SCIENCE, like gambling, often depends on beating the odds. More than 70,000 years ago, a fortuitous series of chance events began in Blombos Cave. First, winds covered the cave floor in dune sand. Over the years, rainwater percolated through shelly sandstone and into the cave. The process continued when a boy named Chris Henshilwood scrambled along the coastal cliff walls of South Africa’s cape and into Blombos Cave. Decades later, the series of events culminated when Henshilwood found a set of ancient bone tools preserved in the cave. Today, scientists are using those tools to rewrite human history. BY DANIKA PAINTER
The evolution of a powerful mind was the major watershed in the history of the human species. Our intelligence makes us fantastically successful creatures. Intelligence gave us the edge over stocky Neanderthals. It gave us the ingenuity to thrive in climates all over the globe, from steaming tropics to frozen tundra. And it made us reflective enough to wonder—Where did our marvelous minds come from? The formal pursuit of this question is the business of archaeologists. Among them is Curtis Marean, professor of anthropology at Arizona State University and a member of ASU’s Institute of Human Origins. For decades, many archaeologists believed that behavioral modernity—the flexible thinking and intellect of modern people—evolved about 40,000 years ago. Europe, the record seemed to say, was its ultimate incubator. Until recently, Marean and Henshilwood, professor of archaeology at the State University of New York at Stony Brook, agreed. But their analyses of the recently discovered bone tools are painting a very different picture. The new image makes the origin of behavioral modernity 70,000 years ago, not 40,000. And puts it in Africa, not Europe.

Many scientists believe that the human species was born in Africa 100,000 to 150,000 years ago. About 50,000 years ago, Homo sapiens started to spread throughout Europe and Asia. Anatomically, these migrants looked like modern humans. However, according to the fading dogma, they lacked modern minds to match. Not until they met the challenges of the chilly north—which included competition with the Neanderthals—did their intellect bloom. Marean, Henshilwood, and a team of archaeologists from around the world are re-seeing that knowledge. They think that humans came out of Africa with mental abilities in full flower.

The bone tools found in Blombos Cave—a set of 28 points and awls—were made by early people who lived there. Constructed with painstaking care and sophistication, these tools far outshine the simple stone tools of Neanderthals and other early hominids. Three of the bone artifacts are finely polished projectile points, probably used for hunting. “To make that point, you would probably have to work half a day,” says Marean. “The beauty of the polishing is what makes it very aerodynamic. When it hits an animal’s skin, it goes through very easily because there’s no resistance. These people didn’t attend physics classes to learn that fact. They figured it out during daily life.”

Such refined tools could have been engineered only by someone with modern intellect. “Experimentation develops it. Then it’s transmitted culturally from parent to offspring,” Marean explains. The creativity and social environment required to develop the tools are hallmarks of modern human capabilities.

The people of Blombos were more than just good engineers. They also produced symbolic art. More than 8,000 pieces of ochre were excavated at Blombos. Ochre is a pigmented mineral traditionally used to paint body decorations. The scientists found two pieces of ochre, as well as a bone fragment, that were engraved with artistic motifs. Similar motifs are seen in 150-year-old art produced by the Khoi-San people. The Khoi-San still live in southern Africa today.

Formal bone tools and the use of symbolism are considered classic evidence for behavioral modernity. As a result, Marean and his colleagues argue, our intellectual ancestors were African. “I think behavioral modernity came into Europe with the Africans,” says Marean. “These are black Africans bringing with them their technology, their ideas, their cognitive flexibility. And they’re evolving into white Europeans.”

Over the last 10 years, archaeologists gathered several clues that indicate modern minds were at work very early on in Africa. But, until now, the evidence has been arguable. Well-preserved, accurately dated bone artifacts are an extremely rare find. Once discovered, they make good evidence only if they are excavated properly. And, even when the data are laid out well, the Euro-centric perspective can be hard to shake.

A century of excavations has produced much information about Homo sapiens’ last 40,000 years in Europe. Most of that work was by European archaeologists digging in their own back yards. Far less is known about the human past in the vast continent of Africa.

“We are only scraping the surface of information about prehistoric Africa,” says Henshilwood. “Africa is geographically enormous when compared to western Europe. But it has been excavated properly for only a very short period, and very few sites in Africa have really been well dug.”

For archaeologists in Africa, Blombos Cave is a windfall. Not only was it meticulously excavated by Henshilwood’s team, it also safeguarded its tools under rare and fortunate conditions. The tools were then subjected to an uncompromising technical analysis by Marean, Henshilwood, and other archaeologists. These circumstances make the finds indisputable.

Marean was invited to study the artifacts because of his expertise in analyzing ancient bones. His research explores the hunting practices of early modern humans. Over the last 10 years, he has traveled all over the globe, from steaming tropics to frozen tundra. And he has attended physics classes to learn that fact. They figured it out during daily life.”

