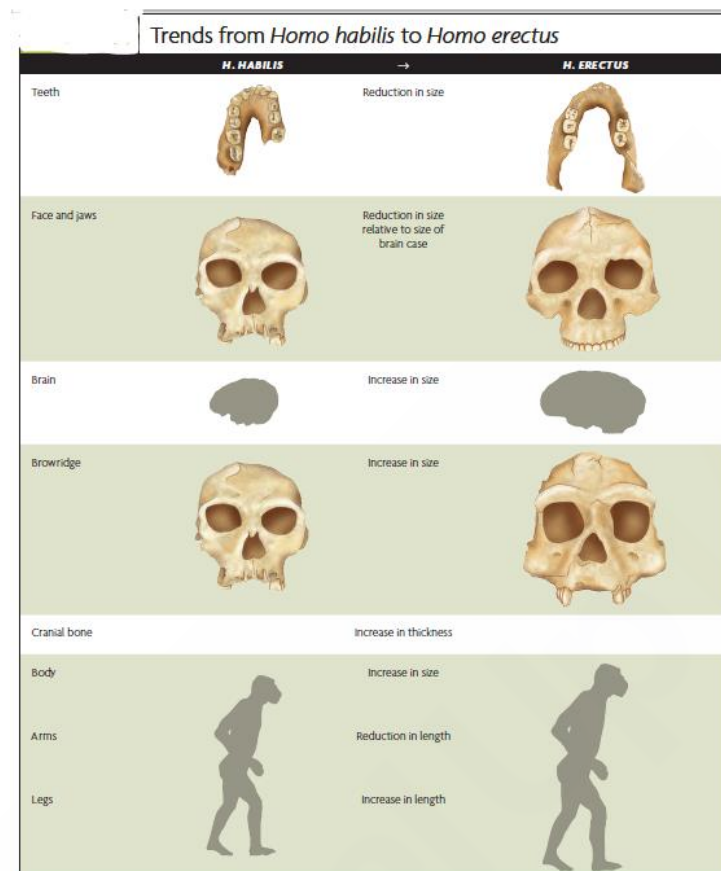


HOMO ERECTUS: BEGINNING GLOBALIZATION



Beginning around 1.8 mya, a new hominid appeared: *Homo erectus* had anatomical characteristics that distinguished it from *Homo habilis*. It was among the earliest fossil hominids described, having been found by Eugène Dubois at Trinil, in Java in 1891.

In the century since Dubois began his work in Java, many fossils with the same general attributes as the Trinil skull—large browridges, long and low skull, and bigger brain—have been found in Europe, Asia, and Africa. These hominids collectively date to about 1.8 mya–300,000 yBP. During this fascinating and dynamic period of human evolution, hominids first left Africa, colonized vast areas of Asia and Europe, and underwent fundamental changes in culture and adaptation that shaped human biological evolution.

HOMO ERECTUS IN AFRICA (1.8–.3 MYA)

The earliest record of *Homo erectus* comes from Africa, less than 2 mya. At that time, the last australopithecines were still around in East Africa and South Africa, and their fossils reveal great differences in anatomy and adaptation from *H. erectus*. Among the earliest and the most spectacular of these fossils is an 80% complete juvenile skeleton from **Nariokotome (Turkana Boy)**, on the west side of Lake Turkana in **1984 by Kamoya Kimeu**. The skeleton dates to about 1.6 mya, placing it on the boundary between the Pliocene and Pleistocene epochs. In contrast to *Australopithecus* and *H. habilis*, Turkana boy has several quintessentially modern anatomical features. **One of the most striking modern characteristics is the relatively short arms and long legs.** That is, the *H. erectus* body plan is much more like that of a living human in its ratio of arm length to leg length. This change in limb

proportions in *H. erectus* signals the beginning of a major alteration in the pattern of bipedal locomotion: *H. erectus* became completely committed to terrestrial life by adopting a fully modern stride. Life in the trees became a thing of the past.

