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The earliest stage of human stone tool technology: the Oldowan

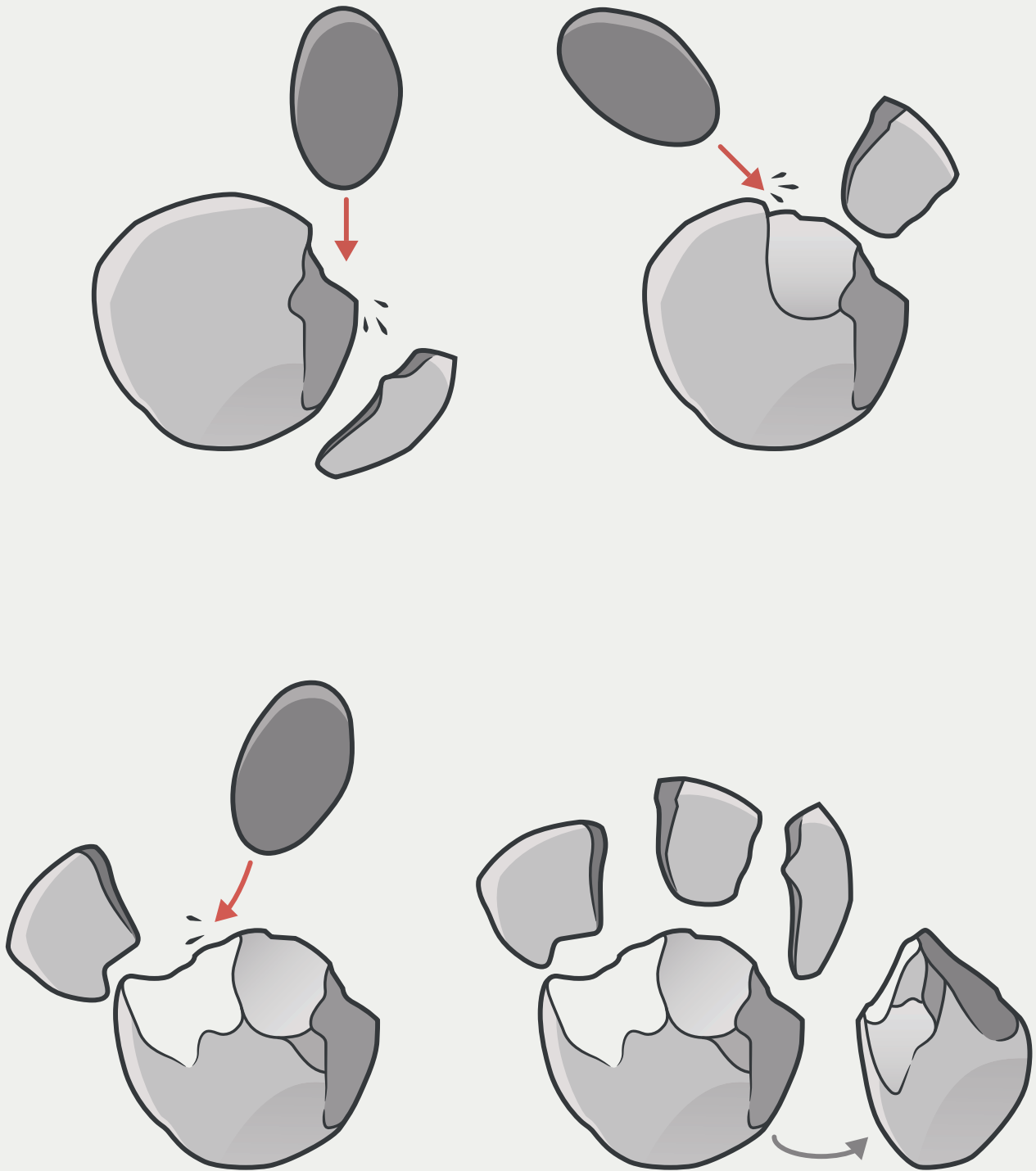
Introduction

The Oldowan belongs to the early part of the African Early Stone Age, the earliest development stage of human stone technology. It is named after the Olduvai (formerly also Oldoway) Gorge in Tanzania, whose history of prehistoric exploration is primarily associated with the couple Mary and Louis Leakey. In December 1931, L. Leakey presented the discovery of a simple stone industry from Bed I at Olduvai Gorge to the public for the first time, at that time using the term “pre-Chellean”. He first coined the term Oldowan in 1936. The Leakeys’ extensive research at Olduvai Gorge brought to light many additional find-bearing layers with artifacts from the Oldowan, and it was above all the research of Mary Leakey, especially in Bed I and Bed II of Olduvai, that provided us with an outline and a better understanding of the Oldowan period.

