New discoveries illuminate early human physical and technological evolution

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Two recently announced discoveries push back the known dates of both the earliest stone tools and the earliest remains likely to represent the genus *Homo*, reinforcing the link between technology and human evolution.

The first find, unveiled at a conference organized by the Paleoanthropology Society in San Francisco last month, and published in the journal *Nature*, included the discovery of stone tools, including flakes, cores, hammers, and anvils, dating to 3.3 million years ago. The assemblage has been called Lomekwian, after the location of its discovery. The find was made in Kenya by a team from the State University of New York at Stony Brook, led by Sonia Harmand.

Previously, the oldest known stone tools dated to 2.6 million years ago and were thought to have been produced by the earliest identified members of the genus *Homo—Homo habilis*. These artifacts were found in Olduvai Gorge, Tanzania. Oldowan tools, as they are known, include flakes of stone and the cores from which they were struck. The flakes and some of the cores as well were used for a variety of tasks, such as cutting, scraping, and chopping. Their manufacture demonstrates a level of skill, both physical and intellectual, not possessed by non-human primates, including the closest human relatives, chimpanzees.

Because no older stone tools were known, prior to this latest discovery, it was postulated that the earlier members of the hominin lineage, consisting of various species of the genus *Australopithecus*, beginning at between 2.4 and 2.3 million years ago, and the earlier *Ardipithicus*, had only a more primitive technological capability. The term "hominin" refers to all human ancestors following the evolutionary split with chimpanzee ancestors, thought to have taken place sometime between 5 and 7 million years ago, based on genetic evidence.

According to the available evidence, sophisticated stone tool making, as represented by the Oldowan industry, and the emergence of the genus *Homo* were thought to have been contemporaneous. However, the fact that modern chimpanzees do make some tools, including modifying sticks to catch termites, and use stone hammers and anvils to crack open nuts, meant that at least this level of skill likely existed in the common ancestor of hominins and chimpanzees. Hence, australopithecines would have had this capability, or better.

Because of their age and the lack of any known contemporaneous fossil evidence of the genus *Homo*, the newly discovered Lomekwian tools raise the possibility that some form of australopithecine had already achieved a level of technological development well on the way to that achieved in the Oldowan.

The Lomekwi tools, first discovered in 2011, are larger than those characteristic of Oldowan technology and, therefore, are thought to represent a distinct culture, perhaps ancestral to Oldowan. Well over one hundred Lomekwian tools have so far been recovered. Their generally larger size could indicate a less well-developed manufacturing technique and/or different functions.

The researchers observe that the Lomekwian toolmakers employed a hammer and anvil or bipolar production technique (the raw material being placed on an anvil then struck with a hand-held hammer) reminiscent of chimpanzee nut-cracking, as opposed to the more sophisticated direct freehand percussion method (both the hammer and the core are hand-held) used to produce Oldowan tools. Nonetheless, the Lomekwian technology indicates a much greater physical and intellectual capacity than that exhibited by

chimps. Furthermore, the variety of Lomekwian tools implies that they were used for a range of tasks, representing a relatively sophisticated organization of labor.

Until this recent find, the pattern of development from chimpanzee-level technology to that represented by Oldowan tools remained unknown. An earlier discovery of apparent cut marks on animal bone, found in Ethiopia, dating to 3.4 million years ago, suggested that early hominins were using sharp implements, presumably made of stone, in animal butchery. However, the evidence was not definitive.

The earliest known australopithecine species—*Australopithecus afarensis* (which includes the famous Lucy specimen)—ranges between approximately 4 and 3 million years ago, overlapping the age of the Lomekwi tools. By contrast, the earliest known *Homo habilis* fossils date to only 2.3 million years ago. No hominin fossil remains were discovered at the Lomekwi site, so a definitive identification of the toolmaker could not be made.

The second recently announced discovery sheds even more light on this as yet little understood period in human evolution. The fossil jaw, reported in *Science*, was recovered in the Afar region of Ethiopia by a team from University of Nevada Las Vegas led by Brian Villmoare, and dates to 2.8 million years ago. Its physical characteristics, including smaller teeth and a parabolic outline of the jaw, resemble those of genus *Homo* more than those of australopithecines, suggesting that it is the earliest specimen of *Homo* yet discovered. The researchers will search for more of the skeleton to provide a fuller view of the individual's morphology. This would, it is hoped, yield clues regarding the evolutionary steps in the emergence of the genus *Homo*.

If indeed this fossil is from an early member of our genus, that would push its origins back at least a half million years, but still a half million years younger than the newly discovered stone tools, leaving open the question of who made those tools. Regardless of whether the fossil is ultimately judged to represent an early example of *Homo* or an advanced *Australopithecus*, it appears to illustrate an evolutionary step in the transition between the two genera.

The evolution of the hominin lineage is intimately connected with the development of technology. As one author put it a few years ago, we are the "artificial ape." Our ancestors' adaptation to the drying climate and expanding open savannas of Africa during the Pliocene geological epoch, roughly 5.3 million to 2.6 million years ago, an environment unsuitable to the apes of the time, was only possible through the increasing reliance on technology as well as a more sophisticated social organization.

Those apes who stayed within the shrinking forests gave rise to chimpanzees and gorillas. Those who ventured out into the savanna, the hominins, were put under tremendous selective pressure to find some way of adapting to this harsh environment. That adaptation included the qualitative expansion of the incipient tool-making capabilities of the ancestral apes. Both our physical and mental evolutions were profoundly shaped by this process. However, the details are as yet largely undocumented in the current paleontological and archaeological record. These two new discoveries help to fill that void.