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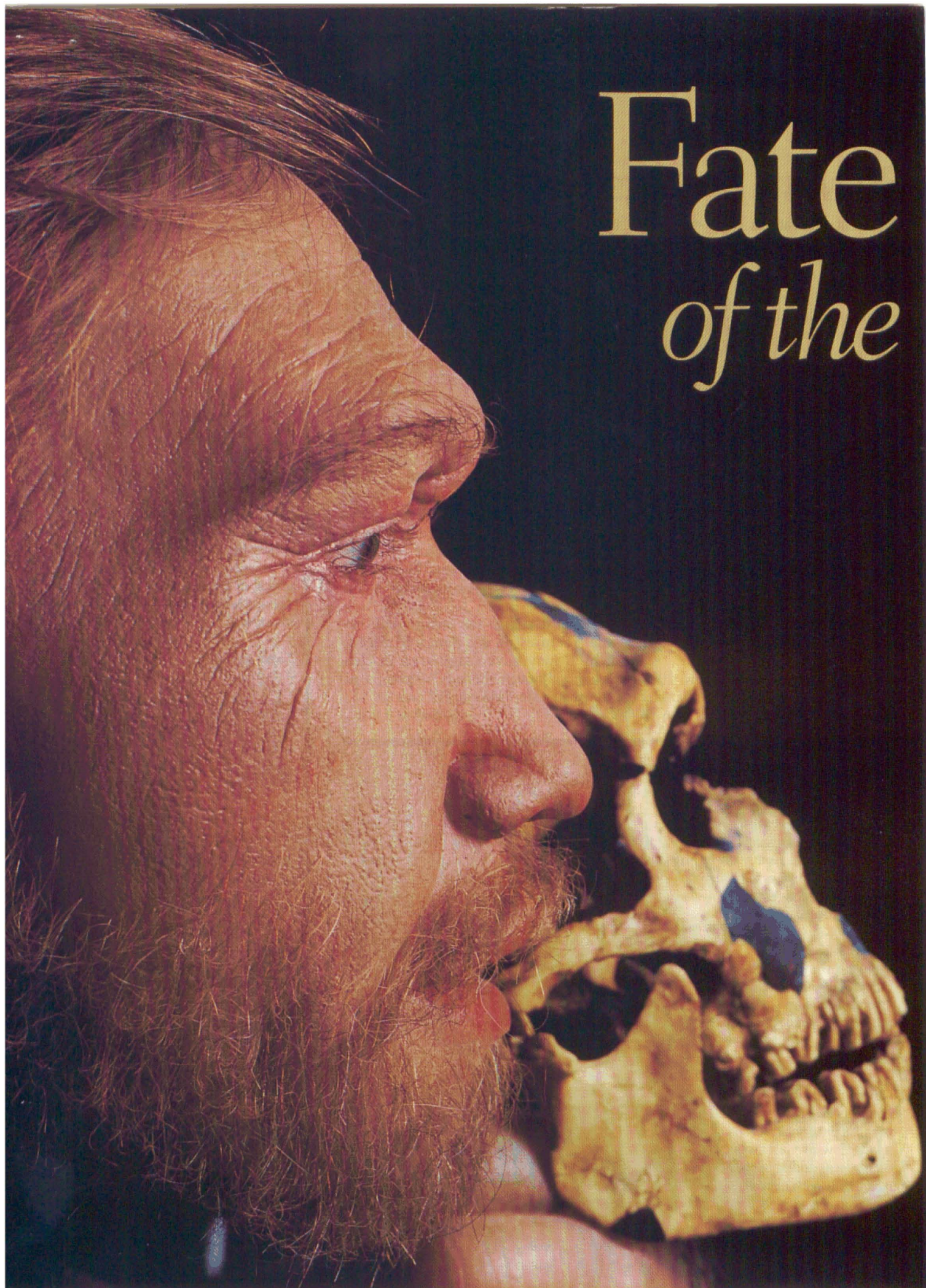
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EXCLUSIVE

**Provocative
New Theory**

Fate
of the
Neandertals

Fate *of the*



Neandertals

Our robust cousins interbred with modern humans,
a preeminent European archaeologist argues.

by JOÃO ZILHÃO

The bones of a four-year-old child, buried for millennia in the rear of a rock-shelter in the Lapedo Valley 85 miles north of Lisbon, Portugal, comprised the first complete Palaeolithic skeleton ever dug in Iberia. Our November 28, 1998, find made national news, but an even greater surprise was in store when my colleague, Washington University anthropologist Erik Trinkaus, who measured the bones weeks after the discovery, reported that the child's anatomy could only have resulted from a mixed Neandertal-early modern human ancestry. Here, finally, was proof that Neandertals did not simply disappear from Europe 28,000 years ago. Instead, they interbred with modern humans and became part of our family.

