A RE-EVALUATION OF POSSIBLE EVOLUTIONARY PROCESSES IN SOUTHEAST ASIA SINCE THE LATE PLEISTOCENE

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A BRIEF HISTORICAL REVIEW OF THE TOPIC

The first historical perspective on Southeast Asian human evolution was derived from mainly non-skeletal comparisons between extant Southeast Asian and Pacific populations. The great variability which was apparent tended to follow geographical patterns in, for instance, the predominance of an 'Australoid' type in Australia and a 'Malay' type in Malaysia and Indonesia. However, discontinuities also occurred, as in the presences of short, dark, kinky-haired people in the interiors of both Southeast Asia and New Guinea. To explain the situation 'pure races' or prototypes were proposed, and after originating in some homeland these putative pure races were claimed to have migrated through Southeast Asia and the Pacific, partially or completely replacing peoples of earlier migrations, or miscegenating with them, to result in the extant distribution of racial types. Evolutionary interest lay in tracing these migrations, and prehistoric specimens were identified in such terms, leaving an early literature cluttered with terms such as proto-Australoid, proto-Negrito, proto-Malay and so forth.

The development of population genetics theory during the twentieth century rendered this 'pure race' theory redundant. Minor anomalies in the geographical distribution of human variability could be explained better through processes such as genetic drift and local selection, and interest turned to identifying the fundamental sources of racial variability.

Concurrently, the 'Java Man' and 'Solo Man' series in Java and 'Peking Man' series in China were being discovered and described. Principally through Weidenreich's (especially 1943) pioneering research, extant circum-Pacific variability was seen to have its roots in the period well before the evolution of modern humanity. Peking man was viewed as the pre-modern ancestor of the Mongoloids, i.e. east Asians and Amerindians, and the Java/Solo man lineage as representing the pre-modern ancestry of the Australian Aborigines. Weidenreich also traced these lineages through specimens of modern grade. He considered the Javanese 'Wajak Man' (Wajak 1) as the descendant of the Java/Solo lineage, and noticing the striking similarities between Wajak 1 and Keilor, viewed the unbroken lineage from Java Man to Australian Aborigines as demonstrated (Weidenreich 1945). Regarding the Peking Man to Mongoloid lineage, however, he was less definite. He also

(Weidenreich 1939, 1943:254-255) considered the Upper Cave Choukoutien material to contain specimens of both proto-Mongoloid and Melanesian physical types, as had frequently been observed with Indochinese prehistoric remains.

Coon, in his remarkable work "The Origin of Races", developed Weidenreich's concept of racial (or cladistic) continuity through time to a plenary theory. Coon rejected the Melanesian affinity of Upper Cave Choukoutien 102, instead noting that these remains approached the end of the Peking Man-Mongoloid lineage, bearing a prototype relationship to the modern Chinese (1962:475). Coon (1962; Coon and Hunt 1965) expanded the concept of the 'Australoid' race, descendents of the Java/Solo/Wajak lineage, to include not only Australian Aborigines but also Melanesians and Southeast Asian 'Negritos' (and, curiously, certain Indian sub-continent ('hill tribes'). Other Southeast Asians (or 'Malays') he regarded to have resulted from the blending of the indigenous Australoid population with Mongoloids continually immigrating from the north, the latter element now predominating. The variability of the Indochinese remains he interpreted as reflecting the first incursions of Mongoloids into previously Australoid Southeast Asia (1962:416-421). However, Coon did not rule out an earlier Mongoloid influence - he noted Wajak 1's flat face (1962:427), interpreting this as evidence that Mongoloid influence had helped push the Australoid subspecies into the bracket of modern humanity (see Fig. 1).

Coon's view of a steady post-Pleistocene Mongoloid immigration has been championed by Howells and Jacob (and called by the latter (1967) the 'Two Layer Hypothesis') but with certain modifications. Howells (1973, 1976, 1977) considers the Wajak, Niah and Tabon remains, but not the prehistoric Malay peninsula and Indochinese remains, morphologically similar to recent Tasmanians, Melanesians and Negritos (except the Andamanese). Though Keilor shows this morphology, recent mainland Australian Aborigines show a different (albeit related) morphology, and Indonesia and the Philippines of late Pleistocene (and early Holocene) times are referred to specifically as 'Old Melanesia'.

Jacob, on the other hand, emphasises the flat face and other Mongoloid characteristics of Wajak 1, and interprets these as evidence of a Mongoloid racial element in the late Pleistocene Indonesian morphology (a far more straightforward interpretation than Coon's). Jacob (1967:51; 1979) suggests that the Wajak 'type' could be ancestral to both the 'Malays' and the Austromelanesians, the latter having evolved independently after crossing Wallacea (see Fig. 1). The 'Negrito problem' he clearly sees as peripheral and open to varying explanations (1967:94-96).

