A New Tool Maker in the Hominid Record?

New data from Australopithecine hand bones challenge the long-held assumption that only members of the genus Homo *are capable of making and using tools*

THE notion that the making and using of tools sets humans apart from the rest of the animal world has a long pedigree, going back at least as far as Benjamin Franklin. Even in recent years, during which sundry animals including chimpanzees have been observed to indulge in simple tool use of various sorts, this supposedly unique domain of human activity—it is usually designated as "culture"—has remained relatively intact. However, the report on page 781 of this issue by Randall Susman of the State University of New York at Stony Brook challenges a cherished anthropological assumption associated with this topic.

This assumption is that, not only do humans uniquely display the ability to make and use tools, but within the human (hominid) family itself, only species of the genus *Homo* were so equipped. *Australopithecus* and *Paranthropus* species, it has usually been said, may have walked around on two legs like all good hominids did, but they lacked the intelligence to develop culture. Not so, says Susman. At least one non-*Homo* species was a tool maker. And if this is true, then it is reasonable to expect that others—but not all—were probably tool makers too.

Susman has been studying some fossil hand bones recently recovered from the cave site of Swartkrans in South Africa. Now, this is a fairly complicated deposit geologically speaking, but Susman's interest is in a layer that was deposited a little less than 2 million years ago. The deposit contains crude stone tools and some prehuman fossils, a few of which are those of *Homo erectus*, which is considered to be a forerunner of *Homo sapiens*, while the majority are of *Paranthropus robustus*, a small-brained member of the human family that became extinct just less than a million years ago.

Susman argues that the finger bones recently discovered are those of *Paranthropus robustus* (called by some authorities *Australopithecus robustus*). And, as he outlines in his report, they bear the telltale signs of a hand capable of sophisticated manipulation. Specifically, this has to do with the size and shape of the thumb and the breadth of the fingertips.

In contrast with apes' fingertips, which are very narrow, sometimes almost like needlepoints, human fingertips are quite broad, covered on one side by a broad nail and on the other by a large pad of tissue. This tissue pad is richly supplied with blood vessels, which is why you bleed so readily when you prick your thumb, and sensory nerve endings, which allow fine control in object manipulation. *Paranthropus* fingertips appear to have been equally endowed.

Several monkeys and apes are adept at manipulating small objects—usually during feeding—but none has the broad finger pads that we and, apparently, *Paranthropus* have. Therefore, argues Susman, it is reasonable to argue that the hands of *Paranthropus* were adapted to the demands of tool making and using. It is an argument that is likely to be contentious, for two reasons: the first has to do with tool making as a cultural activity; the second, to do with the nature of what constitutes convincing evidence.

Although early hominid archeology has undergone something of a revolution in recent years, there still exists a residue of homocentrism. Until the 1970s, the existence of stone tools in the archeological record was interpreted as a signal of a complex set of behaviors that were distinctly human. Tool-making hominids were in effect seen as primitive hunter-gatherers, moving between home bases, sharing food, and dividing tasks differently between males and females.

In this context, the ability to make tools was just part of being incipiently human. It is therefore not surprising that *Homo* was accepted as being the tool maker while other contemporary hominids were not. These days, however, early hominids are no longer seen as merely quaint but primitive versions of ourselves, and stone-tool making is interpreted as having been an adaptation to occasional scavenging. Nevertheless, even though the sociocultural edifice has collapsed, there is still something of a reluctance to accepted non-*Homo* hominids as being tool makers. Old prejudices die hard.

But, as with most prejudices, this one can claim some supporting evidence. For instance, if you look at the full sweep of hominid history you see a clear pattern. The first hominids appeared as much as 5 to 7 million years ago, the first fossil evidence being *Australopithecus afarensis* from Ethiopia and Tanzania, dated at 3.75 million years and younger. And yet the first evidence of stone tools comes at about 2.5 million years ago. It therefore seems fair to conclude that the earliest hominids did not make stone tools. Susman notes that the finger bones of *A. afarensis* have narrow pads, like an ape's.

Going now to the later stages of human history, from a little less than a million years ago only one genus of hominid—*Homo*—existed. By this time stone-tool making had been well developed. Between about 3 mil-

Stone Tools:

These simple pebble tools, made by Nicholas Toth of the University of Indiana, are of the type found at the earliest archeological sites, including Swartkrans cave in South Africa. The hand is that of Homo sapiens.

lion and 1 million years ago several species of hominid coexisted—and stone-tool making developed. The question, therefore, was: Which hominid made the tools? Given what happened later, it is reasonable to suggest that a species of *Homo* did. It certainly is the most parsimonious interpretation.

The earliest occurrence of stone tools in the record is certainly close in time to the earliest appearance of *Homo*, which is circumstantial evidence of a causal relationship. And in one of the South African cave sites—Sterkfontein—you see this clearly. The earlier levels contain only *Australopithecus*, but no *Homo* or tools. The later levels contain both *Australopithecus* and *Homo*—and tools. If there really is a prejudice to restrict supposedly human activities to the genus *Homo*, then here is helpful evidence to bolster it.

