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JOINING IN FELLOWSHIP WITH THE HOBBITS

by Matthew W. Tocheri



October 28th, 2004, was a big day for paleoanthropology—the study of human evolution. On that day two papers were published in the scientific journal *Nature* announcing the discovery of what has become known as the “hobbits” of human evolution. With a tiny brain and an estimated height of about three and a half feet, the first hobbit described was an almost complete skeleton recovered from a cave on an isolated Indonesian island. The authors of the *Nature* papers proclaimed that these remains were so different that they represented a new species, *Homo floresiensis*. If that were not remarkable enough, this hobbit was buried deep within the cave and dated to 18 thousand years ago! The shock-waves of this discovery rippled rapidly through the paleoanthropological world as the hobbits took an immediate and well deserved place in the public consciousness.

When I first heard this incredible news, I was standing in a hotel lobby while attending meetings of the Canadian Association for Physical Anthropology. My eyes suddenly caught a

glimpse of a CNN news item trailing across the bottom of a television screen – “New species of tiny humans found on Indonesian island.” I laughed. It had to be a joke. With no other information to go on, I was left somewhat speechless when the item disappeared from the screen without any further follow-up.

Not long after, I ran into some friends who were also attending the meeting and told them of what I had just seen. One of them handed me copies of the *Nature* papers. I sat down and did not flinch until I had read every word. Then I looked up and exclaimed, “Wow! What a wonderful time to be alive!” My friends still make fun of me for my reaction. But if what I had read was really true, then this was one of the most significant events in the entire history of paleoanthropology, and it was all happening while I was a graduate student studying human evolution. Little did I even imagine that my own Ph.D. research, at that time still in an early stage, would eventually bring me face-to-face with these strange hobbits right when I least expected it.

So what exactly is all the fuss about these so-called hobbits? Human fossils have been found regularly for the past hundred years or so. Each of these important discoveries stirs up scientific and public debate. The hobbit discovery, however, has stirred up much more. The main reasons for this

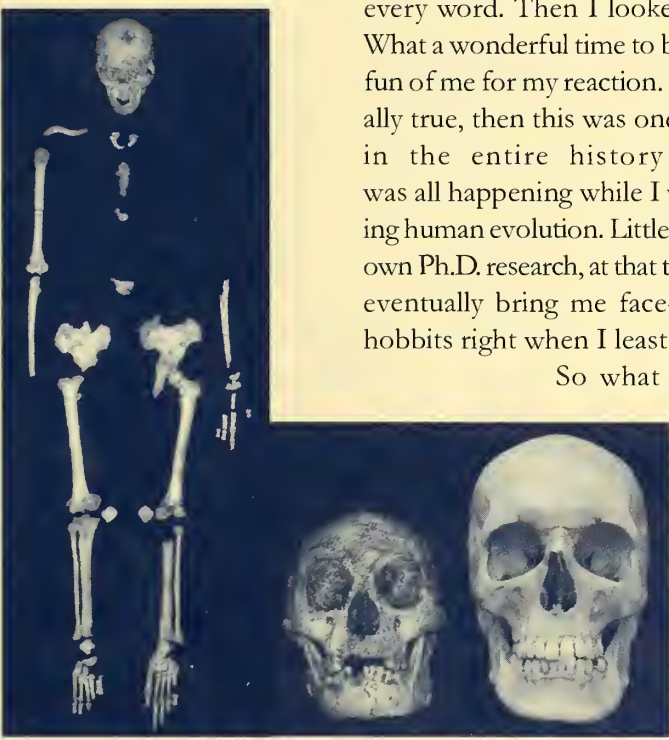


Figure 1. The almost complete skeleton of a hobbit (LB1) (courtesy of Dr. William Jungers). Notice the extremely small skull compared with an adult modern human skull (courtesy Dr. Peter Brown).

are: 1) what they look like (anatomy) (Fig. 1); 2) the objects that are found with them (archaeology) (Fig. 2); 3) where they are found (biogeography) (Fig. 3); and 4) the period of time they are from (geology) (Fig. 4). Their brain is extraordinarily small—less than a third the size of even the smallest modern human brains. They are only about 3 and a half feet tall yet with disproportionately large feet. Stone tools and animal remains are found all around them. Discovered on Flores, a remote island in Southeast Asia, the sediments they come from date to between 95 and 12 thousand years ago, using multiple dating techniques including radiocarbon, luminescence, uranium-series, and electron spin resonance. A completely unexpected discovery! In J.R.R. Tolkien's fictional tale, the hobbits "suddenly became, by no wish of their own, both important and renowned, and troubled the counsels of the Wise and the Great" (1937). These 'real' hobbit fossils have done no less than their fictional namesakes.