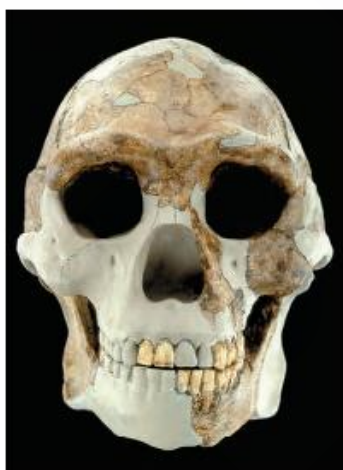
Features of the pelvic bones and overall size indicate that the Turkana boy was likely a young adolescent male. He was quite tall, about 166 cm. This change in height in comparison with *H. habilis* and the australopithecines indicates an enormous body size increase in this taxon. In addition, the Turkana boy cranial capacity was about 900 cc. Even taking into account the body size increase (brain size and body size are roughly correlated), this expansion in brain size is large compared with similar changes in earlier hominids.

Other important *H. erectus* finds have come from **Olduvai Gorge, in Tanzania**, and they include a very robust skull discovered there by **Louis Leakey in 1960**. The skull is dated at 1.4 mya and has a well-preserved cranial vault with just a small part of the upper face. Estimated at 1,067 cm³, the cranial capacity is the largest of all the African *H. erectus* specimens. The browridge is huge, the largest known for any hominin, but the walls of the braincase are thin. This latter characteristic is seen in most East African *H. erectus* specimens; in this respect, they differ from Asian *H. erectus*, in which cranial bones are thick.

A recently discovered **nearly complete female *H. erectus* pelvis** comes from the **Gona area in Ethiopia** and is dated to approximately **1.3 mya** (Simpson et al., 2008). This find is particularly interesting because *H. erectus* postcranial remains are so rare, and this is the first *H. erectus* female pelvis yet found. This new pelvis is very different from that of the Nariokotome pelvis and may reflect considerable sexual dimorphism in skeletal anatomy linked to reproduction as well as body size.

HOMO ERECTUS IN ASIA (1.8–.3 MYA)

The earliest evidence of *Homo erectus* in Asia consists of four skulls, other bones, and many stone tools found, by the Georgian paleontologist David Lordkipanidze and his colleagues, in **Dmanisi, Republic of Georgia**. The date for this important site, 1.7 mya, indicates that *H. erectus* colonized western Asia very soon after it first began to evolve in Africa. Compared with some members of the African *H. erectus*, these hominids' faces and jaws were smaller and their browridges were less developed—all *habilis* like facial characteristics. However, in overall shape the Dmanisi hominids'



Peking Man
Although the original remains of this *Homo erectus* fossil are lost, excellent casts, such as this reconstructed skull, enable modern anthropologists to study this important hominid. (Photograph © 1996 David L. Brill.)

mandible and face strikingly resemble those of the Turkana boy. Also, like those of the Turkana boy skeleton, the leg bones are relatively long compared with the arm bones.

The site yielding the most impressive *H. erectus* remains in East Asia is the cave in **Zhoukoudian**, on Dragon Bone Hill, near the modern city of Beijing (formerly **Peking**). After being discovered in the 1920s, the cave was excavated into the early 1940s. Deposits dating to 600,000–400,000 yBP contained, in fragments, the bones and teeth of 40–50 individuals, as well as many stone tools and food remains. Tragically, the entire collection of priceless bones was lost during World War II, late in 1941. Fortunately, shortly before the loss, the eminent German anatomist and anthropologist **Franz Weidenreich** (1873–1948) had thoroughly studied the bones and teeth, written detailed scientific reports, and made cast replicas, drawings, and photographs. This record has allowed scientists to continue studying the Zhoukoudian remains.

The **Dutch physician Eugene Dubois made the first finds of *H. erectus* in Java in 1891**. Dubois chose Java to look for hominid fossils largely because he was already stationed there with the military. But the choice was also a logical one for the time, since most people thought that humans had first evolved in Asia, despite Darwin's clear suggestion that Africa was the human homeland. The idea that our evolutionary line was originally African apparently did not sit well with many Europeans.

When Dubois found a skullcap and a diseased femur at the site of Trinil, he thought they represented the "missing link" between apes and humans, and he dubbed the specimens "*Pithecanthropus erectus*" (the "upright ape-man"), popularly known as "Java Man." Since Dubois's work, numerous other fossils have been located in Java and are now recognized as fully hominid and assigned to our genus, *Homo*.

