The Inhabitants of Ice Age Europe

Early European Origins

The first inhabitants of Europe were not native to the region. Some 5 to 6 million years ago, hominids (members of our biological family) evolved in Africa from an ancestral population of ape-like creatures that also gave rise to today's chimpanzees, our closest living relatives. These earliest African hominids—very different looking than ourselves—are given the scientific name *Australopithecus* to separate them from the genus *Homo* to which we, and other hominids more closely related to us, belong (see box on hominin taxonomy).

The differences between our...
Scientific Nomenclature and Hominid Taxonomy

A system for classifying organisms is called a taxon.
omy. One such system for scientifically naming living and previously living organisms was devised by the Swedish naturalist Carolus Linnaeus in his historic 1758 publication, Systema Naturae. Under this system, which is still in use today, all organisms are referred to by a two-part name. The first part names the genus, a group of species with many common characteristics. The second name denotes the species to which an organ-
ism belongs. Living things are grouped together into a single species if they have the capacity to interbreed and produce fertile offspring. Obviously, this objective criterion cannot be applied to extinct organisms, mak-
ing it necessary for paleontologists to use anatomical similarities in deciding which fossils should be grouped together as a species.

Since the time of Linnaeus, it has become common to add a third part to the scientific names of many or-
ganisms, in order to identify the subspecies to which they belong. Modern humans have the trinomial, or three-part name, Homo sapiens sapiens, indicating that we belong to the genus Homo, the species sapiens, and the subspecies sapiens. In Latin, this name means "wise, wise man." All living humans belong to this single subspecies.

In tracing the evolution of Ice Age Europeans, several different groups, or taxa, of the genus Homo need to be considered, including the following:

Early Homo (Homo hablis): The earliest form of Homo appeared in Africa approximately 2.5 million years ago. It possessed a brain not much larger than a chimpanzee’s, and fairly large teeth. However, it made tools and is believed to have lived, full-time, on the ground. Some paleoanthropologists believe that the hominin brain began its evolution into the very large organ which it is today when early Homo became fully terrestrial. Without the need to climb trees, early Homo parents could care for helpless infants. This permitted the survival of babies born in a more premature state, allowing for greater brain growth to occur both before and after birth.

Homo erectus: Homo erectus evolved in Africa approxi-
mately 1.6 million years ago. It is notable for its fairly large brain size, and for smaller teeth and larger body size than its predecessors. Approximately 1 million years ago, some Homo erectus populations left Africa and began to colonize the Old World (Fig. 3). By 400,000 years ago, Homo erectus had evolved into the earliest members of our species, the first Homo sapiens.

Homo sapiens: Early Homo sapiens shared so many anatomical similarities with late Homo erectus that the exact time of the transition from one to the other is difficult to pin down. Anatomically, Homo sapiens may be distinguished from Homo erectus by its larger brain, smaller teeth, and less massive face. The first European
selves and the early australo-
thropithecines were major. Their brains were small, their teeth were large, and in many ways they looked more like living chimpanzees than hu-
mans. But in one very fundamental way, even these earliest members of Australopithecus were clearly hom-
inids: they were fully bipedal crea-
tures, who stood and walked erect, freeing their hands for full-time ma-
nipulative purposes such as the use of tools.

Between its appearance some 5 to 6 million years ago, and its eventual extinction as a group, the genus Aus-
tralopithecus evolved into a number of species. One of these, which ap-
peared between 4 and 2.5 million years ago, has been given the name of early Homo, or Homo habilis. Its de-
scendent, Homo erectus, was probably the first hominid to reach Europe.

Homo erectus was different from its predecessor, early Homo, in a num-
ber of ways. Its brain was significantly larger, up to 1,250 milliliters in ca-
capacity. Its overall body size was also larger, within the modern human range, in contrast to the short earlier australopithecines and Homo habilis. The teeth of Homo erectus were smaller, suggesting a greater reliance on tools than on teeth for important activities. This is also seen in the tools associated with these hominids, which are more refined than those found with early Homo. Overall, Homo erectus had far more sophisti-
cated ways of dealing with its envi-
ronment than did earlier hominids, and these skills must have figured prominently in its eventual coloniza-
tion of much of the Old World.