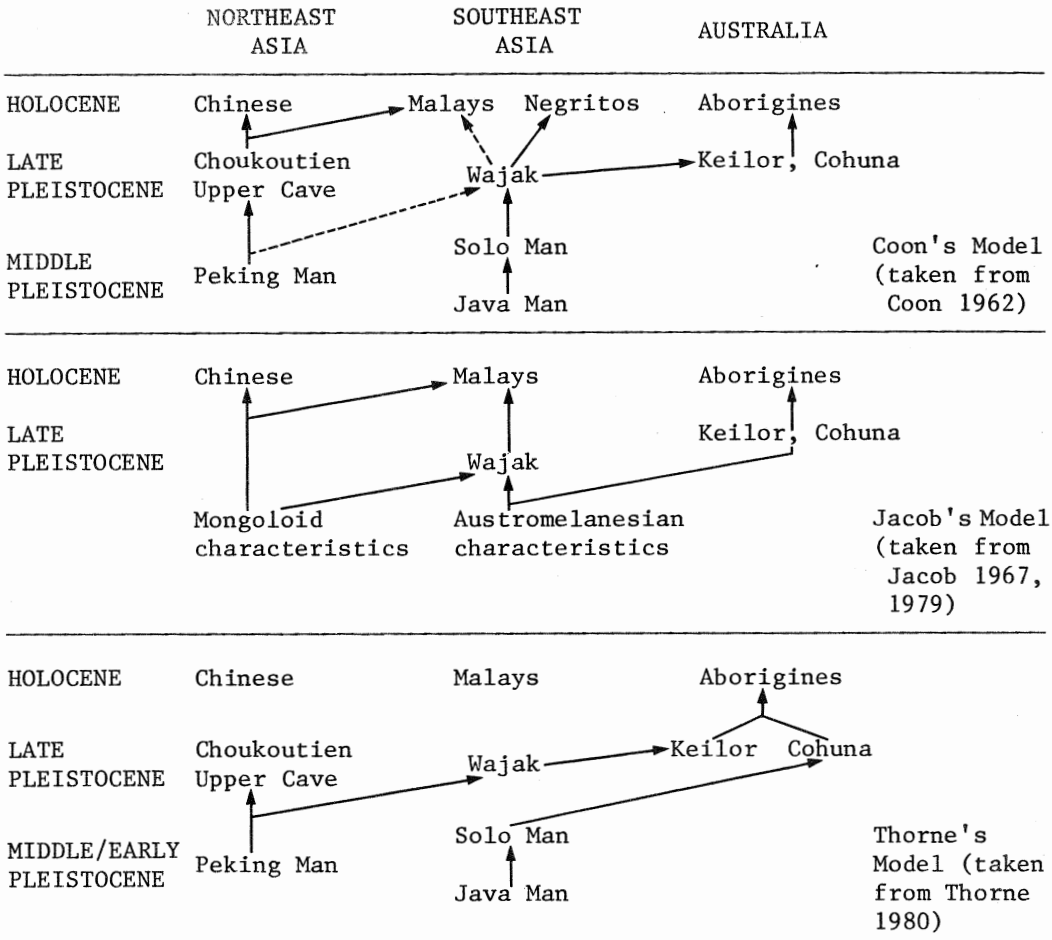

Figure 1. A comparison of models for East Asian and Australian racial evolution.

Notes: A. Fossil names here refer to a class of fossils: i.e. 'Choukoutien Upper Cave' refers to the Chinese late Pleistocene remains; 'Wajak' also includes Niah and Tabon; 'Keilor' refers to the gracile Australian specimens and 'Cohuna' to the robust Australian specimens.

B. These scholars differ in the names they would give to recent Northeast Asians (here called 'Chinese') and Southeast Asians (here called 'Malays').

C. Jacob speaks of Mongoloid and Austromelanesian characteristics without linking these to the premodern specimens, and is reticent upon the significance of the Chinese late Pleistocene remains.

D. With regard to Thorne's model, my own analysis would place an arrow from the late Pleistocene Chinese to recent Northeast Asians and from Wajak to recent Southeast Asians (Thorne makes no comment on this matter).

Coon (1962:407-410) interpreted the then-known Australian fossils as falling within the recent Australian range of variation. Research by Thorne (1976, 1977) has established that the Australian fossils tend rather to diverge from the recent Australian morphology in two opposite directions, creating two series of specimens, one 'robust' (well represented by Cohuna/Kow Swamp) and the other 'gracile'. To explain this Thorne (1980) suggests that the robust specimens are descended from the Java/Solo lineage, and the gracile specimens, including Keilor, from the Peking lineage via the late Pleistocene east Asian remains (see Fig. 1). Thus it is not the Wajak morphology but the Kow Swamp morphology which provides the suitable direct antecedent for the Australoid or robust component of recent Austromelanesian morphology.

