AN INTEGRATED PERSPECTIVE ON THE AUSTRONESIAN DIASPORA:

The Switch from Cereal Agriculture to Maritime Foraging in the Colonisation of Island Southeast Asia

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Abstract

This paper reviews the archaeological evidence for maritime interaction spheres in Island Southeast Asia during the Neolithic and preceding millennia. It accepts that cereal agriculture was well-established in Taiwan during the Neolithic but finds minimal evidence for the transmission of agriculture from Taiwan to Island Southeast Asia. Accordingly, the scholarly dispute in early Austronesian culture history between farming and maritime perspectives is deemed to be based on a vacuous opposition. In terms of a foraging/farming dichotomy, Austronesians' origins were evidently associated with cereal agriculture in the region of the Taiwan Strait, but their southward expansion was predicated on maritime foraging and trade.

Introduction

One of the interests Sandra Bowdler pursued, during the time I was a colleague at the University of Western Australia, was the persistence of the hunter-gatherer economy in the Kimberleys and Arnhem Land despite centuries of visitation by Macassan sea-cucumber collectors. Even though some Aborigines toured Macassar, and witnessed first-hand its agriculturally-based subsistence economy, there was not the slightest tendency for the northern Australian Aboriginal economy to incorporate agricultural practices (Bowdler 2002). My interest looks at this same interaction from an Island Southeast Asian (ISEA) point of view: Why did these visiting Macassans not make some sort of agricultural incursion into northern Australia? Why did they restrict their economic activities in Australia to trade? I see here an ethnohistorical allegory that could clarify poorly-understood aspects of the Austronesian diaspora.

Austronesians are defined as people whose first language belongs to the Austronesian family. Most historical linguists assign all the ex-Taiwan Austronesian languages, from Madagascar through ISEA and the Pacific, to a single 'Malayo-Polynesian' branch, of essentially the same time-depth as the nine branches of Austronesian restricted to Taiwan (Pawley 2002). The hypothetical, reconstructed ancestor of these indistinguishably deep branches, both ex-Taiwan (descended from proto-Malayo-Polynesian, or PMP) and in Taiwan, is referred to as Proto-Austronesian (PAN). PAN itself would have had an ancestor, which may be labelled pre-Austronesian, distinguishable from PAN by dint of the implausibility of its reconstruction from extant Austronesian languages through standard historical linguistic techniques. While numerous proposals have been published for a deep-seated relationship between Austronesian

and the language families of adjacent mainland Asia (Austro-Asiatic, Tai-Kadai, Sino-Tibetan), linguists have been unable to agree on the exact nature of any such relationship (Sagart 2005; Sagart *et al.* 2005).

Howells (1973) and Shutler and Marck (1975) were early proponents for an agriculturally-driven dispersal of Austronesians from a PAN homeland in Taiwan, linked to still earlier food production developments in southern China. In the 1970s and 1980s, archaeologists accepted a mid-Holocene dating for the spread of pottery across Southeast Asia and Taiwan, and its association with the expansion of early, settled agricultural populations, as supported by Pawley and Green's (1973) and Blust's (1976) reconstruction of agricultural terms in the PAN lexicon (see Bellwood 1978, 1985). Subsequently, critical scrutiny of the dating evidence suggested a very rapid spread of Austronesians across ISEA after 4000 BP (Bellwood 1997; Spriggs 1989), but a Taiwan homeland, and agriculturally-fuelled mode of dispersal, have remained as tenets of what is still the orthodox theory on early Austronesian culture history (Pawley 2002). Indeed, recent archaeological research in Taiwan has documented numerous settlements, with cereal agriculture (including millet, another PAN reconstruction), by the fifth millennium BP (Bellwood 2005a; Tsang 2007).

Against this view, W.G. Solheim II has championed a maritime theory on Austronesian origins. He coined the term 'Nusantao' for a sailing people who, according to Solheim, had expanded across a wide swathe of the Pacific and tropical to temperate East Asia. Initially he identified them with the original Austronesians, and located their nursery in southeastern ISEA (Solheim 1975, 1984-1985). Currently, Solheim (2006) proposes that the Nusantao, being the linguistic ancestors of Austro-Asiatic and Thai-Kadai as well as Austronesian, arose on the coast of central Vietnam in the terminal Pleistocene. He identifies southeastern ISEA as the pre-Austronesian homeland, and further recognises a PAN homeland that had connected central Vietnam, northern Borneo, Palawan and Luzon across the South China Sea.

Meacham has developed a similar position to Solheim's. He argues that the Austronesian homeland covered a vast area, the triangle from Taiwan in the north to Sumatra in the southwest and Nusatenggara in the southeast. The Taiwan branches of PAN are deeply-rooted because Taiwan was the first component to become isolated from the remainder of the maritime network; south of Taiwan, PAN only later split into its Western Malayo-Polynesian, Central Malayo-Polynesian and Oceanic branches (Meacham 1984-1985, 2004). Oppenheimer (1998) provided this view with a basis in palaeogeography by proposing that the drowning of Sundaland at the Pleistocene-Holocene junction spurred the maritime expansion of early Austronesians across the ISEA region. Recently, the analysis of large samples of human

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mitochondrial DNA (mtDNA) from ISEA, Taiwan and adjacent regions has provided strong support for population dispersals associated with late Quaternary sea-level rises, in addition to support for some level of emigration from Taiwan into ISEA following the mid-Holocene (Hill *et al.* 2007; Soares *et al.* 2008).

This paper reviews the archaeological evidence for identifying the ISEA Neolithic with the expansion of agricultural populations southward from Taiwan or with the continuation of an indigenous ISEA tradition of maritime sailing. I reserve the term Neolithic for assemblages with pottery or polished stone tools which pre-date c.2500 BP, after which time the dispersal of iron and bronze across ISEA ushered in the region's Early Metal Phase (Bellwood 1997:268; Hung *et al.* 2007). The tendency of some writers to equate the Neolithic with early agriculture (e.g. Bellwood 2005a; Matsumura and Hudson 2005) blatantly assumes what should be a matter of investigation: the specificity of an association between ISEA Neolithic assemblages and agricultural subsistence practices.

In this paper, archaeological materials will receive a 'late dating' by default unless there is reasonable physical evidence for a greater antiquity. For instance, notwithstanding the common occurrence of potsherds in ISEA Neolithic deposits, pottery production continued to increase in ISEA during the Metal Phase (e.g. Bellwood 1998; Soegondho 1995), and this should be the default dating for otherwise undated pottery. Further, as is now well-recognised (e.g. Bellwood 1997, 2000; Spriggs 2003, 2007), potsherds can infiltrate older deposits, accounting for the precocious determinations of 4500–6000 BP for the deepest pottery at rockshelters such as Ulu Leang 2 in Sulawesi, Bukit Tengkorak in Sabah and Lubang Payau in Kalimantan. In cases such as these, other Neolithic materials may also have worked their way downwards with the potsherds, but the charcoal used for dating is inferred to be *in situ* as it returned dates of apparently pre-ceramic antiquity. The conservative dating policy adopted here can be illustrated through application to the East Timor rockshelters excavated by Glover (1986). The distinction between Neolithic and post-Neolithic deposits is based on whether the pottery-bearing layer precedes or post-dates 2500 BP according to Glover's chronological estimates. The distinction between pre-Neolithic and Neolithic, on the other hand, depends on whether a layer older than 2500 BP has any potsherds; greater depth than any pottery is taken as physical evidence of the pre-Neolithic antiquity of all contained remains (Table 1). While conservative, my dating policy avoids the trap of 'creating' Neolithic assemblages based on the archaeologist's preconceptions, as can happen if rampant infiltration or faulty dating is invoked to propose a Neolithic association for selected finds regardless of the stratigraphic and radiometric evidence.

Unique Status of Austronesian as a Neolithic Expansion

Bellwood (2005a; Diamond and Bellwood 2003) attempts to include Austronesian under his general theory that the world's major language families were established through the expansion of early farmers. Austronesian, however, and the area where Austronesian languages are spoken, received limited attention in Bellwood's (2005a) *First Farmers*, which may reflect the fact that Austronesian is completely unlike the world's other widespread language families. Austronesian is unique on one hand by

being the language of an island world, and on the other hand by experiencing an almost total replacement of its staple crops as part and parcel of its major expansion (Spriggs 2003, 2007). The general case with the language families detailed by Bellwood (2005a) involved an overland expansion from an agricultural heartland by farmers who, at the end of their Neolithic journey, were planting essentially the same crops as had been domesticated in the homeland. The Austronesians, by contrast, appear to have been 'terrestrially challenged', having achieved only marginal penetration of mainland Southeast Asia and New Guinea, while they also rapidly switched from grain cultivation to the root and arboreal crops which dominate Pacific agricultural systems. I would like to propose this was no coincidence; rather, colonisation of the Austronesians' island world was predicated on their ability to combine exploitation of maritime environments with the planting of locally-adapted crops which could be productively harvested with minimal tending.

How much agriculture fuelled the ISEA Austronesian expansion may have varied, but probably was generally slight. Consider the twin Neolithic hamlets of Kamassi and Minanga Sipakko in central Sulawesi, whose longevity of occupation has previously been ascribed to these sites' combination of boating access to the sea and up-valley, pedestrian access to highland forests, as well as local access to riverine resources and river flats (Bulbeck and Nasruddin 2002). Recent excavations at Minanga Sipakko demonstrate continuous Neolithic habitation for well over a millennium, but the identified plant remains are restricted to the candlenut, which need hardly have been cultivated, while the faunal remains include fish (marine and riverine), fowl, forest animals (both introduced and indigenous), and dog as the sole identified domesticate (Simanjuntak *et al.* 2008). Analysis of the Minanga Sipakko pollen suggests unchanged vegetation throughout the period of Neolithic habitation (Vita 2008), which implies minimal forest clearance for agriculture. If the assumption of agricultural demic diffusion during the Neolithic has any validity for ISEA, surely Minanga Sipakko would have produced evidence of field agriculture and deforestation, instead of remains which could be comfortably accommodated under the rubric of a foraging subsistence economy.