The discovery was made by João Maurício and Pedro Souto, archaeology field assistants and members of a local archaeology group, who visited the valley at my request to check on reports that a student from a nearby village had found some prehistoric paintings. The reports turned out to be genuine. The student showed them a few small, red anthropomorphic figures in a style characteristic of the Copper Age (fourth and third millennia B.C.) painted on the back wall of a shallow rock-shelter on the north side of the valley.

While they were there, João and Pedro decided to inspect a larger shelter they saw on the opposite side of the valley. When they got there, the first thing they noticed was that archaeological deposits in the shelter had recently been destroyed; we later learned that in

1992 the landowner had bulldozed the upper six to nine feet of the shelter's fill to widen a rural trail used to reach property located farther up the valley. All that was left was a foot-and-a-half remnant of the original deposit in a fissure running along most of the length of the shelter's back wall. This remnant corresponds to a section of the original stratigraphic sequence lying between two and three feet below the former ground surface.

The remnant was extremely rich in charcoal, stone tools, and animal remains, including fossilized horse teeth, all suggesting an Upper Palaeolithic age (between 30,000 and 10,000 years ago) for the site. While collecting surface material that had fallen from the remnant, João and Pedro inspected a recess in the back wall. In the loose sediments they recovered several small bones stained with red ochre



The Lagar Velho child must have been wrapped in a shroud of red ochre-painted animal skin, whose decay caused the transfer of mineral pigment to the skeleton and sediment.

João Zilhão © Instituto Português de Arqueologia

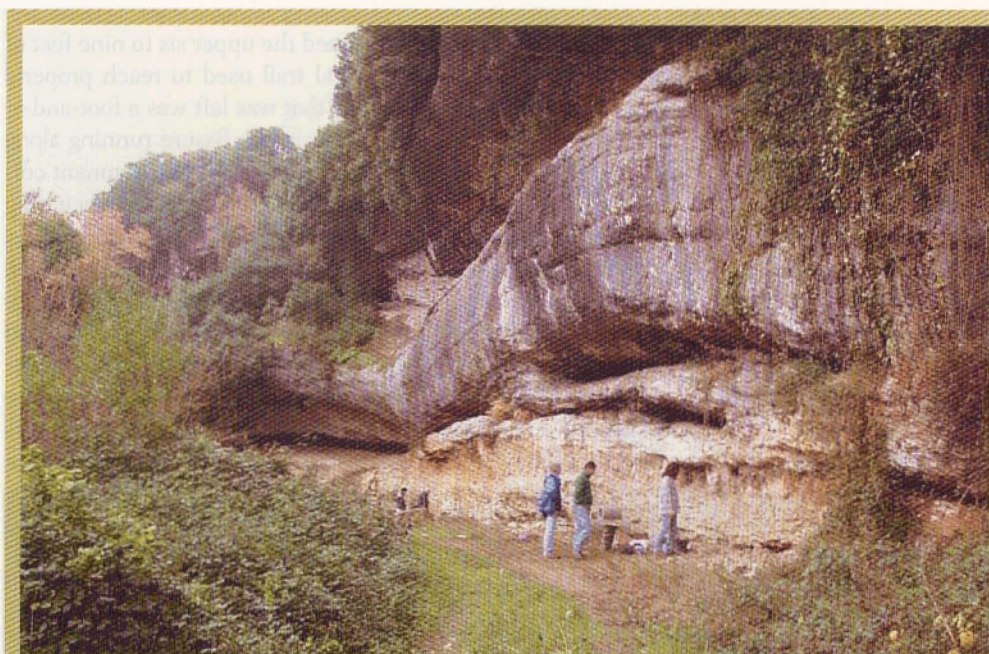
they thought could be human. Recognizing the potential significance of the discovery, they stopped investigating and reported their finds to me.

The following weekend, on December 6, I went to the site with my colleagues Cristina Araújo, a fellow archaeologist, and Cidália Duarte, a bioarchaeologist specializing in burial taphonomy (how bodies are buried and preserved). João and Pedro presented their finds and two things almost immediately became clear. First, the bones they thought could be human were indeed the left forearm and hand bones of a young child. Second, stone tools found in the fissure dated the deposit to the Middle Solutrean and the Proto-Solutrean, that is, the period between 20,000 and 22,000 years ago. Since the juvenile human bones that lay some nine feet below this remnant belonged to a single individual and were very well preserved, the implication was obvious: a child had been buried at the site either in late Middle Palaeolithic or in early Upper Palaeolithic times, between 40,000 and 25,000 years ago. The ochre staining of the bones (a feature of all burials from the Gravettian period between 25,000 and 27,000 years ago) and rough estimates of the rate of sedimentation at the site led us to believe that a date closer to 25,000 years ago was more likely.

