USING STONE TOOLS OF THE PALEOLITHIC

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INTRODUCTION

This slide set illustrates seven types of Paleolithic stone and shows some of the ways these tools may have been used.

The word "may" is used deliberately for it is axiomatic among students of paleolithic tools that the mere fact that a tool can be used for a particular purpose does not prove that it was used that way. As Semenov (1984) points out in his classic work on the use of stone tools, "the only reliable guide to the original purpose of a tool is the traces of wear that it bears."

It is possible, through microscopic examination of the edges, to tell what even the most ancient chipped stone tools were used for, because different uses produce different kinds of polish (Semenov 1984; Keeley 1978; Keeley and Newcome 1977). In experiments using modern replicated tools, Lawrence Keeley was able to identify and consistently distinguish wood polish, bone polish, hide polish, meat polish, antler polish, and non woody plant polish. Furthermore he was able to identify these same distinctive polishes on Lower Paleolithic flakes and bifaces.

While use-wear studies have provided some important information, they have been quite limited. This is partly because different types of stone wear differently, which means that new base line studies must be done whenever new materials are encountered. Also, not all stones, particularly the basalts used for tools in East Africa, are as resistant to weathering as the English flints Keeley used, so they do not preserve evidence of wear as well (Lewin 1986:114; Klein 1989:427).

Even if we are fairly certain what some tools were used for, assumptions about how they were held and used and how well they worked must be made with caution, particularly for the stone tools of the Lower and Middle Paleolithic hominids-- *Australopthecus*, *Homo habilis*, *Homo erectus*, and the Neanderthals-- for these creatures were different from us physically. While it is probably not impossible for modern experimenters to hold and use tools in roughly the same ways they were held and used in the strong, calloused hands of Upper Paleolithic men and women, few, if any, humans alive today have the enormous hand, arm, and upper body strength that Erik Trinkaus (1978:58-60; 1986:200-201) attributes to the Neandertals. *Homo erectus*, who was evidently bigger than the Neandertals and bigger than most populations of modern *Homo sapiens* as well, (Lewin 1984:529) was probably even stronger. In any case, we know little about how *Homo erectus* might have actually handled tools since to this day, 100 years after Eugene Dubois unearthed the first fossil bones of *Homo erectus*, there are no hand and arm bones attributable to that species (Rightmire 1988). The earlier hominids, *Homo habilis* and the *Australopithecines*, were smaller than we are, but they may well have had the phenomenal hand and arm strength of the chimpanzee and the orangutan (Lewin 1987:1061-1063).

Considering these differences in strength, the crude looking tools of the Lower and Middle Paleolithic may have worked better in the hands of their makers than we who handle them today can imagine.

And they may have been held and used in ways that would not occur to us, for the mental differences between us and the early hominids were probably as great as the physical differences. Some investigators believe they involved major differences in kind of mental functioning, rather than just degree of intelligence, so that these creatures were not simply less intelligent versions of ourselves, they were "definitely non-human." (Isaac 1989:374, 378). Indeed, Robert Foley (1987), a physical anthropologist at Cambridge University, has recently hypothesized that among all of the early hominids prior to *Homo sapiens*, tool using and tool making were not the result of learned behavior, as we are wont to assume these days, but instinctive behavior.

The very earliest stone tools are pebble "choppers" and flakes of the "Olduwan industrial complex" from the site of Kada Gona in the Hadar region of Ethiopia where they have been dated to between 2.7 to 2.9 million years ago (Lewin 1981:806; Klein 1983:26). Most sites with tools of the Olduwan industrial complex are in East Africa (Olduvai Gorge, Omo, Koobi Fora, Melka Kunture, Chesowanja, Gadeb) and date from 2.1 to 1.6 million years ago (Klein 1983:26; Isaac 1989:358), but Olduwan tools are also found in South Africa and southern Europe. Most paleoanthropologists think that *Homo habilis*

was responsible for the bulk of the Olduwan tools but they generally admit that the later Australopithecines cannot be ruled out, particularly the robust forms. Randall Susman has recently argued on anatomical evidence from fossil bones that *Paranthropus robustus* (a.k.a. *Australopithecus robustus*) had the hands of a tool maker and tool user and might have been responsible for the stone and bone tools associated with its remains at Swartkrans in South Africa (Susman 1988; Lewin 1988).

