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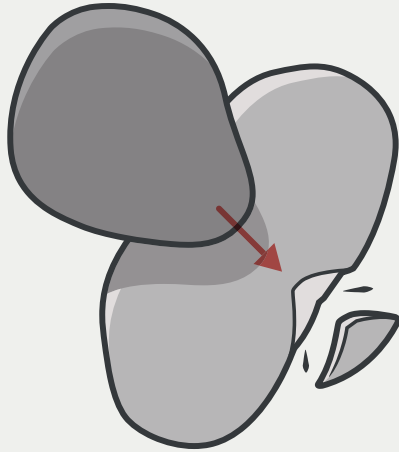
From Africa around the world: the Acheulean

The oldest known tools of early humans, processed pebbles and sharp-edged flakes, were documented in Africa, the cradle of humankind, at the 3.3-million-year-old Lomekwi 3 site in Kenya and various other sites from around 2.6 million years ago (see article by Bolus in this volume). Around 1.76 million years ago, stone tool technology changed significantly and artifacts worked on two surfaces, so-called bifaces, appeared. In addition to the pebble cores and chopping tools of the Oldowan, the recognizable handaxe now appears as the type specimen of the so-called Acheulean culture. It is a much more complex device than the previous stone tools and was mostly fashioned from basalt. These assemblages are named after the site Saint Acheul in northern France, where Jacques Boucher de Perthes (1788–1868) collected handaxes as early as the 1830s and interpreted them as human products. The researcher couple Mary and Louis Leakey carried out the first modern archeological excavations of the Acheulean in Africa at the Olorgesailie site in the years 1943–1947. Further work in Africa followed at Olduvai Gorge, Kalambo Falls, and Peninj, among others. Research into the early Pleistocene cultures of East Africa received considerable impetus from the discovery of fossil hominins in East Africa and the intensification of research into primate behavior, among others by Jane Goodall.

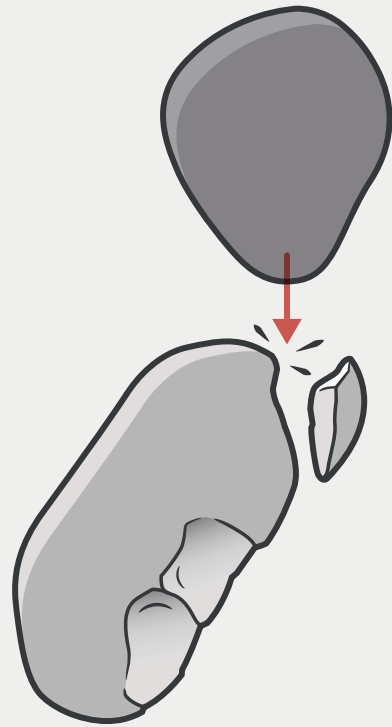
The Acheulean is the younger phase of the African Early Stone Age. It marks an important stage in the history of human technology and behavioral evolution and, with around 1.5 million years, has a similar duration as the previous Oldowan. Bifacial reduction or retouch on both surfaces of a core is also referred to as Mode II, based on the Grahame Clarke classification.

1 Acheulean basalt handaxe from the Makuyuni site in Tanzania.

2 Production scheme of an Acheulean handax.



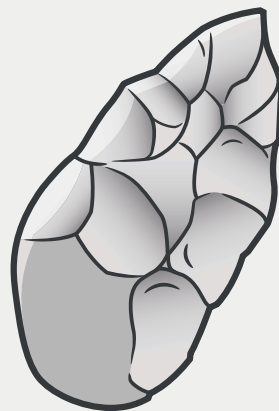
1.



2.



3.



4.

According to the current state of research, the Acheulean appears for the first time in East Africa. The oldest sites are Kokiselei 4 in West Turkana, Kenya, Konso-Gardula and Gona in Ethiopia, circa 1.76 million years old, as well as Peninj on Lake Natron, Tanzania, which is between 1.5 to 1.1 million years old. Until the end of the Middle Pleistocene around 130,000 years ago, the industry was present throughout western Asia south of the mountains, including India. The first Paleolithic handaxes discovered outside of Africa were found in 'Ubeidiya, Israel, and date to 1.4 million years before present.

