

Some initial informal reactions to publication of the discovery of *Homo floresiensis* and replies from Brown & Morwood

Introduction

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The announcement last month in *Nature* of the discovery of a new hominin species – *Homo floresiensis* – continues to reverberate across the palaeoanthropological world. Reactions have been mixed, to put it mildly, ranging from challenges to the interpretation of the holotype as a new species and suggestions of ancestries other than *Homo erectus* to acceptance of the association of the new hominin with a recognisably Southeast Asian archaeological signature. Each of these positions is represented in the following contributions to what is likely to be a prolonged debate, in many different fora, about the significance of the hominins from the site of Liang Bua.

As editor, I approached a range of researchers with expertise in either the fossil or archaeological record of the region and offered them an opportunity to put their views forward in an informal, non-peer reviewed context - this news item. The views published here are of those who chose to respond. Whilst the content of research articles in *Before Farming* is peer-reviewed, this opportunity to express an opinion is just that and does not reflect the views of the associate editors or myself. Some might see this as a glorified chat room, but the issues raised by each of the contributors here are current, valid until proven otherwise and need a public airing. I thank Peter Brown and Mike Morwood for their robust reply.

I am willing to accept further serious contributions to this debate, subject always to editorial approval, for inclusion in our next issue, but will draw a line under this discussion after that - pending, of course, further news from Liang Bua cave



Rendering of *Homo floresiensis*, Flores, East Indonesia; archaeological find featured in National Geographic Channel programme to air early 2005. Artwork by Peter Schouten

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When *Homo floresiensis* turned up so startlingly and unexpectedly, to see it as the descendant of *Homo erectus* - well-known from the Pleistocene of Java, just a few islands further west - seemed the obvious explanation. But I wonder if that is right?

We are handicapped by the unprecedentedly tiny size of *Homo floresiensis*. Pygmy people of today are nowhere near as small - the mean stature of Bambuti men (who live in the Ituri forest of central Africa) is about 145 cm, of women about 138 cm. Their femur and pelvis are exact miniatures of those of large people. The femur of *Homo floresiensis*, on the other hand, has a small head and long neck, like australopithecines and *Homo habilis*; the pelvis is flared, as in australopithecines (that of *Homo habilis* is unknown). On the face of it, *Homo floresiensis* might seem to be descended from something like *Homo habilis*, not from *Homo erectus* whose pelvis and femur are quite different, more 'modern' in part; but there remains the possibility that below a certain body size some new biomechanical relationship might hold, so the resemblances to pre-erectine species could be spurious.

There are other features that also suggest a pre-erectine ancestry for *Homo floresiensis*. One of these, to which the describers draw attention, is the

shape of the mandibular symphysis (the joining of the two halves of the lower jaw - where modern humans have the chin); they find its greatest similarity to australopithecines. Another is that the lower premolars have two roots or a partially fused condition called Tomes' root. *Homo sapiens* almost always has just one root; a few jaws ascribed to *Homo erectus* have double or Tomes' roots, but these jaws are rather unusual and some do not believe that they are actually *Homo erectus*.

Lastly, the cranial capacity is 380 cc, which is chimpanzee-sized. The brains of large species are, of course, larger than those of their small relatives, but not proportionately so; if this relationship holds for size reduction, too, then 380 cc is much smaller than you would expect for a descendant of *Homo erectus*.

Yet we keep coming back to this problem: *Homo floresiensis* is much smaller than any other Pleistocene hominin, and extrapolation of expected morphologies beyond known size ranges is dangerous (except as a working hypothesis). All I can say is that, like some other commentators, I am not entirely comfortable with the hypothesis that it is a descendant of *Homo erectus*, and suggest that we might look closely at *Homo habilis* as an alternative ancestor.

Flores human may be pathological *Homo sapiens*

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The diminutive partial human skeleton from Flores in Indonesia, Liang Bua 1 (LB1) (Brown et al 2004; Moorwood et al 2004) raises a number of morphological, neurological, evolutionary and cultural questions. The conclusion is drawn that a new species of *Homo*, descended from *H erectus*, developed as a dwarfed form surviving until the late Pleistocene or Holocene.

