As demonstrated in Chapter 4, the reconstructions of comparative linguists indicate that the earliest identifiable Austronesian communities were located in Taiwan. Prior to the Austronesian colonization of this island, some degree of common linguistic ancestry with mainland Asian populations (especially ancestral Austroasiatic and Tai-Kadai speakers) is evident in macrofamily reconstructions. Beyond Taiwan, early Austronesian colonists later moved southward through the Philippines into Indonesia and Oceania.

These early Austronesian populations had economies based firmly on agriculture and maritime subsistence, some domesticated animals, and a technology that included canoes, well-constructed wooden houses, and probably pottery. The linguistic evidence can tell a great deal about the geographical patterning of Austronesian expansion and about certain adaptations that took place in the Austronesian lifestyle. It cannot, however, tell very much about absolute chronology or illustrate many stylistic details of material culture.

The provision of information in the latter categories is of course primarily the domain of archaeology, as the bulk of the next three chapters will show. This discipline can also provide some information that can be equated with the record of ethnolinguistic prehistory as derived from linguistics. For instance, the documented spread of pottery and polished stone adzes after 3000 BC through parts of Island Southeast Asia is perhaps mainly a result of Austronesian settlement, although this is naturally impossible to prove in any absolute sense because pots and stones cannot talk. But such categories of material culture have dates, typological characteristics, and distributions that we can attempt to interpret.

To anticipate the following sections, I will set out here a brief version of my
overall model for the later stages of Indo-Malaysian prehistory (Bellwood 1991, 1995a):

1. The Austronesian-speakers who expanded into the Indo-Malaysian Archipelago carried a fully agricultural economy and introduced pottery and a new repertoire of unibewed stone adzes. However, woven in with this agricultural economy were continuing skills in terrestrial and maritime hunting and gathering. Linguistically, a presence of rice in the agricultural repertoire seems certain. Archaeologically, the evidence is less conclusive and I return to this problem below.

2. The pre-Austronesian inhabitants of the archipelago occasionally used edge-ground stone axes and shell adzes, but they did not use pottery. While they undoubtedly exploited many tubers and fruit trees, later to be of major importance as domesticates, they did not systematically cultivate these species. Had they done so, the present representation of non-Austronesian and non-Mongoloid populations in the major islands of Southeast Asia would, for demographic reasons, be much fuller.

3. Non-Austronesian hunters and gatherers survived in ever-diminishing numbers throughout the millennia of Austronesian expansion, but a non-cereal agricultural economy might have developed independently in the New Guinea Highlands before this expansion took place. This could help to explain why Austronesian colonization of New Guinea was restricted only to marginal coastal locations.

4. During the millennia of expansion southward and into Oceania, the economies of Austronesian societies underwent a number of latitudinal and more localized ecological adaptations. Cereals were apparently replaced in eastern Indonesia by tubers and tree fruits. Some groups even specialized away from agriculture in the directions of terrestrial or maritime hunting and gathering (e.g., the Punans and Orang Laut).

5. During the millennium between 500 BC and AD 500, the archipelago was incorporated into wider South and East Asian spheres of interaction. Major introductions or developments of this period include metallurgy and probably domesticated cattle and water buffalo, together perhaps with a significant increase in commitment in certain areas (e.g., Northern Luzon, Java, Bali) to terraced and irrigated rice cultivation. Contacts with the civilizations of India and China also began during this period.

I. THE ORIGINS OF AGRICULTURE

There is now enough botanical, linguistic, and archaeological evidence to allow a partial reconstruction of the early stages of agricultural prehistory in China
and Southeast Asia. This has not always been the case; until a few years ago it was fairly commonplace for geographers and botanists to offer purely hypothetical reconstructions that were always plausible but never testable. One was the well-known theory of Sauer (1952) that agriculture arose with the vegetative planting of tubers and other useful plants in the monsoon regions of Mainland Southeast Asia, especially in resource-rich coastal and riverine situations where varieties of useful plant species were available for many purposes as well as food. The literature that has grown up around Sauer’s theory is too extensive to review here, but I must question (without necessarily entirely rejecting) two widely accepted corollaries of his views. One is that agriculture based on the vegetative planting of trees and tubers long preceded the cultivation of cereals in Southeast Asia. The other is that agriculture began in “affluent forager” conditions of leisure and plenty that allowed experimentation.

As far as the first corollary is concerned, I accept Gorman’s suggestion (1977) that rice was one of the earliest plants to be domesticated in China and Mainland Southeast Asia. Archaeological evidence from China supporting this observation is now prolific and will be reviewed below; there is no direct archaeological evidence supporting an earlier stratum of noncereal cultivation, except in New Guinea, an area of only marginal relevance for early agriculture in Southeast Asia. However, it must be noted here that some of the oldest Neolithic sites in Southeast Asia have not yet produced direct evidence for rice (or for any other domesticated plants for that matter); such sites include Nong Nor in Thailand (ca. 2500 BC; O’Reilly 1995) and the sites of the Ta-p’en-k’eng culture in Taiwan (ca. 3000 BC; Tsang 1992). This problem could simply be one of sampling, but the possibility that rice was not universally grown by some of the earliest agricultural peoples to penetrate Southeast Asia must also be considered. I will return to this very important question later.

In addition, it is entirely plausible that hunter-gatherer populations such as the Hoabinhians practiced occasional protection and even some casual cultivation of forest tubers and fruit trees before systematic agriculture began. The main conceptual difference here is not between totally foraging and totally agricultural economies—few (perhaps no) populations in real life occupy such extreme poles. But a foraging economy with some casual cultivation does not necessarily carry the same evolutionary potential as an agricultural economy with some foraging. Those forager societies that eventually moved into systematic rather than casual agriculture were given unprecedented opportunities for demographic growth, especially if they grew cereals (as they no doubt did in China).

The second “affluence” corollary has long been favored by K.C. Chang (1981, 1986) for China and is currently popular amongst archaeological theoreticians in various forms for other parts of the world, centered mainly on con-
cepts of competitive feasting as spurs to increased food production (e.g., Hayden 1990; Blanton and Taylor 1995). Of course, starving people are perhaps the least likely of any to "invent" agriculture, and relative affluence might have characterized many of the hunter-gatherers who first made the transition to agriculture. Even so, it is difficult to see affluence and social competition as having major causal roles in themselves, partly because so many ethnographic foragers have had such competitive economies without making any transition to agriculture at all (e.g., western North America).

Instead, the majority of published opinions in the 1990s regard the origin of agriculture as a reaction to encouraging and directed forms of stress, whether due to direct demographic pressures on resources or to less specific environmental or seasonal perturbations affecting resource availability (McCorriston and Hole 1991). One very common assumption is that hunter-gatherers will not successfully turn to cultivation—which intermittently requires higher inputs of labor and forward planning for land clearance, weeding, and harvesting—unless they are forced to do so by an insistent and growing imbalance between population size and available food. The ethnographic record in Australia, Southeast Asia, and other regions makes this conclusion virtually unavoidable (Headland 1986; Bellwood 1996b).

This general stress-focused view has always seemed to me to be very plausible, but alone it can hardly explain why agriculture should have developed—apparently independently—in a number of hearth regions in the Old and New Worlds around and immediately following the end of the Pleistocene. Since the first edition of this book was published, the whole topic of agricultural origins has snowballed into one of the biggest debates in archaeology, and of course the issues cannot be covered fully here—they demand a book in themselves (MacNeish 1992 represents one try, but with only limited applicability to eastern Asia). It is now evident that agriculture in Southwest Asia and perhaps China (I am reluctant to include other areas such as the Americas) evolved amongst "complex" terminal Pleistocene foragers who were already practicing some degree of sedentary life and food storage, and that it evolved in those regions where the plant species concerned were somehow "stressed" in supply, perhaps as a result of being at the edges of their distributional ranges and thus very vulnerable to minor environmental changes (for some discussion of these points see Bellwood 1990b, 1996a, b).

The record from Southwest Asia is the most detailed in the world for an early transition to agriculture. In general, last glacial environments in Southwest Asia seem to have been cold, relatively treeless, and perhaps too dry for large-grained annual grasses to have flourished widely. A major environmental change, the most major and most rapid in world history since the beginning of the last interglacial 130,000 years ago, then commenced with the spread of a warmer
climate, apparently with a more dependable winter wet season, after about 14,000 years ago. The rapidity and magnitude of this change perhaps indicates why agriculture developed at this time rather than at various times back into the late Pleistocene. The result of this environmental change was a spread of annual grasses and nut-bearing tree species that allowed some groups, such as the Natufians of the Levant, to inhabit small but fairly permanent villages supported by food storage for lean seasons. Increasing sedentary settlement should then have allowed more frequent births, leading to an inexorable rise in population (as indicated by modern studies on recently settled hunter-gatherers; e.g., Gomes 1982 for settled Negritos in Malaysia). This in itself might have been sufficient to encourage groups to increase their grain yields by systematic cultivation, but a postulated shift back to a cooler and drier climate in the Levant after 11,000 BP (the "Younger Dryas") might have provided an extra stimulus in this regard. Soon after 10,500 years ago, the erstwhile Natufians were building large pre-pottery Neolithic villages such as Jericho, with some villages (Abu Hureyra, Ain Ghazal) attaining sizes over 10 hectares by 9,500 years ago. If this postulated trajectory is correct, the late Natufians were probably the first people in the world to cultivate grains—and we may almost know why (for references on the above see Bellwood 1996b).

**A. The Beginnings of Agriculture in China**

*Note:* The term China refers here to a geographical region, and not purely to the region currently inhabited by the Sinitic (Chinese-speaking) people. Some of the prehistoric societies of the region were perhaps ancestral to modern Chinese. Others, especially those to be described below, certainly were not and are better regarded as ancestral Southeast Asian in cultural affiliation.

It is quite difficult to apply the Southwest Asian model directly to eastern Asia because the necessary details in the archaeological record simply are not there, although this need not imply that a different model is required. Rice and millets were being cultivated in village settlements in central China by at least 8,000 years ago (Chang 1986; Yan 1991, 1992; Shih 1992; Jiang 1994), but in China the Neolithic as known to date begins with the presences of pottery and domestic animals, neither of which appeared in Southwest Asia until up to two millennia after the first evidence for plant cultivation. This suggests strongly that the indigenous roots of agriculture in China still remain to be discovered. Agriculture in China seems unlikely to be a simple transference from Southwest Asia as the crops, technologies, and people in the two regions are quite unrelated.

As in Southwest Asia, the climatic amelioration at the end of the Pleistocene in China involved a rise of temperature, approaching present levels by 13,000
BP, and also the development of a much stronger summer monsoon (see Chapter 1), which would have encouraged dispersal of the ancestors of the cultivated annual millets and rice, both summer monsoon crops (Whyte 1983; Oka 1988; Chang, T. T. 1989). Indeed, climatic conditions in China between 10,000 and 4,000 years ago were slightly warmer and wetter than now and would have been very favorable for summer rice crops in the swamps and lakes of the Yangzi valley (Chang, K. C. 1986:211–212). As in Southwest Asia, there is some evidence that the overall climatic amelioration was temporarily reversed by a Younger Dryas interval between 11,000 and 10,200 years ago, but whether this would have had any impact on the shift to cultivation, as currently claimed by some scholars for Southwest Asia (Moore and Hillman 1992), remains uncertain. Any temporary shortening of the summer growing season on the northern edge of wild rice distribution could, however, have been quite significant for populations targeting it as a food source.

Cultivated rice, *Oryza sativa*, was derived from the wild *Oryza rufipogon* with both annual and perennial habits according to Oka (1988), but via an intermediate wild annual form *Oryza nivara* according to T. T. Chang (1976b) (see Plate 38). According to Oka (1988:131–132), wild rice today grows only as far north as Fujian, but grew as far north as the Yangzi until the Song dynasty. In the warmer climatic conditions of the early Holocene we might expect wild rice to have grown well north into the region between the Yellow and Yangzi Rivers. It certainly appears to have been first domesticated in the swampy regions lining the middle and lower courses of the Yangzi River (Glover 1985; Yan 1991, 1992; Bellwood et al. 1992; Y. Wu 1996), and thus toward the edge of its natural range in a region where winter storage and synchronized annual planting would have been encouraged.