As a part of my thesis research (Bulbeck 1981), I received, for reconstruction and descriptive analysis, Holocene skeletal material from:

(a) Leang Buidane in the Talaud Islands, Northern Sulawesi, Indonesia (see Bellwood 1978a, 1980 for archaeological analysis of Leang Buidane and other sites);

(b) Gua Cha in Kelantan province, West Malaysia; notably a Hoabinhian adult male labelled Gua Cha 1 (see Bellwood and Adi 1981, Adi 1981 for discussion of the site's archaeological significance).

Preservation, particularly of the postcranial material, was generally poor, and accordingly my analysis concentrated on the cranial skeleton.

Useful comparison with other Southeast Asian skeletal material was made difficult by the theoretical disagreements amongst authorities, as discussed above. Accordingly, I proposed an alternative perspective where I investigated the following central questions:

(a) Which characters can reliably distinguish between an Australoid and a Mongoloid influence? More specifically, if Australoid characters include generally archaic features such as cranial robusticity, dolichocephaly and large teeth, how can changes due to Mongoloid influence (by people or gene flow) be distinguished from those due to modernisation? Are there Mongoloid 'markers' which avoid this double meaning?

(b) In which ways do the late Pleistocene Chinese specimens from Liu Kiang and the Choukoutien Upper Cave differ from recent Chinese? Do these differences parallel those distinguishing Wajak and associated remains from recent Southeast Asians?

(c) What has been the filtering effect of Wallacea on the course of human evolution in the regions beyond Indonesia: to maintain a Wajak-like population in Australia virtually unchanged since the late Pleistocene, as Coon (1962:56) attests; to allow the divergent evolution of a Wajak-like descended population in Austromelanesia, as Jacob suggests; or to allow more than one incursion of Indonesian-derived people into Australia at different times, as Thorne suggests?

Was there ever indeed a transition from an Australoid to a Mongoloid phenotype in Southeast Asia, either before or after the Wajak-like morphology was established; or can the record be interpreted as unbroken continuity through time of a Southeast Asian 'clade'?

PROBLEMS IN CHRONOLOGY

Wajak, Niah and Tabon are the best known of the Southeast Asian remains, not only because a late Pleistocene age has been proposed for one or all of them by the authors discussed above, but also because they are generally believed to exhibit an Austromelanesian morphology.

The Wajak remains are undated, and the late Pleistocene age of Niah and Tabon is suspect. Even an early Holocene age for these specimens is speculative. Nevertheless, the current discussion can hardly afford to ignore them, and with the observation of a general morphological similarity between them and other specimens dated more securely to the early Holocene, such as the Gua Cha Hoabinhian, Indochinese Hoabinhian and Sampung remains, I proposed the combined category of 'pre-Neolithic specimens'. If Wajak, Niah and Tabon do differ from the prevailing early Holocene morphology, they do so by being more similar to the recent Southeast Asian morphology, as Jacob (1967:51) also noted comparing Wajak 1 with the Sampung and Guar Kepah remains.

With the Neolithic and Early Metal Period associated remains, we are dealing with specimens where a Southeast Asian morphology, albeit a somewhat robust version, is not seriously contested.

There are problems with dating specimens by the associated cultural remains. Precise dates for Southeast Asian pre-Neolithic sites are scanty; the transition to a Neolithic technology is frequently difficult to detect; and the Southeast Asian Neolithic may have developed earliest in northern mainland Southeast Asia and latest in Nusatenggara (see Bellwood 1978b for the current state of knowledge and doubt). The rational analysis of time-related

	PRE-NEOLITHIC	
Wajak	(Wajak 1 and 2)	Central Java
Niah[1]	(The Niah Cave Skull)	Sarawak, Borneo
Tabon	(The Tabon Frontal and Mandible)	Palawan, Philippines
Indochinese Hoabinhian	(Tam-Pong, Pho-Binh-Gia,) (Quynh-Van and other sites)	Northern Laos and Northern Cambodia
Gua Cha Hoabinhian	(Gua Cha 1 observed by the author)	Malay Peninsula
Guar Kepah[2]		Malay Peninsula
Gua Baik		Malay Peninsula
Sampung		Central Java
Leang Buidane	(Preceramic Burial)	Talaud Islands
Flores Mesolithic	(Leang Toge, Leang Momer and) (other sites)	Flores
	NEOLITHIC	
Ban Kao Neolithic		Southern Thailand
Gua Cha Neolithic		Malay Peninsula
Puger [3]	(Puger 1 and 2)	Eastern Java
Melolo[3]		Sumba
	EARLY METAL PERIOD	
Non Nok Tha[4]		Northern Thailand
Ban Kao Iron Period		Southern Thailand
Gilimanuk		Bali
Leang Cadang[5]		Southern Sulawesi
Leang Buidane	(Jar Burial Material)	Talaud Islands

Table 1. Chronology of the major Southeast Asian skeletal-bearing sites.

