News and Views

Australian Pleistocene variation and the sex of Lake Mungo 3

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Introduction

For over 300 years European observers have debated the biological and geographical origins of Australia's first human inhabitants (Brown, 1996). Most recently Thorne et al. (1999) report that the age of the Lake Mungo 3 (LM3) skeleton indicates colonization of Australia during or before oxygen isotope stage 4 (57,000–71,000). They also argue that while LM3 is a male it is morphologically gracile and distinct from other early Australians at Kow Swamp, which have previously been described as robust and archaic (Thorne & Macumber, 1972; Thorne, 1976, 1977). Thorne has argued that this "gracile or advanced" group of Pleistocene Australians had its origins in East Asian "gracile forms", like Liujiang and Upper Cave from China, which had spread south to Indonesia (Thorne, 1990, 1989). South-east Asian evidence of these people is "present in Indonesia . . . from Niah in Kalimantan and Wajak in Java" (Thorne, 1980:39). Thorne's "robust or skeletally archaic" group and the "general bulk of modern Aboriginal Australians" (1980:38– 39) could be traced directly to Javan *Homo erectus*. Unfortunately, statistical and morphological support for the Asian affinities of these gracile Australians has not been published. It is also clear that the allocation of individual prehistoric Australians to "robust" or "gracile" groups has failed to take sexual dimorphism, and the effect of cultural practices such as intentional cranial deformation, into account (Brown, 1987, 1989, 1994b; Pardoe, 1991; Antón & Weinstein, 1999). The purpose of this paper is an examination of the gracile male status of LM3 through comparison with terminal Pleistocene and Holocene Australian skeletal remains.

The LM3 skeleton, discovered in 1974 (Bowler & Thorne, 1976), is described by Thorne et al. (1999) as gracile and within the range of living Aborigines. The presence of this "modern and gracile morphology" (1999:610) in Australia at about 60,000 years, 40,000 years before what Thorne has argued is a biologically distinct robust population at Kow Swamp (Thorne & Macumber, 1972; Thorne, 1976, 1977; Thorne & Wilson, 1977), has implications for arguments to do with the colonization of Australia and the origins of modern *H. sapiens* in general. Other early Australians, particularly Kow Swamp and Willandra Lakes 50 (Brown, 1998; Stringer, 1998), have formed a keystone in the multiregional model for human origins in the Australasian region (Thorne & Wolpoff, 1981; Frayer et al., 1994). Thorne's (1977) gracile Australians, Lake Mungo 1 (LM1), LM3 and Keilor (Wunderly, 1943; Brown, 1987), did not contribute to the foundations of the multiregional model (Thorne & Wolpoff, 1981) and have made only a limited contribution ever since. If LM3 is 40 ka older than Kow Swamp (Thorne & Macumber, 1972), or Willandra Lakes 50 (Simpson & Grün, 1998), then it might be limited contribution ever since. If LM3 is 40 ka older than Kow Swamp (Thorne & Macumber, 1972), or Willandra Lakes 50 (Simpson & Grün, 1998), then it might be expected that the multiregional traits detailed by Thorne & Wolpoff (1981) are evident in LM3.

The sex of LM3 is important to its place in Thorne & Wolpoff's (1981) multiregional scheme as well as its consideration as one of Thorne's (1977; Thorne et al., 1999) "gracile" Australians. Several of the Australasian regional traits are linked to overall size and robusticity and are therefore better expressed in males than females (Brown, 1992b; Lahr, 1996; Lahr & Wright, 1996). For instance a low position of maximum cranial breadth, and greater tooth size and prognathism are more evident in large individuals. Other traits, for example a prebregmatic eminence, are very rare in Aboriginal female crania regardless of their size. Similarly the identification of separate robust and gracile Pleistocene populations in Australia "depends on a clear definition of [its] sex" (Thorne et al., 1999:609). Apart from overall size the anatomical features distinguishing between the gracile and robust groups have never been clearly defined. It is possible that the morphological extremes identified by Thorne (1977) did exist but that they were simply men and women (Pardoe, 1991; Brown, 1994b). Several lines of evidence suggest to Thorne et al. (1999) that the LM3 skeleton is male while I have previously argued that poor preservation and intermediate size leaves its sex in doubt (Brown, 1987).

