The controlled use of fire was a breakthrough in human evolution. It allowed cooking and meant that early communities were able to generate warmth and light, which also provided protection from predators. There is evidence of cooking as far back as 790 000 years ago, but eventually fire was used for more complex technologies such as firing clay for ceramics and heating ores to make metals. But how did early modern humans get from using fire for simple tasks such as heating and producing light and using it as an engineering tool to alter raw materials? This is not well understood, but it signals an important technological advance that leads to the industrial technologies of today.

During the African Middle Stone Age (280 000 – 235 000 years ago), many stone tool features appear that are only found to occur much later in Europe and Asia. One example is the production of tools with many parts including handles, glue, and replaceable cutting edges, called blades. Blades are defined by archaeologists as stone chips that have a length more than twice their width. Many tools were probably also made from bone.

Early modern humans improved the manufacture of stone tools using fire, showing evidence of complex behaviour. By Kyle Brown and Curtis Marean.
Most of the stone that early modern humans used for making their tools during the Middle Stone Age (MSA) came from sites close to where people lived, but early modern humans probably also gathered rock from distant places as they needed it. Coastal MSA cave sites such as Pinnacle Point, Blombos Cave, and Klasies River show that the early modern humans between 75 000 – 60 000 years ago preferred fine-grained stone for some of their more carefully made tools. In Still Bay, archaeologists have found thin, symmetrical leaf-shaped tools that are skillfully flaked on both sides, made from a stone called silcrete. At Pinnacle Point, there is the early occurrence of small silcrete blade tools that are carefully retouched (or reshaped) to make crescent-shaped tools that could be glued into handles.
Silcrete is a type of stone that is found mainly in Africa and Australia. Silcrete, as the name suggests, contains a high percentage of the element silica, and forms by precipitating or cementing of other rocks that have weathered or broken down. Silcrete stone tools are common in coastal MSA archaeological sites in southern Africa after about 70 000 years ago.

One of the ways that archaeologists learn about how stone tools were manufactured is to try themselves to make and flake or ‘flintknap’ tools. Flintknapping is the process of striking a stone with another hard object – usually wood, bone, or another stone – to drive off a sharp chip or flake. Kyle Brown and his colleagues found it particularly difficult to make replicas of the stone tools because the silcretes that they had collected was so difficult to flake until – by experimentation – they discovered how to use the properties of fire to improve their tools!

The African Middle Stone Age occurred between about 280 000 to 35 000 years ago.

The significance of fire

The evidence that early modern humans used fire as an engineering tool is enormously significant. It allowed groups to use local materials, even if this stone is of poorer quality than rock from more distant sources, although this does mean that they needed a good supply of firewood to use as fuel. It also suggests that early modern humans had a very good understanding of fire and how it could be skillfully used to change the physical properties of the materials they found on the landscape in which they lived. In other words, if they did not have exactly what they needed, they could engineer something from other materials around them using fire.

Fire and behaviour

There is recurring evidence of early symbolic behaviour and complex technologies in South Africa from around 71 000 years ago, before these same technologies and behaviour were found outside Africa. Archaeologists still debate when modern human behaviour first appeared. However, there is increasing evidence that symbolic behaviour – behaviour that involves communicating with others using pictures or language that is characteristic of modern human cultures – had appeared by at least 80 000 – 70 000 years ago and perhaps
earlier during the African MSA. Archaeologists working at Pinnacle Point believe that the process of heat treatment, which involves many careful steps to be successful, would have required language to pass this skill from one generation to the next. The results collected by Brown and his colleagues show that at this same time, early modern humans regularly used fire to increase the efficiency and quality of their stone tool manufacturing process. This means that these early communities had to make the jump to a totally new association between fire, its heat and a structural change in stone that meant that it was easier to flake. This shows creative thought and the ability to take a new observation and make it useful. Their results also show that heat treatment technology may have originated at least 164 000 years ago.

This heat treatment technology in Africa may help to explain the presence of advanced tools in the African MSA – the same tools that were rare in the Middle Paleolithic of Europe and Asia where Neanderthals were the most common humans. As these early modern humans moved from Africa into Europe and Asia, their ability to use fire as an engineering technology may have given them a behavioural advantage over the Neanderthal populations that lived there.

Kyle Brown has been involved in research into African archaeology and human origins since 1995 and has conducted work in the United States, Kenya, Israel and southern Africa. He is finishing his PhD in Archaeology at the University of Cape Town, where he specialises in the analysis of stone tools and the experimental reproduction of technology from southern Africa. Kyle has assisted in directing excavations at Pinnacle Point since 2006.

Curtis Marean is an archaeologist at the Arizona State University in Tempe who studies early modern humans in South Africa. He is the Associate Director of the Institute of Human Origins at ASU, and specialises in human adaptation, evolution and diversity and societies and their natural environments. He also has a keen interest in conservation and biodiversity.

### The Middle Stone Age

The Middle Stone Age (MSA) is a period in the development of human technology between the Paleolithic (Old Stone Age) and the Neolithic (New Stone Age). It is a period of African prehistory that began around 280 000 years ago and which ended around 50 – 25 000 years ago, although certain MSA stone tools originated as far back as 550 – 500 000 years ago.

Anatomically modern humans – Homo sapiens – were present during the MSA. Early physical evidence comes from the Gademotta Formation in Ethiopia, The Kaphurin Formation in Kenya and Kathu Pan in South Africa.

The period is marked by the appearance of artefacts – stone tools – which were usually manufactured from local materials and bone. This period is also the first time that there is evidence of people using locally available materials such as ivory for decoration or jewellery. On the south coast of South Africa, for example, Nasaruan shell beads have been found. There are even earlier examples of jewellery from Tafarrit Caves in Morocco.

### Complex behaviour and language

One of the most important aspects of the MSA is that this was the period when evidence of complex thought and behaviour was first found. Quite how modern humans developed complex thought and behaviour is controversial. It is likely that a vast patchwork of complex events led to modern human behaviour.

The Pinnacle Point site in South Africa has particularly rich evidence for the presence of complex thought (see also Quest volume 6(4)). This evidence includes the oldest confirmed use of ochre for decoration and shellfish for food.

Evidence from elsewhere (Klasies River Cave, South Africa and Howiesons Poort shelter, South Africa) suggests that MSA people were hunters with behaviour patterns that were similar to those of modern humans. It is likely that MSA people managed food resources by deliberately burning the veld to encourage the growth of plants with corms or tubers. Foraging groups seemed to be based on families, the people used colour for symbolism, artefacts were exchanged and living space formalised – all of which suggests very modern behaviour patterns.

Ochre is found at some early MSA sites and is common after about 100 000 years ago. Many archaeologists think that the fact that ochre was used in a symbolic, colour-related way suggests that the people were using it for these abstract concepts could not have done this without a language. Formal bone tools are often associated with modern behaviour and could also be examples of a material culture that is associated with modern language.

### Migration

By about 80 – 50 thousand years ago, MSA humans had spread out of Africa to Asia, Australia and Europe and by about 30 thousand years ago they had replaced Neanderthals and Homo erectus. Genetic and anatomical data support the hypothesis that it was in central/southern Africa that Homo sapiens originated.