The morphological and genetic changes in rice—reduced shattering, greater synchronicity of germination and ripening, increased panicle (rather than grain) size, reduced awns and glumes, tendency to evolve self-pollination—were probably stimulated by the same kinds of harvesting and management activities that led to the related changes in wheat and barley in Southwest Asia (Oka 1988; T. T. Chang 1989; Thompson 1992). Such activities include the use of a sickle/reaping knife, selection of nonshattering stock for planting, planting outside the areas of wild stands, and winter storage of seed leading to reduced selection pressures for tough protective glumes. According to Oka (1988:101), some of these changes could have taken place rapidly. The rice cultivation of Hemudu in Zhejiang Province (c. 5000 BC) is described by Yan (1992:121) as being already "of a fairly advanced form," and according to Li Kunsheng (1985) the Hemudu rice was already differentiated into *indica* and *japonica* varieties.

The overall trajectory of the oldest Chinese Neolithic cultures can be summarized as follows (for site locations, see Fig. 7.1):
Fig. 7.1 Locations of sites described in Chapter 7. A = Tanjung Pinang; B = Buwawansi.
1. 6000 B.C.: A cluster of related millet-growing sites developed in the Yellow River basin (Peiligang, Cishan: Shih 1992, plus the newly discovered Pengtoushan rice-growing complex in the middle Yangzi (Yan 1992). From published data it is not clear whether we have here one primary development of agriculture with two minor sub-foci, or two independent developments, but numerous finds of rice in the Yellow River region indicate that all these groups were in some degree of contact (Jiang 1994; Wu Yaoli 1996). Suggestions that some cave sites in southern China have older pottery than the above are suspect in the absence of well-verified open sites.

2. 5000 B.C.: The Yangshao, Dawenkou, Hemudu, and Majiabang cultures all developed in central China, plus assemblages distributed down the southern coast of China to Fujian and Guangdong (K.C. Chang 1995; Tsang 1992, 1995; and see Meacham 1984–1985a for some possible dates of this order for painted pottery assemblages from Hong Kong and Macau). The assemblages from coastal regions south of the Yangzi, including Taiwan, are all fairly closely related in terms of ceramic detail (e.g., red slip, cord marking, perforated pedestals, general shape repertoire, etc., not to mention the broad range of nonceramic material culture such as stone adzes and stone reaping knives). However, direct evidence for rice cultivation is so far absent from the oldest sites in Guangdong, Taiwan, and Hong Kong, despite a definite presence by 3000 B.C. at the site of Shixia in Guangdong.

There can be no doubt that one of the most important sites excavated in recent years with respect to rice cultivation is Hemudu, which lies on a flat alluvial plain about 25 kilometers to the south of Hangzhou Bay in northeastern Zhejiang (Chekiang 1978; K.C. Chang 1986:208–224; Liu 1985). The bottom waterlogged layer of this site (layer 4) dates to between 5200 and perhaps 4900 B.C. and belonged to a village of rectangular timber houses (one being 7 meters wide by over 23 meters long) constructed with skillful mortice and tenon techniques and raised on rows of small timber piles. Large quantities of rice husks were found as temper in the sherds, and in one area of the excavation a solid mass of rice husks, grains, straw, and leaves formed a layer—perhaps once a threshing floor—with an average thickness of 40–50 centimeters. This rice was presumably cultivated in the alluvial soils around the site, possibly with a range of aquatic plants in low-lying swamps (H-L. Li 1983). Pigs accounted for 90 percent of all animal bones; it is assumed that they were domesticated, together with dogs and possibly water buffalo (domesticated fowl are known from other contemporary Chinese sites). The range of mammals hunted included deer, rhinoceros, elephant, and monkey; birds were hunted as well. An interesting occurrence amongst the plant remains is the gourd (*Lagenaria siceraria*), a plant of widespread importance in Southeast Asia and Oceania. Pollen of species
Fig. 7.2 Artifacts from Hemudu layer 4, ca. 5000 BC: (a–c) perforated clay discs, possibly spindle whorls or ornaments (compare Fig. 7.6f from Taiwan); (d) wooden adze handle; (e) wooden spade blade (?). Other objects shown are bone points and whistles (top right), wooden objects (bottom left) and stone adzes, including one with an incipient step (bottom right). From Chekiang 1978.
found today only in Guangdong and Taiwan suggest that the climate may have been a little warmer then than now.

The material culture of Hemudu (Fig. 7.2 and Fig. 7.3) is particularly impressive. It includes hoes made from animal scapulae, bone tools and whistles, jade penannular earrings, and stone adzes with oval or quadrangular cross-sections,
some resembling the stepped form of the Ta-p'en-k'eng culture of Taiwan (below). Knee-shaped adze hafts were found—this shape occurs in initial Jomon Japan and almost universally amongst the Austronesian peoples of Oceania—and there are also some detachable wooden spade blades. Pottery items include spindle whorls and a range of round or flat-based, cord-marked vessels, the former often having carinated bodies and incised rims. Pot stands, pottery stoves, animal figurines, footed dishes, and lids also occur, and there are a few painted sherds. This pottery tradition shows that the totality of potting knowledge found in the early cultures of Taiwan and Island Southeast Asia was already present in this region a millennium before the beginnings of Austronesian expansion.

I have examined the consequences of the shift to agriculture in China elsewhere (Bellwood 1994, 1995b, 1996a, b). They were massive indeed if we examine both archaeological and linguistic sources of evidence, leading to a demographically driven dispersal of populations that encompassed the next five millennia and over half the world's surface (including Oceania). One part of this dispersal, as a peripheral offshoot from the southeastern part of the early Chinese agricultural domain, is represented by the Austronesians. Their Austroasiatic contemporaries in the Malay Peninsula are dealt with in Chapter 8.

II. THE BEGINNINGS OF AUSTROENESEAN PREHISTORY

I now wish to move straight into a review of the modern archaeological evidence pertinent to Austronesian dispersal. It is not my intention to review the outdated but historically interesting theories about stone adze types and waves of migration into the archipelago—readers will find these details in a previous book (Bellwood 1978:170–175, 207). Solheim (e.g., 1975, 1979a, b, 1984–1985) has also developed a nonlinguistic theory of Austronesian origins amongst mobile trading sea peoples in eastern Indonesia, with secondary movements up to the south Chinese coast and then eventual back movements of Malays and Chams from south China into the archipelago. A similar theory has been developed without reference to linguistic data by Meacham (1984–1985b, 1992). These theories differ from my own in several fundamental respects, as this chapter will indicate.

A. The Prehistory of Taiwan

Prior to the Neolithic, the island of Taiwan has only a limited record of flaked stone assemblages (the "Ch'angpinian"), probably related to the Hoabinhian, which survived in the south and east of the island until about 3000 BC (Sung 1979; K-C. Li 1983a).² (For recent reviews see K-C. Li et al. 1989; P. J-K. Li et al.
The oldest Neolithic assemblages belong to a culture with cord-marked and incised pottery, termed the Ta-p'en-k'eng (henceforth TPK) culture by Chang (for details see K. C. Chang 1969, 1970, 1986; Chang et al. 1974; Dewar 1977). One of these sites (at Pa-chia-ts'un near T'ai-yan) has a single radiocarbon date of about 4300 BC, and the culture appears to have continued in existence in western Taiwan until about 2500 BC (Pearson 1989; Spriggs 1989:605). Characteristic artifacts (Fig. 7.4) include cord-marked globular pots with incised everted rims and occasional lug handles or ring feet (some with perforations), stone adzes with quadrangular cross-sections and occasionally with hafting steps, polished slate points, stone net sinkers, and possibly a stone bark-cloth beater (an artifact type also reported from Neolithic sites in southern China). The whole culture gives the appearance of having been introduced into the island fully formed.

Sites related to the TPK culture have been recently excavated by Tsang (1992; 1995) in the Pescadores (P'eng-hu) Islands, which lie 45 kilometers west of Taiwan and about 140 kilometers from the Chinese mainland. The first phase rep-
resented here is the Kuo-yeh, dated from 3000 to 2500 BC. It contains a material culture of TPK type—without rice or reaping knives—that Tsang believes was brought by colonists from Taiwan. Rice (as husks in pottery), stone knives, and bone fishhooks make an appearance in the next phase, termed the Suo-kang, after 2500 BC.

The economy of the TPK culture has been a matter of some obscurity as cereal remains have not yet been reported from the major excavated sites. The prehistory of millet in Taiwan is a complete mystery, even though linguistic reconstruction suggest a great antiquity for it (Zorc 1994:549). Nevertheless, given the importance of rice cultivation in the mainland province of Zhejiang at least a millennium before the Taiwanese Neolithic commenced, I would be most surprised if this crop was totally absent on the island before 2500 BC. Most authorities on Taiwanese prehistory (e.g., Tsang, above) believe that cereals were not introduced into the island until after 2500 BC, when stone reaping knives became common in the western region. However, the pollen diagram from the Sun-Moon Lake in the mountainous center of Taiwan indicates a marked increase in large grass pollen, second-growth shrubs, and charcoal particles soon after 3000 BC (Tsukada 1966, 1967). As this region is rather remote from the coastal areas where early agriculture must first have been established, then it follows that agriculture (if this is what the core records) must have appeared long before this date in Taiwan. More significantly, actual rice remains (apart from those of the Suo-kang phase, above) have been reported from the Chih-shan-yen site in Taipei (ca. 1500–2000 BC; Wang 1984), and rice impressions in pottery are reported from the K'en-ting site in the far south of the island (ca. 2500 BC; K-C. Li 1983a), although both of these sites belong to cultural phases apparently following the TPK.

The immediate origins of the TPK culture clearly lie on the Chinese mainland. K. C. Chang (1977) has drawn attention to TPK ceramic parallels with the shell-mound site of Fuguodun in nearby Fujian, dated between 5200 and 4200 BC. From here there are potsherds decorated with incised lines, impressed rows of semicircles, and zoned patterns within incisions made by dentate stamping with the toothed edge of an Anadara shell. More recently, both K. C. Chang (1995) and C-H. Tsang have looked in great detail at the question of TPK relations with the Chinese mainland and point to a very large number of pertinent sites, mostly shellmounds and some with evidence for stilt houses (Tsang 1992:246; 1995). These sites include several in Guangdong (Tsang 1992:245–246), plus several farther north in Fujian (Xitou, Keqiutou, early Tanshishan), and there can be little doubt that the similarities indicate contact if not common population origin. Importantly for questions of navigational and canoe-construction technology, several of these sites are on small offshore islands (as are some of the Hemudu culture sites in Zhejiang). Whether these material culture
similarities indicate borrowing by native Ch’angpinians of Taiwan from mainland sources, as suggested by Meacham (1995), or whether they represent an actual colonization of Taiwan by pre-Austronesians of mainland origin, is a question that will doubtless exercise the minds of archaeologists for some time to come. I have no doubts about my own opinions, which, as clearly stated above, give much credence to the results of comparative linguistics.

Pre-Austronesians therefore colonized Taiwan from Fujian or Guangdong, but when did their descendants, following the break-up of Proto-Austronesian, begin their moves into the Philippines? The answers to this question are to be found in the post-TPK cultures of Taiwan. By the late third millennium BC the TPK culture had apparently differentiated into at least three, perhaps four regional archaeological complexes, possibly already with initial linguistic differentiation into the several first-order Austronesian subgroups that are believed to exist on Taiwan (see Chapter 4). In the west and south of the island there are cultures with red cord-marked pottery, originally termed Lungshanoid by K. C. Chang (1969). These are best known from Chang’s excavations at Feng-pi-t’ou and from the Choshui and Tatu River sites (including the site of Niu-ma-t’ou) in the west-center of the island (K. C. Chang et al. 1974; Dewar 1977; Stamps 1977), and also from sites with slightly different assemblages in the far south of the island (K’en-ting and O-luan-pi; K-C. Li 1983a, 1983b). Dates run from about 2500 to 500 BC. The Feng-pi-t’ou assemblage includes red cord-marked and painted pottery with a considerable elaboration of form, represented by tripods, high perforated ring feet, bottle forms, and the use of a slow wheel (Fig. 7.5). In addition there are clay spindle whorls, bone points, large

Fig. 7.5 “Fine red ware” from Feng-pi-t’ou, ca. 2000 BC. From Chang 1969. Courtesy: Yale University, Department of Anthropology.
numbers of ground slate reaping knives and projectile points of coastal Chinese types, and stone hoes and adzes (untanged and shouldered). The postholes of part of a rectangular house were excavated at Feng-pl-t’ou, together with a burial stated to have Mongolid affinities.