Associated stone tools that cannot be excluded from the lithic kit of *H sapiens* are assumed to derive from much older stone tools from Flores and raise questions about a possible parallel development of two specific lithic trajectories. Assumptions and deductions about the cranial capacity of the individual (380 ml) effectively debase palaeoneurological picture drawn from the last

50 years of research with human fossil remains.

We suspect there may be a simple explanation for all these conflicting problems. Microcephaly, a growth disorder of multiple aetiology, producing short individuals with normal-sized faces and very small braincases, may be fairly common in some populations (1 out of 2000) and is known from archaeological finds (Aufderheide & Rodriguez-Martin 1998). Measurements of the LB1 skull (Brown et al 2004, Supplementary) indicate that dimensions of its face, nose and jaws fit within the normal 3 standard deviations range of modern humans, but the measurements of the braincase fall a long way below the normal range (figure 1). This is consistent with appearance of skulls of adult *H sapiens* who suffered secondary microcephaly. A number of such skulls of microcephalics were described from archaeological material from the Americas, Africa and Europe dating back as far as Magdalenian Period (Aufderheide & Rodriguez-Martin 1998). Some had, like a female from central Europe, cranial capacities as small as 355 ml (Dokladal & Horackova 1994). Measurements of a ~4 ka old (Minoan period) microcephalic skull of a young adult male from Crete (Poulianos 1975) were carried out by the same technique as those of LB1 and 15 of them can be directly compared (figure 1). Not a single dimension of the two skulls differs by more than 2.5 standard deviations, indicating that they may come from the same population.

Thus we cannot reject a null hypothesis that both skulls belonged to microcephalic individuals of *H sapiens*. Moreover, both LB1 and the Minoan microcephalic have unerupted third molars. The preserved right lower second premolar (P4) of the Minoan skull shows crowding while the right lower P4 of LB1 was absent and its upper P4s are rotated. Both individuals have crowding of the mandibular incisors. This signifies similarity of orthodontic problems, probably related to poor growth of the mandible. The receding chin of LB1 is consistent with the recession of chins of microcephalics (Aufderheide & Rodriguez-Martin 1998), another manifestation of poor mandibular growth. If LB1's skull is not that of a new species but a pathological example of *Homo sapiens* the question arises as to what, if any, subgroup of *sapiens* the individual belongs. Brown et al (2004) mention a number of features - dolicocephaly, infraorbital fossa, supraorbital torus, occipital torus, vault thickness, obelionic flattening, mandibles with negative chins and

symphyseal recession - all of which fall within the broad features of Australomelanesians (Larnach & Macintosh 1966, 1970, 1971), precisely the form to be expected in late Pleistocene Indonesia.

Although no postcranial skeleton of the Minoan individual has been preserved, it was buried in a very small larnax (container), almost one fourth of the size of normal ones suggesting short stature (Poulianos 1975). Deeper down in the Liang Bua cave a forearm bone, a radius, was discovered. Its reported length of 210 mm (Brown et al 2004) corresponds to a stature of 151-162 cm, depending on method of reconstruction. Even if limb proportions of ancient people on Flores were somewhat different from present-day reference samples for stature reconstruction, this is by no means a dwarfed stature, especially in a tropical zone. A skeleton dated at about 3.5 ka BP found in Liang Toge cave, also on Flores, had delicate bones and short stature of 148.4 cm while its cranial capacity of 1204 ml was normal (Jacob 1967). Fragments of skeletons of other individuals found in the Liang Bua cave seem not to be diagnosable (Moorehead et al 2004).

Until more reasonably complete skulls and skeletons of the purported 'new species' are discovered, a hypothesis that a relatively common pathological condition known to have occurred in the terminal Pleistocene (Aufderheide & Rodriguez-Martin 1998) was responsible for the peculiar appearance of the LB1 cannot be rejected. It seems more consistent with the context of the site, its dating and artefacts.