What of the Neolithic rice remains from Andarayan in northern Luzon, and Gua Sireh and Niah in Sarawak (Table 2)? Both of these areas are clearly important for understanding the ISEA Neolithic, particularly as a second shared distinction is acceptable evidence of pottery before 4000 BP (see below). A third distinction, and this appears critical for correct interpretation of the evidence, is their proximity to areas where the Neolithic had been established well before 4000 years ago – respectively, Taiwan and Vietnam. If Andarayan and Gua Sireh/Niah represent expansion by Neolithic rice farmers, then on current evidence they would represent a failed expansion by rice farmers who had come thus far, and no farther. Indeed, overseas trade of rice to Sarawak and north Luzon from mainland Southeast Asia and Taiwan would not be beyond the bounds of possibility, given the evidence (to be reviewed) for mid-Holocene, long-distance maritime trade. If, however, we are dealing with Neolithic rice farmers in Sarawak and northern Luzon, this subsistence strategy would appear to have been entirely unsuitable for sustained Austronesian expansion, which instead was facilitated by a switch to a subsistence economy that did not tie community members to one spot.

Table 1 Pre-Neolithic, Neolithic and post-Neolithic layers from Glover's (1986) East Timor rockshelters (see text). The distinction between post-Neolithic and Neolithic layers is based on Glover's inferred chronology, but the distinction between Neolithic and pre-Neolithic layers is based on the inclusion of potsherds.

Site	Pre-Neolithic Layers	Neolithic Layers	Post-Neolithic Layers
Lie Siri	I-Vb	Vc-VIb	VII
Beri Ceri Uato	I-IV	V-VII	VIII-X
Uai Bobo 1	I-II	III	IV-VIII
Uai Bobo 2	I-VII	VIII-X	XI-XIII

Table 2 Presences and counts (where available) of identified pre-Neolithic and Neolithic plant remains from Island Southeast Asia (excluding sedges). + = presence, ++ = abundance. References: 1: Bellwood (1995, 1998); Paz (2004, 2005); Simanjuntak and Prasetyo (2002); van Heekeren (1972:146). 2: Glover (1986); Simanjuntak and Prasetyo (2002); Simanjuntak *et al.* (in press). 3: Glover (1986); O'Connor *et al.* (2005a, 2005b). 4: Mijares (2007:19, 53). 5: Paz (2004, 2005). 6: Paz (2005). 7: Paz (2005); Barker (2005); Bellwood (2005a); Mijares (2007). 8: Mijares (2007:49); Paz (2005). 9: Mijares (2007:49-52). 10: Mijares (2007:16, 51). 11: Paz (2004) (further remains from spits 1 and 2 in Leang Burung 1 Trench A probably postdate 1500 BP – cf. Paz 2005:113). 12: Glover (1986).

Plant	Pre-Neolithic		Neolithic	
	Location	Sites	Location	Sites
Three or more islands				
<i>Canarium</i> ¹	Sarawak; South Sulawesi; Java; Flores; North Moluccas	Niah (+); Leang Burung 1 Trench B (292); Gunung Sewu (+); Gua Rundung (15); Tanjung Pinang, Daao 2, Siti Nafisah, Golo, Um Kapat Papo (inferred)	South Sulawesi; Java; North Moluccas	Leang Burung 1 Trench A (19); Gunung Sewu (++) ; Tanjung Pinang, Siti Nafisah, Golo (inferred)
<i>Aleurites</i> ² (candlenut)	Java	Gunung Sewu (+)	Java; South Sulawesi; East Timor	Gunung Sewu (++) ; Minanga Sipakko (+); Beri Ceri Uato (11)
Two islands				
<i>Celtis</i> ³	East Timor; Aru	Lie Siri (++) ; Uai Bobo 1 (12); Uai Bobo 2 (10); Liang Nabulei Lisa (38.8g); Liang Lemdubu (6.3g)	East Timor	Lie Siri (++) ; Uai Bobo 1 (5); Uai Bobo 2 (6)
Particular Unidentified Nut ⁴	North Luzon; Palawan	Eme (+); Ille Cave (+)	North Luzon	Eme; Dalan Serkot (+)
Fabaceae (<i>Vigna</i>) ⁵	Sarawak; South Sulawesi	Niah (+); Leang Burung 1 Trench B (4)	South Sulawesi	Leang Burung 1 Trench A (6)
<i>Colocasia</i> ⁶	South Sulawesi	Leang Burung 1 (+)	Batanes	Rakcuaydi (+)
<i>Oryza</i> ⁷ (rice)			Sarawak; North Luzon	Gua Sireh (++) ; Niah (1); Andarayan (1)
One island				
<i>Dioscorea</i> ⁸	Sarawak	Niah (+)	Sarawak	Niah (+)
<i>Boehmeria</i> ⁸	North Luzon	Eme (+); Mabangog (+)	North Luzon	Callao (15); Eme (203); Dalan Serkot (1)
Probable Moraceae ⁹	North Luzon	Callao (+)		
Unidentified Palms ⁹	North Luzon	Callao (+)		
Breadfruit ¹⁰	Sarawak	Niah (+)		
Apiaceae ¹⁰	Sarawak	Niah (+)		
<i>Alocasia</i> ¹⁰	Sarawak	Niah (+)		
<i>Caryota mitis</i> ¹⁰	Sarawak	Niah (+)		
Unidentified Palms ¹¹	South Sulawesi	Leang Burung 1 Trench B (6)		
Probable Cucurbitae ¹¹	South Sulawesi	Leang Burung 1 Trench B (2)		
Probable Commelinaceae ¹¹	South Sulawesi	Leang Burung 1 Trench B (4)		
<i>Piper</i> ¹²	East Timor	Uai Bobo 1; Uai Bobo 2		
Probable Peanut ¹²	East Timor	Lie Siri		
Probable Job's Tear ¹²	East Timor	Uai Bobo 2		
Polynesian Chestnut ¹²	East Timor	Uai Bobo 2		
<i>Spilanthus</i> ⁹			North Luzon	Callao (2); Dalan Serkot (1)
<i>Cassia</i> ¹¹			South Sulawesi	Leang Burung 1 Trench A (1)
Probable Sweet Potato ⁶			South Sulawesi	Leang Burung 1 Trench A (+)
Probable Millet ¹²			East Timor	Uai Bobo 2 (1)
<i>Areca</i> ¹²			East Timor	Beri Ceri Uato (1)

Bellwood (1997, 2005a), followed by Paz (2002, 2005) and Mijares (2007), argues that the early Austronesians domesticated local tubers and arboreal crops during their migration through ISEA. Central to this argument is, apart from a grudging acceptance of desultory replanting of roots and fruits, the claimed lack of evidence for pre-Neolithic ISEA agriculture. However, the archaeological evidence for the exploitation of non-cereal plant resources appears to be stronger prior to the Neolithic than during the Neolithic (Table 2). Of the plants evidenced for both periods, the candlenut alone appears to have been more intensively and extensively exploited during the Neolithic. Wild ramie (*Boehmeria*) was evidently exploited more intensively during the Neolithic in North Luzon, but it has not been reported elsewhere, and this exploitation may reflect its use for fibres (Mijares 2007:54-59). Overall, a much greater variety of plant remains date to the pre-Neolithic than the Neolithic. Further, apart from the special case of rice, there are as many domesticates identified for the pre-Neolithic (peanut, Job's tear) as for the Neolithic (millet, sweet potato) (or should we reject the peanut and sweet potato identifications as too tendentious, given the origins of these plants in South America, evidence for ISEA agriculture would be diminished for the Neolithic as well as the pre-Neolithic). Even the old argument about non-cereal crop reconstructions in PMP (Blust 1995) has been turned on its head by Blench (2004) who shows that many of the trees planted in ISEA seem to have originated in the Moluccas or Melanesia, before being introduced to ISEA prior to the region's colonisation by Austronesians (see also Spriggs 2007).

The archaeological evidence for faunal transport also mitigates against a scenario of a Taiwan-based incursion of farmers into ISEA. Niah Cave provides us with the northernmost instance of early faunal introduction (dogs, domestic pigs), and even here the remains could be post-Neolithic (Barker 2005:101). Otherwise, all the recorded faunal introductions were to Wallacean islands south of the Philippines. The earliest introductions involved the westward transport of marsupials from New Guinea, succeeded by traffic in potential domesticates – the Celebes boar to Flores, and perhaps *Capra/Ovis* to Timor (Table 3). *Sus celebensis* so dominates the pre-ceramic Holocene faunal remains from the Maros sites in South Sulawesi that it was minimally a commensal and conceivably a domesticate (Simons and Bulbeck 2004). Perhaps this was also the species of pig introduced during the Neolithic to Timor (Spriggs 2003:65) and the Moluccas (Bellwood 1997:230). The problematic early/mid-Holocene *Capra/Ovis* remains in East Timor can hardly be attributed to contamination from the Neolithic layers, which yielded a smaller tally of specimens (Table 4). The specifically Neolithic introductions (Table 3) include wild Eurasian mammals (porcupine, monkey, perhaps the Timor deer) as well as domesticates (cattle/water buffalo, dog, *Sus scrofa*). In summary, the major motivation for faunal transport appears to have been to supplement the depauperate fauna of eastern Indonesia (cf. Bellwood 1997:231), and the evidence is mixed, at best, for a Neolithic switch from wild to domesticated animals.

If we follow Bellwood's (2005a:25-28) one-zero view on agriculture, whereby societies are either caught on the agricultural treadmill or engage in nil to minimal agriculture, then, based on the current archaeological evidence, the Austronesian Neolithic across most of ISEA must be classified as the latter. My designation

of the early Austronesian economy in ISEA as a fundamentally foraging economy should not appear too adventurous, given Higham's (2002) similar characterisation of the Da But, Bau Tro and Khok Phanom Di sites, with their rich Neolithic material culture spanning the general period 3500–6500 BP.

Methodology for Investigating ISEA Maritime Networks

To address the previously raised issues, this study investigates the evidence for interisland exchange and maritime interaction spheres in prehistoric ISEA and adjacent regions. Pottery and domesticates are included but not privileged in the analysis – any archaeological trait will suffice. This is to avoid the circular argument of accepting for analysis only that evidence which would lead to the conclusion of an agriculturally-fuelled, demic diffusion, signalled by the arrival of pottery as the key indicator.

Acceptable evidence for maritime interaction is based on three criteria. The first criterion has been alluded to in the discussion of faunal transport; when a well-sourced item has crossed the sea beyond its natural range, cultural exchange is indicated even in the absence of supporting archaeological evidence for the item's exploitation at its source.