The volcanic sediments of Java have yielded a wealth of other *H. erectus* fossils and also provide the ideal context for estimating the radiometric age of the fossil hominins using the argon–argon technique. The most ancient hominin from Java is the child's calvaria, or braincase, from the site of Mojokerto dated to about 1.8 million years ago. A series of fossils from more than 80 m of section at Sangiran have cranial capacities between 800 and 1,000 cc and are from sediments that range in age from about 1.7 to about 1.0 million years ago (Swisher et al., 1994).

HOMO ERECTUS IN EUROPE (800,000–400,000 YBP)

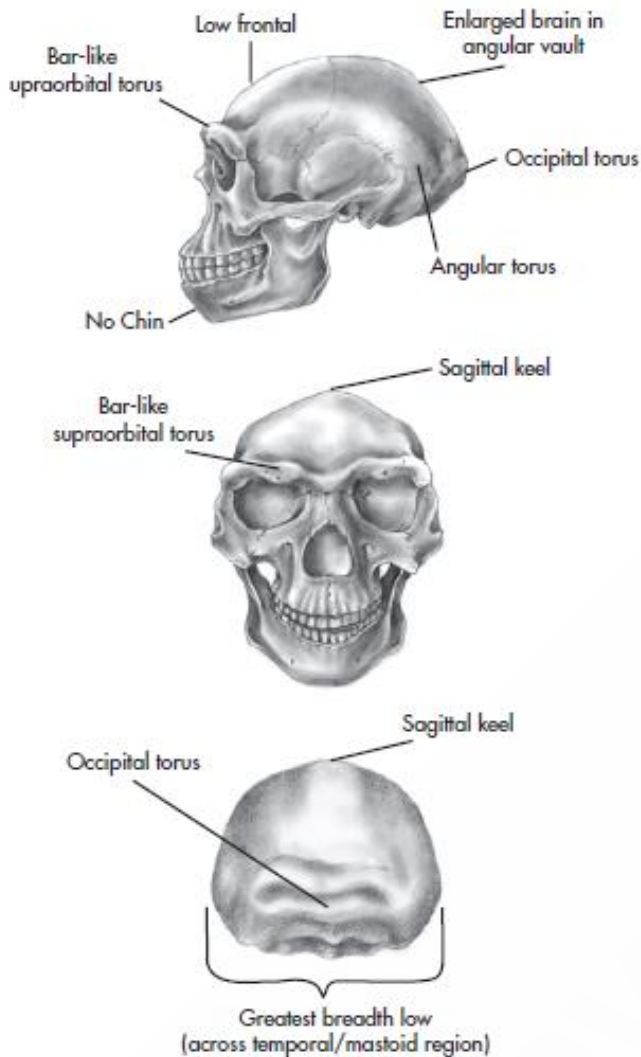
The earliest presence and subsequent evolution of *Homo erectus* were later in Europe than in Africa and Asia. The earliest fossil evidence of *H. erectus* in western Europe dates to about 800,000 yBP in Gran Dolina, Spain, and in Ceprano, Italy—a million years after the earliest hominids first left Africa. Of the half dozen sites in northern Spain's Sierra de Atapuerca, found by the Spanish paleontologist Juan Luis Arsuaga and his colleagues, the most important is Gran Dolina. In addition to many stone tools and animal remains, Arsuaga found the fragmentary bones and teeth of a half dozen hominids. Both animal bones and hominid bones had been cut with stone tools and purposely broken. This evidence indicates that hominids processed and consumed animals and other hominids.

The only other *H. erectus* remains in Europe date to about 500,000 yBP. They include the Mauer jaw—a mandible and most of its associated teeth, found near Heidelberg, Germany.



Variation and Distribution of the Early Species of the Genus *Homo* (a) *H. erectus*, Skull XII, Zhoukoudian, People's Republic of China; (b) *H. erectus*, Skull XI, Zhoukoudian, People's Republic of China; (c) *H. heidelbergensis*, Hexian, People's Republic of China; (d) *H. erectus*, Sangiran, Java; (e) *H. erectus*, Trinil, Java; (f) *H. erectus*, KNM-OL-45500, Olduvai Gorge, Kenya; (g) *H. ergaster*, KNM-ER 3733, Lake Turkana, Kenya; (h) *H. erectus*, OH 9, Olduvai Gorge, Tanzania; (i) *H. habilis*, OH 24, Olduvai Gorge, Tanzania; (j) *H. ergaster*, WT 15000, "Turkana Boy," West Lake Turkana, Kenya; (k) *H. erectus*, Ternifine II, Algeria; (l) *H. erectus*, Dmanisi, Republic of Georgia.

