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## Chapter 21

### The Peștera cu Oase People, Europe's Earliest Modern Humans

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In OIS-3 times, especially during colder episodes when the northern European plain would have been an arctic desert, the Iron Gates of the Danube were the only route bridging the Pannonian basin, and western Europe, with the shores of the Black Sea. If the dispersal of early modern humans into Europe was from the Near East and followed the 'Danube corridor' (Conard & Bolus 2003), one would predict from the strategic location of this narrow bridge that such pioneer migrants should have imprinted the surrounding landscape with traces of their activity. The accidental discovery, in 2002, and subsequent study in 2003–05 of the Peștera cu Oase cave system (Moldovan *et al.* 2003; Trinkaus *et al.* 2003a,b; 2005; 2006), yielded one such window into the presence of humans in the

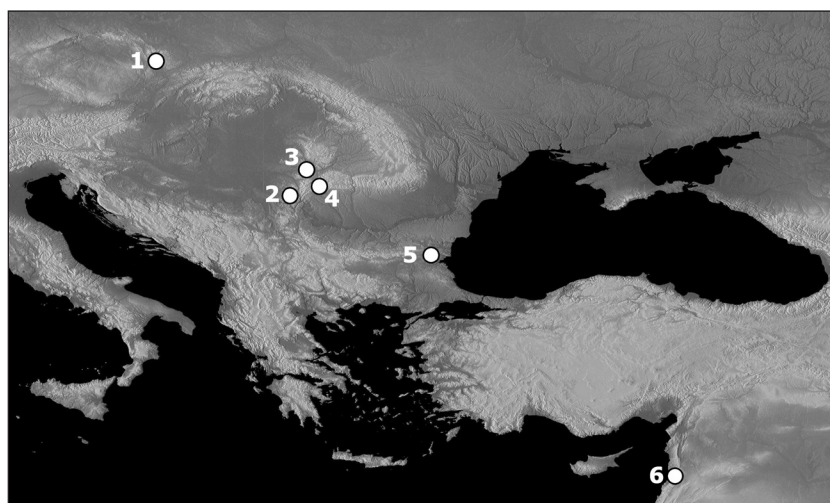
region during this critical time period (Fig. 21.1). Here, we present the site and the human fossils, and then discuss their significance in the light of the broader regional context. The Peștera cu Oase project is an ongoing collaborative international endeavour, and this represents a summary of the current state of our knowledge.

#### Peștera cu Oase: the site

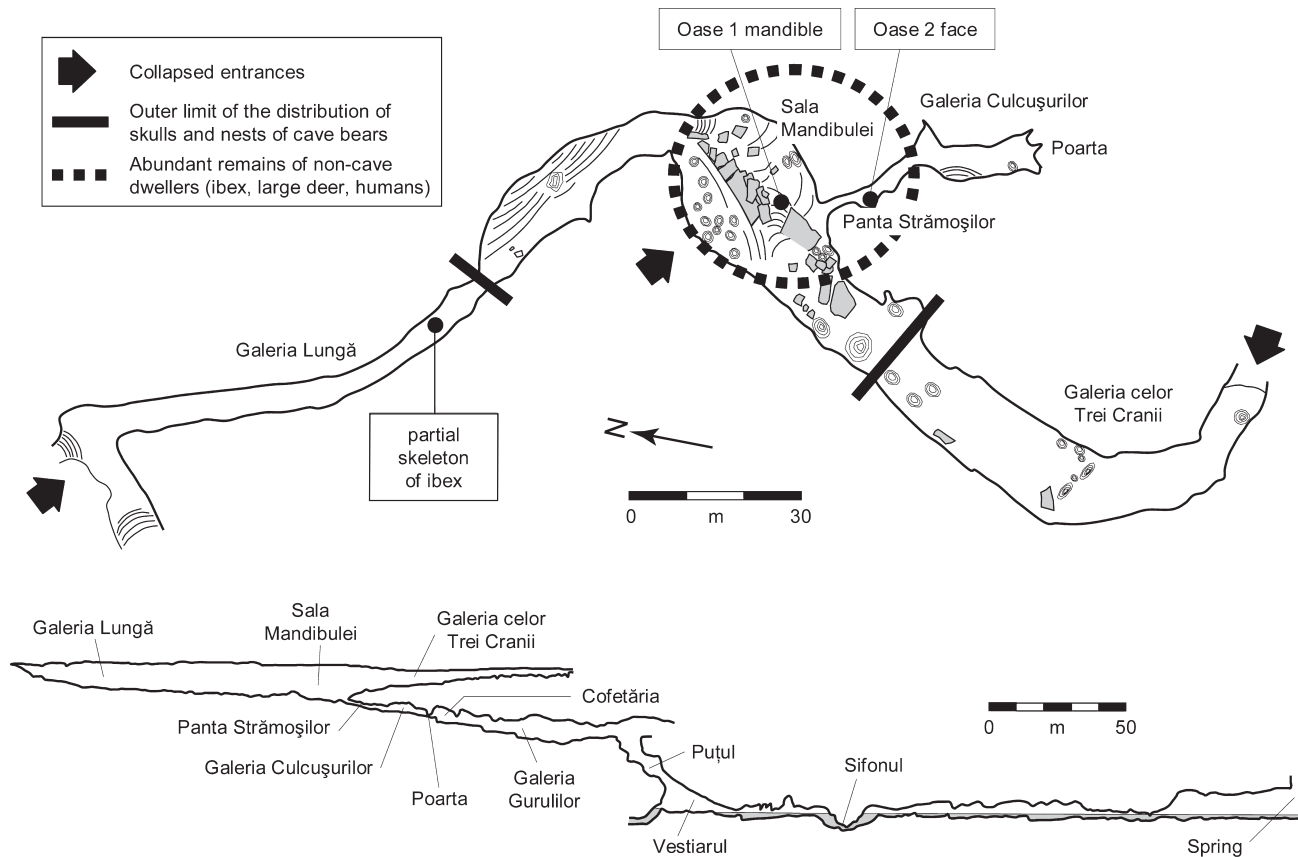
##### *The karstic system*

The Peștera cu Oase (Cave with Bones) is located in the southwestern Carpathians, in the vicinity of Anina, Caraș-Severin, Banat, Romania. This is a region of complex geology and rugged terrain. The average elevation is around 700 m and river valleys are deeply incised between steep slopes.

The cave belongs to the karstic system created by the Ponor stream, which, via the Miniș and the Nera, drains into the Danube, only c. 36 km away. Above the presently active, c. 750-m-long underground stretch of the Ponor, and sharing the same general NW–SE orientation, there is a network of fossil galleries located at different elevations, comprising at least two main levels that reflect prior stages in the incision of the Miniș drainage. The uppermost level is currently exposed over extensive stretches as a result of collapses, originating an exokarst dotted by numerous dolines but whose con-



**Figure 21.1.** Sites that yielded the earliest remains of modern humans in the Near East and southeastern Europe: 1) Mladeč; 2) Oase; 3) Cioclovina; 4) Muierii; 5) Bacho Kiro; 6) Ksar 'Akil.