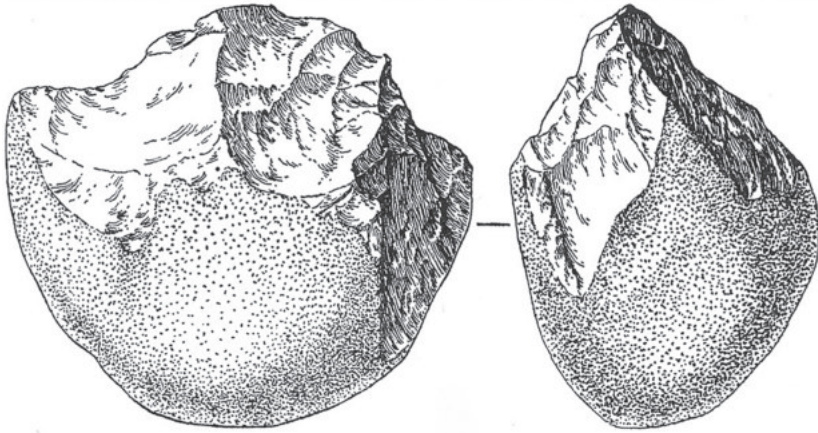
Until a few years ago, the Oldowan, with an age of around 2.6 million years, was considered to be the oldest-known stage of tool production, but recent excavations in Kenya have revealed even older artifacts. From around 1.8 million years ago onwards, the Oldowan existed in Africa parallel to the Acheulean, which is mainly characterized by tools such as bifacial handaxes that are worked on both surfaces, which are missing in the Oldowan (see the article “Acheulean” by Giemsch in this volume). Since worked pebbles are a significant part of the Oldowan assemblages, it is often referred to as a ‘pebble tool’ industry and as a Mode I industry based on the classification by Grahame Clark. We now know that the flakes knapped from these pebbles were at least as important as the pebbles. Against this background, the worked pebbles should be seen not so much as implement but as cores. Of course, this does not rule out that they were also used as crude tools.

Fig. 1

1 Different aspects of a chopping tool from Melka Kunture, Ethiopia.



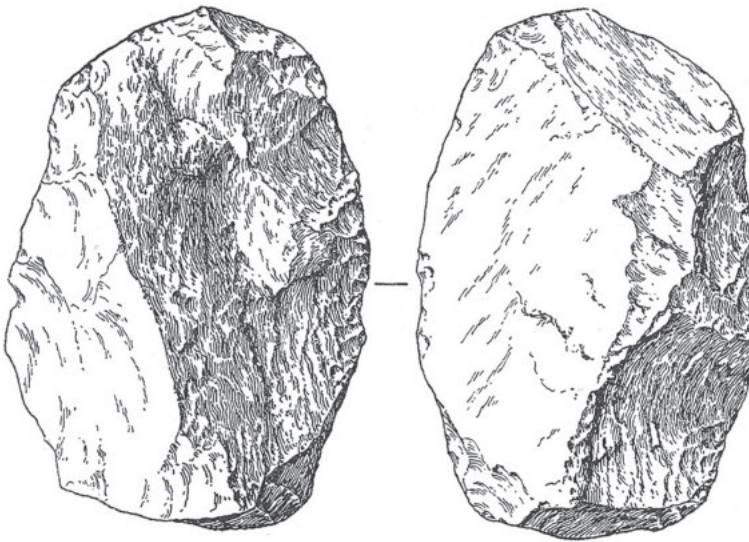
2 Production scheme of an Oldowan implement with flakes.



