

Homo Floresiensis Foodways

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SUMMARY

Tales of miniature people have long been recited among many different cultures around the world. Indeed, the story of the wee little leprechaun in search of his pot of gold at the end of the rainbow has long been told to children across much of the western world.

Other tales such as *Snow White and the Seven Dwarves* and J.R.R. Tolkien's *The Hobbit*, both stories that have now been adapted to the big screen, are considered classics in children's literature.

In spite of their widespread popularity, the idea that any of these stories held a grain of truth when it came to the actual existence of these tiny humans would be considered ludicrous. Thus, when a skeleton resembling a hobbit was unearthed in 2003 from a cave on the Indonesian island of Flores that represented the remains of an adult, human-like skeleton measuring out to be a little over 1 meter in height (~3.5 ft tall), the whole world welcomed the news with an air of shock mixed with an appropriate dose full of skepticism. As the scientists stood over the remains and scratched their heads in a state of befuddled stupor, the local villagers shook their heads in a "told you so" fashion reminding the scientists and the reporters on site that they have long told tales of the island's small, hairy, human-like creatures who often inhabited caves, walked upright albeit with a bit of a lopsided gait, displayed a voracious appetite, and spoke their own unique language with a soft, murmuring speech. With a miniature adult skeleton lying before them, the scientists were left to seriously consider for the first time a question that would have previously been considered absurd, "Was the villagers' folklore rooted in some degree of fact?".

Referred to among villagers as the "ebu gogo," the name refers to their supposed tendency to eat anything, including human babies when the opportunity arose. The folklore also claims that these little people were known to kidnap the villagers' children in hope that the children would teach them how to cook, ending with the children always outwitting the ebu gogo. Besides their alleged kidnappings, these mischievous little creatures were said to have stolen food from the villagers' gardens and dwellings. Tired of dealing with their continuous foul play, the tales tell of how the villagers hunted the ebu gogo, eventually leading to their extinction. While these stories certainly play upon the imagination inciting real curiosity, there is no evidence beyond the newly uncovered skeletal remains of the hobbit-like creatures to corroborate the Flores villagers' folktales. Like any good fairytale, these stories may simply be the product of the human imagination coupled with the motivation to tell a good tale. Nevertheless, the discovery of a miniature human has caused many both within the scientific community and beyond to consider the possibility that some fairytales may actually ring to an air of truth.

According to the villagers, these little people were still living on the island when the Dutch colonists arrived in the 19th century. While the evidence thus far does not support

the presence of these little hobbits like people as recently, the current consensus is that they existed on the island of Flores from around 95,000 years ago up to sometime between 17,000 and 12,000 years ago. This is recent enough to make them the latest surviving human apart from modern humans, becoming extinct even later than the Neanderthals. Going against conventional dogma that held the modern human as the sole human species left to roam the earth since the time of the extinction of the Neanderthals around 28,000 to 24,000 B.C., the Flores hobbits would have lived at the same time as modern humans, and as the folklore suggests, they may have been well aware of one another's existence.

The first skeletal remains of this line of tiny humans that was found has been dated to about 18,000 years ago. This initial find consisted of a skull and a partial skeleton that included the legs, hands, feet, part of the pelvis, and a few other remains (see pictures of fossil LB1 on p. 16). The dental remains were used to confirm that this tiny human was indeed an adult. The shape of the skeleton's pelvis indicated that the individual had once walked on two legs and was female. A little over 1 meter (3.5 ft) in height, the woman was estimated to have weighed about 55 pounds, and had died around the age of 30. Since this initial find, many other bones and teeth have been recovered representing as many as 6-12 different little hobbits depending upon which scientist you are talking to. All of these remains were unearthed from the same cave, Liang Bua, on the island of Flores. Each one of these skeletons gave clues to the unique traits shared by these little hobbits. Together, these traits were distinct enough to consider the tiny skeletons as representative of a new species that was named *Homo floresiensis* after the island on which they were discovered. Among some scientists and within the popular media, the new dwarf species was dubbed the "Flores Hobbits."

Standing at a height roughly equivalent to the typical size of a three year old modern child, these island dwelling hobbits were as tiny as the australopithecines, a line of very ancient relatives to modern humans that lived nearly three million years ago. Their body proportions also most closely resemble those of the australopithecines, differing from all other ancient human relatives (hominins). While their short stature may be the most obvious unique trait belonging to the Flores hobbits, their remains indicate many other traits that are distinct from modern humans. They lacked chins, had more oval shaped faces, a sharply sloping forehead that came to meet their fairly large, hard, and thick brow ridges. Their brains were scaled down in size just as their body resulting in a brain the size of a grapefruit that was as tiny as the smallest australopithecine brain known and roughly equivalent to that of a chimpanzee brain.

Their teeth, however, were large for their size, and their feet were large relative to their short legs. The Flores hobbits' feet spanned out to much greater lengths than one would find in any modern human of the same stature, resembling more closely the foot length of a chimpanzee or an australopithecine. Having longer feet, they would have had to bend their knees farther back than modern people do, ultimately decreasing their walking speed. Nevertheless, the shape and length of their feet still would have been capable of effective walking. Running, on the other hand, would have been more difficult. The hobbits' feet had flat arches that would have lacked the spring-like capabilities of a modern human arch that is so essential to running. The hobbits' long, curved, and robust toes would not have helped matters, since they would have also posed a hindrance to running. All together, the hobbit foot appears to have evolved for walking, unlike the modern human foot with its row of short toes and its high arch that is thought to be better suited for endurance running.

The Flores hobbits appear to have had a slightly more ape-like appearance with shoulders that shrugged forward a bit and were attached to lengthy arms that were longer than their legs. Their build was stocky, far stockier than that of any modern human. Their long bones were more strong and robust than either modern humans or *Homo erectus*, resembling more closely the strength of the limb bones of more ancient hominids such as chimpanzees, australopithecines, and *Homo habilis*. These strong limbs would have enabled the Flores hobbits to take part in vigorous physical activity that *Homo erectus* and modern humans would have found challenging. Together, their long and strong arms may have enabled them to easily climb trees, which would have been of particular benefit when a hungry komodo dragon (also native to Flores) was seen lurking around!

Despite the many differences observed between Flores Hobbits and modern humans, the hobbits share some similarities with modern humans such as walking on two legs, having small canine teeth, and living what seems to have been a sort of 'cave man' lifestyle. Unfortunately, no DNA has been recovered yet from the bones of *Homo floresiensis* to provide us with further clues as to how we may compare genetically to the hobbits. The hot and humid climate of Flores makes the preservation of DNA very unlikely.

If hobbit DNA is ever recovered, it may help us to further understand how the hobbit brain may have been similar to or distinct from our own. Even without their DNA, some interesting findings have been made that have called to question the typical correlation made between brain size and intelligence. The hobbits may have had a brain case that

measured out to be only about one-third as large as a modern human's with a brain volume of only around 400 cc, but the shape of the inside of their skulls tells us that their brains were more evolved than that of an australopithecine who had a similarly sized brain to body size ratio. The imprint of the hobbit's brain left on the inside of the skull most closely resembles that of *Homo erectus*, a hominin (ancient human relative) that originated more than a million years after the australopithecines. Overall, the shape of the hobbit's brain appears to signal the capability for higher cognitive processing.

Higher cognitive abilities would have been a prerequisite to the big game stone technology left behind by the Flores hobbits. The hobbits are thought to have used these weapons to hunt a dwarfed form of the elephant known as the stegodon, an activity that would have also required an impressive degree of intelligence given the fact that it would have involved taking down a creature that relative to the hobbit's size would have been monstrous. The charred remains of stegodon as well as other animals suggests that these hobbits were using fire to cook their meat. Taken together, an ability to manufacture sophisticated stone tools, hunt large game, and control fire to cook food implies a level of intellect that scientists previously thought would be impossible to obtain with such a small brain. Not to mention the fact that these hobbits would have had to have crossed the sea somehow in order to reach the island of Flores. Some have even gone as far as to propose the possibility that these were talking hobbits who had developed their own language. After all, an ability to communicate would have been a critical skill to have when hunting large game such as the stegodon that likely would have necessitated the cooperation of a group of hunters. Since the relation between brain size and intelligence has been firmly planted in the minds of the scientific community, it is no wonder that many have called to question whether or not the hobbits were the true crafters of the recovered stone weapons and whether or not they were responsible for the charred bones. If so, previous rationale that claimed that modern humans have large brains as a result of their increased intelligence compared to their predecessors may be largely called into question.

If these small brained creatures did indeed have such high cognitive capabilities, then in terms of volume they would have outdid every modern day human intellectually. In other words, one ounce of brain matter from a Flores hobbit would have had greater cognitive processing abilities than one ounce of brain from a modern human. Small and compact, the hobbit's small brain might have been composed of a more convoluted surface that would have increased the surface area and thus storage capacity (i.e. brain power). An analysis performed in 2005 of the imprint left inside the skull of a hobbit's

brain suggested that the hobbit's brain included highly convoluted frontal lobes, more so than that seen with *Homo erectus*, folding to a degree more comparable to that of the modern human brain. The shape of the inside of the skull also indicated that the hobbit brain was expanded to an usual degree in an area known as the Brodmann's area 10. Interestingly, in humans, this area is also enlarged, found in greater size both absolutely and relatively than it is found in apes. In humans, this area is thought to be involved in important higher cognitive processes such as reasoning, task flexibility, problem solving, planning, and the execution of initiatives. Of course, it is not yet known whether or not the Flores hobbits' brains were expanded in this area due to an ability to engage in these higher cognitive processes. Although, it does help to further the claim that these little hobbits had brains that were more evolved than their brain size suggests, and that they may have been intelligent enough to partake in the tool making, hunting, and cooking activities that have been proposed.

Perhaps even more mysterious than how the Flores hobbits managed to engage in such activities with their wee little brains, is how these tiny people came to be so small. Did they evolve from another regularly sized hominin such as *Homo erectus*, shrinking for whatever reason over time? Perhaps they evolved from a smaller and more ancient hominin such as *Homo habilis* or an australopithecine that would have been somewhat comparable in body size and would have required just a little bit of brain shrinking to match that of the Flores hobbit. Furthermore, it is not known whether or not the hobbits arrived to the island of Flores already in dwarf form, or whether they shrunk on the island due to a phenomenon known as "insular dwarfing." Insular dwarfing involves the downsize of an animal living on an isolated island due to a limited supply of calories that over long periods of time ranging from tens of thousands of years offers a selective advantage to those who have a smaller body size. In other words, the Flores hobbits may have shrunk in response to limited food supplies. Being small would have decreased their calorie demands, and made them better suited to island life. With a limited food supply, their growth may have been slower, causing them to reach maturity a bit later than normal. Slower growth may have also resulted in a longer lifespan. The oldest hobbit found thus far was 30 years of age, which may sound young by today's standards, but is considered exceptionally old for a small hobbit in terms of the lifespans expected for similarly sized mammals.

To help determine who the Flores hobbits might have evolved from, scientists compared the hobbits' features to those of other early hominins (ancient human relatives). Unfortunately, this generally led to more confusion since the Flores hobbit displays a mix

of features that can be found in both the more recently evolved *Homo erectus* and the more primitive early hominins such as the australopithecines. The hobbits' primitive features include their small heads, short stature, lengthy arms relative to their legs, the structure of their wrist, and their thick limb bones that make them appear more like australopithecines. However, many other features can be likened to those of *Homo erectus* particularly in the structure of the face including the jaws and the teeth, the absence of a chin, the morphology of their foot bones (the metatarsals), and the shape of the brain case and the brain itself. Other characteristics such as the structure of the shoulders appear as a partly evolved, transitional form that would be expected to have existed somewhere along the evolutionary path between the earlier ancient human relatives and modern humans. To add in another twist, the size and proportions of some teeth closely resemble those of modern humans, while the crown shape and root structure of other teeth such as the lower premolars are very primitive looking. This mosaic of both primitive and more evolved features underlies numerous parts of the Flores hobbit skeletons, preventing scientists from making any solid conclusions based upon their anatomy on who the Flores hobbits evolved from.