Notes: (1) Niah has also yielded an extensive burial series going back to about 15,000 B.P., but few morphological details are available.

(2) Mainly Hoabinhian.

(3) Possibly Metal Period.

(4) Mainly Early Metal Period, but also some Neolithic.

(5) Incorrectly treated by Jacob (1967) as Mesolithic.

changes in morphology relies on establishing some systematic chronology, however, and accordingly I have used the chronology shown in Table 1.

AUSTRALOID AND MONGOLOID SKELETAL CHARACTERISTICS

The identification of Australoid and Mongoloid skeletal characteristics is based primarily on the study of recent specimens. Australoid characteristics are those shown more amongst Austromelanesian than east Asian specimens, and generally most intensely in Australia; Mongoloid characteristics are those shown more amongst east Asian specimens, and generally most intensely in China and Mongolia. Discussion of these characteristics, and their significance in the east Asian record since the late Pleistocene, will proceed under three headings: dental, mandibular and cranial.

Dental characteristics

Turner and his colleagues have systematically charted dental morphological variation amongst a large number of indigenous circum-Pacific populations. Turner (1979b) proposes three dental morphological complexes: the Melanesian morphology, evolved *in loco* in Melanesia, distinguished by low incisor shovelling, simple mandibular molars (especially the second) and a low incidence of root anomalies; the Sundadont morphology, shown by the Ainu, Southeast Asian, Polynesian and at least some Micronesian populations, distinguished by moderate incisor shovelling, complicated lower molars and fairly frequent root anomalies; and the Sinodont morphology, shown by Northeast Asian populations (except the Ainu) and Amerindians, distinguished by an intensification of the Sundadont pattern. Turner believes the Sinodont morphology to have evolved from a once more widespread Sundadont morphology.

Considering east Asia and Oceania, I have noted also that hypocone reduction on the upper molars is most intense in Northeast Asia (here including the Ainu), and less intense amongst Southeast Asian and Polynesian/Micronesian populations, differing from Melanesians only by a stronger reduction on the third molar. I also suggested on the available data that Australian Aborigines be considered as showing a fourth morphological complex. Aborigines show a level of incisor shovelling and lower molar cusp complexity comparable with Sundadonts, but the lowest incidence of root anomalies and hypocone reduction in the circum-Pacific.

Jacob (1967), comparing the Guar Kepah remains with Early Metal Period and recent Indonesian dental material, observed the Guar Kepah incisors to show a lower incidence of shovelling. This and related observations led him to suggest that Southeast Asian

dental morphology has changed from a more Austromelanesian to a more Mongoloid phenotype, owing to Mongoloid immigration from the north. While the Guar Kepah sample shows a relatively low incidence of incisor shovelling, the contemporaneous or older Gua Cha Hoabinhian sample appears not to. In addition, the Guar Kepah upper molars exhibit beautifully the Southeast Asian hypocone pattern - low reduction on the first and second upper molars, but strong reduction on the third. Three-rooted lower first molars (3RM1), rare in Melanesia and all but absent in Australia, but occurring with c. 10% frequency in east Asia, are found on the Tabon mandible (Barker 1978) and Gua Cha 1. There is some evidence of an increase in second lower molar complexity in Southeast Asia through time, but no evidence that this was due to influence from the north, for Southeast Asians show a complexity comparable to or greater than recent Northeast Asians.

These data support Turner's thesis of continuity since the late Pleistocene of a Sundadont morphology in Southeast Asia. Turner (1979a; Turner and Swindler 1978) bases this interpretation on the Niah and Non Nok Tha dental samples, few details of which have been published, as have few dental morphological details of the Gua Cha material reported by Trevor and Brothwell (1962). To summarise, the available published data are incomplete but dental morphologies provide little support for an increasing 'Mongoloid' influence in Southeast Asia.

Concerning tooth size, large teeth are considered an Australoid character and small teeth a Mongoloid character (Jacob 1967). By and large this is correct, although some Melanesian populations show small teeth, e.g. the West Nakanai (Turner and Swindler 1978) and Motupore Island Motu (Brown 1978). Generally, Southeast Asians show teeth larger than Northeast Asians, although Surabayans and Tagalese have teeth no larger than Chinese.

There is little dispute that tooth size has reduced in Southeast Asia since the late Pleistocene. Large teeth, generally exceeding the mean dimensions for recent Australian Aborigines (as taken from Campbell 1925), are the rule for pre-Neolithic Indonesian and Malaysian specimens. The three Early Metal Period Indonesian samples show teeth small by pre-Neolithic standards but large by recent standards, indicating continuing tooth size reduction till the present.