Chopping Tool



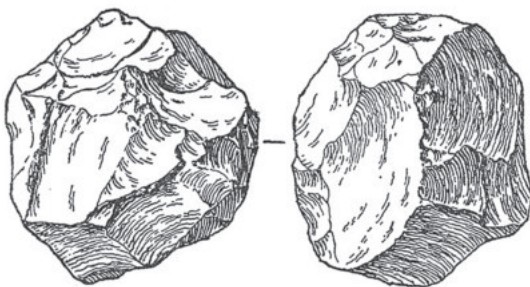
Light-duty scraper



Heavy-duty scraper



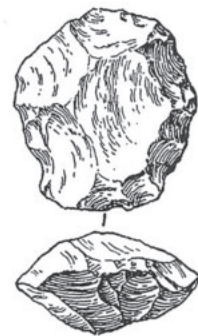
Burin



Polyhedron



Spheroid



Discoid

3 Characteristic Oldowan tool types.



Before the Oldowan: The Lomekwian

Fig. 4

Beginning in 2011, several stone artifacts were found at the Lomekwi 3 site in the West Turkana region of Kenya that are around 3.3 million years old, i.e., around 700,000 years older than the earliest Oldowan artifacts. The manufacturing techniques were simple: as one possibility, the rock to be worked on was held with both hands and struck on an anvil with great force. As another possibility, the piece was held on an anvil with one hand and the other hand struck the piece vertically with a hammerstone (bipolar technique). Evidence of both techniques is very rare in the Oldowan. The new term 'Lomekwian' was proposed since the Lomekwi 3 inventories are different from that of the Oldowan. Typical of the Lomekwian are essentially coarse, often large cores, large flakes, hammerstones, and heavy stone blocks used as anvils.

Characteristics of the Oldowan

Fig. 2

In contrast to the Lomekwian, we find a more targeted basic blank production in the Oldowan, which can even include the serial manufacture of flakes. Usually, the raw piece is held freely in one hand, while the other hand actively knaps off flakes from this core by striking it with the hammerstone. Retouched forms are generally very rare in the Oldowan. Raw materials were usually procured locally, yet research has shown certain rocks with better impact properties were deliberately chosen more frequently than others.

Fig. 3

There are several systems for classifying the Oldowan artifacts. The following description essentially follows the system defined by Mary Leakey in 1971 for the findings from Olduvai Gorge.

- The typical “pebble tools” of the Oldowan are **choppers** and **chopping tools**. For choppers, one single edge is created by knapping off one or more flakes from one side, for chopping tools the edges are prepared by knapping flakes from both sides.
- A **polyhedron** is an angular pebble tool with three or more worked edges that usually intersect. According to Schick and Toth, these are heavily reduced cores.
- A **discoid** is a flat core with a mostly lens-shaped or D-shaped cross-section and a serrated working edge, knapped from both surfaces, that is worked all the way or almost round.
- The **spheroids** include knapped, spherical pebble tools, in which the protruding edges have not been removed or only partially removed. Stone spheres with roughly smoothed surfaces are rare.

- In the context of the Oldowan, the **burin**, a typically Upper Paleolithic and occasionally Middle Paleolithic tool, is a device in which negatives were produced from partially smooth surfaces employing one or more strokes, almost at right angles to the main plane.
- **Heavy-duty scrapers** were often prepared from flat pieces of raw material that are steeply retouched on one or more edges. **Light-duty scrapers**, on the other hand, are made from flakes.

Other characteristic tools include **pointed proto-handaxes**, partially retouched, as a transitional form between choppers and handaxes. Also relevant are **trihe-drons**, three-sided retouched pebble tools, as well as **pics**, massive pebble tools that taper towards the top to form relatively narrow points.

The Oldowan in Africa

There is a great deal of agreement about the beginning of the Oldowan around 2.6 million years ago, which generally corresponds to the beginning of the geological age of the Pleistocene. Its end, however, is less clearly defined. For Africa, the term Oldowan is no longer used for inventories that are less than one million years old. Yet Oldowan-typical artifacts were used here and there up until historical times, which is evidence for the effectiveness of these pieces.

There have been numerous attempts to work out a progressive technological development within the Oldowan, but, in the words of Miriam Haidle, “From a technological point of view (...) it is not expedient to classify the early African flake industries into linear groups from simple to complex developing groups of the pre-Oldowan, Oldowan, and developed Oldowan A and B. The Oldowan is better utilized as an overarching, techno-chronological term for a great flake industry tradition between 2.6 and 1.6 million years ago” (original quotation in German). This article, which follows Haidle’s approach, includes African Oldowan sites up to an age of 1.5 million years because from this time onward, Acheulean sites are far more common than those of the Oldowan. Within this timeframe, a purely chronological distinction is made between the still relatively rare sites dated to between 2.6 and 2.0 million years ago and the more frequent sites dated to between 1.99 and 1.5 million years before present.