Anatomical characteristics of Homo erectus



Homo erectus is characterized by a somewhat larger body and brain and a uniquely shaped skull. H. erectus shows the beginnings of a modern human body plan, with a larger body size than the average Australopithecus.

The Skull and Teeth H. erectus crania are easily identified by their shape. The skull is thick-boned and robust, much longer than it is wide, relatively low and angular from the side, and pentagonal in rear view. The angularity of the skull is enhanced by a series of cranial superstructures, regional thickenings of bone along certain sutures and across certain bones. These include thickenings such as the prominent supraorbital torus or brow ridge on the frontal, a thickened angular torus on the back of the parietal, and the occipital torus, a ridge of bone that runs horizontally across the occipital. In addition, the forehead has a low, sloping or receding appearance. The pentagonal rear view is formed by other thickenings including those along sutures such as the sagittal keel.

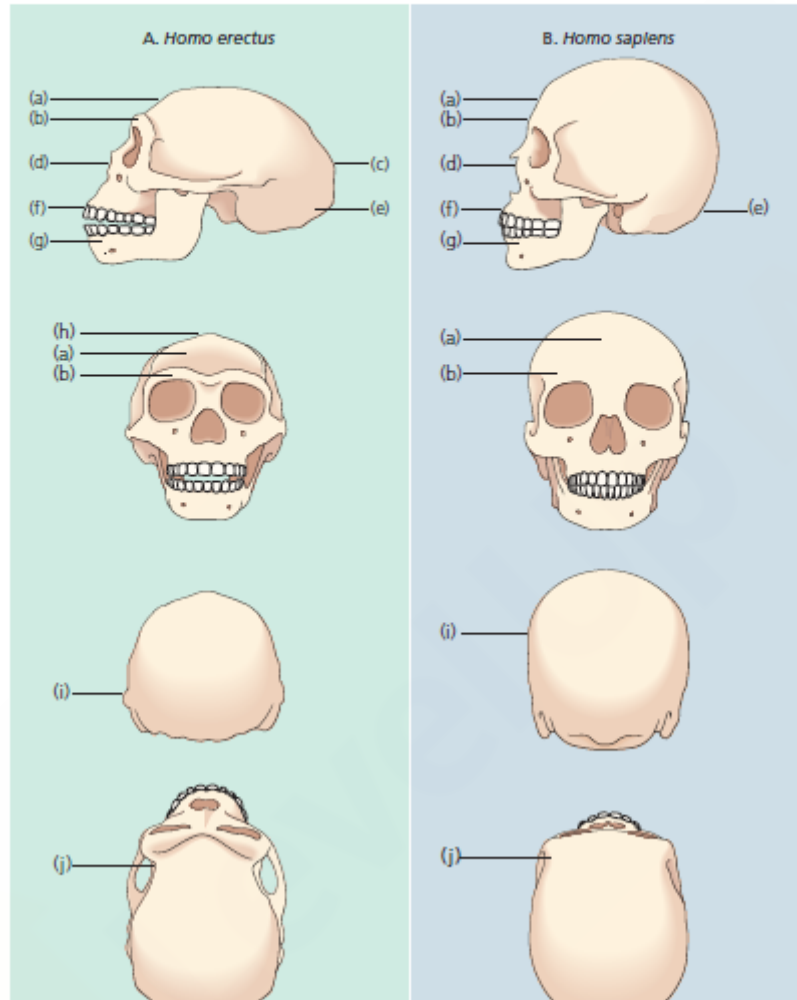
H. erectus brain size ranges from something less than 700 to 1,200 cc, averaging about 900 cc. The jaw of H. erectus was as robust and powerfully built as the rest of the cranial complex.