In science, trouble fuels controversy, which in turn fuels research. And with research comes answers, or at the very least, reasonable explanations given the available evidence. If the hobbit fossils had been discovered in African sediments dating to around 2 to 3 million years ago, undoubtedly the attention and controversy surrounding them would be far less; more like a television program that airs on a long weekend Saturday afternoon rather than during prime time on a weeknight.

One example is Lucy. The small brain and stature of the most complete hobbit skeleton is fairly similar to that of "Lucy", the most complete skeleton of *Australopithecus afarensis*. Lucy was discovered in Africa in sediments dating to about 3 million years ago. Lucy has fueled her share of controversy over the years because she

showed us that upright walking evolved long before big brains and stone tool use. However, unlike the big controversy surrounding the hobbits, no serious argument has ever been made suggesting that Lucy was a member of our own species with some form of disease, pathology, or growth defect. Instead, Lucy's anatomy is controversial only with regard to which fossil human species she is most closely related to, whom she might be an ancestor of, how exactly she walked on two legs, if she spent a lot of time climbing trees, etc. Her anatomy, in combination with the absence of direct evidence that she used stone tools, is not necessarily unexpected given that she lived in Africa around 3 Ma. But if you take her small brain and stature, add some changes to her teeth and face, and imagine her making and using stone tools on a remote southeastern Asian island as recently as 12 thousand years ago, you guessed it—a huge scientific debate is triggered! Immediately, some very basic ideas about what we thought we knew about recent human evolution are in doubt.

With the discovery of the hobbits, several important questions about human evolution suddenly need reexamination and answers. Are the hobbits really a new human species? Are they pathological representatives of our own species? How and when did they first get to Flores? Unlike Java, Flores has not been connected to the Southeast Asian mainland at any time in the last five million years, and requires two sea journeys (15 miles between the islands of Bali and Lombok followed by 6 miles between Sumbawa and Flores). How did they survive so long after they got there? Did the isolated island of Flores protect them as modern humans began colonizing surrounding islands that were easier to get to? That is what paleo-anthropologists do for a living—they try to answer questions about human



Figure 2. Hobbit stone tools are similar to Oldowan tools in Africa and the Lower Paleolithic in Asia, ca. 2.6 million years ago. They are still made by some human populations today (adapted from Morwood et al. 2004).

evolution based on available scientific evidence. Without a doubt, the hobbits have made for extraordinarily exciting and interesting times for paleo-anthropology.

Forty years before the hobbits burst on to the scene, Louis Leakey showed the first evidence that two fossil human species shared the East African landscape around 1.75 million years ago. Both species

walked upright and had small brains, but Leakey argued that only one was a tool-maker. He declared the large cheek-toothed species an evolutionary dead end (known today as *Paranthropus boisei*) while he named the other *Homo habilis*, the tool-making “handy man” and the direct ancestor of our own species. Since the 1960s, however, the human fossil record has continually revealed evidence that for most of human evolutionary history, there have been two or more closely related fossil human species living at the same time. Even our own species overlapped in time with others, like the Neandertals, for instance. Neandertals had big brains and complex stone tools—quite similar to us in many respects—but the last surviving Neandertals disappeared from Europe 30 thousand years ago. For the past 30 thousand years our species has been alone in the world. Or at least, that is what we all thought before the hobbits said hello.

Most estimates about when our own species first began colonizing Southeast Asia and Australia cluster around 50 thousand years ago. The oldest remains of the hobbits, however, currently date as far back as 95 thousand years ago. Everyone was surprised to hear that these remains were that old. I cannot help but imagine the first modern human mariners who landed their rafts on the shores of Flores looking down in the mud and seeing large human-like footprints yet with noticeably short strides alongside a few dis-



Figure 3. The island of Flores is east of Wallace's Line. Courtesy of Dr. Michael Morwood.

carded pieces of flaked stone. Imagination is make-believe, however, and it's time to focus on what we currently think we know about the hobbits.

Currently, there are at least 12 and possibly as many as 15 individuals represented at Liang Bua, the name of the Flores cave in which they were

discovered. This is more anatomical evidence than what is available for many earlier members of the human evolutionary family. While some of these individuals are represented only by one or two pieces of bone or teeth, others such as the most complete specimen (known to scientists as LB1) are represented by many pieces (Fig. 1). What is interesting is that as short as LB1 appears, none of the other hobbit remains look to be any taller than she was.