**Figure 21.2.** The Peștera cu Oase karstic system, with indication of named chambers and galleries. Below: topographic profile. Above: simplified plan of the Oase galleries, with indication of the main features of the distribution of the finds.

nections with the deeper levels are blocked by the accumulation of sediments.

Because of this cluttering, the Oase galleries, situated on an intermediate level *c.* 40 m above the stream (Fig. 21.2), cannot be reached from the present surface. Their discovery and scientific exploration resulted from the establishment, by the Timișoara-based Pro Acva Grup, of an access route from below, via the spring and the underground river. The connection is via a passage (the Poarta, or Gate) excavated into bone-rich clay deposits filling the narrow karstic conduits which link Oase with the Galeria Gururilor (or Gallery of the Gours). The latter leads to a 30-m shaft (the Puțul), at the bottom of which runs the Ponor; the spring is another 220 m away, beyond a 16-m-long, 5-m-deep siphon that has to be negotiated with scuba-diving equipment.

#### *The Peștera cu Oase*

The Oase cave begins with the Galeria Culcușurilor (Gallery of the Bears' Nests), which is *c.* 30 m long, 2–5 m wide, and 2–3 m high. Several hibernation nests (near-circular depressions, *c.* 1 m in diameter and *c.* 20 cm in depth, at least eight of which are so

well-preserved that their nature is unambiguous) are clearly discernable among the mass of cave bear (*Ursus spelaeus*) bones covering the ground surface.

This gallery leads to a broadly round, large chamber (*c.* 15 m high and with an area of *c.* 300 m<sup>2</sup>), formed at the intersection between the two principal components of the Oase system: the Galeria Lungă (Long Gallery, broadly E–W, *c.* 100 m long, 4–7 m wide, and 10 m high) and the Galeria celor Trei Cranii (Gallery of the Three Skulls, broadly N–S, *c.* 75 m long, 8–10 m wide, and 2–3 m high). It was in that chamber that, during their initial exploration of the system in 2002, the Pro Acva Grup found a human mandible lying on the surface, Oase 1 (Trinkaus *et al.* 2003a). This part of the system has been named the Sala Mandibulei (Chamber of the Mandible); the passage uniting it with the Galeria Culcușurilor is a 7.5-m-long slope with an inclination of *c.* 30°, near the bottom of which, some 15 m downslope from the mandible, a human face, parietal bones and temporal were found during topographic work in 2003 (originally designated Oase 2 and 3, but now all Oase 2) (Trinkaus *et al.* 2003b; 2005). This stretch of the cave is the Panta Strămoșilor (Ramp of the Ancestors).

Cave bear bones are abundant in the innermost two thirds of the Galeria Lungă and the Galeria celor Trei Cranii, and nests begin to appear closer to the Sala Mandibulei; towards the end of both galleries, however, surface bones become rarer, especially where the larger material is concerned, and bear skulls are absent. Today, sediments, large boulders and/or thick stalagmitic formations block any connection to the outside, but the fact that bears penetrated the Oase system to shelter, hibernate and occasionally die, proves that such connections existed and must have been horizontal and large enough to allow the access of such beasts. In 2004, the positions of those former entrances were established with precision from the surface, with the help of a SLOTER device, a transmitter/receiver system using very low frequency electromagnetic wave lengths that had been proven successful, under similar conditions, in the Almonda karstic system of Portugal (Carvalho & Veiga 1989; Zilhão *et al.* 1991; 1993). At the ends of both galleries, the entrances opened into the sides of dolines; although their collapses and infilling closed them to larger mammals, surface bones throughout the system (fresh, unfossilized and, in a few cases, articulated skeletons with decomposing organic matter) indicate that fissures large enough for rodents and small carnivores continue to link the bottoms of these dolines with the Oase galleries.

During the 2003 topographic work, the mapping of bear skulls yielded a count in excess of one hundred on the basis of visible, easily identifiable material. In 2004–05, all securely Pleistocene non-bear bone material lying on the surface of the different Oase galleries was also mapped. A single skull of cave lion (*Panthera (Leo) spelaea*) was identified amidst a cluster of bear skulls and long bones at the edge of the single bear nest in the Galeria Lungă, but skeletal parts of wolf (*Canis lupus*) were widely scattered. Since these species are cave dwellers, their remains are likely to relate, with the bears, to the *in situ* death of denning animals. With the odd exception, however, bones of non-cave dwellers are restricted to the Sala Mandibulei, the Panta Strămoșilor (where they consist not only of surface finds but also of excavated material), and the immediately adjacent areas of the other galleries. Besides the humans, such remains correspond to both cranial and postcranial parts of ibex (*Capra ibex*) and of a cervid that is either a very large red deer (*Cervus elaphus*) or a giant deer (*Megaloceros giganteus*).

Cultural agency, i.e. deliberate transport to areas deep inside the system, followed by their abandonment in the framework of whatever activities might have been carried out in such locations, could explain the almost complete absence of remains of Pleistocene

non-cave dwellers in the areas of the Galeria Lungă and the Galeria celor Trei Cranii closer to their collapsed entrances. However, no actual evidence exists that artefacts were made in any of the galleries, the excavated deposits are entirely lacking in artefacts, there are no cut-marks on any of the thousands of bones recovered, and no positive traces of the passage of humans (such as lumps of charcoal, residues of torches or of other illumination material, foot or handprints, parietal art, or even simple graffiti) were seen anywhere inside Oase.

The only conceivable exception to the above is a cave bear femur lying horizontally on the elevated surface of a large boulder situated at the intersection between the Sala Mandibulei and the Galeria celor Trei Cranii, initially thought to represent possible deliberate human arrangement (Trinkaus *et al.* 2003a). Between this boulder and an adjacent circular depression, however, there is an accumulation of bones, some of which are also in strange positions (a mandible leans almost vertically against the boulder). Thus, the femur is likely to have been accidentally raised by a nesting bear, if not by circulating water, and to have remained there because of the tabular upper surface of the boulder. It eventually became cemented to that surface by calcite precipitated from dripping, and the overall stability of the underground environment maintained it there.

Since no evidence exists for a cultural agency, only geological processes (gravity- or water-driven transportation) and/or carnivore behaviour (consumption inside the cave of carcasses or body parts of prey killed in the vicinity of a former opening) must have been involved in the accumulations of bones of non-cave dwelling species. Given the restricted distribution of the latter, however, such processes would have required a direct connection between the Sala Mandibulei and the outside. In 2004, the SLOTER device showed that the huge éboulis cone up against the north wall of the Sala Mandibulei lies directly adjacent to the edge of a doline; thus, it is conceivable that the major collapse responsible for the formation of this cone indeed involved the opening of a third access route, via that doline, to the Oase system.