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Note: All of the replicated tools, with the exception of that shown from the Mount Carmel area, are from Pictures of Record tool kits and were made by Lithic Analysts, of Pullman, Washington. The Mount Carmel replica and debitage were made by Dr. Avraham Ronen, University of Haifa.

1. Typical tools of the Olduwan Industrial Complex. Back row (left to right), possible hammerstone and two "Olduwan choppers" from South Africa: Front row, two cores and two flakes from Olduvai Gorge, East Africa. (From the collection of the American Museum of Natural History and used in the "Ancestors" exhibit. Photograph by Eric Delson; Delson 1980).

2. Using a hammerstone to crack a leg bone of a large mammal for the marrow.

Hammerstones, hand sized cobblestones showing signs of use, were part of most archeological assemblages from the Lower Paleolithic on. The early hominids probably used them to crack bones for marrow, to chip other stones to produce choppers and flakes, to crack nuts and perhaps even to open shellfish. They could have been used as missiles for hunting or defense.

3. A replica of an Olduwan chopper, one of the basic artifacts in the Olduwan industrial complex.

Olduwan choppers are basalt, quartz, or quartzite pebble tools up to 4 inches across, with a short, coarse cutting edge formed by the removal of a few large flakes from one side of the stone (Oakley 1957:66-68. Technically speaking they are "uniface core tools," meaning that the tool consists of the original rock, or the core thereof, rather than the flakes removed from it in the manufacturing process, and that the flakes were only removed from one side, or face, of the core.

4. Using a replica of an Olduwan chopper to cut meat from the carcass of a medium sized mammal as an early hominid scavenger or hunter might have done.

5. and 6. Using a replica of an Olduwan chopper to cut into a leg bone of a large mammal for the marrow.

An Olduwan chopper can be used to strip meat from a carcass or chop into a large bone for marrow, (a good heavy hammerstone would be more efficient for the latter, if available). Olduwan choppers might have served for other coarse work such as splitting wood or bone, husking or peeling tough-skinned fruits and tubers, or hacking through the skins of large animals, (Bordaz 1970:17) but they are clumsy and inefficient cutting and piercing tools, at least in modern hands.

Many choppers might not have been used as tools. Nicholas Toth's and Lawrence Keeley's use wear studies of East African Olduwan choppers, and of the flakes that we once supposed were simply the waste material or "debitage" that resulted from their manufacture, have revealed that the flakes are more apt to show signs of use than the so-called choppers they came from (Lewin 1986:113-114; Klein 1989:168).

7. Using an unaltered flake to butcher a medium sized mammal. Nicholas Toth's use wear studies of Olduwan stone tool assemblages from sites on Lake Turkana in northern Kenya show that the hominids of 1.5 million years ago were using flakes to cut meat, soft plant material and wood (Lewin 1988:114).

Evidently they knew what all modern makers and users of stone tools quickly discover: a flake with an inch or so of cutting edge is a handy and versatile cutting tool. With flakes one can butcher and disarticulate small to medium sized animals, cut raw or cooked meat into bite sized pieces, cut hides and plant fibers, and smooth and shape wood. While flakes dull quickly compared to steel knives, (they can be just as sharp, given the right kind of stone, such as chert or obsidian) worn out flakes are quickly and easily replaced as long as a good supply of chippable stone is available.

8. Skinning an animal with a flake.

9. Cutting meat from a carcass with a flake.

10. A selection of Acheulian tools from Africa. From left to right: a large cleaver, a large core/chopper, a flake, a small hand axe, and a large hand axe. (From the collection of the American Museum of Natural History and used in the "Ancestors" exhibit. Photograph by Eric Delson; Delson 1980).

Hand axes were added to the Olduwan tool kit between 1.6 and 1.5 million years ago (Klein 1983:28) transforming it, in archeologists' eyes, into

the "Acheulian industrial tradition" of Africa, western Europe, the Mediterranean, the Near East, the Middle East and southwest Asia (Klein 1989, Figure 4.11). They are pear-shaped or ovoid tools, usually from 4 to 6 inches long, but sometimes much larger.