The earliest-known Oldowan finds were discovered in East Africa. The oldest were the finds from Gona in Ethiopia with an age of up to 2.6 million years. Recently, however, artifacts from Ledi-Geraru, also in Ethiopia, were published that are up to 2.61 million years old and thus probably somewhat older than the finds from Gona. Both inventories were primarily made up of simple flakes and cores or ‘pebble tools.’ We know of other very old Oldowan inventories with an

Fig. 4



Oldowan sites in Africa

- 1.99 – 1.5 m years
- 2.6 – 1.5 m years
- 2.6 – 2.0 m years
- ~3.3 m years (*Lomekwi*)

4 Selection of important Oldowan find sites in Africa with an age between 2.6 and 1.5 million years ago and the location of the Lomekwi 3 site (Lomekwian); sites mentioned in the text are labeled.

age of up to 2.3 million years in East Africa from the Hadar region and the Shungura formation in the Omo River Valley. The locality Lokalalei 2C in West Turkana in Kenya, which is about 2.34 million years old, deserves special attention. The artifacts testify to further development in the creative drive of their manufacturers. By systematically turning the workpiece several times, it was possible to knap off more than 50 flakes from a single raw material core in a purposeful and directed process – a clear sign of the manufacturer’s already high level of planning depth and technical skill.

Fig. 5

The numerous sites in the eponymous Olduvai Gorge are significantly younger, ‘only’ around 1.8–1.6 million years old. The various sites in the Melka Kunture region in Ethiopia are no more than 1.7 million years old. Evidence of the Oldowan technology was also discovered at very early sites in South Africa, albeit a little later than in East Africa. These include, for example, Sterkfontein with an age of around 2.2 million years, and Swartkrans, 1.7–2.0 million years old. The Oldowan is also very old in North Africa. Two sites in Ain Boucherit in Algeria date back to 2.4 million and 1.9 million years ago, respectively, while the sites Ain Hanech and El-Kherba, also in Algeria, are around 1.8 million years old.

Fig. 4

Expansions: the Oldowan outside of Africa

Although the term Oldowan was and is mainly used for finds from Africa, comparable inventories have also been found outside of Africa, especially in the Levant and in Europe. This article considers sites from the period between 1.8 and 0.78 million years ago, where the end of this period marks the beginning of the Middle Pleistocene. The occurrence of these ancient sites outside of Africa is of great importance for the question of the earliest intercontinental human expansions known under the term ‘Out of Africa’.