#### *The Panta Strămoșilor*

The Peștera cu Oase is a natural monument of exceptional interest, one of the best-preserved cave bear sites currently known. In order to maintain it in pristine condition, access has been restricted, for scientific purposes only, and using the established spelaeodiving route, with no re-opening of the collapsed entrances. The archaeological work inside was no exception; because of this concern to inflict as little damage as



**Figure 21.3.** *The Panta Strămoșilor in Peștera cu Oase; the grid units are 1 m<sup>2</sup>, and the white triangles in the photos left and middle, taken in 2004, indicate the position of the Oase 2 face, recovered in 2003. Left: view from below at the beginning of excavation, July 11, 2004. Middle, above: square O34, before excavation; note the horizontal surface created by the fill-in of the bone jumble's voids by fine sediments. Middle, below: square O34 during excavation; note how the large bones in Level 1 lay on the surface of Level 2, exposed on the lower part of the photo; the depression in the lower left corner is an erosional feature post-dating the stabilization of the slope. Right, top: detail of the Oase 2 face before cleaning and reassembly; note the abrasion of the supraorbital region. Right, bottom: the Oase 2 face in situ; note that it lies above the stabilized surface created by the filling-in of the voids in the bone jumble and that it lacks the homogeneous clay film covering all adjacent finds.*

possible, combined with the limitations of the access route and the need to remove the sediments for sieving, the volume of affected deposits was reduced to the absolute minimum.

Excavation was carried out only in the Panta Strămoșilor, where no nests existed, whence Oase 2 had come, and where the disposition of the large number of jumbled bear bones indicated post-depositional displacement (Fig. 21.3). This work entailed:

1. the excavation, recording, mapping, packing and transporting back to the outside, via the spelaeo-diving route, of thousands of bones (5208 catalogued by April 2006);
2. the removal through the Poarta, for inconspicuous storage in a different part of the system, of all stones and blocks encountered during excavation; and
3. the transporting of the finer fraction of the deposits back to the siphon, through the Poarta and down the Puțul, for water-sieving in the underground Ponor stream.

At the end of the excavation in July 2005, an area of c. 10 m<sup>2</sup> had been excavated down to a maximum depth of c. 80 cm below the surface, corresponding to

the archaeological processing of c. 2.5 m<sup>3</sup> and some six tons of deposits.

The base of the observed stratigraphy is a heterometric, torrentially-accumulated deposit of fine sands, gravel and cobbles, including abundant fragments of heavily rolled speleothems — Level 2. It yielded abundant remains of cave bears, c. 25 per cent by volume. Upslope, large bones were present, but downslope only smaller-sized material occurred: complete bones of neonatal or juvenile individuals plus loose teeth, complete hand and foot bones, and long bone fragments of adults. Besides such size-sorting, some lustre and edge-rounding is apparent on some specimens, but the preservation is otherwise excellent. Chemically, the collagen content of radiocarbon-dated samples often approaches that of modern bone.

Level 1 is a dense interweaving of cave bear bones c. 20–30 cm thick, for the most part complete (including long, curved ribs and extremely thin scapular blades); as is normal in such taphocenoses (Quilès 2004), all skeletal parts are represented, in no particular order and with no evident association by single individual of adjacent finds of, for instance, left and right hemi-mandibles. A few cranial and post-cranial elements

of other species — the large cervid, probably a single individual, and wolves — are also represented among the mass of bones, whose deposition took place within a short interval. Given local topography and extant surface distribution patterns, this material evidently was displaced from the Sala Mandibulei, located immediately upslope, and principally by gravity-driven processes; low-energy water channelling resulting from spring flooding of dolines, however, may also have been involved. Once the bone bed formed, its voids were slowly filled by fine sediments (silts and clays) accumulated by a very low-energy agent; most likely, dripping water generated in the higher reaches of the system and draining down via the Galeria Culcușurilor into the deeper levels of the endokarst.

Damage to the bones in Level 1 is for the most part restricted to carnivore punctures and gnawing marks. Wolves were involved, but more often this damage seems to have been inflicted by bears on other bears, as documented on 12.5 per cent of all bones (excluding isolated teeth) and 23.7 per cent when only those of immature bears are considered (Quilès *et al.* 2006). In some cases, erosional features can be observed where the subperiosteal cortical bone is thinner, as in epiphyses. Such features are consistent with the chemical leaching of these bones, in some cases their collagen content being so low that attempts at radiocarbon dating had to be failed. These observations suggest a long period of exposure to weathering and confirm that, in contrast, the excellent condition of the Level 2 bones indicates the kind of very rapid burial one would associate with the torrential nature of the enveloping deposits.

Completion of the filling-in of the voids in the bone jumble eventually produced a compact layer, on top of whose stabilized surface then came to lay, besides some of the ubiquitous cave bear bones, Oase 2, as well as a few bones of ibex. Subsequently, only

minor displacements of bones occurred, as a result of some level of adjustment and compaction, coupled with continued run-off and with transit along this passage of rodents and small carnivores penetrating the system until the present. Once the slope stabilized, stalagmites developed on its surface; where the deposit was coarser or more porous, dripping water diffusely penetrated it and the precipitation of calcium carbonate created localized patches of hard breccia in which the bones became encased.

#### *Bone accumulation at Oase: a working hypothesis*

Interpretation of the results from dating of numerous bone samples from the three stratigraphic proveniences recognized (Level 2, Level 1, and Surface) is complicated by issues of pre-treatment and decontamination. These issues are especially important where the material from Level 1 and Surface is concerned, because of the impact of leaching on samples whose age is near the limits of the method. An on-going project to simultaneously date another batch of samples by radiocarbon, U-series and ESR is expected to shed more light on the potential impact of such factors.