Although discovered more than 20 years ago, LM3 has not been described in detail. Bowler & Thorne (1976) limit their morphological description to a brief discussion of preservation and the factors which indicate age at death and sex. There is nothing in the original description of LM3 to indicate that its morphology was gracile, or modern, or that it contrasted with that of the Kow Swamp specimens. LM3 was further discussed by Thorne (1977), where in a diagram comparing the morphological extremes of late Holocene and "fossil" Australian crania, the latter group contain-ing mid-Holocene and terminal Pleistocene skeletons, LM3 was placed in the middle of the modern female range and outside the male range. Thorne remarks that "were it not for femoral and pelvic evidence, one could be tempted to diagnose Lake Mungo III as female" (1977:190). It is unfortunate that Thorne presents no details of this evidence.While details of the gracile, morphologically delicate or modern features of LM3 are not provided Thorne (1977:191) states that "all of the Lake Mungo individuals . . . possess very thin cranial vault bones" contrasting with both late Holocene and other late Pleistocene crania such as Kow Swamp. The actual relationship of LM3 to any Australian skeleton, or broadly defined modern humans, has not been tested in Thorne's subsequent publications mentioning this skeleton. More recent comparison of the Australian Pleistocene sample, including LM3, did not support Thorne's division of the sample into two biologically distinct groups (Brown, 1987). It would be unusual if cremation associated shrinkage had not significantly reduced the size of LM1 (Bowler et al., 1970; van Vark, 1975) and LM3 does not have a very thin cranial vault bone (Table 1).

The sex of Lake Mungo 3

Determining the sex of LM3 is complicated by poor skeletal preservation, the significantly larger average body size of terminal Pleistocene Australians compared to their late Holocene equivalents, and the lack of an adequate Pleistocene sexing standard (Brown, 1987, 1989, 1992a,b). While in photographs of the excavation LM3 appears reasonably complete (Thorne et al., 1999), sexually diagnostic parts of the pelvic girdle are missing, the cranial vault is without most of its right side and base, and the facial skeleton is fragmentary. In Bowler & Thorne's (1976) original discussion of LM3 male sex

Table 1 Dimensions of Lake Mungo 3 and descriptive statistics for the late Holocene and Coobool Creek samples (mm).

		Late Holocene males			Late Holocene females			Coobool Creek males			Coobool Creek females		
Variable	LM3	n	$\bar{X}$	S. D.	n	$\bar{X}$	S. D.	n	$\bar{X}$	S. D.	n	$\bar{X}$	S. D.
Opisthion—lambda chord	95	70	94.1	3.79	72	90.6	5.10	22	102.2	6.54	8	102.0	3.62
Bregma—lambda chord	123	70	116.6	4.80	76	111.8	5.33	22	119.3	6.12	9	113.8	7.20
Lambda—asterion chord	88	72	82.7	3.67	75	79.6	3.89	22	87.6	6.70	9	81.2	7.77
Bi- gonial breadth	101	51	99.5	6.48	57	92.2	6.33	15	111.0	7.36	3	102.0	13.74
Minimum ramus breadth	35	58	35.2	2.75	62	33.3	3.05	21	36.3	3.15	9	34.8	3.65
Thickness at mid- frontal	10Æ7	46	8.0	1.56	38	7.7	1.39	21	10.0	2.67	5	7.0	2.09
Thickness at bregma	7Æ2	47	8.3	1.63	39	6.9	1.21	21	10.5	2.01	5	8.1	1.87
Thickness at lambda	8Æ6	42	8.3	1.49	35	8.0	1.33	21	11.2	1.62	4	9.6	1.46
Thickness at occipital protuberance	14Æ2	47	14.6	2.41	39	11.8	2.85	21	18.1	2.24	4	14.1	1.43
Vertical femur head	48*	94	42.8	2.18	73	38.1	1.57						
Femur transverse mid-shaft	29	30	25.1	1.93	22	22.5	1.53						
Right ulna max. length	297	37	272.9	11.84	37	249.1	13.30						

*Vertical femur head dimension for LM3 an estimate from Thorne et al. (1999)

Figure 1. Lateral and facial views of Lake Mungo 3 calvaria.

was suggested by the mandible sexing method of Larnach & Macintosh (1971), where LM3 obtained a score just inside the male range. Unfortunately, there is no evidence that the Larnach and Macintosh's method is an accurate approach to determining the sex of recent, let alone Pleistocene, Aboriginal mandibles. Only 21 of the 155 mandibles used to develop the method could be independently sexed and the relatively truncated female distribution suggests many of Larnach and Macintosh's "males" were actually females. Similar problems were found when the closely associated Larnach and Freedman cranial sexing procedure (Larnach & Freedman, 1964) was tested with an independently sexed sample (Brown, 1981, 1989). At best, therefore, LM3's morphology is only sug-gestive of its sex—it is by no means an unequivocal determination.

