



PEDRO SAURA

# Old masters

The earliest known cave paintings fuel arguments about whether Neanderthals were the mental equals of modern humans.

BY TIM APPENZELLER

In a damp Spanish cave, Alistair Pike applies a small grinder to the world's oldest known paintings. Every few minutes, the dentist-drill sound stops and Pike, an archaeologist from the University of Southampton, UK, stands aside so that a party of tourists can admire the simple artwork — hazy red disks, stencilled handprints, the outlines of bison — daubed on the cave wall tens of thousands of years ago. He hopes that the visitors won't notice the small scuff marks he has left.

In fact, Pike's grinder — and the scalpel that he wields to scrape off tiny samples — is doing no harm to the actual paintings, and he is working with the full approval of the Spanish authorities. Pike is after the crust of calcite that has built up over the millennia from groundwater dripping down the wall. The white flecks that he dislodges hold a smattering of uranium atoms, whose decay acts as a radioactive clock. A clock that has been ticking ever since the calcite formed on top of the art.

The results of an earlier round of sampling in El Castillo cave, published last June<sup>1</sup>, showed that the oldest of the paintings, a simple red spot, dates to at least 40,800 years ago, roughly when the first modern humans reached western Europe. Pike and his colleagues think that when they analyse the latest samples, the paintings may turn out to be older still, perhaps by thousands of years — too old to have been made by modern humans. If so, the artists must have been Neanderthals, the

brawny, archaic people who were already living in Europe.

The answer won't be known for at least a year, but if it favours the Neanderthals, it could tip — if not resolve — a debate that has rumbled for decades: did the Neanderthals, once caricatured as brute cavemen, have minds like our own, capable of abstract thinking, symbolism and even art? It is one of the most haunting questions about the people who once shared a continent with us, then mysteriously vanished.

An early date for the paintings would also be a vindication for the slight, dark-haired man watching as Pike works: João Zilhão, who has emerged as the leading advocate for Neanderthals, relentlessly pressing the case that these ice-age Europeans were our cognitive equals. Zilhão, an archaeologist at the Catalan Institution for Research and Advanced Studies at the University of Barcelona in Spain, believes that other signs of sophisticated Neanderthal culture have already proved his point. But he is willing to debate on his opponents' terms. "To my mind, we don't need that evidence," he says of the paintings. "But I guess for many of my colleagues this would be the smoking gun."

The front line in the Neanderthal wars runs through another cave: Grotte du Renne, 1,000 kilometres away in central France. As early as the 1950s, excavations there unearthed a collection of puzzling artefacts. Among them were bone awls, distinctive stone blades and palaeolithic baubles — the teeth of animals such as foxes or marmots, grooved or



**Spots and stencils in El Castillo cave, Spain — one at least 40,800 years old — might be the handiwork of Neanderthals.**

pierced so that they could be worn on a string. They were buried beneath artefacts typical of the first modern humans in Europe, suggesting that these objects were older. A startling possibility loomed: that artefacts of this style, collectively known as the Châtelperronian industry, were made by Neanderthals.

Close cousins of modern humans, Neanderthals evolved in western Eurasia and had Europe to themselves for more than 200,000 years, enduring several ice ages. In spite of their survival skills and big brains — comparable to our own — they had never been linked to sophisticated tools of this kind, or to ornaments. Yet in 1980, archaeologists reported finding a Neanderthal skeleton among Châtelperronian tools at another site in France<sup>2</sup>. And in 1996, French palaeoanthropologist Jean-Jacques Hublin and his colleagues reported that a skull fragment from the ornament layer in the Grotte du Renne was unmistakably Neanderthal<sup>3</sup>.

Ever since then, the Grotte du Renne has been exhibit A in the case that Neanderthals, like ourselves, trafficked in symbols, using ornaments as badges of identity for individuals or groups.

Hublin himself did not go that far. He suggested that the Neanderthals had fallen under the spell of strange new neighbours: modern humans, who were thought to have reached Europe around the time of the Châtelperronian industry. Neanderthals might have acquired the ice-age bling from modern humans, or made the pendants themselves under the influence of the new arrivals.

That conclusion infuriated Zilhão, turning him into the passionate advocate he is today. He questioned the evidence that modern humans were already on the scene and detected a bias against our extinct cousins. “Why was the equally if not more legitimate hypothesis — that the Neanderthals themselves had been the authors of this stuff and made it for their own use — not even considered?” asks Zilhão.

On a visit to rock-art sites in Portugal, he discussed the paper with Francesco d’Errico, an archaeologist who is now at the University of Bordeaux in France. D’Errico had the same reaction, Zilhão recalls. “And he said: ‘OK, let’s do something about it.’” Since then, the pair has fought a two-front war, advancing evidence for Neanderthal capabilities while challenging studies that reserve symbolism and abstract thinking for modern humans.