The Lungshanoid cultures of western Taiwan do not appear to be of direct significance for the settlement of the Philippine and Indonesian islands to the south. However, I think the situation may be different with the Yüan-shan culture of northern Taiwan, which was derived according to all authorities by local development from the preceding TPK culture (possibly via the Chih-shan-yen culture with its domesticated rice in the Taipei region; Wang 1984). Dates for Yüan-shan and Chih-shan-yen assemblages range from 2500 BC into the first millennium BC. Yüan-shan pottery is characterized by globular vessels with ring feet and strap handles, decorated with some incision or punctation and red or brown slips (Plate 30). Cord marking and tripods are absent; this is quite significant because the oldest pottery assemblages in the Philippines and Indonesia also lack these features. In addition, the slate reaping knives are absent in the Yüan-shan culture, as they are again in the later sites to the south (although they are present in the west of the island). So if rice cultivation continued, people may have turned to bamboo knives, as used today for millet in highland Taiwan (see Note 1, pages 316–317).

Other Yüan-shan items include untanged, shouldered and stepped quadrangular adzes, slate projectile points, chipped stone hoes, stone bark-cloth beaters, and spindle whorls of clay (Fig. 7.6). The latter are of interest as they also occur in the red corded-ware sites of western Taiwan and in the southern Chinese Neolithic cultures; they suggest that a knowledge of weaving, perhaps using hemp fibers on a backstrap loom, was present. Domestic dogs are also claimed from some Yüan-shan sites, but the presence of domesticated pigs seems uncertain in the Taiwanese Neolithic (pig bones are present in many sites, but perhaps they were hunted).

Down the eastern coast of Taiwan, Pearson (1968, 1969) has investigated sites of the related T’ai-yuan culture; these are generally undated but they seem to be associated with stone-slab graves, sarcophagi, and uprights, together with Yüan-shan style pottery with the characteristic ring feet and loop handles. Since the first edition of this book was published, however, east coast Taiwan archaeology has been illuminated by some quite remarkable discoveries at the 40- to 80-hectare village site of Peinan (Lien 1989, 1991, 1993). The excavations here took place owing to railway construction and have yielded remains of fifty house foundations and over 1,500 burials, dating mainly between 1500 and 800 BC, but with an earlier and less well understood component related to the TPK culture beneath. The houses were constructed on rectangular stone pavements and laid out in rows, with adjacent rows of stone-walled storehouses (Plate 31).
Fig. 7.6 Top two rows show artifacts from Feng-pi-t'ou: (a, b) stone knives; (c–e) baked clay spindle whorls; (f) clay disc (compare Fig. 7.2a). Bottom two rows show artifacts from Ta-p’en-k’eng (Yüan-shan culture): (g–j) perforated stone points; (k) untanged adze; (l) stepped adze; (m) shouldered adze. Scale in centimeters. From Chang 1969. Courtesy: Yale University, Department of Anthropology.
Some of the rows were separated by boulder walls, suggesting perhaps lineage divisions of some kind within the village plan. The floors of the dwelling houses sealed slab-lined burial cists (Plate 32), an arrangement indicating a definite interest in ancestor veneration on the part of the inhabitants. The graves, many multiple, revealed a high rate of infant and fetal death, for reasons at present unknown (Lien 1991: 344).³

The pottery from the Peinan graves is mainly a fine orange ware, sometimes red slipped, with no other forms of decoration. The most common form appears to be a jar with two vertical strap handles (like Yüan-shan pottery) and a ring foot. Spindle whorls, pig and dog figurines, and stone bark-cloth beaters also occur in the site. The grave goods include some remarkable items of Taiwan jade: tubular beads, bracelets, penannular earrings with circumferential projections (the so-called lingling-o, a very widespread form in Southeast Asia; see Chapter 9), anthropomorphic earrings (Fig. 7.7), and perforated projectile points. Most adults had four of their upper teeth extracted—canine and first incisor on each side—and stained teeth attest to betel chewing. Lien also suggests (1991: 350) that both rice and millet were cultivated. The Peinan culture is also claimed by Lien to have living representatives in the Paiwan peoples of eastern Taiwan.

Looking at Taiwanese prehistory from an Indo-Malaysian perspective, it is obviously the cultural phase prior to about 2000 bc that is of most interest, since it is clear that Austronesian settlers had already moved into the Philippines and perhaps Indonesia by this time. The Peinan culture is thus a little late to be of direct interest, but its plain pottery style finds some affinity with the oldest pottery assemblages to the south. The TPK culture is of enormous importance as a potential record of the oldest stage of Austronesian society that can be identified on linguistic grounds (i.e., Initial Austonesian). Not only does this culture have clear mainland Chinese origins, but it also has what I believe are clear successors in the Yüan-shan and Peinan cultures and the earliest Neolithic cultures of the Philippines and Indonesia.

It is still uncertain when rice cultivation appeared within this cultural sequence; my suspicion is that rice remains will turn up in TPK sites eventually. Although most highland Austronesians of Taiwan grow harder millets today (Setaria, Panicum, and the more recent Indian Sorghum and Eleusine; Chen 1968; Fogg 1983), it must be remembered that the warmer western lowlands where the oldest Neolithic sites occur are now entirely settled by Chinese rice growers. Other aboriginally cultivated plants in Taiwan include sugarcane and gourd, and it is highly likely that these were grown, with Setaria (foxtail) millet, by TPK societies as well; all are of at least Proto-Austronesian antiquity. Although coconuts and breadfruit grow in southeastern Taiwan today, it seems more than likely that these two tropical species were introduced later into the warmer parts of the island from the Philippines.
Fig. 7.7 Four major types of nephrite (jade) slotted earrings from the Peinan excavations, Taiwan. From Lien 1991. Courtesy: Lien Chaomei.
III. THE NEOLITHIC PHASE IN ISLAND SOUTHEAST ASIA AND WESTERN OCEANIA

I will now consider the archaeological evidence for Neolithic assemblages in the Philippines and Indonesia, and will later expand this evidence into a larger picture of economic change and adaptation. However, I should first go back again to the Neolithic cultures of Taiwan between 3000 and 2000 BC and note the material items present. These include quadrangular cross-sectioned adzes, bone and slate projectile points, and a pottery tradition that trends through time from a predominance of cord marking toward an emphasis on plain or slipped bodies (in the case of the Yuan-shan and Peinan cultures), with the continuing presence of incised, stamped circle, and punctate decoration and perforated ring feet. Other items include stone net weights, hoes, and possibly bones of domesticated pigs and dogs. Reaping knives and spindle whorls are not clearly present until after 2500 BC.

In the Philippines, northern Borneo, and many regions of eastern Indonesia, the oldest Neolithic pottery is characterized by simple forms with plain or red-slipped surfaces, sometimes with perforated ring feet. This phase has no very clear internal divisions at present; it seems to continue everywhere with no marked breaks into the last 2,000 years. However, it is convenient to separate the post-500 BC cultures—those with metallurgy and predominantly incised pottery—from those that went before; these later cultures will be considered in Chapter 9. In the first edition of this book, I also separated a number of decorated pottery assemblages as “late Neolithic” and treated them separately, but subsequent research and dating has left little rationale for this decision. In this chapter I will cover all Neolithic sites in Island Southeast Asia, leaving the Malay Peninsula—a completely separate cultural entity from the islands during the Neolithic—for consideration in Chapter 8.

The most varied Neolithic assemblages occur in the northern Philippines, which is what could be expected given their closeness to Taiwan. The more southerly sites in Borneo, Talaud, the Moluccas, Sulawesi, and Timor show some degree of attenuation of material culture. Java and Sumatra are unclear in this respect because few presumed Neolithic sites there have been excavated—and none dated.

A. The Philippines

The Philippines reveal a widespread horizon of red-slipped pottery beginning perhaps around 2500 BC. In northern Luzon, an important open site called Dimolit has been excavated by Peterson (1974) on Palanan Bay in Isabela Province. The lower occupation level here has three rather widely spread radio-
carbon dates, but was probably occupied between 2500 and 1500 BC. Posthole settings for two 3 x 3-meter square houses were found, each with double walls, the outer post row being set in a slot (Fig. 7.8). The pottery is plain or red slipped and comprises globular or carinated vessels and dishes, some on ring feet with small, clustered perforations.

Many other sites in northern Luzon—located in the main valley and tributaries of the Cagayan River—have yielded types of pottery similar to Dimolit. The caves of Rabel and Laurente have yielded dates for it that might be as early as 2800 BC (Spriggs 1989:593), and at Andarayan similar red-slipped pottery has been dated to 1500 BC, here with rice chaff temper, pottery stoves, and spindle whorls (Snow et al. 1986). Musang Cave (Thiel 1988–1989) has yielded similar plain and red-slipped pottery with ring feet. Another cave called Arku (Thiel 1986–1987a) produced a burial assemblage dated between 1500 BC and 0, with pottery similar to that from Musang. Other items from Arku, many clearly paralleled in Taiwanese Neolithic sites, include shell and stone beads, shell bracelets, two tattooing chisels of horn, penannular earrings of stone (including two
of jade), shell, or pottery like those from Peinan, a stone bark-cloth beater, pottery spindle whorls, barbed bone points, and stone adzes. The burials were apparently primary or secondary and sometimes dusted with ochre or placed in jars.

Other artifacts with Taiwanese parallels, such as slate projectile points, have been found in surface collections in Luzon. It is apparent that excavations on this island are well on the way to demonstrating a significant Taiwan-northern Philippine axis of Neolithic continuity. This conclusion is reinforced by the discovery of a site called Sunget on Batan Island, between Taiwan and Luzon. Although Sunget has not yet been excavated or dated, the preliminary survey report (Kumamoto 1983:55–61) refers to discoveries of red-slipped pottery with ring feet and lug handles, perforated slate points, and stepped and shouldered adzes—all items closely paralleled in the Yüan-shan repertoire.

In addition, there are some sites in the northern and central Philippines that contain incised and dentate-stamped sherds as well as the universal plain or red-slipped wares. At Lal-lo and Magapit, in the lower valley of the Cagayan River in northern Luzon, there are many estuarine bivalve shell middens; they range in location from close to the river to nearly hilltops and in size up to 50 by 100 meters, with depths up to 3 meters. Many sporadic archaeological forays have been made on these middens, but unfortunately there is no overall summary available. However, the material culture is extremely interesting, not least because of the richness of incision and dentate stamping on some of the pottery, with high perforated ring feet and some lime infill of designs. Stepped stone adzes also occur, with dates apparently back to about 2000 BC (Thiel 1984–1985, 1986–1987b; Aoyagi et al. 1991; Ogawa 1993). The richness of the dentate stamping, dated in the Magapit hilltop site to ca. 800 BC by Aoyagi, is important for considering the affinities of the oldest pottery in the Micronesian and Melanesian islands (see the discussion on the Lapita culture below). Pottery very similar to that from the Cagayan middens is also reported from a disturbed burial cave excavated by Solheim (1968) in Batungan Mountain on the island of Masbate (central Philippines). A carbon date of about 900 BC from an adjacent and perhaps slightly later cave may be pertinent for this, and the Batungan assemblage concerned (from cave 1) includes a quantity of red-slipped sherds from carinated vessels, with incised, dentate-stamped, and stamped-circle motifs much like those from the Yüan-shan repertoire on Taiwan (compare Plate 30 and Fig. 7.9). So far, this stamped and incised pottery decoration does not appear to be present in the oldest pottery sites in the Philippines, but this may simply be a sampling bias; much further work is needed on this question.

Moving toward the southern Philippines, Fox (1970) has excavated in Du-yong Cave on Palawan a flexed and face-down burial of a male provided with a quadrangular-sectioned stone adze, four Tridacna shell adzes, two ear discs and
a breast pendant made from perforated *Conus* shells (Fig. 7.10), and six *Anadara* shells that may have been used as lime containers for betel chewing (the skeleton also had betel-stained teeth). Charcoal from the burial pit was dated to about 3000 BC, and similar shell implements also occurred in a level in the cave deposits dated to about 4300 BC. This site is unusual in having no pottery and its early date suggests that the stone adze may have been traded from agricultural populations situated elsewhere into an indigenous hunting and gathering community. The shell tools may indicate a local tradition, a continuance perhaps of the preceramic tradition of shell adzes represented in the northern Moluccas (Chapter 6; see Plate 25).