Thus, the hobbits true origin remains obscure. Many claims that *Homo floresiensis* is a downsized form of *Homo erectus* are based upon the most current widely held belief that *Homo erectus* was the first ancient human relative to migrate out of Africa and into Asia where the hobbit skeletons were found. However, no fossils of large bodied ancestors representing *Homo erectus* or perhaps some transitional form in between *Homo erectus* and *Homo floresiensis* have yet been found on the island of Flores. One of the only potential pieces of concrete evidence left to scientists so far are some stone tools unearthed on Flores that date to 840,000 years ago, and that may have been the work of *Homo erectus*, but without accompanying skeletons of *Homo erectus* nearby it is impossible to know who made these tools. The closest remains of *Homo erectus* were discovered on the nearby island of Java. Today, Flores is 388 miles east of Java and 400 km away from continental Asia. Flores has never been connected to any mainlands or any other island. Thus, unless *Homo erectus* was forced into island hopping by a tsunami, the water that lay between Java and Flores would have been too great and too treacherous for *Homo erectus* to have swam. Perhaps *Homo erectus* could have drifted on logs or other floating debris, or maybe had crafted some sort of boat, but there is certainly no evidence to support any of these possibilities.

Of course, it is also possible that the ancestors to the Flores hobbits left Africa before *Homo erectus* had come into existence, arriving to the islands of Indonesia long before

the modern humans and *Homo erectus*. This would help to explain the presence of some of the primitive features present in the Flores hobbit skeletons that are shared by australopithecines and *Homo habilis*, who came into existence long before *Homo erectus*. Unfortunately, there is currently no evidence to indicate the presence of the more primitive *Homo habilis* or australopithecines anywhere in southeast Asia.

With no clear answer, another alternative explanation has been proposed. Some scientists have ascertained the idea that *Homo floresiensis* may represent the endpoint of an ancient and otherwise unknown, small bodied lineage of *Homo*. Furthermore, there are still some scientists who are not yet convinced that this is indeed a new species, and that believe instead that these are the skeletons of modern humans who have been afflicted with a health disorder such as dwarfism or microcephaly. So far a large body of evidence has come to refute this scenario, but nevertheless, the debate is still alive and the possibility is still lingering in the minds of some scientists.

As already mentioned, the teeth, jaw, and cranium of the Flores hobbits display many features that can be linked back to the ancient human relatives of the more evolved *Homo* genus more so than the earlier human relatives such as australopithecines. Most of the hobbit's teeth resemble those of *Homo erectus*. Overall, their teeth are larger than those of modern humans, although they have small canine teeth similar in size to modern humans. The hobbits' robust jaw bones and other adaptations in their jaw suggest an adaptation to high masticatory loads, similar to, but not as extreme as is seen with the australopithecines. The wear on their teeth also indicates forceful mastication. The shape of their molars would have made chewing uncooked meat a time consuming activity that involved forceful chewing, resulting in the kind of wear that was found on their hobbit teeth. The wear found on their molars is flat, similar to hunter-gatherers like the Inuit and Plio-Pleistocene hominids, and distinct from that of the agriculturalists who commonly display highly angled wear. The hobbits teeth were completely free of dental caries, but contained moderate to heavy amounts of dental calculus with associated periodontal (gum) disease and receding gums found in the molar regions of the mouth. The occurrence of gum disease is not surprising as it has been found among many pre-Neolithic (pre-agriculture) people, modern human foragers, as well as some species of wild primates. *Homo erectus* who lived on the nearby island of Java later on also has the markings of gum disease.

The moderate to substantial amounts of dental calculus remaining on the hobbits' teeth tell us more than that these little people were not brushing their teeth or getting their

biannual professional dental cleaning. These little people had dental calculus as a result of the plant foods they were continuously chomping up. The remains of starch grains and other plant residues on stone tools further suggests that the hobbits ate their share of plants, and that various plant products were being processed into different forms by the hobbits. These pieces of evidence add support to the assumption previously made by some scientists that the hobbit's diet was predominated by plant foods. This assumption was based upon the high risk that would have been involved in hunting, especially taking into account their small size, and also the fact that one of their most favored meats, that of the juvenile stegodon (the dwarf elephant), was likely only seasonally available. As of yet, it is currently unknown what kind of edible plant species were growing on Flores at the time and would have been available for the hobbits' consumption. The climate on Flores is thought to have fluctuated considerably during the time of the hobbits, transitioning from periods of high rainfall that supported dense rainforest vegetation to periods of decreased rainfall the spanned as long as 20,000 years and gave way to organic poor open grasslands. There is some evidence to suggest that the hobbits inhabited the Liang Bua cave more frequently during the wet phases, and then moved out into the open air locales during the dry periods.

While the kinds of plants they were eating remains elusive, the animals they were consuming can be determined from the many bones found alongside those of the hobbits. While some of these bones may have accumulated by natural means, and do not represent the food of the hobbits, the collection of bones that have been found that are charred from exposure to fire or bearing cuts that indicate butchery confirm that these bones are the actual remnants of a hobbit feast. In sum, we know that meat was an important part of their diet in addition to the plant foods they consumed.

As has already been mentioned, stegodon, an extinct Asian relative of the elephant that existed in dwarf form on Flores, was their meat of choice as indicated by the hundreds of stegodon bone fragments found accompanying the bones of the hobbits. Although smaller than today's full-sized elephant, the dwarf stegodon is still estimated to have weighed around 1,000 to 2,000 pounds! Thus, taking into account again that the hobbits were the size of a three year old modern child, hunting the stegodon would have certainly been a challenging and also dangerous endeavor. Even from the point of view of a modern human, the dwarf stegodon would be considered big game. Hunting these beasts would have likely required joint planning as well as some form of communication, particularly for the adult stegodons. What is most impressive is the success and frequency by which the hobbits were hunting these massive beasts as is reflected in the

hundreds of stegodon bones accompanying the hobbits' remains. This degree of success would have required cognitive and linguistic skills well in advance of modern day apes, potentially outdoing *Homo erectus* as well. One hobbit might have been able to bring down the young stegodon on their own, but even taking down one of these smaller ones would have been a feat that would have been made easier by way of a coordinated group effort. Based upon the bones left behind, it does appear that the Flores hobbits preferred to hunt the young stegodons, probably because they were so much easier to hunt.

Another animal that lived on the island of Flores during the time of the Flores hobbits and still lives there is the giant lizard, the komodo dragon. It is currently unknown whether or not the hobbits ever hunted or scavenged the remains of the komodo dragon. Regardless, the komodo dragon would have posed a major threat to the hobbits that would have undoubtedly made a meal out of a vulnerable hobbit given the chance. The hobbits may have scared the giant lizard with a long, forked stick, in the same manner that modern humans do, or maybe they simply fled to a nearby tree as their longer and stronger arms may have made them more adept at climbing trees than modern humans.

Besides stegodons and perhaps the occasional komodo dragon, the Flores hobbits were also found among the remains of many other small, land dwelling animals that may have served as a welcome meal for a hungry hobbit. Fish, frogs, snakes, tortoises, birds, large rodents, bats, and large monitor lizards were all potential entrées on the hobbit's menu. Also found aside the hobbit remains was the skeleton of a giant marabou stork measuring up to 6 feet tall, almost double that of the average 3 foot hobbit (see page 20 for a visual). This giant bird is thought to have been largely land dwelling and also carnivorous, but it is not known whether the bird ever hunted hobbit or if hobbits ever hunted this giant bird. Nevertheless, it draws attention to just how different the animals found on Flores were from the ones we know today.

Overall, there are no apparent changes in their choice of prey over time. From what we currently know, their focus upon hunting or scavenging terrestrial mammals ranging in size from the stegodons to small birds and reptiles persisted throughout their existence on Flores. There is currently no evidence to suggest that the Flores hobbits consumed fish, shellfish, or any other kinds of seafood, even though they were in such close proximity to the sea. From the Liang Bua cave, the sea was located approximately 40 km away.

As was previously stated, the bones left behind as remnants of a hobbit meal bear many cutmarks and charred bits reflecting their use of fire to cook their meat. For the

butchering, they used stone tools that still bear residues of blood, bone collagen and scratches known to be made by scraping tools against bone. Clusters and circles of reddened and fire-cracked pebbles also point to the presence of hearths located within the cave of Liang Bua, and suggest that the hobbits frequently transported their meat back to the cave for cooking. While they were using fire, these little hobbits were not using fire to the same extent as modern humans would later on. Nevertheless, the fact that such tiny brained creatures had mastered the manipulation of fire enough to cook with it turns all of our orthodox beliefs of the intellectual capabilities of small primate brains upside down.

Equally astounding is the fact that these small brained hobbits were able to make and use the stone tools that were found among their remains. Some have deemed such a feat for a small brain too miraculous to be true, claiming that the tools must have been the work of modern humans or perhaps the larger brained, tool making *Homo erectus* who lived on nearby Java. Paleoanthropologist Richard Klein of Stanford University points out that the tools found closest to the first hobbit skeleton to be found include few, if any, of the most sophisticated types of tools that were found elsewhere in the cave. Thus, Klein reasons that these other tools found farther away from the hobbit skeleton may have been produced by modern humans who occupied the cave later on. In Klein's opinion, more excavations are needed before the possibility that these tools belonged to modern humans and not the Flores hobbits may be fully ruled out. In spite of this dissent, there is currently not enough actual evidence to refute the current consensus that the Flores hobbits were the makers of these tools.

The number of stone tools found in the Liang Bua cave is astounding. Thousands of stone tools have been recovered from the cave found in association with the skeletons of the Flores hobbits. The collection primarily includes small, simple flakes struck from volcanic rock and chert. Some scientists explain that while the Flores hobbits show a high degree of skill and control with the knapping of these flakes, they are really no more advanced than the tools made by late australopithecines and early *Homo*. From some scientists' perspectives, the shapes and level of technology of the tools from Flores closely resemble the earliest Oldowan stone artifact assemblages from the Olduvai Gorge in East Africa that date to 1.2-1.9 million years ago. This association with tools of a more primitive origin from Africa has been used to support the idea that these tools were in actuality not that advanced and would have been well within the cognitive capabilities of the small brained hobbits. However, not everyone agrees with this interpretation.

From other scientists' perspectives, mixed in with these simpler and more ancient tools were a set of fancier and more advanced set of tools that included finely worked points, perforators, awls, blades and microblades. The microblades are thought to have been hafted (glued) onto spears as evidenced by residues of resin typically used for hafting still remaining on the tiny blades. Some scientists have gone as far as to claim that they are in many respects as sophisticated as anything that was being made during this time period by modern humans or Neanderthals, a claim that has been strongly refuted by other scientists. With a primitive hand and wrist, the hobbits would have had to have made these tools and held these tools in a different way than modern humans or the Neanderthals did. Thus, if the Flores hobbits were making advanced stone tools, it would prove that modern human hands and modern human sized brains are not needed to practice these more complex stone tool technologies. Again, this would be remarkable considering that the size of the hobbit brain was about that of the smallest brained australopithecines who left remains of crude tools at best.

