Archaeology and the Austronesian expansion: where are we now?

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Author: *Spriggs, Matthew*
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Introduction

My own particular inspiration for embarking on an examination of the ISEA and Pacific radiocarbon corpus in the late 1980s was threefold. Perhaps most directly it came from an article by Ellen and Glover (1974) on pottery production and trade in eastern Indonesia, where Glover presented what dates were then available for the Neolithic spread across ISEA and into the western Pacific. Another inspiration was Highams attempt at what has come to be known as chronometric hygiene'--Wilfred Shawcross' marvellous ad-libbed term adopted by me in 1989--in trying to bring some order to disordered mainland Southeast Asian sequences for the beginnings of bronze use (Higham 1983, 1996/7 [first pub. 1988]). Finally, in most people's minds the link between the spread of AN languages and that of the Neolithic across ISEA is particularly associated with Peter Bellwood and his major syntheses starting from Mans conquest of the Pacific (1978) to Prehistory of the Indo-Malaysian archipelago (1985; second edition 1997). The latter of these works was indeed another inspiration. My initial published reaction (Spriggs 1989) to the first edition was that the volume did not discuss the minutiae of the radiocarbon dates it was underpinned by--which left one somewhat unsatisfied. There was certainly a need for a critical examination of the ISEA radiocarbon corpus by the end of the 1980s as new dates became available. One of my papers explicitly considered changes in the 1997, second edition, of Bellwood's Prehistory of the Indo-Malaysian archipelago in relation to the latest radiocarbon dates available (Spriggs 1999; see also Spriggs 1996a, 1998, 2000, 2001). A subsequent paper gave a full listing of all pertinent dates in ISEA and Near Oceania (Spriggs 2003), and was itself updated four years later (Spriggs 2007a).

I return to the theme of these papers here, not to give a further update (see Spriggs 2010), but to consider some of the important issues that have come up over the last 20 years in relation to the nature of the expansion of the ISEA Neolithic and the link between it and the spread of AN languages across the region. These issues include: the fall-out from the collapse of the consensus model of ISEA AN subgrouping; the question of one Neolithic or multiple 'Neolithics' in ISEA; the early spread of domesticated plants westward into ISEA from the New Guinea centre of agriculture; the question of whether there was a Neolithic cultural 'package' that spread along with the AN languages and whether we are comparing the right

sites in examining the AN spread (for sites mentioned see Figure 1).

Blust's subgrouping model challenged

The most important development has been the collapse in acceptance of Blusts 1970s and 1980s model of AN subgrouping in ISEA, adopted by many archaeologists for decades as the last word on the subject (Blust 1976, 1978, 1982, 1988). Linguists such as Mark Donohue and others have launched major assaults on the model in recent years, proposing a trajectory from Proto-Austronesian to Proto-Malayo-Polynesian (PMP) to Eastern Malayo-Polynesian (EMP) to Proto-Oceanic (PO) (Donohue & Grimes 2008; Klamer et al 2008; Donohue & Denham 2010; see Figure 2).

We can use the spread of the ISEA Neolithic as a proxy for AN language spread, as justified at length by Pawley (2004) and Ross (2008), among others. In doing this, it is very hard to see anything between PMP and EMP at all from the archaeology. It would seem that movements out of Taiwan were rapid after about 4000 BP and by 3800 BP dialects of PMP were spoken everywhere from the Philippines to eastern Borneo, Sulawesi and south to East Timor, spreading with the first pottery-using cultures in those areas. Currently the dates for the EMP area in northern Maluku do seem to reflect a later time of spread, at about 3500 BP, as with Palau and the Marianas and Java. This could conceivably have been a pause related to a shift from rice and millet to predominately New Guinea-derived root crops (see below). Ross (2008) provides a good summary of the state-of-play in regard to AN subgrouping.