Until approximately 1 million years ago, hominids evolved exclu-
sively within the confines of the African continent. Then, Homo erectus began to push beyond its bound-
aries into other regions of the Old World. With this expansion of the hominid range, the first people ar-
ived in Europe no later than 900,000 years ago. These immigrants of African ancestry probably came by way of the Middle East (Fig. 5). The Middle East provides the logical route of passage from Africa into Europe for a variety of reasons. For one thing, the Straits of Gibraltar are very deep. Even during times in the earth’s history when a far greater proportion of the earth’s total water supply was tied up in massive conti-
nental ice sheets than today, ocean water levels have never dropped low enough to expose a land bridge connecting Gibraltar and North Africa. This would have made entry into Europe by foot from the west impossible.

The earliest signs of human arriv-
al in the prehistoric record of the Middle East come from ‘Ubeidiya, Is-
rael, an open air site on the west

bank of the Jordan River dated to ap-
proximately 1 million years ago. The highly fragmentary hominid fossils found at ‘Ubeidiya almost certainly represent ancestors of the people who initially populated Europe. They have the extremely thick cran-
ial bones found in Homo erectus, but the fossils are so poorly preserved that it is difficult to be completely certain of their identity. Neverthe-
less, their presence in Israel at this date indicates that by this time ho-
inids had ventured out of Africa towards Asia Minor. Pushing north-
ward through the Jordan River Val-
ley, perhaps pursuing game or merely following their adventure-
some curiosity, their descendants eventually traversed the land bridge which emerged at the Dardanelles during periods of lowered sea level, and reached Europe. A short 100,000 years later, they had not only arrived along the northern shores of the Mediterranean, but had already penetrated far into the rugged continental interior.

The time from 700,000 to 120,000 years ago is called the Middle Pleis-
tocene epoch by geologists and pale-
ontologists. Although hominids entered Europe well before Middle Pleistocene times, our earliest glimpses of them come not from their bones and teeth, but from vest-
gees of their behavior left behind at the earliest known European archaeo-
logical site, Le Vallonet Cave, on the French Riviera and the open-air site of Sede-Elac in the rugged interi-
or of the French Massif Central.

Figure 5. From Africa to Europe. One natural route for hominids finding their way from Africa to Europe (indicated by arrows) would have been via the Great Rift Valley system, which extends from eastern Africa north into present-day Israel. Various famous fossil sites mentioned throughout this article are also shown.

Figure 6. Chronology of European Ice Age fossils.

Figure 7. Middle Pleistocene faces. These specimens from Stuttgart, Germany, and Arago, France, are unusually complete. While both demonstrate the large face and prominent browridge characteristic of these early Europeans, the Stuttgart fossil (left) is believed to have belonged to a female individualized and the Arago face to a male.
Early European Evolution

The fossil evidence for Middle Pleistocene Europeans is known from several sites in eastern, central, and western Europe, all located below the 51st parallel. However, as is often the case with hominid fossils, they are disappointingly sparse and extremely poorly dated, making their study a difficult undertaking.

Like all human ancestors living during Middle Pleistocene times, the earliest Europeans had extremely large faces with broad cheekbones. Their brains were larger than those of earlier species of Homo, and they included in a massive skull. A large ridge of bone extended across the top of the head, this bone eye socket, about where our eyebrows are today (Fig. 2). The back of the skull was particularly thick, probably because the neck muscles attached there had to be unusually strong to lift the heavy face. The widest part of the skull was low, just above the ears, so that it had the shape of a flattened pentagon when viewed from the rear. Although very few limb and trunk bones are known from these Middle Pleistocene Europeans, one portion

Figure 8. A view of a Neandertal child's lower jaw from Devil's Tower, Gibraltar. This specimen shows the extreme development of the pulp chambers and roots found in aurotodontism, a common trait among Neandertals. X-ray courtesy of Dr. Mark Skinner.

of a pelvis from Arago, France, includes features reminiscent of those seen in its Homo erectus contemporaries from elsewhere in the Old World.

However, there are also some differences between the European Middle Pleistocene people and the fossils from other areas of the Old World at this time. For example, the back portion of a skull found at Swanscombe, England, in the gravel of the Thames River, has a curious oval depression on the outside of the back of the braincase. The significance of this feature is unknown, but we find it in the braincases of later ancient Europeans, the Neandertals, as well. Likewise, the flattened, backward projection of the rear of the skull, known as an occipital bun or chignon because of its resemblance to a roll of hair worn at the back of a woman's head, is found in an early fossil skull from Bacho Saint-Vaast, a site in northern France. This too foreshadows the Neandertals and other subsequent European populations.

