

how genes act in the brain to affect our habitual reactions to stress and adversity, but also benefit patients with mental conditions such as depression, anxiety disorders and psychosis. ■

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PALAEOANTHROPOLOGY

Australopithecine butchers

David R. Braun

How far back in the human lineage does tool use extend? Fossil bones that bear evidence of butchery marks made by stone implements increase the known range of that behaviour to at least 3.2 million years ago.

Palaeoanthropologists have long associated tool use with the later part of human ancestors' evolutionary history. One of the key features of 'handy man' (*Homo habilis*), first discovered at Olduvai Gorge in Tanzania, was the use of stone tools. More recently, the discovery¹ of sharp-edged stone tools in the Gona region of Ethiopia, dating to about 2.5 million years ago, modified this definition, extending the time over which tools were known to be used. But the implements found at these sites seemed too well made to have been early humans' first attempt at making such sharp-edged tools.

Evidence from the Dikika area of Ethiopia now indicates that human ancestors may have been practising for almost 800,000 years before the first appearance of chipped stone tools. On page 857 of this issue, McPherron *et al.*² report that the fossilized bones of two animals show clear evidence of early humans using stones to remove scraps of flesh from the carcasses of large mammals. These bones were found in a region where the sediments are at least 3.2 million years old.

The Dikika specimens were found in the Andedo drainage system, and a systematic survey of the area recovered several well-preserved fossils of animals that lived on this ancient landscape, possibly near a large lake. McPherron *et al.* realized that some of the bone surfaces had marks indicative of butchery, presumably of carrion. Detailed analyses confirmed that the marks were made by the cutting and scraping of flesh from animal bones and therefore are evidence of butchery practices by early humans. Other marks that represent pounding on the bone surfaces suggest that these hominins (members of the human lineage) also took an interest in the nutrient-rich bone marrow.

Until now, there has been no direct evidence that meat and marrow formed part of the diet of hominins at this early age. Furthermore, it is notable that these early humans departed

from the typical primate pattern of disregarding relatively large animals as food. The meat and marrow of large animals must have been a valued resource, because McPherron *et al.* conclude that the tool users incurred the cost of transporting stones 6 kilometres from where they occurred naturally to the site where the butchery took place. Further costs that were associated with the consumption of carrion, and were apparently worth the risk, include exposure to parasites and competition with large carnivores. This kind of behaviour may have set the stage for a greater reliance on animal tissues and more sophisticated stone-tool production by other hominin species, including our own immediate ancestors in the genus *Homo*.

Although palaeoanthropologists have been studying butchery marks on bones for 30 years³, their studies have largely been restricted to evidence from the past 2 million years. Recent discoveries show that as soon as stone tools appear in the archaeological record, hominins were using them to cut and scrape flesh from bones⁴. However, many processes can make marks on bone surfaces. McPherron *et al.*² used various types of scanning electron microscopy to confirm that the marks on the fossil bones they studied were made by sharp-edged stones, and chemical analyses of the bone surfaces confirmed that the marks were made in the deep past.

This is not the first surprise from the Dikika region. The well-preserved skeleton of a juvenile *Australopithecus afarensis* was recovered⁵ less than 300 metres from the DIK-55 site where the butchered bones were found. McPherron *et al.* relied on extensive geological mapping of the region to show that the youngest deposits in the Andedo drainage system date to more than 3.2 million years ago. This therefore is the minimum age for the specimens, but they may be up to 3.39 million years old.

McPherron *et al.* attribute the butchered bones to the use of sharp-edged stones by *A. afarensis*, the species that the famous specimen 'Lucy' belongs to. Although no hominin bones were found at DIK-55, the only early human known to be present in the Dikika region at that time is *A. afarensis*. This provides exciting evidence of how *A. afarensis* behaved. At one time, the species was considered to be a relatively primitive hominin, but this perception is being redefined. For example, it now seems that Lucy's kin had body proportions that were more similar to those of humans than of apes⁶. Analyses of the hand of *A. afarensis* show that it had relatively short fingers that would allow the kind of fine-scale manipulation necessary for tool use⁷. A recently discovered skeleton from the Woranso-Mille area of Ethiopia suggests that *A. afarensis* did not have the ape-like, 'funnel-shaped' thorax usually associated with a large digestive tract and low-quality diet⁸. Perhaps the findings that these hominins used tools and had a carnivorous component to their diet should not have been so unexpected.

Nonetheless, many scientists will be surprised that hominins were using tools more than 3 million years ago, because of the scant evidence of this behaviour until now. McPherron *et al.* note that early tool use was probably infrequent and did not result in the large accumulations of artefacts and bones that usually catch the eye of archaeologists and palaeoanthropologists. The authors can confirm only the use of sharp-edged stones, which may have been picked up from the ground rather than made by actively chipping rocks. If tool use has such a deep ancestry in the human lineage, the value of using sharp-edged stones may have been independently discovered by hominins at several points during our evolutionary history⁹. This makes identifying the tenuous link between stone-tool forms and hominin species later on in time even more difficult.

There is the potential for discovering more evidence of this behaviour not only at Dikika but also elsewhere. Fossils of *A. afarensis* have been found in various places in Kenya, Tanzania and Ethiopia, and determining whether this species was a habitual tool user will require the identification of several sites where butchered bones occur in sediments of similar antiquity. More surprises surely await us in the fossil-rich sedimentary basins of East Africa. ■

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