The second criterion is to infer evidence for social interaction based on shared, contemporary rarities in the archaeological record from sites within reasonable proximity to each other, even if separated by bodies of water. The rarer the trait, the more discrete the match and the closer the locations, the stronger the evidence. *Celtis*, whose seeds appear to be edible and whose bark can be used for cloth and has medicinal properties (Glover 1986:193), provides a good example. The only published report of *Celtis* seeds in prehistoric ISEA appear to be from East Timor and Aru, particularly during the terminal Pleistocene and mid-Holocene (Table 2); even in East Timor, where the seeds also occur in Neolithic contexts, evidence for *Celtis* disappears with the Early Metal Phase (Glover 1986:193). Beyond Aru and East Timor, the next closest occurrence seems to be from Yap in Negros (Paz 2005:Table 1), but this is an early historical site (Bacus 2004:130), and otherwise as far afield as Tapenkeng culture sites in Taiwan (Tsang 2007:78). Thus, the apparently rare trait of prehistoric ISEA *Celtis* exploitation suggests pre-Neolithic cultural interaction between Timor and Aru.

The third criterion is to accept the widespread occurrence of a novel archaeological phenomenon as evidence of large-scale interaction and potentially a diaspora. However, even here the analysis drills down to the finest available level of detail, recognising (for instance) different types of pottery and polished stone tools rather than these two broad artefact classes *per se*. This fine grain of analysis differs from the approach taken by Hill *et al.* (2006), Soares *et al.* (2008) and Hill *et al.* (2007), whose studies respectively accept the Hoabinhian technocomplex of mainland Southeast Asia, the flake-blade tradition of ISEA, and the Taiwan-ISEA Neolithic as archaeological evidence for population dispersals (but without racial replacement) based on a geographical and chronological match with widely dispersed mtDNA clades. My current intention is to identify interaction spheres where there is repeated evidence from different archaeological traits for interaction between two (or more) places. For that reason, my maps of pre-4000 BP and post-4000 BP maritime interaction (Figures 1-6) include a template for all

Table 3 Archaeologically attested Neolithic and earlier faunal introductions into Island Southeast Asia.

Mammal	Introduced To:	Earliest Date	Sites	Probable Source	References
Cuscus	East Timor	9000 BP	Matju Kuru (+Uai Bobo 2 pre-4000 BP)	New Guinea	O'Connor 2006; Table 4
<i>Dorcopsis wallaby</i>	Gebe	8500 BP	Golo; Um Kapat Papo	Misool Island	Flannery <i>et al.</i> 1998
<i>Sus celebensis</i>	Flores	8000 BP	Liang Bua	South Sulawesi	Morwood and van Oosterzee 2007:101
Cuscus	Gebe; Morotai; Halmahera	>7000 BP	Golo; Um Kapat Papo; Daeo 2; Siti Nafisah	New Guinea	Bellwood 1997:188-189
<i>Capra/Ovis</i> (presumably goat)	East Timor	7500 BP?; 6000 BP?	Beri Ceri Uato; Uai Bobo 2	Eurasia	Glover 1986:97, 169; Table 4
<i>Cervus timorensis</i>	South Sulawesi	4000-5000 BP	Leang Burung 1	Java/Bali	Simons and Bulbeck 2004
<i>Dorcopsis wallaby</i>	Halmahera	4500 BP	Siti Nafisah	Gebe	Flannery <i>et al.</i> 1998
Cuscus	Halmahera	4500 BP	Siti Nafisah	Gebe or Morotai	Pasveer and Bellwood 2004:303
Civet cat	East Timor	4000-5000 BP	Uai Bobo 2	Eurasia	Table 4
Pig	East Timor	c.4000 BP	Uai Bobo 2	Flores/Sulawesi	Table 4; cf. Spriggs 2003
<i>Sus scrofa</i>	Sarawak	Neolithic	Niah	Eurasia	Barker 2005
<i>Sus scrofa</i>	South Sulawesi	Neolithic	Kalumpang	Eurasia	Bulbeck and Nasruddin 2002
Pig	Kayoa	Neolithic	Uattamdi	Eurasia	Bellwood 1997:229
Pig	Banda	Neolithic	Pulau Ay 1	Eurasia	Spriggs 2007:111
Dog	Sarawak	Neolithic	Niah	Eurasia	Barker 2005
Dog	South Sulawesi	Neolithic	Minanga Sipakko	Eurasia	Simanjuntak <i>et al.</i> 2008
Dog	East Timor	Neolithic	Beri Ceri Uato; Uai Bobo 2; Matju Kuru 2	Eurasia	Table 4; Spriggs 2007
Dog	Kayoa	Neolithic	Uattamdi	Eurasia	Bellwood 1997:229
<i>Bos</i>	South Sulawesi	Neolithic	Leang Burung 1	Eurasia	Simons and Bulbeck 2004
<i>Bos</i>	East Timor	Neolithic	Beri Ceri Uato	Eurasia	Table 4
Porcupine	South Sulawesi	Neolithic	Minanga Sipakko	Eurasia	Simanjuntak <i>et al.</i> 2008
Monkey	East Timor	Neolithic	Uai Bobo 2	Eurasia	Glover 1986
<i>Cervus timorensis</i>	East Timor	Neolithic (?)	Uai Bobo 1	Java/ Sulawesi	Table 4

Table 4 Medium to large mammal identifications, minimum numbers of individuals, in Glover's (1986:121, 158, 192) East Timor rockshelters based on the chronology outlined in Table 1. Figures in brackets include uncertain identifications.

Site	Pre-Neolithic	Neolithic	Post-Neolithic
<i>Capra/Ovis</i>	1 (3)	1 (2)	13
Cuscus	1	4	2
Civet	1	2 (3)	4 (5)
Pig	(1)	11	14
Dog	0	2 (3)	6
Cattle	0	2	4 (6)
Monkey	0	2	6
Timor deer	0	(1)	1 (3)
Horse	0	0	(1)

of the interaction axes evidenced for each period, although the individual maps will emphasise particular axes to assist their legibility by readers.

The main value of the current exercise is to employ a bottom-up approach to detect overarching patterns of maritime interaction. Re-performance of the exercise at a future date may well vary the individual interaction axes suggested by the archaeological traits used here, or recognise additional interaction axes, as our knowledge of ISEA prehistory grows. Large areas such as Mindanao, eastern Sulawesi, Indonesian Borneo (Kalimantan) and Sumatra remain sparsely documented in terms of their pre-Metal Phase archaeology. The relative scarcity of open-air sites compared to caves and rockshelters, and the typically poor preservation conditions for organic remains in the open-air sites that have been excavated, are also recognised as sampling problems which, hopefully, future fieldwork will ameliorate. The present study stands or falls to the degree that it identifies patterns of maritime interaction that will be confirmed rather than falsified by future research.

Tropical and Subtropical Interaction Spheres before 4000 BP

Table 5 presents the evidence for interaction spheres that extended across the sea in ISEA and its environs during the millennia prior to 4000 BP. None of these cases is argued here to be associated with the expansion of languages, leastways languages that have left modern descendants, except where explicitly specified. In addition, all cited age estimates are based on calibrated radiocarbon dates except where otherwise specified or else quoted as a mean radiocarbon determination and standard error. The antiquity estimates presented in Table 5 are indicative approximations.

The Hagop Bilo assemblage in Sabah, dated to 18,000–12,000 BP, includes a class of elongate blade-like flakes (Bellwood 1997:179). This assemblage is contemporary with the late Pleistocene industry featuring blade-like flakes from Leang Saru, in the Talaud Islands, which Tanudirjo (2001:264) conservatively dates to between 21,000 and 10,000 years ago (Figure 1). No other published ISEA industries from the terminal Pleistocene feature these blade-like flakes; the similar assemblage from Callao Cave, Luzon, dates to 26,000 years ago (Mijares 2007).

Intriguingly, blade-like flakes are absent from later assemblages in Sabah (Bellwood 1997:180), but continued in production on the Talaud Islands (at Leang Tuwo Mane'e), and then appeared in early to middle Holocene assemblages on Palawan (Duyong and Guri Caves), Cebu (Carcar), and probably Buad, Daram and surrounding islets of the central Philippines (Bulbeck *et al.* 2000:99–100). In proposing an interaction sphere that connected the Talaud Islands to Palawan and the central Philippines (Figure 3), I point out that it is ringed by coeval sites that lack these blade-like flakes, not only sites in Sabah, but also Paso in North Sulawesi (Bellwood 1997:185–186), Kimanis and Lubang Payau in East Kalimantan (Arifin 2004), the Cagayan Valley rockshelter assemblages in Luzon (Mijares 2007), and numerous North Moluccan sites (Bellwood 1998; Tanudirjo 2001:286–291).

This mooted maritime interaction sphere is confirmed by the evidence of obsidian exchange, at least as far as the Philippine zone is concerned (Neri 2007). Philippine archaeologists have recovered obsidian artefacts from islands lacking obsidian

sources in aceramic contexts: specifically, the deeper layers of Ille on Palawan, believed to pre-date 10,000 BP; and, less securely, from the Bungiao Shelter on Mindanao and as surface collections on Cebu. The source of the chemically-tested Ille and Mindanao obsidian is unknown but would not appear to be Luzon (Figure 1). The only evidence I can find of a pre-Neolithic connection between Luzon and the islands to the south is the exploitation of the same species of nut in the Cagayan Valley sites and at Ille Cave in Palawan (Table 2; Figure 2).

Another feasible interaction sphere with terminal Pleistocene origins involves the earliest edge-ground stone tools in Southeast Asia, which are dated to between 20,000 and 10,000 BP at Niah Cave in Sarawak, and between 11,000 and 7000 BP at Bacsonian sites in North Vietnam (Mijares 2007:12, 16). Although Borneo would have still been connected by land to mainland Southeast Asia at 11,000 years ago, the lack of other edge-ground stone tools older than the mid-Holocene suggests a direct maritime connection (Figure 1).

One likely instance of early Holocene interaction traced by lithics involves sumatraliths, which are pebble tools flaked across most or all of one face (Figure 2). These occur at Togi Ndrawa on Nias Island (Forestier *et al.* 2005), Gua Pandan in South Sumatra (Forestier *et al.* 2006), the northern Sumatra shell middens (Bellwood 1997:169–170; van Heekeren 1972:86–87), and the shell middens and lowland rockshelters (such as Gua Kerbau) of the western Malay Peninsula (Adi 2000:157; Bulbeck 2003:135, 139). At Togi Ndrawa, sumatraliths are not reported from the basal Pleistocene deposit, and first appear in horizon 3, which dates from around 9000 BP. All of the other Sumatra and Malaya sumatraliths appear to be Holocene and those that can be dated with any confidence post-date 8000 BP. These points suggest expansion of the technology of invasive unifacial flaking of pebbles (resulting in sumatraliths) after post-Pleistocene sea-level rises had separated Sumatra and Malaya, and isolated Nias from the Sumatra mainland.