Homo erectus

- (a) Low, flat forehead
- (b) Prominent brow ridges extending as a bar
- (c) Occipital torus
- (d) Relatively large facial skeleton with large orbits and large nasal opening
- (e) Angular occipital
- (f) Relatively large teeth
- (g) Large mandible
- (h) Sagittal keel
- (i) Widest point low on brain case
- (j) Pronounced postorbital constriction

Homo sapiens

- Vertical forehead
- Brow ridges slight or absent
- Relatively small facial skeleton
- Rounded occipital
- Relatively small teeth
- Small mandible (sometimes with chin)
- Widest point high on brain case
- Pronounced to minor postorbital constriction



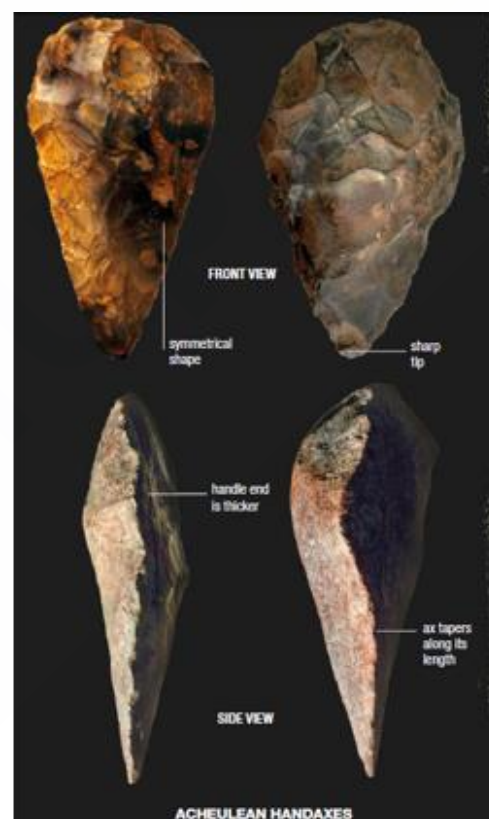
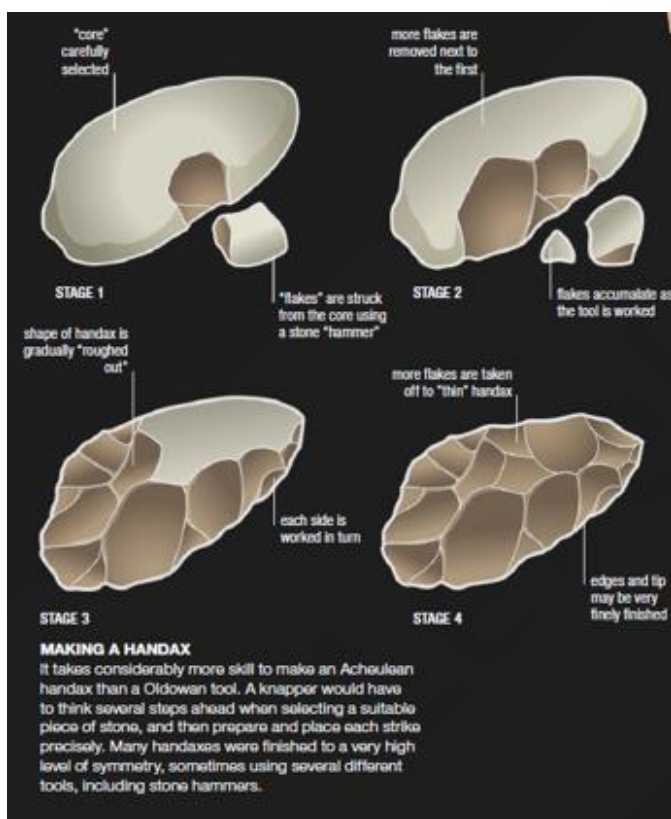
Body Size and Shape Despite the large numbers of *H. erectus* skulls and teeth that have been found over the past century, what we know of the postcranial skeleton comes from just three partial skeletons and some isolated bones, mostly from East Africa and some recently discovered remains from the Republic of Georgia. These specimens suggest not only that *H. erectus* was robustly proportioned but also that some individuals were quite tall as adults, between five and a half and six feet (Walker, 1993; McHenry and Coffing, 2000). The long bones of the arms and legs are thick; the femur is platymetric, which means it is flattened from front to back, and the tibia is platycnemic, flattened from side to side. These features are distinctive to *H. erectus*.

The species had a robust skeleton similar to *Homo sapiens*. The body is shorter stockier than modern humans. Limbs were like those of modern humans but bones were comparatively thicker suggesting a physically demanding lifestyle.

