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OASE CAVE

DISCOVERING EUROPE'S OLDEST MODERN HUMANS

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Above
Caver Ştefan Milota holds the face of the oldest-known modern person to set foot in Europe, found at the Peştera cu Oase – or the Cave with Bones. This photo was taken at the time of discovery, in June 2003.

Oase Cave:

The discovery of Europe's oldest modern humans

What were the earliest modern Europeans like? The latest research suggests they might have been closer to the Neanderthals than previously portrayed. The recent discovery of a jaw and a skull belonging to the earliest known modern humans to set foot in Europe is rewriting the story of our evolution. Professors **Erik Trinkaus** and **João Zilhão**, two scholars of human evolution, have been investigating the material found deep within a cave in the Romanian Carpathian Mountains. Here they tell the extraordinary story of the discoveries there.

Above The location of the Peştera cu Oase (black triangle): in the Banat province of Romania, on the south-western tip of the Carpathian mountains.

Below The shaft leading up to the galleries, at the end of which caver Ştefan Milota found a mouse-hole. He felt air percolating through and decided to investigate. The rest, so they say, is prehistory. Note the yellow "banana" (cavers' jargon) on the back of the person climbing down the ladder. These 'bananas' are used to safely transport excavated bones and sediments through the water so that they can be sieved by the archaeologists waiting outside the cave.

Peştera cu Oase, the Cave with Bones

During the last Ice Age, the "Iron Gates" of the Danube, a long and deep gorge cutting across the Southern Carpathian mountain range and nowadays separating Romania and Serbia, were an obligatory passageway for humans moving back and forth between the margins of the Black Sea and the herbivore-rich steppe plains of Central Europe. Evidence of our forebears has been uncovered – by cavers and archaeologists – from several of the caves that are sprinkled throughout these mountains.

Romania has a large number of serious, dedicated, energetic amateur cavers that see themselves as the custodians of the country's underground world. One such group, the Pro Acva Grup (from the city of Timişoara), has been exploring and mapping caves in the Southern Carpathian mountains for many years. In February 2002, while exploring a cave system near the southwest Romanian town of Anina, Ştefan Milota and his fellow Pro Acva cavers decided to climb a 30m tall pit. As the group came to the top of the pit, they found themselves before a stretch of wide galleries. They made their way along the galleries, which ended with a mouse hole through which a draft of cool fresh air percolated. Inspired by the possibility that more of the cave system existed beyond, they excavated a passage just large enough for one person to crawl through.

“Lying on the surface of the cave ...was a complete lower human jaw.”

On the other side, they emerged into a set of galleries, upwards of 10m in diameter, littered with the bones of long since dead bears, goats, wolves and other animals. These galleries had been effectively blocked off for at least 17,000 years. Lying on the surface of the cave, at the intersection of the main upper galleries and a side gallery, was a complete lower human jaw. Finding this interesting and potentially important, the cavers consulted cave biologist, Oana Moldovan, from Romania’s oldest scientific institute dedicated to the study of caves, the Institutul de Speologie “Emil Racoviṣa”. She in turn contacted evolution specialist Erik Trinkaus for feedback.

Trinkaus saw that the bone was old, and – thanks to its clear chin – confirmed that it belonged to a modern human. However, he hardly guessed it was as old as it was. In 2002, it was radiocarbon dated to around 40,000 calendar years old. The cavers had found the oldest carbon-dated modern human fossil known in Europe.

In 2004 and 2005, the team returned to the cave to undertake further investigations. Accessing the Oase galleries was no easy task.

Top
Here we see a team member preparing to enter the underground river that has to be dived through to reach the cave.

Above
Team member Laurenşiu Sarcina up to his elbows in the underground river; the diving site is some 220m further inside the limestone massif.

Right
Sarcina goes through a narrow section of the underground river leading to the diving site.

Right A team member emerges from the inky water. After changing from diving to caving gear, he will be ready to climb the shaft leading to the Oase galleries.

Below Having entered the cave, rewards await the divers. A cluster of animal bones from within the Oase cave; the skull on the left is of a cave lion, that on the right is of a cave bear. Before the original entrances collapsed and became sealed by sediments and speleothems (mineral deposits), these galleries were mostly used by cave bears as a den and hibernation site. In the restricted area excavated, over 5,000 bones were collected and examined.

