Modern behaviour in ancient South Africans: evidence for the heat treatment of stones in the Middle Stone Age

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To what extent was fire used as an engineering tool by early modern humans? Kyle Brown and co-authors marshal an impressive array of evidence to show that by 72 000 years ago, and perhaps as far back as 164 000 years ago, prehistoric people prepared the stone from which they planned to make artefacts by intentionally heat-treating it to improve its flaking qualities.1 This practice is well known from later sites but the increased time depth reported here is remarkable, and contributes to a growing body of evidence that Middle Stone Age people in South Africa were capable of far more sophisticated behaviour than previously realised.

The study is part of a major research project focused on the caves at Pinnacle Point, near Mossel Bay, led by Curtis Marean from Arizona State University. Marean and an international team are excavating a series of archaeological sites near Mossel Bay and researching environmental conditions between about 400 000 and 30 000 years ago,2–3 obtaining detailed information about environmental conditions during the period in which modern humans—people like us—evolved. There is general agreement among palaeoanthropologists that modern human anatomy developed between 250 000–150 000 years ago, but much less agreement on the beginnings of ‘modern behaviour’, i.e. the highly-developed intelligence and cognitive abilities of people alive today.

For many years, the dominant view has been that behaviour lagged behind anatomy, developing perhaps as recently as 40 000 years ago. This was based on the observation that archaeological sites older than 40 000 years contain a narrower range of artefacts and food waste than more recent sites, consistent with a more limited behavioural repertoire. As more sites are excavated, this picture is changing, though disagreement persists about the origins of modern behaviour, and the criteria by which we can recog-
temperature (350°C) for many hours. This is far beyond the degree of heating that would occur in an ordinary campfire, and required a great deal of fuel (20 kg of dried hardwood per 3 kg stone). To properly modify silcrete, ancient tool-makers would have had to expend considerable time and energy collecting firewood before beginning the process, making heat-treated silcrete a valuable commodity. The treated silcrete was found to have much improved flaking qualities, allowing the production of thinner points.

The most persuasive part of the study, however, was the battery of analytical techniques which the team applied to unheated silcrete, experimentally heated material and archaeological specimens, comparing gloss, magnetism and thermoluminescence in each sample set. Experimentally heat-treated silcrete was significantly glossier (had higher reflectance) than untreated. Most archaeological specimens dating to 65–60 kya were within the heat-treated range, as were some of the oldest artefacts recovered, c. 164 kya. Magnetic analyses showed that the sediments surrounding the archaeological artefacts were not burned, but that the artefacts themselves were. The final technique used was thermoluminescence analysis, which measures the amount of trapped charge that accumulates in the crystal lattice of minerals over time, as a result of naturally-occurring radioactivity in the soil. Heating releases the trapped charge, zeroing the signal. All the archaeological samples analysed gave thermoluminescence signals indicating that they had been heated in prehistory. These concordant results from three independent techniques provide wholly convincing evidence for Brown et al.’s argument.

The next question is the role of heat-treatment in the Middle Stone Age, including how widespread it was. Opinions vary among researchers working at similar sites elsewhere in South Africa. For instance, in a recent study of silcrete bifacial points from Blombos Cave, less than 100 km west of Pinnacle Point, Villa et al. note that many of their artefacts are made of silcrete that is grey or yellowish in colour, rather than red, and therefore that heat treatment may not always have been practised. Of course, the change to red colouration with heating occurs only if iron is present. Further work will no doubt address this issue.

As Brown et al. point out, one of the reasons this study is of interest to a wider audience is that it helps chart the development of human mastery over fire, a key component of our ability to manipulate the world around us for our own purposes. In later times, this led to the firing of pottery and eventually metal working. In addition, if people were using fire in a highly controlled way to alter the properties of stone raw materials, they were clearly capable of complex goal-oriented behaviour that included solving a range of problems along the way. Brown et al.’s study gives us precious insight into the chain of purposeful, planned, interlinked activities required to heat-treat silcrete. It is rare to be able to identify anything in archaeological sites of this age that allows reconstruction of ancient behavioural processes in quite such detail. The more information we accumulate, the more it appears that complex human behaviour goes back a long way. There is now a sizeable body of evidence dating from 70 000 to 100 000 years ago but stretching it as far as 164 000 years ago constitutes a substantial extension, to a time close to the emergence of modern human anatomy.