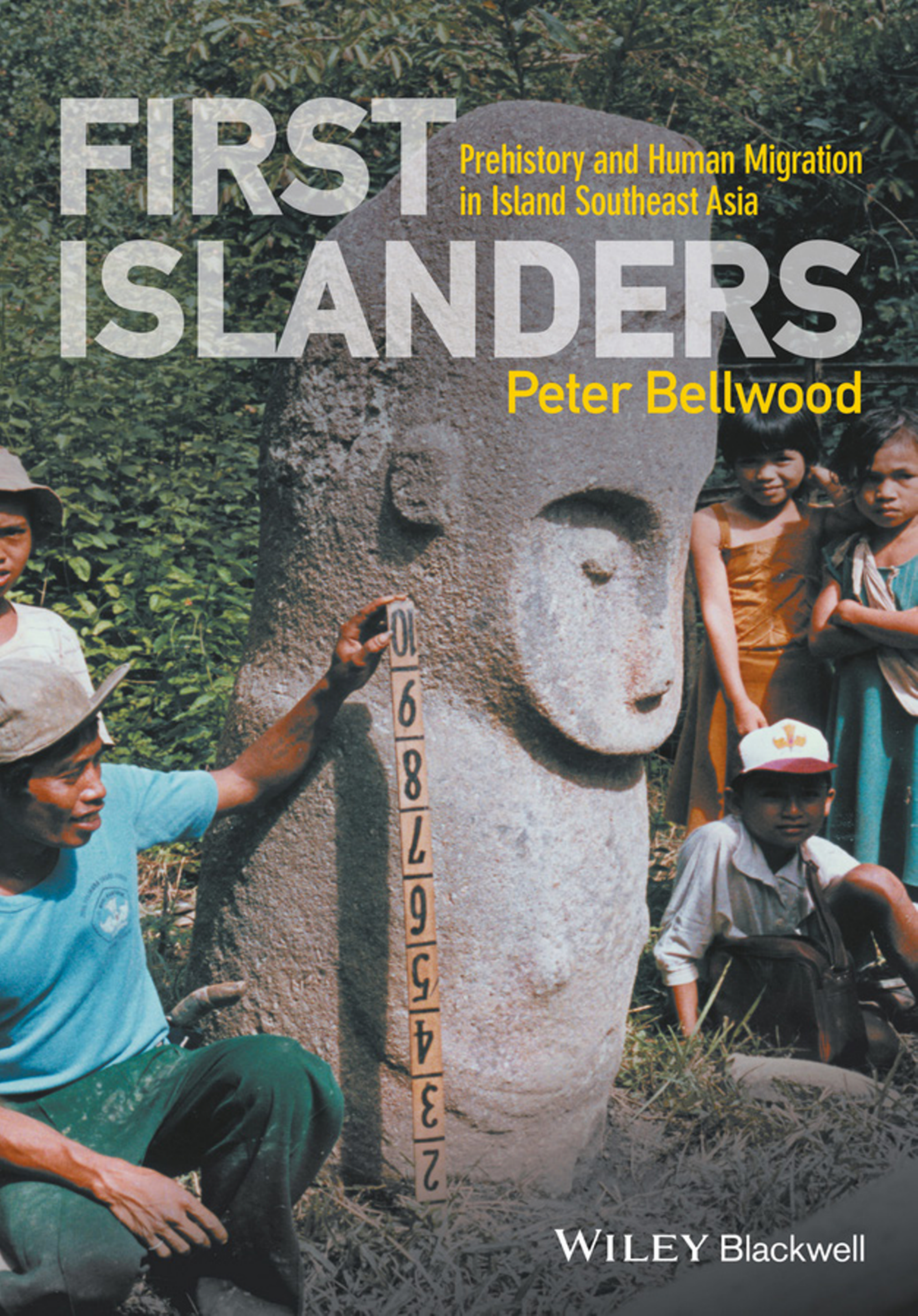
FIRST ISLANDERS

Prehistory and Human Migration in Island Southeast Asia

Peter Bellwood



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With invited contributions by (in order of appearance)
Colin Groves, Debbie Argue, Hirofumi Matsumura,
Marc Oxenham, Truman Simanjuntak, Mariko Yamagata,
Murray Cox, Philip J. Piper, Robert Blust,
Daud Aris Tanudirjo, Hsiao-chun Hung and Mike T. Carson

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For my wife Claudia Morris, who has supported me in writing this book with her love and her considerable editorial skills.

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I wish to thank all the invited authors, all of whom read and commented on the main chapter in which their own contribution occurs. Many colleagues also provided or gave permission to use illustrations, as credited in the captions. Wiley-Blackwell also sent the manuscript to four anonymous readers, who submitted various suggestions. My wife Claudia Morris read and commented on all of the text, and I wish to thank the Australian National University for providing the campus resources that made the writing of this book much easier than it might otherwise have been for a retired professor.

I wish also to thank the many Wiley editorial staff members who helped bring this book to fruition, especially former Wiley editor Mark Graney who sent me the contract in September 2015, copy editor Joanna Pyke who flushed out all the little gremlins in the text, current Wiley editor Tanya McMullin in the Oxford office, and production editor Vimali Joseph and project editor Manish Luthra in the Chennai office.

Finally, I must also emphasize the increasing contributions made to understanding the human past in Island Southeast Asia by indigenous archaeological researchers in Taiwan, Vietnam, the Philippines, and Indonesia. My bookshelves literally sag under the weight of their productions in the Chinese, Vietnamese, and Indonesian languages (and of course in English from the Philippines). Many archaeologists from these countries have studied their archaeology to MA and PhD level with me at the Australian National University in Canberra. I hope that this book can contribute something towards an understanding of the past of Island Southeast Asia by the indigenous populations of the region, scholars, and general public alike. Pride in one's ancestors, if handled with good sense, can hopefully fuel a desire to understand other people's ancestors and to bring some peace to a troubled world.

Chapter 1
Introducing *First Islanders*

The islands of Southeast Asia – Sumatra to the Moluccas, Taiwan to Timor (Figure 1.1) – present prehistorians with a unique opportunity to study some of the earliest recorded interactions between humanity and the oceans. This region has witnessed some remarkable changes in geographical configuration throughout the past 1.5 million years, throughout both an extinct hominin and an extant *Homo sapiens* presence. Land bridges have alternated with coastal submergence and tectonic activity has created some of the greatest volcanic eruptions in earth history, together with very rapid rates of crustal movement. An amazingly diverse variety of tropical wildlife (including humans!) has passed to and fro, some across land bridges and some across one of the most significant biogeographical divides on earth, which many of us know as the "Wallace Line." This delineates the western edge of the Wallacea region of biogeographers, which extends from Borneo and Bali across to the continental shelf of New Guinea and Australia. Because of its multiple sea passages, Wallacea has always separated the Asian and Australian continents, ensuring that cattle and pigs never met kangaroos and wombats until humans started to interfere with their natural distributions.

In terms of ocean travel, hominins reached the island of Flores across at least two sea passages around 1 million years ago, or perhaps before. Modern human ancestors crossed multiple sea passages to reach Australia and New Guinea at least 50,000 years ago. Within the past 5000 years these islands have fueled the genesis of the greatest maritime migration in human prehistory, that of the Austronesian-speaking peoples, who made absolutely incredible canoe voyages to reach places such as Guam, Madagascar, Easter Island, New Zealand, Hawai'i, and even South America. These voyages occurred over a period of more than 4000 years, dating between 3000 BCE and 1250 CE if we begin in Neolithic Taiwan and end with the Maori settlement of New Zealand, but the sheer achievement demands great respect from all humanity and indeed was the main attraction that persuaded me to migrate from England to New Zealand in 1967, in order to study Polynesian origins and archaeology (Bellwood 1978a, 1978b, 1987).

First Islanders: Prehistory and Human Migration in Island Southeast Asia, First Edition. Peter Bellwood.