Erik Trinkaus and Oana Moldovan wanted to take a team to document the cave scientifically, which had become known as Peştera cu Oase or the Cave with Bones, and provide a context for the human jaw. But how? The cave had one curious restriction, a restriction that had led to its preservation over the tens of millennia – one had to be able to scuba dive safely in restricted spaces within the cave in order to access the galleries with the fossils.

They harnessed the help of Ricardo Rodrigo, a Portuguese underwater archaeologist and experienced cave diver. In June 2003, he drove across Europe with a carload of equipment to help map the cave. Together, he and the cavers explored further. On the last hour of the last day of a hard week's work, caver Ştefan Milota placed his hand on a curious bone lying among hundreds of bear bones. He lifted up the bone and found a nearly complete human face looking back at him. Scientific dating showed that this face was the same age as the mandible.

Several bottles of celebratory wine later around a campfire, the essentials of what needed to be done had been laid out. The team decided to launch an international project to document properly the Peştera cu Oase, its geology, its palaeontology, and its humans. Two field seasons – in 2004 and 2005 – were planned. João Zilhão, a Palaeolithic archaeol-

ogist and experienced caver, learnt how to dive in order to lead the excavations. Trinkaus, who is neither a caver nor a diver, was to take charge of the lab in Anina. Caver Milota, plus Romanian geologist Silviu Constantin, also worked as co-directors.

Together the small international team excavated more than 5,000 bones from the side gallery that had contained the human face, they mapped the cave bear hibernating nests, and collected samples for dating and geology. Their field work has produced one of the best dated and best documented cave bear sites in Europe, and an abundance of data for the past climates of the region. But it was the two human specimens, and particularly the face discovered in 2003 (which became a near-complete cranium after reconstruction with the additional skull bones recovered during the 2004-05 excavations) that would help to solve the puzzle of who we are.

Neanderthals and us

However, these early modern humans were not alone. Already present in Europe was another human group, the Neanderthals. Current evidence (despite some claims to the

Top Dare-devil work! Geologist Viorel Horoi sampling hanging deposits left by the underground river in the upper reaches of the shaft.

Above Team member Catalin Petrea comes out of the mouse hole into the galleries of Oase, the surface of which is littered with bear bones.

How to dig a cave site
Top Team members Ştefan Milota, Hélène Rougier and João Zilhão excavating at the findspot of the Oase 2 skull.

Above Catalin Petrea, Hélène Rougier and João Zilhão transport finds away from the excavation area.

contrary) indicates that they existed from around 250,000 to some 35,000 years ago. Neanderthals have a rather bad reputation, and are often thought of as sub-intelligent cultureless brutes.Indeed, as Trinkaus and Zilhão point out, it has been a common academic view on either side of the English Channel and just south of the Bronx, but rarely elsewhere in the World, that the inherently superior modern humans simply displaced (ecologically or violently) the inferior Neanderthals. After all, no Neanderthals now exist; we won. Primitive DNA analyses undertaken through the 1980s and 1990s seemed to settle the question. Scientists concluded that there was little or no gene flow between the two; Neanderthals were a separate species.

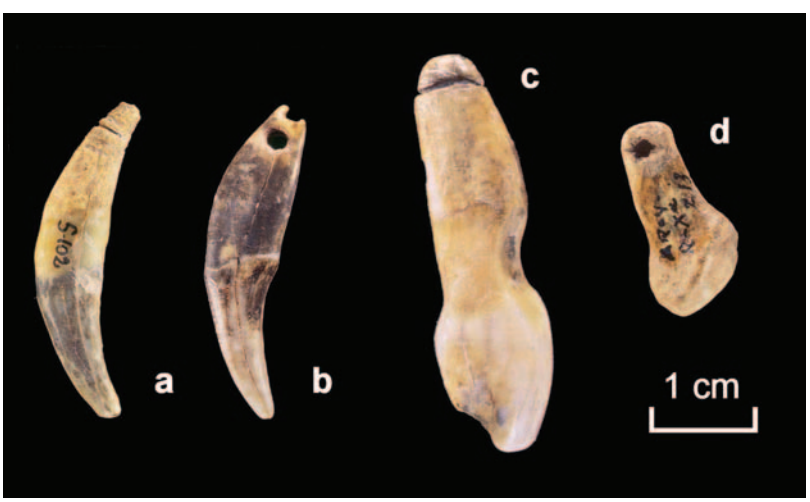
Yet, was this really the case? Indeed, were the Neanderthals really so inferior? The evidence indicates that, just like modern humans, the Neanderthals were expert hunters, they showed respect for their dead through burials, and by at least 50,000 years ago had developed external signs of an aesthetic. Indeed, it has been steadfastly maintained by some that when these two human groups met, they simply did what humans normally do, they shared ideas, blended and reproduced and intermingled. This group of scientists argues that the only reason why they have been unable to show this was that there were no fossils securely dated to the right time and in the appropriate place to evaluate what might have really taken place.