[FIGURE 1 OMITTED]

Track forward to about 3350-3300 BP on the current radiocarbon chronology and we have the earliest Lapita sites in the Oceanic AN 'homeland' of the Bismarck Archipelago as the eastwards push of the ISEA Neolithic (Summerhayes 2007). This is rather disingenuously discussed as 'the spread of Lapita pottery by Torrence and Swadling (2008: 600), as if we were talking of an isolated innovation rather than the spread of a much broader cultural complex. Even with the pottery, we are talking of a distinctive design system, specialised vessel forms and particular surface treatments, not just the idea of pottery in general. In addition, Petrequin and Petrequin (1999) have argued, given the particular manufacturing techniques of Lapita pottery, that potters themselves must have migrated from ISEA to the Bismarcks as a long apprenticeship was needed to be able to produce these particular forms; contra the earlier assertions of Ambrose (1997).

[FIGURE 2 OMITTED]

The spread of Neolithic AN-speaking cultures across much of ISEA is a similar phenomenon, in terms of its rapidity, to the Lapita expansion beyond the Bismarck Archipelago between about 3100 and 2900 BP when that culture spread beyond Near Oceania through the south-east Solomons, Vanuatu, New Caledonia, Fiji and into western Polynesia. The distinction between Near and Remote Oceania was first made by Pawley and Green (1973). Near Oceania refers to New Guinea, the Bismarck Archipelago and the main Solomon Islands chain down to the southern end of Makira. Near Oceania was potentially occupied around 40 000 BP. Remote Oceania is the rest of the Pacific Islands, including all of Micronesia and Polynesia, which was first occupied only about 3500 BP in the case of the Marianas and possibly Palau, and not long after about 3100 BP for the rest of Island Melanesia and western Polynesia.

Abandoning the straitjacket of an outmoded way of looking at the linguistic subgrouping of Malayo-Polynesian languages frees up both linguists and archaeologists to look at more interesting cultural processes: Donohue and Denham's (2010) paper is a notable example. But if PMP was spoken over much of ISEA, then we may not be able to show linguistically where New Guinea crops were adopted, as very early borrowings will be undetectable. Only archaeological evidence will be pertinent to this issue.

Very closely related dialects of Proto-Oceanic AN were clearly spoken around 3100-2900 BP from the Bismarcks to Tonga and Samoa; the spread was so rapid that it can hardly be otherwise (Spriggs 2007b). The subsequent differentiation between its constituent subgroups developed once levels of inter-archipelago mobility decreased in succeeding centuries.

One Neolithic or two?

Bellwood (2005: 6, 2006: 63, fn. 2) seems more recently to have abandoned his ideas on a potentially earlier pre-Austronesian Neolithic spread associated with cord-marked pottery and encompassing western Borneo, Sumatra and parts of Java (1997: 237-8). But it may be that he was right first time. There is potentially a major input from the spread of Neolithic cultures, seemingly associated with Austro-Asiatic speaking groups, down through the Malay Peninsula and into ISEA. This is particularly clear in both Sumatra and western Borneo (Simanjuntak & Forestier 2004; Guillaud 2006). Java seems to show different patterns in different areas: with Red-slipped pottery and more AN-looking cultures in some parts, and assemblages with clearer links to Sumatra in others (Bellwood 1997: 231-2). How far to the east and south-east this influence goes is another question for research (cf. Anderson 2005).

The current form of the domestic pig that spread out into the Pacific would seem to derive from mainland Southeast Asia rather than from any movement south from Taiwan (Larson et al. 2007), so some cross-over must have taken place prior to the Neolithic settlement of northern Maluku at about 3500 BP Domestic pigs in the northern Philippines' Neolithic site of Nagsabaran, however, came from Taiwan, and the situation in Borneo and Sulawesi is unclear (Piper et al. 2009). There is at present little evidence of further crossover between the two Neolithics beyond Pacific clade pigs. The claim that chickens having followed a similar route (Dobney etal. 2008: 69, after Liu et al. 2006) is on hold because of a general lack of direct archaeological evidence across ISEA (Storey etal. 2010). Pigs, chickens, a small rat species (Rattus exulans) and (probably) the dog all spread from ISEA into the western Pacific at the start of the Lapita phase, and so clearly accompany the Neolithic expansion (Spriggs 1996b).