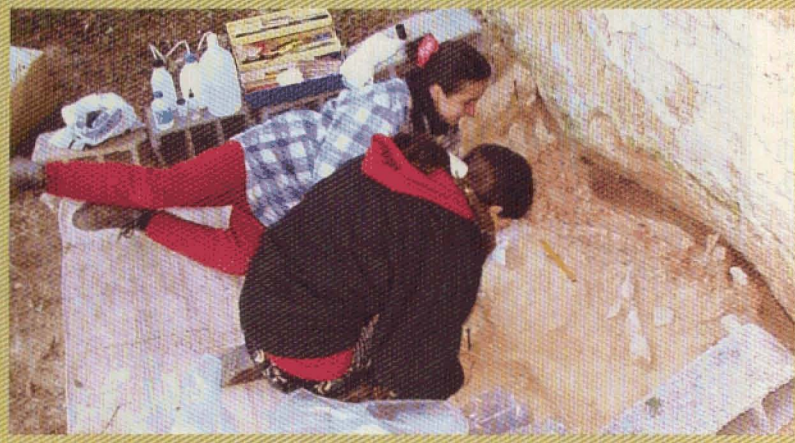
This conclusion prompted me to start a salvage excavation of the site, which we called the Lagar Velho rock-shelter after the ruin of an ancient olive-oil press at its entrance. The excavation began on December 12, 1998, continuing without interruption through Christmas and the New Year until January 7, 1999. Subsequently, in July and August, deep testing of the preserved deposits under the burial and in the central part of the shelter further documented the site's stratigraphy. The surface of the site was also excavated and extensively screened, enabling the recovery of many of the child's missing teeth and skull fragments. We realized the bulldozer had come within an inch or two of the skeleton, leaving it miraculously intact except for the skull, which had been crushed into more than 100 pieces. The presence of ancient fractures in the cranial fragments suggests that natural processes had collapsed it inward not long after burial, but fresh breaks show that further fragmentation occurred when the site was bulldozed, scattering skull fragments east of the burial.

The broken left side of the child's lower jaw, including the chin region, had been recovered at the outset in a very thin layer of disturbed deposits overlying the burial. The chin featured the characteristic "snow-plow" shape found in Cro-

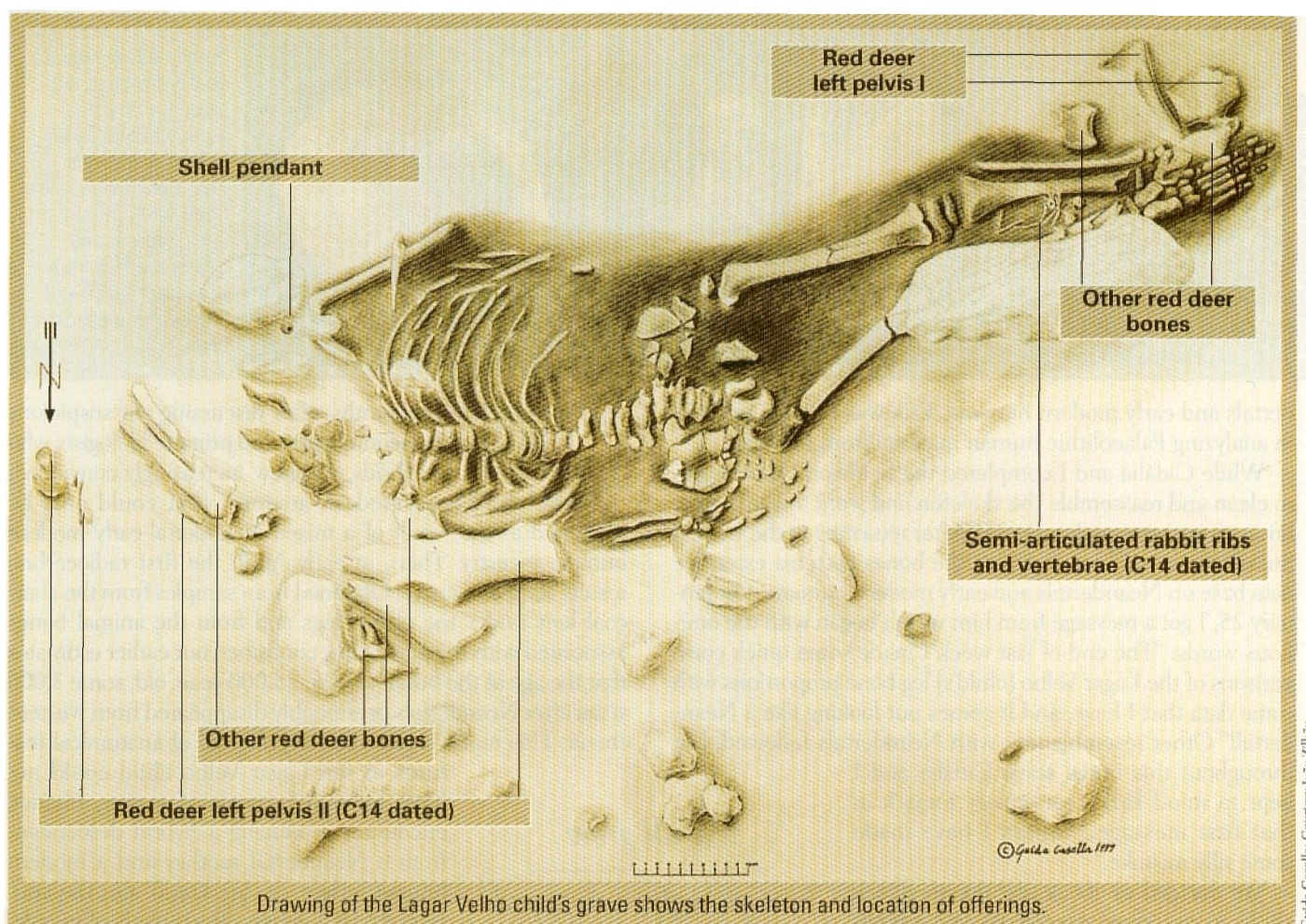
Magnon people, the first anatomically modern humans, whose appearance on the European continent coincides with the disappearance of Neandertals. The day after that lower jaw was recovered, discovery of a pierced marine shell of the species *Littorina obtusata*, the most common ornament in the Upper Palaeolithic of Portugal, reinforced the hypothesis that this was an early Upper Palaeolithic burial. The shell was found near the neck vertebrae, suggesting that the dead child was wearing it as a pendant when he was buried. As the excavation continued, we were able to uncover a nearly complete, *in situ* skeleton (minus an intact skull), and establish that the body had been laid on its back, left side parallel to the cliff base, head to the east, feet crossed. Four red deer (*Cervus elaphus*) canines pierced through the root were found with the cranial remains. They suggest that the child was buried with some kind of decorated head wear. Pierced red deer canines have also been found on the skulls of Gravettian period people buried in Italy and Moravia.