These early Europeans of the Middle Pleistocene had huge faces, with jaws that projected so far forward that even though their teeth were larger than ours, they did not fill the entire horizontal part of the jaw. Instead, there was a gap between the back teeth and the vertical part of the jaw. In two specimens from Arago, France, and another from the site of Petralona, Greece, this forward projection is further accentuated by the swollen appearance of the middle part of the face, from the nose to the cheekbones. Both

Figure 9. The Engis child, the first Neandertal specimen discovered, Lake in 1829, Dr. Paul Schmerling, a Dutch physician turned paleontologist, once thought that the first hominid fossil remains ever discovered: several beautifully preserved parts of a 4-5-year-old Neandertal child (reconstructed in the drawing) and the fossil remains of a more modern adult. While scientific attention focused on the adult, the pieces of the Engis Neandertal child were overlooked and forgotten. For nearly 100 years, Schmerling's former assistant, he that discovered an archaic variety of Homo.

Drawing by Helmut Befah. -

have yielded artifacts suggesting the presence of Homo in Europe by 900,000 years ago. Actual fossil remains of these earliest Europeans have only been recovered from later in the paleontological record, from sites dating well within the 730,000 to 125,000 year time range of the Middle Pleistocene itself (Fig. 1).

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One researcher, the late Carleton S. Coon, suggested that the peculiar Neanderthal face, with its voluminous nasal aperture and large, puffed-out cheek regions, was a specialized anatomical complex for warming frigid air to prevent it from chilling the brain and lungs (Coon 1962). The extensive mucous membranes lining the wide nose would, additionally, have moistened the air, thus ameliorating it.

The limb skeletons of Neanderthals also suggest that they were cold-adapted people. Just as in arctic populations today, such as the Inuit of North America, the lower segment of Neanderthal arms and legs was shorter than the upper segment. This design conserves body heat by reducing the potential amount of exposed surface area available for heat dissipation through the skin. The Neanderthal's stocky build would also have conserved body heat.

Yet another feature which can perhaps be explained as a cold climate adaptation is the most intriguing of all aspects of Neanderthal biology: their large brains (estimated by measuring the internal volume of fossilized braincases), which equaled or slightly exceeded the average modern human brain in size. However, just because Neanderthal brains were somewhat larger than our own does not mean that they were more intelligent. Average brain size among modern human populations and individuals varies widely within a range of approximately 1,100 to 2,000 milliliters and cannot be taken as an indicator of relative intelligence. For metabolic reasons, however, modern human populations living in colder regions tend to have larger cranial capacities, on average, than those in tropical environments. This correlation again points to the possibility that Neanderthals possessed a strong biological adaptation to the cold climate of Ice Age Europe.

The cold adaptation hypothesis also supports the idea that Neanderthals evolved strictly within the confines of Europe, a notion suggested by the paucity of their remains outside of this fairly circumscribed geographical area. One unanswered question then is, if the Neanderthals were indeed well adapted to cold climates, why did they never penetrate into Siberia or Scandinavia as the early Homo sapiens sapiens did? Was it because their populations remained fairly small, so that there was no need to push into new territory? Or does it suggest that they did not have the technology to survive the even greater extremes of cold in these regions?

Many paleoanthropologists have begun to suspect that the distinctive Neanderthal morphology might be a result of a different process, related to a less sophisticated technology rather than cold adaptation. We know Neanderthals used their front teeth for utilitarian purposes, such as holding objects while working with them, far more than do modern humans. This is obvious from the extreme, rounded wear and fine microchipping seen on their front teeth (Fig. 11). Using the front teeth as a kind of tool or pull object would transmit considerable force through the face. This could explain, in part, the extreme forward projection of the Neanderthal midfacial region, with its flattened cheekbones and large nose. It could also explain the impressive development of the Neanderthal temporal muscle (Fig. 12). Even the strong browridges over their eyes may have provided buttresses for distributing biomechanical stress, generated by using the teeth as tools, through the facial bones.