New Guinea and influences from the east

One major issue in current discussions of Austronesian expansion is the increasing evidence provided by scholars such as Denham, Donohue, Lebot and Kennedy, primarily using genetic data, for a significant westward expansion of New Guinea area (sensu lato) plant domesticates before the spread of pottery-using cultures across ISEA (Lebot 1999; Denham et al. 2003, 2004; Allaby 2007; Kennedy 2008; Denham & Donohue 2009). How far west and north this spread goes is clearly a major topic for continued investigation. One notes that a word for sugarcane (one of the NG domesticates) occurs in PAN (Blust 1976), spoken in Taiwan before the spread of pottery-using cultures across ISEA. Either this reflects a very early spread north (Donohue & Denham 2010: 236), or the term referred originally in Taiwan to another Saccharum species (Daniels & Daniels 1993).

Sulawesi has been held up as showing linguistic and archaeological signs of being a key area of potential hybridity between northern Taiwan-derived patterns of Neolithic culture and those coming from the New Guinea area to the east or indigenous to the island itself (Bulbeck et al. 2000; Spriggs 2003: 65; Hakim et al. 2009). A lot more archaeology has been undertaken on Sulawesi, compared to adjacent areas, and so its salience may, however, be somewhat exaggerated in our present state of knowledge. Since archaeological research recommenced in East Timor from 2000, it has also appeared as a key area in such discussions (O'Connor 2006).

The Austronesian and Neolithic 'package'

So where does this leave the supposed AN-Neolithic package' as enumerated by Bellwood and others? As we have more information on all aspects of the material culture of the time period in question, the picture inevitably becomes more complex. Bulbeck, O'Connor and others have rightly pointed out some aspects of continuity in areas such as Sulawesi and East Timor in flaked stone technology, simple shell beads and fishhooks, and the use of the earth oven (Bulbeck etal. 2000; Szabo & O'Connor 2004; O'Connor & Veth 2005; O'Connor 2006). There are also earlier Tridacna shell adzes--but these are either of a different style than those associated with the Neolithic spread out into the Pacific (Bellwood 1997: pi. 25) or are surface finds possibly made from fossil shell (O'Connor 2006). Comparison is not helped by both taphonomic processes, whereby shell appears not to survive at some key sites, and rather confused claims in the literature: the 'large numbers of shell artefacts which are common in Lapita contexts ... recovered from early Holocene assemblages in East Timor (Anderson & O'Connor 2008: 4) refers to numbers of artefacts, not to artefact types, which only incontestably include shell beads and fishhooks. In ISEA only three at most of out of the ten shell ornament types found in Lapita sites in the western Pacific (see Kirch 1988) occur in pre-Neolithic contexts. Two of these represent shell bead types that are themselves very variable within ISEA and which are generally made on different shell species (Szabo & O'Connor 2004: 623-4).

Shell ornament types found in Taiwanese Neolithic sites are missing from early Neolithic levels in the Cagayan Valley sites of northern Luzon and in the Karama River sites on Sulawesi (See Figure 1 for the locations of ISEA Neolithic sites mentioned in this paper). This may be attributed to marine shellfish not being readily available in these inland locations (Hung 2008: 225).

It is now well-established that dentate-stamping on pottery to produce at least some of the simpler motifs found in later Lapita pottery does have a chronological priority in northern Luzon over its rapid development in the Bismarcks to become the classic design system of Lapita (Hung 2008; see Figure 3 for an example). Spindle whorls, and therefore a particular technology of weaving, can also now be established as having a Taiwanese origin in ISEA and having spread over much of the region (Cameron 2002). Recently, the Teouma Lapita cemetery site on Efate Island in Vanuatu has provided evidence for the earliest jar burials in the Pacific at about 3000 BP, again harking back to contemporary and earlier Neolithic practices in more northern parts of ISEA such as Borneo and Taiwan (Bedford etal. 2006; Bedford & Spriggs 2007).

[FIGURE 3 OMITTED]

There is also a point made long ago: just because there is evidence of shell fishhooks, for instance, in pre-Neolithic contexts in places such as East Timor, this is only necessarily

significant if there were no such items in early Taiwanese or northern Philippines assemblages (Spriggs 1996b). If they were also found there--and they were--then the Timor evidence does not negate them being part of an AN-associated Neolithic 'package'. Achugao in the Marianas (Butler 1994) and Neolithic sites in northern Luzon do have such fishhooks (Hung 2008: 220). The late Roger Green's Triple-I model to identify intrusive, innovated or integrated elements in assemblages, if properly understood, gives us a way of assessing these issues quite adequately--not just in the case of Lapita where he applied it, but back to the west in ISEA as well (Green 1991, 2000).