Elsewhere in the Philippines, plain pottery is reported from shell midden deposits dated to about 2000 BC in the Bagumbayan site on Masbate (Bay Peter-
sen 1982–1983), here with a few rice grains derived by flotation of the deposits, but considered intrusive by the excavator. Plain, slipped, and incised sherds occur at around the same date in the Edjek site on Negros (Hutterer and MacDonald 1982:223). Plain and red-slipped sherds also occur in the Balobok (Sangasanga) shelter in the Sulu Archipelago (Spoehr 1973; Ronquillo et al. 1993), but in this case with very uncertain dates.

In general, the Philippine Neolithic sites have continuing evidence for pig and deer hunting as well as for the use of flake tools (some with an edge gloss at Dimolit), but to my knowledge stone reaping knives are not found at all and the pottery spindle whorls do not occur south of Luzon. As noted for the Yüanshan and Pelinan cultures of Taiwan, grain reaping may have been carried out with organic tools, or it may have faded away toward equatorial latitudes. The
latter is an option that I will elaborate upon in due course. Weaving may have been replaced by bark-cloth production in many areas (a conclusion also reached by Ngo 1984–1985 to explain the shift away from cord-marked pottery to the south of Taiwan), but as weaving was so widespread ethnographically, an initial retraction followed much later by an expansion—perhaps with fibers such as cotton or abaca (*Musa textilis*)—might have occurred.

**B. Indonesia and Sabah**

Within Indonesia, the Leang Tuwo Mane'e shelter in the Talauld Islands has yielded plain and red-slipped sherds from thin-walled vessels with globular bodies and everted rims (Fig. 7.11 top) dating possibly from about 2500 BC (Bellwood 1976a, 1981; the date comes from a single determination and is not very secure). Large numbers of shellfish continued to be discarded in the Neolithic layers in this site and the preceramic chert industry continued, but without the earlier tendency toward blade production (see Chapter 6, Section IIIA). Across the Sulawesi Sea in the cave of Agop Atas (Madai) in northern Borneo (see Chapter 6, Section IIB), the early Holocene pebble and flake industry was succeeded—after a long gap in occupation—by a pottery assemblage similar to that from Talauld (Fig. 7.11 bottom) with a continuing stone flake industry. This has been dated a little uncertainly—by thermoluminescence and radiocarbon—between 2000 and 500 BC (Bellwood 1988). After 500 BC the cave was again abandoned until the early Metal phase about 2,000 years ago.

Both Leang Tuwo Mane’e and Agop Atas produced little more than pottery, leading me in the earlier edition of this book to suggest an attenuation of material culture as Austronesian groups colonized southward. In 1987, excavations in the rock shelter of Bukit Tengkorak—formed amongst tumbled boulders on the rim of an extinct volcano near the town of Semporna in southeastern Sabah—have led me to change my mind somewhat (Bellwood 1989; Bellwood and Koon 1989). The lower layer in this shelter, dated between 1000 and 300 BC, yielded red-slipped pottery with plain or incised pedestals, a superbly decorated incised vessel with a lid (Fig. 7.12), and lots of shell items including adzes, beads, bracelets, and a possible fishhook shank, together with shell manufacturing debris. Stone tools included lava files, adze chips, a remarkable agate blade and awl industry made on prismatic cores and, perhaps most remarkable of all, small chips of obsidian from two sources: one unknown and the other being one of the Talasea sources in northern New Britain in Melanesia. The Talasea obsidian sources were used by Lapita people in the western Pacific, and the Bukit Tengkorak discovery of this material increases its distribution at ca. 1000 BC to 6,500 kilometers—from Borneo to Fiji—thus making it perhaps the most widely distributed material in the Neolithic world.
Fig. 7.11 Neolithic pottery from Leang Tuwo Mane'e (top) and Agop Atas (bottom).
Fig. 7.12 Artifacts mainly from the lower layer (1000 to 300 bc) at Bukit Tengkorak, Sabah. Top: red-slipped and incised pottery, including ring-feet. Bottom: agate microblades and awls, agate microcores, and obsidian chips. Bottom right: two trapezoidal sectioned stone adzes from uncertain stratigraphic contexts.
The upper layer in Bukit Tengkorak, also pre-Metal, produced more floridly decorated pottery with much incision, rim notching, cord marking, and paddle impression. Red slip faded in importance. Fragments of pottery stoves, an important artifact class known as far back as 4500 BC in the Hemudu site in Zhejiang (Bellwood 1989:Plate 3), are quite common, as are decorated lids and pedestals. Talasea obsidian was no longer imported in this phase, which dates between 300 BC and the early first millennium AD, but the other shell and stone industries seem to have continued. Both phases at Bukit Tengkorak are rich in fish bones and these, plus the obsidian, pottery stoves (used ethnographically by sea nomads in the Sabah-Sulu region), and shell ornament manufacture indicate that the Bukit Tengkorak people were adept seafarers—and perhaps traders. Indeed, the agate prismatic blade industry is quite unique in Island Southeast Asia and, if not a local innovation, could reflect contact with an apparently contemporary region of similar microblade production in Guangdong, especially the site complex of Xiqiaoshan, near Guangzhou (Huang et al. 1982). The much poorer assemblage of this period from Agop Atas could thus represent a community of inland cultivators, people not a part of this interisland network of contacts.

Does the Bukit Tengkorak assemblage represent the kind of maritime-oriented tradition that should have characterized the earliest Austronesian colonists who moved into Oceania? The site has yielded no direct evidence for agriculture, but then neither have most others of this phase in Island Southeast Asia; the problem may have more to do with sampling and survival than a true absence.

The late-phase decorated pottery from Bukit Tengkorak has some perhaps superficial similarities with the pottery assemblage known for many years from the inland sites of Kalumpang and Minango Sipakko, which lie close together on the middle course of the Karama River in west-central Sulawesi. These two sites have produced perhaps the most remarkable pottery assemblages of any sites in Indonesia. Unfortunately, neither is dated, and Kalumpang—the most important—was investigated long ago by Stein Callenfels in 1933 and by Heekeren in 1949 (Heekeren 1950a, 1972:184–190; Sutayasa 1973). Both are open sites with no stratigraphic differentiation of the materials found, and the assemblages include quadrangular and lenticular-sectioned stone adzes, some with unusual waisted or knobbed profiles, ground slate projectile points similar to the Taiwanese Neolithic types (but without perforations), a stone bark-cloth beater, and some possible stone reaping knives (Plate 33). The pottery is especially remarkable—some of the motifs are shown in Fig. 7.13—and there are also some knobbed lids and ring feet with cut-out decoration. Of all the presumed pre-Metal assemblages excavated in Indonesia, this one—at least in its stone repertoire and some aspects of pottery decoration—seems to have the closest resemblance to the Neolithic assemblages of Taiwan.
Fig. 7.13 Incised sherds and a modeled face from Kalumpang, west-central Sulawesi. From Heekeren 1972. Courtesy: Kluwer Academic Publishers.
It is most unfortunate that these two sites have no dates, and it must be admitted that there are certain ceramic parallels with the late phase at Bukit Tengkorak, especially for the knobbed lids and some of the incised decoration, which could make a late Neolithic (post–300 BC) date for the Kalumpang material seem likely. However, given the Taiwanese parallels for the stone points and the Oceanic Lapita parallels for the pottery decoration, I would personally not be too surprised if an age of over 3,000 years can one day be demonstrated. As always, more research is needed.

In southwestern Sulawesi, pottery appears in small quantities in the upper layers of Toalian sites, perhaps here used by continuing hunter-gatherer populations. In the shelter of Ulu Leang, Glover (1976) has reported the first pottery at about 2500 BC in a continuing Toalian industry with Maros points, although Bulbeck (1992:13), on the basis of some new radiocarbon dates on human bone from Leang Burung 1, is unwilling to date pottery here earlier than 1500 BC. The sherds here are of plain, unslipped globular cooking pots with everted rims.

In the northern Moluccas, the type of red-slipped and occasionally incised pottery typical of the Bukit Tengkorak early phase, Agop Atas, and Leang Tuwo Mane'e is also found in the excavated rock shelter of Uattamdi, on Kayoa Island to the west of Halmahera. The Uattamdi red-slipped pottery occurs in the lower layer of the site, beneath an upper layer of early Metal phase jar burials. It contains red-slipped pottery—some with painted stripes identical to examples from Leang Tuwo Mane'e (see Fig 7.11)—lots of shell beads, bracelets and spoons/scrapers, a lenticular-sectioned stone adze and a stone chisel (plus an abundance of adze chips) (Plate 34). In addition, significantly, there are well-stratified bones of pig and dog—both of which were no doubt domesticated animals in this region. The whole assemblage is well dated between 1200 and 300 BC, after which it is replaced by the more elaborately incised early Metal phase pottery assemblage (Bellwood et al. 1993; Bellwood 1995c).

The shelter of Uattamdi also has a basal and culturally sterile beach sand dated to about 1300 BC; this could be taken to indicate that the makers of the red-slipped pottery were not occupying Kayoa Island at this time (a statement of course subject to a certain sampling proviso). Uattamdi has no obsidian and lacks indications of shell artifact manufacture—unlike Bukit Tengkorak—but its pottery assemblage is clearly closely related to those of the other sites just listed, to a degree that surely indicates close ethnic connection across this northeastern corner of Island Southeast Asia at ca. 1000 BC. Similar red-slipped pottery, in this case with some incised decoration, dates from about 900 BC onward in the open site of Buwawansi, on Gebe Island to the east of Halmahera.

From caves in eastern Timor, Glover (1977a, 1986) has also reported similar but apparently unslipped pottery dated initially from somewhere between 2500 and 2000 BC. A few decorated sherds were also found in layers dated loosely be-
tween 1000 BC and AD 500; the patterns include incised hatched triangles and rows of interlocking semicircles like those from Kalumpang (Plate 35). The Timorese caves have also produced shell beads, bracelets, and one-piece angling hooks of *Trochus* shell (Fig. 7.14). As at Uattamdi, pig bones appear with the pottery, again surely domesticated here and derived from *Sus scrofa* of Java or *S. celebensis* of Sulawesi (Groves 1981, 1995). Even more surprisingly, Glover was able to show that cuscuses, civets, and macaques were also introduced at about the same time as the pigs. It is not clear whether these animals were tamed or wild at the time of introduction, but this evidence for transport of nondomesti-
cated animals into the faunally impoverished islands of eastern Indonesia from Neolithic times onward is particularly interesting, especially in light of the much earlier evidence for marsupial translocation in the northern Moluccas. Although possibly historic introductions in many cases, the presence of macaques, civets, deer, and Javan porcupines on various other islands in the Lesser Sundas and Moluccas (Musser 1981; Groves 1984) and of the cassowary in Seram (Wallace 1962:300) should also be noted. Dog, cattle, and goats appear in the Timorese cave record after 1000 BC, but the goats and cattle could be more recent.

Plant remains from the Neolithic layers in Timor include the Polynesian chestnut (*Inocarpus*), bamboo, gourd, and (after 1000 BC) a single grain of foxtail millet (Glover 1977b). These Timorese finds are thus of great potential significance, since they allow the suggestion that an agricultural economy involving at least some form of pig husbandry and possibly millet cultivation was introduced to the island sometime around 2000 BC.

The early Neolithic sites I have described so far are really the only ones from which there is coherent dated information, with the exception of sites in Sarawak that I will consider in Section D below. For Sumatra there is little of a usable archaeological nature, and Java still remains something of a mystery. The problem for Java and Sumatra may be that Neolithic sites along former northern coastlines are now likely to be buried under many meters of alluvium and beneath the water table (like the Hoabinhian middens of Sumatra), and hence unavailable for archaeological research. Nevertheless, the enormous number of superbly manufactured quadrangular and pick adzes from Java (Duff types 2A and 7A: Fig. 7.15), often made from semiprecious stones such as serpentine, agate, or chalcedony, suggests that Neolithic populations once occupied the island (although some of the finer adzes may actually be of early Metal phase date). The extensive working floors for adzes and stone bracelets found in several places in central and western Java add support to this view (Heine Geldern 1945); a detailed analysis of material from one such site located between the villages of Bomo and Teleng in south-central Java has been carried out by Tanudirjo (1991).