Our next two cases involve specific comparisons between the bone points which, as a group, occur quite frequently in Southeast Asian assemblages that post-date 11,000 BP, arguably associated with exploitation of the expanding mangrove forests of the terminal Pleistocene and early Holocene (Rabett 2005). With these bone points, a potential use as blowpipe darts has been nominated only for examples from Niah, which date predominantly to the initial Holocene (Rabett 2005:155, 181), and from South Sulawesi where bone points were manufactured as of the early Holocene (Olsen and Glover 2004). Note that an origin of blowpipe technology in Borneo would be supported on ethnographic grounds (Jett 1970). Rabett's own study of bone point technology, morphology and use-wear identified the same tool types at Niah and Khok Phanom Di in south-central Thailand (large scraped tubular points), and at Pulau Balambangan in Sabah and Khok Phanom Di (hafted woodworkers), but the much later dating of the Khok Phanom Di examples (Rabett 2005) rules out the use of these comparisons to indicate interaction spheres. The situation is more favourable in far eastern Indonesia, based on Pasveer's (2005; Pasveer and Bellwood 2004) study of the bone points from Aru, North Maluku, and Kria in New Guinea's Vogelkop. In contrast to the Aru bone points, the latter two assemblages are rich in bipoints, relatively homogeneous in their metrical attributes, have a bimodal breakage pattern consistent

Table 5 Evidence of cross-sea interaction spheres prior to 4000 BP in Island Southeast Asia and its environs. Continuations of these interaction spheres after 4000 BP are not considered here.

Areas	Sites	Items	Antiquity	Key Sources
Sabah; Talaud Islands	Hagop Bilo; Leang Sarru	Blade-like flakes	18,000-12,000 BP	Bellwood 1997; Tanudirjo 2001
Talaud Islands; Palawan; central Philippines	Leang Tuwo Mane'e; Duyong Cave; Carcar	Blade-like flakes	7000-4000 BP	Bulbeck <i>et al.</i> 2000
Palawan; Cebu; Mindanao	Ille; Bungaio; Tagatong Hill	Obsidian	>10,000-5000 BP	Neri 2007
Luzon; Palawan	See Table 2	Unidentified nut	>4000 BP	See Table 2
Sarawak; North Vietnam	Niah; Bacsonian sites	Edge-ground stone tools	11,000-10,000 BP	Mijares 2007
Sarawak; South Sulawesi	Niah; Leang Burung 1; Ulu Leang 1	Mooted bone blowpipe darts	10,000-7000 BP	Olsen and Glover 2004; Rabett 2005
North Maluku; New Guinea	Siti Nafisah; Daao 2; Golo; Kria	Lashed bone bipoints	7000-4000 BP	Pasveer 2005
Nias; Sumatra; West Malaya	Togi Ndrawa; Gua Pandan; mid-Holocene shell middens	Sumatraliths	9000-4000 BP	Bulbeck 2003; Forestier <i>et al.</i> 2005, 2006
Sarawak; South Sulawesi	Niah; Leang Burung 1	Fabaceae	10,000-4500 BP	See Table 2
East Kalimantan; South Sulawesi	Various sites	Rich parietal art focused on hand stencils	10,000-4000 BP	Bulbeck 2004; Chazine 2004, 2005
East Kalimantan; South Sulawesi; Java; Flores	Kimanis; various Java and Sulawesi sites; Liang Toge; Gua Pandan	Marine shell scrapers	9000-4000 BP	Arifin 2004; Bulbeck <i>et al.</i> 2000; van Heekeren 1972; Prasetyo 2002
Flores; South Sulawesi	Liang Bua; Maros sites	<i>Sus celebensis</i>	8000 BP	See Table 3
Java/Bali; South Sulawesi	Leang Burung 1	<i>Cervus timorensis</i>	5000-4000 BP	See Table 3
East Timor; Flores/South Sulawesi?	Uai Bobo 2	Pig	>4000 BP (?)	See Table 3
East Timor; Java?	Beri Ceri Uato; Uai Bobo 2	<i>Capra/Ovis</i> (goat?)	7500-6000 BP (?)	See Table 3
East Timor; Java?	Uai Bobo 2	Civet cat	5000-4000 BP	See Table 3
New Guinea; Gebe; North Maluku	See Table 3	<i>Dorcopsis wallaby</i>	8500 BP; 5500 BP	See Table 3
New Guinea; East Timor; North Maluku	See Table 3	Cuscus	9000 BP	See Table 3
Java; South Sulawesi	Numerous sites	Pirri points; double-pointed bone needles	7000-4000 BP	Bulbeck <i>et al.</i> 2000; Prasetyo 2002
Rote; East Timor; East Kalimantan; Aru, Flores; Java	Numerous sites	Shell beads and pendants	13,000-4000 BP	See Tables 6-8
East Timor; Aru	See Table 2	<i>Celtis</i> seeds	13,000-6000 BP	See Table 2
Sarawak; Vietnam	Gua Sireh	Basket-impressed pottery	4500-4000 BP	Datan 1990; Nguyen 2005
Sarawak; Vietnam	Gua Sireh	Rice	4500-4000 BP	See Table 2
Palawan; North Vietnam	Da But sites; Sa'gung Shelter	Edge-ground stone adzes	6500-6000 BP	Kress 2004; Nguyen 2005
Palawan; North Vietnam	Da But sites; Duyong Cave; Paredes Shelter	Polished stone adzes; shell jewellery	6000-5000 BP	Fox 1970; Nguyen 2005
Palawan; Talaud Islands; North Maluku; East Timor	Duyong Cave; Leang Tahuna; Leang Manaf; Gebe; Tutuala	Shell adzes	9000-4000 BP	Bellwood 1998; Fox 1970; Tanudirjo 2001
South China; Pescadores; Taiwan	Kwangtung sites; Suogang; Tapenkeng culture sites	Cord-marked pottery; clay spindle whorls	5500-4500 BP	Bellwood 2005a; Tsang 2005
South China; Pescadores; Taiwan	Kwangtung sites; Suogang; Tapenkeng culture sites	Rice; millet	5500-4500 BP	Bellwood 2005a; Tsang 2005
South China; Pescadores; Taiwan	Kwangtung sites; Suogang; Tapenkeng culture sites	Polished stone artefacts	5500-4500 BP	Bellwood 2005a; Tsang 2005
Northern Luzon; Taiwan	Cagayan sites; Baxiandong sites	Small flake tools	6000-5000 BP	Mijares 2007; Zhang 2000
Taiwan; northern Luzon	Fushan culture sites; Rabel Cave; Minori Cave	Plain pottery	5000-4000 BP	See text

with lashed hafting, appear to have been used predominantly as borers or engravers, and post-date 7400 BP, with a chronological focus between 7000 and 3000 BP (Figure 3).

The possibility of a Borneo-Sulawesi connection is reinforced by the botanical evidence of Fabaceae exploitation restricted to these two islands (Table 2). Additionally, Borneo and Sulawesi include the only two documented locations in ISEA with rock art galleries featuring hand stencils and painted zoomorphs as the dominant motifs. In East Kalimantan these date back to around 10,000 BP (Chazine 2005; Fage 2005); in southwest South Sulawesi, direct dating of the art has not been pursued, but the paintings are typically associated with Mesolithic cultural deposits (Bulbeck 2004a:150-151; van Heekeren 1972). Holocene interaction between East Kalimantan and South Sulawesi is confirmed by the recovery of scrapers of marine shell (the earliest associated with a radiocarbon date of 8840 ± 250 BP) from Kimanis (Arifin 2004:247-249), and broadly coeval rockshelter deposits at Maros in South Sulawesi (Bulbeck *et al.* 2000:84-87). However, in this case similar scrapers also occur in pre-ceramic contexts at a number of sites within Flores, on Java's eastern tip (van Heekeren 1972:100-104, 141-146), and at Gunung Sewu in southern Java (Prasetyo 2002:185-186).

South Sulawesi was involved in at least two and possibly three of the seven faunal introductions recorded for pre-Neolithic times (Table 5). Further, both Bellwood (1997:197-198) and Bulbeck *et al.* (2000) drew comparisons between the Toalean of South Sulawesi, and industries in Java broadly dated to the mid-Holocene, based on their commonalities of unifacially retouched stone points and double-pointed bone needles (see also Prasetyo 2002). Indeed, mooted overseas connections for the Toalean tool types crop up regularly in the literature, and include Japan, in regard to the hollow-based Maros points (Bellwood 1997:200), South Asia, vis-à-vis backed microliths (Glover and Presland 1985), and northern Australia, in relation to stone and bone points (Olsen and Glover 2004). These long-distance comparisons strengthen the case for widespread maritime exchange that had enmeshed South Sulawesi by the mid-Holocene.

Shell ornaments including beads and pendants appear to date to the late Pleistocene or early Holocene at three Rote rockshelters excavated by Mahirta (2003). Table 6 summarises the relevant data. Despite the evident archaeological associations, and the lack of Neolithic dates from any of the Rote shelters, Mahirta (2003:159-163) concluded that the perforated olive shells may be pre-ceramic, but the other shell ornaments reflect a technology introduced by Austronesian settlers along with their pottery. However, except at Lua Meko, where a shell bead was recovered from the layer beneath the deepest perforated olive shell, perforated olive shells occur together with the other shell ornaments. These other shell ornaments outnumber the potsherd count by a factor of two, which strongly suggests no relationship with the pottery, and instead an association with the abundant flaked lithics. Accordingly, I follow a parsimonious interpretation of the Rote archaeological record, and date the shell artefacts (including the perforated olive shells) to the period between 15,000 (as a minimum date) and 5500 BP, unrelated to the pottery which, as noted by Spriggs (2007:110), appears to be a sparsely deposited, late Holocene intrusion.

