Paleoanthropology

The dawn of *Homo floresiensis*

New fossil findings from the Mata Menge site demonstrate that *Homo floresiensis* lived on the Indonesian island of Flores at least 700,000 years ago, and may point to its rapid dwarfism from the larger *Homo erectus*. See Letters p.XXX & p.YYY

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Since the first description of *Homo floresiensis* was published in 2004 (ref. 1), these little hominins have raised very big questions. Do these skeletal remains represent a new species in the extinct hominin family or are they from modern humans that were pathologically dwarfed or members of a low-stature population? If they belong to a different species, what was its evolutionary origin? Why was it so different from other hominin species? The most common answer to these questions has been repeated for more than ten years: we need more remains from Flores, especially from different sites and older time periods, to form a judgement. On pages XXX and YYY of this issue, van den Bergh *et al*.[2] and Brumm *et al*.[3] report on the finding of those long-awaited remains.

After the definition of *H. floresiensis*, many paleoanthropologists embraced the idea of a new and odd-looking hominin species with a diminutive brain and body size. Supporters of the pathology hypothesis, however, have been unrelenting in looking for syndromes and conditions that could be responsible for the unexpectedly small size of these hominins; some suggestions have been published quite recently[4]. The new findings — consisting of a lower-jaw fragment, an indeterminate cranial fragment and some small teeth from at least three different individuals — confirm beyond any reasonable doubt that *H. floresiensis* is a distinct hominin species with deep evolutionary roots that trace back more than 700,000 years.

Comparisons with other hominin species made by van den Bergh and colleagues as part of their detailed analysis of the size and shape of the fossils from Mata Menge show that such tiny teeth

are only found in *Homo sapiens*, whose origin and migration to Asia are substantially later than the age of the new fossils, and in *H. floresiensis*. Brumm and colleagues describe the open grassland habitat and simple stone tools associated with these hominins. They describe these tools as technologically similar as the ones found in later *H. floresiensis* from the Liang Bua site, which, in the opinion of the authors, points to the behavioural stability of the hominins from Flores over a long period of time. In addition, Brumm *et al*. use a combination of different dating techniques to provide evidence that the fossils were deposited around 700,000 years ago, thus confirming the early origin of this species.

Although this confirmation finally ends the debate about the validity of *H. floresiensis* as a species, its evolutionary origins are likely to remain under discussion for much longer. There are two main models (Fig. 1). *H. floresiensis* may have evolved from the larger *Homo erectus* through a process of island dwarfing — an extreme reduction in size owing to the absence of predators and resource scarcity that is typical of island ecosystems. Alternatively, it may have descended from the earlier *Homo habilis* or even from a small form of hominin from the *Australopithecus* genus. This second model implies that very primitive hominins would have had to leave Africa by 2 million years ago, but there is no fossil or archaeological evidence for such an early dispersal.

Based mostly on the morphology of a lower molar tooth and on general affinities of the jaw fragment, van den Bergh and colleagues claim that the remains from Mata Menge are more closely related to *H. erectus* than to *H. habilis*. The reliability of lower-molar morphology to assess species' relationships supports their claim[5]. However, the traits that point to a more primitive ancestor for *H. floresiensis* mostly come from body parts other than the skull[6,7] and cannot be assessed using the Mata Menge sample, which does not include such postcranial remains.

Without further fossil evidence, the discussion between proponents of the two models will continue. Some will think that extreme dwarfing from *H. erectus* is unlikely, especially to the dramatic extent of brain-size reduction that is observed in *H. floresiensis*[8]. Others will argue that a long-distance migration route from Africa to Southeast Asia of *H. habilis* or an earlier form is

even more implausible. For now, it seems that all possible explanations remain outside the comfort zone of classic scenarios of human evolution.

Van den Bergh *et al*. and Brumm *et al.* propose that the hominins from Mata Menge may descend from the hominins that made stone tools at the site of Wolo Sege[9], also in Flores, which is dated to approximately 1 million years ago. They further hypothesize that large-bodied *H. erectus* hominins are the ones who made these tools. This speculation could be proven wrong if remains from other small hominins were found with the tools in the future, but it raises the interesting question: can the extreme reduction in brain and body size of *H. floresiensis* have evolved over a mere 300,000 years?