## UNKNOWN ARTISTS

More than 15 years later, the Grotte du Renne continues to be a battleground. Since 2010, three papers have given duelling interpretations of the artefact-bearing layers. In the first, a group led by dating expert Thomas Higham of the University of Oxford, UK, used new carbon dates to argue that the layers were scrambled, mixing older remains with younger<sup>4</sup>. If that was correct, said Higham’s team, the relics adjacent to the telltale skull fragment might not have belonged to Neanderthals after all.

Within months, Zilhão, d’Errico and their colleagues fired back with an analysis<sup>5</sup> of how artefacts of different types were distributed in the Grotte du Renne, concluding that the layers were undisturbed and that the Neanderthal link could be trusted. A group led by Hublin (now at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany) presented its own dates last year, backing Zilhão’s claim<sup>6</sup>. But Hublin still denied the Neanderthals full credit. Neanderthals did make the objects, now dated to between 45,000 and 40,000 years ago, he said — but only after they encountered modern humans. And this time he had fresh evidence to draw on.

Carbon dates measured by Higham and others at caves in Italy, Britain and Germany suggest that modern humans began expanding into Europe as early as 45,000 years ago, several thousand years earlier than was thought (see *Nature* 485, 27–29; 2012). Zilhão strenuously disputes those claims, doubting whether the shells or animal bones used for dating truly reflect the age of the human fossils at the sites, or whether the human remains are modern. “The evidence to show an early presence of modern

humans in Europe is worse today than it was 20 years ago,” he declares.

Hublin, however, has no doubt that our ancestors had already entered the picture when Neanderthals in France began making bone awls and animal-tooth pendants. To assume that Neanderthals invented these technologies on their own is to accept “an incredible coincidence”, he says. “Just as modern humans arrive with these things in their pocket — bingo!”

## LIKE MINDS

Despite the stalemate, Zilhão says that the record of Neanderthal behaviour tens of thousands of years before modern humans arrived in Europe proves his point (see ‘Minds at work’). Neanderthals are believed to have buried their dead, suggesting that they had some kind of spirituality. They made glue for securing spear points by heating birch sap while protecting it from the air, a feat that even modern experimental archaeologists have trouble replicating. Many Neanderthal sites include lumps of pigment — red ochre and black manganese — that sometimes seem to be worn down like stone-age crayons. Zilhão and others think that the Neanderthals painted themselves, creating striking patterns on their pale, northern skin that were every bit as symbolic as the art and ornaments of modern humans.

“You don’t need to have shell beads, you don’t need to have artefacts with graphical representation to have behaviour that can be defined archaeologically as symbolic,” he says. “Burying your dead is symbolic behaviour. Making sophisticated chemical compounds in order to haft your stone tools implies a capacity to think in abstract ways, a capacity to plan ahead, that’s fundamentally similar to ours.”

Where Zilhão sees a clear pattern, sceptics see uncertainties. Harold Dibble, an anthropologist at the University of Pennsylvania in Philadelphia, is re-examining supposed Neanderthal burial sites. At one, the French cave of Roc de Marsal, he says that what seemed to be a deliberately excavated grave is actually a natural pit. At another, La Ferrassie, he sees evidence that sediments swept into the cave by water — not grieving kin — could have buried Neanderthal remains.

As for the ochre crayons, Dibble is dismissive. “You see some wear on a piece of ochre and soon you’ve got Neanderthal body painting,” he says. “What a lot of logical leaps.” He and others say that the pigment has many possible uses: as an insect repellent, a preservative for food or animal skins, an ingredient in adhesives. Even Wil Roebroeks of the University of Leiden in the Netherlands, who found evidence for ochre use as early as 250,000 years ago at a Dutch Neanderthal site<sup>7</sup>, says that Zilhão “jumps too fast from the presence of ochre to body decoration”.

Ask Dibble, Hublin and other sceptics what would persuade them that Neanderthals had minds like ours, and their answer is simple: a pattern of art or other sophisticated symbolic expression from a time when no modern humans could possibly have been around. “But I don’t think it exists,” says Hublin.

Zilhão, however, points to a singular finding from a Neanderthal site in southern Spain that he reported three years ago<sup>8</sup>: three cockle shells each with holes near one edge, as if they had been worn as ornaments. One contains a trace of red pigment, and a fourth shell is stained with a mixture of colours, as if it had been used as a paint container. The shells, says Zilhão, imply symbolic thinking fully equivalent to that of the modern humans who left troves of beads in South Africa 75,000 years ago. And at roughly 50,000 years old, he says, the Spanish shells date from a time well before modern humans reached the region.

Critics are not satisfied. The perforations are natural, as Zilhão himself noted, which suggests to Hublin and Dibble that rather than systematically fashioning ornaments, Neanderthals might have picked up a few odd shells on a whim. “When you’ve got isolated occurrences, one-offs, that’s not going to convince most of us,” says Dibble.