Fig. 6

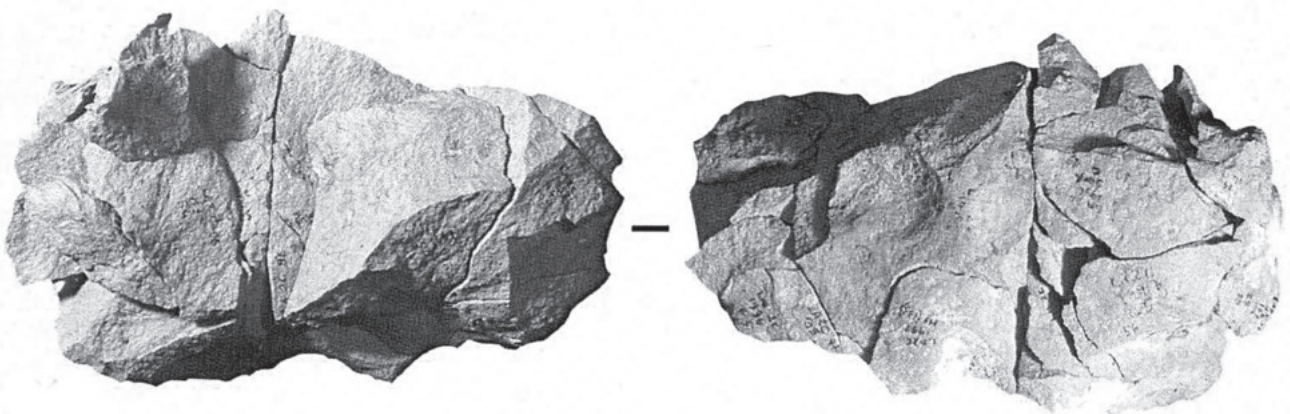
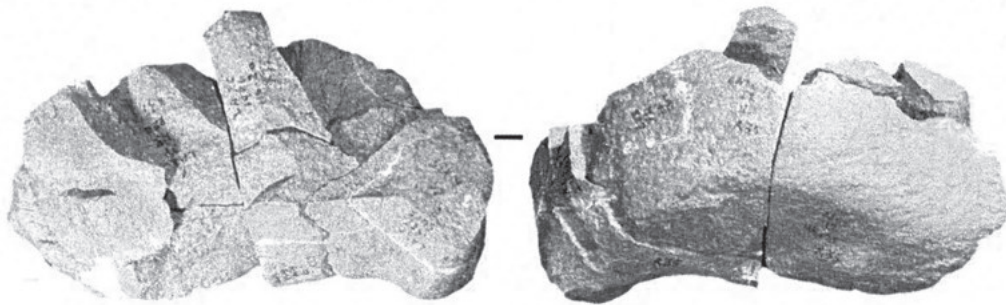
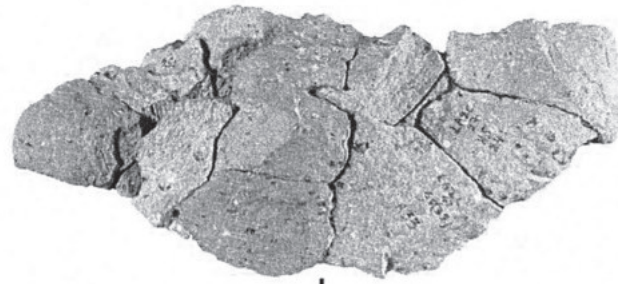
The oldest substantiated site of early humans outside of Africa is currently Dmanisi in Georgia with an age of around 1.8 million years. The stone industry is dominated by choppers and chopping tools, cores, and flakes, while retouched pieces are rare. It follows that intercontinental expansions were possible with a simple set of tools and that no Acheulean handaxes, or other bifacial tools, were necessary. On the other hand, since the oldest Oldowan artifacts from Africa are almost a million years older than those from Dmanisi, it can be assumed that the mere possession of a stone tool technology was not enough to facilitate early human expansion out of Africa.

Fig. 7

In Europe, sites in southern and western Europe in particular produced finds that are typical of the Oldowan. The oldest is Pirro Nord in Italy with an age of 1.6 to 1.3 million years. Two sites in the Orce region of southern Spain, namely Barranco León and Fuente Nueva 3, the site Sima del Elefante in the Sierra de

Fig. 8

5 Lokalalei 2C (Kenya).
Three circa 2.3 million years old
complexes of refits, which
document a well-thought-out
and organized flake
production.