Their primary maker and user was undoubtedly *Homo erectus*, the dominant hominid from between 1.8 and 1.7 million years ago to between 500,000 and 400,000 years ago. The late hominids, the Neandertals and early *Homo sapiens*, used them too for they occur in great number on sites dating as recent as 200,000 to 130,000 years ago, and were made even after that in small numbers (Klein 1989:424).

11. and 12. Front and side views of a replica of an early Acheulian or "Abbevillian" hand axe. These early hand axes have steep edges and thick midsections, making them poor cutting tools. The hominids who made them had not learned the complicated techniques needed to remove long, thin flakes to produce a thin tool. The only technique they knew was direct percussion, hitting the edge of the core with a hammerstone or striking it against an anvil stone. This simple technique produces short wedge-shaped flakes and a tool with a steep cutting edge (Oakley 1959:7; Bordaz 1970:21-25; Klein 1989:410).

13. A replica of an Abbevillian hand axe, from one of the cave sites at Mount Carmel in the Near East, with all of the flakes that were produced in the process of manufacturing it.

Abbevillian hand axes, particularly those from Africa where the local basalts and quartzites do not chip very well, are
often so thick and coarse-edged that some archeologists have
speculated that, like some Olduwan choppers, they were not tools at all, but simply the "exhausted cores" or residue from the process of knocking as many usable flakes as possible off a hand sized cobble stone (O'Brian 1984:20). On the other hand, Nicholas Toth has found them to be excellent for butchering large animals (Lewin 1986:113) and they would have been fairly good digging implements, (O'Brien 1984) certainly superior to the fingers for digging roots or burrowing animals out of dry or frozen ground.

There are other possible uses as well. Valerius Geist (1981) speculates that Neandertal hunters made use of their great leg and upper body strength to kill long haired Ice Age mammals such as such as mammoths, bison. and the steppe rhinoceros with hand axes. Their method, he suggests, was to leap on the back of an animal and ride it, bucking bronco style, holding on to its long hair with one hand and hacking at its spine with a hand axe with the other. Geist calls this "close-quarter confrontation hunting." At the very least, his idea is an interesting attempt to break the habit of thinking the early hominids could only have used tools in ways that seem reasonable and obvious to us.

14. and 15. Hundreds of hand axes in situ at the 900,000 to 700,000 year old site of Olorgesailie in Kenya, forty miles southwest of Nairobi. One of the mysteries about hand axes and their uses is why they were discarded in such great numbers at Olorgesailie and other Acheulian sites in eastern and southern Africa (Klein 1989:211, 217). Eileen M. O'Brien, who has pondered this problem, notes that sites where hand axes turn up in large numbers are mostly places "within or alongside what were once (and may still be) water course or wetland environments" (1984:20). She suggests that these were not living sites but kill sites, sites where hand axes were thrown at birds and small to medium sized animals coming to drink or feed, and were lost in the water or mud. Through some simple experiments, she determined that hand axes, whether thrown side arm (discus-style) or overhand (football style) almost always land edge first and tend to land point first. This characteristic might have made them significantly better than ordinary rocks at inflicting wounds that would immobilize small and medium sized animals, particularly if thrown with the enormous strength of *Homo erectus*.

16. Like all tools of the Lower and Middle Paleolithic, hand axes were probably used unhafted. Although a horny handed *Homo erectus* or Neandertal artisan might not have needed as much protection from the sharp edges as a modern user, these tools were probably padded with leather or bark for heavy work such as chopping bone or wood or frozen meat (Bordaz 1972:21). On some Neandertal hand axes the edge held in the hand was coated with a thick mastic made from "clay and tree resins" (Geist 1981:26).

17. Using a replica of an Abbevillian hand axe to butcher a medium sized mammal.

18, 19, 20, and 21. Using a replica of an Abbevillian hand axe to cut and sharpen a hardwood sapling to produce a simple digging stick.