One working floor for quadrangular adzes, excavated at Kendeng Lembu in eastern Java (Heekeren 1972), produced sherds of thin, red-slipped vessels with round bases and everted rims. My own examination of this material in Jakarta suggests that it is related to the early red-slipped pottery of the Philippines and eastern Indonesia, but few details are available. Otherwise, a scatter of cord-marked and incised pottery finds, particularly from western Java, is summarized by Sutayasa (1973, 1979; see also Bellwood 1978:220–221). This material is undated and much of it could of course be long post-Neolithic. As far as Java is concerned, only the linguistic evidence suggests settlement by an Austronesian
population, expanding perhaps from Borneo—possibly as recently as 1000 BC according to the estimate of one linguist (Blust 1984–1985:57).

To summarize some of the above, it is apparent that oldest dates for red-slipped and plain pottery anywhere south of Taiwan are not much older than 2000 BC, except possibly for Luzon. Because Austronesian populations had already reached Samoa, in the central Pacific, by 1000 BC, it is beginning to look
as if the Austronesian migrations, at least for the first 10,000 kilometers (Taiwan to Indonesia and eastward to Samoa), took place within a relatively short time scale within the second millennium BC. Another source of information, albeit very diffuse with respect to dating, comes from the pollen record of forest clearance. Pollen diagrams from highland swamps in northern and central Sumatra and western Java provide some interesting but rather equivocal evidence for forest clearance that may be related to settlement of these regions by cultivators, although unfortunately there are no archaeological records in direct association (for summaries see Flenley 1985a, 1985b, 1988; Maloney 1985, 1994).

For instance, a pollen core from Pea Sim Sim Swamp near Lake Toba in northern Sumatra (1,450 meters above sea level) indicates that some minor forest clearance could have started as early as 4500 BC, but the major phase, evidenced by an increase in large grass pollen, began during the first millennium BC. Lake Diatas near Padang (1,535 meters above sea level) in central Sumatra has yielded a similar sequence. The nearby Lake Padang core (950 meters above sea level) indicates swamp vegetation clearance and burning by about 2000 BC, and there is evidence here for an increasing protection of the useful Arenga palm species by 2,000 years ago. At Situ Gunung in western Java (1,015 meters above sea level) there is an increase of pandanus and fern spores—perhaps indicating some forest clearance—at about 2800 BC. However, other Sumatran and Javan cores, admittedly from quite high altitudes, offer evidence for major forest clearance only after 1000 BC (Flenley 1988; Stujiits 1993).

The overall pollen record therefore seems to suggest some intermittent forest clearance in Sumatra and Java occurring at high altitudes during the mid-Holocene, but with permanent clearance occurring only after about 3,000 years ago. As these records are all from highland areas, it may be reasonable to expect that cultivation in coastal lowlands began slightly earlier, but this remains uncertain. It is also apparent that the Pea Sim Sim dates for initial forest clearance are a little earlier than would be expected from the archaeological record alone. This may reflect the fact that hunter-gatherers are quite capable of burning forest in drought periods, even close to the equator, a circumstance made clear by the presences of charcoal particles in pollen cores going back well into the late Pleistocene in New Guinea (Haberle 1993) and by charcoal particles radiocarbon dated to about 10,000 years ago from soils in Brunei (Cranbrook and Edwards 1994:339). Given what we know of the chronology of dispersal of the Austronesians, it seems unlikely that systematic forest clearance for agriculture would have begun in Java and Sumatra much prior to 1500 BC, but new data could change this view. On the other hand, it is not impossible that Sumatra and western Borneo were settled by agricultural groups from southern Thailand or Malaysia before Austronesian settlement commenced; this possibility will be discussed further for Sarawak in Section D.
Earlier agriculturalists, or at least intensive harvesters of tree crops, could also have occupied parts of eastern Indonesia before Austronesians arrived. The New Guinea Highlands clearly witnessed an independent transition to swamp agriculture—perhaps for taro—about 10,000 years ago (Golson 1977; Bellwood 1996b), and questions arise as to whether or not this system ever spread off the New Guinea mainland. Present indications are that it did not in its fully fledged swamp-cultivation form (Spriggs 1993), but van der Kaars (1991) notes an increase in palm pollen at about 6,000 years ago in Kau Bay, northern Halmahera. This could represent a record of indigenous intensification of arboriculture, with consequent population growth. Austronesians clearly were never able to settle this area successfully, for Papuan languages still dominate the northern Moluccas today.

C. Western Oceania

In the western Pacific, Austronesian colonists between 1500 and 1000 BC left an extremely clear-cut trail of pioneer archaeological sites across about 6,500 kilometers of ocean and islands (many previously uninhabited), from the Admiralty Islands north of New Guinea to as far east as Samoa, in western Polynesia. This impressive migration probably correlates linguistically with the period of Proto-Oceanic (see Chapter 4, Section VB). Although much of western Melanesia had long been occupied by Papuan-speaking groups, it is clear that these tended to be settled mainly in the larger islands of New Guinea, the Bismarcks, and the Solomons. Many small islands, and all territories from perhaps New Caledonia and Vanuatu eastward (certainly including Fiji), were thus available for canoe-borne colonization by Austronesian groups.

The resulting Lapita culture, which represents colonization of virgin territory in most locations where it has been found beyond the Solomons, is generally well dated and well studied in terms of artifacts and economy. It suffers from few of the chronological problems that beset the often mixed and undated Neolithic assemblages from Island Southeast Asia. Lapita, therefore, can provide an excellent insight into its logical antecedents, which lie somewhere in the eastern regions of Indonesia or the Philippines (the linguistic evidence points to the Moluccas and western New Guinea) in the mid-second millennium BC. No one has yet located these antecedents very precisely, but even if many elaborations of ceramic decoration (such as dentate stamping) were developed within Melanesia itself, we now have clear evidence for the prior existence of cultures with similar economic, technological, and navigational skills in the Indo-Malaysian Archipelago (with Taiwan). A brief review of the Lapita culture, and its contemporary in the Mariana Islands, is thus offered here.

The Lapita evidence, when viewed from an Indo-Malaysian viewpoint, reveals
quite clearly an integrated culture between 1500 and 1000 BC (the later phases
of disintegration are not of concern here) with the following archaeological fea-
tures (for summaries see Kirch and Hunt 1988; Green 1991; Allen and Gosden

a. A range of coiled or slab-built vessels with volcanic or coral sand tempers,
ranging in form from globular cooking pots through narrow-necked water
jars to a variety of open bowls, some with flat bases. Some vessel profiles
are sharply carinated, and other accessories include lug and strap handles,
lids, and pedestals, the latter being most common in the earliest sites such
as those in the Mussau Islands (ca. 1500 BC). Vessel surfaces are often red
slipped, and the decoration, generally in zones around the upper surfaces
of some of the vessels, includes a quite astonishing and intricate range of
incised and dentate-stamped motifs (Plate 35d) of rectilinear, curvilinear,
and even anthropomorphic forms (Spriggs 1990), the latter perhaps indic-
ating a concern with ancestors common to all Austronesian populations.
Later Lapita pottery tends to have simpler designs, and dentate stamping
fades in popularity first in favor of incision, and eventually plain ware.

b. Economically, the Lapita culture was based on a mixed horticultural and
maritime subsistence. Pigs, fowls, and dogs were all present; plant remains
from waterlogged sites include taro, coconut, candlenut, pandanus, and
canarium, all exploited by pre-Lapita populations in western Melanesia as
well (Kirch 1989; Swadling et al. 1991; Loy et al. 1992). Village settle-
ments, in some cases of stilt houses, occupied zones marked by sherdage,
earth ovens, hearths, and other features averaging about one hectare in
size (maximum seven hectares in the Mussau Islands) in coastal and small
offshore island locations. A fairly healthy interisland exchange of obsid-
ian and other tool stones was carried out, especially in western Melanesia
between the Bismarck Archipelago and the Santa Cruz Islands. Rats (Rattus
exulans) and occasional wallabies and cuscuses were transported, too.

c. Items of Lapita material culture apart from pottery include stone adzes (all
untangled) with quadrangular and lenticular cross-sections, stone chisels,
shell adzes, a range of shell ornaments (beads, armrings, necklace units),
and one-piece bait fishhooks for angling. The shell fishhooks suggest a
technological adaptation confined mainly to Oceania, but bait hooks of
shell are also found in a few Indo-Malaysian Neolithic sites, especially in
Taiwan and Timor.

The Mariana Islands of western Micronesia were also settled about 1500 BC
(Craib 1993; Butler 1994; Rainbird 1994; Amesbury et al. 1996) by users of a
thin-walled, red-slipped, and coral-sand-tempered pottery, formerly termed Mari-
anas Redware but now perhaps better known as pottery of the Tarague Phase
(1500 to 500 B.C.; Butler 1994). There are very strong indications that this pottery may be closely related to the Philippine and early Talaud/Moluccan red-slipped assemblages described above, and all Micronesian archaeologists seem to agree that the Marian Islands were settled from the Philippines or northeastern Indonesia by a separate and possibly slightly earlier movement than that indicated by Lapita in more southerly latitudes.

For Lapita itself, in Melanesia, there is less agreement, with many archaeologists who undertake research in the Melanesian region continuing to claim that Lapita origins reflect no significant contact with Indonesia at all and that all Pacific populations are derived in isolation from the early settler populations of western Melanesia in the Pleistocene. This view is to me completely at odds with the evidence from linguistics and genetics, and is rejected here in its entirety. The archaeological record alone is quite insufficient to prove or disprove movements of people in prehistory. Not only does the linguistic sub-grouping of the Austronesian family make a Southeast Asian source for Oceanic Austronesian speakers almost unarguable (I say “almost,” because there have of course been processes of population contact and influence at work in Melanesia during the past 3,000 years that obviously make the picture less than crystal clear), but we also have the striking fact that most Proto-Oceanic terms associated with agriculture are derived from Proto-Malayo-Polynesian forebears in Island Southeast Asia, rather than from the native Papuan languages of western Melanesia. Although Papuan peoples had developed some forms of agriculture before Austronesians arrived, especially in the interior of New Guinea, little of their knowledge seems to have been transmitted into those Lapita/Austronesian populations that moved eastward to settle Fiji and Polynesia. The “creolization” between Papuan and Austronesian cultures in western Melanesia occurred later.

**D. The Neolithic of Sarawak**

As I have noted, the Neolithic period of western Indonesia is virtually a total blank, despite the numerous reports of pottery from scattered sites in Java and Sumatra, often cord-marked or carved-paddle-impressed in contradistinction to that from eastern Indonesia (e.g., see Bronson and Asmar 1975 for Sumatra). Unfortunately, these assemblages are so far undated and generally resist any historical interpretation. The situation is different for Sarawak, however, which has a good sequence of Neolithic human activity covering the past 4,500 years from the cave of Guo Sireh inland from Kuching—a sequence illuminated also from the Niah Caves and from Lubang Angin Cave in the Gunung Mulu National Park.
1. Gua Sireh

It will be remembered from Chapter 4 that the Land Dayak languages of western Sarawak have linguistic features identified as a possibly Aslian (Austroasiatic) substratum by Adelaar (1995). The work at Gua Sireh brings this observation into especial prominence, although it should be stressed that the bulk of the archaeological record during at least the past 3,000 years in Sarawak is likely to be of Austronesian affinity. Nevertheless, the earliest Neolithic assemblages of Gua Sireh have much in common with the Peninsular Malaysian and southern Thai Neolithic, perhaps more than they do with the red-slipped wares of Sabah and eastern Indonesia. This suggests that an Austroasiatic settlement of western Borneo (and perhaps also parts of Sumatra) could have occurred before the arrival of Austronesian populations in the region. The latter have come to dominate the linguistic scene, just as did their cousins who established the Chamic (Austronesian) enclaves in formerly Austroasiatic regions of southern Vietnam (see Chapter 9).

