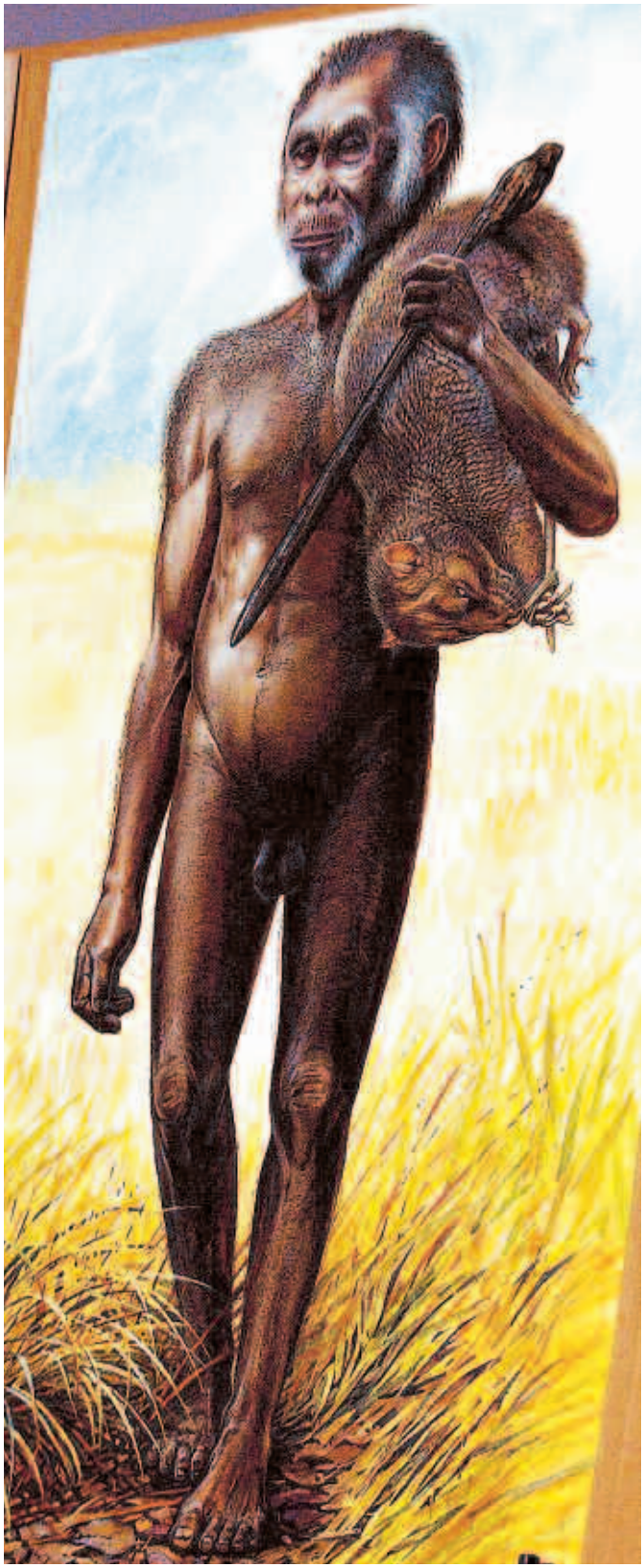
Finding the Hobbit

Chris Turney's expertise in radiocarbon analysis helped date a newly-discovered human species.



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An artist's impression of Homo Floresiensis.