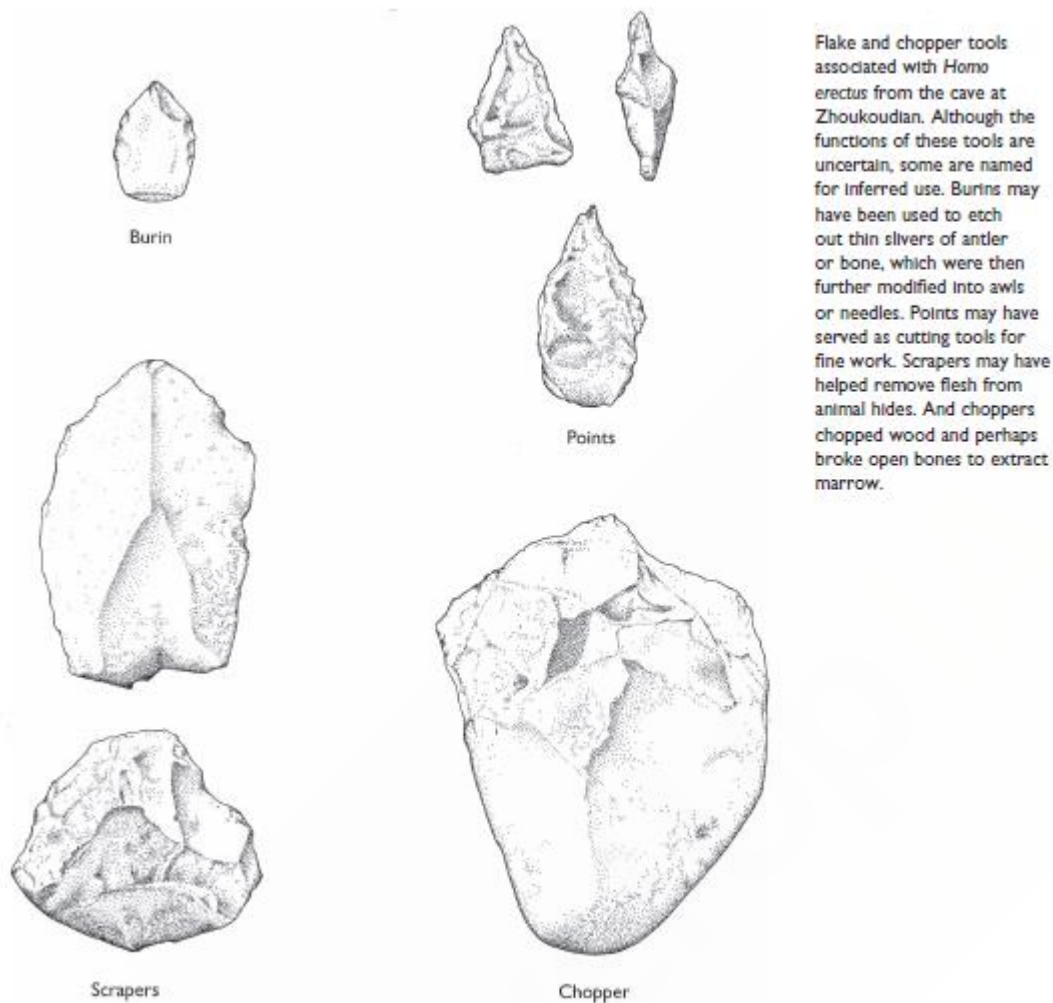
The Life of Homo erectus

Tools Like early Homo, early *H. erectus* made stone tools by taking a few flakes off a core, just enough to make the “business end.” They also, of course, used the flakes as tools. But beginning about 1.76 mya, *H. erectus* elaborated on this stone toolmaking technique by flaking the entire stone, controlling the shape of the whole core tool. This toolmaking tradition is called the Acheulian technique, after the site in France where it was first identified. The core tool produced by the Acheulian technique is the hand axe.

Acheulean assemblages are characterized by specifically shaped tools called hand axes and cleavers that are worked on two sides. Both are thus **bifaces**, tools whose cutting edge is formed by the removal of flakes from opposing sides of the piece. The scars left by the removal of these flakes meet to form the sharp edge. A **hand axe** is a bifacially worked, symmetrical, teardrop-shaped tool. It is symmetrical, edged and pointed, and bifacial (flaked on both sides). It was the all-purpose tool of its time, used for any number of tasks, from butchering to cutting wood.