The cave of Gua Sireh lies about 55 kilometers southeast of Kuching in western Sarawak, in the limestone massif of Gunung Nambi. It is flanked by flat alluvial terrain, used today and perhaps since about 4,500 years ago for the growing of rice. The site was first excavated by Harrisson and Solheim in 1959, then by Zuraina Majid in 1977, and most recently by Ipoi and Bellwood in 1989 (Ipoi 1993; Ipoi and Bellwood 1991). The Neolithic phase in Gua Sireh began about 4,500 years ago with the appearance of pottery with carved, cord-wrapped, or basketry-wrapped paddle-impressed surfaces. Other kinds of decoration such as red slip or incision/punctation were virtually absent. Some sherds had rice grain or husk inclusions, and a single rice grain in one sherd has been AMS radiocarbon dated to an age of ca. 4,500 years. This is a highly important discovery, supported by conventional C14 dates from the same layer and more recently by the discovery of many rice husk fragments in the soil of this phase (Sen 1995).

This date for rice from Gua Sireh is the oldest evidence for putatively domesticated rice in the Indo-Malaysian Archipelago and, as will be noted in Chapter 8, it is roughly contemporary with the plentiful evidence for rice in some sites in central Thailand. Furthermore, the paddle-impressed pottery of Gua Sireh is very different from the red-slipped Neolithic pottery of Sabah, the Philippines, and eastern Indonesia (although some paddle-impressed pottery does occur in these latter regions during the early Metal phase). The early date, the rice temper, and the predominance of paddle impression on the pottery must open the possibility that the assemblage reflects the arrival in Sarawak of a Mainland Southeast Asian (Austroasiatic?) rather than an Austronesian population, although it
should be noted that the mainland assemblages to be described in Chapter 8 are only similar to Gua Sireh—not identical. The Niah caves, farther to the northeast, also have paddle-impressed pottery similar to Gua Sireh.

2. The Niah Caves and Gunung Mulu

I will now continue the Niah sequence where I left off in Chapter 6, Section IIA. According to the original reports of Harrisson (e.g., 1957, 1958, 1959, 1970), pottery first appeared in the West Mouth sequence at around 2500 or 2000 BC together with quadrangular cross-sectioned adzes, which were preceded by an earlier lenticular-sectioned form. Spriggs (1989:603) has since pointed out many of the problems associated with the Niah C14 series and suggests that the oldest acceptable Neolithic date from Niah is ca. 1400 BC. However, the Niah pottery appears to be mainly of simple globular forms with plain or carved-paddle-impressed surfaces, and cord marking is rather rare (Solheim, Harrisson, and Wall 1959; Wall 1962; Zuraina 1982). The assemblage is similar to that from Gua Sireh, and may be of a similar commencement date.

In the Niah Caves, and also in another cave called Lubang Angin in the Gunung Mulu National Park (Ipoi 1993; Ipoi and Bellwood 1991), some very striking types of non-paddle-impressed pottery made an appearance after about

![Fig. 7.16 Double-spouted vessels from Lobang Jeragan, near Niah. From Harrisson 1971. Courtesy: Malaysian Branch of the Royal Asiatic Society.](image)
1000 BC, especially as grave goods. These vessel types, which do not occur in Gua Sireh, include closed water vessels with double spouts (Harrison 1971) and elaborately incised and painted "three-color ware," which has painted or impressed designs enclosed within incised lines (Fig. 7.16, Plate 36). The double-spouted vessels are unique within Island Southeast Asia but do have distant parallels—possibly dated to about 2,000 years ago—in the Admiralty Islands to the north of Papua New Guinea (Kennedy 1982). Because a fragment of bronze of similar date has also been found in the Admiralties, presumably an import from somewhere in Indonesia (Ambrose 1988), this distant parallel may reflect more than coincidence.

The 1989 excavations in the cave of Lubang Angin in Gunung Mulu National Park (about 160 kilometers southeast of Niah; Ipoi 1993; Ipoi and Bellwood 1991) yielded extended burials wrapped in bark cloth and laid in shallow pits in the floor of the cave; the grave goods seem to have been placed on the surface. This has led to much mixture within the deposits, but as the material culture is quite homogeneous the site might have been in use only for a relatively short period. The pottery contains some cord-impressed or carved-paddle-impressed vessels, together with double-spouted vessels identical to those from Niah, large carinated vessels of three-color ware decorated with red and black pigment (the third color being the surface of the pot) and complex designs of infilled incision, and two unusual deer heads attached to a pottery vessel of some unknown overall shape. The radiocarbon dates for Lubang Angin fall between about 700 BC and AD 500, and as glass beads and iron fragments were also found in the site it is possible that the assemblage spans the period (perhaps late first millennium BC; see Chapter 9) when these items were first introduced to the region.

The Niah and Lubang Angin three-color ware is similar to some early Metal phase pottery from Sabah and especially the Philippines, where similar motifs are tentatively dated in Manunggul Cave A on Palawan to the early first millennium BC (Fox 1970). The Manunggul pottery, like the Niah three-color ware, has fairly exuberant incised curvilinear designs with punctate infillings. The three-color decoration also resembles that on pottery from the upper layer at Bukit Tengkorak in Sabah, dating after 300 BC (above), and also the undated assemblage from Kalumpang in western Sulawesi. The interesting possibility arises that this three-color pottery in these interior regions of Sarawak might be a record of the inland expansion of Austronesian populations from coastal locations some time in the early first millennium BC.

As far as the overall sequence of Neolithic activity in the West Mouth at Niah itself is concerned, the general lack of information on habitation assemblages forces one to turn to burial types and their associations. During the Neolithic, an inner portion of the cave behind the area previously occupied in preceramic
times was used for burial purposes. About 130 burials were excavated from this “cemetery sector” prior to 1967; cultural details have been described by Barbara Harrisson (1967). All graves are shallow and seem to belong to one continuous phase of activity dated quite uncertainly to some time between 3000 BC and the first millennium AD; dating was by a large series of thirty collagen or apatite radiocarbon dates from human bone reported by Brooks et al. (1977). However, these dates are of such extremely uncertain reliability and contain so many internal contradictions that I refer below only to dates determined on other materials, such as charcoal or shell.

The main burial types at Niah are as follows:

a. Extended burials, totaling sixty-eight, laid in shallow graves marked with stakes, with (in most cases) heads pointing into the cave. Many skeletons were coated with hematite or partially burnt, and it is interesting to note that a similar incomplete burning of corpses has been reported ethnographically for Land Dayak groups in Sarawak (Roth 1896:137). At Niah the bodies were placed in log coffins with plank lids or in cigar-shaped caskets of sewn bamboo strips, and in some cases they were also wrapped in pandanus mats before being placed in the containers. Some of the burials in bamboo caskets were provided with pillows of wood, matting, bamboo, or leaves. There are also traces of textiles with two burials that are probably quite late in the sequence. Associated artifacts, possibly grave goods, include a quadrangular adze, sherds of three-color ware, two bone rings, and a wooden disc-shaped earplug. Later graves in this series have glass beads and metal goods. Three radiocarbon dates from a mat and two wooden coffins (burials 75 and 60: Harrisson 1975b; Harrisson 1967:154) fall between about 1750 and 500 BC.

b. Cremations and burnt secondary burials. These two categories were separated by Barbara Harrisson, but it seems best to consider them together. Fifty-nine were found (twenty-six fully cremated and thirty-three less fully burnt), placed in small wooden coffins, pottery jars (Plate 37), or baskets. One was in a Chinese jar, presumably postdating AD 1000. Associated goods for the whole group included quadrangular adzes, shell rings and perforated discs, some double-spouted jar sherds, and a single copper object. Two burial jars are dated to about 1500 BC (burial 69, and from wood with burial 159; Harrisson 1968), and another burial jar to about 750 BC (burial 67). These dates for jar burial do seem a little early given the patterning elsewhere in the archipelago, but similar dates in the late second millennium BC for double-spouted sherds have been claimed from two other caves near Niah: Magala and Lobang Jeragan (Harrisson and Harrisson 1968; Harrisson 1971). The problem with Magala, however, is
that the sherd concerned was found on the surface of the cave and not in
definite association with the bone that was dated.

The Niah evidence thus presents some major problems. On the one hand there
is a large series of radiocarbon dates, but mainly on bone collagen or apatite
and of uncertain reliability. On the other hand there are large numbers of arti-
facts, but it is almost impossible to associate the vast majority of them in any
convincing way with the dated bones. Nothing short of massive reexcavation,
perhaps now impossible, can resolve this problem.

If the Niah dates are correct, the sequence there may indeed contain jar
burial from the late second millennium BC in fully Neolithic contexts, as now
appears to be the case in southern Vietnam (Ha Van Tan 1985b). I am also will-
ing in principle to accept late second millennium BC dates for the double-
spouted and three-color sherds, given the evidence from Lubang Angin. A few
other comments can be added to the Niah story. It is possible that a small
domestic dog was present in the Neolithic phase (Clutton Brock 1959; Medway
1977b) together with the domestic pig, although definitive evidence for the
latter before the fifteenth century AD seems to be lacking (Medway 1973; Cran-
brook 1979). Neither the dog nor the domesticated species of pig (Sus scrofa) is
native to Borneo, and the native wild boar (Sus barbatus) appears never to have
been domesticated. Otherwise, the economic evidence from the West Mouth
suggests little real change from pre-pottery times, and it looks as if the site was
used predominantly for burial during the Neolithic—and perhaps for occasional
visits—rather than as a base for a sedentary agricultural population.

IV. AN INTEGRATED VIEW OF EARLY AUSTRONESIAN EXPANSION

If the linguistic data from Chapter 4 plus a number of important botanical and
ecological observations are added to the above archaeological record, then the
course of Austronesian prehistory from the Initial Austronesian settlement of
Taiwan (fourth millennium BC?) through about 1500 BC, when Neolithic voy-
agers were beginning the Austronesian settlement of Oceania, can be recon-
structed.

During the late fifth or fourth millennium BC, colonists from the mainland
of southern China (probably Zhejiang or Fujian) settled Taiwan. Initial Austro-
nesian languages were spoken on this island for several centuries (a mille-
nium?) before further expansion took place. During the third millennium BC
colonists moved into Luzon, and the Malayo-Polynesian subgroup now began
its separation from the other primary subgroups of Austronesian that remained
on Taiwan. The linguistic reconstruction for Proto-Austronesian (located on Tai-
wan) reveals an economy with domestic pigs and dogs and cultivated rice,
millet, sugarcane (perhaps domesticated from the wild Chinese species *Saccharum sinense*; Daniels and Daniels 1993), yams, and *Alocasia* (Wolff 1994; Zorc 1994). The archaeological evidence adds pottery, weaving, and bark cloth, plus the stone and bone items (reaping knives, projectile points, adzes) already described for the Taiwan Neolithic.

By at least 2000 BC, Proto-Malayo-Polynesian began to break up, probably with settlement expanding in various directions into the southern Philippines, Borneo, Sulawesi, and the Moluccas. The Proto-Malayo-Polynesian vocabulary items presumably reflect the tropical environments of the Philippines, and important new items were added to the economic repertoire: the chicken, coconut, breadfruit, *Colocasia* (taro), banana, sago, betel chewing, and the addition of sails to canoes. Of course, none of these items can be proven definitely absent from the Proto-Austronesian vocabulary; all the linguistic evidence can say is that it cannot be demonstrated that they were present. Certainly it would not be at all surprising if taro and domestic fowl were present in the Taiwanese economy at around 3000 BC. But breadfruit, coconut, banana, and sago were most probably first incorporated into the Austronesian crop inventory in the tropics.

By about 2000 BC the Central-Eastern Malayo-Polynesians had expanded, presumably through the Moluccas, to at least as far as Timor. Navigational skills and sailing techniques must have been improving by this time—as the impending settlement of Oceania makes clear—and rapid coastal expansion was probably preferred to the more laborious process of settling island interiors, which might in some cases have sheltered hostile populations. Cereal cultivation declined to only minor importance in eastern Indonesia, and the Austronesian settlers of Oceania based their economy purely on tubers, tree fruits, and other vegetatively reproduced plants. I will now fill out the botanical background to these Austronesian adaptations by looking at some of the major crop plants and at the dynamics of shifting cultivation.

### A. Rice and Other Cereals

As indicated earlier in this chapter, the earliest cultivated rices developed, according to the archaeological record, from wild annual or perennial forebears in central China (Plate 38a). It is apparent from studies of modern varieties that both the wild forms and the early varieties domesticated from them at this latitude would have been highly sensitive, during their growth and ripening cycles, to variations in day length (photoperiod) and sunshine incidence (Oka 1988). Flowering would have depended on latitudinally determined day length at the start of the dry season, and the ripening process would have required about forty-five days of dependable and adequate sunshine (Chandler 1979:44) and a
precise progression of daylight durations (Oka and Chang 1960; Vergara 1976; IRRI n.d.). In effect these cultivars were genetically conditioned for successful growth cycles under specific latitudinal and climatic conditions.