In support of the argument that the Flores hobbits made these tools, the stone technology found in the Liang Bua cave is generally consistent, and continues from the oldest deposits associated with the Flores hobbits dating from 95-74 kyr to 12 kyr when both Flores hobbits and the stegodon disappear from the archaeological record. They are also broadly similar to those found earlier on Flores dating to around 840,000 years ago that have yet to be assigned to a hominin (ancient human relative). The tools that are associated with modern human skeletons on Flores, however, display major changes and additions to the standard tool set including an increased preference for the raw material chert to make their tools, as well as the introduction of new stone artifacts such as edge-glossed flakes and grinding stones. Thus, while the tools associated with the Flores hobbits reflect an impressive amount of intelligence and skill, there is still no evidence that the hobbits could produce the diverse set of standardized and complex stone technology manufactured by modern humans from around 40,000 years onward. Taken together, it is still safe to bet that the hobbits were substantially less intelligent than ourselves!

As has already been noted, their small brains may have supported some form of language as well. While we can only really speculate on whether or not they had language, the likelihood that they hunted in groups to take down massive beasts such as the stegodon suggests that they must have had at least some functional level of communication in order to coordinate such group efforts. Of course, they could have communicated well enough without a structured, spoken language as lots of animals are able to do. The Ebu Gogo

legends formed among the Flores people say that they mumbled to one another, often sounding like a soft murmur of speech, but were also capable of repeating what humans said to them in a parrot-like fashion. In reality, whether or not they had language and whether or not it bore any similarities to modern humans' we may never know.

While it remains a possibility that the Flores hobbits communicated in a somewhat human like fashion, we know that they did not engage in many of the activities typically associated with the cultures of the earliest modern humans to arrive to Flores. Evidence of the disposal of the dead, new ways of processing plant materials, the use of coastal resources such as mollusks, the importation of medium and large game animals to the island, and the use of pigments, ornamentation, and other symbolic items is only present in conjunction with the arrival of modern humans. The Flores hobbits left behind no forms of art, nor is there any evidence to suggest that they had a religion. There are no remains of hobbit houses, and nothing to indicate that the hobbits wore clothing.

It is interesting that these differences held through even despite the fact that the Flores hobbits most likely shared Flores and possibly even the cave Liang Bua with modern humans for as long as 15,000 to maybe even as much as 30,000 years. Of course, it has and may always remain a mystery whether or not modern humans and the Flores hobbits ever actually met face to face. An even more interesting question is whether or not modern humans ever successfully bred with the hobbits. A look at their DNA and comparing it to our own would give us some answers, but unfortunately as was previously explained, hot and humid climates such as that present on Flores rarely allows for DNA to remain preserved. Thus, we may never know whether or not we all have a little hobbit DNA in us.

It is also possible that the interaction between modern humans and the Flores hobbits eventually led to the hobbits' extinction. Most estimates for the Flores hobbits' extinction range around 17,000 years ago to 12,000 years ago when a volcanic eruption took place on Flores as indicated by the layer of ash in the Liang Bua cave. This is thought to have been a major volcanic eruption that may have killed off many of the animals native to Flores as well, including the dwarf elephants, the stegodons. While this volcanic eruption would have made Liang Bua and the surrounding area unlivable, we do not know for certain whether or not it actually killed off all of the hobbits. Instead, it may have just forced the hobbits to migrate away from Liang Bua to areas left undamaged by the eruption. If they did survive, who knows how long they lived before becoming extinct. If you listen to the stories told by the villagers, the tiny little creatures referred to as Ebu

Gogo were living as recently as 300 years ago or less. A few even claim that they still exist, lurking about unseen on the Indonesian island today!

INTRODUCTION

"...a hobbit-like species of human that grew no larger than a three-year-old modern child. The tiny humans, who had skulls about the size of grapefruits, lived with pygmy elephants and Komodo dragons **on a remote island in Indonesia** 18,000 years ago." (Mayell, Hillary).

"Interestingly, local legends exist in Flores of the Ebu Gogo – small, hairy, cave dwellers similar in size to *H. floresiensis*. It is suggested that perhaps the hobbits survived longer in other parts of Flores to become the source of these stories." (Fran, Dorey).

"**On the island of Flores in Indonesia**, villagers have long told tales of a diminutive, upright-walking creature with a lopsided gait, a voracious appetite, and soft, murmuring speech." (Wong, K.).

"**On Flores, oral histories hold that the *ebu gogo* was still in existence when Dutch colonists settled there in the 19th century.**" (Wong, K.).

"Remains of the most recently discovered early human species, *Homo floresiensis* (nicknamed 'Hobbit'), have been found **between 95,000 and 17,000 years ago** on the Island of Flores, Indonesia. *H. floresiensis* individuals stood approximately **3 feet 6 inches tall, had tiny brains, large teeth for their small size, shrugged-forward shoulders, no chins, receding foreheads, and relatively large feet due to their short legs.** Despite their small body and brain size, *H. floresiensis* **made and used stone tools, hunted small elephants and large rodents, coped with predators such as giant Komodo dragons, and may have used fire.**" (Smithsonian National Museum of Natural History "Homo floresiensis").

"...it was concluded that *Homo floresiensis* not only made stone tools found in the deposits but also hunted juvenile stegodon and possibly even used fire for cooking, in view of the presence of charred animal bones." (Martin, Robert D. p. 1124).

HISTORY

"Conventional wisdom holds that Homo sapiens has been the sole human species on the earth for the past 25,000 years. Remains discovered on the Indonesian island of Flores have upended that view." (Wong, K.).

"The species inhabited Flores as recently as 13,000 years ago, which means it would have lived at the same time as modern humans, scientists say." (Mayel, Hillary).

"The researchers estimate that the tiny people lived on Flores from about 95,000 years ago until at least 13,000 years ago. The scientists base their theory on charred bones and stone tools found on the island." (Mayel, Hillary).

"Our best evidence indicates that the Flores hobbits lived between ninety-five thousand and seventeen thousand years ago..." (Chip, Walter).

"The bulk of the finds related to H. floresiensis date between 95,000 and 17,000 years ago." (Smithsonian National Museum of Natural History "Homo floresiensis - First Discovered").

"The human remains date from about 38,000 to 18,000 years old, but archaeological evidence suggests H. floresiensis lived at Liang Bua from at least 95,000 to 13,000 years ago. These dates make it the latest-surviving human apart from our species H. sapiens." (Fran, Dorey).

ENVIRONMENT



(Wong, K. p. 55).

"...its [Flores'] geographic position 400 km east of continental Asia..." (Morwood, MJ; Jungers, WL 2009).

"...Liang Bua, a cave on the island of Flores, 388 miles east of Java in Indonesia." (Walter, Chip p. 96).

"The island of Flores...never had a land connection with either the mainland or any other island...So how did humans get to Flores? We do not know. **One answer would be that they had craft capable of traveling over water that far back but another would be that they drifted accidentally on logs and other floating debris between islands, particularly after storms.**" (Finlayson, Clive p. 61-62).

"This environmental backdrop for the last ~50 ka in eastern Indonesia demonstrates the rapidly fluctuating nature of the climate **at this time, ranging from high rainfall with dense rainforest vegetation (mainly C3 species) to periods of reduced rainfall with organic-poor open grassland environments (mainly C4 species).** These changes may have influenced human occupation in the cave. According to the reconstructions outside the cave there were **at least two wet phases and one drier phase** during a ~42 ka period (from 47 to 5 ka) (Fig. 6a, dark grey and light grey vertical boxes, respectively)." (Westaway KE, Morwood MJ, Sutikna T et. al. p. 2905).

"**In the face of adverse environmental and habitat pressures,** the *H. floresiensis* population was able to survive throughout extended dry periods (94–75 and 36–19 ka) by

occupying open-air locations or by migrating to another area in Flores.” (Westaway KE, Morwood MJ, Sutikna T et. al.).

FOSSILS

LB-1:

Date of discovery: 2003

Age: 18,000 years old

(Smithsonian National Museum of Natural History "LB-1").

“This adult female, who died around the age of 30, was only a little over 1 m (3.5 ft) tall. **Her brain, estimated at 400 cubic centimeters, was as small as those of chimpanzees and the smallest australopithecines. She had fairly large brow ridges, and her teeth were large relative to the rest of the skull. Her fossils consist of an almost-complete skull and partial skeleton that include her legs, hands, feet, part of her pelvis, and other fragments. LB-1 is the most complete H. floresiensis fossil found to date.**” (Smithsonian National Museum of Natural History "LB-1").

“The key specimen, LB1, dates from about 18 ka.” (Klein, Richard G. p. 723).



Courtesy of: Jennifer Clark, Human Origins Program



Courtesy of: Chip Clark, Smithsonian Institution

(Smithsonian National Museum of Natural History "LB-1"
<<http://humanorigins.si.edu/evidence/human-fossils/fossils/lb-1>>. Accessed 1/7/2014).

"The primary evidence, dated at ~18,000 years, is a skull and partial skeleton of a very small but dentally adult individual (LB1). Incomplete specimens are attributed to eight additional individuals." (Martin, Robert D. 2006 p. 1123).

"The pelvis anatomy revealed that the individual was bipedal and probably a female, and the tooth eruption and wear indicated that it was an adult. Yet it was only as tall as a modern three-year-old, and its brain was as small as the smallest australopithecine brain known. There were **other primitive traits as well, including the broad pelvis and the long neck of the femur.**" (Wong, K.).

"The original skeleton, a female, stood at just **1 meter (3.3 feet) tall**, weighed about **25 kilograms (55 pounds)**, and was around **30 years old** at the time of her **death 18,000 years ago**...was found in the same sediment deposits on Flores that have also been found to contain stone tools." (Mayel, Hillary).

“The original fossil remains consisted primarily of a single partial skeleton (LB1), excavated from deposits in Liang Bua dated to the end of the last ice age... The LB1 skeleton, dated to 18,000 years ago, was probably a female, just over a meter tall.”
(Lieberman, Daniel 2005 p. 957).

"A joint Indonesian-Australian research team found LB-1—the **nearly complete female skeleton of a tiny human that lived about 18,000 years ago—in Liang Bua cave on the island of Flores, Indonesia.** The skeleton’s unique traits such as its small body and brain size led scientists to assign the skeleton to a new species, *Homo floresiensis*, named after the island on which it was discovered. Since the initial find, bones and teeth representing as many as 12 *H. floresiensis* individuals have been recovered at Liang Bua—the only site where *H. floresiensis* has been found so far.” (Smithsonian National Museum of Natural History "Homo floresiensis - First Discovered").

"So far, remains of *H. floresiensis* have been excavated from just a single cave, Liang Bua. The fossils include a partial skeleton (LB1) plus fragments of at least half a dozen more individuals now dated to between 95,000 and 17,000 years ago.”
(Lieberman, Daniel E. 2009).

“The new fossils consist of the right humerus, radius and ulna of the LB1 skeleton, the mandible of a second individual (LB6), and assorted other remains including two tibiae, a femur, two radii, an ulna, a scapula, a vertebra, and various toe and finger bones. The researchers think that the sample includes the remains of at least nine individuals.”
(Lieberman, Daniel 2005 p. 957).

DNA

“So far, no DNA has been retrieved from the bones of a *H. floresiensis* individual.”
(Smithsonian National Museum of Natural History "Homo floresiensis - The Unknown.").

"As the remains are relatively young and unfossilized, researchers hoped to find mitochondrial DNA. Initial efforts were unsuccessful, but the research continues." (Fran, Dorey).

“So far, however, conditions have not been right to extract DNA from *H. floresiensis* bones.” (Viegas, Jennifer 2013).

“A third group of extinct humans, Homo floresiensis, nicknamed “the hobbits” because they were so small, also walked the earth until about 17,000 years ago. **It is not known whether modern humans bred with them because the hot, humid climate of the Indonesian island of Flores, where their remains were found, impairs the preservation of DNA.**” (Mitchell, Alanna).