The Rote evidence fits snugly within a well-attested tradition of marine shell ornament manufacture in southern Indonesia

(Figure 1). Additional examples from the Pleistocene/Holocene junction have been recorded in East Kalimantan, East Timor and Aru, and early to mid-Holocene specimens are known from Java and Flores (Table 7). Glover's excavations in East Timor reinforce the impression of widespread pre-Neolithic shell working even if they also indicate an increase in the number and variety of shell artefacts produced during the Neolithic (Table 8). While Glover's findings may have suggested a Neolithic dating for the fish hooks, Lene Hara yielded two *Trochus* fishhooks directly and stratigraphically dated to between 6000 and 10,000 BP (O'Connor 2006:78), while Jerimalai, another East Timor rockshelter, has produced an early Holocene shell fishhook (O'Connor 2007:531).

Our coverage now turns to the controversy over 4000-4500 year old pottery, with rice husk inclusions, at Gua Sireh in Sarawak. Bellwood (1997:237-238, 2005b, 2006) has proffered two associations, both of them evidently driven more by the hunt for a historical linguistic correlation than the archaeological evidence. His first explanation proposed an origin in Malaya, based on Adelaar's (1995) suggestion of a possible affinity between Malaya's Aslian languages and Land Dayak in Sarawak; but when Adelaar pointed out that he was certainly not proposing an ancient Aslian presence in Sarawak, Bellwood (2005b, 2006:57-58) opted for a precocious emigration of Austronesians from Taiwan during its Middle Neolithic, marked by fine cord-marked pottery (cf. Hung 2005). However, if we review Datan's (1990) description of the Gua Sireh pottery, we nowhere find it described as fine, and also learn that cord-marked decorations are rare, affecting a mere 4% of decorated sherds (Datan 1990:74). Instead, basket-marked and carved paddle-impressed decorations dominate. The only point of similarity would appear to be the rarity of red-slipping (Datan 1990:72; Hung 2005).

The most parsimonious origin for Gua Sireh's early pottery and rice is North Vietnam (Figure 3). Early pottery in North Vietnam, none of it described as red-slipped, dates back to at least 6500 BP (Higham 2002:36). The Da But pottery outperforms Taiwan's pottery in matching the Gua Sireh sherds (Datan 1990), as it is described as simple, with cord-marked decorations appearing only after c.5000 BP, alongside the older practice of impressing the vessels with unspun fibres (Nguyen 2005). Bower *et al.* (2006) report stable isotope evidence for rice consumption in a Da But culture site by 5000-6000 BP even though Vietnam's earliest rice remains post-date 5000 BP. Certainly, the origins of riziculture in mainland Southeast Asia can be conservatively dated at 4000-4500 BP (Higham 2002:94). Geographical intermediates between North Vietnam and Sarawak may be present amongst the various coastal and lowland sites of central and southern Vietnam with pottery dated to 4000-4500 BP, although, from the sources available to me, the pottery is either undescribed or else designated as cord-marked (Higham 2002:37-38, 108).

The Da But sites appear to be implicated in another maritime exchange network, consistent with their possible direct link to Sarawak. From the data in Kress (2004), the burials in the Sa'gung Shelter, Palawan, can be divided into two mutually exclusive groups (Table 9). The flexed burials are associated with edge-ground adzes, necklaces of crocodile teeth, and a lime plug, while the other burials are associated with ceramic objects (including a Ming bowl), glass beads, and shell grave goods. Although the flexed burials are not well dated, their disposition is reminiscent

Table 6 Summary of artefacts excavated from Roté rockshelters (Mahirta 2003). LP signifies a radiocarbon date of over 20,000 BP, TP signifies calibrated radiocarbon dates between 15,000 and 10,000 BP, while EH signifies calibrated radiocarbon dates between 8,000 and 5,500 BP.

Assemblage	Perforated Olive Shells	Other Shell Ornaments	Flaked Stone Artefacts	Potsherds
Lower Pia Hudale (TP)	0	0	1951	0
Upper Pia Hudale (TP)	2	8	16987	5
Lower Lua Mungettai (TP)	0	0	3899	0
Upper Lua Mungettai (EH)	2	4	1266	18
Lower Lua Meko (LP)	0	1	345	0
Middle Lua Meko (TP)	1	0	1476	0
Upper Lua Meko (EH)	9	36	2401	2
Total	14	49	28325	25

Table 7 Pre-Neolithic shell ornaments from Island Southeast Asia sites outside of Roté.

Areas	Sites	Items	Antiquity	References
East Kalimantan	Kimanis	15 cowry ornaments	12,000-5000 BP	Arifin 2004:104, 246
East Timor	Matju Kuru 1	Simple shell beads	<13,690±130 BP	Veth <i>et al.</i> 2005:184-185
Aru	Liang Nabulei Lisa	<i>Terebra subulata</i> ornament	9750±60 BP	O'Connor <i>et al.</i> 2005a:134-135
East Timor	Matju Kuru 2	<i>Trochus</i> and <i>Nautilus</i> beads	>9000 BP	Szabó and O'Connor 2004:625-626; O'Connor 2006:79
Gunung Sewu; Java	Gua Braholo; Song Keplek	Drilled <i>Pelycypods</i> ornaments	Early/mid-Holocene	Prasetyo 2002:187-188
East Timor	Beri Ceri Uato; Uai Bobo 1 & 2	Perforated shells; <i>Nautilus</i> beads	6500-4000 BP	Table 8
Flores	Leang Toge; Gua Rundung	Drilled shell and mother-of-pearl ornaments	Pre-ceramic (5000-40000 BP?)	van Heekeren 1972:141, 146

Table 8 Marine shell artefacts from Glover's (1986:75, 118, 151-152, 189) East Timor sites based on the Table 1 chronology.

	Olive Shells	<i>Nautilus</i> Beads	<i>Trochus</i> Armlets	Miscellaneous Ornaments	<i>Trochus</i> Fish Hooks	Shell Scrapers	<i>Tridacna</i> Adze
Pre-Neolithic							
Lie Siri	0	0	0	0	0	1	0
Beri Ceri Uato	0	1	0	1	0	0	0
Uai Bobo 1	1	0	0	0	0	0	0
Uai Bobo 2	6	5	0	6	0	0	0
Total	7	6	0	7	0	1	0
Neolithic							
Lie Siri	0	1	0	0	0	5	0
Beri Ceri Uato	2	3	0	2	2	0	1
Uai Bobo 1	2	19	2	1	0	1	0
Uai Bobo 2	2	33	0	1	0	0	0
Total	6	56	2	4	2	6	1

Table 9 Summary of the Sa'gung burials (Kress 2004:Table 2).

	Flexed Burials	Non-Flexed Burials, Head to Right	Sundry other Burials
Edge-Ground Adzes	5	0	0
Crocodile-Tooth Necklace	2	0	0
Lime Plug	1	0	0
Ceramic Grave Goods	0	2	1
Shell Grave Goods	0	2	1
Burial with Glass Beads	0	1	1

of the flexed burials associated with the Da But sites in North Vietnam (Higham 2002:37), and the lack of ceramics suggests a pre-4000 BP age. Mijares (2007:21) proposes a similarity between the Sa'gung edge-ground axes and those in Bacsonian contexts, but a more plausible connection, also in North Vietnam, may be early Da But culture, given Nguyen's information (2005:92) that the polishing of stone tools in these contexts was largely limited to polishing tool edges.

The fact that fully polished stone tools, including those with a quadrangular cross-section, predominated in late Da But contexts may additionally provide a source for the quadrangular polished stone adze excavated with a flexed burial at Duyong Cave, Palawan. The Duyong Cave flexed burial certainly stands out as an anomaly for 'Austronesian package' theorists: no pottery, two dates that calibrate to c.5000–6000 BP, ear discs and a breast pendant of *Conus* shell, and multiple *Tridacna* shell adzes (Bellwood 1997:221–222). Precisely these same shell artefacts were recovered with two flexed, aceramic burials at the Paredes Shelter on Langen Island immediately north of Duyong (Fox 1970:64). Intriguingly, the flexed Da But burials are also associated with shell jewellery (Higham 2002:37). Further, as regards the shell adzes, Bellwood (1997:222) himself suggests a relationship with the pre-ceramic tradition of shell adzes (*Tridacna* and *Hippopus*) from Golo Cave, Gebe, North Moluccas, dated to 12,000–8000 BP (see also Bellwood 1995:9, 1998) or perhaps a little later (Bellwood 2000).

There is considerable evidence for a chain of sites with early to mid-Holocene shell adzes connecting Palawan and eastern Indonesia (Figure 2). At the Sanga Sanga Island shell midden in the Sulu Archipelago, Casiño retrieved five *Tridacna* tools, and subsequent excavation into the pre-ceramic levels yielded shell tools associated with radiocarbon dates (on marine shell) of 6650 ± 180 BP and 7945 ± 190 BP (Solheim *et al.* 1979:117). In the same archipelago, Balobok Cave yielded shell tools including a *Tridacna* adze in a layer with a radiocarbon date of 8760 ± 130 BP, although the adze is of a different type from the Duyong examples (Ono 2003:200). Farther south, Tanudirjo (2001) recovered and directly dated three *Tridacna* adzes: the oldest determination, 6900 ± 90 BP, was for a surface find from Leang Manaf, which yielded just one potsherd upon excavation (Sanana Island, southeast of Halmahera); the second oldest determination, 4367–4484 cal BP, was for an adze recovered stratigraphically beneath the deepest pottery deemed to be *in situ* (Leang Tahuna, Talaud Islands); while the youngest determination, 3750–4150 cal BP, was associated with *in situ* pottery at Waylia, on the same island as Leang Manaf. Tanudirjo (2001) argued that these adzes had been made during the Neolithic and Metal Phase on old shell, but this argument would dismiss as coincidence the fact that the younger their direct dating, the stronger the association with pottery. In this paper I accept the direct dates on the Leang Manaf and Leang Tahuna adzes as reasonable evidence for their pre-4000 BP antiquity, as well as the direct dating of 8600 ± 245 BP for a *Tridacna* adze found on the surface at Tutuala, East Timor (O'Connor 2006:81).

The archaeologically best-attested interaction sphere to be considered here stretched from coastal South China across the Pescadores to the coastal fringes of Taiwan (Figure 3). The association of pottery, cereal agriculture, polished stone artefacts and other Neolithic items (Table 5) is well described in numerous

sources, and needs no belabouring here. I follow Tsang (2005) in sourcing Taiwan's Tapenkeng or early Neolithic culture to coastal Kwangtung. I also endorse the emphasis by Rolett *et al.* (2002) on the maritime aspect of this interaction sphere that straddled the Taiwan Strait, but I disagree with these authors (2002:316–317) on its precociousness – instead it falls into a pattern encountered numerous times to the south.