View of the Lagar Velho rock-shelter. Right, archaeologists Cidália Duarte and Cristina Araújo excavated the child's skeleton.



Courtesy João Zilhão



Drawing of the Lagar Velho child's grave shows the skeleton and location of offerings.

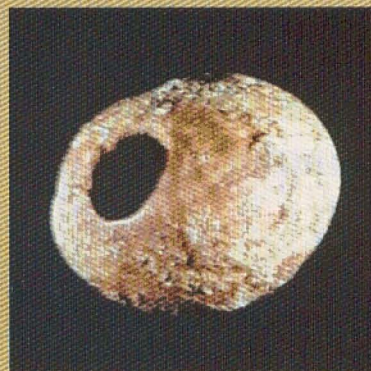
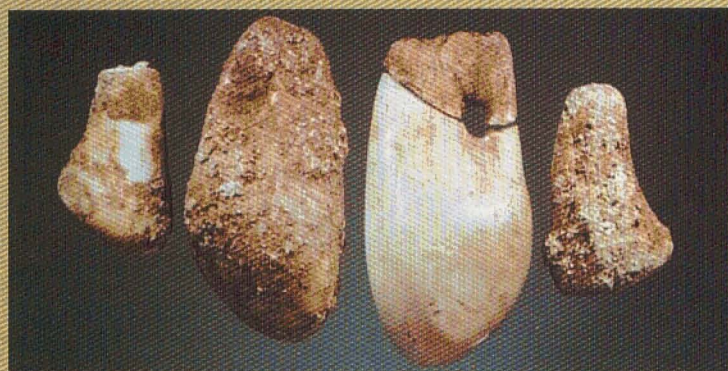
The skeleton, especially the skull pieces, were heavily stained with red ochre as was the sediment in which the bones lay. This, and the fact that both the upper and the lower surfaces of the bones were stained, indicates that the body must have been wrapped in a shroud of ochre-painted skin, whose subsequent decay caused the transfer of the mineral pigment to the skeleton and sediment. The presence of a semi-rigid durable wrap around the body would also have provided the space for the post-mortem collapse of the child's ankle ligaments, evident in the position of the feet. At the base of the pit, immediately below and in contact with the child's legs, there was a thin black lens of charcoal, which belonged to a single branch of Scots pine. This suggests that a ritual fire was lit before the deposition of the body; the adjacent deposits contained no traces of charcoal.

Red deer bones found in association with the burial pit are distinct from those found in the surrounding and immediately underlying sediments. The latter present eroded surfaces, have a shine suggesting they were chewed and digest-

ed by carnivores, often display actual teeth punctures, and are associated with coprolites. In contrast, the deer bones found by the head and feet of the child's skeleton are well preserved, show no evidence of being mauled by carnivores, were in direct contact with the body, and provided a C14 date showing contemporaneity with the burial. Furthermore, no artifacts or other evidence of habitation were recovered at this level in this part of the shelter. The simplest explanation is that these bones belonged to parts of deer carcasses deposited in the grave as food offerings. The same may be true of the rabbit bones that overlay the child's right leg (three vertebrae, four ribs, and one sacrum fragment). They were also stained red, and two of the ribs were complete, suggesting that they were originally joined to the vertebrae.