Characteristics of the Acheulean

The Acheulean is divided into three phases: an early (about 1.76 to 1 million years before present), a middle (about 1 to 0.6 million years before present), and a late phase (about 0.6 to 0, 3 million years before present). In the last phase of the Oldowan culture, the first proto-handaxes appeared, heralding the transition to the Acheulean. This transition appears to be rapid and very few transitional assemblages exist. The cognitive processes associated with the conception of the typical Acheulean tool forms and the techniques for producing handaxes are very different from those used in the Oldowan. While Oldowan flakes were generally knapped from fist-sized pebbles, the Acheulean toolmakers preferred to knap off very large flakes from large boulders or cores in order to continue to process them into handaxes, picks, or cleavers. Experiments have shown that in contrast to the striking technique practiced in the Oldowan, in which the workpiece was held freely in the hand, the large flakes of the Acheulean were made by placing the piece onto a stone or wooden anvil or simply by placing the core on the ground. This knapping-off strategy required a lot more strength as well as excellent coordination and precision.

In the early Acheulean, handaxes included a round, thick end and a narrow, pointed end. The middle phase of the Acheulean is not a clearly defined cultural/technological stage, either chronologically or technologically. The pieces show moderately refined biface production and, from about one million years ago, oval, triangular, and other handax forms with a more predetermined shape and an increasing emphasis on symmetry and balance. The late Acheulean is ascribed in Africa from between 600,000 to 500,000 years ago up into the Middle Stone Age around 300,000 years ago. The bifaces undoubtedly became finer (thinner, more symmetrical, and with more flake negatives), which may have been possible due to the introduction of the soft knapping technique. In contrast to the hard striking technique with a hammerstone, the soft knapping technique requires an organic mallet made of antler or bone to work the stone. This makes it possible to knap off significantly finer flakes and to produce

Fig. 2

Fig. 3



3 The sophistication of handaxe production over time can be seen at the site in Konso (Ethiopia).

Pictured from left to right are sets of two handaxes each: approx. 1.75 million years, 1.6 million years, 1.25 million years, and 0.85 million years old (above the dorsal, below the ventral surfaces). The degree of preparation varies from nearly unifacial (left) to extensive bifacial processing (right).

correspondingly finer tools. Furthermore, numerous sites in Africa already exhibit evidence for the use of the so-called Levallois technique for the extraction of much finer and thinner flakes, which heralded the transition to the Middle Stone Age industries around 300,000 years ago. The abandonment of handaxes and cleavers in favor of smaller flaked tools in the Middle Stone Age represented the replacement of tools that were freely held in the hand with hafted pieces. It signals a profound technological reorganization during the transition from the Acheulean to the Middle Stone Age, which is associated with the appearance of *Homo sapiens*. The earliest Middle Stone Age artifacts from the Baringo site date back to 284,000 years ago. The Acheulean disappears in most regions of Africa around 200,000 years ago.

Fig. 4

The Acheulean is characterized by two special tool shapes: the handaxe and the cleaver. Handaxes, for some THE symbol of the Paleolithic, are large (> 10 cm) tools made from a pebble or large flake and reduced into a teardrop or triangular shape, with one narrow pointed end and another wider and often rounded end. Cleavers are similar in size, but instead of a pointed end, they have a wide



4 Handaxes and cleavers (below) from the Makuyuni site at Lake Manyara in Tanzania. The basalt and quartz finds are about 600,000–400,000 years old.



5 Facial reconstruction of a *Homo erectus*.

cutting edge across the longitudinal axis of the tool. Both handaxes and cleavers are usually bifacial, that is, worked on both surfaces. Picks are similar to handaxes, but thicker overall and often triangular in cross-section. There is evidence that these large tools were used effectively to dissect large animals such as elephants and rhinos but were also used to dig in the earth for woodworking. Due to the similarities in the mode of production and morphological transition phenomena, cleavers are also understood as broad-edged handaxes. They were probably used in almost the same functional context. Since the handax also occurs beyond the Acheulean in the cultures of the Middle Paleolithic, it accompanies human history over an immense period of circa 1.7 million years!