There are very good grounds for identifying this interaction sphere with the PAN homeland. It is geographically discrete, matches the subtropical nature of the PAN lexicon reconstructed by historical linguists (Blust 1995), and would incorporate both the maritime (including sailing) and terrestrial components present in that lexicon. In particular, it resolves the peculiar anomaly in the standard interpretation of early Austronesian dispersal, whereby nine branches had remained stuck on Taiwan while one, PMP, alone colonised the southern seas from Madagascar to Easter Island. Instead, under the present proposal, PMP would have retained the primitive Austronesian orientation, while the 'stay-at-home' Taiwan language branches would relate to Taiwan's colonisation from the island's various coastal quarters, equipped with a material culture brought across the Strait of Taiwan.

Prior to 4000 BP, the only likely connection between Taiwan and ISEA with evidence for interaction in both directions, confirming the connection, involves North Luzon (Figure 3). The Cagayan Valley in Luzon has sparse pottery, not described as red-slipped, associated with flaked lithics and radiocarbon dates that calibrate to c.4000–5000 BP at two sites: Rabel Cave and Minori Cave. Rabel Cave is particularly hard to dismiss as there are two separate but indistinguishable dates which calibrate to this range, and no suggestion of any pre-ceramic occupation (see Mijares 2007:33–35; Spriggs 2003). Evidence for an influence from Luzon on coastal Taiwan comes from the Baxiandong sites on Taiwan's eastern coast. All the published radiocarbon dates (Zhang 2000) calibrate to a tight range between 5000 and 6000 BP, and the lithics are dominated by small flakes including points, bipolar flakes and scrapers (Zhang 2000). These assemblages evidently reflect an intrusive culture, contrasting with Taiwan's older, Hoabinhian-like 'Changpanian culture' (cf. Bellwood 1997:170; Rolett *et al.* 2002), and they post-date any similar industries on mainland China by thousands of years (Zhang 2000). North Luzon, where similar, undifferentiated flake tools were knapped throughout the Holocene (Mijares 2007), would be the logical source (see also Soares *et al.* 2008). The initiators for this interaction sphere would appear to have been based in Luzon rather than Taiwan, with only the faintest echo of Taiwan's burgeoning Neolithic reaching Luzon pre-4000 BP. This straightforward inference matches the much greater ease of maritime travel from Luzon to Taiwan than in the opposite direction (Solheim *et al.* 1979:146–150).

There are two other cases of a strong correlation between the interaction spheres outlined in Figures 1 and 3, and the region's prevailing currents as described by Solheim *et al.* (1979:145–155). These are the connections from Palawan to East Timor, and from Borneo to southwest Sulawesi (plus Java and Flores), which respectively correspond to the prevailing movement of wind and current across the Sulawesi Sea and through the Macassar Strait.

The first case typically involves sites with abundant marine shell refuse and has tools of marine shell as its particular insignia.

Diffusion of a relatively structured stone flaking technology is inferred for the northern half, where isotropic stone sources are present (in stark contrast to the northern Moluccas), but the only suggestion of maritime trade is some movement of obsidian across the Philippines. That is, this interaction sphere evidently involved the movement of 'ideas' (read: artisans) rather than goods – artisans who could well have belonged to raft-using maritime communities similar to those proposed by Solheim *et al.* (1979:145-155). However, I can find no evidence that the Palawan-Talaud-Moluccan axis was any kind of nursery for large-scale developments in Southeast Asia. Instead, it appears to represent a specialised adaptation to a belt of islands which

are typically small and depauperate in terrestrial resources. Most of these islands' resources would have been rapidly depleted by pedestrian forager populations; maritime transport would have been a vital requirement both to expand the breadth of foraging niches and to link groups of islands into the single range of a forager group.

The Macassar Strait sphere has a totally different character. Borneo and Sulawesi (which is visible from Borneo at certain locations) are large islands with a rich terrestrial ecology; the utilised resources recorded archaeologically at the sites are predominantly terrestrial; and the technological commonalities have a terrestrial focus. The maritime aspect, while secondary,

Table 10 Evidence of cross-sea interaction spheres c.2500 to 4000 BP in Island Southeast Asia.

Areas	Sites	Items	Key Sources
Taiwan; northern Luzon; Saipan	Taiwan sites; Andarayan; Chalan Piao	Rice	Bellwood 2005a; Blench 2005
Taiwan; Batanes; northern Luzon	Taiwan; Batanes; Cagayan Valley sites	Clay spindle whorls, discs and pendants; stone net sinkers	Bellwood and Dizon 2005; Hung 2005; Mijares 2007
Taiwan; Batanes; Luzon; Palawan	Multiple	Taiwan nephrite beads and bracelets	Hung <i>et al.</i> 2007
Taiwan; Batanes; Sulawesi	Taiwan and Batanes sites; Kalumpang	Polished slate	Bellwood and Dizon 2005; Bulbeck and Nasruddin 2002
Taiwan; Batanes; Luzon; Sarawak; Sulawesi	Various sites including Niah and Kalumpang	Stone barkcloth beaters	Bellwood 1997; Bellwood and Dizon 2005; Mijares 2007
Taiwan; Batanes	Taiwan and Batanes sites	Green nephrite polished adzes	Bellwood and Dizon 2005
Batanes; northern Luzon	Anaro; Irigayen	Metamorphic polished adzes	Bellwood and Dizon 2005
Southern Luzon; Langen Island	Various sites; Leta Leta	White nephrite polished adzes	Fox 1970
Sulawesi; Java; southern Sumatra	Kalumpang, plus various other sites	Polished adzes of fine siliceous stone	van Heekeren 1972
Taiwan; Philippines; Borneo; Sumatra; east Java and Bali; East Timor; Kayao	Numerous	Polished adzes mainly of volcanic stone	Bellwood 1997; Mijares 2007; van Heekeren 1972
Taiwan; south Vietnam; eastern Indo-Malaysia; Pacific	Numerous	Red-slipped pottery	Bellwood 1997, 2005a; Solheim 2006
Borneo; Malaya, Sumatra; Java	Numerous	Paddle-impressed pottery	Bellwood 1997
Taiwan; northern Luzon	Fengpitou; Cagayan sites	Black pottery	Mijares 2007
Flores; East Timor	Liang Bua; East Timor sites	Unslipped pottery	Glover 1986; Soejono 1985
Luzon; Sabah; Langen Island; Palawan; East Timor	Arku; Callao; Leta Leta; Duyong, Bukit Tengkorak; Table 7 sites	Shell beads	Bellwood 1997; Glover 1986; Mijares 2007
Sabah; Talaud Islands; Sulawesi; southern Philippines	Bukit Tengkorak; Leang Tuwo Mane'e; Kalumpang; various sites	Obsidian	Bellwood 1997; Neri 2007; Simanjuntak <i>et al.</i> 2008
Sarawak; South Sulawesi; North Maluku; East Timor	See Table 3	Dogs; pigs; <i>Bos</i> ; porcupines; monkeys; deer (?)	See Table 3
South Sulawesi; Java; East Timor	See Table 2	Candlenuts	See Table 2
South Sulawesi; Central Java	Numerous	Hollow-based stone arrowheads	Bulbeck <i>et al.</i> 2000; Prasetyo 2002
East Timor; Seram; Kei; Buru; southwest New Guinea	Multiple	Early Austronesian Painting Tradition	Ballard 1988; O'Connor and Vasco Oliveira 2007

was nonetheless the essential ingredient to transport people across the Strait.

Here we seem to have archaeological confirmation of Oppenheimer's (1998) hypothesis of a population dispersal triggered by the drowning of Sundaland, especially as the available dates are older in Borneo than in Sulawesi, and reach back to the onset of the Holocene. The suggested dispersal of edge-ground tool technology from Sarawak to North Vietnam at the end of the Pleistocene, and blade-like flake technology connecting Sabah and the Talaud Islands as of the Late Glacial Maximum, could also relate to population dispersals associated with rising sea-levels. True, the creation of vast lengths of additional coastline during periods of sea-level rise would have expanded the potential for coastally-adapted foragers, and this would explain the lack of evidence for ancient Borneo links to Malaya or Sumatra, or directly to Java. As the rising seas deluged the intervening lowlands, there would have been a centrifugal withdrawal of populations to the emergent coastlines. However, northern and eastern Borneo would have merely experienced the drowning of coastal land without compensatory coastline expansion. This would have created conflicts over land where hinterland-adapted populations now found themselves hemmed in by an unfamiliar habitat which itself ushered in newcomers specifically adapted to that environment. A capacity for systematic maritime travel would often have been highly beneficial both for the reconnaissance of the newly created littoral niches and, where necessary, temporary or permanent evacuation of those niches under dispute.

In contrast to the Sulawesi Sea and Macassar Strait spheres, the Da But-centred, Neolithic interaction spheres to Palawan and Sarawak cut across the prevailing winds and currents of the South China Sea. This is a difficult point to accommodate, unless we infer mid-Holocene sailing technology. The resulting, enhanced capacity to exploit the fruits of the sea indeed helps to explain the evidence for millennia of densely settled, sedentary Neolithic 'foragers' along the seaboard of northern and central Vietnam (cf. Higham 2002:36-38). While there is an echo here of Solheim's PAN homeland (noted above), his proposed link between Sarawak and the Philippines lacks archaeological confirmation, and Luzon in particular appears rather isolated from the islands farther south.

The mid-Holocene nursery for sailing in the region appears to have been the shoreline from North Vietnam to southwest China (see also Chen 2002), consistent with the rich Neolithic assemblages dated to 5000 BP and earlier along this coastal stretch. Accepting this addition to Figures 1 to 3, we could characterise the early maritime network as a quadrangle with its sides connecting North Vietnam to Taiwan, Taiwan to New Guinea's Vogelkop, the Vogelkop to Java, and Java to North Vietnam, which was also the source of a cross-cutting link to Palawan. While this depiction would indicate widespread maritime travel and cultural exchange, archaeological evidence for richly interconnected maritime networks, and the macro-scale dispersals that mark a diaspora, post-dates 4000 BP, as we shall now see.

Maritime Interaction Spheres 2500–4000 BP

Our survey of archaeologically attested interaction spheres post-dating 4000 BP will proceed from north to south. I use a cut-off date of c.2500 BP for items listed in Table 10. After 2500

BP, with the spread of metallurgy widely across ISEA, and the establishment of trade routes which ultimately connected the Mediterranean to China, we would be dealing with a totally different world from the Neolithic. Reference will, however, be made to where Neolithic trading patterns persisted or indeed expanded after 2500 BP.