Noted from the earliest recovered specimens, this observation has been a cornerstone of the 'Two Layer Hypothesis'. Equally, this observation could perform as a cornerstone for the hypothesis of Holocene modernisation, without 'racial' intervention, of Southeast Asians. Decrease in tooth size since the late Pleistocene has been observed in Europe (Wolpoff 1980:348-349) and Nubia (Carlson and van Gerven 1977), where no Mongoloid influence is suspected, and most relevantly in Northeast

Asia (vide Coon 1962:465-476), where the genes for Southeast Asians' smaller teeth are purported by some to have originated. In addition, this trend is of key significance for the other trends to be discussed below.

Mandibular characteristics

Prehistoric Southeast Asian mandibles tend to be large by recent standards, and there may have been some decrease in mandibular size with time, especially as the Wajak 2 mandible is relatively huge. Alternatively, when we consider that many of the Neolithic (Ban Kao) and Early Metal Period (Leang Buidane and especially Non Nok Tha) mandibles also are large, and that mandibles are less solid than teeth, it may be that the larger mandibles have tended to survive the better. Possibly we are receiving an unrepresentative sample not necessarily indicative of total populations with mandibles larger than the recent.

The largest mandibles documented for recent east Asian/Pacific populations come from Polynesia, then Melanesia east of New Guinea and Australia. If prehistoric Southeast Asians did have large mandibles, this might be taken to indicate a Pacific affinity; or we might expect larger mandibles simply to match their larger teeth.

Larnach and Macintosh (1971) documented morphological differences between Australian Aboriginal and Northeast Asian mandibles, which data Macintosh (1978) used in concluding that the Tabon mandible is not Mongoloid but lies towards the non-Mongoloid end of the Australian range of variation. As Howells (1973:179) points out, this observation does not actually disprove a Southeast Asian morphology. I have reviewed Macintosh's analysis of Tabon, and analysed the Wajak 2 and Gua Cha 1 mandibles using the method of Larnach and Macintosh, to conclude that their morphology could not be distinguished from the Leang Buidane Metal Period or recent Indonesian morphology. This Indonesian range of variation consistently falls between the ranges shown by Northeast Asians and Austromelanesians.

There also appears to be continuity of a Southeast Asian mandibular shape from the pre-Neolithic to the recent context, characterised by a short ramus which is shared with Northeast Asians and a large bigonial breadth which is not.

Cranial characteristics

As with mandibles, prehistoric Southeast Asian crania, including Ban Kao, Non Nok Tha and Leang Buidane, tend to be large by recent standards. Again this may be an artifact of differential preservation. However, if large crania are a biological

characteristic of prehistoric Southeast Asians, this speaks against an Australoid affinity, for Austromelanesians tend to show crania slightly smaller than Southeast Asians. It is Polynesians, Micronesians and Northeast Asians such as the Ainu and Buriat who show large crania in the recent east Asian/Pacific context.

Palate size data present a different story: pre-Neolithic specimens tend to show large palates whereas Neolithic to recent Southeast Asians tend to show distinctly smaller palates. The anterior projection of the palate from the cranial base, i.e. facial prognathism, tends to be strong for pre-Neolithic specimens (notably the Niah skull and the two documented Gua Cha Hoabinhian crania), intermediate for Neolithic and Metal Period specimens and weak for recent Southeast Asians. While palate size and facial prognathism are not directly related to each other nor to tooth size, the Holocene reduction of all three traits suggests we are dealing with a single trend: reduction in the size of the oral apparatus.

For a long time morphologists have noted that pre-Neolithic Southeast Asian specimens show well-developed superciliary ridges, vault gabling and certain other signs of cranial robusticity. What they have not observed systematically is the ocurrence of these characters amongst recent Southeast Asians. These, judging from observations made by Kamminga (n.d.), show a robusticity greater than Northeast Asians (the usually invoked 'Mongoloid' comparative sample), and would readily encompass the pre-Neolithic specimens in their range of variation. Wajak 1, Niah and Tabon, especially, are gracile compared with recent Australian Aborigines and very gracile compared with the 'robust' prehistoric Australian specimens. A cranial robusticity comparable to that of the pre-Neolithic Southeast Asians occurs in the late Pleistocene Chinese remains.

Currently, a modest decrease of cranial robusticity throughout east Asia since the late Pleistocene seems a reasonable hypothesis. Biomechanical models (Wolpoff 1980:178 ff.) indicate that cranial robusticity largely functions to dissipate upon the neurocranium those forces generated during prolonged or powerful tooth use. Decreased size of the oral apparatus may diminish the need for a robust neurocranial buttressing system. Similarly the pan-east Asian post-Pleistocene trend towards brachycephalisation may also reflect the smaller oral apparatus. Narrower heads bring the temporal muscles closer to the line of action of the mandibular corpora which deliver the masticatory stroke. With the relaxation of the need for this biomechanical efficiency, the neurocranium would be allowed to fill out to a more spherical shape, the most efficient and economical shape for containing the brain.