Thorne et al. (1999:609–610) also argue that the position of the hands, "clasping and protecting the penis" indicates male sex. Support is claimed from contemporary traditional burial practice and oral history, which also suggests to the authors that this "mortuary practice has a very long prehistory in Australia." Blackwood & Simpson (1973) provide evidence that placing the hands over the pubic region was a common burial practice in the Murray River Region, 60 km south of Lake Mungo, over the last 5000 years. However, it was not restricted to particular age or sex classes. It was just one of the more frequent arrangements of the limbs in extended burials. While it may be that this is a preferred burial arrangement for male Aborigines in south-western New South Wales today there is neither archaeological nor ethnographic evidence to indicate that this was so in the past (Meehan, 1971).

The extent of supraorbital development is normally an excellent indicator of sex in Australian Aboriginal crania (Larnach & Freedman, 1964; Brown, 1981). In LM3 the superciliary ridges and zygomatic trigones are weakly developed placing them out-side the recent and Pleistocene Aboriginal male range (Figure 1).

Thorne et al. (1999) state that the eroded left femur head had a vertical diameter which was originally close to 48 mm. If correct, this is at the top of the late Holocene male distribution and outside the female

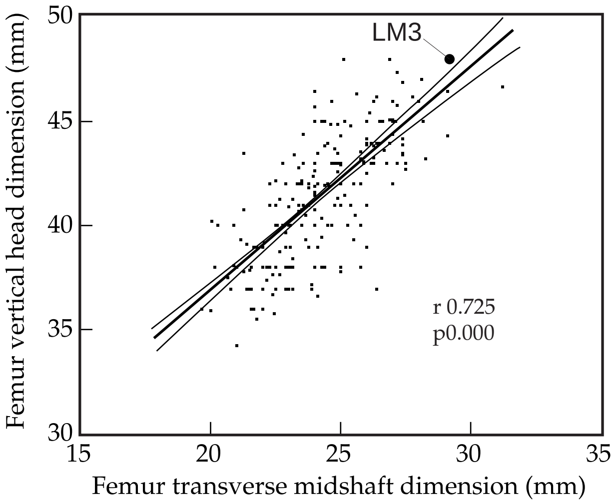

Figure 2. Scatter plot of the relationship between femur vertical head and transverse mid-shaft dimensions in late Holocene AustraliaAborigines from south-eastern Australia (mm).

range (Figure 2, Table 1). Considered together with a transverse midshaft dimension of 29 mm this indicates an extremely robust femus, which while it may suggest male sex does little to support the status of LM3 as a "gracile" Australian (Figure 2, Table 1). With the exception of the right ulna the other major limb bones do not have their articular surfaces preserved. The right ulna has a maximum length of 297 mm which is towards the top of the late Holocene male range (male range 246–300 mm, female range 220–274 mm, Table 1). Using stature estimation formulae from a population with similar relative limb lengths (Lundy, 1983) provides a stature of approximately 170 cm. While slightly above the late Holocene male average of 167 cm, it is below the Coobool Creek–Nacurrie Pleis-tocene male average of 180 cm (Brown, 1992a, 1994a).

An alternative approach to determining the sex of LM3 is through the use of standardized discriminant function coefficients developed from an appropriate known sex population (Giles & Elliot, 1963; Snow et al., 1979; Brown, 1989). A major limitation is the restricted number of osteological dimensions that may be recorded from LM3. Those which are preserved are not necessarily the variables of choice for the separation of groups, and the identification of individuals, based on sex. There is also no known sex, terminal Pleistocene Aboriginal sample of adequate size in which to develop the discriminant function coefficients. A late Holocene Aboriginal sample from south-eastern Australia was used instead (Brown, 1981b, 1989). The cranial and mandibular dimensions used were opisthion–lambda, bregma–lambda, lambda–asterion, bi-gonial breath and ramus minimum breadth (Table 1). Statistical calculations were performed using SPSS (SPSS Inc, 1990). The raw data are available at Brown (1998).