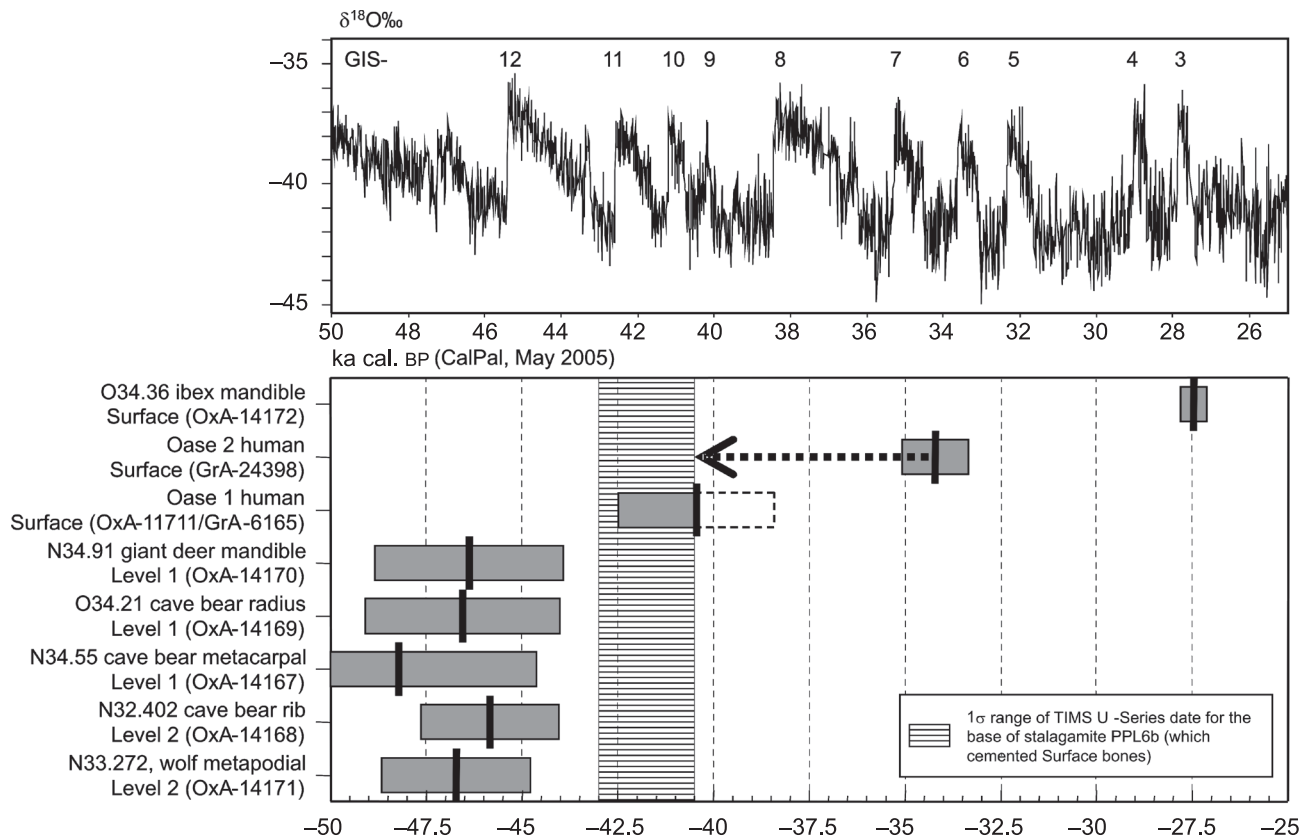
Meanwhile, coupled with the stratigraphic observations, the available dating evidence suffices to formulate the working hypothesis presented below. Table 21.1 and Figure 21.4 include the direct dates on the human remains as well as all OxA faunal dates available at the time of writing; calendar ages (cal. BP) are used, and calibration of radiocarbon results is via the last version (May 2006) of the CalPal software package (Weninger & Jöris 2006).

The nature of Level 2 is such that it implies successive episodes of major ‘sweeping’ of whatever bone material lay at the surface of the cave by the high-energy masses of water implicated in the torrential events that accumulated the deposit. A clay level in

**Table 21.1.** Radiocarbon dates from the Peștera cu Oase, calibrated with CalPal (Weninger & Jöris 2006).

Field no.	Level	Material	% collagen	Lab no.	Result BP	cal. BP	cal. BP (2sd)
<i>Sala Mandibulei</i>							
Oase 1	Surface	Human mandible	0.4	OxA-11711	>35,200	–	–
			4.0	GrA-6165	34,290/+970/–870	–	–
			–	combined	34,950/+990/–890	40,450±1020	38,410–42,490
<i>Panta Strămoșilor</i>							
O34.36	Surface	Mandible, <i>Capra</i> sp.	1.5	OxA-14172	22,640±110	27,460±170	27,120–27,800
O34.170	Surface	Oase 2 cranium (a)	–	GrA-24398	28,980/+180/–170	34,210±430	33,350–35,070
N34.91	Level 1	Mandible, <i>Megaloceros</i> sp.	1.1	OxA-14170	42,900±1100	46,380±1230	43,920–48,840
O34.21	Level 1	Radius, <i>Ursus spelaeus</i>	1.5	OxA-14169	43,100±1100	46,550±1270	44,010–49,090
N34.55	Level 1	Metacarpal, <i>Ursus spelaeus</i>	2.5	OxA-14167	45,000±1600	48,220±1800	44,620–51,820
N32.402	Level 2	Rib, <i>Ursus spelaeus</i>	3.7	OxA-14168	42,450±750	45,840±900	44,040–47,640
N33.272	Level 2	Metapodial, <i>Canis lupus</i>	12.6	OxA-14171	43,500±500	46,720±970	44,780–48,660

(a) owing to poor organic preservation and ‘soft’ HCl pre-treatment, the result yielded by this sample is a minimum age only



**Figure 21.4.** The Oase samples that provide a terminus post quem for the accumulation of the Surface bones, including the human remains, are consistent with the U-series date for the beginning of the growth of stalagmite PPL6b, and correlation with GISP2 suggests that the stabilization of the Panta Strămoșilor slope reflects the local impact of GIS-11; the Oase people's first settlement of the region thus dates to no earlier than the onset of that interstadial. (Calibration after Weninger & Jöris 2006.)

stalagmite PP10 of Peștera Poleva, situated c. 40 km to the southwest (Constantin 2003), provides additional evidence for similar episodes of cave flooding at this time in the region, and a U-series date from above that in-stalagmitic clay level provides a *terminus ante quem* of 41,923/+1211/-1193 cal. BP for the flooding. This result is consistent with those for the upper 15 cm of Oase Level 2, which, in turn, provide a *terminus post quem* of c. 46.5 kya cal. BP for the later history of the site.

The range of dates for Level 1 overlaps with that for Level 2, implying that bone accumulation on the cave surface resumed shortly after the water left by the last major torrential sweep of the Oase galleries drained, making the site again available for animals. Given the large margins of error involved, a hiatus of several centuries remains possible, but those Level 1 dates are in any case a *terminus ante quem* for the two episodes documented in the subsequent stage of the site's history: the erosional event that produced the interwoven mass of displaced bones in the upper reaches

of the Panta Strămoșilor's stratigraphy, followed by the consequent stabilization and partial calcite encrusting of the sloping surface upon which came to lay the bones of the ibex and the humans.