Throughout the 1998–1999 salvage work we were able to count on the invaluable advice of Erik Trinkaus, to whom I e-mailed digital pictures of the excavation daily. Realizing the potential significance of the burial, Cidália Duarte and I invited him to the site to study the skeleton. An authority on Nean-

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This pierced shell was found near the child's neck vertebrae, suggesting that it had been worn as a pendant. The four red deer canines, possibly head-wear decorations, were found nearly ten feet from the burial with fragments of the child's skull.

dertals and early modern humans, Erik was already involved in analyzing Palaeolithic human material from Portugal.

While Cidália and I completed the fieldwork, Erik began to clean and reassemble the skeleton and work toward a preliminary anatomical description. After returning to the United States, he was able to compare the bones with his extensive data base on Neandertals and early modern humans. On January 25, I got a message from him which began with the ominous words: "The end of last week I made some quick comparisons of the Lagar Velho [child's] leg bone proportions with some data that I have, and it comes out looking like a Neandertal!" Other resemblances with Neandertals followed, but throughout this initial stage Cidália and I kept in mind Erik's cautionary remark in that first message: "unless I have made some silly mistake."

We decided to check and double check all the measurements ourselves, and eventually concluded that Erik had made no mistake—the child did present a mosaic of Neandertal and modern human features. Most prominent among the former, the arctic body proportions (with short limbs, especially the lower parts of the arms and legs), the robusticity of the limb bones and the angle at which the jaw bones meet at the chin; among the latter, the characteristic "snow-plow" chin and the size of the dentition. Body proportions are particularly important in this regard because the study of present-day populations has proved that they are genetically inherited and that the basic patterns of body shape are already established in the fetal stage of development. This makes it possible to compare the bones of the Lagar Velho child not only with those of other children but also with available adult skeletons from the same time period. Among the two possible ancestral populations of the group to which this child belonged, it is well-established that all Neandertals had arctic body proportions. On the contrary, all European early modern humans had tropical body proportions (long limbs), betraying their recent (in evolutionary time) African origin, in spite of the fact that they had been living for many millennia in the very cold steppe-tundra environments then present throughout the unglaciated parts of the continent located north of the Pyrenees.

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In the following months, after discussing our suspicions with human palaeontologists and primate biologists who study natural hybrids, we grew increasingly convinced: the child possessed an anatomy that could only be explained as the result of a mixed Neandertal-early modern human ancestry. Then, in early April, the first radiocarbon results started to arrive. Obtained from samples from the charcoal lens under the child's legs and from the animal bones associated with the grave, they confirmed our earlier estimates that the age of the burial was ca. 25,000 years old, some 3,000 years after Neandertals presumably disappeared from western Iberia. This made it clear that the mosaic of anatomical fea-

tures in the Lagar Velho child could not have been the result of a rare, chance encounter producing a hybrid descendant from a Neandertal mother and a modern human father (or vice versa). On the contrary, it had to represent a mixture of populations. Put another way, Neandertals had not simply disappeared without descendants, they had been absorbed, through extensive interbreeding, into the modern human groups that had started to take over Iberia ca. 30,000 years ago. They had contributed to the gene pool of subsequent early Upper Palaeolithic populations of the peninsula and, therefore, had to be counted among our ancestors: they were family.

This conclusion contrasts with the prevailing view of the Neandertals as an evolutionary dead end, a side branch of the human tree, that has become so popular in the wake of the Eve hypothesis based on

mitochondrial DNA (mtDNA). First proposed in 1987, this hypothesis states that Europeans descended entirely from anatomically modern human populations that gradually evolved in Africa from an ancestral *Homo erectus* stock after 250,000 years ago. Having begun to spread from there to the rest of the world some 50,000 years ago, these anatomically modern groups eventually replaced, without admixture, all indigenous anatomically archaic human forms of Eurasia. Thus, Neandertals became extinct with no descendants.

This view received strong support from the publication, in 1997, by Svante Pääbo of the University of Munich and his colleagues, of a comparison between mtDNA extracted from