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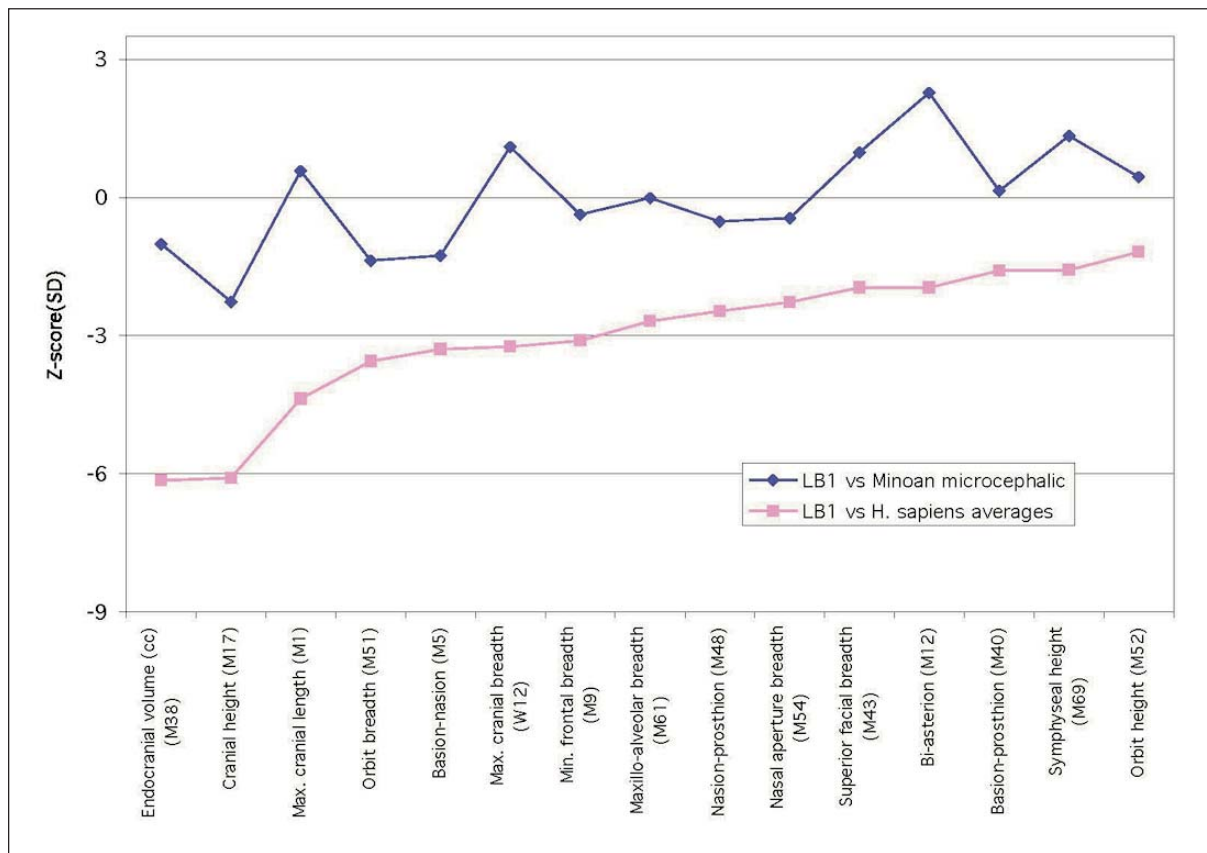


Figure 1 Comparison of 15 dimensions of the braincase and face of LB1 with averages for *H sapiens* pooled sample (Brown et al 2004, Supplementary) and with dimensions of microcephalic skull from Minoan Crete (Poulianos 1975). Z-scores calculated by subtracting comparative data from LB1 dimensions and dividing them by standard deviations for the *H sapiens* pooled sample

