

The Hobbits

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A woman, about 35 years old, lies dead in a cave on the Indonesian island of Flores. She is peculiarly small by modern-day standards. Though an adult, she is only three and a half feet tall and has a head about the size of a grapefruit. Her feet, however, are exceptionally long and flat. Each foot measures seven and a half inches or one fifth her total height. The woman lies on a gentle slope, and as the years go by, falling dust from the cave wall covers her entire body.

The woman lies buried until a team of Australian and Indonesian scientists uncovers her fragile bones 18,000 years later, in September 2003. Led by Peter Brown of the University of New England and Michael Morwood of the University of Wollongong, the scientists named her LB1 for the Liang Bua cave where she was found [1]. Her short stature and large feet soon earned her the nickname “hobbit,” after the small creatures in J.R.R. Tolkien’s fantasy stories.

Scientists are slowly writing their own story for LB1 and the eight other hobbits whose bones have been found on Flores. They have struggled to determine the evolutionary relationship between the hobbits and modern humans.

Modern humans, *Homo sapiens*, evolved in Africa 200,000 years ago from a much older species called *Homo erectus* [2]. Over the next 150,000 years, *H. sapiens* migrated out of Africa into Europe and Asia, eventually displacing all other *Homo* species.

The majority of anthropologists now believe that the hobbits, who lived until 12,000 years ago, were exceptions to the *H. sapiens* takeover [3]. While these anthropologists argue that hobbits and *H. sapiens* are two different species, a vocal minority maintains that the hobbits were genetically deformed *H. sapiens*.

Critics point out that the last species which had a brain as small as LB1’s became extinct several million years ago [4]. They remain skeptical that an obscure and primitive island

species could have lived as recently as 18,000 years ago.

The implications of this debate extend far beyond the hobbits themselves. The hobbits challenge the basic notion that human evolution has been a direct progression towards larger brains and bigger bodies. Instead, “the evolutionary tree is more like a bush,” said Mike Morwood, one of the first to discover LB1’s body on Flores.

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Scientists have excavated Flores for human fossils as far back as the 1960s. Before Morwood began his research there, anthropologists had only been looking for evidence of modern humans on the island. Surprisingly, their work unearthed animal bones with cut marks and stone tools that were dated to 840,000 years ago [5].

Since anthropologists knew *H. sapiens* had first reached Australia 50,000 years ago, the findings piqued Morwood’s interest in Flores as a pit stop along *H. sapiens*’ haphazard, accidental journey from mainland Asia to Australia.

Morwood originally wanted to find the individuals who made those 840,000-year-old stone tools, but six meters into the ground, he and his team found LB1 instead. Morwood was immediately struck by the skeleton’s strange dating. Anatomically, she should have been several million years old, but testing showed she was only tens of thousands of years old.

Morwood and his collaborators were incredulous at first. “Either the dating was wrong, or there had been some moving around,” said Peter Brown, Morwood’s close colleague and co-author of the original discovery papers.

Brown, an expert on hominid skeletons, received hastily taken pictures of LB1 soon after the skeleton’s discovery, but he initially could make little of the small body. “It could have been anything. It could have been an urn with two sticks attached,” he said. However, he was intrigued enough to fly to Indonesia and examine LB1 himself. In Indonesia, he was the first to measure and discover LB1’s small brain capacity [6].

After studying her skeleton for a week, Brown and Morwood determined that LB1 did not belong to *H. sapiens*. The hobbit’s brain was too small to be a modern human while the rest of her skeleton – jaw, arms, and legs – were more primate-like than human.

Describing their discovery in a 2004 issue of *Nature*, Brown, Morwood, and their co-authors named LB1 *Homo floresiensis*. *H. floresiensis*, they said, shared an ancestor with *H. sapiens*, but was itself a distinct species. The authors argued that



The cave where the specimens were discovered. Reproduced from [17]



Fragments. Reproduced from [18]

the hobbits were different from modern humans because they evolved to be smaller and shorter.

Their conclusion was contested from the start. Teuku Jacob, a renowned Indonesian anthropologist at Gadjah Mada University, was one of the first to challenge Morwood and Brown's separate-species theory [7]. Besides disagreeing with Brown and Morwood's scientific analysis, Jacob also felt that the Australians had unfairly benefited from Indonesia's fossils [8]. Shortly after the 2004 Nature papers were published, he requisitioned LB1's bones to his lab at Gadjah Mada University and persuaded the Indonesian government to temporarily halt further excavation on Flores [6].

Teuku Jacob was convinced from studying LB1 that she had been a *H. sapiens* individual suffering from microcephaly, a developmental disorder which shrinks the brain. Over the five years since the discovery of LB1, scientists from Australia, America, and Israel have also expressed dissatisfaction with the theory that hobbits were a separate species which somehow retained million-year-old body features

into modern times [9].

The hobbits do seem like a fantastical thought experiment come to life. Take a brain that is one-third the size of a *H. sapiens* brain but give it the ability to use equally sophisticated tools. The cave where LB1 was found was also littered with charred animal bones and small stone tools [10]. The bones and tools indicated that Floresian hobbits kindled fire, fashioned weaponry, and hunted animals just as *H. sapiens* were doing at the time. Like Mary Poppins' magic black bag, the hobbits' brains were able to store the same amount of information in much less space.