MORPHOLOGY

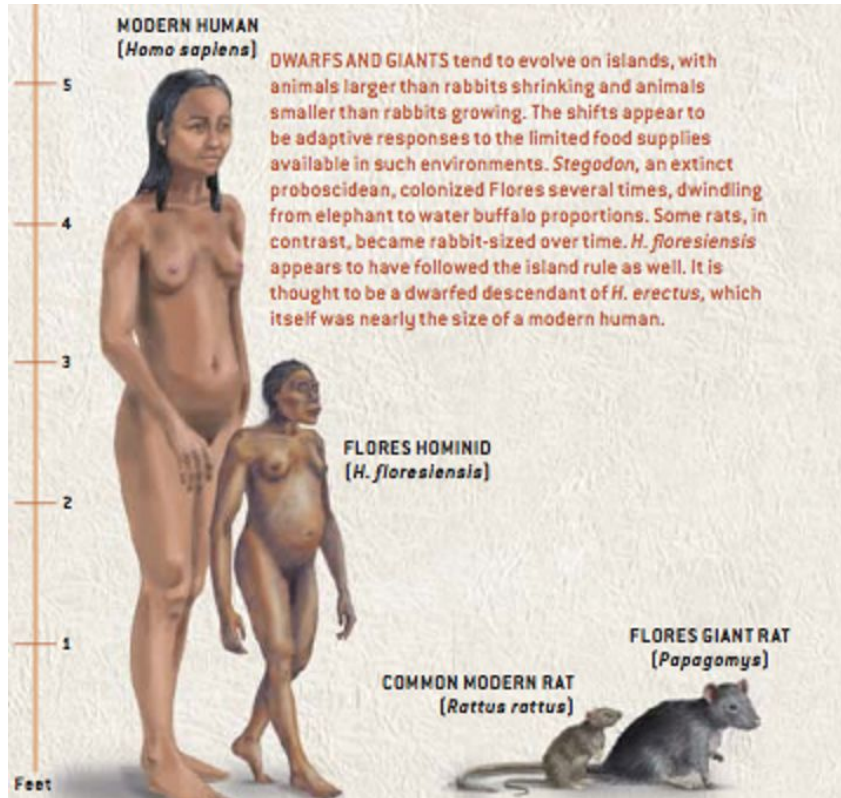
“The original skeleton, a female, stood at just 1 meter (3.3 feet) tall, weighed about 25 kilograms (55 pounds), and was around 30 years old at the time of her death 18,000 years ago...” (Mayel, Hillary).

“The dentition of LB1 shows it was a full adult, but its femoral length implies it stood only about 1 m tall, and its body mass has been estimated at between 16 and 29 kg. **The remains of other individuals imply comparably small size...**” (Klein, Richard G. p. 722).

"These were small people, about a metre tall....approximately 30-kg body." (Lieberman, Daniel E. 2009).

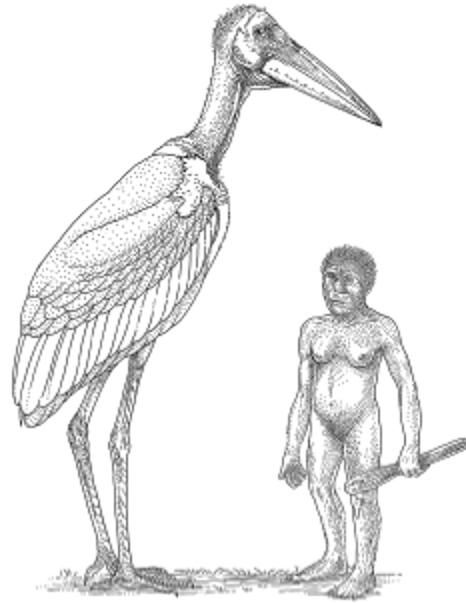
"...hominids this tiny were known only from fossils of australopithecines (Lucy and the like) that lived nearly three million years ago—long before the emergence of H. sapiens." (Wong, K.).

“Physically, they were about the size of a three-year old Homo sapiens [modern human] child, but with a braincase only one-third as large," said Richard Roberts, a geochronologist at the University of Wollongong, Australia, and one on the co-authors of the research paper. "They had slightly longer arms than us. More conspicuously, they had hard, thicker eyebrow ridges than us, a sharply sloping forehead, and no chin.” (Mayel, Hillary).



(Wong, K. p. 51).

The Flores Hobbit & the Giant Marabou Stork of Flores:



*J. van Nourtwijk
2008*

Figure 12. Artist's impression of the size of *Leptoptilos robustus* sp. nov. (estimated at 1.8 m) compared to *Homo floresiensis* (estimated at 1.0 m). Drawing by J. van Nourtwijk.

(Meijer, Hanneke J.M. & Due, Rokus Awe).

Why were the Flores Hobbits so small?... "In the absence of agriculture, these **rainforests may have offered a more limited supply of calories for hominins** (Bailey and Headland, 1991) **and may also have favored smaller body size** (Peters, 1983 and Schmidt-Nielsen, 1984). With this background, one of us (PB) argued that *H. floresiensis* was a possible example of insular dwarfing, either on Flores, or another island in Southeast Asia, where the local environmental conditions placed small body size at a selective advantage." (Brown, Peter & Maeda, Tomoko 2009).

"Evidence reviewed herein shows that features exhibited by *H. floresiensis*, such as small stature, a small brain, relatively long arms, robust lower limbs and long feet, are not unique, but are shared by other insular taxa. Therefore, the evolution of *H. floresiensis* can be explained by existing models of insular evolution..." (Meijer, Hanneke J.M. et. al. p. 995).

The Flores Hobbits were not just human pygmies: "Human pygmies bear no meaningful resemblance to *Homo floresiensis* save for small body mass." (Morwood, MJ; Jungers, WL 2009).

"The distinctive mandibular morphology of LB1 is associated with many other distinctive attributes, including an estimated stature of only 109 cm (Brown et al., 2004), an endocranial volume of 385–417 cm³ (Brown et al., 2004, Falk et al., 2005b and Holloway et al., 2006), an estimated brain weight/body mass ratio similar to Pan and *A. afarensis* (Brown et al., 2004 and Falk et al., 2005b), a humerus and ulna that are both long relative to the lengths of the femur and tibia, and distinct from known limb proportions in the genus *Homo* (Morwood et al., 2005, Lordkipanidze et al., 2007, Brown, in preparation-a and Brown, in preparation-b), a pelvis, femur, and basicranium indicative of obligate bipedalism (Brown et al., 2004 and Jungers et al., 2009), long bone relative shaft robusticity **overlapping Pan and A. afarensis and distinct from small-bodied H. sapiens** (Morwood et al., 2005, Brown, in preparation-a and Brown, in preparation-b), carpal morphology **shared with Australopithecus and African apes but not H. sapiens and Neanderthals** (Larson et al., 2007b and Tocheri et al., 2007b), a relatively short clavicle and a humerus with a low torsion angle as in KNM-WT 15000 (Morwood et al., 2005 and Larson et al., 2007b) and Dmanisi (Lordkipanidze et al., 2007), and a cranial and facial morphology with a distinctive combination of symplesiomorphic, shared-derived, and unique traits (Brown et al., 2004, Argue et al., 2006, Baab et al., 2007, Brown, in preparation-a and Brown, in preparation-b)." (Brown, Peter & Maeda, Tomoko 2009).

"Our hobbit is far stockier than any modern human." (Jungers, William & Baab, Karen p. 163).



(A full-body reconstruction of LB1 created by Elisabeth Daynès (© 2009, S. Plailly/E. Daynès – Reconstruction Atelier Daynès Paris).

“...they were ‘similar to modern humans in many respects.’ For example, he explained that they **walked on two legs, had small canine teeth, and lived what appears to have been an iconic ‘cave man’ lifestyle.**”(Viegas, Jennifer).

“The Hobbits had **arms that were longer than their legs, giving them a slightly more ape-like structure.**” (Viegas, Jennifer).

“Hobbits also possessed much stronger limbs relative to body weight than either Homo sapiens or its presumed predecessor, Homo erectus, Jungers’ team concluded. **Limb strength for H. floresiensis approaches that previously estimated for more ancient hominid species such as the 3.2-million-year-old Australopithecus afarensis — a.k.a. Lucy — and 2.3-million-year-old Homo habilis, according to Junger’s analysis.** These results imply that hobbits were able to engage in vigorous physical activities that neither modern humans nor H. erectus could manage. Hobbits may have spent much of

their time climbing trees, as Lucy's kind did, the Stony Brook researchers propose." (Bower, Bruce).

"...anatomical studies showed that australopithecines and early Homo species such as habilis had **good climbing abilities** (e.g., Collard and Wood 1999) (some of which persisted into Homo georgicus **and possibly even Homo floresiensis**, see Lordkipanidze et al. 2007, and Tocheri et al. 2007)." (Verhaegen, Marc; Munro, Stephen; Vaneechoutte, Mario et. al. p. 10).

BODY PROPORTIONS

"...the Liang Bua hominids were short, about a metre tall, but also indicate that they had relatively long arms. In many ways, the LB1 skeleton's body proportions are less like any adult human's, including adult pygmies, than those of an australopithecine — an earlier hominid lineage, thought to have been confined to Africa." (Lieberman, Daniel 2005 p. 957).

"The more complete left ilium also indicates that the pelvis is flared antero-laterally, consistent with an australopithecine-shaped thoracic region. **Body proportions of LB1 are the same as AL288-1 A. afarensis, but differ from all other hominins for which there are reliable data, including H. erectus.**" (Morwood, M.J. et. al. p. 1016).

"However, although tooth size and facial morphology dictate inclusion of the species in the genus Homo, the genealogy of H. floresiensis remains uncertain. Similarities in stature and body proportions with Australopithecus, for example, may reflect phylogeny or secondary evolutionary convergence. Either way, **H. floresiensis is not just an allometrically scaled-down version of H. erectus.**" (Morwood, M.J. et. al. p. 1016).

ENCEPHALIZATION

"LB1's brain/body size ratio scales like that of an australopithecine, but its endocast shape resembles that of Homo erectus. LB1 has derived frontal and temporal lobes and a lunate sulcus in a derived position, which are consistent with capabilities for higher cognitive processing." (Falk, Dean et. al. p. 242).

"LB1's [brain] shape most resembles that of...classic Homo erectus from China and Java (Trinil)...least resembles the microcephalic's [i.e. a modern human with a genetic disorder that leads to a small head & brain]..." (Falk, Dean et. al. p. 242-243).

“...with a braincase only one-third as large...” (Mayel, Hillary).

“...the endocranial capacity of LB1 was only about 400 cc, just above the lower limit for adult australopiths.”(Klein, Richard G. p. 722).

“Most remarkably, LB1's skull has a chimp-size brain of 417 cm³...” (Lieberman, Daniel E. 2009).

“It [LB1] had a brain volume of 380 cm³, roughly the size of a chimpanzee brain.” (Lieberman, Daniel 2005 p. 957).

"Given that Homo floresiensis is the smallest human species ever discovered, they out-punch every known human intellectually, pound for pound." (Mayel, Hillary).

“The type specimen of Homo floresiensis (LB1, female) has a brain size of ~400 cm³, which is similar to that of Australopithecus afarensis specimen AL-288-1 (Lucy), who lived approximately 3.0 million years ago. **Yet LB1's species was associated with big-game stone technology, remains of Stegodon, and charred animal bones that hint at the use of fire and cooking. Its ancestors also had to cross the sea to reach the Indonesian island of Flores.** Could a tiny hominin with an ape-sized brain really have engaged in such advanced behaviors?” (Falk, Dean et. al. p. 242).

"Could a smaller, less intelligent species such as Homo habilis or Australopithecus afarensis have made the ten-thousand-mile journey by land to Flores without the benefit of fairly advanced tools? It would be a remarkable feat." (Walter, Chip p. 97).

