range in the extreme north. The central range, Pegunungan Iran, is a prominent water divide along the Indonesian-Malaysian border. Around Bukit Batubrok (2,240m) it bifurcates into three ranges. One continues south-west along Muller Range towards Schwaner Range. The western branch, Kapus Hulu, defines the boundary between Indonesia and Malaysia. The eastern branch, the Meratus Range is the lowest of the three. The main relief pattern is determined by the axes of Tertiary folding running in a series of parallel curves. Although parts of the northern heights, including Kinabalu Peak, are granitic, most rock formations are sandstone and limestone. These highlands have dense equatorial rain forests with successions of montane and even alpine types on the highest elevations with over 4,000 plant species. The various indigenous groups include the Dusun, Kadazan and Murut in Sabah; the Iban and Penan in Sarawak; and the Barito and Maloh in Kalimantan.

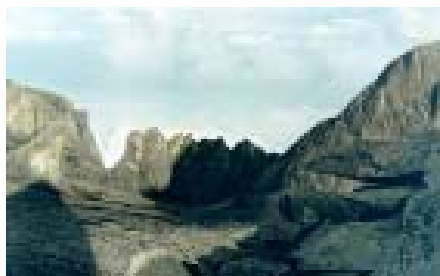
The islands of The Philippines straddle a zone of Tertiary/Quaternary folding of active vulcanism trending north-south between deep sea basins. Nearly all have rugged interior highlands and in combination resemble the upper portions of submarine mountain ranges. Superior elevations are, however, confined to the larger islands, Luzon and Mindanao respectively, in the extreme north and south. Mount Pulug (2,929m) in Luzon in the north and Mount Apo (2,954m) in Mindanao in the south are in the same elevation range. Luzon includes two parallel ranges with the higher Cordillera Central as the spine and the Sierra Madre along the east coast. The dominant rocks are Tertiary sedimentaries with some exposures of ancient basement complex in mountain cores. Zambales, across the Lingayen Gulf, is a volcanic range that receives a lot of rain and has dense forests. The highlands around Banaue are famous for elaborate field terraces. However, this wet rice culture of the Bontoc and Ifugao is an exception amid a vast area of shifting cultivation (*kaingin*) by other tribes and the still primitive Negrito of the Sierra Madre and Zambales.

The southern island of Mindanao has, as in Luzon, two north-south trending ranges. Here also, the western range forms the core of the island whereas the eastern one is mainly littoral. The former traverses the entire island as a distinct watershed between the Agusan Valley to the east and the Mindanao Basin to the west. A western spur, the Katanglad Mountains, has many peaks above 2,800 m, but the highest one, Mount Apo, on the main range, lies further south. Rainfall on the highlands is about 800m lower than on the east coast but occurs all the year round and supports dense vegetation. The uplands are also used for vegetable production under a fallow system with an average re-cultivation period of four years. The highland tribals are mostly Moro, and they are sandwiched between adherents of Islam in the west and Christianity in the east.

Indonesia consists of numerous large and small islands spread over a vast area. The major structural alignment is east-west, dictated by two par-

Box 3

Climbing Mount Kinabalu



Author

16.Mt. Kinabalu, Malaysia. Mount Kinabalu (4,101m) is the highest peak on the vast stretch between the continental Hengduan Ranges and New Guinea in the Pacific. The granite massifs are shaped by glacial scouring and frost shattering. It is considered sacred – as the resting place of departed Kadazan/Dusun people.

The Kinabalu Park in Sabah is crowned by Mount Kinabalu (4,101m) (Plate 16), the highest peak in South-East Asia. The Park covers an area of 754 sq. km. With probably the richest flora in the world. These include 1,500 species of orchids, 80 of figs, 60 of oak/chestnut, and 26 rhododendron varieties. The Park headquarters at 1,524m is about two hours drive from Kota Kinabalu. The summit lies nine kilometres north of Park headquarters, involving an ascent of 2,577 metres. The climb can be accomplished in two to three days. It is, however, an entirely different matter for those with proven stamina. Passing the welcome gate ('Selamat Mendaki') in October 1994, I came across the following bill-board.