In addition to hand axes, *H. erectus* also made tools with straight, sharp edges called **cleavers**. Moreover, making a hand axe or cleaver produces a great many flakes—as many as fifty usable ones by one estimate—used either unmodified or further worked to produce a desired shape. **Hand axes appeared in Africa about 1.76 mya and lasted for over a million years.** They spread throughout Africa and into Europe. They are, however, **rarely found in Asia**. Instead, **Asian erectus populations made choppers**, with flakes removed from one or both sides but asymmetrical and not flaked over the whole surface.



Fire Perhaps the most striking behavioural advance associated with *Homo erectus* is the purposeful use of fire. There is some evidence, though it is disputed, for the use of fire in Africa at 1.5 mya and France at 750,000 ya. A rock shelter in Thailand has yielded evidence of fire dated at 700,000 ya. The earliest well-accepted date is from the cave at Zhoukoudian sometime after 500,000 ya (Binford and Chuan 1985; Binford and Stone 1986). Fire, of course, provides heat, and so it is not surprising that some of the earliest evidence of fire comes from cold northern areas. Fire also provides protection from animals and can be used for cooking, making meat easier to chew and digest.

But in the long run, perhaps its most important use is as a source of light. Science writer John Pfeiffer (1966) suggests that fire could extend the hours of activity into the night and provide a social focus for group interaction. Sitting around the campfire at night was when people experimented, created, talked, and socialized. Fire serves these functions in human cultures today. Moreover, the use of fire may well have given people a psychological advantage—a sense of mastery and control over a force of nature—and a source of energy. As Pfeiffer says in the title of his article, “When *Homo erectus* Tamed Fire, He Tamed Himself.”

SHELTERS

Acheulian sites were usually located close to water sources, lush vegetation, and large stocks of herbivorous animals. Some camps were found in caves but most were in open areas surrounded by rudimentary fortifications or windbreaks. Several African sites are marked by stony rubble brought

there by H. erectus, possibly for the dual purpose of securing the windbreaks and providing the ammunition in case of sudden attack.

The presumed base campsites display a wide variety of tools, indicating that the camp was the center of many group functions. More specialized sites away from the camp have also been found. These are marked by the predominance of particular type of tool. For example, a butchering site in Tanzania contained a dismembered hippopotamus carcasses and cutting tools.

The site of Terra Amata in the city of Nice, in France, about 400,000 years old contain several huts. A basic feature of each hut was a central hearth that seems to have been protected from drafts by a small wall built just outside the corner of the hearth. The animal remains suggest that they obtained both small and large animals.

The Homo erectus used open campsites. They constructed protective shelters. Initially they hunted and gathered across the grasslands of Africa, and later in the dense forests and cold Tundra of Europe and Asia. Some erectus population like Zhoukoudian in China lived in caves. Others lived in large rock shelters or up against a cliff. The site of Terra Amata in the city of Nice, in France, about 400,000 years old contain several huts.

FOOD GATHERING

The homo erectus were food gatherers and hunters. As Zhoukoudian wild seeds survive as scanty evidence of the vegetable materials gathered by the Homo erectus.

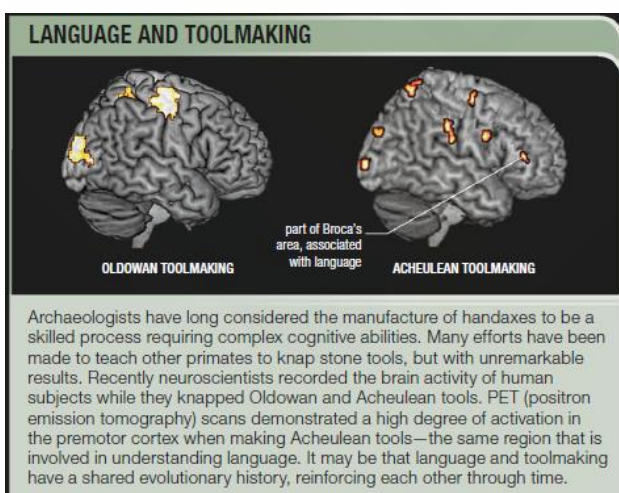
HUNTING

The Homo erectus were efficient big game hunters. The number of bones at Zhoukoudian and number and size of animals at Tera Amata in France indicate that erectus were hunters. The use of tool and fire for hunting is clearly evident in these sites.