However, critics of the separate-species theory maintain that only *H. sapiens* was intelligent enough to make the tools in LB1's cave. Robert Martin, professor and curator of biological anthropology at the Field Museum in Chicago, notes that the stone tools in LB1's cave were carved with a technique that has only been attributed to *H. sapiens* [9]. "Nobody has ever explained the small brain to my satisfaction," he said, "and nobody has explained those stone tools to my satisfaction."

Martin's initial reaction to the LB1 discovery was to graph LB1's brain size with all known human and primate brain sizes. "You would have to go back three and a half million years to find a brain that small in hominids," said Martin, referring to the group of animals which include chimpanzees, gorillas, and humans. But at 18,000 years old, LB1 is young by evolutionary standards. To Martin, this disparity suggests that hobbits were deformed *H. sapiens* and not another species. "When I first saw the tiny size of the brain, I immediately knew there was something wrong with the original analysis," he said.

The debate over the hobbits has volleyed across the pages of many scholarly journals. In a 2006 paper, Debbie Argue of Australian National University compared LB1's skull with a range of skulls from human to chimpanzee. She concluded that LB1's skull was much more similar to primate skulls than to normal or microcephalic human skulls [11]. In a paper later that year, Robert Martin criticized Argue's choice to only use a child microcephalic skull. He pointed out that skull shapes range greatly among different types of microcephaly, especially between child and adult microcephaly [12]. The possibility that LB1 suffered from a different form of microcephaly, Martin maintains, "is simply being ignored."

Despite Martin and his colleagues' conviction, they are in the clear minority. Research within the past two years has only reaffirmed the hypothesis that the hobbits were not *H. sapiens* but offshoots from a more primitive hominid line.

In 2007, Matt Tocheri of the Smithsonian Institute

“ The hobbits seem like a fantastical thought experiment come to life ”

published a paper which described how a key wrist bone in LB1's skeleton was not boot-shaped like *H. sapiens*' but wedge-shaped like a primate's [13]. He later collaborated with William Jungers of Stony Brook University on a paper about LB1's foot. Those seven-and-a-half inch feet, they concluded,

were too long and flat to have been human [14].

Together, Tocheri and Jungers created a partial picture of how LB1's body worked. Though LB1 could hunt like *H. sapiens*, her primitive features probably made it harder



H. floresiensis skull. Reproduced from [19]

to do so. She was not as good at gripping tools because her primate-like wrists were less efficient at moving her thumbs. She also could not run, since running requires shorter, more arched feet. And though the hobbit could walk, her body was better suited to four-limbed walking. "The same would be true if we tried to do a lot of climbing, or if we tried to knuckle-walk," explained Tocheri.

Tocheri and Jungers convinced many anthropologists who were previously undecided about the hobbits. In an editorial which appeared with Jungers' article, Harvard anthropologist Daniel Lieberman wrote that he and many other scientists had "sat on the fence, waiting for more evidence about the nature and forms of *H. floresiensis*" [15]. With this recent research, he declared that "now we have some."

The recent findings have simultaneously fueled a separate debate among the group of anthropologists who believe that the hobbits were a separate species. Brown and Morwood originally hypothesized that the hobbits came from *H. erectus*, a species which first evolved 1.7 million years ago and eventually gave rise to modern humans [10]. They suggested that the taller *H. erectus* gradually became shorter on Flores because smaller bodies are better at competing for resources on islands. This process, which has also been found in dinosaurs, elephants, and modern humans, is called island dwarfing.

Island dwarfs have smaller bodies but the same size brain as their mainland counterparts [16]. The hobbits, however, have both smaller bodies and brains than *H. erectus*, which suggests they did not dwarf from *H. erectus*. But in 2009, Eleanor Weston of the Natural History Museum in London published evidence that brains can also become smaller in island dwarfing [16]. Weston showed that pygmy hippo brains on Madagascar dwarfed to 30 percent of the brain size of mainland hippos, a scale that is close to the proportion between hobbit and *H. erectus* brains. Perhaps, Weston noted, brain dwarfing occurred in hobbits as well as hippos.

Some are skeptical of the island dwarf theory because hobbits were not just smaller than *H. erectus*; their bodies were also more primitive. Tocheri and Jungers argued in their papers that LB1 looked most like *H. habilis*, an even older human ancestor than *H. erectus*, or *Australopithecus*, a group of hominids which became extinct in Africa around 3 million years ago. According to Jungers, the island dwarf

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theory is problematic because it implies that *H. erectus* also had to "reverse evolution literally from jawbone to toes" in order to evolve into *H. floresiensis*.

But anthropologists aren't placing their bets yet. Most are waiting for more fossils before they can begin piecing together the hobbits' family history. As Peter Brown said, "there's almost nothing between Indonesia and Africa" in terms of the fossil records for *H. habilis* or *Australopithecus*.

There is also hope that researchers will find another skeleton as complete as LB1 on Flores. Finding a hobbit skeleton like LB1's would confirm that she was a normal individual of *H. floresiensis* and not a small-brained anomaly of *H. sapiens*. But skeptics like Robert Martin, who advocate the same species theory, live in hope that they may someday be vindicated. "If they find a skeleton that's a small size but with a normal size brain, then I'm right," Martin said. "I've said my piece about this. My first answer is that we need more evidence." ■

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