“...if the stone tools from Liang Bua imply that H. floresiensis converged behaviorally on H. sapiens, it did so with a brain that was far smaller than the brain of any normally functioning individual of H. sapiens. Since key functional components of the brain scale closely to brain size in living primates, the implication would be that scaling in H. floresiensis departed from the general primate pattern. From a behavioral perspective, this means that 1 cc of brain in H. floresiensis could not have been functionally equivalent to 1 cc of brain in either modern humans or modern chimpanzees.” (Klein, Richard G. p. 724).

“In other words the brain grew tinier, but its complex architecture remained intact, like the perfectly replicated miniatures of homes and furniture you might see in a history museum.” (Chip, Walter).

"Because metabolic cost of the brain tissue is expensive, in an insular environment with limited food resources and increased intraspecific competition under the absence of predators, it is advantageous to reduce brain size at the cost of some neural functions such as sensory, motor, social and/or intellectual activities. If one applies a similar energetic explanation for the brain size evolution in *H. floresiensis*, then **we need to answer what aspects of central nervous system were sacrificed in this little hominin who show no sign of retrogression at least in stone tool technology compared with earlier hominins on Flores or elsewhere in island Southeast Asia.**" (Kubo, Daisuke; Kono, Reiko T.; Kaifu, Yousuke p. 7).

"The **cognitive capabilities** of early hominins, however, should not be underestimated, **as indicated by the technology of the stone artefacts associated with *H. floresiensis* at Liang Bua.** It is also significant that hominins were able to colonize Flores by the Early Pleistocene, whereas the required sea crossings were beyond the dispersal abilities of most other land animals, even during glacial periods of lowered sea level." (Morwood, M.J. et. al. p. 1091).

"...it appears to have made sophisticated stone tools, raising questions about the relation between brain size and intelligence." (Wong, K.).

"...an interpretation of the archaeological context suggests that **the tiny hominids may have fashioned sophisticated stone tools and hunted pygmy stegodons** (similarly dwarfed animals that became extinct on Flores some 12,000 years ago, possibly around the same time as *Homo floresiensis* also ceased to be). It has even been speculated that they had language. Although the linguistic and technological attributions have been questioned on the grounds of the creature's small brain, a recent endocast analysis of the cranium has indicated a hominid with highly convoluted frontal lobes, suggesting cognitive capabilities superior to those of *Homo erectus* and more comparable to *Homo sapiens* (Falk et al. 2005, Balter 2005)." (Forth, Gregory p. 13).

“Their brain size at 420cc was also not much larger than Lucy's, a hominin that had walked the earth more than 3 million years earlier. Yet these creatures could control

fire, make sophisticated tools, and hunt game, though it's still an open question as to whether they could speak or used any advanced language.”(Walter, Chip p. 96).

"Such dwarfing is enough to account for LB1's 417-cm³ brain and 30-kg body if H. floresiensis were a dwarfed version of the small early H. erectus females from Dmanisi, Georgia, that were 40 kg and had brain volumes in the range 600–650 cm³ (ref. 22). Alternatively, H. floresiensis might be descended from H. habilis, whose body size was possibly just as small, about 30 kg in females. But this hypothesis, too, requires some significant brain shrinking, about 25%, because the smallest known H. habilis cranium (KNM-ER 1813) has a 509-cm³ brain." (Lieberman, Daniel E. 2009).

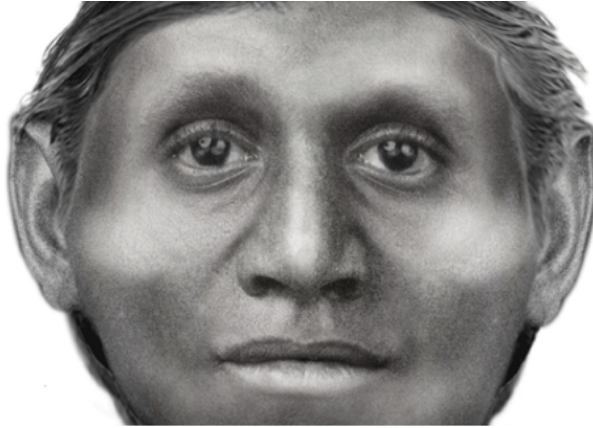
"the close relative brain sizes between H. habilis and H. floresiensis documented above may imply that intellectual capacity comparable to the former was enough for the latter. Otherwise, H. floresiensis may have experienced ‘neurological reorganization’ where brain functions are largely maintained in spite of its overall size change..." (Kubo, Daisuke; Kono, Reiko T.; Kaifu, Yousuke p. 7).

"Cranial endocasts taken from the inside of the skull of Homo floresiensis show an expansion in the frontal polar region suggesting enlargement in its Brodmann's area 10." (WIKI: Brodmann area 10").

"...swellings that square off the frontal lobes and give their outline a ruffled appearance in the dorsal view. Although hints of such contours may be seen in chimpanzee and hominin endocasts such as in the no. 2 specimen from Sterkfontein, the extent of these expansions in the frontal polar region of LB1 is unusual. This part of the prefrontal cortex in humans and apes consists of Brodmann's area 10, which in humans may be involved in higher cognitive processes such as the undertaking of initiatives and the planning of future activities. Human frontal lobes are not larger than expected for apes of similar brain volume, but area 10 is both absolutely and relatively enlarged in Homo sapiens as compared to apes." (Falk, Dean et. al. p. 245).

"Brodmann area 10 is the anterior-most portion of the prefrontal cortex in the human brain....**Present research suggests that it is involved in strategic processes in memory recall and various executive functions (i.e. reasoning, task flexibility, problem solving, planning, and execution). During human evolution, the functions in this area resulted in its expansion relative to the rest of the brain.**" (WIKI: "Brodmann area 10" and "Executive functions").

FACIAL FEATURES



(Susan Hayes. A Reconstruction of a Hobbit face. *n.d.* "New Fossils Help Bring Hobbit Humans to Life." *Discovery News*. Web. Accessed 01 Jul 2014.

<http://news.discovery.com/human/evolution/new-fossils-hobbit-face-13010.htm>).

"Their skulls had no bony chins, so their faces had more of an oval shape. Their forehead was sloping."(Viegas, Jennifer).

"But what about the head of *H. floresiensis*? LB1 has a vertical face, no snout, and most of its teeth generally resemble those of *H. erectus*. A state-of-the-art shape analysis indicates that the **LB1 skull** conforms to what one predicts from a scaled-down *H. erectus* or possibly a *H. habilis*." (Lieberman, Daniel E. 2009).

"...it is possible that the craniofacial morphology of *Homo floresiensis* was derived from early Javanese *Homo erectus*, with substantial facial gracilization associated with reduced masticatory activities."(Kaifu, Yousuke et. al.).

"The forehead slopes backwards and the eye sockets are topped by prominent brow ridges." (Jungers, William & Baab, Karen p. 162).

FEET

"...this is no human foot. Its approximate length, 20 cm, is much longer than one would find in any person of that stature, and instead has the proportionate length of a chimpanzee or an australopith (a genus of early hominin). **Additional primitive features**

include long, curved and robust lateral toes; a short big toe; and a weight-bearing process on a crucial bone, the navicular, which acts like the keystone at the top of the inside of the human arch.” (Lieberman, Daniel E. 2009).

“Together, these features suggest that the foot of *H. floresiensis* was capable of effective walking, because the middle of the foot could be stiffened when the calf muscles raised the heel off the ground. This mechanism permits the toe flexors to push the body up and forwards at the end of stance. But the inside of LB1's arch was either weak or flat, and apparently lacked the spring-like mechanism that humans use to store and release energy during running. In addition, the long, slightly curved toes probably posed no hindrance to walking, but would have created problematically high torques around the toe joints during running.” (Lieberman, Daniel E. 2009).

"The feet of *H. floresiensis* were unusually flat and unusually long in relation with the rest of the body. As a result, when walking, it would have had to bend its knees further back than modern people do. This forced the gait to be high stepped and walking speed to be low. **The toes had an unusual shape and the big toe was very short.**" (Wikipedia Online Encyclopedia "Homo floresiensis").

“It is often assumed that a human-like foot with short toes and a high arch evolved for walking. But the primitive foot of *H. floresiensis* provides a tantalizing model for a non-modern hominin foot that had evolved for effective walking before selection for endurance running occurred in human evolution. **Recently discovered footprints from Kenya indicate that a modern foot had evolved by 1.5 million years ago, presumably in *H. erectus*. Unless the Flores fossils re-evolved a primitive foot, they must have branched off the human line before this time.” (Lieberman, Daniel E. 2009).**

ANCESTRAL LINEAGE

"Because of *Homo floresiensis*' size, especially the size of its brain, scientists have enjoyed some spirited debate about whether it came to the island in the form of a lean and tall *Homo erectus* (remains of *erectus* have been found on nearby Java), then shrank over time due to island dwarfing, or whether it may have been the descendant of smaller, Lucy-size creatures who came out of Africa before *erectus* and then made their way somehow to the islands of Indonesia." (Chip, Walter p. 97).

“As of this writing (2010), there is considerable controversy over floresiensis. **Some anthropologists believe that floresiensis is a dwarf form of *Homo erectus*. Others believe that it evolved from a still smaller species. Still others believe floresiensis are simply the remains of *Homo sapiens* with diseases or congenital deformities.**” (Nanda, Serena & Warms, Richard p. 37).

“Homo floresiensis displays an unusual mixture of primitive and derived features (Brown et al., 2004; Falk et al., 2005, 2007; Morwood et al., 2005; Tocheri et al., 2007; Lyras et al., 2008; Argue et al., 2009; Jungers et al., 2009a,b). **The small endocranial volume, short stature, morphology of the carpals and robustness of the limbs are shared with australopithecines, whereas the reduced prognathism, mandibular and dental morphology, metatarsal morphology and shape of the brain are considered more derived. The shoulder configuration was found to be transitional between early hominins and modern humans** (Lordkipanidze et al., 2007; Larson et al., 2009). It is this mosaic of characters that puzzles most scientists. However, in many insular mammals, derived features are lost and a return to the primitive condition is observed.” (Meijer, Hanneke J.M. et. al. p. 1002).

“In some features, including the long, low shape of the LB1 braincase and the absence of a ‘chin’ (mental eminence) on both mandibles, the fossils suggest a miniature *Homo erectus*. In others, including the great length of the arms relative to the legs or the structure of the wrist, LB1 was arguably more australopith-like, while in still others, including the size and proportions of the teeth, it could pass for *Homo sapiens*.” (Klein, Richard G. p. 722).

"Primitive traits occur throughout the *Homo floresiensis* skeleton. Some are shared with *Homo erectus/ergaster*, while others concern skeletal elements for which there is no morphological information for *Homo erectus*. **For example, the humerus of LB1 exhibits a primitive weak torsion angle, as found in *Homo ergaster* and Dmanisi Homo, while the wrist and foot bones have Australopithecus-like traits, but few *Homo erectus* foot or hand bones are available for comparison.**" (Kaifu, Yousuke et. al.).

"...there are also numerous primitive features that resemble those of either australopiths or early *Homo*. **Primitive features in the upper limbs include** a relatively short, very curved clavicle; a straight humerus that lacked the normal degree of twisting between the shoulder and the elbow; and an ape-like wrist. **Primitive features in the hip and lower**

limbs include flared iliac blades, relatively small joints and relatively short leg bones." (Lieberman, Daniel E. 2009).

"One key feature, which gives the visual impression of primitive morphology in LB1, is the absence of a chin in the mandible." (Martin, Robert D. p. 1124).

"The anatomy of some teeth (especially the lower premolars) is strikingly primitive in both crown shape and root structure." (Jungers, William & Baab, Karen p. 162).

"A study of three tokens of carpal (wrist) bones concluded there were similarities to the carpal bones of a chimpanzee or an early hominin such as Australopithecus and also differences from the bones of modern humans. **A study of the bones and joints of the arm, shoulder, and lower limbs also concluded that H. floresiensis was more similar to early humans and apes than modern humans.**" (Wikipedia Online Encyclopedia "Homo floresiensis").