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Of course, dramatic claims demand sound data. To reconstruct history, archaeologists need to be able to unequivocally date their artifacts. Neither carbon dating nor any other current techniques can accurately date soil or bone older than 40,000 years. Therefore, the bones’ exact age is impossible to determine directly. Thanks to the dune sand in Blombos Cave, however, their minimum age is clear.

“We know the sand dune dates to the last glacial period 70,000
years ago. That’s when the Indian Ocean retreated. There were active sand dunes all along the coastline of South Africa,” Marean says. From the far southern tip of Africa, Blombos Cave looked out over these dunes.

The sand was scattered over Blombos Cave, where it capped the ancient earth below. Later, it was topped by layers of new soil. Ten years ago, archaeologists began digging into the cave floor. They found a pale sandy horizon that provided a bright historical reference point. The strata below the unbroken sand had to come from the Middle Stone Age—the epoch immediately predating the sand itself. Like an inscribed sarcophagus, the dune sealed the bones below and told their history.

“The dune is 70,000 years old. The bone tools could be 100,000 years old. We don’t know how much earlier than 70,000 years they are, but it could be a lot earlier,” says Marean. “My guess is that the tools are 90,000 years old.”

Preservation of the bones themselves was also the result of lucky conditions. In most soils, acidity causes bone artifacts to dissolve away before they can be discovered. There are countless sites in Africa where bone was likely once buried. “But, now, there’s not a bone in ‘em,” says Marean. “There are thousands of stone artifacts, but all the bone has been burned away. If the geological conditions are wrong, you’re not going to get bone!”

Blombos Cave’s bones were preserved because the earth surrounding them contained crushed sea shells. Water passing through the ground shells made the soil alkaline. This environment preserved the tools perfectly—even tiny scrapes made during construction and wear were still visible. Those markings tell the researchers how the tools were built and used.

The fact that Henshilwood chose to excavate Blombos Cave can only be called kismet. Superficially, the site looked unpromising.

“I never would have picked that site,” says Marean. Henshilwood chose it, mostly because it happened to be easily accessible. “Chris’s family owned the land that the site was on. He used to go and play there when he was a little kid. When he was looking for a site to dig for his dissertation, he said ‘Oh, maybe I’ll go dig that site.’ He didn’t even know there was Middle Stone Age material on the bottom.”

The rest of the story, of course, is history.

Marean and Henshilwood’s work at Blombos has rattled many anthropologists assumptions about human evolution. It also has refocused some fundamental questions about our origins. Did modern human intelligence evolve hand-in-hand with modern human anatomy? What were the conditions that gave birth to our unique wit and creativity? Who were our original intelligent ancestors?

Marean argues that the recent breakthroughs tell us where we should look for the answers. “Africa is the first place that hominids rose up, became bipedal, and set the agenda for the evolution of people. Africa is the first place where there was a large increase in brain size. Africa is the first place where there were anatomically modern people. And, if our data is right, Africa is the first place where behavioral modernity occurred.” Marean says.

“Africa has been a precocious engine of human evolution. Why? That’s a big question,” Marean stresses. “It will take a long time to resolve. I’ll be long dead before we have an answer.” he jokingly concedes.

In the meantime, the ASU scientist is digging for more clues at other sites in southern Africa. “We’re not going to know anything about the origins of modern humans until we have 30 or 40 sites dug, all with modern techniques, good bone preservation, and so on. We won’t know if bone tools were rare or common in the Middle Stone Age.”

Marean is focusing his efforts at Mössel Bay, another location at the extreme south of the South African cape. The bank of coastal caves is built into a sheer cliff just 60 miles east of Blombos.

His team has already spent three years laying the groundwork at Mössel Bay. They have surveyed and mapped the site. They have also built a staircase to make access to the caves a bit less treacherous.

Excavation is still in the early stages. But the site’s potential, Marean believes, is enormous. “I think Mössel Bay is going to be one of the richest locations ever discovered. In one little section there are 15 caves that have Middle Stone Age material. I think we’ll be digging there for 30 years.”

A project of ASU’s Institute of Human Origins is supported by the National Geographic Society, National Science Foundation, and many private individuals. For more information, call 480.727.6580. Send email to IHO@ASU.EDU. Visit the IHO web site at HTTP://WWW.ASU.EDU/CLAS/IHO/

—LOUISE L. WALTERS

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The Art of Digging

When it’s potatoes you’re looking for, the best way to get started is to grab a shovel and dig. But when it comes to mining ancient artifacts, a shovel is the archaeologist’s worst enemy. Over the decades, archaeologists have refined the art of digging. They traded shovels for chopsticks, burlap sacks for fine mesh screens, and measuring tapes for computers. The improvements in their excavation methods result in far better data, and more of it.