Some writers seem to expect to see a monothetic Neolithic package' (in Clarke's [1968: 37] terms) with all artefact types occurring at all sites. Calls are made to throw out the model entirely when a particular claimed item is found in pre-Neolithic contexts. Denham (2004: 616) seems to take this line, based on 'processual and factual deficiencies with the types of models that accompany delineation of such packages. A distinctively polythetic set of artefacts and practices should be expected, however, for a colonising group moving through varied environments with changing resources, and encountering a variety of in situ cultures with their own effective adaptations to place'. The Indonesian scholar Daud Tanudirjo (2006: 86, citing Robertson 1992), similarly using Clarke's (1968) terms, has noted the polythetic nature of 'glocal' (globalised-localised) cultures, such as we would expect from such encounters. Dewar (2003) has pointed out how rice agriculture would have been increasingly difficult as people moved from the temperate environments of Taiwan through the Philippines to the equatorial wet tropics of eastern ISEA and out into the Pacific. The adoption of root and tree crops of New Guinea origin is thus not surprising in eastern ISEA. The lack of easy access to marine shells for ornament manufacture in inland areas of Luzon and Sulawesi has already been mentioned. Substitutes in clay and stone were made in Luzon, but the technology clearly continued to spread in coastal areas: thus we find Tridacna shell adzes of Neolithic type reappearing in Bukit Tengkorak and East Timor (Glover 1986: 117; Bellwood & Koon 1989: 618) and then in Lapita. Distinctive shell ornaments such as Conus rings have been found on Palawan at Leta Leta (Szabo & Ramirez 2009), at Krai near Surakarta on Java (van Heekeren 1972: 164, pi. 88), at Uattamdi on Kayoa near Halmahera and in the earliest Marianas and Lapita sites (Hung 2008: 222).

Are we comparing the right sites in ISEA?

The spread of Lapita culture beyond Near Oceania took place within about 200 years between 3100 and 2900 BP There are over 120 Lapita open settlement sites between 3100 and 2800/2700 BP in Remote Oceania that document this spread (Anderson et al. 2001; Bedford & Sand 2007: 9-10). This contrasts with the situation in ISEA beyond Taiwan and the Cagayan Valley in northern Luzon. In much of the region we have generally fragmentary and poorly-dated Neolithic assemblages, often considerably disturbed, and covering a nearly 2000-year time-span between 4000 and 2300/2100 BP (Bellwood 1997: 219-34). The majority are cave sites, and if we exclude the 20+ dated cave and shelter sites with Neolithic deposits, the number of open settlement sites reported for this period which have been radiocarbon dated to before 3000 BP totals less than 20 for the whole of ISEA outside of Taiwan (Table 1). The same point has been made previously by Anderson and O'Connor (2008: 2), but their claim that 'virtually all of the early pottery sites investigated in ISEA are caves or shelters is clearly an exaggeration. It remains the case, however, that the universe of sites that are being compared to Lapita in order to document patterns of Neolithic spread ?n ISEA is not at all equivalent.

A 4000 BP pottery assemblage in Luzon may not be directly comparable to a 3500 BP

assemblage in Sulawesi or the Marianas, or a 3000 BP assemblage in Sabah. When they are very similar that is all to the good, but if they are not then we should not be too surprised. There is a desperate need for closed assemblages of comparable ages as the comparison sample in lSEA--as we have with Lapita. Such sites are extremely scarce in this region at present.

We can take central Vanuatu in the western Pacific as an example where the cultural sequences are well established (Bedford 2006, 2009). It is clear from there that 3000 BP Lapita cultural assemblages are very different from their successor Late or post-Lapita ones at 2750 BP and even further removed from those of 2500 or 2000 BR lndeed, in the 1960s when the full cultural sequences had not been fleshed out, it was believed that Lapita (c. 3050-2800 BP) and the Early Mangaasi (2300-1800/1600 BP) culture assemblages found in central Vanuatu represented separate migrations of distinct populations (Garanger 1972). With well-dated assemblages filling in the gaps between them we can now see a continuous development in pottery style and material culture deriving one from the other. The two stylistically very distinct assemblages of Lapita and Mangaasi are separated by a minimum of only 500 years.