"...In contrast, a number of recent analyses of the skull, face, foot and wrist have confirmed the many unusual primitive features of H. floresiensis remains and stated that they are more similar to australopithecines." (Fran, Dorey).

"Modern humans have 'dwarfed' to pygmy size repeatedly and independently around the world, including Southeast Asia, and there is no hint of correlated evolutionary reversals in body shape or bone morphology."(Morwood, MJ; Jungers, WL 2009).

"While we are certain that H. floresiensis was a small-brained, tool making, hominin biped, with australopithecine-like limb proportions, the origins of this species remain obscure. Until recently, it was generally accepted that the first hominin to leave Africa was H. erectus (Antón, 2003), with the 1.77 Ma Dmanisi hominins morphologically representative of the first emigrants (Gabunia and Vekua, 1995, Bräuer and Schultz, 1996, Gabunia et al., 2000, Gabunia et al., 2002, Lordkipanidze and Vekua, 2002, Vekua et al., 2002, Rightmire et al., 2006 and Lordkipanidze et al., 2007)." (Brown, Peter & Maeda, Tomoko 2009).

" 'H. floresiensis presents an intriguing problem in evolutionary biology,' Brown said. **The most likely explanation is that, over thousands of years, the species became smaller because environmental conditions favored smaller body size.** Dwarfing of mammals on islands is a well-known process and seen worldwide. Islands

frequently provide a limited food supply, few predators, and few species competing for the same environmental niche. Survival would depend on minimizing daily energy requirements. But there is no absolute proof that this [insular dwarfing] is what in fact happened with this small human. **‘While there are stone tools dated as far back as 840,000 years ago, no fossils of large-bodied ancestors have ever been found’** on Flores, Brown said. **‘There is some possibility [Homo floresiensis] arrived on the island small-bodied.’**” (Mayel, Hillary).

"...could have descended from an early Pleistocene Homo erectus population in Java or elsewhere in Southeast Asia." (Kaifu, Yousuke et. al.).

"Other researchers have argued that H. floresiensis is descended from the larger-bodied H. erectus, widely considered to be the first hominin to leave Africa. Remains of H. erectus have been found throughout Asia, including on the Indonesian island of Java. **According to this hypothesis, H. erectus somehow made its way to Flores, where its descendants shrunk in size through a process called island dwarfism, in which species grow smaller to make the most of limited resources...But critics of this theory have argued that the brain size difference between H. erectus and H. floresiensis—991 cubic centimeters (cc) and about 400 cc, respectively—represents an extreme and unprecedented example of island dwarfism. For comparison, modern humans have an average brain size of about 1,300 cc.**" (Than, Ker).

"More unusual is the proposal that H. floresiensis evolved from H. erectus through dwarfing. This phenomenon, known as endemic or island dwarfing, sometimes occurs on islands when species are released from the pressures of predation but become constrained by limited resources and small population sizes. In such conditions, large animals tend to become smaller and small animals tend to become larger. **The process was clearly occurring on Flores, whose fauna includes giant rats and now-extinct miniature elephants. What captures the imagination is that dwarfing might have occurred in humans, who often buffer themselves from natural selection through cultural means such as tool production and fire-making, both evident at Liang Bua.**" (Lieberman, Daniel 2005 p. 957).

"Despite its **smaller body size, smaller brain, and mixture of primitive and advanced anatomical features, the new species falls firmly within the genus Homo.** The researchers speculate that the hobbit and her peers evolved from a normal-size,

island-hopping Homo erectus population that reached Flores around 840,000 years ago."
(Mayel, Hillary).

"...the arrival of hominins by 880 ka was probably the result of an extremely rare event, such as a tsunami... a small colonizing group could have accidentally crossed to the island while clinging to a natural raft of vegetation or an up-rooted tree washed out to sea." (Morwood, MJ; Jungers, WL 2009).

"Elephants and other large mammals have repeatedly evolved dwarf forms when they become isolated on islands, and Flores Stegodon provides a prime example. H. erectus may provide another, since diminutive human bones found on Flores have been assigned to a dwarf form, Homo floresiensis, that is argued to derive from H. erectus. The alternative is that H. floresiensis is not a valid species and that its bones actually come from one or more modern humans afflicted by dwarfism and microcephaly." (Klein, Richard G. p. 383-384).

"When first discovered, it was suggested that H. floresiensis was possibly descended from Javanese H. erectus. However, more detailed analysis of skeletal remains has uncovered traits more archaic than Asian H. erectus and more similar to australopithecines, H. habilis or the hominins from Dmanisi in Georgia (classified as Homo ergaster or Homo georgicus). Most scientists that accept H. floresiensis as a legitimate species now think its ancestor may have come from an early African dispersal by a primitive Homo species similar in appearance to H. habilis or the Dmanisi hominins. This means that it shared a common ancestor with Asian H. erectus but was not descended from it. Cladistic analysis supports the lack of a close relationship with H. erectus. Unfortunately, no transitional forms, or the actual remains of H. erectus itself, have been found in Flores. However, stone tools that may have been made by H. erectus (or a similar species) were discovered on Flores. These date to 840,000 years ago, so indicate that a hominin species was probably living on the island at that time." (Fran, Dorey).

"We believe that the Liang Bua hominins arrived on Flores in the middle Pleistocene, essentially with the skeletal and dental characteristics that distinguished them until they became extinct at approximately 18 ka. **Comparison with Dmanisi H. erectus suggests that the Liang Bua hominin lineage left Africa before 1.8 Ma, and possibly before the evolution of the genus Homo.** We believe that these distinctive, tool making, small-brained, australopithecine-like, obligate bipeds moved from the Asian mainland

through the Lesser Sunda Islands to Flores, before the arrival of H. erectus and H. sapiens in the region. They apparently survived in isolation until the end of the Pleistocene." (Brown, Peter & Maeda, Tomoko 2009).

"Researchers are debating whether H. floresiensis originated from H. erectus or more primitive forms of African Homo or even Australopithecus... **Some studies support the latter view, although currently we have no evidence for the presence of such primitive hominins in eastern Asia. Recent craniological studies strongly suggest that H. floresiensis evolved from early Indonesian H. erectus from the Early Pleistocene of Java...the oldest H. erectus assemblage from Java, is a likely ancestor candidate for H. floresiensis.**" (Kubo, Daisuke; Kono, Reiko T.; Kaifu, Yousuke p. 2).

"...we hypothesize...that the Homo floresiensis lineage exited Africa between 1.8-2.6 million years ago - i.e., before hominins occupied Dmanisi, but after they began making stone artifacts."(Morwood, MJ; Jungers, WL 2009).

"These features suggest that H. floresiensis evolved from a species that was anatomically more primitive than classic H. erectus from Asia. One possibility is that H. floresiensis evolved from H. habilis, whose skeleton is poorly known but is australopith-like in many respects. **Another is that H. floresiensis descended from an earlier type of H. erectus,** whose body may have been much less modern than we currently credit, and which perhaps deserves a separate species designation (H. ergaster)." (Lieberman, Daniel E. 2009).

"One possibility is that the hobbit evolved from another small-bodied, small-brained early human, or "hominin," called Homo Habilis. **The main problem with this theory is that there is no evidence that H. habilis ever made it to Southeast Asia, let alone Flores.**" (Than, Ker).

"Falk (an anthropologist at Florida State University) also raised a third possibility regarding Flores's mysterious inhabitants: **Perhaps the hobbit wasn't descended from a member of the Homo genus at all, but rather was a shrunken member of a far older, and more ape-like, human ancestor known as an australopith that wandered out of Africa long ago.**" (Than, Ker).

"As an alternative to dwarfing in H. erectus, the discoverers of H. floresiensis have suggested it might represent the end point of an ancient and otherwise unknown,

small-bodied lineage of Homo. This could explain both its small size and peculiarities of the LB1 postcranium like exceptionally long arms and short legs.” (Klein, Richard G. p. 723).

“All in all, it seems reasonable for Morwood and colleagues to stick to their original hypothesis that H. floresiensis is a new species. But they are less certain about whether it evolved from H. erectus or from some other species, and raise the possibility that the species derives from an unknown small-bodied hominid, more primitive than H. erectus and with australopithecine-like body proportions.”
(Lieberman, Daniel 2005 p. 958).

TEETH

“Although LB1 has a somewhat **primitively shaped pelvis**, it **shares many derived characteristics of the genus Homo, particularly in the teeth, jaw and cranium.**”
(Lieberman, Daniel 2005 p. 957).

“...H. floresiensis has a structurally robust corpus and symphysis, and is somewhat megadont in comparison to most Homo sapiens.” (Brown, Peter & Maeda, Tomoko 2009).

“...LB1, and the developmentally younger LB6, both have marked occlusal and interproximal tooth wear suggesting forceful mastication. For both LB1 and LB6, the plane of molar occlusal wear is flat, similar to hunter-gatherers like the Inuit and Plio-Pleistocene hominids, rather than the high attrition angled wear in Mesolithic agriculturalists.” (Brown, Peter & Maeda, Tomoko 2009).

"...the flat occlusal wear plane seen in LB1 and LB6 is similar to those in hunter-gatherers, including Pleistocene hominins, and is distinguished from the highly angled wear seen in agriculturalists." (Jungers, William L. & Kaifu, Yousuke p. 285).

“The mastication of uncooked meat, with low crowned hominin molars, would require prolonged and forceful chewing and may have contributed to the interproximal wear in LB1 and LB6.” (Brown, Peter & Maeda, Tomoko 2009).

"Biomechanical adaptations in the Liang Bua mandibles, while not as extreme as in australopiths, suggest a similar adaptation to high masticatory loads." (Brown, Peter & Maeda, Tomoko 2009).

"...LB1 is free of dental caries, but there is moderate to heavy dental calculus with associated periodontal disease and alveolar recession in the molar regions...The presence of calculus and/or periodontal disease itself is not unique to people in agricultural societies, but is known in various pre-Neolithic people and some species of wild primates. It is well documented in modern human foragers too...[and]...in Homo erectus from Sangiran, Central Java." (Jungers, William L. & Kaifu, Yousuke p. 286).

TOOLS

"The original skeleton, a female, stood at just 1 meter (3.3 feet) tall, weighed about 25 kilograms (55 pounds), and was around 30 years old at the time of her death 18,000 years ago...was **found in the same sediment deposits on Flores that have also been found to contain** stone tools." (Mayel, Hillary).

"...the increase in stone tool count correlates quite closely with an increase in H. floresiensis bones, Stegodon bones, charcoal and burnt stones..." (Westaway KE, Morwood MJ, Sutikna T et. al.).

"Stone tools found on the island of Flores show that early humans arrived there at least 800,000 years ago, but it's not known how early humans got there as the nearest island is 9 km (6 mi) away across treacherous seas. **Paleoanthropologists found many stone tools associated with H. floresiensis, and these tools are broadly similar to those found earlier on Flores and throughout the human evolutionary career** (i.e., Lower Paleolithic tools in Asia or Oldowan tools in Africa)." (Smithsonian National Museum of Natural History "Homo floresiensis - How They Survived").

"The find is controversial, however-**some experts wonder whether the discoverers have correctly diagnosed the bones and whether anatomically modern humans might have made those advanced artifacts.**" (Wong, K.).

"Pronouncements that Homo floresiensis lacked the brain size necessary to make stone artifacts are therefore based on preconceptions rather than actual evidence." (Brumm, Adam et. al. p. 628).

“Literally thousands of stone tools have been recovered in the sequence associated with *Homo floresiensis*, of which approximately six thousand have been subjected to further study. The assemblage includes small flakes struck from radial bipolar and burinated cores, as well as points, perforators, and microblades.” (Schalley, Andrea C. & Khlentzos, Drew p. 59).