The paintings in El Castillo could help to establish a pattern. The research group was conservative with the ages it reported last June<sup>1</sup>, which put the earliest calcite at nearly 41,000 years old. Nervous about damaging the pigment, the team left several millimetres of the veneer intact at each

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## MINDS AT WORK

Disputes over whether Neanderthals were capable of symbolic thinking turn on a smattering of discoveries spanning more than 200,000 years.

◆ Neanderthal ● Modern human ● Neanderthal or modern human

**300,000 years ago (ya)** First appearance of Neanderthals in Europe



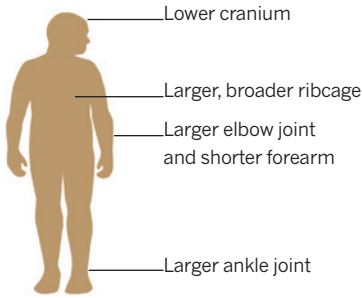
Evidence suggests that not long after Neanderthals appeared in Europe, they were using ochre. The pigment can serve for decoration, but it also has practical uses.

**250,000 ya** Evidence of ochre use

Neanderthals were more robustly built than modern humans, which may have put different demands on their brains.



Modern human



Neanderthal



By heating birch sap while protecting it from air, Neanderthals made a glue for attaching stone flakes and points to spear handles.

**120,000 ya** Sophisticated hafting of spear points



Neanderthals are thought to have buried their dead, including this individual from La Ferrassie, France. But some researchers question whether the burials were deliberate.

**70,000–50,000 ya** Possible burials at La Ferrassie

**50,000 ya** Shell beads from Spain

Neanderthals may have worn pendants of coloured shells before the arrival of modern humans in Europe.

**45,000 ya** Modern humans appear in Italy

**43,000 ya** Modern humans appear in the United Kingdom

**40,800 ya** Oldest cave paintings in El Castillo, Spain

**45,000–40,000 ya** Animal-tooth pendants in France



sampled spot. Deeper, older layers might push back the paintings' minimum ages by several thousand years.

That prospect brought the team back to El Castillo last October. Grinding and scraping through a long day, the researchers concentrate on the red disks and hand stencils that had yielded the earliest dates last time around. The goal, says Zilhão, is “to date pigments in these paintings to an age that is clearly and to everyone’s satisfaction beyond the range of modern humans in Europe”.

Yet an early date may not settle the long-running dispute. Hublin sets the bar high. “If Zilhão finds a date of earlier than 50,000 years ago, I’ll be convinced!” he says. Any younger, and modern human influence would remain a possibility, he says, noting recent hints that our ancestors had advanced into Turkey or even central Europe by 50,000 years ago. And one example of crude painting — what Dibble calls “Neanderthal doodling” — might not be enough to win over the doubters. Zilhão’s knockout blow may simply lead to more fighting.

Yet signs of a middle ground are emerging. Chris Stringer, a palaeoanthropologist at the Natural History Museum in London, says that 20 years ago, he believed that if the Neanderthals made the Châtelperronian ornaments, they were blindly imitating modern humans. “Our interpretation was that they were copying but that they didn’t have the brainpower to give full value” to the objects. He wouldn’t say so now. Two decades of discoveries of sophisticated Neanderthal tools and weapons have made him think that “the gulf was not as great”: that the difference between Neanderthals and ourselves was a matter more of culture than of ability.

“You can see the Neanderthals were held back by various factors that were not down to their brains,” he adds. The climate of ice-age Europe kept their population size “frighteningly small”, he says — at times just a few thousand people across a whole continent, most of them dead by the age of 30. How could such a sparse, beleaguered people develop and sustain a sophisticated culture?

That’s not so different from what d’Errico, Zilhão’s comrade-in-arms for almost 20 years, now says. He still thinks that the Neanderthals probably invented the Châtelperronian artefacts before modern humans were on the scene. But he is open to the idea that aspects of modern human culture preceded their wholesale arrival in Europe. “It’s possible that some influence did spread,” says d’Errico. “I’m less militant than João.” That takes nothing away from the Neanderthals, he adds. “The fact that Neanderthals can absorb influences, can re-elaborate them, can make them part of their own culture, is very modern behaviour.”

But there is a final stretch of ground that neither side will concede. Were the Neanderthals truly the same as us, cognitively? No, says Stringer. The Neanderthal genome, decoded<sup>9</sup> in 2010, differs from that of modern humans in some regions linked to brain function, he notes. And this year, he suggested that, compared with modern humans, larger volumes of Neanderthals brains were devoted to vision and to controlling their heavier bodies<sup>10</sup>. That might have left them with less capacity for social awareness and interaction. “If you imagine a Neanderthal in modern society, there would still be differences,” says Stringer.

Zilhão rejects any distinctions. Emerging from the cave into a rainy evening, he muses that if he pushes back the age of the El Castillo paintings, his critics may argue that he has simply proved an earlier presence of modern humans in Europe. “To which I will say, ‘Of course. Neanderthals were modern humans too.’” ■

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