Rice remains in sherds are directly dated to around 3500 BP in North Luzon (Paz 2002) and a similar age in the Marianas (Blench 2005:36), and presumably represent echoes of Taiwan riziculture (Figure 4). The uncertainly dated Niah sherd with a rice grain in its temper (Barker 2005:101) is not included here because it hardly implies an overseas derivation, given that rice is archaeologically well attested at Gua Sireh and in evidence before 4000 BP (Table 2). Sarawak would also be the likely source for Neolithic rice in South Sulawesi, should confirmation be found for the tentative dating by Paz (2005) of 4000 BP for some grains from Ulu Leang 1. An early first millennium BC dating for rice husk from Sembiran in Bali appears too early for the site's chronology, especially as the husk was contained in non-local pottery probably imported from India (Bellwood *et al.* 1992:166). Otherwise, all age determinations for rice in ISEA probably post-date 2500 BP (Glover 1985:272; Paz 2002:227, 2005:112).

A rich package of material culture arrived on the Batanes, almost certainly from Taiwan, during the Neolithic (Bellwood and Dizon 2005). Some of these items, such as spindle whorls and discs of clay, and net sinkers, appear to have penetrated farther south to northern Luzon (Hung 2005; Mijares 2007), but no farther. Clay pendants probably belong here as well, even though they found their way farther south to Palawan by the Early Metal Phase (Fox 1970:147). A wider distribution applies to valuables manufactured from Taiwan nephrite, which include beads and bracelets from Neolithic contexts across Taiwan and south into the Philippines as far as Palawan (Figure 5). The trade in Taiwan nephrite continued to expand during the Early Metal Phase, with *lingling-o* ear pendants, some manufactured in the Batanes from imported nephrite, distributed as far as Sarawak (Niah Cave), coastal Vietnam, Cambodia and southern Thailand (Hung *et al.* 2007).

Polished slate artefacts (Figure 6) can be viewed in two ways. Taiwan slate itself was evidently imported to the Batanes and worked there, but the wider distribution of the technology extended to the Kalumpang sites in Sulawesi, albeit bypassing the Philippines south of the Batanes (Bellwood 1997:227; Bellwood and Dizon 2005). Barkcloth beaters of stone show a similar distribution in the islands (they are additionally widespread on mainland Southeast Asia), with the horned variety a specific feature of ISEA sites to the south of Taiwan (see Bellwood 1997; Bellwood and Dizon 2005:22; Mijares 2007; van Heekeren 1972:165-166).

The technology of polished stone adzes extended across a very wide area of Taiwan, ISEA and the Pacific during the Neolithic (Bellwood 1978, 1997, 1998; Bellwood and Dizon 2005; Bulbeck 2008; Clark 2005; Fox 1970:126, 177; Glover 1986:112; Guillard *et al.* 2006; Hung 2004; Iizuka and Hung 2005; Mijares 2007; Simanjuntak *et al.* 2008; van Heekeren 1972:168-170, 187), but it is far from clear that Taiwan was the single source. Objections to any such notion include the pre-ceramic presence of this artefact class in Palawan, the widespread occurrence of polished adzes on mainland Southeast Asia, and the differences in the stone

utilised. While adzes of volcanic stone occur across a wide area from southern Taiwan in the north, to West Sumatra in the west, Besuki, Flores and East Timor in the south, and Micronesia in the east, locally used stone sources include green nephrite in Taiwan and the Batanes, pale grey metamorphic stone in the Batanes and north Luzon, local white nephrite in southern Luzon (with two from a Neolithic context at Leta Leta Cave on Langen Island), and semi-precious siliceous stone in southern Sumatra, Java and at Kalumpang. For present purposes I recognise five interisland spheres, involving polished adzes of volcanic stone across most of the region (and the Pacific), and smaller spheres characterised by adzes of fine chert, Taiwan nephrite, white nephrite, and grey metamorphic stone (Figure 6).

Comparative analysis of the adzes in terms of morphology and cross-section lies beyond the scope of this paper, but may suggest a similarly dissected distribution, with stepped adzes largely restricted to Taiwan, the Batanes and northern Luzon (Bellwood 1997:215-221; Bellwood and Dizon 2005), round axes common in Sarawak and Wallacea from the Philippines southwards, as well as the Pacific, and rectangular cross-section adzes as the most common form in the western Archipelago (Bellwood 1978:283; van Heekeren 1972:168-172). A complication, of course, is that many of the ISEA adzes would have been manufactured during the Early Metal Phase, as noted by various commentators.

Pottery also suggests internal differentiation within its broader distribution (Figure 4). Mijares (2007:80) relates the black pottery present in northern Luzon by 3500 BP to similar pottery in southwest Taiwan dating back to 3800 BP. Such pottery is not noted for the Batanes, even though the oldest pottery here may slightly pre-date 4000 BP (Spriggs 2007:108). The Batanes pottery instead belongs to the red-slipped pottery tradition which has been documented across a huge swathe of the Pacific as far as western Polynesia, as well as Wallacea and adjoining regions, with extensions into eastern Java (Bellwood 2005a:135-139; Spriggs 2007:113-114) and southern Vietnam (Solheim 2006:111-113). Red-slipped pottery, however, has a minimal presence in Borneo (outside of Sabah), Malaya, western Java and Sumatra, where a tradition of paddle-impressed pottery, with its origins probably associated with the Gua Sireh pottery, held sway (Arifin 2004; Bellwood 1997:231, 2005a:139; Chazine 2005; Datan 1990; Forestier *et al.* 2006). These two Neolithic pottery complexes, which respectively correspond to Anderson's (2005) 'Neolithic B' and 'Neolithic A', were not hermetically-sealed, as suggested by small amounts of paddle-impressed sherds found in Sabah, Kalumpang and Palawan (Bellwood 1997:227; Bulbeck and Nasruddin 2002; Solheim 2006:104), and some incised red-slipped pottery from Pondok Selabe 1 in South Sumatra (Simanjuntak *et al.* 2006:Foto 14). Finally, a fourth interaction sphere characterised by mainly unslipped, occasionally burnished pottery appears to be characteristic of the Neolithic of Flores (Soejono 1985) and East Timor (Glover 1986). With reasonable samples of Neolithic pottery now known across the Indo-Malaysian Archipelago, detailed earthenware comparisons should be highly rewarding in delineating interaction spheres, but lie beyond the scope of this contribution.

Neolithic shell beads, albeit unreported from Taiwan or the Batanes, are recorded in Luzon (Mijares 2007), Sabah, and East Timor (Figure 5), as well as the west Pacific as part of the 'Lapita cultural complex' (Bellwood 1997:224-230; Ono 2003).

A likely source for ISEA's shell-bead technology is East Timor, where these beads were manufactured throughout the Holocene (Tables 7-8). On the other hand, evidence for shell tools in ISEA ceramic contexts is patchy. The two *Tridacna* adzes from Waylia (noted above) and Glover's East Timor sites (Table 8) may be relicts from the technology's pre-Neolithic distribution. In the North Moluccas, a new class of shell adzes made of *Cassia cornuta* lips, with Pacific parallels, appeared after 3000 BP (Bellwood 1997:188). Bellwood (1997:224) reports shell adzes and a possible fish hook from Bukit Tengkorak in Sabah, but Ono (2003:197) emphasises the site's scarcity of shell tools. A fossil shell adze from Anaro 2 in the Batanes (Bellwood and Dizon 2005:12-13) would actually be made of stone rather than shell.

ISEA obsidian exchange came to scholarly renown with the revelation that some of the obsidian excavated in Bukit Tengkorak had originated from Talasea, New Britain (Bellwood and Koon 1989). The 6500km distribution of Talasea obsidian at c.3000 BP from Borneo to Fiji, making it the most widely distributed material in the Neolithic world, should surely have opened eyes to the uniqueness of the Austronesian diaspora. Bukit Tengkorak also yielded a second type of obsidian, possibly from the Admiralty Islands (Tykot and Chia 1997), although its concentration in the site's lower levels, and chemical match with obsidian imported to the Talaud Islands on the eve of the Neolithic (Bulbeck *et al.* 2000:99; Ono 2004:79), would suggest a more local source. Exogenous obsidian, presumably from overseas, is also known in Neolithic contexts from Minanga Sipakko (Simanjuntak *et al.* 2008) and Leang Lampoa (Bulbeck 2004a) in Sulawesi, and the Philippines south of Luzon (Neri 2007) (Figure 5). Obsidian was also being moved across Luzon (Neri 2007), Sumatra (Forestier *et al.* 2006) and Timor (Glover 1986) during the Neolithic, but we do not know yet whether through overland or maritime trade.

Transport of fauna was a feature of the ISEA Neolithic, but as previously noted the evidence for Taiwan as a source is yet to be adduced (Table 3). Apart from rice in the north of the region, the only suggestion of a Neolithic, plant-based interaction sphere involves the occurrence of candlenuts in Java, Sulawesi and Timor (Table 2). In this context, the Sulawesi-Java connection would be confirmed by the hollow-based, bifacially retouched stone points which are a feature of the South Sulawesi Toalean until 3500-4000 BP (Bulbeck 2004a; Bulbeck *et al.* 2000), and which appear to date specifically to the Neolithic in Java (Forestier 2007:70; Prasetyo 2002; van Heekeren 1972:169). Although the bifacial trimming of the Java arrowheads is more invasive, the case for a Toalean influence is strengthened by the pre-ceramic Toalean-Java connection noted previously.

Finally, the 'Austronesian Painting Tradition' features hand stencils, abstract designs, and anthropomorphs evidently engaged in rites or travelling in boats, painted on high cliffs overlooking the sea. Sites with all of these features circumscribe the Banda Sea in ISEA (East Timor, Buru, Seram, southwest New Guinea, and Kei) and extend to the western Pacific, including Vanuatu, where they pre-date 1500 BP (Ballard 1988; O'Connor and Vasco Oliveira 2007). As a later development in ISEA, the site location shifted to rockshelters and hand stencils dropped out of the repertoire. This development is dated to the Early Metal Phase at Niah's Painted Cave (Pyatt *et al.* 2005) and at Racolo in East Timor (O'Connor and Vasco Oliveira 2007:400), and is probably even more recent at Gua Sireh in Sarawak (Datan 1990).