“...stone tools found on the island. The blades, perforators, points, and other cutting and chopping utensils were apparently used to hunt big game.” (Mayel, Hillary).

“The artifacts are mostly simple flakes, but they include “points,” “perforators,” blades, and bladelets that are said to imply technological convergence on *Homo sapiens*.” (Klein, Richard G. p. 723).

"...stone artifact assemblages (from Flores) show...particular emphasis on production of radial cores, as found in the earliest Oldowan stone artifact assemblages in East Africa. **Claims by some critics that stone artifacts found with *Homo floresiensis* at Liang Bua are so sophisticated that modern humans must have made them are, therefore, ill-founded.**" (Morwood, MJ; Jungers, WL 2009).

"Some researchers have argued that *H. floresiensis* represents pathological individuals from a behaviorally modern *Homo sapiens* population, arguing in part that the stone-tools found in association are too “advanced” to have been manufactured by a nonmodern hominin. Here we show that the Pleistocene stone-tools from Flores, including Liang Bua, are technologically and morphologically similar to the 1.2–1.9 Mya Oldowan/Developed Oldowan tools from Olduvai Gorge in Africa. The Pleistocene lithic technology on Flores was therefore within the capabilities of small-brained, nonmodern hominins." (Moore, Mark W. & Brumm, Adam p. 61).

"Since tools like those on Flores are associated with nonmodern hominins in Africa, we infer that the Flores stone tool assemblages were within the cognitive capabilities of a small-brained hominin such as *Homo floresiensis*."(Moore, Mark W. & Brumm, Adam p. 62).

"What is clear from the archeological and paleontological remains at Liang Bua is that modern human hands and modern human-sized brains are not needed to produce core and flake technologies." (Morwood, MJ; Jungers, WL 2009).

“(Its primitive hand and wrist were) still apparently capable of making and using stone tools, suggesting that H. floresiensis solved the morphological and manipulative demands of tool-making and tool-use in a different way than Neanderthals and ourselves.” (Viegas, Jennifer).

“Team leader Mike Morwood and Ph.D. scholar Mark Moore at the University of New England in Australia have studied these tools closely. The tools found alongside the remains of Homo floresiensis are as sophisticated as anything that modern humans (Homo sapiens) were making at around this time.” (Roberts, Bert).

"Some associated tools were generated with a prepared core technique previously unknown for Homo erectus, including bladelets otherwise associated exclusively with Homo sapiens." (Martin, Robert D. p. 1123).

Other scientists disagree: "...assertions that tools like those at Liang Bua are elsewhere only associated with H. sapiens or H. neanderthalensis are incorrect (see also Clark 1971:xvi) and the belief that such tools are necessarily outside the capabilities of a small-brained hominin like H. floresiensis is unfounded." (Moore, Mark W. & Brumm, Adam p. 66).

"Yet whereas the pea-brained australopithecines left behind only crude stone tools at best (and most seem not to have done any stone working at all), the comparably gray-matter-impoverished H. floresiensis is said to have manufactured implements that exhibit a level of sophistication elsewhere associated exclusively with H. sapiens. **The bulk of the artifacts from Liang Bua are simple flake tools struck from volcanic rock and chert, no more advanced than the implements made by late australopithecines and early Homo. But mixed in among the pygmy Stegodon remains excavators found a fancier set of tools, one that included finely worked points, large blades, awls and small blades that may have been hafted for use as spears.** To the team, this association suggests that H. floresiensis regularly hunted Stegodon.” (Wong, K.).

“Finally, many of the flakes systematically produced from tiny bipolar, burinated and radial cores were too small for hand-held use. Why then, were they painstakingly produced? In ourselves, such microliths are produced in order to be hafted. **One possible explanation, then, is that they were also hafted by our cousin species; that**

is, that the technology of H. floresiensis indeed included composite tools. During preparation of this chapter, studies of the residues on some of these microblades have added an additional line of evidence to support this position, revealing patterns of resin residues on the tiny blades that are suggestive of hafting (Lentfer pers. com.). (Resin is the common glue used by Homo sapiens in many parts of the world when hafting stone blades onto wooden handles or spear shafts.)” (Schalley, Andrea C. & Khlentzos, Drew p. 60).

"In Sector IV, however, **dense concentrations of stone artefacts occur in the same level as H. floresiensis—up to 5,500 artefacts per cubic metre.** Simple flakes predominate, **struck bifacially from small radial cores and mainly on volcanics and chert,** but there is also a more formal component found only with evidence of Stegodon, including points, perforators, blades and microblades that were probably hafted as barbs **(Fig. 5).** In all excavated Sectors, this ‘big game’ stone artefact technology continues from the oldest cultural deposits, dated from about 95 to 74kyr, until the disappearance of Stegodon about 12 kyr, immediately below the ‘white’ tuffaceous silts derived from volcanic eruptions that coincide with the extinction of this species. **The juxtaposition of these distinctive stone tools with Stegodon remains suggests that hominins at the site in the Late Pleistocene were selectively hunting juvenile Stegodon.** The chronologies for Sectors IV and VII show that H. floresiensis was at the site from before 38 kyr until at least 18 kyr—long after the 55 to 35 kyr time of arrival of H. sapiens in the region. None of the hominin remains found in the Pleistocene deposits, however, could be attributed to H. sapiens. **In the absence of such evidence, we conclude that H. floresiensis made the associated stone artefacts.**" (Morwood, M.J. et. al. p. 1089).

“...Moore (2004) nevertheless emphasizes that a coordinated mental and physical sequence is required for the consistent, error-free production of the basic flakes, and H. floresiensis showed a very high degree of skill and control in such knapping.” (Schalley, Andrea C. & Khlentzos, Drew p. 59-60).

“Note, too, that there is no evidence that the snack-sized ‘hobbit’ brain could produce the diverse standardized and complex technology that typifies H. sapiens from about 40,000 onwards...Just how smart the ‘hobbits’ could have been under ideal conditions, we will never know -- but on balance, though well above apes, it is a safe bet that they were also substantially less intelligent than ourselves.” (Schalley, Andrea C. & Khlentzos, Drew p. 63).

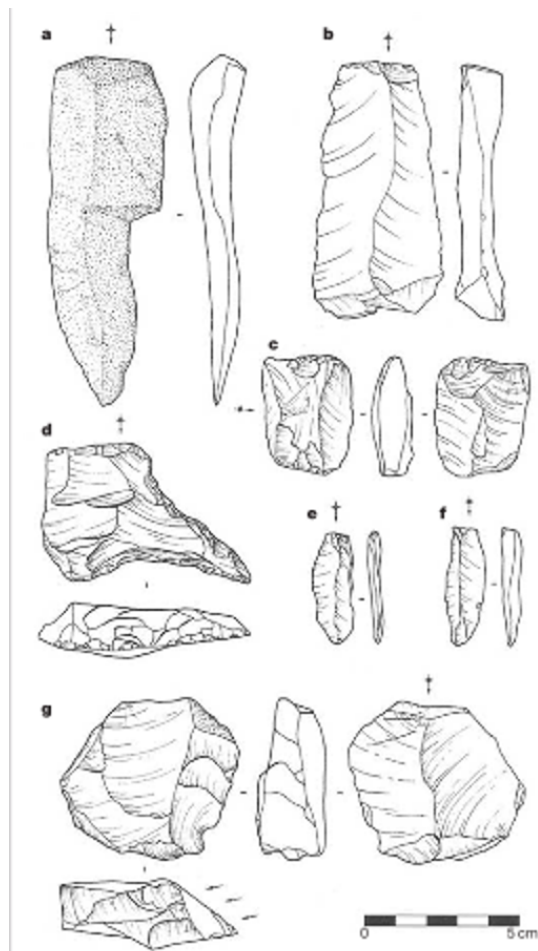


Figure 5 Range of stone artefacts associated with remains of *H. floresiensis* and *Slogodon*. **a, b**, Macroblades. **c**, Bipolar core. **d**, Perforator. **e, f**, Microblades. **g**, Burin core for producing microblades. Arrows indicate position of striking platforms, where knappers detached the flakes from cores by direct percussion using hammerstones.

(Morwood, M.J. et. al. p. 1091).

"Stanford University paleoanthropologist Richard Klein notes that the artifacts found near LB1 appear to include few, if any, of the sophisticated types found elsewhere in the cave. This brings up the possibility that the modern-looking tools were produced by modern humans, who could have occupied the cave at a different time. Further excavations are necessary to determine the stratigraphic relation between the implements and the hominid remains, Klein opines..."At the moment there isn't enough evidence" to establish that *H. floresiensis* created the advanced tools, concurs Bernard Wood of George Washington University. **But as a thought experiment, he says, "let's pretend that they did." In that case, "I don't have a clue about brain size**

and ability," he confesses. If a hominid with no more gray matter than a chimp has can create a material culture like this one, Wood contemplates, "why did it take people such a bloody long time to make tools" in the first place?" (Wong, K.).

"Brummet al. conclude that **“a long-term technological theme, involving the reduction of cores bifacially and radially, and the manufacture of a suite of technically and morphologically distinctive artifacts, is evident on Flores from at least 840 Kyr ago right up to the disappearance of H. floresiensis 12 Kyr ago.”** " (Moore, Mark W. & Brumm, Adam p. 65).

"There are strong similarities between the stone artifact assemblages from Mata Menge and Liang Bua [both on Flores] (Brumm et al.2006)." (Moore, Mark W. & Brumm, Adam p. 64).

"Overall...a long-term technological theme involving the reduction of cores bifacially and radially, and the manufacture of a suite of technically and morphologically distinctive artifacts, is evident on Flores from at least 840,000 years ago right up to the disappearance of Homo floresiensis 12,000 years ago. In contrast, the first skeletal evidence currently available for modern humans on the island, at Liang Bua around 10,500 years ago, is associated with various changes and additions to the stone artifact record, including an increased emphasis on the use of chert and the appearance of new stone artifact types (for example, edge-glossed flakes, grinding stones), as well as the first evidence for symbolic behavior, such as personal ornaments (for example, beads), pigments, and formal disposal of the dead." (Brumm, Adam et. al. p. 628).

ANIMAL FOODS

"Archaeological data showed that H. floresiensis made stone tools, and hunted dwarfed elephants (Stegodon) and giant varanid lizards (Komodo dragons) that were also present on the island." (Lieberman, Daniel E. 2009).

“The Flores humans' diets also included fish, frogs, snakes, tortoises, birds, and rodents.” (Mayel, Hillary).

“The animal bones come mainly from two large species of monitor lizard (*Varanus*) and a dwarf form of *Stegodon* (an extinct east Asian relative of the elephants).” (Klein, Richard G. p. 723).

"Concerning the behavioural context of *H. floresiensis*, associated small faunal remains include those of fish, frog, snake, tortoise, varanids, birds, rodents and bats. Many are likely to have accumulated through natural processes, but some bones are charred, which is unlikely to have occurred naturally on a bare cave floor." (Morwood, M.J. et. al. p. 1089).

"Apart from the bones of *Stegodon* and Komodo dragon, some of which have cut marks (van den Bergh et al., 2009), there is little direct trophic evidence from the Pleistocene deposits at Liang Bua. While there are thousands of rodents, and some may have been consumed by *H. floresiensis*, their presence in the cave could equally have been part of their normal life cycle. Most of the *Stegodon* are infants, and would have been preferred prey for large Komodo dragons (*Varanus komodensis*) (Jessop et al., 2006), and **relatively easy targets for an active hominin** (van den Bergh et al., 2009)." (Brown, Peter & Maeda, Tomoko 2009).

“While there is only limited trophic evidence from Liang Bua, and the vegetative component of the diet is unknown, meat was a component in the diet.” (Brown, Peter & Maeda, Tomoko 2009).