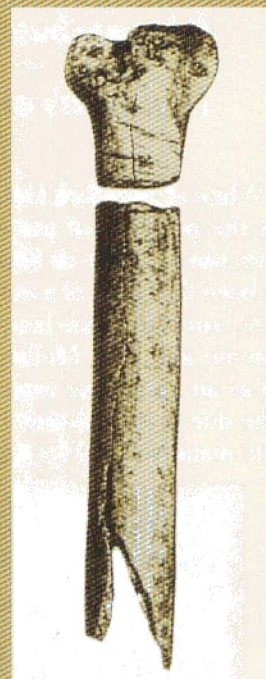
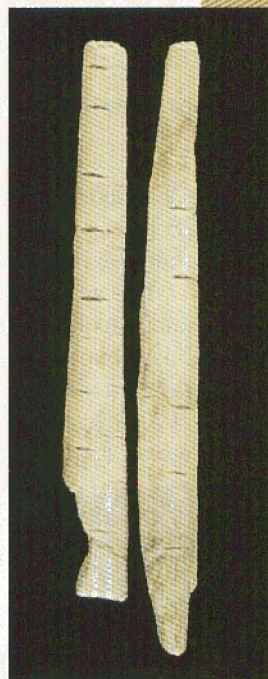
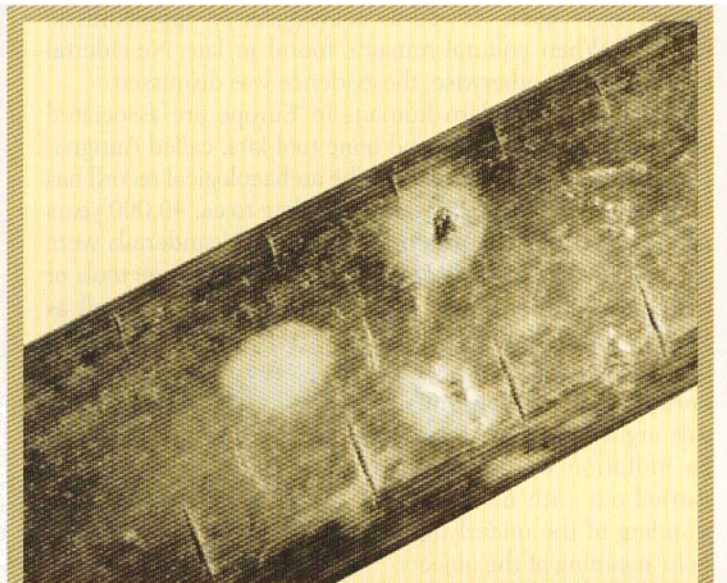
the original Feldhofer Cave Neandertal type specimen found in 1856 and that of present-day human populations. It inferred that the difference was so significant as to put Neandertals outside the range of modern humanity, suggesting that they had belonged to an altogether different biological species and that interbreeding, although conceivable, could not have been significant. Possible support for this view comes from the mtDNA analysis of the rib of a 29,000-year-old fetal or neo-natal skeleton from Mezmaiskaya Cave, in the northern Caucasus, recently published in the journal *Nature*. The significance of the latter, however, remains to be seen. It is reported as a Neandertal infant, but its classification is in fact uncertain.

Analysis of the Lagar Velho child's mtDNA would certainly help to test our interpretation. Unfortunately, this is likely to be impossible, due to the chemical weathering undergone by the child's

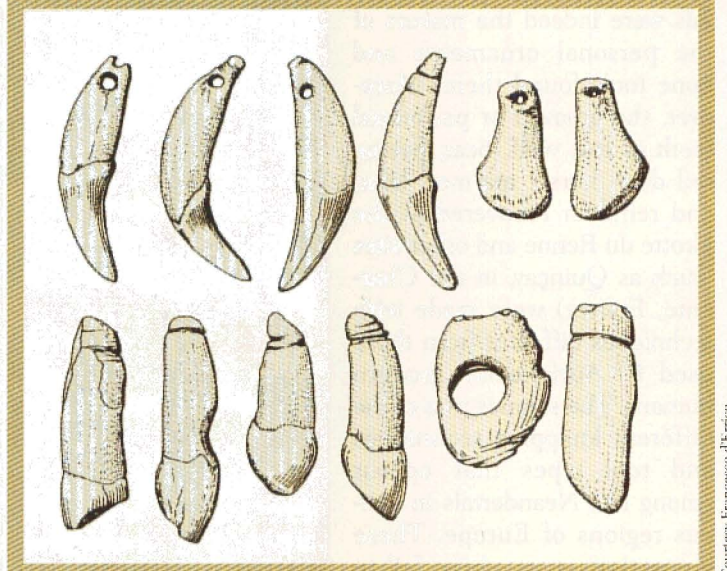
fragile bones. However, as we prepared the preliminary publication of the burial and of our interpretation of the child's anatomy, the journal to which we had submitted it (*Proceedings of the National Academy of Sciences USA*) published a major paper on the variability of the DNA of African apes, our closest living relatives. This work showed that contemporary interbreeding populations of chimpanzees are genetically more diverse than modern humans and our Late Pleistocene fossil ancestors, including the one Neandertal specimen Pääbo analyzed. By primate standards, therefore, the results obtained by Pääbo's team indicated that present-day humans ought to be considered abnormally homogeneous. This low DNA variability is consistent with a single recent origin for modern humans (the Out-of-Africa model), but does not imply that Neandertals were a different species.