From the male and female late Holocene groups a single discriminant function was calculated, with a $\chi 2$ =55·72, P<0·0000. Equality of group covariance was indicated by a non-significant value for Box's M (P=0·775). Overall 81·05% of grouped case, 83·7% of the males and 78·8% of the females, were correctly classified by the function. The loading matrix correlations between predictors and discriminant func-tions indicating that the primary discrimi-nating variable was bi-gonial breadth (0·66), followed by bregma–lambda (0·51), lambda–asterion (0·43), opisthion–lambda (0·42), and ramus minimum breadth (0·35). The distribution of the late Holocene male and female discriminant function scores is plotted in Figure 3. There is considerable overlap between the two distributions and this is not an ideal discriminant function for purpose of sex determination. Application of the standardized coefficients to LM3 places it above the male mean, but still within the female range.

Given the significantly larger mean body size of terminal Pleistocene Australians (Thorne & Macumber, 1972; Brown, 1992a,b) the same standardized coefficients were applied to the Coobool Creek crania and mandibles (Brown, 1989). Their larger dimensions are reflected in the male and female mean scores for Coobool Creek in Figure 3. Due to poor preservation of the bi-gonial dimension only a small number of Coobol Creek females were available, which narrowed the range of their distributions. Relative to Coobool Creek, LM3 falls at the bottom of the male distribution and top of the female. Overall these results are not conclusive and the sex of LM3 remains uncer-

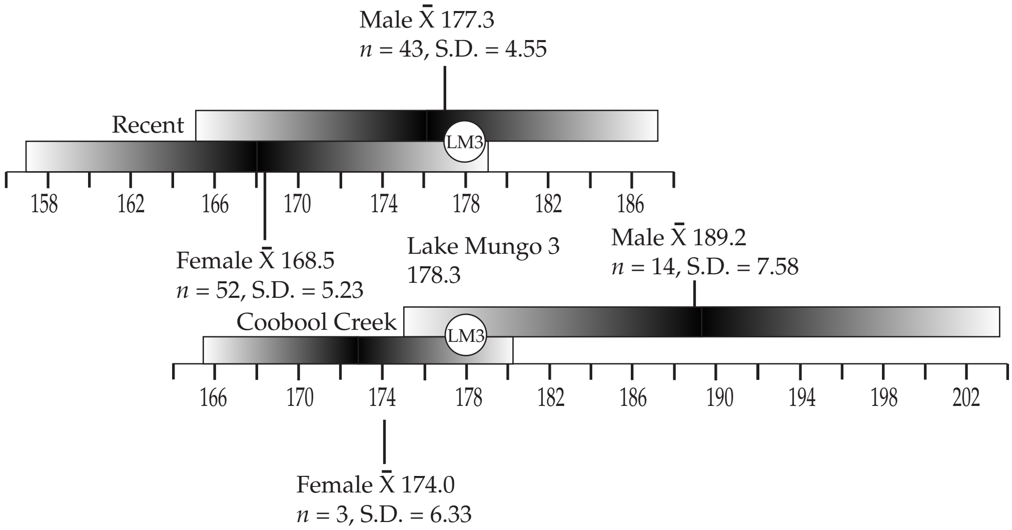

Figure 3. Distribution of the discriminant function scores in male and female late Holocene (top) and Coobool Creek (bottom) crania from south-eastern Australia, and the location of Lake Mungo 3.

tain. While LM3 is certainly tall and robustly built in comparison with late Holocene female Aborigines, outside the Holocene female range for some postcranial dimensions, this is not enough to indicate male status for a Pleistocene Australian. Supraorbital morphology, as well as frontal curvature and absence of a medium frontal ridge, is decidedly feminine and contrasts with all of the Coobool Creek, Kow Swamp and Nacurrie males (Thorne, 1976; Brown, 1989; 1994a). The choice would appear to be between a postcranially robust female of approximately 170 cm tall or a male with very feminine cranial morphology and intermediate cranial size. Short of recovering DNA (Hagelberg et al., 1994) I cannot see how the sex of LM3 can be decided with any greater degree of certainty.

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