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The discoveries at Liang Bua are rightly regarded as exciting and challenging and whilst the discussion over the hominin is centre stage it is also worth considering the nature and implications of the associated archaeology. There is one other example of a non-modern human contemporary with ourselves and there the overlap shows not just in skeletal evidence but also in associated industry, the Mousterian/Middle Stone Age. Questions of the cultural behaviour and development associated with each hominin type come into sharp contrast only through the middle to upper Palaeolithic transition. The Flores finds report a rich lithic assemblage associated with a premolar of *H floresiensis* and a dwarf Stegadon fauna. The more complete

skeleton is associated with 32 lithics. There is no evidence for deliberate human burial or items that could be considered 'art'. Whilst some will question the association of the industry with the hominin evidence, the most economical interpretation, in the absence of evidence for the presence of modern humans, is that *H floresiensis* is responsible for the industry. Typically for Southeast Asian Palaeolithic contexts, the industry does not show significant development of tool types or systematic reduction but the presence of some blades, both large and small, and a few retouched tools would fit evidence of similar date for elsewhere in Island Southeast Asia. This industrial form may be regarded as being a minimal investment in lithic technology by a

mobile and flexibly adapted social group. This minimal investment is sufficient for achieving the needed sustenance and is probably linked to the extensive use of non-lithic technology in food gaining. However, Morwood et al do suggest more developed hafted 'big-game' hunting equipment is used. The assemblage is large and offers an unequalled opportunity to examine reduction and use in a Southeast Asian context. It is notable that at a site such as Niah, Sarawak, Borneo, the total struck stone artefact count is less than 1,000 despite the c 40, 000 years of intermittent activity. The Niah site has been taken to represent a stratified sequence showing chronological development through time and is associated with anatomically modern humans. The sector IV collection of Liang Bua numbers c 5500 artefacts per cubic metre. This assemblage, therefore, represents a significant opportunity to test assumptions made about the nature of lithic adaptations in Southeast Asia. The publication of the fauna with evidence for the 'big-game' hunting linked to

technological and functional analysis of the lithics would be the archaeological equivalent of the debate about the hominin. Additionally, the role of hunting in the extinction of the dwarf Stegodon has been raised and needs further work.

The earliest industry so far recorded (c 0.88 – 0.80 Myr) for Flores, from Mata Menge, is physically larger and appears less patterned than that of Liang Bua and there is currently a huge chronological gap between the two assemblages. The question of the cultural abilities of the associated hominins needs direct examination through technological and functional studies. If *H floresiensis* is responsible for the industry at Liang Bua then it seems to have successfully paralleled lithic adaptation elsewhere in the region. Simple links between physical hominin type and lithic industry again should be questioned. Stone tools appear to under-represent the cultural and adaptive capacities of hominins in most cases.

Comments from Peter Brown and Mike Morwood

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Comments on Groves

The possibility that the LB1 skeleton, and LB2 premolar, represented the migration of an early, pre-*erectus*, small-bodied and small-brained hominin were considered during the writing of the *Nature* paper. However, at present the evidence is less convincing than an association with *Homo erectus*. For instance, while double rooted, and Tomes rooted, mandibular premolars are the primitive condition for australopithecines and early *Homo* they are more common in Javan *H erectus* and Dmanisi *H georgicus/erectus*, than Groves is aware. While there are some similarities in the morphology and size of the femur and pelvis with *Australopithecus*, there are many detailed differences from the Hadar and Sterkfontein innominates and femora (Johanson, Lovejoy et al 1982; Kibii & Clarke 2003). It needs to be remembered that modern humans are a compromise between the gynaecological demands of giving birth to large brained offspring and the functional requirements of bipedal locomotion. Given that both *Australopithecus* and *Homo floresiensis* gave birth to small brained infants, and were both bipedal, you would expect some structural