"The Oase fossils are most certainly the remains of early modern humans."

This is where the newly discovered bones take centre stage. Prior to their discovery, the only other known early modern human fossils were either somewhat later – such as the 32,000 year old skeletons from the famous site of Cro-Magnon in southwest France – or they were too fragmentary or poorly dated to be useful. In contrast, the two human fossils from the Peştera cu Oase are reasonably complete with diagnostic elements of the skeleton, they are undistorted, and they are securely dated to within a couple of millennia of the probable time of the spread of modern humans past the "Iron Gates."

Above
Oase 1: the complete modern human mandible (or lower jaw).

Below
Neanderthal ornamentation. Neanderthals had developed their own tradition of personal ornamentation well before modern humans began to disperse into the European continent. This is best seen in the Châtelperronian culture of France. Here we see some pierced and grooved pendants from Châtelperronian level X of the Grotte du Renne: a-b. fox canines, c. bison incisor, d. lateral phalange of reindeer.



The Oase fossils

The Oase fossils are most certainly the remains of early modern humans. There is a whole range of skeletal elements that make us 'modern' when compared to the 'archaic' features of the Neanderthals and other earlier humans. The complete modern human mandible (or lower jaw), labelled Oase 1, has a chin – a thoroughly modern trait. The nearly complete cranium (a skull without the mandible) of the second individual, or Oase 2, lacks a brow ridge – again, a modern trait since heavy brow ridges are archaic and found on Neanderthals. There is a host of other minor features on the mandible, the face, the ear region, the neck muscle attachments, and the braincases, that make the Oase specimens unequivocally modern humans. Yet, they are not quite that.

Oase 1 has a bridging over of a nerve canal – this is a trait known only in the Neanderthals among earlier fossils. Oase 2 has a long and flat forehead but higher rear braincase, a pattern matched only by a couple of Neanderthals. Both of them have cheek teeth that get larger towards the back of the jaw, a distinctly archaic feature. Moreover, the two specimens have the largest wisdom teeth (third molars) known in

Above
Oase 2: the nearly complete modern human cranium of the second individual (the lower jaw of whom was not found).

the last half-million years. What does this mean? These are features best explained as a result of prior mixing of our modern human ancestors with Neanderthals – either from Neanderthal traits being passed down to the Oase specimens or a complex genetic mixing taking place to produce unique features.

"...you and I may be ever so slightly Neanderthal."

Inspired by the observations on the Oase fossils, Trinkaus (in part building on the work of others) re-examined other, but slightly more recent, early modern European fossils, including those from the sites of Peştera Muierii and Peştera Cioclovina in Romania, Mladeş in Moravia, Les Rois in France, and others. Close examination indicates that those basically modern human fossils also exhibit tell-tale signs of prior mixing with Neanderthals.

From these fossils a pattern has emerged. It appears that as modern humans dispersed westwards across Europe, they mixed with the local Neanderthals, absorbing them into their populations. The evidence from this part of the lower Danube in Romania gels with the conclusions Trinkaus and Zilhão had previously reached on their study of the Lagar Velho child (a modern human who possesses some clear Neanderthal and archaic features) from Portugal at the other end of Europe, where modern humans arrived last. In short, these researchers are convinced that Neanderthals and modern humans must have seen each other as appropriate mates, as fellow people, whatever minor differences in appearance they noticed. Thus you and I may be ever so slightly Neanderthal.