Changes in facial shape also are apparent, whether we compare the late Pleistocene and recent Chinese, or pre-Neolithic and recent Southeast Asians. The older specimens frequently show an upper facial or bifrontal breadth equal to or greater than the middle facial or bimaxillary breadth (Fig. 2). With time the breadth of the upper facial skeleton has reduced, leaving the typical recent east Asian condition of the middle face broader than the upper face. Bizygomatic breadth also has tended to reduce, especially in relation to middle facial breadth. Accordingly, the malar bone was directed more laterally and less posteriorly amongst the older east Asian specimens (Fig. 2).

The upper lateral facial skeleton is a key region for transmitting masticatory stresses from the face to the neurocranium; and malar morphology significantly affects masticatory strength, as the malar carries the bulk of the masseteric musculature and outlines the lateral extent of the temporal fossa. Possible biomechanical explanations seem less plausible for another pan-east Asian change in facial shape: elongation of the face with concomitant narrowing of the nasal aperture and orbits. Here, in addition, a Northeast-Southeast Asian contrast is apparent throughout the record with Northeast Asians tending to show the longer face and narrower nasal aperture at the pre-Neolithic, Neolithic and post-Neolithic stages.

Finally, Jacob has drawn attention to Wajak 1's flat face, and comparably flat faces are also shown by the Niah skull (as reconstructed), Tam-Pong and Gua Cha 1. Wajak 2 shows strong external occipital protuberance development but a weak transverse occipital torus, a combination rarely encountered amongst Austromelanesians. Modest post-orbital constriction graces the Tabon frontal and most Southeast Asian specimens past or present. These observations indicate continuity from the late Pleistocene of a morphology involving a number of distinctly non-Austromelanesian characters.

'MONGOLOIDISATION' OR MODERNISATION OF SOUTHEAST ASIANS SINCE THE LATE PLEISTOCENE?

The *prima facie* attractiveness of the Two Layer Hypothesis, as well as its shortcomings upon closer analysis, are clear from examination of the precise morphological changes involved (Table 2). Shortcomings of the Hypothesis are of three types.

The so-called 'Austromelanesian morphology' of pre-Neolithic Southeast Asians may include characters shown non-universally amongst recent Austromelanesians. Dental morphology is a case in point. Increases in second lower molar cusp number and frequency of incisor shovelling possibly characterise the

CHANGES STRONGLY SUGGESTED BY THE RECORD	'TWO LAYER HYPOTHESIS' OR A CLADE CHANGE
Tooth size reduction	Yes
Palate size reduction	Yes
Facial prognathism reduction	Yes
Brachycephalisation	To some degree
Upper facial breadth reduction	Yes
OTHER CHANGES SUGGESTED BY THE RECORD	
Cranial gracilisation	Yes
More posteriorly directed malar	Possibly a change from a Pacific phenotype
Facial elongation	To some degree
Increased M_2 cusp number	Possibly a change from a Melanesian-like phenotype
CHANGES SUGGESTED AS POSSIBLE BY THE RECORD	
Cranial size reduction	No
Mandibular size reduction	Possibly a change from a Pacific phenotype
Increased incisor shovelling	Possibly a change from a Melanesian-like phenotype

Table 2. Morphological changes documented in the Southeast Asian record since the late Pleistocene, and their significance (for documentation see Bulbeck 1981).

Note: 1. As suggested by Woo (1959:115).

MODERNISATION OR A GRADE CHANGE	ALSO DOCUMENTED IN THE NORTHEAST ASIAN RECORD?	EVOLUTIONARY SIGNIFICANCE
Yes	Yes	Grade or Clade
Yes	Yes	Grade or Clade
Yes	Yes	Grade or Clade
Yes	Yes	Grade preferable
Yes	Yes	Grade or Clade
Yes	Yes	Grade or Clade
Yes	Yes	Grade or Clade
Possibly (1)	Yes	Grade or Clade
Unclear	Unclear	Local evolution
Yes	Yes	Grade
Yes	Unclear	Grade or Clade
Unclear	Unclear	Unclear

Table 2. (continued from opposite page).