Today, varieties with little or no photoperiod sensitivity have been developed that will grow successfully in equatorial or high latitudes, but rice yields are still highest in the intermediate tropical latitudes, especially where irrigation is carried out. They drop off (as do protein and starch contents) as one moves toward the equator (Fig. 7.17). For the early centuries of Austronesian expansion it may perhaps be assumed that all varieties were sensitive to daylight lengths, and any attempts to move them relatively quickly into equatorial latitudes would have met with either decreased harvests or no harvests at all (Spencer 1963:84). For instance, excessive cloudiness or rain during the ripening period, high night temperatures, and unvarying day lengths would in combination promote prolific vegetative growth, but grains would tend to be small and in many instances would probably never reach maturity (Oka 1975; J. H. Chang 1968). Grains might also ripen in the middle of an exceptionally wet period so that successful harvesting would be difficult or impossible.

![Figure 7.17 Present-day relationships between rice cultivation and environment: (1) "home" area of rice where crop may be raised year after year without climatic modification; (2) important rice-producing areas where at least one parameter of climate is frequently less than ideal for successful crops; (3) areas where climate must be modified to produce a crop; (4) areas with no important rice production. From Huke 1976. Courtesy: International Rice Research Institute.](image-url)
All of this means, basically, that equatorial latitudes have never been the most suitable for rice cultivation. Many rice specialists have stressed the difficulties and drops in yields that result in changing from a monsoon to an equatorial climate (see especially Spencer 1963); I have also summarized the basic situation in more detail elsewhere (Bellwood 1980). As Austronesians moved south toward the equator and east toward Oceania, rice evidently dropped out of the crop repertoire until suitable southern hemisphere environments in Java and Bali were reached. This, at least, was a scenario I favored for the first edition of this book—a scenario basically driven by environmental factors—but now I think it needs slight modification.

The environmental factors are of course unarguable and undoubtedly of significance. But earlier in this chapter and in Chapter 5, I raised the possibility—with Sather (1995)—that early Austronesian economies were varied and not entirely “standard agricultural.” In other words, some groups probably grew rice in sedentary terrestrial circumstances, especially in Taiwan and the Philippines. Others adopted foraging, as some of the ancestral Punans of Borneo (Chapter 5, Section I). Still others favored maritime specialization and mobility, as perhaps the people of Bukit Tengkorak in the first millennium BC. It almost stands to reason that the latter type of adaptation would be the one most likely to lead to island colonization, and such people are perhaps the least likely to have had sedentary rice-growing lifestyles. It is also salutary to note that the earliest colonists of the Pacific Islands, from Lapita at ca. 1500 BC through to the ends of Polynesia (especially New Zealand) at about 900 years ago, generally adopted mainly foraging economies in the first few centuries of settlement owing to the profusion of natural resources. Of course, this behavior often led to rapid faunal extinction, as in the case of the New Zealand moas (Anderson 1989). But these populations never abandoned agriculture entirely and were able to revert to it more and more in the later stages of prehistory.

The same might have happened in Island Southeast Asia. Those Austronesians who moved into Oceania abandoned rice cultivation and never thereafter recovered it. Their cousins in much of Malaysia and western Indonesia, if the historical and ethnographic records are any guides, recovered it with gusto (if indeed any of them ever dropped it entirely, which is perhaps unlikely). The archaeological record of rice cultivation, albeit faint, indicates this with clarity. Rice is now well attested in Taiwan and western Borneo by 2000 BC, so its cultivation was clearly known to many communities during the early millennia of Austronesian expansion. Sites in central Thailand also have domesticated rice at 2000 BC (Chapter 8). Although Hill (1977) suggested that rice was of minor importance in Peninsular Malaysia prior to the period of Funan (early first millennium AD), I suspect future archaeological research there will push dates for rice cultivation back to an earlier period as well. In eastern Indonesia, rice seems to
have been less important than millet, yams, taro, and sago even as late as AD 1500 (Spencer 1966), although it clearly was grown in quantity in favorable lowland regions of the Philippines and Sulawesi (e.g., see Pelras 1981 for Makassar). However, it is almost universally of great importance today in the islands of western Indonesia, including equatorial Borneo and Sumatra, and may always have been so throughout Austronesian prehistory in the monsoon islands of Java and Bali.

Given the above observations, I would incline to the following view of the prehistory of Austronesian cereal cultivation. Firstly, the northern populations in Taiwan and Luzon have probably always cultivated rice and foxtail millet in varying proportions, although the failure to find direct evidence of rice in the oldest Neolithic sites of the TPK culture in Taiwan does raise some problems. Other cereals of Southeast Asian origin, such as the perennial Job’s tears and the annual “Japanese barnyard” millet *Echinochloa frumentacea* (Li 1970), were probably also grown on a minor scale as well.

A second stage of adaptation followed with expansion, probably involving much coastal foraging mobility, into and beyond the southern Philippines after 2000 BC. The groups who moved toward Sulawesi and eastern Indonesia clearly dropped rice to the scale of a very minor crop but probably continued to grow Job’s tears and some foxtail millet; I am unsure whether the latter would have suffered the same traumas as rice during an equatorial shift. Foxtail millet, of an apparently ancient and shattering variety, is still of importance in Halmahera (Ishige 1980), in central Sulawesi (Downs 1956), and in other parts of eastern Indonesia (Fig. 7.27). It has also retained considerable importance in Taiwan and Lan Yü (Botel Tobago Island; Arnaud 1974; Fogg 1983).

The other side of this second stage concerns those groups who moved toward western Indonesia, Peninsular Malaysia, and southern Vietnam. These appear to have concentrated more on rice and possibly *Echinochloa* (which does not occur in eastern Indonesia; see Fig. 7.18). Although millet has survived ethnographically amongst the Senoi of central Malaya, there is a chance that it may be a relatively recent introduction. Rice would undoubtedly always have been important in the ideal soil and climatic conditions of magnificently fertile Java and Bali. Nonphotoperiod-sensitive varieties better suited to an equatorial climate may already have developed by the time the first Austronesians began to settle Sumatra and the Malay Peninsula.

**B. The Tubers and Tree Fruits**

As far as eastern Indonesia and Oceania are concerned, the equatorial shift during the second stage described above clearly led to a dominance of fruits and tubers over cereals. Of the tubers, the most important are the aroids (Plate 39)
Fig. 7.18 The present eastern limits of cereal crops in the islands of Southeast Asia. Finger millet = *Eleusine coracana*, of Indian origin; common millet = *Panicum miliaceum*, of Chinese origin; Japanese barnyard millet = *Echinochloa frumentacea*; foxtail millet = *Setaria italica*; Job's tears = *Coix lachryma-jobi*. From Ishige 1980. Courtesy: National Museum of Ethnology, Osaka.

and the yams. The greater yam (*Dioscorea alata*) has its homeland in the monsoon regions of northern Mainland Southeast Asia (Burkill 1951) and may have been cultivated by Austronesians throughout their prehistory. Other species of yam were probably first domesticated in Sulawesi and the eastern Indonesia-Melanesia region (Coursey 1972, 1976). Today, yams survive as staples only in
parts of Taiwan, Mentawai, and Banggai; wild yams still sustain some of the hunters and gatherers, such as the Negritos.

The taro (*Colocasia*) (Plate 39 left) poses a more difficult origin problem since it grows freely in a wild or feral state along river banks in many parts of Southeast Asia and India. Its homeland, if it ever had a restricted one, remains unknown (Barrau 1965; Yen and Wheeler 1968). Matthews (1995) has suggested the ancestor of cultivated taro is a wild form, *Colocasia esculenta* var. *aquatilis*, which grows widely from India to northern Australia and New Guinea; it could have been domesticated on more than one occasion independently. The same applies to the giant aroid *Alorasia macrorrhizos*, which has a similar widespread distribution (excluding Australia and New Guinea). *Colocasia* attained some importance in the islands of Southeast Asia; it has been reported as a traditional staple in regions as far apart as Nias, parts of northern Borneo and northern Luzon, and Lan Yü. In the latter island it is grown by the Yami using terraced wet-field techniques similar to those used widely in Oceania (Kano and Segawa 1956). Both the aroids and the yams have probably given way in the face of an expansion of rice cultivation in recent centuries, yet it is clear that they were both of major importance in eastern Indonesia prior to AD 1500 (Spencer 1966).

Of the more important fruits, bananas were domesticated locally from *Eumusa* species in Indonesia and Malaysia and from *Australimusa* species in the Moluccas and New Guinea (Simmonds 1966). Wild forms of both still grow on Halmahera today. Coconuts, despite a rather uncertain ancestry, may well have been first domesticated (or at least systematically planted) in the Indonesian-Melanesian region. Coconut remains are common in Lapita sites in Melanesia and coconuts from prehuman contexts have been excavated on Aneityum Island in Vanuatu, far out in the western Pacific (Hope and Spriggs 1982). Harries (1978) believes the round-fruited and thin-husked form of coconut most commonly grown today was first domesticated in Thailand or Island Southeast Asia, but indigenous domestication of a long-fruited and thick-husked variety in Island Melanesia is also possible.

The starch-yielding sago species (*Metroxylon, Corypha, Arenga*, and *Caryota*) are also native to equatorial Indonesia and Melanesia (Ruddle et al. 1978), while *Eugeissona* is restricted to Borneo and Peninsular Malaysia. All have localized roles in hunter-gatherer and agricultural subsistence in some swampy equatorial lowlands, particularly in eastern Indonesia and Melanesia (e.g., see Ohtsuka 1977; Ellen 1978; Ishige 1980). These trees, together with the breadfruit, pandanus, rambutan, durian, and other good fruit-bearing species, would all have been available for systematic exploitation by Austronesian societies expanding into equatorial Indo-Malaysian latitudes. Most were probably also exploited by previous hunting and gathering groups, but full domestication and the devel-
opment of seedless varieties (as in the bananas and breadfruits) would have re-
quired at least some conscious selection and planting.

C. Shifting Cultivation

Shifting cultivation of cereals is still practiced widely in Island Southeast Asia
today, in both equatorial and drier monsoon climatic regimes. The system obvi-
ously varies tremendously from place to place depending on a number of social
and ecological factors, but it can support modern populations at densities of up
to sixty persons per square kilometer (e.g., see Freeman 1955; C. Geertz 1963;
Spencer 1966; Unesco 1978) or above in certain regions of high fertility such as
Java (Chin 1977). Compared to the average densities of 0.005 to 0.12 persons
per square kilometer given by Unesco (1978) for hunter-gatherers in tropical
forests, these figures clearly reveal the demographic significance of this type of
agriculture, even if they are small when compared to modern wet-rice popula-
tion densities of up to 2,000 persons per square kilometer for Java.

Traditional systems of shifting cultivation in Island Southeast Asia normally
require short cropping cycles of one or two years to be spaced with much longer
fallow periods (e.g., see Freeman 1955; Rousseau 1977), when secondary forest
can reestablish itself and shade out the thick-rooted grasses that would other-
wise take over and render future cultivation difficult (Seavoy 1973b). The whole
system depends a great deal on the nutrients provided by the burning of vegeta-
tion prior to planting; most nutrients in tropical forests are contained in the
topsoil and vegetation rather than in the subsoil. If cropping continues for too
long, the topsoil may be eroded away or depleted in nutrients, and grasslands
requiring much more labor-intensive methods of cultivation will establish
themselves (this has of course happened in many areas). Prolific weed growth
can also promote frequent field shifts, since newly cleared plots require less
weeding than old ones (Clarke 1976).