similarities in the pelvic region, with implications for hip and knee morphology. As for whether you would predict a brain size of 380 cc from a dwarfed *H erectus* it depends upon which *H erectus* you use as a model, and their body size. In this respect it will be interesting when the Dmanisi postcrania are published in the near future. As pointed out in the *Nature* paper reduction of sensory systems, including brain size, in endemic island dwarfs can greatly exceed what would be predicted by allometry (Köhler & Moyà-Solà 2004). Groves concludes by suggesting a closer look at *Homo habilis* as a potential ancestor for *H floresiensis*. Depending upon what you include, or exclude, in the broad *H habilis* grab bag, the dental proportions and facial anatomy of this 'species' are generally more similar to australopithecines than they are to the more derived facial and dental features in *H floresiensis*. Recent research by McHenry and co-workers (Haeusler & McHenry 2004) is also suggesting that *H habilis* had body height closer to modern humans than australopithecines. We do, however, agree with Groves in the difficulty imposed by working with a hominin of

such extremely small body size. To what extent observed morphology is indicative of primitive retentions, allometry, or less predictable results of

Comments on Henneberg and Thorne

This is an extremely poorly informed, and ill designed, piece of 'research' and could not have been published in a substantial peer reviewed journal. The authors have either not read the article upon which they are commenting, or have a very limited knowledge of hominin evolutionary anatomy, perhaps both. The authors suggest that one possible explanation of LB1, particularly brain size and facial proportions, is a pathological modern human. Leaving aside the consistent evidence we have for at least seven individuals with similar body, dental and facial proportions from Liang Bua, what are the chances that this is some form of modern human? The answer is none, with a simple example provided by the well preserved mandible. As described in our *Nature* article the mandible combines a symphyseal region without a chin and prominent superior and inferior tori on the posterior symphysis (most similar to *Australopithecus* and not in the human range of variation), double rooted and Tomes rooted mandibular premolars with molariform crowns (some Javan *H erectus*, *Homo georgicus*, early *Homo* and australopithecines), multiple

Comments on Reynolds

Further excavations were undertaken at Liang Bua this year. On the basis of a longer stratigraphic section, we now know that there were relatively few stone artefacts associated directly with the partial skeleton of *Homo floresiensis*, because the corpse was rapidly buried in the muds of a small water body against the east wall of the cave. High artefact densities are not anticipated in such a depositional context. However, occupation floors with high stone artefact and bone densities occur in adjacent and slightly younger deposits in this section of the cave – again the only associated hominin remains are all *Homo floresiensis*. The first evidence for modern humans only occurs above massive tuffaceous silts dated to around 12,000 years ago, which appears to have been an extinction event for *Stegodon* as well as

insular dwarfing will remain unclear until the putative large bodied ancestor is found.

mental foramina (Asian *H erectus*), small incisor teeth and a tooth row which narrows anteriorly (early *Homo* and australopithecines), and a ramus which is large relative to the tooth bearing segment (many pre-sapiens hominins). Contrary to Henneberg and Thorne the incisors are not crowded, both third molars are present, and the interproximal facets on adjacent teeth indicate that the right second premolar was lost during life. The only unusual dental trait is the rotated maxillary second premolars. As one of the Dmanisi *H erectus* crania also has a rotated second maxillary premolar the authors may also like to consider that these relatively small-brained hominins are also pathological. The combination of mandibular traits in LB1 is not present in any *Homo sapiens* mandible, pathological or otherwise. The proposition becomes even more remote when the other distinctive attributes of the LB1 cranial and postcranial skeleton are considered, and brain size, endocast morphology, skeletal proportions and facial anatomy, do not have any of the distinctive traits of primary or secondary microcephaly (Graham & Lantos 2001).

well as for the endemic, dwarfed hominin species.

We concur with Reynolds that this represents an ideal opportunity to see if, and how, the replacement of one hominin species by another is reflected in the stone artefact sequence. Mark Moore, a PhD scholar at the University of New England, is currently completing such an analysis on the Liang Bua material, while Adam Brumm, from the Australian National University, has just commenced a comparative technological study of stone artefacts from the 840,000 year old Mata Menge site, located in the Soa Basin of Central Flores about 50 km to the east (Morwood et al 1998). The work is still in progress but there are clear continuities as well as differences between the two stone artefact assemblages.

[references follow on page 7]

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