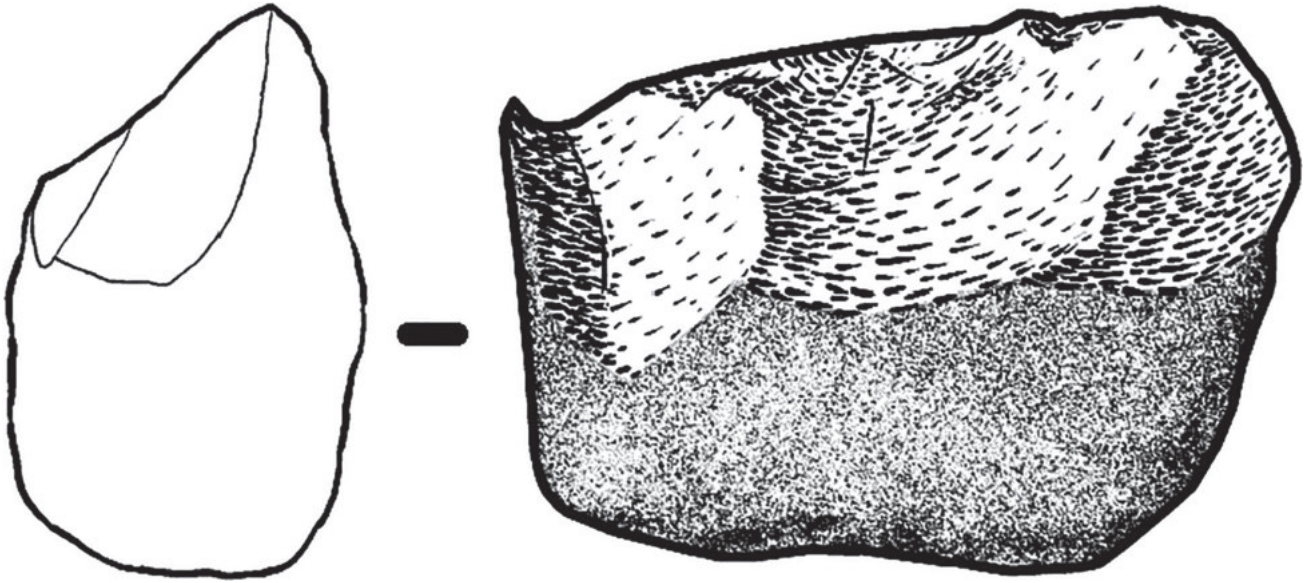




6 Oldowan sites in Europe and the Levant mentioned in the text.

Atapuerca in northern Spain, the French sites Bois de Riquet (Lézignan-la-Cèbe), and Pont-de-Lavaud and Monte Poggiolo in Italy are between 1.4 and around 1.0 million years old. Somewhat surprising, due to the geographical location, is the occurrence of such finds in the British site Happisburgh 3, which are between 970,000 and 780,000 years old.

The Dursunlu site in Anatolia is geographically outside of Europe and no more than 1.1 million years old. Also relevant for the Levant are the Israeli sites Erk-el-Ahmar and Yiron with an age of 1.7 million years and 'Ubeidiya with about 1.4 million years. The age of the Oldowan in the lowest strata of Hummal in Syria is about one million years. Some sites in China and Southeast Asia with stone artifacts typical of Oldowan are only slightly younger than Dmanisi.



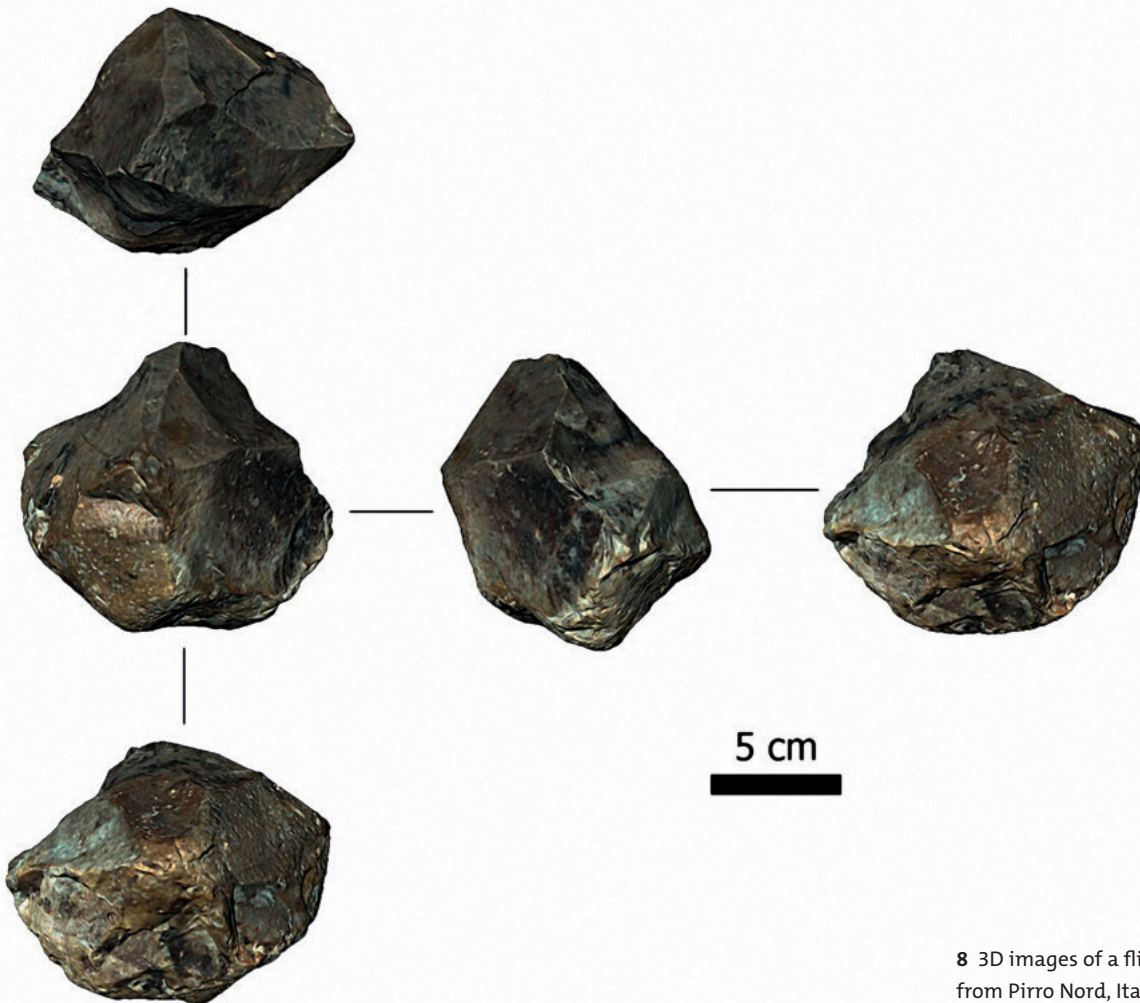
7 Chopper from Dmanisi.