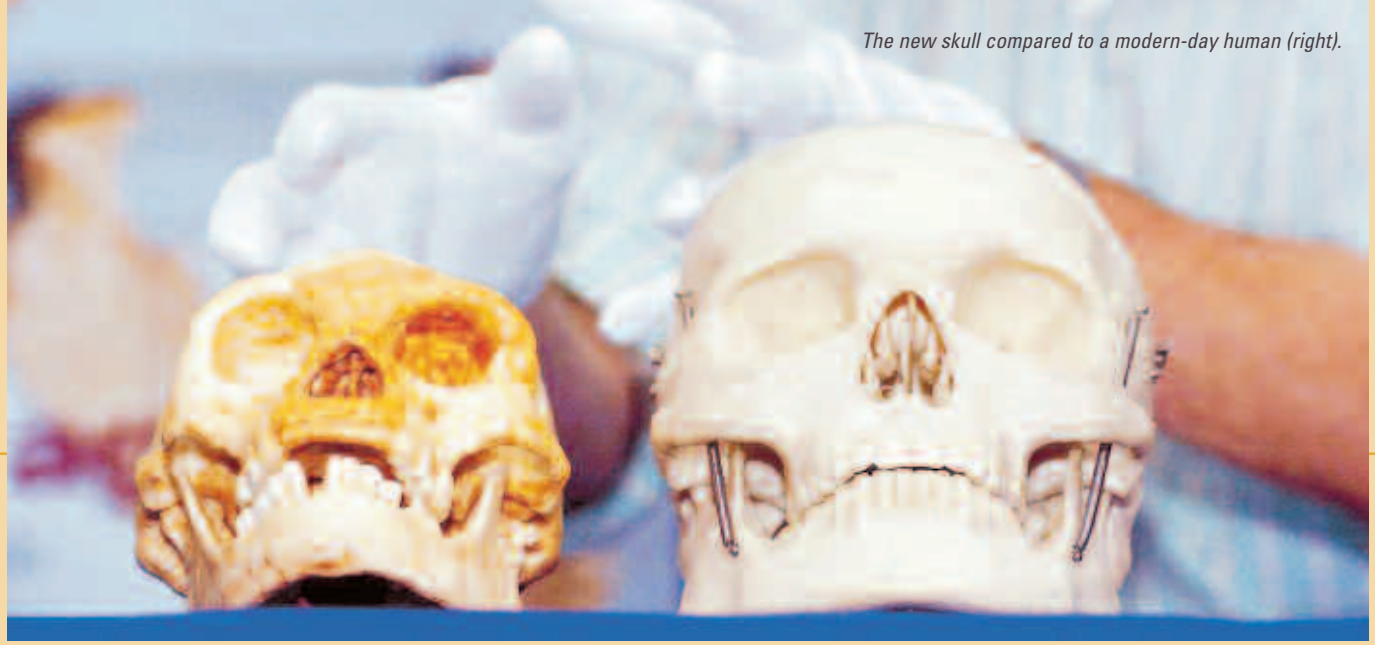
In October 2004, a team of international researchers discovered a new species of pygmy-sized human on the Indonesian island of Flores. The skeleton, which was from a hominid 1m tall, and probably about 30 years old, was quickly nicknamed the Hobbit. The discovery is helping answer questions about humankind's early evolution.

My part in the research was to help date the find. My interest started in 2003. Based at Queen's University, Belfast, I had a NERC Small Grant to look into the timing and environmental impact of the first human arrivals in Australia. I was using a new method developed with an Australian colleague, Michael Bird, to push the limits of radiocarbon dating.

It was in the mid-1940s that the American chemist Willard Libby first proposed that a radioactive form of carbon (radiocarbon or ^{14}C) is naturally produced in the upper atmosphere. He argued that as radiocarbon would rapidly be converted to carbon dioxide and taken up by plants, it should exist in virtually all living matter. Because radiocarbon is radioactive and decays away, by measuring the amount of ^{14}C remaining in dead material it would be possible to backcalculate the age of the sample. By the end of the 1940s, Libby and colleagues were using radiocarbon to make the first independent age estimates of important archaeological sites and samples from around the globe (the work later led to Libby receiving a Nobel laureate in 1960).

At that time, radiocarbon dating went back about 40,000 years. But this was suspiciously close to many of the ages reported for the earliest human occupation sites in Australia. Could it be these ages were an artefact of the dating method and not real? Michael and I developed a new preparation method that took radiocarbon dating back to 60,000 years ago. With the new technique, we confirmed that 'early' humans had definitely arrived in Australia by 48,000 years ago and possibly as early as 60,000 years ago.