Over the decades, most archaeologists adhered to the potable-digging philosophy of excavation. “They went in with picks and shovels,” says Curtis Marean, a scientist with the Institute of Human Origins and professor of anthropology at Arizona State University. “They destroyed a lot of stuff. It’s terribly frustrating.”

Blombos River in South Africa is an archaeological site reaped by early excavations. Because it sits below more than a million years of earth, the site is one of South Africa’s most important. Most of its artifacts, however, are far too good. “Marean was looking for hominids,” says Marean. “They were sucking the stuff out. They only kept the very best bones.”

Shovels and other large tools are too big to pick apart finer materials. Metal tools, even dental picks, can scratch and break bone and other objects. Marean uses tools so harmless they couldn’t even hurt a child. “We use tiny shovels,” he says. “You know, the little plastic things. That’s the biggest tool we use. We use chopsticks because the wood doesn’t scar the bone. We use spoons and brushes.”

This more delicate approach reduces the likelihood that researchers will damage any artifacts during the process of unwrapping them. Digging at a finer scale also makes it possible to collect smaller pieces of evidence. Many of these would have been overlooked in earlier days. But sometimes the tiniest bits can tell the big story. “We find beads, little pieces of ochre, the tiny teeth of mice and birds, and a lot of very specific to vegetation types, so their changing frequencies can tell us a lot about how the vegetation is changing,” says Marean.

Vegetation and climate are crucial elements of the environment in which modern humans evolved. Archaeological artifacts are meaningful only if their age is known. Often the best indicator of a found object’s age is its location. Lake rings, for example, show layers of soil accumulate over time. Objects found in deepest strata are therefore the oldest. Items near the top are the recent.

Decades ago, an artifact’s location might not have been recorded at all. Marean now maps the three-dimensional coordinates of every object larger than one centimeter. Instruments called electronic total stations take the needed measurements. A laser beam is emitted by the instrument and maps each item. A computer then directly captures the data.

“It allows you to get very precise measurements very quickly on all your artifacts,” Marean says. “In the past, when you found a little patch of loose remains and a puzzle box, you’d try to map it yourself. You’d try to measure its position in three directions. That’s about a 15-minute enterprise. With this new technology, I shoot that in a second.”

Originally designed for surveyors, these instruments are a boon to archaeologists. “In archaeology, we’re scavengers of techniques,” Marean says. “Radio, geochronometry, engineering, whatever it is, we go out and grab it. Then we concentrate it for our own uses.”

Marean is hoping for the development of new methods to date very old samples. The bone tools, ochre, and soil from the depths of Blombos Cave are too old to be accurately dated using current techniques.

“Ten years from now, we might have a technique to date Whatever is in that soil. But radiocarbon dating only goes back 40,000 years,” Marean says. “Otherwise, we could date the bone directly.”

Using radiocarbon dating, scientists can estimate an object’s age from its content of carbon-14, a radioactive, heavy form of carbon. To emit electrons. When a grain of sand is sheltered from the sun, such as in a cave, it is never stimulated to release new electrons. But if the sand is exposed to light, it emits electrons. The longer a sand grain has been buried, the more electrons it will give off. Some samples contain too little carbon in the dark until the moment they are ready to be measured. “We use a big tube to collect the sand,” says Marean. “We get sand grains.”

The scientist then sends the sand samples to a laboratory that specializes in luminescence dating. “They are carefully exposed to light,” says Marean. “The electrons accumulate in minute crystals within the sand grains. Over time, more and more electrons build up.”

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Marean says that the conditions in Blombos Cave made relative dating very reliable. The dune sand looked much paler than the dark Middle Stone Age soils below, and any breaks in the soil layer were easy to see.

Only one small area near the back of the cave showed any such disturbance. The two bone tools found below it were excluded from the scientists’ final analyses. The remaining findings were all securely dated using a combination of techniques.

Other archaeologists have suggested that formal bone tools were produced in Africa long before they were in Europe. Unlike Marean’s group, the credibility of those researchers was widely questioned.

“They got a lot of heat,” says Marean. “They were criticized mercilessly because the dates on their findings were equivalent. And old ideas weren’t likely to be let go without a fight. ‘There’s very much a hermetic bias that’s accruing to this record,'” Marean admits. “It’s very hard to push those things through to science because they become entrenched.

“People’s careers become based on those ideas. So they’re not willing to give up very easily.”

Marean credits the thoroughness of the excavations and analyses at Blombos for keeping his group’s data resilient to similar criticism. Even some of the staunchest proponents of a European origin for behavioral modernity are now beginning to concede, he says.

“What we’re seeing now is kind of a rear guard action in the process of an orderly retreat. You fight as you back up. But I think we’ll probably get them now.”

Danika Painter