This type of field shifting may eventually require village movement, al-
though it need not necessarily require territorial expansion. For instance, the
Mnong Gar of Vietnam need to move their villages every seven years or so
(Condominas 1980), but they do so in a cyclical fashion so that an abandoned
locality will eventually be reoccupied after many years. The traditional system
of the Kayan of Central Borneo appears to have been similar (Hose and McDou-
gall 1912), with village moves occurring every twelve to fifteen years. However,
the Iban of Sarawak provide a classic example of a unidirectional type of expan-
sion that has allowed single bilek families to move as much as 300 kilometers in
a single lifetime (Freeman 1955:25, 1970:286), through conscious selection of
virgin rain forest for new ricefields that are used only for one or two years until
weeds promote their abandonment. This phenomenal expansion is of course
relatively recent and it has involved iron tools and an unlimited expanse of rain forest previously inhabited by only sparse populations, but it does still provide an idea of how rapidly Neolithic cultivators could have expanded into virgin agricultural territories when conditions were right. As the prehistory of Oceania shows, Stone Age people can clear forest quickly, perhaps by using techniques such as ring-barking rather than clear-felling.

Other features of modern shifting cultivation in Island Southeast Asia are also of interest for possible reconstructions of how such systems might have been managed in prehistory. For instance, most groups simply place seeds in holes made by digging sticks in the untilled ash and topsoil, and the system does not require tillage or plowing if it is maintained at a balanced level with sufficient forest regrowth during fallows. Grasslands and greatly increased population densities do of course require more intensive techniques of tillage and mulching, as in parts of the New Guinea Highlands, but in Island Southeast Asia it seems that intensification was directed much more toward the elaboration of wet-rice cultivation, which I will discuss in more detail below. Most modern shifting cultivators also mix their crops in the fields; for instance, the Iban dribble in a few cucumber, pumpkin, and gourd seeds with the rice (Freeman 1955). This diversity may help to offset some of the risks associated with dependence on a single crop species and it may also help to discourage the depredations of crop pests and rats, which often tend to flourish in totally monocultural systems (e.g., see Takaya 1980 for modern rice cultivation and rat infestation in lowland Sumatra). Planting in holes rather than direct broadcasting also allows for more conscious selection of seeds and thus for the development of different varieties.

V. THE STAGES OF AUSTRONESIAN AGRICULTURAL PREHISTORY

In a previous paper (Bellwood 1980), I concluded a discussion of Austronesian agricultural prehistory by postulating four main stages of development. These stages can be reduced to three for purposes of the following discussion, in which I will expand on the types of cultivation practiced. The stages overlap in time, although they are successive in terms of commencement, and each has continued in some form to the present.

A. Stage 1

Stage 1 is the early phase of Austronesian expansion, centered in southern China, Taiwan, and the northern Philippines. Incorporating the pre-Austronesian Chinese mainland sites, this phase can be dated between 5000 and 2000 BC. Economies seem to have had both maritime and agricultural economies in
varying proportions, the latter with a cereal component including rice and foxtail millet. As populations spread southward, rice might have continued to be grown in localized swamp or alluvial backswamp conditions similar to those in which its annual forebears originated. These were perhaps similar to those used by modern Borneo peoples such as the Lun Dayeh (Padoch 1985) and Kantu (Dove 1985), in which an initial labor investment can produce flooded fields on riverine flats or in swamps that are easy to maintain and consistently produce higher yields than dryland systems. However, as populations expanded in density, cultivation surely developed more toward the shifting dryland form. Millet can only be grown by dryland techniques, and the dry (or upland) rices were probably developed secondarily at this time by selection for thick and deep roots, loss of photoperiod sensitivity, and a tendency for early maturity to escape the effects of drought (T. T. Chang 1976a; 1989).

**B. Stage 2**

The Austronesian expansion toward the equatorial zone after 2000 BC led to a partial replacement of the cereals by the ecologically better adapted tubers (especially the nonseasonal taro) and fruit or starch-bearing trees. The system of shifting cultivation also underwent changes. During Stage 1, plot preparation in the monsoon regions would have demanded a fairly complete clearance for cereals (which need full sunlight), with successful burning of vegetation. In the wetter equatorial zone, clearance would not have been so easy for a people with only stone tools. Vegetation grows prolifically throughout the year and the rain forest trees are more massive and could perhaps only be ring-barked. More importantly, heavy rain can make burning impossible (Freeman 1955; C. Geertz 1963). In Mindanao, yields can apparently double when a good dry period allows a burn (Yengoyan, in C. Geertz 1963:22). So there would be obvious pressures toward the development of cultivation systems requiring less forest clearance and more emphasis on trees and tubers that do not require such broad expanses of uninterrupted sunlight as cereals.

Systems of this type are still widespread in remoter parts of Indonesia and Melanesia today. The Nuaulu of equatorial Seram (Ellen 1978) cultivate taro, yams, bananas, and sago (wild sago stands are also exploited) in multicrop gardens where up to fifteen different species may be grown together (including sugarcane, manioc, coconut, and others). Because the region has no dependable dry season, up to ten burns may take place before planting can occur. If we subtract the iron tools these people now have, it is not difficult to see that large-scale garden clearance would not have been a very viable option for Neolithic groups in such an environment. Another example comes from Mentawai, off
the western coast of Sumatra, where sago, taro, and bananas are grown in swamps with very little clearing and no burning—the cut vegetation is simply used as a mulch (Mitchell and Weitzel 1983). Neither of these groups grows cereals at all, and I rather suspect that systems of this kind, which were eventually taken right through tropical Oceania, began to characterize Austronesian economic patterns increasingly after about 2000 BC in the truly equatorial and ever-wet lowland zone.

It should also be remembered that agricultural systems based on tubers and tree fruits may have developed independently in New Guinea, although the only direct evidence for this at present relates to a tradition of swamp drainage for unknown cultigens (taro?) that commenced at about 7000 BC in the Wahgi Valley, deep in the highlands of Papua New Guinea (Golson 1977, 1985). I have mentioned the role of New Guinea in this regard several times previously, and I have tried to make it clear that some parts of western Melanesia might already have been settled by agricultural groups before the period of Austronesian expansion (the biological and linguistic evidence both provide strong support for this viewpoint). However, while such developments may have been of profound significance for western Melanesia, there is no compelling evidence at the present time suggesting that they had any great effect on the development of agriculture in the Indo-Malaysian Archipelago.

C. Stage 3

By 3000 years ago most cultivation systems were probably still based on shifting and localized swamp cultivation, with a predominance of cereals in northern regions such as Taiwan and the northern Philippines, and perhaps in Java and some of the dry Lesser Sundas. Along the equator, cereal cultivation may have been of importance in the western islands of Borneo and Sumatra, but there is very good evidence that tuber and fruit dominance had long been developed in eastern Indonesia and, of course, in Oceania. Prior to 3,000 years ago it is possible that varieties of rice with low photoperiod sensitivity had developed within the archipelago and that these rices (like weaving and the backstrap loom) might have been undergoing geographical expansions in popularity through quite a long period. However, the main features of Stage 3 as recorded historically cannot really be stated to involve changes in crop dominance; instead it appears that a major but regionally localized shift toward intensive wet-rice cultivation in bunded fields (sawahs) occurred, contemporary with but perhaps independent of a similar shift to bunded field cultivation of taro in Oceania (Kirch and Lepofsky 1993). Such bunded or embanked fields for rice utilize water supplies derived either from wet-season rains (rainfed systems) or artifi-
cial canals (irrigated systems). Both rainfed and irrigated systems can be laid out as a checkerboard network of bunds on flat land, or they may be terraced into slopes and even steep hillsides (Plates 40 and 41).

It is most unfortunate that wet-rice cultivation, a system that in both irrigated and rainfed forms has obviously transformed islands such as Java, Bali, and Luzon, has no clear archaeological or linguistic prehistory in the Indo-Malaysian Archipelago. The massive success in the archaeological recognition of ancient rice fields through excavations and phytolith analyses in recent years in Japan suggests that modern technology might soon make some breakthroughs, but the fact remains that none have occurred yet. On present evidence, mainly based on guesswork, any great economic importance for this kind of cultivation prior to perhaps 2,500 years ago can hardly be assumed. Historical records indicate wet-rice cultivation in northern Vietnam from about 200 BC (Wheatley 1965); here and in northern Thailand there is archaeological evidence that wet-rice cultivation in bunded fields may have developed during the Iron Age (after 500 BC), together with the use of water buffalo for plowing (Higham 1989:198–200). In Java the oldest inscriptions referring to irrigation (presumably for rice) date from the eighth century AD (Meer 1979). This is about as far as the direct evidence goes, and at this rather vague level it is clearly inappropriate to debate whether rainfed systems preceded canal-irrigated systems (or vice versa), or whether both forms developed together as a result of local differences in topography.

But there are other important points to note about wet rice. Most modern systems depend on iron and water buffalo for successful management, and this has led to the idea that wet rice must be an Iron Age phenomenon. This, of course, is not so, since the Polynesians managed quite well to develop and use similar wet taro systems with only stone tools and no traction animals. Nevertheless, there is no doubt that wet-rice cultivation as known today is mainly (but not entirely) related to large, dense populations and the iron-buffalo complex of technology. It is not commonly found in regions of light population and the system clearly flourishes best on fertile volcanic and alluvial soils, as in Java and Bali, where it was so closely tied historically with the Indianized civilizations that a major development during the first millennium AD must always remain likely (there is no good evidence against this possibility). Wet rice in these islands can support enormous populations as yields can be increased through more careful field preparation, transplanting, and continuous cropping through the year with irrigation (Geertz 1963). Wet rice also matures faster than dry rice. The sawahs themselves can be cropped indefinitely in many regions without fallows, partly because the irrigation waters carry nutrients and also because fern-dwelling algae in the sawahs are efficient fixers of atmospheric nitrogen.
A major point here, of course, is that wet-rice cultivation on a given unit of land can feed many more people than dry rice grown by shifting cultivation, but the establishment of the necessary field systems does require a great deal of initial labor. So it is hardly surprising that many shifting cultivators would continue with swiddening unless obliged to intensify, perhaps owing to population pressure (e.g., see Seavoy 1973a for Kalimantan), or in the face of managerial demands for increased production to support a state or bureaucratic apparatus. The Indianized civilizations may well have been able to enforce such managerial demands in Java and Bali, but explanations of this type hardly suffice for wet-rice cultivation by the remote Kelabits and Lun Dayeh of inland Borneo (Schneeeberger 1979; Padoch 1983), or by the peoples of the northern interior of Luzon whose magnificent terraces are amongst the most spectacular anywhere in eastern Asia (see Plate 41).

The Ifugao terraces of Luzon (Conklin 1980) comprise 20,000 kilometers of embanked terraced fields, of which 7,000 kilometers are stone faced. They support a relatively small-scale bilateral society with densities of between 100 and 250 persons per square kilometer. About one-half of Ifugao subsistence needs are also provided by shifting cultivation, and land does not seem to be in short supply. According to Reid (1994d), the linguistic terminology for rice agriculture and terracing in northern Luzon descends from Proto-Nuclear Cordilleran, a language that might have existed 1,500 to 2,000 years ago. There is as yet no archaeological evidence to support this rough date, but it seems not unreasonable. The terraces are clearly not associated in any way with the presence of a centralized authority or a master plan; they have probably been developed piecemeal by wealthy but tribally organized families of high status, able to command sufficient labor for construction and maintenance. The mountainous Luzon terrain is obviously also suited to terracing in an aesthetic sense, and one cannot entirely discount the importance of such a factor.

Perhaps I can draw one moral from this story: Wet-rice irrigation can exist on a large scale without bureaucratic intervention of the type associated with the ancient canal irrigation systems of Mesopotamia or northern China. This, as pointed out by Bray (1986) for southern China, is because wet-rice irrigation can operate as a piecemeal family or small group system, as with the subak irrigation corporations of Bali. There is, therefore, a potentially optative basis to the origins of wet-rice cultivation; the system need not always reflect the demands of a state organization and a dense population, although history of course shows that this has often been the case. Seemingly aberrant cases such as Luzon and central Borneo are really rather hard to explain without at least a partial model of free choice—and perhaps emulation.

Prior to AD 1500, sawah rice may have been the limit of intensification in the Indo-Malaysian Archipelago, although I should perhaps mention the intensive
tapping of the juices of the lontar palm (*Borassus sundaicus*) in Roti and Savu in eastern Indonesia (Fox 1977). In addition, the modern story of the opening of the lowland swamps of Sumatra, Kalimantan, and Irian Jaya to rice cultivation (Collier 1979; Tsubouchi 1980) shows just how productive such apparently useless environments can become, but this is a technology-based and organizational option that probably would not have been at all attractive to, or even feasible for, prehistoric Austronesian cultivators.