The second area of contention concerns the nature of the evidence available. For Susman, the origin of broad finger pads in hominid species from about 2.5 million years onward is persuasive evidence. For many people, however, this really will be fingertip evidence, both metaphorically as well as literally. The equation of broad finger pads with manipulation, and manipulation with tool making may be correct—but it is impossible to be certain. In which case, what evidence might settle the issue?

"It is difficult to suggest anything that would be conclusive," says Richard Potts of the Smithsonian Institution in Washington. "You would have to look at the full context of behavioral ecology, and try to draw some conclusions from that."

In the case of *Paranthropus*, there has always been an assumption that it was a pure vegetarian: its cheek teeth are enormous grinding millstones, apparently adapted to processing large quantities of low-quality plant foods. Such an interpretation would fit in with the use of digging sticks for unearthing tubers. And C. K. Brain of the Transvaal Museum in Pretoria has found pieces of bone at Swartkrans that might have been used in this way. But whether such a subsistence would also have included the use of stone tools is difficult to say.

If it proved to be true that other hominid species contemporary with the earliest *Homo* were also tool users, whereas the earliest known hominid, *A. afarensis*, was not, then there would be at least two interpretations of what might have occurred. Many people believe that *A. afarensis* was the ancestor of all later hominids, in which case the ability for tool making must have arisen in several different hominid lineages in parallel. Alternatively, *A. afarensis* could have given rise to another species, in which tool making evolved and from which later hominids derived. ■ ROGER LEWIN

One Species . . . One Tool

As a result of an expanding fossil record, the impact of evolutionary biology and ecological theory, and the insinuation of certain methods of classification, hominid evolution has been pushed into more of biological than strictly human context. Meanwhile, for a mix of practical and historical reasons, the study of stone artifacts—paleolithic archeology—has tended to remain rather separate from these developments in hominid evolutionary biology. In a recent, deliberately provocative paper, Robert Foley of the University of Cambridge, England, has tried to bring the two a little closer together. Until late in human history—approaching the advent of anatomically modern humans—stone technology is viewed by Foley as being very much in terms of specific behavioral adaptation, not a mark of human "culture."

Foley looked through the broad sweep of human history, noting the pace and distribution of change in hominid anatomy and associated stone-tool technologies throughout the Old World. "There is indeed general congruence when both spatial and temporal variability are taken into account," he says, "sufficient to support the hypothesis that hominid technology and hominid morphology reflect the same evolutionary processes."

Broadly speaking, developments in stone tool technology go through three phases prior to the origin of modern humans. Beginning in Africa about 2.5 million years ago, pebble tools and flakes are made. Foley associates this with the activity of *Homo habilis*, the first species in the *Homo* lineage, but, as we see from the accompanying article, other interpretations are possible. About a million years later, coincident with the appearance of *Homo erectus*, teardrop-shaped hand axes begin to be made, and the technology becomes somewhat more systematic. Both these developments took place in Africa. Not until about a million years ago did hominids move into the rest of the Old World, where geographical alterations in the basic theme developed.

For instance, in eastern Asia there was a reversion to the pebble tool style, whereas in India and Europe the hand axe industry persisted, though modified. "The stone-tool assemblages behave in the same way as the morphological traits of the fossils themselves," says Foley, noting the emergence of geographically distinct anatomy. This anatomical divergence undoubtedly is associated with simple geographical variation in some cases, but also with the evolution of separate species in others. One of the trends in recent years in hominid origins research is the recognition that the human family probably has more branches on it than was previously recognized. This being the case, it is worth speculating that stone-tool technology tracks anatomy through time and space, the relationship being of true biological significance. "It is these matches that support the hypothesis, put at its most simple, of 'one species, one technology'."

Even though this is surely likely to be an oversimplification, Foley's principal point is in recognizing the real nature of stone-tool technologies. "They are conservative, being maintained over periods of hundreds of thousands of years and distributed on a continental scale," he says. "This suggests a radically different animal from that of the modern human."

When we think of culture we tend to think of a highly flexible, fast-changing behavior, and this pattern certainly begins to apply following the origin of anatomically modern humans. But the notion has often been adduced for earlier periods too, perhaps by the very use of the word culture. Foley urges a more tempered view. "As a lesson in human evolution the conclusion that might be drawn [here] is that earlier hominids had aspects of behavior that may have been fixed and stereotyped relative to modern humans," he says. "Stone tools were undoubtedly an important part of their adaptive strategies, but rather than tracking closely the environmental needs of populations, they are relatively inflexible traits reflecting hominid phylogeny. . . . The implication is that paleolithic archeology must be treated in the same biological perspective as hominid evolution." ■ **R.L.**

ADDITIONAL READING

R. Foley, "Hominid species and stone-tool assemblages," *Antiquity* **61**, 380 (1988).