Way of life

Overall, little is known about the way of life of the people of the Acheulean. While even spears made of wood were preserved in the advanced Middle Pleistocene, very little is known for its early phase. At a few sites such as Olorgesailie in Kenya, artifacts could be documented in the context of butchered elephant remains, which are evidence for the hunt for large mammals. Many of the

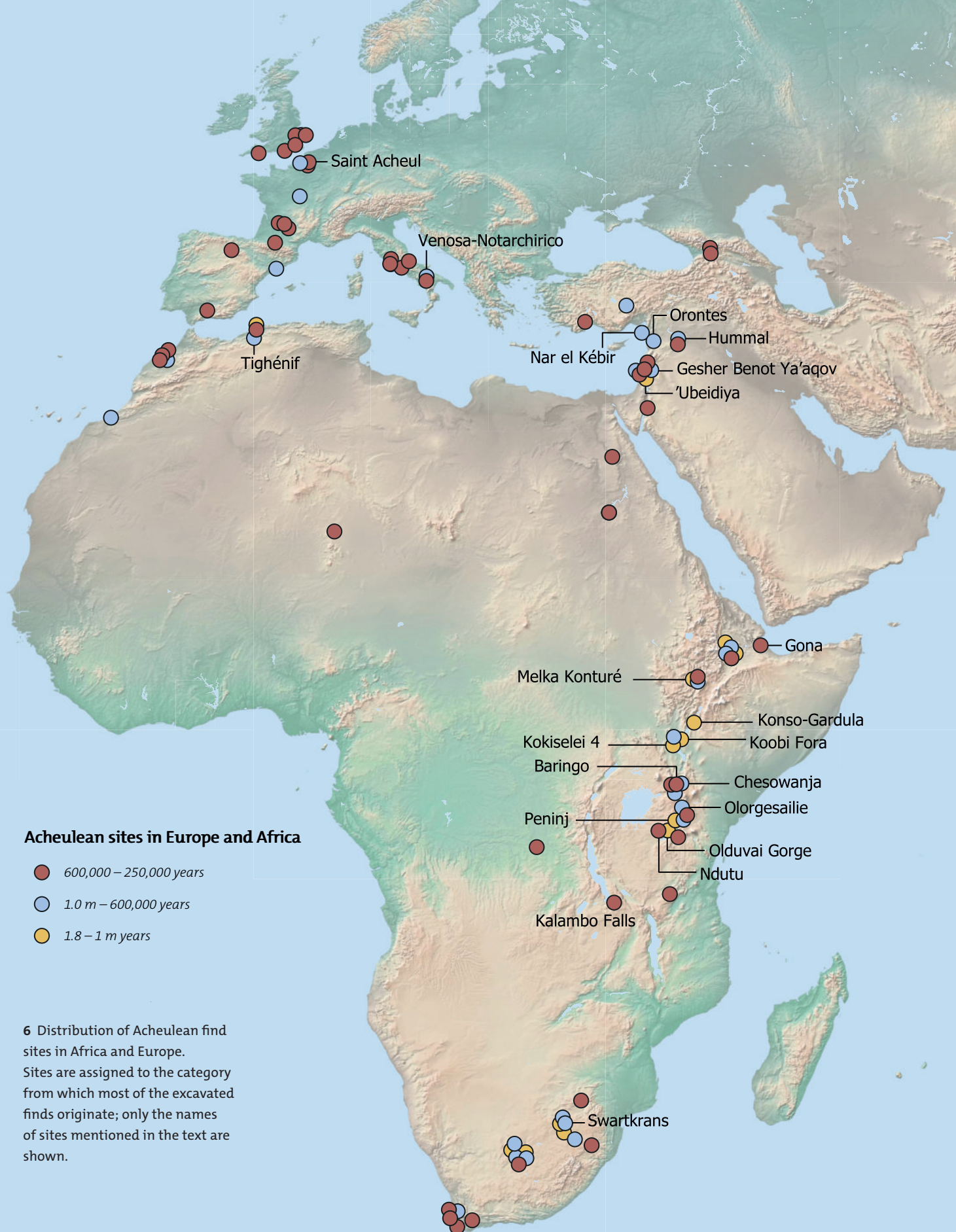
animal bones were broken open to allow for bone marrow extraction. Aside from the use of stone tools, plant remains from Kalambo Falls in Tanzania show that humans probably used plant resources as tools and food, as was the case in Gesher Benot Ya'aqov in Israel, where stones were found with dimples that were created through the repeated cracking of nuts. It should also be noted that the maximum transport distance of the raw materials increased from 15 km in the Oldowan and early Acheulean periods to 45 km in the Middle Acheulean. Evidence of early fire use from 1.5 million years ago is available from various sites such as Swartkrans (South Africa), Koobi Fora and Chesowanja (both Kenya) (see the article "Fire" by Giemsch in this volume).