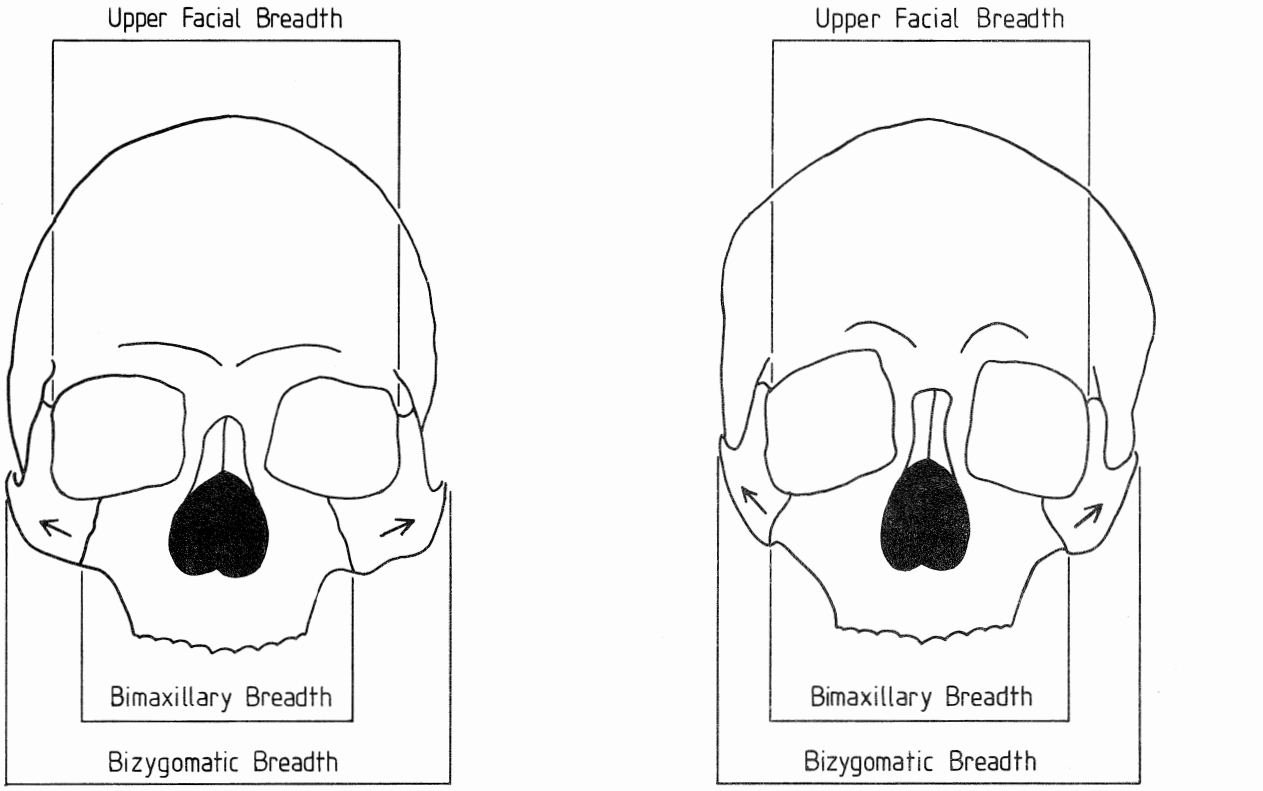

Figure 2. Early Holocene and recent Southeast Asian cranial morphologies: note the shorter face with broader structures and more laterally directed malar bone of the early Holocene morphology.

Southeast Asian record, but here Southeast Asians would have changed from a specifically Melanesian-like, not Austromelanesian, phenotype. Reciprocally, Australian Aborigines and Melanesians are similar regarding the low expression of 3RM1 and third molar hypocone reduction, but the evidence suggests that pre-Neolithic Southeast Asians differ from Austromelanesians in these regards.

Where change from an Austromelanesian to a Mongoloid phenotype has reasonable explanatory power, change to a more modern phenotype has equal explanatory power. For other changes the interpretation is unclear or the modernisation hypothesis the more attractive.

There are many parallels between Northeast and Southeast Asian evolution, and no evidence that these changes occurred earlier in Northeast Asia. A northern source for Southeast Asian post-Pleistocene evolutionary processes is called into serious doubt.

This last point raises an interesting observation. While the Northeast and Southeast Asian morphologies have shown parallel changes in certain characters associated with modernisation, for many other characters they have retained their distinctiveness. Neither migration nor random gene flow explain this pattern. Either the genetic changes responsible for modernisation arose in both gene pools independently, or, these genetic changes having arisen mainly in the north or the south, gene flow was largely confined to them. In either case the apparent cause was local selection pressure in both regions for a smaller oral apparatus and the associated craniomorphological changes.

Wolpoff (1980:325) argues that the development of agriculture and pottery (for food preparation) provided these selection pressures, and identifies south China as a central early locus. Current archaeological thinking stresses the approximate contemporaneity of these technological developments in China and much of Southeast Asia (Bellwood 1978b). Owing to deficiencies in the skeletal record, the precise chronology of modernisation in east Asia is unknown. If Holocene technological advances and biological modernisation are interlocked, as Wolpoff argues, it is interesting that a similar state of ignorance, of precisely where events happened first, pertains to both processes.

WALLACEA AND THE PACIFIC

The colonisation, sometime in the late Pleistocene, of Sahulland (the Australia-New Guinea land mass) undoubtedly sprang from Southeast Asia. The Australian fossil record cannot be dismissed from the present discussion, particularly as some of the

late Pleistocene Australian fossils (e.g. Keilor) are morphologically similar to the approximately contemporary east Asian fossils.