The result for Oase 1 comes from two independent measurements producing a joint-lab result with a 2σ interval of 38.4–42.5 kya cal. BP (Table 21.1). One of these measurements, however, is an infinite age (>35.2 kya <sup>14</sup>C BP), which, compared with the most recent dates obtained for underlying Levels 1 and 2, might be used to speculate that the fossil could in fact be as old as c. 46 kya cal. BP. However, a TIMS U-series result of 41.6±2.4 kya cal. BP (2σ error) (Table 21.2) for the base of fallen stalagmite PPL6b, originally cemented against the uppermost material in the bone jumble, at the foot of the Panta Strămoșilor, provides a tighter stratigraphic constraint, and one that is in excellent agreement with the lower limit of the interval indicated by the joint-lab radiocarbon date. On the basis of the adequate consideration of all of these results, the age of the fossil can thus be narrowed down with

**Table 21.2.** Selected U-series dates for Upper Pleistocene and Early Holocene speleothems from the Peștera cu Oase.

Provenance	Number	Method	Sample	Result cal. BP (1sd)	Result cal. BP (2sd)
Panta Strămoșilor	PPL6b/1	Alpha spectrometry	Basal 1 cm of stalagmite	43,800/+2410/–2360	–
	PPL6b/1	TIMS	Basal 7 mm of stalagmite	–	41,620/+2430/–2380
	PPL20/1	Alpha spectrometry	Basal 1 cm of stalagmite	18,920/+1510/–1490	–
	PPL14/1	Alpha spectrometry	Basal 2 cm of stalagmite	18,000/+1810/–1780	–
	PPL18b/1-2	Alpha spectrometry	Basal 2 cm of stalagmite	14,050/+1970/–1930	–
	PPL15/1	Alpha spectrometry	Basal 1 cm of stalagmite	10,870±580	–
Galeria Lungă	PPL24/1-2	Alpha spectrometry	Basal 3 cm of stalagmite	20,570/+4480/–4300	–
	PPL25/1	Alpha spectrometry	Basal 0.5 cm of stalagmite	17,930±1310	–
	PPL16/1	Alpha spectrometry	Basal 2.5 cm of stalagmite	15,840/+1270/–1260	–
Galeria celor Trei Cranii	PPL27/1	Alpha spectrometry	Basal 1.5 cm of stalagmite	8530/+1300/–1280	–
	PPL26/1	Alpha spectrometry	Basal 1.5 cm of stalagmite	7690/+1200/–1190	–

considerable certainty to the plus side of the standard deviation of the combined OxA-GrA date, i.e. to the 42.5–40.5 kya cal. BP interval.

The Oase 2 cranium belongs to a different individual and, therefore, does not necessarily date to the same time range as Oase 1; moreover, the result obtained for the dated ibex mandible shows that the accumulation inside the cave of animal body parts of comparable size continued until about the Last Glacial Maximum. Conceivably, thus, Oase 2 could be significantly later than Oase 1, and, at first glance, that is indeed what the direct radiocarbon dating of the fossil to c. 29.0 kya  $^{14}\text{C}$  BP (c. 34.2 kya cal. BP) suggests. This result, however, is simply a minimum age, because, given the poor organic preservation of the bone, the sample was treated with a ‘soft’ solution of HCl (2 per cent, rather than the usual 4 per cent), and there was insufficient organic material to assess the C: N ratio (J. van der Plicht pers. comm.), a key analysis for assessing whether full decontamination has taken place. Moreover, given the overall morphological similarity between Oase 2 and Oase 1 (see below), we believe that they are of similar age. This conclusion is consistent with the minimum radiocarbon date for Oase 2 and warrants that the two fossils be discussed as part of a single population.

Correlation with climate proxy, using the SFCP age-model and CalPal (Shackleton *et al.* 2004; Weninger & Jöris 2006), suggests that the flooding events which accumulated Level 2 predate Heinrich Event 5, and that use of the cave by hibernating bears ceased at the end of this cold phase; this abandonment may be related to the local impact of the abrupt climatic shift marking the beginning of Greenland Interstadial 12 (GIS-12). The subsequent period of rather more temperate conditions led to stalagmite growth on the stabilized surface of the Panta Strămoșilor, documented by U-series dates at least by GIS-11 times. The arrival of the Oase folk in the regional landscape, thus,

apparently took place no earlier than the onset of this latter milder period.

Bringing together this evidence and the spelaeogenetic and stratigraphic data reviewed above, we can reconstruct the following scenario:

- until c. 46.5 kya cal. BP, cave bears hibernated in the Oase galleries; given the surface distribution of their bones, and the fact that hibernation requires moving away from daylight, their access to these galleries was probably via the now collapsed/in-filled entrances located at the ends of the Lungă and Trei Cranii galleries; at this time, the Sala Mandibulei, where their remains, including nests, are numerous, and whence came the abundant material accumulated downslope in the Panta Strămoșilor, must have been an inner chamber with no connection to the outside;
- some time after c. 46.5 kya cal. BP, a major structural collapse opened an entrance on the north side of the Sala Mandibulei; bear bones under the boulders that now form the major éboulis cone piled up against that side of the chamber are consistent with this timing of events; as a result, even if cave bears had continued to live in the region after the onset of GIS-12, they would no longer be able to hibernate in the Sala Mandibulei and adjacent galleries; these areas became denning and consumption areas for other carnivores, mostly wolves, who brought in carcasses of large-bodied herbivores, including red deer or giant deer; the bones of dead wolves and of their prey thus mixed with those of the last bears and were removed together, as a single assemblage, by the syn-depositional colluvial processes that produced the Panta Strămoșilor’s Level 1 bone jumble;
- U-series dating of speleothems indicates that, c. 20.5 kya cal. BP and c. 8.5 kya cal. BP, respectively, the Galeria Lungă and the Galeria celor Trei Cranii had already become inaccessible (Table 21.2); given that a single structural cause may have different



**Figure 21.5.** *The Oase fossils. Above: different views of the Oase 2 cranium after reconstruction with the fragments recovered in 2003 and 2004. Below, left: right mandibular tooth row of Oase 1. Below, middle: the Oase 1 mandible with the right ramus fragment recovered in 2004; note the area sampled for radiocarbon dating. Below, right: the Oase 2 palate and maxillary dentition.*

consequences in different parts of the karst, it is conceivable that the major collapse event opening the Sala Mandibulei may, in contrast, have resulted in the blocking of previous accesses; this hypothesis is consistent with the general absence of bones on the floor, particularly of non-cave dwelling species, close to those two former gallery entrances;

- as the bottom of the doline adjacent to the Sala Mandibulei began to fill up and the passage to the endokarst accordingly reduced in size, only smaller prey, or separate body parts, could make their way

into the interior of the chamber; wolves may have continued to be active and accumulated the cranial and post-cranial ibex material; eventually, the passages were completely sealed, a process which, given the Last Glacial Maximum date for an ibex mandible and the fact that the formation of a curtain of very thick stalagmitic columns was involved, probably was not completed until Tardiglacial or early Holocene times of wetter climate, documented everywhere at Oase by significant speleothem growth after c. 20 kya cal. BP (Table 21.2).

### Peștera cu Oase: the humans

The above scenario leaves open a major issue: how the human remains (Fig. 21.5) ended up in the cave. For the same reasons that led us to reject cultural agency in the accumulation of the bones of cervids and caprids, we believe that human action cannot explain the presence of human bones inside Oase. On the other hand, no gnawing or carnivore tooth punctures have been observed that could support the involvement of wolves or other carnivores in the accumulation of those bones. At present, geology seems to represent the most parsimonious way of explaining the process.