Thus it would be reasonable to assign a post-Neolithic date to the tradition in the two locations where it co-occurs with the earlier hand stencil/zoomorph tradition in ISEA, viz. the rockshelters of East Kalimantan (Chazine 2004:167-168) and South Sulawesi, especially Pangkajene (Bulbeck 2004a:151; Sumantri 1996). On current evidence, the Neolithic manifestation of the Austronesian Painting Tradition in ISEA would appear to have been restricted to the Banda Sea.

An overall view of the Neolithic interaction axes (Figures 4-6) reveals a strong geographical coincidence with the distribution of ISEA Austronesian languages, such that identification with the Malayo-Polynesian diaspora could hardly be doubted. On the other hand, the overlapping complexity of the interaction axes would abnegate the suggestion of a single interaction sphere, which we would expect had Austronesian traders sailed from one corner of ISEA to the other, or had farmers (or sailors) expanded relentlessly from a single source. There appears to be some structure within the total network, including a far northern sphere (from Taiwan to northern Luzon), a Wallacean sphere from the Batanes to East Timor, a western sphere (including most of Sumatra, Java and Borneo), and a Java-Sulawesi sphere (linking the two previously mentioned spheres). This apparent structure evinces intriguing parallels with Pawley's (2002:260-262) scenario for the diversification of the Malayo-Polynesian languages; unfortunately, detailed comparisons lie beyond the scope of this paper.

Evidently, the ISEA Austronesian diaspora had very little to do with the migration of a farming complex, and everything to do with the traffic of valuable goods (including fauna) and technology (cf. Spriggs 2007:106). Adzes suitable for boat-building pervaded ISEA, whether as the widely distributed polished adzes of volcanic stone, or the shell adzes of the northern Moluccas and East Timor. Obsidian, fine stone point technology, net sinkers, and personal ornaments were also exchanged during the Neolithic. Given the very sparse evidence for any transport of crops, the major contribution to the ISEA subsistence economy during the Neolithic would appear to have been an enhanced capacity to exploit the fruits of the sea, thanks to the widespread availability of advanced sailing technology (cf. Pawley 2002:265). Should future archaeological research recover evidence of more intensive plant exploitation in ISEA with the advent of the Neolithic, such a finding need not contradict my emphasis on the period's maritime orientation. The enhanced availability of exotic goods during the Neolithic would have stimulated food production so as to provide victuals for visiting and departing traders, and to augment the economic basis of the more complex social organisation that presumably accompanied the ISEA Neolithic.

Evidence from Biological Anthropology

Proponents of the theory of a migration of Austronesian Mongoloid farmers to ISEA place considerable emphasis on the region's 'Negritos' populations, presumed to be descended from the indigenous 'Australo-melanesoid' foragers (e.g. Bellwood 1997; Matsumura and Hudson 2005; Mijares 2007). This argument however pays scant regard to the location details of the Negritos. Such populations, characterised by dark skin and woolly hair, are absent from the former subcontinent of Sundaland and the neighbouring large island of Sulawesi, and instead ring

this region with presences in the Philippines, south Cambodia, Malaya, the Andamans, Nusatenggara and the Moluccas (Bulbeck 1999). The persistence of numerous Negrito groups in the Philippines until ethnographic times is particularly anomalous, since surely here the immigrant Mongoloid farmers should have replaced or absorbed the resident Australo-melanesoid foragers before continuing their demic diffusion to islands farther south. Sumatra and Borneo both have populations of 'Mongoloids' dedicated to traditional foraging (the Kubu and Penan), not Australo-melanesoids as would be expected. This last anomaly prompted Bellwood (2005a:37-39) to propose that the original Borneo rainforest foragers had somehow perished without trace, leaving the rainforest niche available for occupation by the Mongoloid Penan – despite the clear archaeological (Arifin 2004; Barker 2005) and osteological (Manser 2005) evidence for continuity of Borneo rainforest foragers from the late Pleistocene/early Holocene to modern times.

There is a simple solution to the anomalies observed above; the occupation of former Sundaland by populations which were Mongoloid, at least in terms of their external phenotype. Sulawesi could also be brought into the equation based on its archaeological evidence for early to mid-Holocene interaction with Borneo and Java. Oppenheimer (2004a:255-262) presents mtDNA evidence for a circa Late Glacial Maximum incursion of populations from mainland East Asia into Sundaland. It should also be observed that much of Sundaland would have been covered by savannah or open forest during the last millennia of the Pleistocene (Bird *et al.* 2005), quite different from the closed forests associated ethnographically with Negrito foragers. Osteologically, evidence for pre-Neolithic Australo-melanesoids in Sulawesi or the Sundaland region is weak (Bulbeck 2004b, 2005; Storm 1995). Widiyanto's (2002) claim of predominantly Australo-melanesoid burials (as well as one Mongoloid) from pre-Neolithic Gunung Sewu in Java is unaccompanied by any metrical data. Manser's (2005; Krigbaum and Manser 2005) demonstration of Southeast Asian or Polynesian affinities for the pre-ceramic Niah West Mouth crania is a far more informative finding.

The genetic evidence on the question of a Neolithic racial replacement (complete or otherwise, cf. Bellwood and Diamond 2005) in ISEA, due to demic diffusion from Taiwan, has been extensively debated (e.g. Oppenheimer and Richards 2002; Oppenheimer 2004b; Spriggs 2007). Currently, the last word on the debate, based on the study of nearly 1000 mtDNA control region sequences from ISEA and Taiwan, comes from Hill *et al.* (2007) who demonstrate that the maximum proportion of the mtDNA gene pool in ISEA attributable to population expansion from Taiwan is 20%. This finding would be consistent with the archaeological evidence that Taiwan had an intense but localised impact, during the Neolithic, on the northern Philippines, and a much fainter influence farther south (whether directly, or as a cascading effect from the Batanes and Luzon). It is also important to note that Taiwan's influence on ISEA may have increased rather than declined during the Early Metal Phase. It is during this time that large populations built up on Taiwan (Bellwood 2001:300; Tsang 2000), with a concomitant increase in the capacity for sustained emigration, and, as reviewed above, it is then that Taiwan jade and certain Taiwan-derived artefact types reached their widest distribution. The proportions of the 20% maximum mtDNA impact of Taiwan on ISEA, to be split

Figure 1 Maritime interaction axes in ISEA and adjacent regions with terminal Pleistocene origins.

Figure 2 Early to mid-Holocene maritime interaction axes in ISEA and adjacent regions.

Figure 3 Specifically mid-Holocene maritime interaction axes in ISEA and adjacent regions.

Figure 4 Distribution of pottery, economic plants and transported fauna across ISEA and adjacent regions 2500-4000 BP.

Figure 5 Distribution of miscellaneous items associated with the Neolithic across ISEA and adjacent regions.

Figure 6 Distribution of polished stone tools across ISEA and adjacent regions 2500–4000 BP.

between the Neolithic and the Early Metal Phase are a matter for future research.

Discussion

On the available archaeological and biological evidence, interpreting the linguistic evidence to infer an agriculturally-fuelled population expansion of early Austronesians into ISEA (Bellwood 1997; Diamond and Bellwood 2003; Howells 1973; Pawley 2002; Shutler and Marck 1975) is currently untenable. Yet the archaeological evidence certainly supports an origin of Austronesian in the Taiwan Strait, and subsequent dispersal of Malayo-Polynesians across ISEA. The advantage that evidently allowed this dispersal was an advanced maritime capacity, as would be logical for expansion across an island world. The benefits included superior exploitation of marine resources which abound in the region, and the traffic in useful technology, human experiences, and sumptuary goods across the Archipelago. Precursors of this maritime capacity are in evidence in ISEA before 4000 BP, and may have contributed to the geographical structure of the ISEA Neolithic maritime network, but the latter was clearly a quantum leap above previous developments. So pervasive was this Neolithic network, and so advantaged were those who operated it or at least connected to it, that, by ethnographic times, the vast majority of the languages of ISEA, whether spoken by 'Mongoloids' or 'Negritos', were Malayo-Polynesian.

I hope it is clear from my contribution that I heartily endorse a multidisciplinary approach to ISEA prehistory, and the 'triangulation' of the linguistic, archaeological and biological evidence relevant to the Neolithic (e.g. Sagart *et al.* 2005). However, I have little sympathy for taking a particular interpretation of the historical linguistics, one based on idealist culture history and the assumption of an expanding Malayo-Polynesian monoculture, and using it to overwrite the archaeological and biological evidence. In my view this reduces the number of disciplines that count to one, which is the opposite of multidisciplinary research. Although the link between Austronesian origins and a farming capacity in the region of the Taiwan Strait is clear, this is no reason to amplify this finding into an agricultural expansion of Malayo-Polynesians across ISEA, a proposition for which the evidence is sorely lacking. The biological evidence is our guide to the timing and extent of prehistoric population movement, while the archaeology is our handle on the material culture available at different places and the connections forged between prehistoric communities in the past. Multidisciplinary use of the historical linguistic evidence would accept the independently adduced biological and archaeological evidence, and interpret the wider implications of the historical linguistics accordingly.

A clear advantage of the multidisciplinary approach, and hence my contribution here, is the provision of maps detailing the relevant archaeological evidence (Figures 1-6). Previous overviews (e.g. Bellwood 1997; Oppenheimer 1998; Solheim 2006) offer an anecdotal coverage of the archaeology, and provide maps primarily to depict site locations, putative homelands, and arrows representing hypothesised population movements. When we actually plot the archaeological evidence, we encounter partial justification for all the keynote views expressed on Austronesian origins, but full support for none of them. Additionally, the exercise I have undertaken has highlighted previously disregarded

connections such as the strong and long-lived Java-Sulawesi axis. The methodology employed here, which takes an explicitly empirical approach to the archaeological evidence rather than force it into a preconceived scenario, is hardly the final word on the topic, but hopefully forges a step in the right direction.

Conclusion

Solheim (2006) and Oppenheimer and Richards (2002) appear to be justified in their argument that Austronesian foundations in ISEA are based on maritime trade and foraging. To the degree that agriculture played any significant role in early Malayo-Polynesian dispersal, it would appear to have involved trees and tubers equally exploited in pre-Neolithic times. Bellwood (1997, 2005a) appears to be justified in his argument for Austronesian origins associated with cereal agriculture in southeast China and Taiwan. However, the linguistic expansion southwards did not involve the transplantation of this economy to ISEA, but instead enhanced the latent benefits of a maritime economy already in place.

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