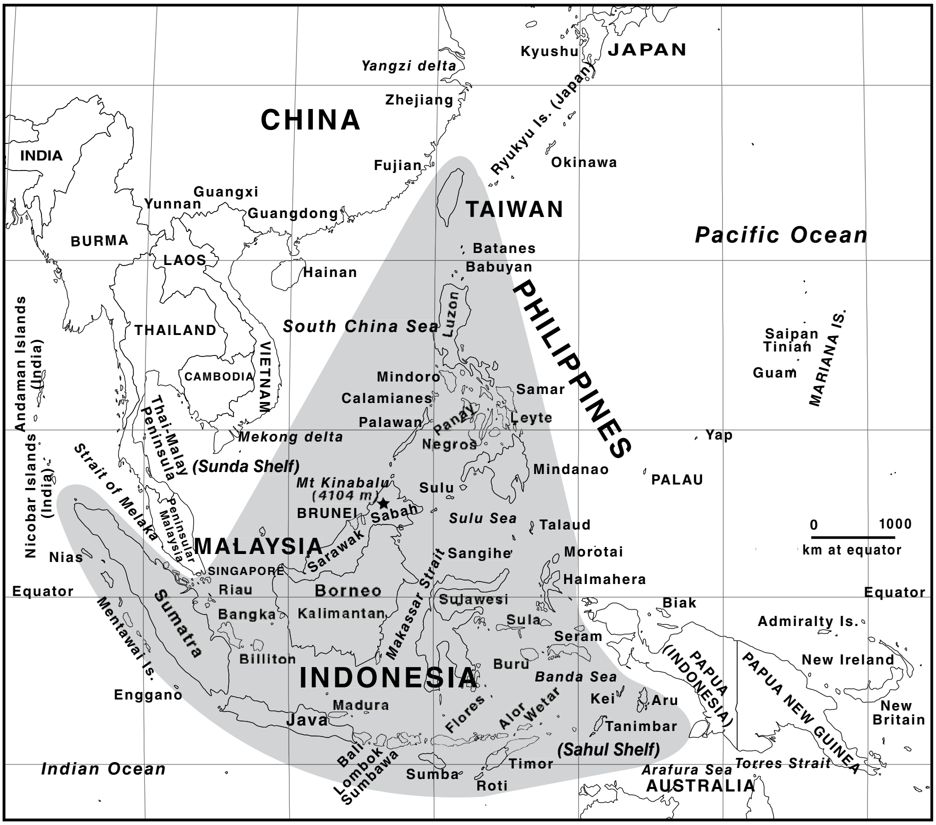

Figure 1.1 The basic geography and definition (shaded area) of Island Southeast Asia in its regional setting. Source: base map by Multimedia Services, ANU; details added by the author.

During my career as an archaeologist, I have to admit that I have always found the ancestries and migrations of human populations, whether still living, or extinct and deep in the past, to be amongst the most interesting aspects of human prehistory. This book, therefore, presents a multidisciplinary reconstruction of the biological and cultural migrations of the inhabitants of Island Southeast Asia during the past 1.5 million years, finishing on the eve of the early historical Indic and Islamic kingdoms and religions between 500 and 1500 CE. With its focus on migration, this book links with my three other recent Wiley-Blackwell books – *First Farmers* (2005), *First Migrants* (2013), and *The Global Prehistory of Human Migration* (ed. 2015). For *First Islanders* the geographical canvas is far smaller, although I must on occasion extend my investigations as far away as the Yangzi Valley, Mainland Southeast Asia, Australia, and the islands of Oceania in order to put everything into its proper perspective.

I have also traveled a great deal in Island Southeast Asia during my career, as no doubt will have many readers of this book, and one fundamental observation never ceases to interest me. The seasoned traveler in Island Southeast Asia will be impressed by the panoply of ancient Hindu and Buddhist temples in Java, by the cultural achievements of Hinduism in Bali, by the modern vibrancy of Islam in most regions of

Indonesia and Malaysia, and by the extensive influence of Christianity in the Philippines and parts of eastern Indonesia. These cultural and religious traditions were, and still are, very different in many ways from those of prehistoric times. They were external to Southeast Asia in origin, and even if the outsider religions sometimes became admixed with indigenous beliefs they still reflected the penetration of Southeast Asia by the cultural and religious interests of far-away societies. With this in mind, it is remarkable to me that the modern Island Southeast Asian peoples themselves, in their biology and languages, are entirely indigenous and have been so since long before the age of international trade and empires. These people do not speak languages derived from Sanskrit, Arabic, Spanish, or Dutch, and have never done so, despite a borrowing of large numbers of often specialized vocabulary items from these external linguistic sources. They carry indigenous DNA, apart from some minor immigration of genes, mostly on the male side, during historical times.

Anyone who has read Alfred Crosby's *Ecological Imperialism* (1986) will realize why this situation exists. The indigenous populations of Island Southeast Asia were already numerous and densely settled 2000 years ago, living in a tropical landscape that was unsuitable for more westerly Eurasian settlers with their Fertile Crescent domesticated crops and animals. They were also protected by a suite of diseases that literally stopped many would-be invaders from temperate lands dead in their tracks. Unlike their less fortunate cousins in the heavily colonized regions of the Americas and Australasia, Island Southeast Asians lived sufficiently close to the teeming populations of Eurasia to be only lightly affected by the diseases of immigrants, to which they had reasonable levels of immunity. Instead, their own tropical diseases often turned the tables in the other direction, as any visit to an early European cemetery in the region will probably reveal.

In other words, the peoples of Island Southeast Asia, in terms of biological and linguistic genesis, were essentially in existence almost as they are now by at least 2000 years ago. Since that time there has been a great deal of population admixture over the whole of Island Southeast Asia, as is to be expected given the lively history of the region in trade, commerce, and sea-borne interaction. But were we to travel with a time machine across the region in 500 BCE, the faces that would hopefully smile at us as we landed on each island would look essentially much as they do today.

This Book

The predecessor of this book, entitled *Prehistory of the Indo-Malaysian Archipelago*, was first published in 1985 by Academic Press in Sydney. A revised edition was published in 1997 by the University of Hawai'i Press in Honolulu, and translated into Bahasa Indonesia as *Prasejarah Kepulauan Indo-Malaysia* by PT Gramedia Pustaka Utama in Jakarta in 2000. In 2007, the ANU E Press (now ANU Press) republished the revised edition as a third edition, but with only a new preface – the remainder of the text was reprinted exactly as it was in 1997. This third edition remains in print, available for free download at http://press.anu.edu.au/titles/prehistory-of-the-indo-malaysian-archipelago/, and it continues to reflect the state of knowledge about the region in the mid-1990s. What you are about to read here is a new book that builds upon the foundation of *Prehistory of the Indo-Malaysian Archipelago*, rewritten and updated with a new title and a new chapter organization.