It simply confirms, from genetic data, what palaeontologists have established for about a century on the basis of fossil bones: that Neandertals, as a separate, well-defined geographic variant of humanity that became differentiated during the Middle Pleistocene, are now extinct. That does not mean that they did not contribute to the gene pool of subsequent populations. The Lagar Velho child's anatomical mosaic suggests that they did, even if such a contribution eventually became so diluted as to become unrecognizable today.

Recent developments in the archaeology of the last Neandertals and the earliest modern humans in Europe point to a similar conclusion. Ever since the original Neander Valley fossil was discovered, most researchers have doubted that the Neandertals were capable of using symbols or manufacturing complex bone and ivory objects. While modern humans are thought to have created cave art and delicate carvings and to have engaged in specialized hunting, Nean-



Bone tube of a swan's left wing, left interior, manufactured by Neandertals at the Grotte du Renne in Burgundy, France, provide unequivocal evidence for local production of the bone tools—not traded with or scavenged from modern humans. Decorated bird-bone tubes (far left) and bone awls (top) indicate that symbolism was not imported but permeated all aspects of life in late Neandertal society. In most late Neandertal ornaments a furrow was carved around tooth roots, below, which were punctured then smoothed and the perforation enlarged. The earliest European modern humans, on the other hand, always pierced their teeth pendants by first scraping them thin.



dertals have been viewed as scavengers or opportunistic hunters. When cultural remains found in late Neandertal sites suggested otherwise, the evidence was dismissed.

The earliest modern humans in Europe are associated with characteristic stone and bone tool-kits, called Aurignacian, whose first appearance in the archaeological record has been assumed for the last decade to date to ca. 40,000 years ago. In France and northern Spain, local Neandertals were thought to have copied some of the stone and bone tools of their new neighbors, the Aurignacian moderns, as well as their personal ornaments, giving rise to a new Neandertal cultural entity, the Châtelperronian. It was argued, however, that such an imitation would have been carried out with no real understanding of the underlying symbolic meaning of the objects.

Other kinds of explanations postulated post-depositional disturbance of sites to deny Neandertals any role in the manufacture of those items. Scholars such as Yvette Taborin of the University of Paris I and Randall White of New York University, for instance, suggested that the presence of personal ornaments and bone tools at the key site of Grotte du Renne, in Burgundy, France, would have been the result of a mixing of archaeological strata. Others, such as Jean-Jacques Hublin of Paris' Musée de l'Homme and Paul Mellars of Cambridge University suggested as an alternative explanation that such a presence might be due to Neandertals having collected or traded for objects manufactured by neighboring moderns.

The reassessment of the evidence from Grotte du Renne by Francesco d'Errico of the University of Bordeaux I, myself, and other colleagues showed that Châtelperronian Neandertals were indeed the makers of the personal ornaments and bone tools found there. Moreover, the grooved or perforated teeth of fox, wolf, bear, hyena, red deer, horse, marmot, bear, and reindeer recovered at the Grotte du Renne and other sites (such as Quinçay, in the Charente, France) were made with techniques different from those used by Aurignacian modern humans. The same is true of the different knapping techniques and tool types that appear among late Neandertals in various regions of Europe. These innovations everywhere fail to

show any influence from the Aurignacian, while maintaining affinities with preceding Neandertal traditions.

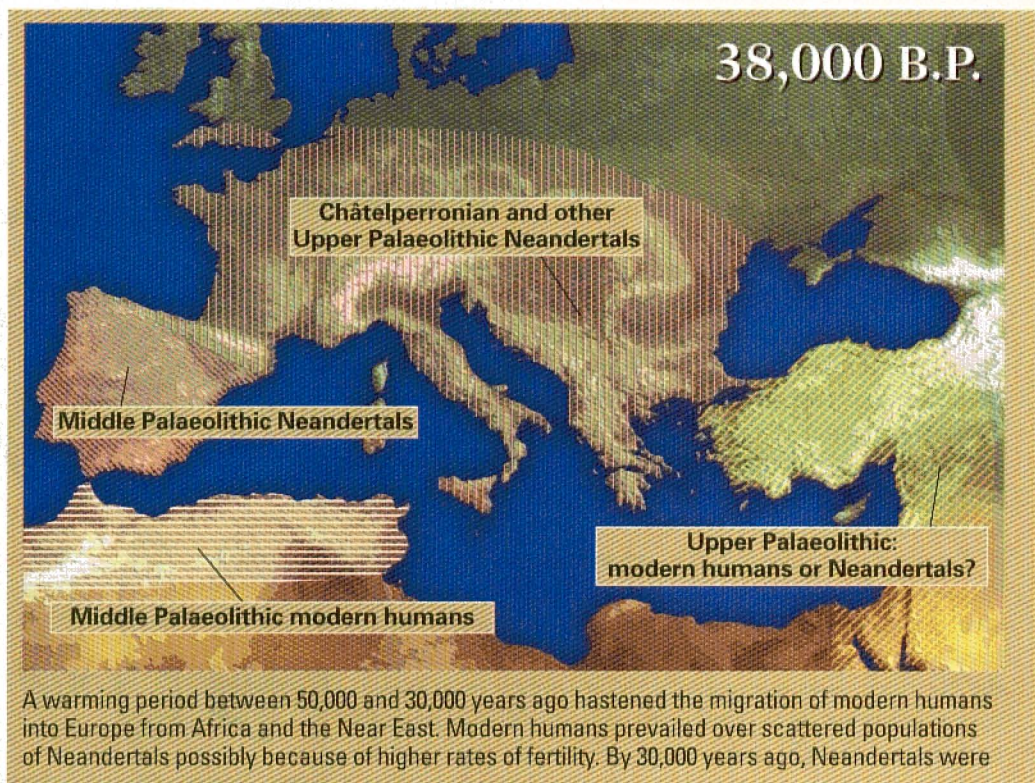
D'Errico and I have also closely examined the archaeological record to verify whether the arrival of early modern humans in western Europe did indeed predate these Neandertal innovations, as had to be the case if the emergence of the innovations had been triggered by contact with the newcomers. We found, however, that wherever archaeological layers of both cultures are represented at the same sites, the Châtelperronian always underlies the Aurignacian. Similarly,