Other forms of inference are beginning to point in the same direction. Living human genetic data, which since the 1980s have been taken to indicate simple replacement of the Neanderthals, are now revealing alternative conclusions. There is a growing series of human genetic systems whose modern variation cannot be explained without some degree of admixture. The same applies to the global distribution of a variety of living human anatomical features, mostly ones that are only skin deep and hence do not preserve from the past (including skin colour, hair shape and colour, and nose shape, but also some aspects of tooth shape).

In a total replacement scenario, these traits had

to have evolved independently among Eurasian modern humans in the last 50,000 years, which is simply not long enough; there must have been intermingling to account for the current patterns.

Furthermore, the few examples of Neanderthal DNA that have been sequenced are compatible with this conclusion. Although admixture itself is not documented by those Neanderthal DNA samples, it should not be expected to: the Neanderthals that have been genetically tested predate the time of contact and, therefore, their genes (as their anatomy) can only reflect what had happened in the past history of their lineage, not what was to happen in its future – once they met modern humans.

Artful thinking

The archaeological record at the time of the transition also fits the story told by the modern human bones. The "creative explosion" of the Upper Palaeolithic, best represented by the emergence of figurative art, is often invoked as evidence for the cognitive superiority of modern humans, and as the explanation for why they would have outcompeted the Neanderthals. However, this explosion occurred several millennia after modern humans entered Europe. Trinkaus and Zilhão therefore argue that it is of no relevance to understanding what happened at the time of contact, and that whatever evidence exists to assess issues of intelligence and cognition points to identical capabilities and equivalent levels of technical and cultural achievement between Neanderthals and modern humans.

> "...Neanderthals may well have contributed culturally, as well as genetically, to the blended populations..."

Trinkaus and Zilhão also argue that Neanderthals may well have contributed culturally, as well as genetically, to the blended populations generated by interbreeding. For instance, early modern Europeans (broadly represented by what archaeologists call the Aurignacian culture) were in the habit of using animal teeth (mostly of deer and fox) as pendants. Yet the known pre-contact body ornamentation in modern human cultures is restricted to beadworks made of small marine shells and ostrich egg shell discs (a practice that first arose in Africa and the Near East, between 100,000 and 50,000 years ago). It is likely, therefore, that tooth pendants were added to the traditional modern human repertoire as a result of interaction with the Neanderthal cultures of Europe (such as the Bachokirian of Bulgaria or the Châtelperronian of France), where the practice of using animal tooth pendants as personal ornaments emerged several millennia prior to the dispersal of modern humans into the continent.

Below
João Zilhão (left) and Erik Trinkaus (right) with archaeologist Ricardo Rodrigo (centre), discussing finds in the lab.

Bottom
Erik Trinkaus is neither a caver nor a diver, so he took on the job of overseeing the lab where the team examined huge amounts of data. Here he is seen (standing) with cave bear paleontologist Jérôme Quilès.

From the darkness, light

The caves of Romania have certainly produced more than the bones of dead bears and a playground for the cave enthusiasts of Europe. From their darkness, they have shed light onto our early modern human forebears, their biology and their ancestry. We can only be

thankful that, when Ştefan Milota felt the air percolating through the mouse hole, his perception and curiosity led him to find what lay behind.

Human evolution is a contentious discipline. Each new find can cause a new twist and turn in the story. Yet the controversies result more from the weight of preconceptions than from the lack of order or meaning in the evidence. Some details do remain problematic, but a lot of progress has been made over the last decade, and a general consensus now exists among researchers that Neanderthals and moderns interacted at the time of contact. The frequency of this interaction, and its genetic and biological implications for subsequent populations, is what lies at the heart of current debates. Additional fossil and archaeological finds will certainly help in the clarification of the issues that remain open. Given the critical geographical location of the 'Iron Gates', the Southern Carpathian mountains are destined to become a key region for early modern human research. Oase may well be but the first chapter in a long story. ■

Photos by Mircea Gherase, www.gherase.com

Above
Team members prepare for the Oase dive. From the darkness of the Romanian cave, much new knowledge about human evolution has emerged.

Below
Hélène Rougier and Erik Trinkaus studying the Oase 2 cranium. Who was this early person to venture to Europe? How far did such early modern humans interbreed with the Neanderthals? And how many more secrets do the Carpathian Mountains hold?