Three hundred millennia may not look like a 'short' period of time to many readers. However, no other such dramatic transformation in hominin evolution is known to have occurred over a similarly brief time scale. A quantitative analysis and comparison of evolutionary rates across different hominin species and with *H. floresiensis* would lend formal support to this informal observation. Alongside such quantification, it might be helpful to look beyond the hominin fossil record. Some mammals show evidence of even stronger degrees of dwarfing over substantially shorter periods of time, and extremely fast rates of size reduction in island environments[10,11]. In addition, we must not rule out the possibility that the direct ancestors of *H. floresiensis* were not the most typical representatives of their species. Indeed, the strange combination of primitive and derived traits in *H. floresiensis* anatomy could be the result of a pronounced founder effect, which occurs when a new population is established from a small sample of a parental one that does not reflect its diversity and most common traits.

Some scenarios that look mind-blowing from our anthropocentric point of view become underwhelmingly conventional when we expand our horizons. Rapid island dwarfism is not extraordinary in nature, nor is the founder effect or the long-scale migration of species without human-like cognitive abilities. Whatever the actual origin of *H. floresiensis*, we will be much closer to an answer if we look beyond hominins in our search for explanations.

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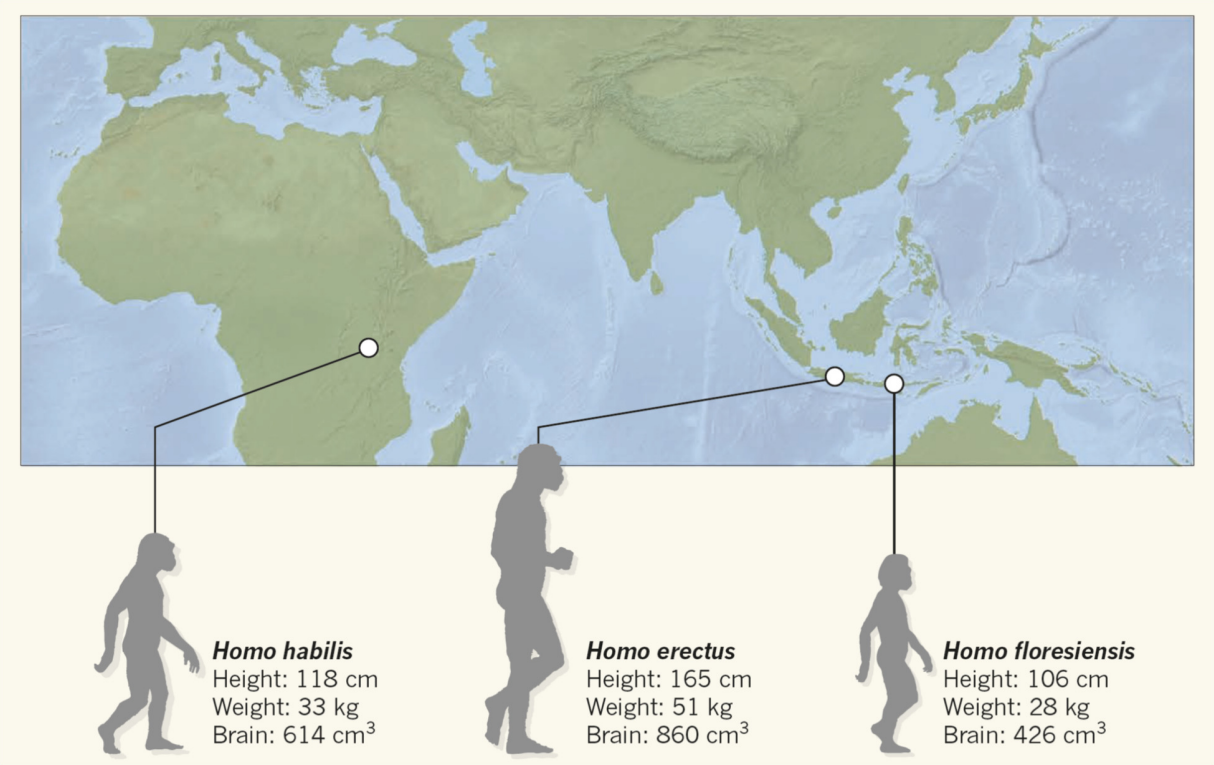

Figure 1 | Candidates for the ancestry of *Homo floresiensis*. There are two main models for the evolutionary origin of the hominin species *H. floresiensis*, which inhabited the Indonesian island of Flores and had a particularly small brain and body size. One possibility is that *Homo habilis*, or a similar form also with a relatively small body and brain size, may have left Africa by 2 million years ago and reduced in size even further. But there is no evidence for such early hominins outside Africa. Alternatively, *H. floresiensis* may descend from the later and larger-bodied *Homo erectus,* for which there is evidence on Java around 1 million years ago and earlier. This second model would involve much stronger body and brain reduction over a much shorter period of time. (Data on brain and body size are from refs. 12–14 and are based on Liang Bua remains for *H. floresiensis*).