#### *Taphonomy*

Oase 2 has an apparently contradictory preservation pattern. On the one hand, the supraorbital and nasal areas are abraded; on the other hand, the paper-thin margins of most of the alveoli are in pristine condition, as are internal structures of the nasal and sphenoidal regions. The abrasion is best explained as a result of a face-down displacement of the skull, over some distance. However, in order for the thin elements of the cranial skeleton to be preserved in such circumstances, the skull had to be protected by soft tissue. Partial mummification, or the retention of soft tissue on portions of the cranium, is the likely reason for this result. Indeed, the auditory ossicles of the left temporal bone are close to their original anatomical position, indicating a slow process of tissue decomposition while fine sediments filled the auditory canal.

This interpretation is consistent with the predominantly cold and very dry climate inferred for the region at about this time from the observation that, in the Banat caves, stalagmite growth was slow between *c.* 60 and *c.* 30 kya cal. BP, and stopped altogether between *c.* 25 and *c.* 20 kya cal. BP (Constantin 2003). Moreover, many of the bear bones preserve fragile edges intact, and two articulating vertebrae were found adjacent to each other in the torrential Level 2 deposits.

Given this preservation, it is striking that the two human individuals are in each case represented by isolated pieces of the cephalic skeleton. With a single exception — the fragment missing at the edge of the right ramus of Oase 1, which was found in 2004, less than one metre upslope from the original findspot of the mandible — all other fragments of human bone recovered in 2004–05 belong to the Oase 2 cranium. The excavated area yielded no postcrania, nor the teeth missing from Oase 2, despite systematic water-sieving of the sediments. The most parsimonious explanation for these facts is that no such remains were found because the Panta Strămoșilor is simply the last, defini-

tive, and, possibly, only recently acquired resting place of Oase 2, whose original locus of deposition inside the cave must also have been the Sala Mandibulei.

In fact, as Figure 21.5 makes it clear, the number of skull fragments of Oase 2 that we have recovered suffices to reconstruct a near-complete cranium. The distribution of these fragments along the slope of the Panta suggests a mode of deposition where the fossil, rolling down complete from higher up, broke as it fell over a large block outcropping from the otherwise rather homogeneously sloping ground surface. Such a process can explain the nature of the trail left by the breakage process; immediately adjacent to that block, only small cranial fragments were found, the larger pieces (the Oase 2 face and adjacent parietal fragments, the temporal, and the occipital) having been recovered 2–3 m further down, in a recess of the west wall of the gallery that acted as a sediment trap where the topography of the deposits was nearly horizontal. This reconstruction is consistent with the edges of the different fragments indicating dry bone breaks, as well as with the absence of the maxillary teeth mesial of the molars.

The implication of the above is that human postcrania may also exist in Oase, as one would expect on the basis of the evidence reviewed above for:

1. a natural, non-cultural mode of accumulation of the human remains;
  2. a syn-depositional partial mummification of the bodies of both animals and humans (which at least predicts that no dissociation between cranium, mandible and cervical vertebrae should have taken place prior to the arrival inside the cave of the two human heads represented by the finds); and
  3. a representation of all parts of the skeleton of the other non-cave dwelling species found inside Oase.
- In all likelihood, postcranial material, and probably the cranium of Oase 1 and the mandible of Oase 2, rest peacefully somewhere below the surface of the Sala Mandibulei. They may have ended up in lateral recesses, buried at a shallow depth by the kinds of very fine deposits that water run-off has continued to accumulate inside the system until the present.

#### *Morphology*

Oase 1 (Trinkaus *et al.* 2003a; Crevecoeur & Trinkaus 2004) is a virtually complete mandible, retaining five molars, of a young adult. Oase 2 (Trinkaus *et al.* 2003b; Rougier *et al.* 2007) is now a largely complete cranium of an adolescent (*c.* 15 years old at death), assembled from an intact face, a complete left temporal bone, and a number of pieces of parietal, right temporal, occipital and frontal bone, all of which join cleanly once the adhering matrix is removed. It has a complete mid-sagittal contour from sphenobasion superiorly

around to opisthion, and lacks only some pieces of the superior vault and the basioccipital.

These fossils present a suite of derived modern human features, ones that distinguish them from the Neanderthals. These aspects include the absence of a supraorbital torus, sub-quadrilateral orbits, a narrow nasal aperture, rounded inferior nasal margin with a level nasal floor, distinct canine fossae, angled zygomatic bones, superiorly located zygomatic roots, laterally bulbous mastoid processes, prominent parietal bosses, no nuchal torus, a prominent chin, narrow mandibular corpus, no retromolar spaces, mesial mental foramina, and no midtrigonid crests. These features are sufficient to refer to them as 'early modern humans', and with their geological age, document the morphology of the earliest European modern humans.

However, in the context of these derived features, they present a mosaic of Neanderthal and/or archaic features. These include the vertical mandibular symphysis, very broad ramus and associated anteriorly placed zygomatic bone, lingular bridging (unilaterally) of the mandibular foramen, wide dental arcades (probably associated with large anterior teeth), very flat frontal squamous, clear juxtamastoid eminence, occlusally complex maxillary M3s, and exceptionally large molars. In particular, the third molars exceed the dimensions of any human M3s known from the last 500,000 years.

Only the bridging of the mandibular foramen is a distinctly Neanderthal feature, and the wide rami are also found in the penecontemporaneous (see below) Nazlet Khater 2 mandible, but the other features are common in Neanderthals and generally absent from earlier 'African' (Herto, Kibish, Qafzeh and Skhul) modern humans. Some of these features are shared with later European modern humans (see below), but the overall combination of features both links Oase 1 and 2 (especially the anteriorly placed coronoid process/zygomatic bone and the distal molar megadontia) and separates them from other, later European modern humans. They further the general pattern among the earliest modern humans across North Africa and Eurasia of providing diverse mosaics of archaic and modern features, and reinforce the notion that the earliest modern Europeans are 'modern' without being particularly 'modern'.

### The regional context

#### *Human fossils*

Over the last five years, direct dating of the relevant fossils has shown that most purportedly early modern human remains from central and western Europe

are much more recent, for the most part Holocene in age. As a result, the earliest diagnostic remains of western European modern humans are at present the juvenile mandibles from La Quina Aval and Les Rois, the isolated teeth from Les Rois and Brassempouy and the hand phalanges from Brassempouy (cf. Trinkaus 2005). Given their stratigraphic position, archaeological context, and associated radiocarbon dates, they can be no earlier than *c.* 33 kya <sup>14</sup>C BP (*c.* 38 kya cal. BP), i.e. they are broadly contemporary with the central European Mladeč sample, whose age has recently been established through direct radiocarbon dating (Wild *et al.* 2005) to lie *c.* 31 kya <sup>14</sup>C BP, i.e. *c.* 36 kya cal. BP.