Why a new book? The answer is basically that *Prehistory of the Indo-Malaysian Archipelago* is now out of date and simple revision of the existing structure is no longer sufficient. The time has come for a new perspective, not just from me, but also from a number of my colleagues who specialize in areas of research that are becoming ever more complex and prolific, such that a single individual can no longer keep on top of absolutely everything. For instance, here are some important aspects of Island Southeast Asian prehistory that have undergone fundamental change in terms of both data and interpretation since the text of the second edition of *Prehistory of the Indo-Malaysian Archipelago* was submitted to the publisher in 1995:

1. The Pleistocene biogeography of Island Southeast Asia is better understood now than 20 years ago, especially in terms of the glacial–postglacial fluctuations in sea level, temperature, and rainfall during the past 100,000 years. Much new research has, of course, been driven by the current world concern with the dangers posed by the El Niño climatic phenomenon and by anthropogenic global warming.
2. As far as new discoveries in the Southeast Asian fossil record are concerned, we can point to the 2003 and 2016 publications of the bones of a new hominin species from Flores island in eastern Indonesia, the tiny *Homo floresiensis*, as well as to other small archaic hominin remains dating from almost 70,000 years ago from northern Luzon in the Philippines. There have also been considerable strides in the craniometric analysis and absolute dating of many early modern human (*Homo sapiens*) remains from Late Pleistocene contexts.
3. It is now generally agreed by geneticists, biological anthropologists, and archaeologists alike that ancestral *Homo sapiens* did not evolve "multiregionally" all over the Old World, but evolved in and spread out of Africa between 100,000 and 50,000 years ago. For instance, few today would favor continuous multiregional evolution from *Homo erectus* in Java into the modern indigenous populations of Indonesia and Australia/New Guinea. There was, however, some degree of admixture between modern humans and archaic (and now-extinct) hominin species, such as Neanderthals in western Eurasia and so-called "Denisovans" in Southeast Asia. None of this was at all clear in 1995, although even then I tended to favor an "Out of Africa" rather than multiregional scenario for the origins of *Homo sapiens* in Eurasia.
4. There have been absolutely fundamental advances in the past decade in understanding the biochemistry of the human genome, both modern and ancient. In 1995, little could be stated from genetics about deeper human history beyond the level of mitochondrial DNA, blood groups and serum proteins, since whole genome and ancient DNA studies were simply not available at that time. Today, geneticists can scan and compare whole human genomes and even extract DNA from 300,000-year-old

skeletal remains (in Europe, but not yet in Southeast Asia!). The advances in genetic knowledge about population origins and ancestries have been astonishing, and are coming to dominate international publication venues.

5. The most recent statistical analyses of craniofacial variables in prehistoric cemetery populations are also of tremendous importance and allow us to witness the arrival of an Asian Neolithic genetic and phenotypic population throughout much of Island Southeast Asia, commencing about 3500 BCE in Taiwan. This population admixed with the preceding Australo-Papuan populations who were dominant to as far north as southern China and Taiwan prior to the Neolithic. The results are still visible today in many populations in southern and eastern Indonesia.
6. There have been major advances in recent years in understanding the beginnings of rice and millet agriculture in central China and the consequent spreads of Neolithic farming economies and human populations with rice, pigs, and dogs into southern China, Taiwan, the Philippines, and Vietnam. There have also been major archaeological research projects in Taiwan, the Philippines, and Indonesia that provide much clearer dating and directionality for the whole Neolithic migration process.
7. In collaboration with several of my colleagues who have contributed their invited perspectives to the following chapters, evidence is provided in support of a very important Neolithic movement through Taiwan into the Philippines, carrying Austronesian languages and Neolithic material culture, including the cultivation of rice. This commenced sometime between 2500 and 2000 BCE and passed through the Batanes Islands into northern Luzon. Although this "Out of Taiwan" hypothesis still has critics, in my view none provide a coherent multidisciplinary case for any other *major* hypothesis to explain the ancestry of early Austronesian-speaking populations. While the Out of Taiwan hypothesis was clearly stated in *Prehistory of the Indo-Malaysian Archipelago*, the multidisciplinary evidence in favor of it has now become overwhelming.
8. In various stages between 2200 BCE and 1200 CE, ancestral Austronesian-speaking peoples undertook further migrations across a vast area of the earth's surface. They settled throughout the Philippines and Indonesia, in all of the Pacific Islands beyond the Solomons, and westwards into Peninsular Malaysia, Vietnam, and Madagascar. Accordingly, it is possible to add new observations on the first truly long-distance voyagers in world prehistory, for instance the ancestral Chamorro population of the Mariana Islands and the people who produced Lapita pottery in Island Melanesia and western Polynesia. The movement from the Philippines to the Marianas around 1500 BCE marked the beginnings of Austronesian long-distance seafaring, in this case perhaps across 2300 km of open sea. The Lapita movement around 900 BCE from Island Melanesia into western Polynesia, by populations now known to be of Asian Neolithic genetic ancestry, continued this expansion process and eventually led to the settlement of the furthest-flung islands on the earth's surface.
9. Although New Guinea is not dealt with in detail in this book since it is not considered a part of Island Southeast Asia, major advances in understanding the

archaeological record of the New Guinea Highlands reveal this area to have been an indigenous source of a food-producing economy in the mid-Holocene, with potential repercussions in the prehistory of eastern Island Southeast Asia and Island Melanesia.

10. There have been major advances in post-Neolithic archaeology in Island Southeast Asia, especially concerning the exchange of Taiwan nephrite ear ornaments across and around the South China Sea. New understanding has also developed of Indian contact-era archaeology through the excavation of settlements dating to around 2000 years ago in southern Thailand and Bali, and of the impact, by around 500 BCE, of bronze-working traditions of Mainland Southeast Asian origin on the indigenous Early Metal Age societies of western Indonesia. The Early Metal Age also witnessed the migrations out of Island Southeast Asia (especially Borneo) of ancestral Chams to Vietnam, Malays to Peninsular Malaysia, and Malagasy to Madagascar. Interestingly, Taiwan at this time continued to interact mainly with other regions of Southeast Asia, rather than with Qin and Han Dynasty China.

This new book differs from its predecessors in my decision to ask many of my colleagues to add short chapters, under their own names as authors, describing their disciplinary perspectives on specific aspects of Island Southeast Asian prehistory. The total field covered by this book has now grown very large and the rate of publication increases continually, not just in quantity but also in degree of complexity. The time has come for collaboration between disciplinary specialists, and while I can read and understand what scholars in disciplines outside my own field (archaeology) have to say, I feel more comfortable if they also appear in person and in support. I do not wish to suggest that all will agree entirely with my views, since research in a field of the humanities such as human prehistory cannot proceed very far if everyone agrees in total unison. But I also know that our views are mostly in accord.

I should also add that in *First Islanders* I have replaced the term "Indo-Malaysian Archipelago" with "Island Southeast Asia." The former, while undoubtedly still valid and mellifluous, can give a wrong impression that this book is concerned only with Indonesia and Malaysia, thus leaving out Taiwan and the Philippines. Another difference between this book and *Prehistory of the Indo-Malaysian Archipelago* is that the latter still contains additional sections on the ethnography of the modern inhabitants (Chapter 5), on the Hoabinhian lithic industries of southern Thailand and Peninsular Malaysia (part of Chapter 6), as well as on the Neolithic of the Malay Peninsula (Chapter 8). I consider these sections still to be reasonably up to date and they have not been imported into *First Islanders*, which is focused more deeply on Island Southeast Asia *per se* rather than the Malay Peninsula, and on prehistory prior to 500 CE as reconstructed from the disciplines of archaeology, linguistics, genetics, and biological anthropology. *First Islanders* also has a stronger focus on human migration than did *Prehistory of the Indo-Malaysian Archipelago*.

A Note on Dating Terminology

Chronological statements in this book are always based on solar years, expressed as "years ago" for the Pleistocene and early Holocene (11,700 to 8200 years ago for the latter), and thereafter BCE (Before Common Era) and CE (Common Era, i.e., after AD 1) for the middle and late Holocene. Dates in millions of years ago are abbreviated to **mya**, and in thousands of years ago to **kya**. In a broad-scale review such as this, there is no need to refer to individual uncalibrated laboratory radiocarbon determinations.

The terms Pleistocene and Holocene refer to geological epochs. The former spanned the period from 2.58 mya to 11.7 kya, the latter date marking the end of the Younger Dryas brief return to glacial climatic conditions (Head et al. 2015). The Holocene has spanned the past 11,700 years (or roughly 10,000 uncalibrated radiocarbon years) and is still unfolding. It commenced with the establishment of current interglacial climatic conditions across the world after the Younger Dryas, and has witnessed the rise of humanity from a universal baseline of hunting and gathering through food production to statehood and global domination. The Pleistocene was preceded by the Pliocene, within which the earliest recorded stages of human evolution occurred in Africa.