This suggests that, beyond perhaps being able to establish the earliest dates for pottery at a regional level, we may have a hard job establishing connections between cultural assemblages separated in time by more than a few hundred years in lSEA. Given this, the occasional 'Lapita-like sherds in lSEA sites may be more significant than first appears; heirlooms from or remnants of assemblages that would have been more widespread and homogeneous in the initial Neolithic of 4000-3800 BP. Outside northern Luzon where such assemblages are reasonably common (Figure 3), we have such sherds from sites such as: the Batungan Caves on Masbate in the Philippines (Solheim 1968: 28, 56); Bukit Pantaraan on Sulawesi (Anggraenipers. comm. 2010; see Figure 4); Bukit Tengkorak in Sabah on Borneo (Bellwood & Koon 1989: 617; Chia 2003: 92, 95) and on Pulau Ay in the Banda Group (Lape 2000a: 226, 2000b: 141). Bellwood (2004: 31) provides a useful photograph of several relevant sherds.

The current state of our knowledge of the early Neolithic of lSEA is sparse: it is as if 195 of the 200 or so Lapita sites remain unlocated. We would be comparing the five located ones--all from a restricted 'homeland' area--with a handful of sites over a much larger area that date 300--600 years later. And from this sample we would be hoping to say something about initial Lapita spread. Recall too that more than 90 per cent of Lapita sites are open settlements where a wide range of activities took place, whereas more than 50 per cent of lSEA dated Neolithic assemblages come from caves and rockshelters that are not likely to have formed similar settlement foci; they most probably represent short-term transit stops or special use sites, such as cemeteries.

The furphy (rumour Aus) of pre-Lapita pottery, betel nuts and pigs in New Guinea (see criticism in Spriggs 1996b, 2001) is now nearly laid to rest, with a major paper by O'Connor et al. (in press) critiquing the case for northern New Guinea early pigs and pots. Direct dating of the supposed early betel nut (clearly a Southeast Asian-derived domesticate) from the Dongan site in the Sepik Basin has shown it to be a modern contaminant (Fairbairn & Swadling 2005).

[FIGURE 4 OMITTED]

Discussion

In discussing cultures in northern and central Europe of different periods, Vandkilde (2007: 16-17) has very usefully drawn attention to 'macro-regional phases of conjuncture' in which 'the social climate appears "extra hot", foreign impulses are actively and creatively incorporated, and identities rapidly and profoundly change". Such a macro regional phase of conjuncture' is surely what we are witnessing with the start of the Neolithic of ISEA. Tanudirjo (2006: 84-6) specifically sees the process as akin to globalisation in the modern world.

If we look at the ISEA Neolithic like this, we focus on the cultural implications of the spread both of new identities and a new language in a way that a simple farming/language dispersal model does not. At various stages new crops may have been key, and the introduction of the suite of domestic fauna of pigs, chickens and dogs may have been increasingly critical the further east they spread. But subsistence changes were not needed to change identities. It was the possibilities opened up by a suite of new ideas and artefacts that were key--the real Neolithic 'package' or process of 'Neolithisation did not necessarily involve agriculture at all. But it certainly did involve pottery, its complex vessel forms and surface finish surely betokening new social relations; it certainly did involve a suite of shell artefacts with equally novel meanings, and also new technologies of cloth and barkcloth. Julian Thomas (1997: 59) has put it succinctly: 'material things did not attend the Neolithic, they were the Neolithic'.

One participated in this new world by speaking the new (Austronesian) language. In particular cases this may well have been affected by substratal influence from older local languages when adopted in situ (Donohue & Denham 2010: 231). Some scholars suggest that nothing much changed across the Neolithic boundary and that those who think it did have constructed 'a mirage of isolation (Denham 2004: 613) to characterise earlier periods. But they support this contention by stringing together every piece of evidence of pre-Neolithic interaction in the region over a period of 6000 or more years and putting it on a map as being somehow equivalent to the 'hot' period of a few centuries that is being discussed here (Bulbeck 2008; Torrence & Swadling 2008). There are sampling problems with the early Neolithic 'signal' as discussed earlier, but they are as nothing compared to the collapsing of thousands of years of process to produce static representations of long-lived artefact classes. These do not represent an operating exchange system on the eve of the spread of the ISEA Neolithic, but produce merely a palimpsest, or a 'mirage of interaction if you like.