International Climbathon, 1993

<u>Name</u>	<u>Country</u>	<u>Placed</u>	<u>Time Recorded</u>		
			<u>Hour</u>	<u>Minute</u>	<u>Second</u>
Kusang Gurung	Nepal	1st	2	44	36
John Hosson	Britain	2nd	2	52	41
Dil Bahadur Gurung	Nepal	3rd	2	55	23

Those from Nepal were Gurkha soldiers serving in Hong Kong. In the female category, the top three places were taken by local Malays, the first covering in 3 hours, 28 minutes and 16 seconds.

For an average climber, there is no need to rush. It can be a journey to discover the rich variety of flora and fauna. The climb starts beside the Power Station (1829m), which lies above the tropical Dipterocarp vegetarian zone. Then the path ascends under a temperate forest of oak, chestnut, myrtle laurel, and rhododendron.

Around 1,900m begins the cloud forest zone of gnarled tree-trunks festooned with moss, epiphytic ferns, and orchids. Beyond 2,100m, appear Pitcher plants of various species. Higher up, *Schima breviforme* with white flowers and *Vaccinium* with crimson leaves are notable. There are six rest places between the climb entrance (Power Station) and Panar Laban (3,353m). Panar Laban ('Place of Sacrifice') is 1,500 meters higher from the commencement of the trek at the Power Station, and has lodging facilities. Beyond Panar Laban, vegetation becomes stunted and scarce. Instead, bare rock faces of granite loom large. A narrow gully and then a rocky traverse leads to Sayat-Sayat (3,810m), the highest hut on the mountain. Sayat-Sayat is the native name for the *Leptospermum* bush, abundant around here.

The final ascent is across the summit plateau of wide slabs of granite assisted with a rope line. Most begin their climb in the very early morning from Panar Laban or Sayat-Sayat to be in time to see the sunrise from the summit. The highest summit, Low's Peak, provides excellent views all around. The place can be windy with mist swirling around.

Source: Harka Gurung. ADIPA Newsletter (Kuala Lumpur), August, 1995, pp. 1,23 & 24.

allel ranges of Tertiary/ Quaternary folding. In the north-east, the axes of the fold turn north towards The Philippines to which they are geologically linked. The inner of the two major east-west folds indeed forms the spine of the long island chain through a series of volcanic cones from Sumatra to Timor. The description of the mountains of Indonesia is given in five sections: (1) Sumatra, (2) Java, (3) Lesser Sundas, (4) Sulawesi, and (5) Moluccas.

Sumatra Island is marked by highlands along its entire length of over 1,700 km. Although it is called Bukit Barisan (The Mountain Range), it consists of two or more parallel ridges separated by structural troughs adjacent to numerous extinct and active volcanoes. In the north, Pulau Samosar is an island within the crater of Toba Lake. The range runs close to the western side of the island and has a precipitous slope facing the Indian Ocean. The main sections are the Aceh Range in the north, the lava and tuff plateau of Batak, the ridge and basin of Padang highlands, and finally the Benkulen Ridge to the south. Some peaks approach 3,000m in elevation, the highest being Kerinci (3,805m) in the Padang highlands. These highlands receive heavy rain from the south-west monsoon. Except for the intermontane Batak Plateau with savanna vegetation, most of the highlands have dense tropical rain forest. The indigenous people are the Batak and Gajo in the north, the Menangkabau in Padang, and the Lamponger in the south. Shifting cultivation, or ladang, is common in these highlands.