The Pleistocene is divided into three periods of unequal length: Early Pleistocene from 2.58 mya to the Brunhes-Matuyama paleomagnetic reversal at 790 kya, Middle Pleistocene from 790 kya to the beginning of the last interglacial at 130 kya, and Late Pleistocene from 130 kya to the beginning of the Holocene at 11.7 kya. The Late Pleistocene contained the penultimate interglacial and final glacial periods, a time of massive change in global environments in which anatomically and behaviorally modern humans were propelled into prominence, and other more archaic hominin species in Indonesia, such as *Homo erectus* and *Homo floresiensis*, finally succumbed to extinction.

A Note on Archaeological Terminology

The basic structure of this book still revolves around the technological phase, or "age," system that has underpinned Eurasian (but not American!) archaeology since the nineteenth century. I make no apologies for this, but stress that clear definition is necessary from the outset, especially when we are discussing the evolving products of human technology (stone, bone, shell, pottery, metal, glass, etc.). There are four fundamental technological phases across the Southeast Asian region, overlapping in date and cultural content, but each also marked by one or more new marker combinations or appearances.[1]

Paleolithic. In Island Southeast Asia, the Paleolithic continued from the first Pleistocene appearance of stone tools in Java and Flores to the regional beginnings of the Neolithic, the latter between 3500 BCE in Taiwan and 1500/1300 BCE in southern and eastern Indonesia. In general, the Paleolithic was characterized by flaked and unground stone, bone, or shell tools, but in its terminal Pleistocene phases and into the Holocene there were a number of additions to the basic Paleolithic repertoire in Island Southeast Asia. These included edge-ground stone tools (Niah Cave, Sarawak), bifacial points (Sabah), ground shell tools (Philippines, southeastern Indonesia, and Timor-Leste), and microliths and backed flakes/blades (South Sulawesi). Further afield, the world's oldest examples of edge-grinding are reported from Japan (Izuho and Kaifu 2015) and tropical northern Australia (Geneste et al. 2012), dating back to around 38 kya. The Paleolithic was the long time span when both archaic hominins and early modern humans appeared in Island Southeast Asia, although the secondary elaborations just listed belong to a time when archaic hominins were extinct and only modern humans existed.

Para-Neolithic. This term Para-Neolithic[2] is used for a specific set of sites in southern China, northern Vietnam, and possibly Peninsula Malaysia that are defined by continuing hunter-gatherer economies and Paleolithic technology, but with the additions of *both* fully polished and symmetrically beveled stone axes, usually hammer-dressed from river pebbles, *and* simple vine-rolled or cord-marked pottery with gently inflected rather than angular rim and body contours. The presence of both of these artifact categories means that this phase deserves a special recognition. These Para-Neolithic sites belong to the early and middle Holocene and were located on the southern fringes of the contemporary central Chinese Neolithic, which commenced around 7000 BC. No examples are yet reported from Island Southeast Asia. The Para-Neolithic sites of China and Vietnam are discussed further in chapters 4 and 5, partly because of their carefully analyzed human burials with their implications for population history in Island Southeast Asia.

Neolithic. The Neolithic in Southeast Asia is defined by a presence of domesticated animals and crops, polished stone uni-beveled adzes (as opposed to axes) and body ornaments, and pottery of complex shape and decorative style (slipped, stamped, incised, with angled or inflected body contours and rims). One must bear in mind that very few tropical sites in Island Southeast Asia have paleobotanical records, so dogmatic statements to the effect that food production did or did not exist in specific archaeological circumstances are to be avoided. However, food production in general is an essential element of the Neolithic definition and its presence in Island Southeast Asia is strongly supported by Austronesian comparative linguistic data and increasing numbers of archaeobotanical analyses, especially in Taiwan and the northern Philippines. The Neolithic was also a period of major demographic growth according to archaeological and cranial/genetic data, the latter documenting the immigration of a population from southern China and Taiwan with Asian Neolithic as opposed to Australo-Papuan craniometric and genetic affinities. The Neolithic in Southeast Asia is associated with the first large-scale open-air settlements of village type, and Neolithic burials were mostly extended supine or placed in large earthenware jars, often with pots or body ornaments as grave goods, unlike their tightly folded Paleolithic and Para-Neolithic predecessors.

Early Metal Age. The Early Metal Age, or "Paleometallic" in much Indonesian literature, is marked by the appearances of copper, bronze, and iron, with the oldest items of copper/bronze dating to about 600–500 BCE in southern Sumatra and iron perhaps a little later. Bronze appeared slightly before 1000 BC in Vietnam and Thailand, thus definitely earlier than iron, and bronze was present even earlier (by 2000–1500 BCE) in central China. The Early Metal Age is also associated with the first evidence of contact with traders from the growing Hindu and Buddhist civilizations of Gangetic and eastern peninsular India, with Sri Lanka. In Taiwan, the Early Metal Age commenced around 400 BCE, surprisingly with almost all attested cultural contacts with Island Southeast Asia to the south rather than with contemporary dynastic China.

The period after 400 CE is essentially **Early Historical**, focusing on early trading networks involving China and India, located in regions such as the Red and Mekong river deltas, the Malay Peninsula, Sumatra, and Java. By 500 CE, inscriptions in Sanskrit and Austronesian languages, together with the first temples dedicated to Indic religions such as Hinduism and Buddhism, were beginning to appear across the region from Burma to eastern Borneo. This book is not concerned in detail with the Early Historical period or its art history, except for its roots in the indigenous societies of the preceding Early Metal Age.

The reader will note that I have not attempted to put rigid chronological boundaries around the above archaeological ages, simply because the pace of new discovery, with so many new radiocarbon dates being published all the time, makes absolute precision rather an elusive concept. Furthermore, in recent millennia we see gradients in the dating of shifts between ages, for instance into the Neolithic, as we move across geographical space. Absolute chronology is of enormous importance in specific instances of understanding how peoples and cultures have evolved through time, but imposition of a region-wide chronology for no specific purpose is unwise.

Pronunciation and Place-names

In Indonesian place-names the "c" is pronounced "ch" as in English "church," "ng" is pronounced as in "singer," and "ngg" as in "finger." The common place-name elements *gua* (cave or rock shelter), *liang* (aperture or cave), *gunung* (mountain), *bukit* (hill), *tengkorak* (skeleton), *tulang* (bone), *angin* (wind), *sungai* (river), *batu* (rock), and *kota* (town) are all in the modern Bahasa Indonesia and Malay vocabularies. Chinese place-names are all in *pinyin* Romanization for both China and Taiwan. Vietnamese place-names are rendered without diacritical (tone and vowel) marks.

Notes

1. Naturally, in preparing this edition I have thought deeply about the possibility of replacing this phase sequence with another classification, but any such classification will always involve a presence of human behavioral concepts that are often very hard to verify from the archaeological record. For instance, Indonesian archaeologists (e.g., Soejono 1984) have for many years used a three-part descriptive terminology that relates directly to aspects of behavior. This commences with *masa berburu dan mengumpulkan makanan* (age of hunting and food collection), with simple and extended (*sederhana* and *lanjut*) phases that correspond

to the single-phase Paleolithic as defined here. It then progresses into *masa bercocok-tanam* (age of planting, or Neolithic), and finishes with *masa perundagian* (age of craftsmanship, or Early Metal Age). Use of such a system does not in my view solve the problem of classifying the hundreds of undated sites in Island Southeast Asia that lack diagnostic artifacts or economic evidence, any more than does the system advocated here. I suggest we keep the *status quo*.

2. I am using the Oxford Dictionary definition of the prefix para-, meaning "beside" (as in "paramilitary"), or "beyond" (as in "paranormal").