Roger Green's (1991, 2000) model of intrusion, integration and innovation captures the situation well in ISEA as well as the western Pacific, whether we are talking of material culture, language or people. There was indeed some migration out of Taiwan (Kayser et al. 2008); there was mass recruitment of people from populations already resident in ISEA and Near Oceania as the Neolithic spread (Soares et al. 2011); artefacts and practices were integrated from already-resident groups and others were discarded by them; new ideas were brought into being as unexpected human and environmental situations were encountered. And then at the end of the main Solomons, the participants in this process jumped off the inhabited world into a world nobody had ever seen, and beyond it, in Remote Oceania, it was all new and it was all migration. That too must have led to further changes, further inventions of social relations. These true pioneers were constrained only by the need to maintain links back to proximate 'homelands' to ensure demographic balance, whether in the Bismarck Archipelago or in major staging posts further east, such as the Reefs-Santa Cruz Islands between the Solomons and Vanuatu (Kirch 1988: 113-14).

The ongoing debates about the meaning of the ISEA Neolithic and the Lapita culture have come from the fact that we are struggling to find appropriate models to deal with just what

happens during such temporal 'hot spots'. This is just as true in Europe with debates over the meaning of cultural forms such as the Battle Axe culture, Bell Beakers, the Early Bronze Age, the Tumulus and Urnfield cultures, or Hallstatt and La Tene (Vandkilde 2007). For ISEA I have previously suggested elite dominance as the explanatory model (Spriggs 2003) rather than demographic-subsistence or farming/language dispersal to use Renfrew's (1989, 1992) terms. But this model is not really adequate either in its current form. The Neolithisation of ISEA was a new process of identity formation that seized the imagination of a mass of people on hundreds of islands across thousands of kilometres of ocean, spreading like a pulse across ISEA and into the Pacific over a few centuries. It spread through processes both of migration and recruitment in-place.

Powerful ideologies backed by new material symbols and practices and a new language may be necessary for such wave-like spreads (cf. Best 2002); but it is not exactly comparable to, say, the spread of Islam either. Terrell and Welsch (1997: 568) were on to something with their idea of Lapita as 'some kind of cult, dance complex or social ritual', but on its own that would not have been enough for it and its ISEA precursor to spread with such speed and to have given such an imprint to the cultures of the region down to the present day. In considering the European Bronze Age, Kristiansen and Larsson (2005: 7) have made a brave attempt to come up with a theory that is neither diffusion nor functionalism, one attempting to develop "a more complex theoretical framework that is able to integrate world system analysis with local and regional studies . We need a similar broadening of perspectives in ISEA and the western Pacific as well. Progress will surely not be found in either retreat to a sterile processualism which denies any significance beyond the local region or the construction of fantasy interaction spheres in the pre-Neolithic.

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Matthew Spriggs, School of Archaeology and Anthropology, Building 14, A. D. Hope Building, The Australian National University, ACT0200, Australia (Email: matthew.spriggs@anu.edu.au)

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Table 1. Dated Neolithic open sites in Island Southeast Asia, excluding Taiwan, dating to 3000 BP or before.