Which humans were responsible for the Oldowan?

Commonly, representatives of the genus *Homo* were considered to be the producers of the oldest stone artifacts, however, late australopithecines also existed during the period assigned to the artifacts from Gona and Ledi-Geraru, and since no fossils were found directly associated with these stone artifacts, the question who produced them remains open. Some evidence that they were produced by a representative of the genus *Homo* was the discovery of the human lower jawbone in Ledi-Geraru, located only about 5 km from the site where the Oldowan artifacts were found. It presumably belongs to *Homo* and, with an age 2.8 million years old, would be the oldest *Homo*-fossil ever found. The finds from Lomekwi 3, on the other hand, date to a period from which no representative of the genus *Homo* is known. The producers must have been representatives of another genus. The numerous human remains from Dmanisi in Georgia are attributed to *Homo erectus* which suggests that the excavated Oldowan artifacts were also produced by these hominins. In Europe and the Levant, *Homo erectus* is also the only species that can be held responsible for the corresponding artifacts.

Oldowan technology and human cognition

The artifacts from Lomekwi 3 already attest to a certain knowledge of the fracture mechanical properties of the stones used by their manufacturers. It can be assumed all the more for the Oldowan technology. This understanding is arguably something that distinguishes even early humans from all animals, including non-human primates such as chimpanzees and bonobos. Another typical human aspect of the production of artifacts is that planning was carried out with foresight. This means that the early humans did not produce the artifacts exclusively for immediate use but were also able to produce tools for some future need for a yet unknown purpose at an unknown place and time. The reduction series from Lokalalei 2C shows that our ancestors finally reached a stage at which humans as artifact producers have left all animals far behind.



8 3D images of a flint core from Pirro Nord, Italy.

Further reading

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Australopithecus africanus

Profile

Discovery

The first fossil was discovered in 1924 by Raymond Dart in a fossil collection in Taung, South Africa. It was an almost complete skull of a child with a few teeth and led to the first initial description of *Australopithecus*.

Sites

South Africa: Sterkfontein, Makapanggat, Taung.

Finds

Skull and lower jaw bone of a child, fossilized cranial imprint, skull (“Mrs. Ples”), isolated teeth and lower jaw bone fragments

Age

3.0–2.1 million years.

Brain size

450–550 cm³.

Characteristics

Australopithecus africanus has only been found in southern Africa. They have a slightly sloping, protruding face, a fleeing forehead, but pronounced brow ridges above the eyes. The position of the occipital hole is more similar to humans than African great apes, which is why it can be assumed that they were constantly moving around on two legs. Representatives of the species *Australopithecus africanus* were estimated to be 1.30 m tall and weighed around 30–40 kg. Since they were omnivores, their diet probably included not only leaves, tubers, roots, lichens, tree bark, and seeds, but also meat. Their habitat were wooded areas near rivers, so-called gallery forests.



Facial reconstruction



“Mrs. Ples” from Sterkfontein, South Africa (STS 5)



Skull of the “Taung Baby”, South Africa