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Chapter 2
Island Southeast Asia as a Canvas for Human Migration

For the purposes of this book, Island Southeast Asia includes Taiwan, the Philippines, Brunei and the Sarawak and Sabah provinces of East Malaysia (northern Borneo), and all of the islands of Indonesia to the west of New Guinea (Figure 1.1). Adjacent regions to the west and north that will also require extended comment in the following chapters include the Thai-Malaysian Peninsula, Vietnam, southern Thailand, and southern China below the Yangzi River. To the east lies the Greater Australian continent comprising Australia and New Guinea (with its two political divisions of Indonesian Papua and independent Papua New Guinea). Beyond New Guinea lie the islands of the Pacific Ocean, or Oceania.

Island Southeast Asia thus extends from about 25° north latitude (northern tip of Taiwan) to 11° south (Sumba and Timor) and from the western tip of Sumatra to the Moluccas in the east. The region is about 4200 km long from west to east and a similar distance from north to south. It now supports 400 million humans who live on about 2.5 million km^2 of dry land, of which about 75% is located in Indonesia. During Pleistocene periods of glacial low sea level and continental shelf emergence, the area of land exposed above the sea in Island Southeast Asia increased to a maximum of 4.5 million km^2, although the length of exploitable coastline actually decreased under these conditions to as low as one half of the present length (Dunn and Dunn 1977).

The islands of this region differ greatly in size. Borneo[1] covers 750,000 km^2 (only slightly smaller than New Guinea, at 785,000 km^2). Sumatra comes next with 475,000 km^2, then Sulawesi (180,000 km^2) and Java (139,000 km^2). The Philippines occupy 300,000 km^2 of land in total, but because of their tectonic history, with seabed subduction from both west and east (Figure 2.1), these islands form a uniquely compact archipelago organized around a chain of small inland seas. In many ways, the Philippines can be regarded as a single landmass for archaeological analysis. Taiwan, located off the coast of southern China but until the seventeenth century ethnically and linguistically a part of Island Southeast Asia, covers 36,000 km^2.

First Islanders: Prehistory and Human Migration in Island Southeast Asia, First Edition. Peter Bellwood.

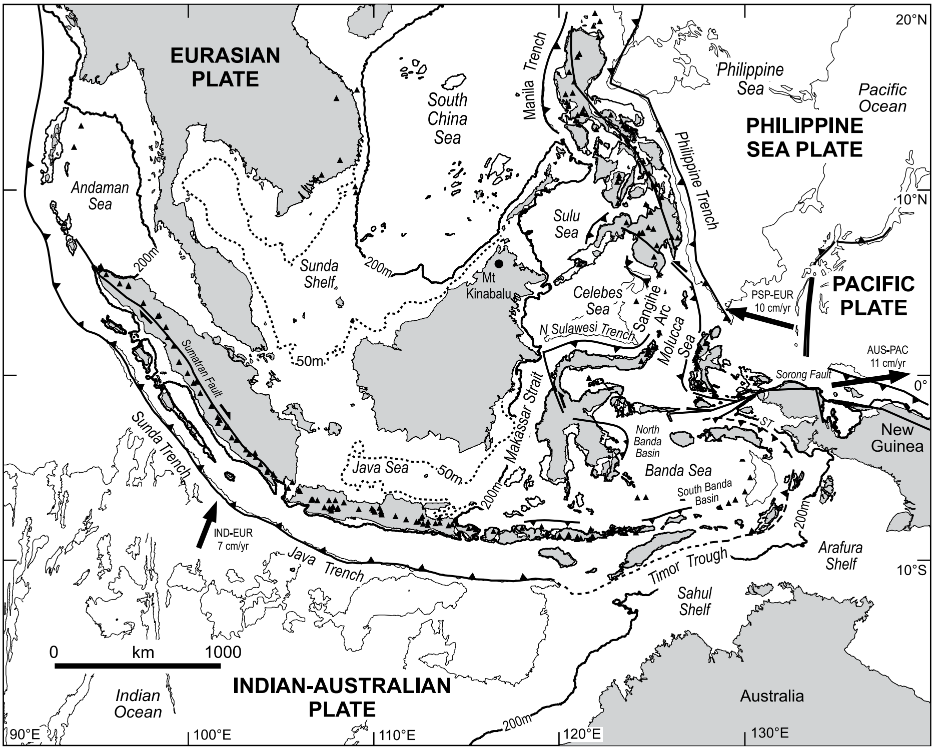

Figure 2.1 Structural map of Southeast Asia and Australasia showing the main lines of continental plate subduction (in the direction of the arrows, sliding downwards beneath the landmasses), the Sunda and Sahul shelves (delimited by the 200 m bathymetric contour), and the volcanic arcs. The 50 m bathymetric contour is also shown as a dotted line for the main portions of Sundaland, since coastlines would have approximated this shape between glacial and interglacial maxima during much of the Pleistocene. Volcanoes are shown as black triangles. Source: base map courtesy of Robert Hall (2012: Figure 3.1) and The Systematics Association, modified slightly by the author.

The Shelves and Basins

The islands of western Indonesia are in general larger than those of eastern Indonesia and the reasons for this lie in the structure of the archipelago. The Southeast Asian islands, "the remarkable festoon of islands that swing around the equator in the East Indies" (Umbgrove 1949), fall into three fundamental structural divisions (Figure 2.2). The first, forming a direct extension of the Asian mainland, comprises the Sunda continental shelf – the ancient and stable "Sundaland." The second, the Pliocene and Pleistocene Sunda–Banda volcanic arc, is attached to the Indian Ocean edge of the Sunda shelf and extends eastwards beyond it into Nusa Tenggara (the Lesser Sundas) and the southern Moluccas. The third consists of the Sangihe, Philippine, and Halmahera volcanic arcs, with their extensions northwards

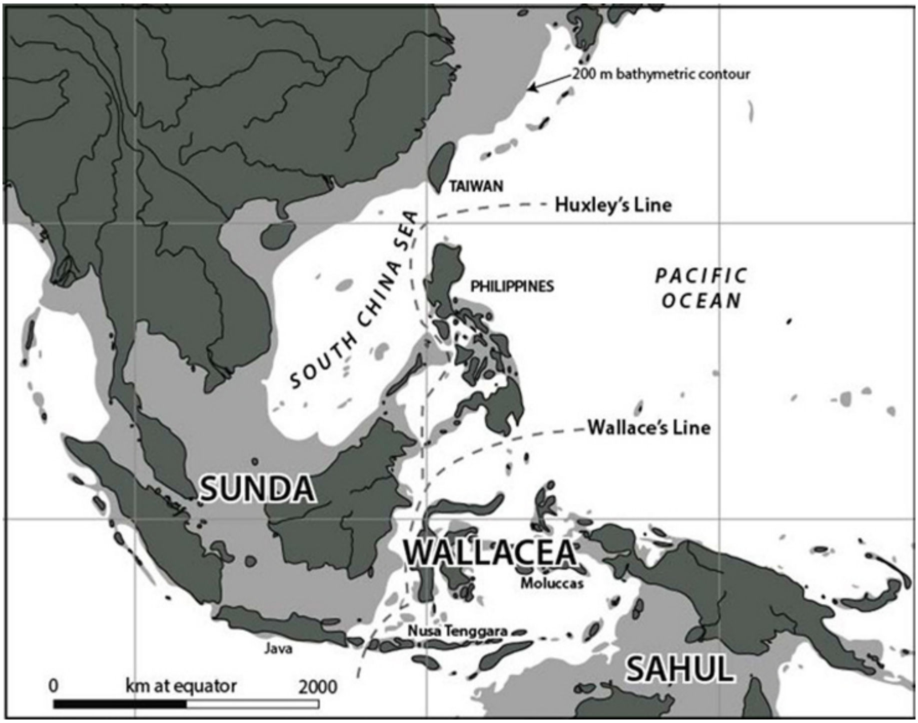

Figure 2.2 Major biogeographical divisions and boundary lines within Island Southeast Asia, especially Sundaland, Wallacea, and Sahul, shown at an absolute maximum bathymetric contour of −200 m, which was never actually attained during the Pleistocene. Separate Philippine land masses (too complex and close together to show in this map) during glacial periods of maximum low sea level (−120 m) would have included (a) Luzon; (b) Mindanao, Samar, Leyte, and Bohol; (c) Panay, Negros, and Cebu; (d) Palawan; (e) Sulu; (f) Mindoro (after Croft et al. 2006: Figure 1; Robles 2013). Source: base map by Multimedia Services, ANU; details added by the author.

towards Taiwan and Japan. These volcanic arcs are shown in the form of individual volcanoes (black triangles) in Figure 2.1.