East of the Iron Gates, sufficiently complete, diagnostic remains of modern humans securely dated to this time range come from the Romanian cave sites of Cioclovina and Muierii (Soficaru *et al.* 2006; in press). The Cioclovina skull lacks any stratigraphic context, but it is directly dated to 28,510±171 <sup>14</sup>C BP (OxA-15527), i.e. *c.* 33.2 kya cal. BP; it is a robust modern human adult male neurocranium with distinctively Neanderthal occipital features. Muierii 1 to 3 consist of a partial female cranium with a probably associated mandible, scapula and tibia, an isolated temporal bone and a fibula. The bones represent an Upper Palaeolithic accumulation onto the Mousterian fill of an inner gallery; Upper Palaeolithic artefacts, referred to the Aurignacian by Păunescu (2001), were found elsewhere in the cave and are consistent with the direct date obtained on samples from the cranium, the scapula and the temporal bone, all statistically identical and in the range of *c.* 29.1–30.2 kya <sup>14</sup>C BP, i.e. *c.* 34.3–35.3 kya cal. BP.

Further south, fragmentary human remains of similar age have been recovered in Aurignacian levels 7/6b and 7 of Bacho Kiro cave, Bulgaria. Gleń & Kaczanowski (1982) noted that the dental material in the sample has Neanderthal affinities, but Churchill & Smith's (2000) subsequent analysis of the permanent teeth concluded that aspects of size, shape and crown morphology aligned this material with modern humans. The associated radiocarbon dates, AMS on charcoal, are 33,300±820 <sup>14</sup>C BP (OxA-3182) for level 6b and 32,200±780 <sup>14</sup>C BP (OxA-3181) for level 7, i.e. *c.* 38.9 and *c.* 37.6 kya cal. BP, respectively. A left mandibular fragment with deciduous first molar was found in level 11 of the site, which features a pre-Aurignacian, so-called Bachokirian assemblage and is dated, on charcoal, to >43,000 <sup>14</sup>C BP (GrN-7545) and 37,650±1450 <sup>14</sup>C BP (OxA-3183), i.e. in excess of 42.5 kya cal. BP; taxonomically, however, this fragment is undiagnostic, as Churchill & Smith unambiguously point out.

The next geographically closest evidence for early modern humans is that provided by the juvenile

skeleton ('Egbert'), found in the Early Ahmarian levels of the Lebanese rockshelter of Ksar 'Akil (Bergman & Stringer 1989). Given that only a cast of the skull survives, the hypothesis that this was an intrusive burial from overlying occupations cannot be tested by direct dating; Mellars (2004), however, notes that the thickness of the deposits (the bones appear to have come from levels XVIII or XVII, >1 m below the surface of the Early Ahmarian) argues against such a hypothesis. No dates are available for the IUP and Early Ahmarian sequence of Ksar 'Akil, but the chronology of the underlying Initial Upper Palaeolithic (IUP) level XXI can be estimated at *c.* 37.9 kya  $^{14}\text{C}$  BP (*c.* 42.5 kya cal. BP), the average of six AMS results on charcoal obtained for levels G–H of the southern Turkish cave site of Üçağizli, which feature a remarkably similar lithic assemblage (Kuhn *et al.* 2001; Kuhn 2002; 2003). The Üçağizli results can thus be taken as a *terminus post quem* for 'Egbert', whereas the AMS charcoal result of  $32,400 \pm 1100$   $^{14}\text{C}$  BP (OxA-1805) — i.e. *c.* 37.9 kya cal. BP — for the lowermost overlying level that could be dated at Ksar 'Akil (Aurignacian level VI) provides a secure *terminus ante quem*.

If *in situ*, 'Egbert' therefore would date to the time range of the Oase 1 mandible. The only conceivably earlier, directly relevant modern human remains are from Egypt, where the Nazlet Khater 1 burial pit yielded charcoal AMS dated to  $37,570 \pm 350$ – $310$   $^{14}\text{C}$  BP, i.e. *c.* 42.5 kya cal. BP (Vermeersch 2002); older modern human remains (e.g. Herto, Omo-Kibish, Qafzeh and Skhul) are essentially African and document an earlier phase in the emergence of modern humans (Trinkaus 2005).

This evidence indicates that the initial dispersal of modern humans into Europe cannot have taken place before *c.* 42.5 kya cal. BP, and that it had already begun by *c.* 40.5 kya cal. BP. The Oase fossils therefore indeed represent the human populations involved in that dispersal.

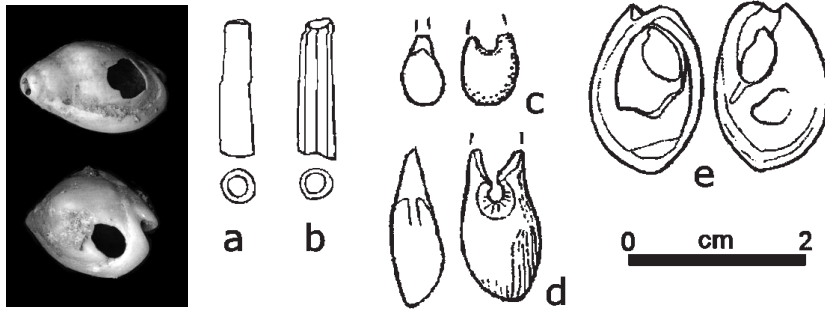
This conclusion is consistent with the fact that, from Greece to Iberia, all humans reliably dated to the time range immediately before *c.* 42.5 kya cal. BP are Neanderthals. Three direct AMS dates for the El Sidrón fossils (Asturias, Spain), for instance, are between  $40,840 \pm 1200$   $^{14}\text{C}$  BP (Beta-192065) and  $37,300 \pm 830$   $^{14}\text{C}$  BP (Beta-192066) (Lalueza *et al.* 2005), i.e. between 44.6 and 42.4 kya cal. BP. The three direct AMS dates for the Neanderthal specimens from the type site in Germany (Schmitz *et al.* 2002) fall within the same time interval, as do the associated charcoal results for the morphologically Neanderthal lower third molar from level 1a of the Lakonis I rock shelter, in Greece (Harvati *et al.* 2003). A bit older is the AMS directly dated Neanderthal femur from Rochers-de-Villeneuve (Beauval *et al.* 2006).

#### *Archaeological associations*

This geographical pattern and dating of Europe's latest Neanderthals and earliest modern humans carries the implication that suggestions of a modern human authorship of the Bachokirian and the Bohunician (cf. papers in this volume by Kozłowski, Svoboda, and Tostevin) are unsupported. Given the temporal window to which Oase 1 has been dated, the earliest cultural entity to which one can relate the initial dispersal of modern humans into Europe is the Protoaurignacian (Zilhão 2007). Although a direct archaeological context for the Oase people does not exist, there is a cluster of Aurignacian open air sites *c.* 100 km north; one of these sites, Seliște I (Tincova), yielded a lithic assemblage (Hahn 1977; Chirica *et al.* 1996; Păunescu 2001) strongly suggestive of the Protoaurignacian. Further west at Krems-Hundsteig, Austria, Protoaurignacian material is clearly identifiable in the nineteenth-century, multi-component museum collection (Hahn 1977; Neugebauer-Maresch 1999; Teyssandier 2003), and the date of  $35,500 \pm 2000$   $^{14}\text{C}$  BP (KN-654) (*c.* 41.6 kya cal. BP) obtained on a sample of associated charcoal most probably relates to it.