research on hundreds of radiometric datings available for this period in Europe and the Near East shows that, wherever the context of the dated samples is well established, the first Aurignacian ones date to no earlier than ca. 36,500 years ago. The same radiometric data, however, indicate that, by then, Neandertals had already accomplished their own transition to behavioral modernity. In other words, there is no doubt that the

Châtelperronian and other late Neandertal cultures emerged in Europe well before any modern humans established themselves in neighboring areas.

This autonomous development included the manufacture and use of symbolic objects created for visual display on the body that reflected, as often observed in present-day traditional societies, different social roles. It is also at about 40,000 years ago that the earliest evidence for personal ornaments appears in the anatomically modern human popula-

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continent's earliest modern humans.*



tions of eastern and southern Africa. Thus, “modern” behavior seems to have appeared independently in different regions and among different groups of humans, much as would happen later in history with the invention of agriculture, writing, and social organization. On the strength of available data, our hypothesis that late Neandertal groups invented their own tools and ornaments is firmly supported. The notion that we were the only human type capable of developing a symbolic culture has collapsed.

If the two groups did not represent biologically different species and had attained a similar level of cultural achievement, why then did modern humans prevail? Why was it that the immigrants absorbed the locals and not the other way around? These are the really interesting questions for archaeologists and geneticists to ask. Biogeographic and demographic explanations may provide the answers. In the Pleistocene period, under climatic conditions much colder than today’s, most of Eurasia was uninhabitable. The northernmost areas were covered by ice sheets and barren tundras, and population densities in the settled areas must have been much lower than in Africa. Erik Trinkaus’ palaeodemographic analysis of Neandertal remains reveals those populations were highly unstable. Therefore, it is quite likely that between 100,000 and 40,000 years ago a large majority of all the planet’s human beings lived in Africa, where the modern morphological form evolved.

If these African groups also had a higher fertility, as is commonly the case with warm climate populations of the same species when compared with those from colder climates, we can plausibly explain what happened. Africans started to disperse into the neighboring regions, a process that must have been hastened by a warming period between ca. 50,000 and ca. 30,000 years ago, during which the savannas of eastern Africa, and their faunas, spread into the Middle East. Given enough time, even a very small difference in fertility would put the much smaller and more

scattered populations of Neandertals at a demographic disadvantage, especially if interbreeding were common.

Once modern humans became established throughout most of the European continent, their absorption of remnant Neandertal populations was just a matter of time. Radiometric data suggest that isolated Neandertal communities existed until quite late, not only in Iberia, where the evidence is the

strongest, but also in Croatia and Crimea. In the case of southwestern Europe, the Ebro River in northern Spain seems to have represented some sort of biocultural “frontier” separating Aurignacian modern humans established north of the Cantabrian-Pyrenean mountains since ca. 36,500 years ago from Neandertals surviving south of them until ca. 28,000 years ago. That Neandertals held on for so long shows just how well-adapted they must have been. No wonder that, when modern humans started to cross that “frontier,” they saw them as fellow

human beings and interbred, as demonstrated by the Lagar Velho child.

If, for our anatomically modern ancestors, Neandertals were just people—perhaps a little funny-looking, but people nonetheless—why should we believe otherwise and persist, against all available biological and cultural evidence, in trying to put them in an entirely different category? ■

JOÃO ZILHÃO is director-general of the Instituto Português de Arqueologia, the department of the Ministry of Culture that supervises all archaeological activity in Portugal.

This is the first of a two-part series offering different views on the fate of the Neandertals.

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