The Sunda shelf proper supports the largest area of shallow submerged continental edge in the world, built around an old and fairly stable Mesozoic core that has had little recent volcanic activity. Much of the shelf lies beneath the sediments of the South China and Java seas as a virtual peneplain worn down by erosion. Present land areas that rise directly from the old partly submerged shelf core include the Thai-Malaysian Peninsula, Borneo, and the northern coastal lowlands of Sumatra, Java, and Bali.

The volcanoes of the Sunda–Banda arc were formed by crustal subduction of the Indo-Australian plate along the Indian Ocean rim of the Sunda shelf and beyond it to the east. They form the highland spines of Sumatra, Java, and Nusa Tenggara and are visually one of the most remarkable volcanic mountain systems in the world.

The arc is actually expressed as two separate island chains, the inner and higher one being volcanic and the outer and lower one consisting of uplifted sediments (including widespread coral limestones) without active volcanoes. The inner chain includes 82 active volcanoes that extend in a curve from Sumatra through Java and into Nusa Tenggara. Outside this arc lies a deep marine trench, beyond which rise the non-volcanic outer arc islands off the western coast of Sumatra (Nias, Simeulue, Mentawai, and Enggano), as well as the southeastern islands of Sumba, Timor, and Tanimbar. The Sunda–Banda arc is still in active construction as demonstrated by very frequent volcanic eruptions, such as Tambora in 1815 and Krakatoa in 1883, and earthquakes, including that which produced the Indian Ocean tsunami of 2004.

The Sangihe, Philippine, and Halmahera volcanic arcs are of Pacific basin origin, having originally moved westwards since 20 mya from original positions north of New Guinea. They are similar to but much smaller than the Sunda–Banda arc, and other such arcs continue northward around the western Pacific rim to form a "Ring of Fire" through the Ryukyu Islands, Japan, and the Aleutians.

General accounts of the formation through geological time of the Island Southeast Asian region have been given by many geologists and earth scientists and a number of reconstructions with animated colored maps have been published by geologist Robert Hall (2002, 2012, 2013). In recent years it has become clear that Sundaland has a complex geological history, being composed not just of successive volcanic arcs but also of numerous continental fragments, including some from Australia, forged together through subduction, crustal rafting, and volcanic arc formation at different times since the Triassic (250–200 mya). Much of the present shape of Sundaland also reflects an increased rate of plate subduction and tectonic activity during and since the Eocene, starting around 45 mya (Hall 2013).

One interesting aspect of all of this continental movement is that it has allowed some degree of mixing of very different floras and faunas through geological time, the faunas coming from separate Asian placental and Australasian marsupial evolutionary origins. The northward drift of Australia has been occurring at a rate of about 80 km per million years since this landmass began its migration from Gondwanaland early in the Tertiary. The eventual result was that some outer crustal fragments that split off the Australian continent began to collide with the Sunda–Banda arc and the eastern part of Sulawesi. The geological structure of the Wallacean region of Indonesia is therefore particularly complex, with the Australasian plate contributing portions of the two eastern arms of Sulawesi, plus Timor, Seram, Buru, and the Sula Islands. Western Sulawesi apparently became separated from eastern Borneo and moved eastwards during the Eocene, around 45 mya. The island began to approach its present composite and complex shape with major uplift and collision with the Australasian crustal fragments during the Pliocene. As a result, Sulawesi has a unique endemic fauna of both placental and marsupial mammals.

Whatever the underlying geological forces, the Southeast Asian archipelago had attained much of its present basic shape by the time hominins[2] first arrived, around 1.8–1.2 mya, although some regions such as eastern Java and some smaller Sunda–Banda islands might have been still emerging at that time. In terms of human and biotic developments, the three major structural divisions just described can be rearranged into three west to east biogeographical divisions of much more direct relevance for human prehistory. These are Sundaland in the west, Wallacea in the middle, and the separate Sahul continent to the east (Figure 2.2).

Sundaland

Sundaland comprises the regions on or attached to the present Sunda shelf – the Thai-Malaysian Peninsula, Sumatra, Java, Borneo, and other small groups such as the Riau and Lingga Islands. Palawan is normally considered a part of Sundaland but its mammal fauna also has phylogenetic affinities with those of the Oceanic islands that form the main Philippines, including Luzon and Mindanao (Esseltyn et al. 2010). The eastern edge of Sundaland is marked by Huxley's Line of biogeographers, not to be confused with its better-known antecedent the Wallace Line, which its creator Alfred Russel Wallace drew in 1869 to the south of the Philippines (Wallace 1962:8–9; he termed it the "Division of Indo-Malayan & Austro-Malayan Regions"). Huxley's Line runs between Bali and Lombok, Borneo and Sulawesi, Borneo and the Sulu Archipelago, then east of the Calamianes and Palawan, and finally off into the Pacific between Luzon and Taiwan.

Much of Sundaland is now covered by shallow sea, but varying extensions would have been exposed as dry land by low sea levels for long periods during successive Pleistocene glaciations, especially at the peak of the last glaciation (or LGM – last glacial maximum) at about 28–18 kya, when no less than 2 million extra km^2 emerged as dry land from the shallow beds of the South China and Java seas. Drowned river channels and sediments in the beds of these seas show this long-term exposure and erosion very clearly.

Wallacea

The term "Wallacea" was first introduced into the zoogeographical literature by Dickerson (1928). He defined the region as that between Huxley's Line in the west and Weber's Line in eastern Indonesia, the latter marking a balance in species numbers between the Oriental and Australasian faunas. In this book, however, I will adopt a definition more relevant for human prehistory. Wallacea includes all those islands lying between the continental shelves of Sunda to the west and Sahul to the east, including Nusa Tenggara from Lombok eastwards to Timor, Timor-Leste, Sulawesi, the Moluccas including Tanimbar and Kei, and the Philippines with Sulu but not Palawan (which formed a long northeasterly peninsula of Sundaland). The islands of Wallacea all share one important factor – they were never land-bridged continuously (as far as we know) to any of the larger land masses to their west or east. Humans and other terrestrial animals had always to cross ocean gaps to reach and pass through them.

Wallacea has evolved as a zone of enormous crustal instability and now exists as a number of islands separated by deep ocean basins, particularly the Sulu, Sulawesi, and

Banda seas, the whole formed by rapid processes of uplift and down-faulting. Some of the enclosed seas have particularly impressive features. For instance, the Sulu Sea is 4633 m deep and yet is totally enclosed by high ridges that never sink more than 380 m below sea level. This means that the temperature of this sea remains fairly even from top to bottom, without the rapid cooling with depth found in the great oceans (Molengraaff 1921). The islands of Wallacea rise from the seabed ridges of the region and the rate of uplift has been very rapid in places; corals of presumed Pleistocene date have been reported from an altitude of 1500 m in Timor, and many islands have series of raised coral coastal terraces. Subsidence can, of course, be just as rapid, and corals of similar age have been found to depths of 1600 m on the bed of the Seram Sea.

Sahul

The Sahul shelf forms a shallow, drowned, and tectonically stable link between the Australian continent and the massive island of New Guinea – it is thus the Australasian equivalent of the Sunda shelf. The term "Sahulland" may be used to denote the New Guinea-Australian land masses (with the Aru Islands and Tasmania) when both were joined together during periods of low sea level. Environmental changes in northern Sahulland, particularly during the later Pleistocene and Holocene, are of particular significance for an understanding of similar events in Island Southeast Asia, although Sahulland is not included within Island Southeast Asia for the purposes of this book.