Now a dating expert in the UK with a firm interest in early human sites, I was invited by Mike Morwood from the University of New England and Bert Roberts from the University of Wollongong, to join an Australian-led research project looking at the arrival of humans in Indonesia. In collaboration with Indonesian scientists, Mike and Bert had selected sites that spanned both sides of Wallace's Line. Wallace's Line is the most significant biogeographical boundary in Southeast Asia. Throughout the last two million years, at times of low sea level, islands to the west of the 'line' (such as Java) were joined to the Asian mainland, and as a result had very similar wildlife. In contrast, islands to the east (like Flores) continued to be



Johnny Green/PA/EMPICS

The new skull compared to a modern-day human (right).

separated by sea barriers and contained a distinctly different wildlife, more closely associated with Australia. Evidence of human settlements had already been found in islands to the east, indicating that early humans could build boats. The first humans must have migrated across Wallace's Line to reach Australia, and the most likely route was down through the Indonesian Archipelago. By examining early sites in Indonesia we hoped to get a potential minimum age for the first modern humans in this part of the world and the earliest date for their migration to Australia.

On 12 September 2003, the news we had all hoped for arrived. Mike Morwood emailed to say he and colleagues had discovered a hominid skeleton during an archaeological dig in Liang Bua, a cave on Flores, 600 km east of Bali. He wrote:

'In Sector VII, a 2 x 2 metre square against the east wall of the cave, we recovered a complete hominid skeleton from a depth of 5.9 metres, associated with high concentrations of stone artefacts and evidence for intensive hunting of *Stegodon*…. Although adult with worn teeth, the individual is very small (about one metre tall) and its teeth are of unique morphology.'

The finding was to hit the headlines around the world.

The remains indicated a human species – pygmy-sized, with a small brain capacity (380cc) and many ancient features, including distinctive teeth, a sloping forehead and relatively long arms. We named the species *Homo floresiensis*, more affectionately known as 'the Hobbit'. To put the brain size in perspective, modern humans have a brain capacity of around 1400cc. The Hobbit's brain was closer in size to a chimpanzee than modern humans, yet this hominid was apparently capable of making stone artefacts. Later, the team discovered that bones from at least six more individuals were buried in the archaeological sequence up to a prominent layer of volcanic ash. I visited the site as soon as I could and was sent charcoal samples for radiocarbon dating. The results were completely out of left field. The age for the skeleton was only around 18,000 calendar years ago, while the most recent bones immediately below the ash were dated to just over 13,000 years ago. In geological terms, the species was living yesterday. The skeleton was too recent to tell us about the first human migrants to Australia, but it had enormous implications for understanding human evolution.

The skeleton had enormous implications for understanding human evolution

We think that one early migration of 'ancient' early humans (*Homo erectus*) took place out of Africa two to one million years ago, colonising large parts of Asia and Europe. But there are two conflicting ideas about how modern humans evolved and spread. In the 'Out of Africa' theory, the *H. erectus* that had remained in Africa evolved into *H. sapiens* and colonised the world 100,000 to 50,000 years ago, displacing any ancient populations. In the 'Multi-regional' theory, ancient populations in different parts of the world independently evolved into *H. sapiens*. We know an early population of *H. erectus* migrated out of Africa sometime around 1.8 million years ago, and reached as far as Georgia. Now known as *H. georgicus*, this species appears to have been relatively short (around 1.5m tall) with a brain capacity of around 600cc. Out of all the early human remains so far discovered, the Hobbit's size and shape fits most closely to the find in Georgia, suggesting the first migration out of Africa was considerably more widespread than previously thought. If this is the case, the Hobbit's ancestors were capable of building a boat to cross the sea east of Java and breach Wallace's Line. Furthermore, the ancient features clearly indicated that the Hobbit and its kind had not evolved into our species but had merely dwarfed from an early ancient population, strongly arguing against the multi-regional hypothesis for modern human evolution.

We now have a a lot of work to do. A whole host of questions present themselves, including questions about the Hobbit's DNA; when did the ancestors of the Hobbit reach Flores; when did they finally die out; and are there other species of hominid in other islands across the Wallace Line? There may be several other pygmy-sized species of hominid waiting to be discovered. It may be a much smaller world than we once thought!

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