The slender island of Java, extending nearly 1,000km east-west, is dominated by a chain of volcanic cones. Of these 17 are still active and 14 exceed 3,000m in elevation, the highest being Gunung Slamet (3,428m). In the west, a clus-

ter of peaks forms the rugged relief of the Priangan Plateau. In central and eastern Java, the peaks are more spaced and are separated with lowlands. The central range is composed mainly of Tertiary basalts and andesites and Quaternary volcanics. As in the case of Sumatra, the southern slope facing the Indian Ocean is steep. Overall, the soils derived from ejected lava and ash combined with abundant rainfall make the base of these highlands fertile, and it is an area where the rural population is extremely dense.

Lesser Sundas is composed of small islands aligned east-west between Bali and Timor. In structure and physiography they are an eastern extension of Java, but on a smaller scale. Most of the island cores are volcanic peaks that rise abruptly from the sea. These high points reach 3,142m in Bali, 3,726m in Lombok, 2,850m in Sumbawa, 2,400m in Flores, and 2,427m in Timor Island. The area has scrub-like vegetation, due to its long dry season. The population is basically Malay who engage in wet-rice cultivation. However, the Balinese stand out as a relict of the Hindu-Javanese culture amidst an Islamic realm (Plate 17).

The spread-eagled island of Sulawesi lies north of Lesser Sundas. Its distinctive layout and relief are related to a number of factors: convergence of several axes of Tertiary folding and extensive uplift, faulting, and subsidence. Therefore, it is distinguished by high relief and wide occurrence of lakes with a maze of rift valleys. The highest point, Rantekombola (3,455m), is located south of the central axis from where ranges diverge to the extremities of the peninsula. Most of the vegetation is tropical rain forest. The highland people, mostly animist Toradja in various tribes, practice shifting cultivation. Those engaged in wet-



17. Traditional Bali Dance, Indonesia

rice cultivation are Muslim Buginese and Christian Minahasan.

The Moluccas form a group of small islands on the extreme east of South-East Asia. These include Halmahera in the north, Obi in the centre, and Buru and Seram in the south. They represent a collision of north-south and east-

west aligned structural axes. The uplands in Halmahera in the north are volcanic. The elevation rises towards the south, culminating on Gunung Binaiya (3,119m) in Seram. The highland people are of Melanesoid, Australoid, and Negrito origins, and their occupations range from shifting cultivation to hunting and fishing.

(see Figure 7)

Annex E : Ranges of South-East Asia			
S.N.	Range (Subsidiary)	Prominent Peak (M)	Location
1.	Ailao Shan	Fam Si Pan (3,143)	Vietnam
2.	Bilaktaung Range (Dawna)	Myinmoletkat (2,072) Mawkhi (2,080)	Myanmar Myanmar
3.	Borneo (Crocker, Iran, Kalimantan)	Gunung Kinabal (4,094)	Malaysia
4.	Banjaran Titiwangsa	Gunung Tahan (2,187)	Malayasia
5.	Chuor Phnum Kravanh (, , , , Damrei)	Phnam Aoral (1,771)	Cambodia
6.	Cordillera Central	Mt. Pulog (2,929)	Philippines
7.	Java	G. Slamet (3,428)	Indonesia
8.	Kachin	Hkakabao Raz (5,881)	Myanmar
9.	Lombok	G. Rinjani (3,726)	Indonesia
10.	Mindanao	Mt. Apo (2,954)	Philippines
11.	Moluccas	G. Binaiya (3,019)	Indonesia
12.	Pegu Yoma	Popa Hill (1,519)	Myanmar
13.	Shan Hills	- (2,603)	Myanmar
14.	Sierra Madre	Mingan (1,901)	Philippines
15.	Sulawesi	Bulu Rantekombola (3,455)	Indonesia
16.	Sumatra	G. Kerinci (3,800)	Indonesia
17.	Thailand, North	Doi Inthonon (2,595)	Thailand
18.	Timor	G. Mutis (2,427)	Indonesia
19.	Truong San	Ngoc Linh (2,598)	Vietnam
20.	Xiang Khoang Plateau	Phou Bea (2,820)	Laos
21.	Zambales	High Peak (2,037)	Philippines