The Island Southeast Asian Environment

Climate

As the whole of Island Southeast Asia lies well within the tropics, temperatures are uniformly hot and vary little throughout the day or from season to season. The only major variation in temperature occurs with altitude (average temperature drops 1 °C every 160 m), but even on the highest peak in Southeast Asia, Mt Kinabalu in Sabah at 4100 m, the temperature never gets colder than an occasional night-time frost. The only permanent glaciers occur to the east in New Guinea, but only 8 km^2 of the total 785,000 km^2 of this island are so covered.

The crucial climatic variable across the region is rainfall, and for general purposes it is useful to recognize two distinct zones – equatorial and monsoonal (Figure 2.3):

1. The equatorial zone, where rain occurs all year round, lies within approximately 5° north and south of the equator. Most regions do have two slight rainfall peaks with the movement of the Intertropical Convergence Zone, but for practical purposes the rainfall is frequent, heavy, and reliable and the evergreen rainforest grows luxuriantly in constantly damp or wet soils. Peninsular Malaysia, Sumatra, western Java, Borneo, central Sulawesi, the southern and eastern Philippines, and parts of the Moluccas fall generally in this zone, as does most of New Guinea, albeit with temperature fall-off with altitude.

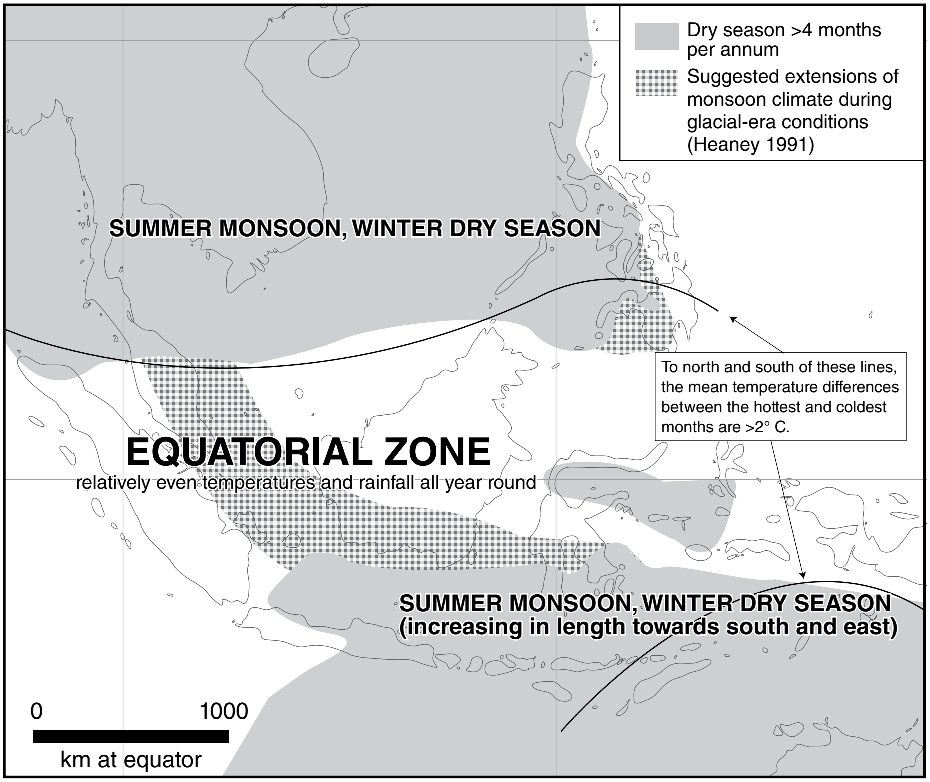

Figure 2.3 Climatic regimes and dry-season distribution in Island Southeast Asia.
Source: base map by Multimedia Services, ANU; details added by the author.

2. The monsoonal zone extends beyond the equatorial zone, beyond 5° north and south of the equator, and is characterized by clearly differentiated summer wet seasons and winter dry seasons, the latter between 2.5 and 7.5 months in length. Within Southeast Asia this monsoonal zone includes the mainland north of the Malay Peninsula, the western and northern Philippines, southern Sulawesi, and the Sunda–Banda arc islands from central Java eastwards. The monsoonal zone ultimately fades into the temperate monsoonal climates of China and the deserts of central Asia and Australia. Monsoon forests tend to be more open than equatorial ones and to have a deciduous tendency during the peak of the dry season.

To explain these rainfall variations, a major feature of global air circulation concerns a constant exchange of air which flows as winds between the equator and the Poles. In the tropics, warm air is constantly rising and flowing poleward at intermediate altitudes. It cools, sinks in the fringing tropical latitudes at about 20–30° north and south and flows equatorward again as the trade or monsoon winds. The trade winds in the open Pacific, where there is no interference from large land masses, blow from the northeast in the northern hemisphere and from the southeast in the southern as a result of the earth's east to west rotation. The region where these two sets of trade winds converge and where air convection is strongest is termed the Intertropical Convergence Zone. This zone is not fixed in position but moves seasonally to north and south of the equator according to temperatures in the continental interiors of Asia and Australia.

Because of their large sizes, these two continents are responsible for modifications to the trade winds in their vicinities, giving rise to what are known as the monsoons. In January the Asian interior is cold, the Australian interior hot. The resulting pressure gradient outward from Asia deflects the Intertropical Convergence Zone southwards into the southern part of Indonesia and the northern tip of Australia (to about 10–12° south). These areas then receive their rainy seasons (southern summer), because the front is a constant formation zone of depressions and squalls and the northern hemisphere trade winds are sucked as monsoon winds southwards across the equator, bringing additional moisture from the seas that they cross.

Conversely, in the northern summer (July), the front is pushed much further to the north (up to 32° north) because Asia, as a much larger continent, has greater influence on global climate than Australia. Mainland Southeast Asia and the Philippines then get their wet seasons. The equatorial regions proper tend to have a double rainfall peak because the front passes over them twice in each year. The extended trade winds in Island Southeast Asia thus become the monsoons, which are usually named after their predominant directions.

These climatic variations are of great importance for recent prehistory and postulated changes in them were also of great importance in the Pleistocene, especially with respect to the history and changing extent of the Sundaland equatorial rainforest. Typhoons and hurricanes also form in the monsoonal zone and are common in the northern Philippines and Taiwan, where they blow in from the Pacific Ocean, and likewise in the southern hemisphere in northern Australia and the southern islands of Melanesia. They are almost unheard of in the equatorial latitudes of Indonesia and Malaysia, although current global warming appears to be pulling some equatorward into the latitude of the southern Philippines.

Landforms and Soils

Humans, animals, and plants depend not only on climate for their existence, but also on the nature of the ground upon which they live. In Island Southeast Asia there are some very important variations in landforms and soils which lie at the base of the enormous differences in population density seen today between islands such as Java and Borneo. It is apparent that they were equally important in prehistoric times.

The main soils of the equatorial ever-wet region are yellow to red leached lateritic clays that are rich in iron and aluminum, acidic, and generally low in plant nutrients and organic matter. They do, indeed, support dense and luxuriant forests, but these are products of long evolution whereby 50–80% of the nutrients are accumulated in the biomass and constantly recycled in the upper layers of the soil as vegetation grows, dies, and decays. Once these forests are cleared the cycle is broken, as the nutrients simply leach away through the exposed soil, often with disastrous results.

These lateritic soils are generally characteristic of the equatorial and non-volcanic lowlands of Sumatra, the Malay Peninsula, Borneo, Sulawesi, and southern New Guinea. Today, they support low populations because they are fairly infertile, unsuited in traditional cultivation systems to anything but shifting agriculture, and difficult for reasons of structure and excessive rainfall to bring under irrigated and terraced rice. Furthermore, the forest itself is normally always wet, hard to clear and burn with simple equipment, and subject to rapid regrowth of weeds and secondary vegetation. In addition, many low-lying Sunda Shelf coastal regions of the Malay Peninsula, eastern Sumatra, and southern and western Borneo have extensive areas of lowland peat soil, very difficult for any traditional food-producing economy apart from sago management.