PLANT FOODS

"Although there is evidence of meat eating, apart from dental calculus in LB1, there is no direct evidence of the vegetative component of the *H. floresiensis* diet. Given the relativity of risks involved (Hawkes et al., 1991), and the likelihood that infant *Stegodon* may have only been a seasonal resource, we assume that plant foods dominated. **It is presently unknown which edible plant species may have been available during the late Pleistocene of Flores but further paleoenvironmental reconstruction, and isotope analysis (Sponheimer et al., 2005a and Sponheimer et al., 2005b), may narrow the focus.**" (Brown, Peter & Maeda, Tomoko 2009).

“Macro and micro botanical remains, including fibres, starches, and phytoliths on associated stone artifacts also show that various plant products were being brought into the site and processed.” (van den Bergh, G.D. et. al.).

HUNTING

“The Flores people...hunted stegodon, a primitive dwarf elephant found on the island. **Although small, the stegodon still weighed about 1,000 kilograms (2,200 pounds), and would pose a significant challenge to a hunter the size of a three-year-old modern human child.** Hunting must have required joint communication and planning, the researchers say. Almost all of the stegodon bones associated with the human artifacts are of juveniles, suggesting the tiny humans selectively hunted the smallest stegodons.” (Mayel, Hillary).

“There is also evidence that *H. floresiensis* selectively hunted *Stegodon* (an extinct type of elephant) as hundreds of *Stegodon* bone fragments are found within *H. floresiensis* occupation layers and some of these *Stegodon* bones show butchery marks.” (Smithsonian National Museum of Natural History "Homo floresiensis - How They Survived.").

“The occurrence of large numbers of *Stegodon* remains in the Pleistocene levels of Liang Bua demonstrates that *Homo floresiensis* subsisted, at least in part, by hunting and/or scavenging neonatal juvenile stegodons, Komodo dragons, endemic giant rats, and birds. **The predominance of very young *Stegodon*, with the inclusion of just a few older individuals, implies that the small-bodied hominins were either unable or unwilling to tackle full-grown pygmy *Stegodon* that are estimated to have weighed 350-950 k.g.**”(van den Bergh, G.D. et. al.).

“**Many of the *Stegodon* bones are those of young individuals that one *H. floresiensis* might have been able to bring down alone. But some belonged to adults that weighed up to half a ton, the hunting and transport of which must have been a coordinated group activity—one that probably required language, surmises team member Richard G. ("Bert") Roberts of the University of Wollongong in Australia.**” (Wong, K.).

“**...an adult pygmy *Stegodon* of the period weighed some 500 kg. Even to today's *Homo sapiens* this would count as big game...**The frequency and success with which they were hunted point very strongly indeed to cognitive and linguistic skills well in advance of extant apes; arguably, also, in advance of *H. erectus*, for whom big game hunting and

even the widespread use of fire is often discounted.” (Schalley, Andrea C. & Khlentzos, Drew p. 59).

“The bone accumulations associated with Homo floresiensis also contained the remains of Komodo dragon. Whether or not the hominins hunted live Komodos or scavenged their carcasses is a matter of speculation, but as a predator, the animal was certainly to be treated with caution...**They would undoubtedly have fed on Stegodon and Homo floresiensis given the opportunity,** but people can fend off Komodo with long, forked stick, as is common practice...today...” (van den Bergh, G. D. et. al.).

“There are no notable changes in Homo floresiensis subsistence patterning throughout the Late Pleistocene that would indicate modifications in subsistence procurement over time. The focus appears to have been on the hunting and/or scavenging of terrestrial mammals ranging in size from Stegodon and Komodo dragon to rats, birds, and small reptiles....There is currently no evidence for Late Pleistocene exploitation of marine coastal resources or the harvesting of freshwater shellfish for subsistence purposes at Liang Bua, **and certainly no evidence for the production of shell tools or adornments.**” (van den Bergh, G.D. et. al.).

PROCESSING

“The Flores people used fire in hearths for cooking...” (Mayel, Hillary).

“The archeologists have discovered hearths and burnt bones at Liang Bua, so Homo floresiensis used fire and did some cooking, which might have been a communal activity.” (Roberts, Bert).

“...modern humans used fire much more than hobbits.” (Moore, Mark).

“After capture, these prey were evidently transported, at considerable cost of energy and time, to the cave-where clusters and circles of reddened and fire-cracked pebbles point to the presence of hearths.” (Schalley, Andrea C. & Khlentzos, Drew p. 59).

"The discovery of charred animal remains in the cave suggests that cooking, too, was part of the cultural repertoire of H. floresiensis. That a hominid as cerebrally limited as this one might have had control of fire gives pause." (Wong, K.).

“The animal bones come mainly from two large species of monitor lizard (*Varanus*) and a dwarf form of *Stegodon* (an extinct east Asian relative of the elephants). They include pieces that were cut or charred and that therefore imply butchery and cooking.” (Klein, Richard G. p. 723).

“The total *Stegodon* counts reflect human influences, because the presence of cutmarks on some of the bones and the overwhelming dominance of juvenile individuals suggests that *Stegodon* carcasses were brought into the cave to be butchered.” (Westaway KE, Morwood MJ, Sutikna T et. al.).

“Lentfer also has a Australian Research Council grant through the University of Queensland, where she will be working closely with residues expert Dr Tom Loy, to analyze evidence of plants and animals on tools from the Liang Bua site. When she analyzed stone tools about 13,000 to 15,000 years old from the site, she found residues of blood, bone collagen and scratches made by scraping tools against bone. These tools, which were made from volcanic rocks, were used to butcher animals, said Lentfer. But other tools show evidence of starch grains and other plant residues. “This tells us that that the Hobbit was processing starchy plants at the site as well as butchering meat.”” (Salleh, Anna).

LANGUAGE

“What did they talk about, or did they even talk? Again, we can only speculate, but the range of activities they engaged in probably as a group (hunting, for example) suggests that a functional level of communication existed among them. **But lots of animals communicate perfectly well without structured, spoken language (including invertebrates, such as bees and ants!), so we can only guess as to what they might have sounded like. If you believe the Ebu Gogo legends, they mumbled to each other**—like most of us do for much of the time!” (Roberts, Bert).

[According to the Ebu Gogo legends]...“**They were said to have murmured in what was assumed to be their own language and could reportedly repeat what was said to them in a parrot-like fashion.**”(Wikipedia, the Free Online Encyclopedia “Ebu Gogo.”).

CULTURE

"no pigments or symbolic items **were found**, in contrast with Holocene occupation levels." (Morwood, M.J. et. al. p. 1012).

"...evidence for use of mollusks and symbolic behaviors symptomatic of modern humans, such as use of pigments, personal adornments, and formal disposal of the dead, is conspicuously absent from levels containing skeletal evidence for *Homo floresiensis*." (Morwood, MJ; Jungers, WL 2009).

"...we have no indication of deliberate burials for *Homo floresiensis*." (Roberts, Bert).

"The arrival of modern humans at the site [Liang Bua] by ~11 ka is clearly evident in the hominin skeletal record, but is also signaled by the appearance of new diagnostic behaviors, including formal disposal of the dead, new ways for processing plant materials (as indicated by edge gloss on some stone artifacts), the import of resources from the coast ~40 km away (i.e. marine shell), and the use of pigments and ornaments...**The two most obvious components of modern human subsistence that separate them from earlier hominin populations on Flores, however, are the use of molluscs and the import of medium and large-bodied animals to supplement the impoverished range of such animals on the islands.** With respect to molluscs, there is no evidence for this in the Pleistocene deposits at Liang Bua or in the Early and Middle Pleistocene sites of the Soa Basin." (van den Bergh, G.D. et. al.).

Possible Interaction with Modern Humans:

"The overlying deposits contain remains of *H. sapiens*, which also occur in other parts of the cave where they might be as old as those of *H. floresiensis*....from 45-30 ka forward, *H. floresiensis* and *H. sapiens* probably shared Flores and perhaps even Liang Bua." (Klein, Richard G. p. 723).

"Modern humans and *Homo floresiensis* also coexisted on the island of Flores east of Java for a substantial period of time, perhaps from 40,000 to 10,000 B.P." (Friedmann, Theodore; Dunlap, Jay C.; Goodwin, Stephen F. p. 29).

"A third group of extinct humans, *Homo floresiensis*, nicknamed "the hobbits" because they were so small, also walked the earth until about 17,000 years ago. **It is not known**

whether modern humans bred with them because the hot, humid climate of the Indonesian island of Flores, where their remains were found, impairs the preservation of DNA.” (Mitchell, Alanna).

Artificial Shelter (Lodging) & Clothing:

No research confirming or rejecting this possibility yet.

LIFESPAN

“Dietary restriction of Hobbits would have favored **slow growth and maturation, leading to the intriguing possibility that Hobbits may have been exceptionally long lived for their body size.** Tropical temperatures may have allowed dwarfing without great increases in endothermic expenditures. The originally described Hobbit was a female about 30 years of age. **Given that standard mammalian allometry predicts that humans should only live to about 25 years of age, an age of 30 for a much smaller Hobbit is already exceptional.**” (Samaras, Thomas T. p. 268).

EXTINCTION

“The species is thought to have survived on Flores at least until 12,000 years before present, **making it the longest lasting non-modern human, surviving long past the Neanderthals (H. neanderthalensis), which became extinct about 24,000 years ago.**” (Wikipedia, the Free Online Encyclopedia. “Homo floresiensis”).

“Their disappearance, along with that of other local fauna, is suggested as being due to a volcanic eruption that occurred on Flores approximately 12,000 years ago. A layer of ash dating to this time exists in the Liang Bua cave. **It is also possible that the arrival of modern humans played a role, but there is no evidence of them in Liang Bua cave until 11,000 years ago. Climate change has also been suggested, but there is no evidence for this.**” (Fran, Dorey).

“**Both the tiny humans and the dwarfed elephants appear to have become extinct at about the same time** as the result of a major volcanic eruption.” (Mayel, Hillary).

"From the faunal evidence, the intensity of Stegodon bones correlates with Homo counts until ~17 ka, after which a volcanic eruption occurred and both Stegodon and

H. floresiensis bones disappear from the sediment column. This absence may represent the extinction of both species at this site, and possibly in Flores.

(Westaway KE, Morwood MJ, Sutikna T et. al.).

The absence of evidence for *H. floresiensis* in the sedimentary record after ~17 ka implies that despite surviving reduced rainfall and widespread habitat changes for over ~175 ka, **this volcanic event may have signified the end of occupation of Liang Bua by this hominin.** This event may not necessarily have caused the total extinction of the species on Flores, but rather forced a migration away from Liang Bua to more favourable environments, possibly to the east, which were not affected by ash accumulation on vegetation or ash contamination of water supplies.” (Westaway KE, Morwood MJ, Sutikna T et. al.).

“The current consensus is that the last hobbit departed about seventeen thousand years ago, but some have speculated they may have lived on. **Anthropologist Gregory Forth has hypothesized that Flores hobbits might be the source of stories among local tribes about the Ebu Gogo, small, hairy, cave dwellers who supposedly spoke a strange language and were reportedly seen by Portugese explorers who came to the islands in the early 1600s. Henry Gee, a senior editor at Nature magazine, has even opined that species like Homo floresiensis might still exist in the unexplored tropical forests of Indonesia.**” (Chip, Walter p. 98).

[According to the Ebu gogo legends]... “The Ebu Gogo are believed to have been hunted to extinction by the human inhabitants of Flores. They believe that the extermination, which culminated around seven generations ago, was undertaken because the Ebu Gogo stole food from human dwellings, and kidnapped children... There are also legends about the Ebu Gogo kidnapping human children, hoping to learn from them how to cook. The children always easily outwit the Ebu Gogo in the tales.” (Wikipedia, the free Online Encyclopedia. “Ebu gogo.”).

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