Coon's (1962) view of the virtually unchanged maintenance of the Wajak-like morphology in Australia, or Howells' (1977) view of the maintenance of that same morphology in Melanesia and Tasmania, do not stand up to close scrutiny. Recent Austromelanesians do not evince a Wajak-like morphology. Picking up Jacob's suggestion of a divergent evolution of Austromelanesians, we may hypothesise that a Wajak-like population colonised Sahulland in the late Pleistocene, in excess of 40,000 years from Australian archaeological evidence, and that local evolution accounts for the biological diversity within the Australian fossil record and amongst recent Austromelanesians. In this case, the establishment of an Austromelanesian 'race' depends on its genetic isolation east of Wallacea. The east Asian specimens including Wajak may be called 'proto-Mongoloid', 'proto' implying a slightly more archaic version of the present inhabitants.

Thorne's hypothesis of two recognisable colonising 'events' for Sahulland also is compatible with my present argument. Although the oldest accurately-dated Australian remains are of the 'gracile' variety, Lake Mungo 1 and 3, Thorne (1980:40) appears to prefer an earlier occupation of people with a more Solo-like morphology in accounting for the robusticity of recent Australian Aborigines and especially certain late Pleistocene series such as Kow Swamp. The late Pleistocene Chinese specimens, together with Wajak and related Southeast Asian specimens, Lake Mungo 1 and 3 and Keilor, all show a similar morphology which could be called 'proto-Mongoloid'. The difference in Australia is that this morphology encountered a previously-established, more Solo-like or strongly 'Australoid' morphology.

WIDER ISSUES OF EAST ASIAN EVOLUTION

The possibility of two major colonising thrusts into Sahulland, by people at two evolutionary grades, highlights the difficulty we have in distinguishing Australoid and 'archaic' characters from Mongoloid or 'modern' characters. This difficulty is also apparent with the pre-*Homo sapiens* material. Weidenreich's and Coon's formulation of the two major east Asian/Oceanic lineages tacitly assumes the Peking and Java *Homo erectus* series to be more or less contemporaneous. This assumption is wide open to debate and Wolpoff (1980:197-198) suggests that many of the differences reflect the greater antiquity of the Java series. On the other hand, the Solo series, while undated, does not appear to be older than a few hundred thousand years at the most (Thorne 1980:39; Wolpoff 1980:219). This may imply continuity of robusticity as a

regional Javan characteristic, but Wolpoff (1980:221) adds a question mark here as well, noting a specific similarity between the Solo morphology and one of the Peking specimens recovered from higher up in the sequence.

In short, the cladistic differences between the Chinese and Javanese pre-modern material may have been overstressed, and there is no clear resolution given the current paucity of dates for strategic specimens. In addition, many of the characters proposed to distinguish the Java and Peking series - the larger teeth, larger frontal sinuses, and cranial robusticity of the former - also tend to characterise recent Southeast Asians when compared with recent Northeast Asians. The sceptic need not be convinced that Southeast and Northeast Asian morphological contrasts have been more intense at any time in the past than they are now.

At the same time, the sceptic could argue that a Solo-like morphology could have been present in Southeast Asia as late as, say, 10,000 years ago. Lake Mungo 1 and 3 are indirect evidence of a more modern morphology somewhere in Southeast Asia by at least 30,000 years ago, but this does not exclude the possibility of two morphologies co-inhabiting the same general region in the late Pleistocene, as the Australian record demonstrates. The date at which the Solo-like morphology disappeared from Southeast Asia has important implications for interpreting its transition to a Wajak-like morphology. In general, the longer ago the Solo-like morphology was phased out, the more the process can be viewed as modernisation; the more recently it was replaced, the more important would genetic intrusion from the north appear to be.

The above wider issues do not impinge upon the real conclusions of the present argument, based as they are on the Southeast Asian record of the fairly recent past. These are:

(1) The specimens from Wajak, Niah and Tabon cannot be demonstrated to be morphologically or chronologically distinct from the larger sample of early Holocene dated specimens. Accordingly, these are combined for practical purposes into a single pre-Neolithic sample.

(2) Owing to deficiencies in the Northeast Asian early Holocene record, pre-Neolithic Southeast Asian specimens are compared with late Pleistocene Chinese specimens when investigating east Asian evolution since the late Pleistocene. Such a comparison suggests that the same basic evolutionary processes have occurred throughout east Asia, jeapordising the conventional view of modernisation in the north and 'Mongoloidisation' in the south.

(3) Resolution of the remaining difficulties will not be aided by inflexible thinking in terms of 'Mongoloid' and 'Australoid', which are easy to confuse with 'modern' and 'archaic' respectively. Neither will it be aided by insisting that evolutionary events in the Pacific must find their morphological mirror-image in Southeast Asia. We require well-dated contemporary sequences from both Northeast and Southeast Asia, and close attention to the precise morphological details involved, in order to assess the true evolutionary relationships between these two regions.

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