Which hominins are responsible for the Acheulean?

The Acheulean probably emerged with the first representatives of *Homo ergaster* or archaic *Homo erectus*. From the Middle Pleistocene onwards, *Homo heidelbergensis* probably also used this technology. Examples are known from Tighénif (Algeria), Olduvai (Tanzania), Melka Kunture (Ethiopia), Ndutu (Tanzania), and Ologesailie (Kenya). Early representatives of *Homo sapiens*, for example from Jebel Irhoud (Morocco), Ngaloba (Tanzania), and Haua Fteah (Libya) can be linked to the Middle Stone Age technology that followed the Acheulean. This leads to the assumption that the Acheulean-to-Middle Stone Age transition about 250,000–300,000 years ago corresponds to the species change from *Homo heidelbergensis* to *Homo sapiens*.

Fig. 5

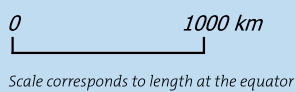
What role do environmental changes play in the emergence and evolution of *Homo ergaster* and the Acheulean? Most of the Oldowan sites in Africa are located on the banks of a lake or in floodplains, and mainly in lower areas of the rift, while the toolmakers of the Acheulean occupied a wider variety of habitats, including drier and higher-lying areas. They were also likely the first hominins to venture out of Africa in large numbers, although Acheulean technology wasn't widespread in Eurasia until much later, after one million years. Significant changes in the global climate took place in East Africa by 1.9–1.7 million years. There was increased drought and grassland expansion. While it is likely that these environmental changes and increased seasonality and variability played a significant role in the emergence of *Homo erectus*, the Acheulean, and possibly in the changing adaptations of the Middle and Late Acheulean, it is still not clear which specific selective factors triggered these biological and technological changes.



Acheulean sites in Europe and Africa

- 600,000 – 250,000 years
- 1.0 m – 600,000 years
- 1.8 – 1 m years

6 Distribution of Acheulean find sites in Africa and Europe. Sites are assigned to the category from which most of the excavated finds originate; only the names of sites mentioned in the text are shown.



Spread of the Acheulean culture

In addition to Africa, the Acheulean technology is also documented in large parts of Europe and Asia. The oldest unambiguous handaxes in the Middle East were discovered in 'Ubeidiya with an age between 1.4 and 1 million years before present. The pieces from Hummal, Sitt Markho (Nar el Kébir), and Khattab (Orontes) in Syria are of comparable age. In Europe, there are only a few sites in Spain, Italy, and southern and central France that have delivered proto-handaxes or poorly preserved handaxes that are more than 780,000 years old. Another expansion wave could be documented through the 800,000-year-old Gesher Benot Ya'aqov site in Israel. In addition to basalt handaxes, cleavers that first appeared in Africa around a million years ago, for example, at the Olorgesailie site in Kenya, were also found at the site in Israel. The first handax inventories in Europe date to between 900,000 and 500,000 years ago. In Venosa-Notarchirico, southern Italy, the industry occurs together with the remains of forest elephants. The geographical bottleneck of the Middle East on one side and the Strait of Gibraltar on the other side are both conceivable as diffusion routes to Europe and Asia.