Thousands of stone artifacts are found around hobbit remains. Although these artifacts were initially described as quite sophisticated, further detailed study has revealed that they represent a basic approach to flaking stone that is observed throughout the past 2.6 million years (Fig. 2). In other words, the stone tools at Liang Bua are broadly similar to the oldest stone tools ever found (e.g., Oldowan-like tools), but unlike the more sophisticated stone tools made by our own species and Neandertals beginning around 200 to 300 thousand years ago.

Biogeographically, the hobbits are also fascinating. Flores is not an easy island to get to despite not being far away from the Asian mainland as well as other surrounding Indonesian islands. Flores is east of the Wallace line (Fig. 3), a biogeographical barrier that has prevented most animal species living west of it to reach areas east of it (and vice-versa). Areas east of the barrier mostly have animals that are of Australian origin, while those west mostly

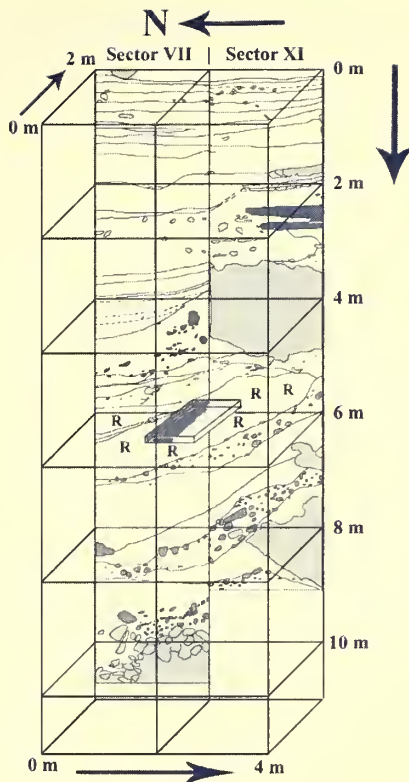


Figure 4. This illustration shows where LB1 was recovered in Liang Bua cave. Sectors VII and XI are 2 by 2 m squares that were excavated to a depth of 11 and 9 m respectively. The 2003 excavation of Sector VII resulted in the recovery of the cranium, mandible, and associated postcranial material of LB1 including the wrist bones (blue area). Subsequent excavation in 2004 of Sector XI resulted in the recovery of additional upper and lower limb elements (yellow area). All of LB1's remains occur within the same layer of clayey silt (Layer R) about 6 m below the surface of the cave. AMS radiocarbon dating of charcoal from Layer R suggests that LB1 died approximately 18 thousand years ago. (Color shown in web version.)

Finally, sediments from different layers in the cave have been dated by several established geological techniques. The various dating techniques give similar results for each geological sample—the oldest layers with hobbit anatomy present are 95 thousand years old, the youngest 12 thousand, and the layer in which LB1 was found, 18 thousand (Fig. 4).

But what about disease, pathology, or growth defect as an explanation for the hobbits? There are still some that remain skeptical that the hobbits represent a separate species of human. Skepticism is an important component

of the scientific process because it ultimately leads to better demonstrations that the perceived facts are what we think they are. In other words, skepticism results in better science in the long run.

have animals of Asian origin. Ocean currents make it even more difficult to get to Flores. These currents tend to flow away from the island rather than toward it. Over the past million years only a small number of animal species have made it to the island and survived for generations afterward.

of the scientific process because it ultimately leads to better demonstrations that the perceived facts are what we think they are. In other words, skepticism results in better science in the long run.

Skeptics in the hobbit controversy suggest that the hobbit remains more likely represent a population of our own species. They explain the small brain of LB1 as the result of microcephaly—a condition in modern humans that results in an abnormally small brain case. The small body sizes are explained as the result of similar ecological factors to those implicated in modern human populations with small average body size (e.g., African Pygmies). Other explanations involve genetically or environmentally-induced metabolic disorders that cause imbalances in the hormones the body needs to grow properly. Thus, because the Flores population may have been isolated, genetic mutations that result in such imbalances may have become more common.

Needless to say, for two years after the initial hobbit announcement, I followed all hobbit-related news very closely. I admit that I did not have particularly strong opinions about either side of the basic argument—are the hobbits a legitimate new species of human, or are they just small modern humans, perhaps with some form of pathology? Either way, I thought it was fascinating. Even finding a three and a half foot tall adult modern human with microcephaly that lived on a remote island in Southeast Asia 18 thousand years ago is still an extraordinary discovery. So I constantly looked forward to hearing about the next installment on the hobbits, whatever it might be.