CANNIBALISM

Some fractures hominid bones and skulls with enlarged foramen magnum from China indicate the technique of removal of human brains from skull. E.A. Hoebel suggests that cannibalism was practiced by Peking man for ritualistic and survival (in case of Scarcity) purposes.

LANGUAGE AND COMMUNICATION



According to Pilbeam the abundance of tools, smaller teeth and also controlled use of fire by the erectus revealed that they cooked food and tool making and group living acted as selective forces. These favoured the development of memory sites in Occipital lobe, thinking sites in frontal lobe and different motor areas in cerebral cortex in the brain enabling the erectus population with symbolic behaviour.

Homo erectus, had vocal tracts more like those of modern humans, positioned lower in the throat and allowing for a greater range and speed of sound production. Thus, erectus could have produced vocal

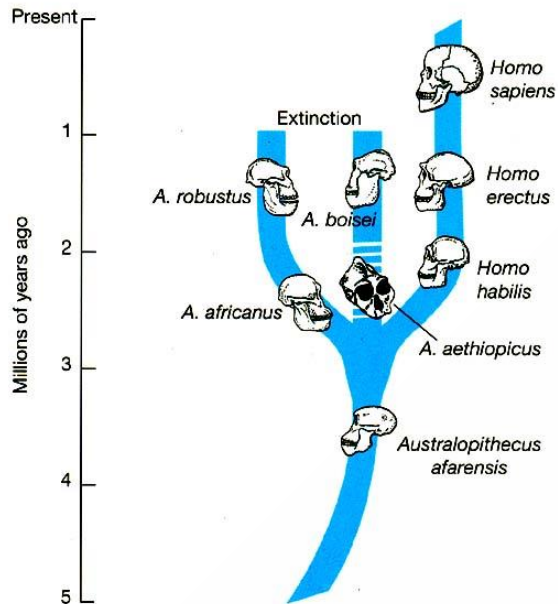
communication that involved many sounds with precise differences. Whether or not they did so is another question. But given their ability to manufacture fairly complex tools, to control fire, and to survive in different and changing environmental circumstances, erectus certainly had complex things to talk about.

PHYLOGENETIC POSITION

Though *Homo erectus* has been placed in genus *Homo* along with modern man. He exhibited many primitive characters like- thick bones, supraorbital ridges, receding frontal bone, Prognathism, large upper incisor.

He however exhibited several character which place him closer to modern man compared to his predecessor. These are: Cranial capacity, center foramen magnum, Dental arch parabolic in shape, limb bones similar to *H. sapiens* in size and shape.

H. erectus is thus more advanced than *h. habilis* but less than *H. sapiens*.



CONCEPT CHECK

Homo erectus: Beginning Globalization

Homo erectus was the first hominid to inhabit territory all over the world. After first evolving in Africa, it spread rapidly to Asia and then to Europe. Increased intelligence, increased dependence on technology and on material culture, social hunting, and access to more protein and to better nutrition contributed to this early hominid's remarkable adaptive success.



LOCATION/SITES		
Africa (Olduvai Gorge, Lake Turkana, Ileret, Bouri, Buia, Bodo, Ologesailie); Asia (Dmanisi, Kocabaş, Trinil, Sangiran, Sambungmacan, Gongwangling, Majuangou, Zhoukoudian); Europe (Gran Dolina, Mauer, Boxgrove)		
CHRONOLOGY		
1.8 mya–300,000 yBP in Africa; 1.8 mya–300,000 yBP in Asia; .8–.4 mya in Europe		
BIOLOGY AND CULTURE (COMPARED WITH <i>HOMO HABILIS</i>)		
FEATURE	EVIDENCE	OUTCOME
Tool use (Acheulian)	Skulls Teeth	Smaller face and smaller jaws Reduced size
Fire and cooking	Ash in habitation sites	Smaller face and smaller jaws Smaller teeth
Intelligence	Brain size	Increase (to 950 cc)
Hunting and increased meat protein	Butchered large animal remains	Increased body size
Possible cannibalism	Cutmarks	New ritual or dietary innovation
Growth	Enamel perikymata	Slower growth but not modern
Locomotion	Leg length/arm length	Fully modern striding