Site & Island	Radiocarbon dates
Sunget Main Terrace, Batan Island, Batanes Group	Food residues: 2910 [+ or -] 190 & 2915 [+ or -] 49; Charcoal: 2383 [+ or -] 35
Andarayan, Cagayan, Luzon	Rice husk: 3400 [+ or -] 125; Charcoal: 3240 [+ or -] 160
Gaerlan, Cagayan, Luzon	Animal bone dates: 3810 [+ or -] 30 [preceramic], 3665 [+ or -] 35, 3555- [+ or -] 30 & 3485 [+ or -] 30
Irigayen, Cagayan, Luzon	Charcoal: 3185 [+ or -] 25, 3165 [+ or -] 25, 3025 [+ or -] 20 & 2925 [+ or -] 20
Leodivico Capina, Cagayan, Luzon	Charcoal: 4875 [+ or -] 90 [aceramic], freshwater shell dates down to 5250 [+ or -] 220 [aceramic], freshwater shell date with possible ceramic association: 5575 [+ or -] 95 [rejected, relation to calendar age unclear]
Magapit, 'Lal-lo' Cagayan, Luzon	Freshwater shell: 3790 [+ or -] -100, 3680 [+ or -] 100 & 3550 [+ or -] 110 [rejected, relation to calendar age unclear]; Charcoal 2800 [+ or -] 140 & 2760 [+ or -] 125 (earlier reported as 2720 [+ or -] 135 & 2680 [+ or -] 120)
Miguel Supnet, Cagayan, Luzon	Charcoal: 4560 [+ or -] 290 [aceramic] & 4240 [+ or -] 50 [occasional pottery in this layer]; Freshwater shell: 5100 [+ or -] 150, 4845

	[+ or -] 90, 4740 [+ or -] 90 & 4680 [+ or -] 90 [occasional pottery in these layers; rejected, relation to calendar age unclear]
Nagsabaran, Cagayan, Luzon	Charcoal: 6610 [+ or -] 290 [rejected by excavator]; Marine shell 3450 [+ or -] 40; Charcoal: 3390 [+ or -] 130 & 3050 [+ or -] 70; Pig bone: 3940 [+ or -] 40
Pamittan, Cagayan, Luzon	Charcoal: 3810 [+ or -] 200 & 3390 [+ or -] 100
Dimolit, Luzon	Charcoal: 5100 [+ or -] 210, 3900 [+ or -] 140 & 3280 [+ or -] 110 [early series Gakushuin dates, rejected]
Bagumbayan, Masbate	Marine shell: 3620 [+ or -] 90 & 3510 [+ or -] 60
Edjek, Negros	Charcoal: 3470- [+ or -] 235
Nangabalang, West Kalimantan, Borneo	Two charcoal dates calibrated between 3562-2964 cal BP: conventional ages not given
Bukit Tengkorak, Sabah [shelters and open areas]	Charcoal: 5330 [+ or -] 80 [pottery association contested], 3360 [+ or -] 190, 2970 [+ or -] 130, 2940 [+ or -] 40 & 2940 [+ or -] 50; Marine shell: 3190 [+ or -] 60
Minanga Sipakko, Karama River, Sulawesi	Charcoal: 4950 [+ or -] 180 [rejected, pottery association unclear], 3690 [+ or -] 160, 3446 [+ or -] 51, 3343 [+ or -] 46 & 3082 [+ or -] 50; Deer antler: 2810 [+ or -] 50; Charcoal: 2570 [+ or -] 110
Mallawa, Sulawesi	Charcoal: 3580 [+ or -] 130, 2710 [+ or -] 170 & 2281 [+ or -] 46
Site PAL Pulau Ay, Banda Islands	Pig bone: 3150 [+ or -] 180 & 2870 [+ or -] 60
Site & Island	Cultural assemblage
Sunget Main Terrace, Batan Island, Batanes Group	Red-slipped pottery; complex vessel forms; lugs/handles, impressed circle decoration with lime infill; biconical spindle whorls; notched and flat pebble ovate sinkers; stepped adzes; quadrangular or trapezoidal cross-sectioned adzes; Taiwan nephrite quadrangular adze; Taiwan slate point
Andarayan, Cagayan, Luzon	Red-slipped pottery; biconical spindle whorl; baked clay earrings; quadrangular adze; flaked stone; rice inclusions in pottery
Gaerlan, Cagayan, Luzon	Red-slipped pottery
Irigayen, Cagayan,	Lower alluvial layer: Red-slipped pottery,