In this context, it must be noted that the Protoaurignacian, as well as the subsequent Early Aurignacian or Aurignacian I, displays affinities with both the Near Eastern Early Ahmarian — seemingly associated, given 'Egbert', with modern humans — and preceding Neanderthal-associated technocomplexes, such as the Châtelperronian of France and the Uluzzian of Italy (Zilhão 2007). With the Early Ahmarian, the Protoaurignacian shares the basic lithic technology and index fossil (the El-Wad or Font-Yves point), as well as the abundant marine shell ornaments, including the two taxa — *Nassarius* (= *Arcularia*) *gibbosula* and *Columbella rustica* — that make up 90 to 99 per cent of the bead assemblages of the Early Ahmarian and the IUP of the Near East. With the Uluzzian and the Châtelperronian, the Aurignacian shares, respectively, *Dentalium* tubes, on one hand, and pierced animal teeth and beads made of bone, ivory or soft stone, on the other hand (Fig. 21.6).

If we construe the beginnings of the Protoaurignacian as the cultural signature of modern humans dispersing out of Africa, its preference for marine shell beads is not difficult to explain: such is the nature of the earliest African ornaments, those from Taforalt (Morocco) and Blombos (South Africa) (Henshilwood *et al.* 2004; d'Errico *et al.* 2005; Bouzouggar *et al.* 2007). The Taforalt beads are also *N. gibbosula*, while those from Blombos are of the very similar species *N. kraussianus*. For at least 35,000 years after the first appearance of personal ornaments at these sites, *c.* 75–85 kya cal. BP, however, neither in Africa



**Figure 21.6.** Ornaments of the IUP and Early Ahmarian of the Near East compared with those from the Protoaurignacian. Left: two *Nassarius (=Arcularia) gibbosula* from Üçağizli (photo after Kuhn 2002), which, with *Columbella rustica*, very similar in shape and size, form 90 to 99 per cent of the bead assemblages of the Early Ahmarian and the IUP of the Near East, where all personal ornaments are made on marine shells. Right (drawings after Barge 1983): Protoaurignacian ornament assemblages (here, from the Abri Rothschild, in Mediterranean France) also include *Nassarius gibbosula* (e), but are enriched with items that, previously, are known only in Uluzzian and Châtelperronian contexts, such as *Dentalium* tubes (a–b), pendants made of pierced animal teeth (d) or beads of bone, ivory and soft stone (c).

nor in the Near East do we have a single piece of evidence documenting the use of bone, ivory or teeth for their manufacture. Moreover, *Dentalium* tubes, the single type of ornament recorded in the Uluzzian, are unknown in IUP and Early Ahmarian sites of coastal Mediterranean locations where such shells would have been as abundant as in the shores of Greece or Italy. Clearly, these absences cannot be due to raw-material availability and must be interpreted as evidence for the long-term stability of traditions of personal ornamentation (Stiner 1999; Vanhaeren 2002; d'Errico & Vanhaeren and Kuhn & Stiner this volume).

In these circumstances, the composition of Protoaurignacian and Early Aurignacian assemblages of personal ornaments can only be understood as a result of the blending of such separate traditions — that represented by the Near Eastern Early Ahmarian, and those represented by the western European Châtelperronian and the southern European Uluzzian. Given that Neanderthals are associated with the latter two, a corollary of this notion is that significant levels of cultural exchange took place at the time of contact and were the most common type of behavioural response, on both sides of the taxonomic divide, to the dispersal of modern humans into the continent.

Thus, the patterning in the material culture of these times is fully consistent with, and lends further credence to, the interpretation of the Oase fossils as integrating archaic and Neanderthal features in their otherwise modern human morphology. Moreover,

across Europe the modern human fossils within 10 ka of the 'ancients'-to-'moderns' transition exhibit varying mosaics of archaic/Neanderthal features that are absent from the presumably ancestral Herto, Omo-Kibish, Qafzeh and Skhul remains. This is evident in the occipital morphology of Cioclovina 1, the prominent occipital buns of Muierii 1 and Mladeč 5, the scapular glenoid fossa of Muierii 1, the mandibular notch of Muierii 1, the broad interorbital breadths of Oase 2, Mladeč 2 and Muierii 1, the juxtamas-toid eminences of Oase 2 and Mladeč 2, the large dental arcades of Mladeč 8 and Oase 1 and 2, the exceptionally large third molars of Oase 1 and 2, the maxillary incisor shovelling of Les Rois teeth, and the limb segment proportions of Lagar Velho 1. Most of the archaic/Neanderthal features disappear by the subsequent, post-28 kya

<sup>14</sup>C BP (post-32.4 kya cal. BP) Gravettian populations, but a host of cranial, dental and postcranial features persist in variable frequencies (Trinkaus 2007).

### Conclusion

If we bear in mind that objects and ideas can travel much faster than people and their genes, these conclusions carry the further implication that, on a regional basis, the biological affinities of the different groups involved in the emergence of modern human morphology in Europe cannot be simplistically inferred from the nature of the archaeological assemblages. In other words, it remains conceivable that the earliest Aurignacian of Europe (the Protoaurignacian and the Aurignacian I) may have been manufactured by people that, taxonomically speaking, would be classified as modern humans in the east, Neanderthals in the west, and variably mixed in between.

Given the palaeontological evidence, it is in any case clear that the pattern of cultural exchange suggested for Europe by the personal ornaments of the earliest Aurignacian must have been associated with a similar level of genetic exchange. A significant degree of admixture (the assimilation model of modern human emergence) has been repeatedly proposed since the early 1980s (cf. Trinkaus & Zilhão 2002; Smith *et al.* 2005; Trinkaus 2007), and the growing body of securely dated and adequately analyzed human remains, from Romania to Portugal, from 40,000 to 30,000 cal. BP, only reinforce what is

natural given Europe's widely dispersed, low-density foraging populations in the harsh and fluctuating climates of OIS 3. The long-term effect, as suggested by Relethford (2003), may have been genetic swamping of the Neanderthals. But the reproductive and cultural dynamics of the 'transitional' (in the human evolutionary sense) Aurignacian period must have been a complex behavioural mosaic.

Twenty years ago, the 'Human Revolution' paradigm integrated several strands of empirical data into a coherent model of the Neanderthals' complete biological separateness and fundamental cognitive inferiority, effectively reducing the explanation of the last 40,000 years of the human story to the consequences of the unfolding of the behavioural potential released by the genetic correlates of a speciation event that had occurred in a restricted region of the African continent. The evidence reviewed here, however, now suggests that the emergence of modern human morphology and behaviour was a much more complex and varied process, and, in particular, that positive interaction with non-African, anatomically archaic populations, resulting in productive, bi-directional exchange of both culture and genes, must have been an important feature of what happened during the period of contact in Europe. The Peștera cu Oase, with its bears, wolves, ibex, deer, cat and a couple of humans, has become a key piece in this mosaic puzzle.

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