

No Hobbits in this Shire

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LB1 in three different views to illustrate facial asymmetry. A is the actual specimen, B is the Right side doubled at the midline and mirrored, and C is the left side doubled and mirrored. Differences in left and right side facial architectures are apparent, and illustrate growth abnormalities of LB1. Credit: A, E. Indriati, B&C, D.W. Frayer

The skeletal remains found in a cave on the island of Flores, Indonesia, reported in 2004, do not represent a new species as then claimed but are some of the ancestors of modern human pygmies who live on the island today, according to an international scientific team.

The researchers also demonstrate that the fairly complete skeleton designated LB1 is microcephalic, while other remains excavated from the site share LB1's small stature but show no evidence of microcephaly, since no other brain cases are known. Microcephaly is a condition in which the head and brain are much smaller than average for the person's age and gender. It can be present at birth or develop afterwards and is

associated with a complex of other growth and skeletal anomalies.

"Our work documents the real dimensions of human variation here," said Robert B. Eckhardt, professor of developmental genetics and evolutionary morphology in the Department of Kinesiology at Penn State. "LB1 looks different if researchers think in terms of European characteristics because it samples a population that is not European, but Australomelanesian, and further because it is a developmentally abnormal individual, being microcephalic."

Teuku Jacob, of the laboratory of bioanthropology and paleoanthropology at Gadjah Mada University, Indonesia, was granted permission to study the original bones by Radien P. Soejono, National Archaeological Research Center, Jakarta, Indonesia. The analysis by Jacob's full research team, including Eckhardt and others mentioned below, demonstrates that claims of a new species -- "Homo floresiensis" -- commonly called hobbits, are incorrect.

Jacob and colleagues found four major areas of evidence where the 2004 evaluation was wrong: geographical factors, craniofacial asymmetry, dental traits and postcranial abnormalities. They discuss these areas in today's (Aug. 21) online edition of the Proceedings of the National Academy of Sciences.

Those proposing a separate species had claimed that early human ancestors, *Homo erectus*, traveled to the island about 840,000 years ago and evolved into "Homo floresiensis," based on the discovery of stone tools on the island. This claim assumed that there was no subsequent human migration to the island until after "Homo floresiensis" died out about 15,000 years ago. Jacob and colleagues contend this is false since pygmy elephants (*Stegodon*) arrived on the island at least two separate times, and during periods of low sea levels Flores was isolated from other islands by only a few kilometers, as shown by K. Hsu, of the

National Institute of Earth Sciences, Beijing. Repeated influxes by later humans not only were possible, but likely.

For LB1'S cranium, face, dentition and skeleton, they find that many of the key features previously said to be diagnostic of a new species still are present in the Rampasasa pygmies on the island today, along with evidence for growth abnormalities.

One error made in the earlier proposal of a new species was that "comparisons of LB1 were made mostly with Homo sapiens from other geographic areas of the world, principally Europe," the researchers noted. "Yet it would have been logical even for a supposedly novel human species from the Australomelanesian region to have been compared with other human populations, present as well as past, from that region," they added.

"To establish a new species, paleoanthropologists are required to document a unique complex of normal traits not found in any other species," said Eckhardt. "But this was not done. The normal traits of LB1 were not unique, and its unusually small braincase was not normal."

To study LB1's traits, 94 cranial features and 46 features of its mandible were compared to values for modern humans. All fell within the normal range of variation for Australomelanesians. Two anatomical details, particular grooves in the cranial base singled out as "not seen in modern humans," in the 2004 new species announcement are commonly found in Australian and Tasmanian crania, according to Alan Thorne, archaeology and natural history, Research School of Pacific and Asian Studies, Australian National University, Canberra.

Dental configuration also can be used to designate a new species. The original researchers argued that a CT scan showed the absence of a third molar and that there was some atypical positioning of other teeth.

However, Maciej Henneberg, anatomical sciences, University of Adelaide, Australia, and ETTY Indriati, laboratory of bioanthropology and paleoanthropology, Gadjah Mada University, found an existing socket and a tooth fragment in the space where the molar supposedly was missing. The unusually positioned teeth were there, but such teeth also are found in a sample of Rampasasa pygmies who still live on Flores.

LB1 is short in stature and has a small brain, but rather than a sign of a new species, the researchers consider this to represent microcephaly. The ratios of LB1's cranial capacity and stature are similar to ratios found over several generations in some 20th-century families of microcephalics.

Understanding normal biological development may be the key to showing that LB1 really is pathological. Of 184 syndromes that include microcephaly, 57 also include short stature; some also include facial asymmetry and dental anomalies. Henneberg noted that "while we do not in this paper diagnose the specific syndrome present, many characteristics point to an abnormal developmental disorder."

To visualize the facial asymmetry, David W. Frayer, professor, department of anthropology, University of Kansas, composed split photographs of LB1's face, combining two left or two right sides as composite faces. The dissimilarities from the original face and between the two left or right composites were striking. To quantify these differences the researchers compared left and right side measurements on the original face.

"I was looking for a standard of how much asymmetry was normal and eventually found a review article covering dozens of papers, some published nearly a century ago in England's prestigious Galton Laboratory" said Eckhardt. "While most faces are not perfectly symmetrical, asymmetry of the facial skeleton that exceeds about 1

percent is unusual."

He and Adam J. Kuperavage, graduate student in kinesiology at Penn State, found that six of seven measurements were larger on LB1's right side by as much as 40 percent, while the seventh was 6 percent larger on the left. LB1's craniofacial asymmetry indicates that this individual was not developmentally normal.

Another supposed indication of a new species was the unusual robustness of the leg bones. "CT scans show that the cortex, the outer solid bone, is very thin, not robust at all," said Henneberg. "The bone is thin and straight. The attachment of the muscles suggests muscle paralysis."

Eckhardt found that the low degree of humeral torsion -- twisting of the upper arm bone between the shoulder and elbow -- also was not a sign of a new species, but of developmental problems. The normal humeral torsion for a human is about 142 degrees, but LB1 has only 110 degrees of torsion. However, humeral torsion is influenced by both genetic and developmental factors, with about two thirds coming from inherited programming and one third from use. With disuse, torsion is usually only about 110 degrees. Both humeral torsion in the arm and the muscle markings on the femur and tibia in the leg indicate an individual with movement disabilities.

While other skeleton parts were found with LB1 in the same cave, no other cranial parts attributed to this population were unearthed and LB1 is the only reasonably complete skeleton.

The researchers conclude that "the LB1 individual exhibits a combination of characteristics that are not primitive but instead regional, not unique but found in other modern human populations, particularly some still living on Flores, and not derived but strikingly disordered developmentally.

"LB1 is not a normal member of a new species, but an abnormal member of our own," said Eckhardt.

Source: Penn State

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