Luzon	complex vessel forms dentate-stamped
Leodivico Capina, Cagayan, Luzon	Sparse pottery in top 0.3m, a few sherds with red slip or linear incised; sparse flaked stone
Magapit, 'Lal-lo' Cagayan, Luzon	Red-slipped pottery, complex vessel forms dentate-stamped; biconical spindle whorl; baked clay earrings and pendants; stone pendant; jade and quartz schist beads; bone earrings'; quadrangular adzes with trapezoidal and (1) lenticular cross-section; flaked stone
Miguel Supnet, Cagayan, Luzon	Sparse pottery, some Red-slipped or linear incised in Layers I-III; sparse flaked stone; freshwater shell midden
Nagsabaran, Cagayan, Luzon	Lower alluvial layer: Red-slipped pottery, complex vessel forms with linear incision and dentate stamping with lime infill; biconical spindle whorls; baked clay earrings; double-perforated clay object; quadrangular stone adzes with trapezoid cross section; Taiwan jade bracelet fragment; six quartz schist beads; two grindstones
Pamittan, Cagayan, Luzon	Red-slipped pottery
Dimolit, Luzon	Layer 5: Red-slipped and plain pottery with complex vessel forms; rectangular houses; stone flakes, some with silica gloss; two sandstone mortars; five flat, round quartzite grinders; two possibly Taiwan nephrite beads
Bagumbayan, Masbate	Plain pottery with one stamped impressed sherd; flake tools; deer antler pick; marine shell midden but no shell artefacts
Edjek, Negros	Pottery and fired clay lumps only, some with 'orange' slip
Nangabalang, West Kalimantan, Borneo	Pottery paddle-impressed, likened to Niah Cave pottery; quadrangular adzes; pounding stones; stone anvils; grinding stones; beads
Bukit Tengkorak, Sabah [shelters and open areas]	Red-slipped pottery, including stamped impressed designs, complex vessel forms; Conus ring fragment (may be late); core of a shell ring, shell disc beads and barrel-shaped bead bored longitudinally; two shell pendants; shank of one piece fishhook; small Tridacna axe-adze; quadrangular adzes with trapezoidal and (rare) oval or lenticular cross-section; Melanesian obsidian; flaked stone with silica gloss; rice inclusions in pottery
Minanga Sipakko, Karama River, Sulawesi	Thin Red-slipped pottery pre-3000 BP, complex vessel forms, followed by non-slipped incised and impressed pottery post-3000 BP; schist and slate adzes; andesite pestles and mortars/ anvils; sandstone grinding stones; flaked

	stone, arrow and spearpoints; stone barkcloth beater (surface find); bone points; stone bracelet, polished and perforated earrings and beads; no mention of any shell
Mallawa, Sulawesi	Red-slipped and plain pottery, complex vessel forms with impressed circles and incised decoration, including handles; quadrangular stone adzes; flake tools; hammerstones; mortars and pestles; carnelian bead; Mahmud thinks later than Minanga Sipakko
Site PAL Pulau Ay, Banda Islands	Red-slipped pottery, 1 sherd with incised decoration; chert and obsidian flakes
Site & Island	References
Sunget Main Terrace, Batan Island, Batanes Group	Bellwood & Dizon 2005
Andarayan, Cagayan, Luzon	Snow et al. 1986
Gaerlan, Cagayan, Luzon	Hung 2008: 143-4
Irigayen, Cagayan, Luzon	Hung 2005, 2008: 144-5
Leodivico Capina, Cagayan, Luzon	Tsang 2007; Spriggs 2003: 68
Magapit, 'Lal-lo' Cagayan, Luzon	Radiocarbon 14(2)[1972]: 300; Aoyagi et al. 1986, 1993; Thiel 1989
Miguel Supnet, Cagayan, Luzon	Tsang 2007
Nagsabaran, Cagayan, Luzon	Hung 2005, 2008; Tsang 2007
Pamittan, Cagayan, Luzon	Tanaka & Orogo 2000
Dimolit, Luzon	Peterson 1974
Bagumbayan, Masbate	Bay-Peterson 1987
Edjek, Negros	Hutterer & MacDonald 1982
Nangabalang, West Kalimantan, Borneo	Arifin 2006: 153; Wibisono 2006: 113
Bukit Tengkorak, Sabah [shelters and	Bellwood & Koon 1989; Doherty et al. 2000:

open areas]	152; Chia 2003
Minanga Sipakko, Karama River, Sulawesi	Bulbeck & Nasruddin 2002; Simanjuntak et al. 2008
Mallawa, Sulawesi	Mahmud 2008; Hakim et al. 2009
Site PAL Pulau Ay, Banda Islands	Lape 2000a & b