Abbevillian hand axes work fairly well, even in comparatively weak *Homo sapiens* hands for cutting green hardwood to make tools like digging sticks, wooden spears, and perhaps wooden clubs and throwing sticks. Although the earliest known wooden implement is a 300,000 year old yew spear or digging stick point from Clacton-on-Sea in England, (Bordaz 1970:7; Oakley 1964:Figure 5)) which would be very late Acheulian, at best, it is likely that wooden tools were made much earlier.

22. A replica of a late Acheulian hand axe, an improvement over the Abbevillian form because it is thinner and has comparatively even cutting edges.

Late Acheulian hand axes were evidently general purpose cutting and chopping tools, the Paleolithic equivalent of the Swiss army knife.

23. Using the pointed end of a late Acheulian hand axe replica to make initial skinning cuts on the inside of the hind leg of a medium sized mammal. Although this tool works fairly well for this purpose, considerable sawing is required. A small flake would work better.

24. Skinning a medium sized mammal with a late Acheulian hand axe replica. Hand axes are fairly good tools for skinning medium sized or larger animals, better perhaps than sharp flakes or steel knives in that there is less danger of cutting through the hide accidentally and spoiling it.

25. and 26. Disarticulating a medium sized mammal with a late Acheulian hand axe replica: slide 25, removing a foot, slide 26 separating ribs. Disarticulation is easily accomplished with a hand axe; it is not necessary to cut through bones, provided the user has some knowledge of bone and muscle anatomy.

27. and 28. Stripping meat from a carcass with a hand axe.

29. and 30. Cutting meat with a hand axe. Hand axes are good tools for cutting meat, raw or cooked. Their sinuous edges seem to work on the same principle as modern steak knives.

31. Using a hand axe as a chopper to detach the ribs from the backbone of a medium sized mammal.

32. Simple woodworking with a late Acheulian hand axe; sharpening a green hardwood sapling to make a digging stick or spear.

33. Cutting a woody vine with a late Acheulian hand axe replica.

34. A replica of a Levallois flake.

The Levallois technique of producing flake tools of more or less uniform size and shape from a preshaped core was developed between 400.000 and 200,000 years ago. Levallois flakes and Levallois cores appear in some late Acheulian assemblages, and they are common in some Mousterian assemblages in Europe and the Near East (Klein 1989:420-421) As cutting and scraping tools Levallois flakes are a considerable improvement over randomly produced flakes.

35. Using a Levallois flake to skin an animal.

36. and 37. Using a Levallois flake to work green wood.

38. A replica of an Upper Paleolithic blade.

The technique of manufacturing blades (flakes that are at least twice as long as they are wide) of uniform size from a specially prepared cylindrical core is one of the diagnostic traits of the Upper Paleolithic (Klein 1989:356). The Upper Paleolithic blade--core technique is the ultimate technique for producing the maximum amount of usable cutting edge from a core (Bordaz 1970:56-57). It also produces tools of more or less standard size and shape, which probably tended to improve craftsmanship.

Blade tools can be used as is, as knives, or they can be modified into scrapers, burins or projectile points.

39. Butchering an animal with an Upper Paleolithic blade.

40. Cutting leather with an Upper Paleolithic blade.

41. A replica of an Upper Paleolithic end scraper on a blade.

End scrapers on blades--blades with one steeply beveled end appear first in Solutrean assemblages, and are abundant in Magdalenian and later assemblages, including the upper Paleolithic "Paleo Indian" assemblages of the New World and many Neolithic assemblages in the Old World and the New World.

Although there is speculation that they were used as gouges for wood working or for cutting skins, there is good evidence from use wear studies, as well as good circumstantial evidence, that they were used primarily for scraping skins, both to deflesh and dehair them and, more important, to make them soft, like chamois leather. Among modern furriers scraping hides to soften them is called "currying." Use wear studies indicate that end scrapers of blades were used unhafted, generally being held at a 75 to 80 degree angle and pushed across the hide so the rounded, steeply beveled edge could do its work of softening the hide without cutting it (Semenov 1965:86-87).

42. and 43. Defleshing a hide.

Using an end scraper to deflesh a hide. The tool works best if the hide is either stretched taut or draped over a log or board.