The soil patterns change, however, when we move into the Philippines and south-eastern Indonesia, from central Java through Nusa Tenggara. Here, the soil can be sometimes enriched by the fertile outpourings of the many volcanoes, particularly where the products are chemically of basic rather than acidic composition, as they are in central and eastern Java, Bali, Lombok, and the Minahasa Peninsula of northern Sulawesi. Most (but not all) of the Sumatran volcanoes are more acidic in this respect and consequently produce soils less favorable for agriculture.

This volcanic replenishment means that the normal tropical trends of leaching and nutrient loss in soils are constantly reversed when eruptions occur. The resulting volcanic ashes are often firm and ideally suited for purposes of rice terrace construction, as any visitor to Bali or eastern Java will observe (Fig. 8.7). This lucky combination does not cease here, for these regions, like the western Philippines, have a climate with a definite dry season which lessens the rate of soil leaching and also promotes a partially deciduous and more open vegetation, an easier target for clearance by agricultural societies than the ever-wet equatorial rainforest. However, this monsoon vegetation is fragile when subjected to clearance and degraded lands in these regions tend to degenerate to extensive grasslands, particularly where droughts are common.

The results of these differences in soil fertility are very visible today because regions where wet rice is grown in paddy fields surrounded by small banks (*sawah* in Bahasa Indonesia), fed by both artificial irrigation and monsoon rainfall, tend to be concentrated on alluvial and deltaic soils in major river valleys and along coastal plains, or in regions of fertile volcanic soil. Modern wet rice cultivation is therefore of tremendous importance in regions such as Java and Bali, South Sulawesi, parts of the Philippines, and in other favored coastal and riverine pockets elsewhere (Huke 1982). However, the major portions of the large islands of Sumatra, Borneo, and Sulawesi were (and still are) mostly under less productive shifting cultivation.

These differences were very clearly pointed out for Indonesia by Mohr in 1945. From a census taken in 1930 he was able to show that Java and Madura had average densities at that time of over 300 persons per km^2, Bali and Lombok about 175, Sulawesi 22, Indonesian Borneo 4, and West New Guinea only 0.73. These figures, even if now outdated (Java has a density of over 1100 persons per km^2 today and Luzon over 500), still tell an important tale. Although the high Javanese densities reflected in part the Dutch introduction of intensive agricultural techniques after 1830, including permanent dry-field cultivation, Mohr was still able to show convincingly how high population densities in Indonesia depended on a triple combination of basic volcanic soils, non-excessive rainfall with a good dry season for cereal ripening and harvest, and rice cultivation in permanent irrigated fields. He concluded: "In the Netherlands Indies the population density is a function of the nature of the soil and this is a function of the presence of active volcanoes" (Mohr 1945:262).

However, as we will see in Chapter 7, many of the lowland alluvial areas that support so much wet rice cultivation today simply did not exist above sea level when agriculture was introduced into Island Southeast Asia between 5000 and 3500 years ago. At that time, sea levels were slightly higher than now and coastlines were extensively drowned. The sea washed directly against coastal foothills, especially along the steep coastlines of Wallacea, and the lower courses of rivers were turned into deep estuaries.[3] This means that many of the lowland riverine, deltaic, and coastal plain regions of Mainland as well as Island Southeast Asia that we see covered in such a beautiful patchwork of wet rice fields today were not part of the Neolithic landscape.

The Floras of Island Southeast Asia

Island Southeast Asia forms part of the "Malesia" of botanists. In its ever-wet equatorial regions, the evergreen mixed dipterocarp rainforest forms the most complex terrestrial ecosystem in the world (Walker 1980:21). Botanists are always eager to quote impressive statistics about this vegetation. Within Malesia, about 10% of all the plant species, 25% of the genera, and over 50% of the families in the world are represented. Over 25,000 species of flowering plants occur in the region, with 11,000 on Borneo alone. Associated with this variety is a rarity of extensive stands of single tree species and extreme spatial variation is the rule. No fewer than 780 tree species have been recorded from a single 10 hectare plot in northern Sarawak (Hanbury-Tenison 1980), and a 1 hectare forest plot at Belalong in Brunei contained 550 trees in 43 families, represented by 231 different species (Cranbrook and Edwards 1994:103).

This equatorial rainforest is characteristic of the lowland regions along the equator that lack dry seasons, but in eastern Java, Nusa Tenggara, the southern tips of Sulawesi, and the western Philippines the longer dry season has favored more open monsoon forests with a deciduous tendency, characterized by stands of casuarina, sandalwood, and eucalypts. In western Java, southern Sumatra, and northern Peninsular Malaysia there is a shorter three- to five-week dry season that also encourages some elements of this type of forest. Local ecological variations cross-cut the major climatic patterns to create such specialized ecosystems as the coastal mangrove and swamp forests, the limestone forests, and the high mountain moss forests.

From a human prehistoric perspective, it is the broad distinction between the equatorial and the monsoon forests that is likely to be of the greatest significance on a large scale. Monsoon forests support larger population densities than equatorial forests, and offer easier routes for migration. Modern plant geography also reflects the geological history of the Indonesian region, in that the floras of Sundaland are of Asian origin and rich in species, a reflection of the frequency of dryland connections across the subcontinent in the past. The floras of Wallacea, on the other hand, have fewer species, higher proportions of endemics, and a larger Australian element. Wallacea may be regarded as a transition zone between two ancient continental areas with quite different floras.

Faunal and Biogeographical Boundaries

The differences between Sundaland and Wallacea in terms of flora are also reflected in the distribution of animal species, particularly the large mammals that have a fairly prolific fossil record. Basically, Sundaland has an Asian placental mammal fauna that includes many species ranging in size from elephants and rhinos downwards. Peninsular Malaysia, for instance, has 203 species of land mammals (Cranbrook and Edwards 1994:79). Wallacea, on the other hand, has fewer species than Sunda and a greater proportion of endemics, with an increasing Australasian marsupial element in Sulawesi and further east.

The sluggishness or absence of faunal dispersal across Huxley's Line into the eastern part of the archipelago is clearly of importance for understanding prehistoric human dispersal. There have been no Wallacean land bridges of anything more than a very ephemeral and local nature within the past 2 million years, an observation underlined by biogeographical as well as geological considerations. Of placental mammals, only rats and bats are distributed from Sunda right through to Sahul, and of marsupials a number have spread naturally from New Guinea into the Moluccas (Flannery 1995). But only marsupial phalangers (cuscuses) ever reached Sulawesi and Timor, in the former case by prehuman crustal rafting and in the latter by human translocation. Both wallabies and bandicoots were once present in Halmahera and adjacent islands in the northern Moluccas, very close to New Guinea, before their apparent extirpation in Neolithic times or later. However, it is unclear whether these animals were introduced by humans or if they reached these islands by natural means.

Discussions of the significance of Huxley's Line have been numerous, with ample disagreement about how to subdivide the Wallacean region in zoogeographical terms (Simpson 1977; Esseltyn et al. 2010). The line works quite well for freshwater fish, mammals, and birds (in that order), but is less decisive for insects and plants. It also works well between Borneo and Sulawesi, but the Philippine (especially Palawan) and Nusa Tenggara boundaries are hazy. Although Oriental bird faunas drop off sharply down the Nusa Tenggara chain from Java, the reasons may be more to do with changing ecology than the mere presence of sea passages. Furthermore, there is no sharp break in plant distribution down the Nusa Tenggara chain, although the break is sharper between Borneo and Sulawesi. In general, however, it is best to regard Wallacea as a zone of transition rather than as a zone of total barriers.

As we will see, the biogeographical divide of the Huxley/Wallace Line was also important in early hominin dispersals, although some clearly managed to cross it.