Fig. 6

Conclusion

The Acheulean is perhaps the longest-lived technological tradition in human history. In Africa, it extends from 1.7 to 0.3 million years and corresponds roughly to the time in which *Homo erectus* (*Homo ergaster*) and *Homo heidelbergensis* lived there. In contrast to the earlier Oldowan technology, Acheulean tools—mostly handaxes, cleavers, and picks—were formed from large boulders and flakes and became increasingly standardized. The long duration of the Acheulean for over 1.4 million years is proof of the success of this technology in different habitats, altitudes, and environments, but also its conservative character since its tradition was passed on among highly mobile hominin groups with small populations over thousands of generations. Although there are differences between the early and late Acheulean industry, several researchers see technological inertia in the stone tool technology of the Acheulean, which also characterizes the previous Oldowan. Nevertheless, the makers of these tools experienced major changes through the use of other technologies (for example the use of wood, bone, and fire), strategic land use, and way of life (for example group size, organization, type of cultural transmission). Although technologically almost static, the symmetry and standardization of the Acheulean formed the basis for the later development of symbolism and language.

Further reading

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Paranthropus boisei

Profile

Discovery

The first remains of a *Paranthropus boisei*, a skull including teeth, were discovered by Mary Leakey in 1959 at Olduvai Gorge in Tanzania.

Sites

Tanzania: Peninj, Olduvai.

Malawi: Malema.

Kenya: Koobi Fora, Nachukui, Chesowanja.

Ethiopia: Konso, Shungura.

Finds

Skull, teeth, lower jaw bone, an ankle joint, thumb bones, and lower leg bones.

Age

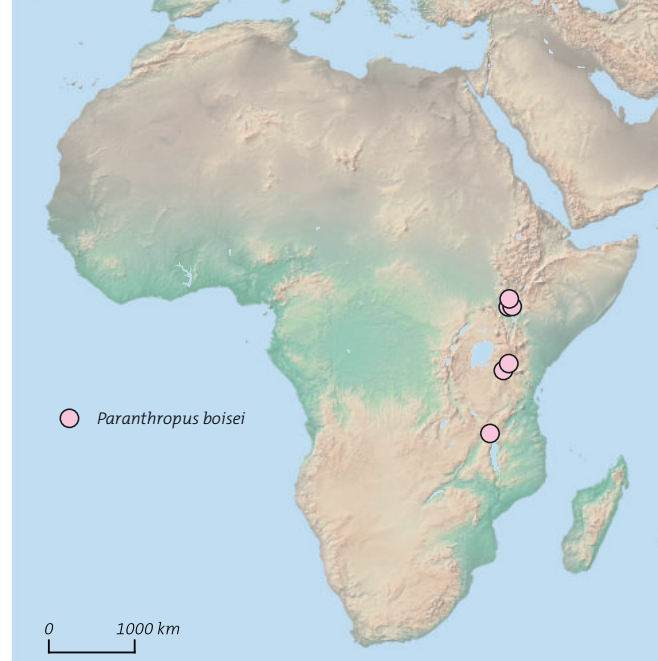
2.3–1.4 million years.

Brain size

475–545 cm³.

Characteristics

The skulls of *Paranthropus boisei* are large and have a long face with a powerful lower jaw. Special features are the broad cheekbones and the very large molars. The strong masticatory muscles were attached to a bony sagittal crest. As with *Paranthropus robustus*, the diet was probably limited to seeds, roots, and tubers, supplemented by fruits, leaves, and occasional insects. It is not yet clear whether *Paranthropus boisei* also ate meat.



Facial reconstruction



Skull KNM-ER 406 from Koobi Fora, Kenya