In between installments, I went about my business diligently collecting data for my dissertation research, which involved studying wrist bones in living and fossil humans and great apes. This included an entire year going through the skeletal collections at the National Museum of Natural History (NMNH) in Washington, D.C. Night after night, I walked up and down the darkened hallways of the museum carrying trays of human, chimpanzee, gorilla, orangutan, and other primate wrist bones back and forth to my small office for study.

After my analyses were complete, I started writing. Writing was relatively straightforward because my results were quite clear and easy to interpret. I had learned that modern humans and Neandertals have very different wrist bones compared with great apes and other primates. Even the handful of wrist bones from *Australopithecus* (at

~3 mya) and *Homo habilis* (at 1.7 mya) looked more like great apes than like ours and Neandertals. But I knew my research was not going to make headlines easily. This was partly because wrist bones are very small and oddly-shaped, and most paleoanthropologists try to stay as far away from them as they possibly can.

However, that all changed one year ago on November 15, 2006. With my dissertation mostly written, I found myself rushing up to the museum's seminar room to be on time for a "hobbit talk" by Lorraine Cornish, a conservator from the British Natural History Museum. She had been sent to Indonesia to help conserve the hobbit remains so that future researchers would be able to study them. I was thrilled to get to hear someone who had actually seen the hobbit remains up close as well as maybe get to see some photos that had not been published before. Imagine my surprise when all of a sudden Lorraine showed a slide of LB1's assembled skeleton (Fig. 1)! That had not been published and it was the first time I realized that hobbit wrist bones had been found. I literally almost fell out of my chair. Next, she mentioned that she made casts of the wrist bones, choosing them because they were small and she had only brought a small amount of molding material! My blood pressure soared. If that was not enough, within minutes she announced that the small container in front of her had the casts inside! It was unbelievable. Suddenly and without warning I—having spent the last five years study-

ing funny-looking wrist bones—was in the same room as wrist bones from Flores. I don't remember much from the rest of her talk, but as soon as she finished, I rushed up and asked if I could open that container.

As the lid slid off, every wrist bone I had ever looked at flashed before my eyes. I did not expect to see what I did inside that container. What I saw is illustrated in Figure 5. It was obvious. These wrist bones did not belong to a modern human; instead, they looked like the bones of African apes and Lucy—exactly like what you would expect the wrist bones of a primitive human species to look like. The hobbits were for real: another human species that survived at least until 12 thousand years ago, sharing this world with us as close evolutionary cousins. I felt my knees begin to buckle beneath me. There I was, joining a fellowship with a hobbit. In return for telling a part of her species story as I now understood it from her wrist, she would help convince everyone of the importance of the wrist for understanding the recent evolutionary history of our own species.

It was almost as if I was present at the council of Elrond at Rivendell as told by J.R.R. Tolkien himself. Everyone was standing, arguing, and shouting at one another over brain size, tools, and pathologies while the hobbit and I sat silently in the shadows, unnoticed by the others. I like to imagine that she turned to me at that very moment and asked, "So are you ready for a little adventure?" Deep down a part of me always wanted to go on an adventure with a hobbit. Like Samwise Gamgee, the gardener caught eavesdropping by Gandalf outside of Frodo's window, I knew my fate was sealed. There was no turning back—I had seen too much. "Why not," I said, noticeably shaken but excited, "Let's go to Mordor!"

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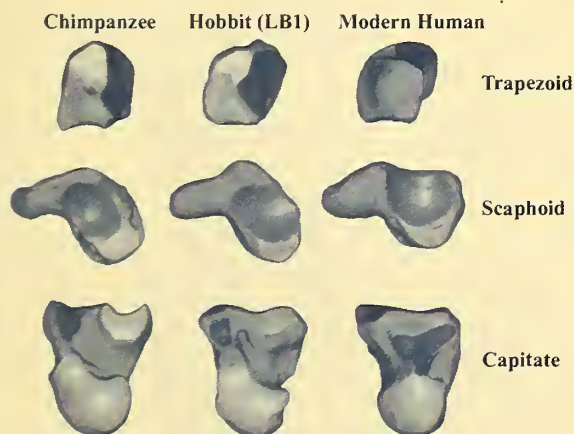


Figure 5. A visual comparison of the hobbit's wrist bones scaled to the same size as those of a chimpanzee and a modern human. The colors indicate the articular and nonarticular bones surfaces.

(continued on p. 11)

(“Hobbits,” continued from p. 5)

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