Another part of the Neanderthal skeleton which suggests their teeth were being used for strenuous work over and above food processing is the neck region of the vertebral col-
Some clues as to why Neandertals might have needed to use their teeth as tools have been offered by Erik Trinkaus, a paleoanthropologist at the University of New Mexico. His reconstructions, based on the enlarged muscle attachment areas as well as joint surfaces on their fossilized upper limb bones, indicate that their arms were considerably stronger than those of most modern humans. Trinkaus suggests that Neandertals were able to grip objects in their hands more powerfully but less precisely than modern humans, and therefore also used their teeth. However, his interpretation has not gone unquestioned, because we know that the earliest Homo sapiens sapiens in the Middle East were making and using the same tools as the Neandertals there, despite their less muscular and more modern upper limb anatomy.

Components of both the cold adapts: his hypothesis and the facial stress hypothesis might, of course, account for Neandertal morphol- ogy. However, one of the most surprising aspects of Neandertal adaptation does not fit into either of these models.

"old Neandertals suffered from many of the same ailments affecting elderly persons today."

Ralph Holloway, a paleoneurolo- gist at Columbia University, has studied Neandertal brain endocasts (see Fig. 13) and found no evidence that their brain was in any way more primitive than our own. Instead, he finds that the majority of adult Neandertal specimens exhibit modern human patterns of left cerebral dominance, indicating that they, like most of us, were righthanded.

Holloway's studies of the endocra- nial casts of Homo sapiens nean- derthalensis do show one puzzling
difference, however. They possessed a larger amount of tissue in the rear, or occipital area, of their brains, that area of the cerebral cortex in charge of vision, than do modern humans. Research on the remains of Neandertal children has shown that the majority of Neandertal brain growth was completed very early in life just as in modern humans. The only exception was in the growth in the occipital region, which occurred quite late in the growth period—during adolescence. This pattern was not unique to Neandertals; it is seen in the remains of early Homo sapiens sapiens from Europe as well (Trinkaus and Le May 1982; Min- nghurst-Purvis 1988). Since that time, however, modern humans have lost this pattern, but the evidence for the great similarity between brain growth in Neandertals and early Homo sapiens sapiens, as well as ourselves, suggests that striking similarities must have existed between Neandertal and our own cognitive and behavioral systems.

Before Neandertals, very few examples of older adults are known from the prehistoric record. But many of the Neandertal fossils which have been discovered be- longed to oldsters, well past their bi- ological prime at the time of their deaths. These old Neandertals suffered from many of the same ailments affecting elderly persons today. There is conspicuous evidence of arthritis in the joints of their limbs and back, and many are missing most of, if not all, their teeth. Yet these individuals survived, disabled, for some time prior to their deaths. Oldsters without teeth must have been eating prepared foods which could be easily ingested without the aid of teeth. Neandertals with severe arthritis were probably assisted or even cared for by other

"members of their social group, a be- havior we tend to regard as uniquely human among primates. Even more striking is the evidence that some older Neandertals did care not end at death. Several Neandertals, some elderly, others in their prime, and still others young children or infants, have been found in what appear to have been deliberate-ly preserved, perhaps even ceremonial, lu- nals."

Another difficult question con- cerns whether Neandertals possessed language. This fundamental human characteristic is linked to many other types of symbolic behav- ior. Thus, it is extremely important to determine whether this was part of the Neandertal behavioral reperto- rie if we wish to assess or perhaps use it as a gauge of their humanness. The biological evidence for the evo- lution of language comes from two distinct areas: the brain and the speech apparatus. Holloway's studies of Neandertal brain endocasts give every indication that their neural cir- cuitry for language capacity was well evolved. However, it is just as diffi- cult to document and analyze the anatomy of the vocal apparatus as it is to study the anatomy of the brain from the fossil record.

The vocal tract consists of a com- plex of structures including the teeth, palate, tongue, and larynx or voice box. Unfortunately, most of the anatomy of these areas is soft tissue and cartilage, which like the brain, do not fossilize. To study the Neandertal capacity for speech, we must again rely heavily on indirect evidence: the areas of the vocal tract that are soft tissue attachment to bones, such as the skull base, and a small, horse-shoeshaped bone, the hyoid, which rests just underneath the lower jaw high in the throat (see Fig. 9 in Chase's "Language in the Ice Age.") These areas are so delicate and pre- served so rarely that, for example, only a single hyoid bone is known from the entire hominid fossil record.

The single known hyoid bone was discovered in 1983 with the remains of a Neandertal skeleton from the Israeli site of Kebara. Because the hyoid of the Kebara Neandertal is unmistakably modern in form, it suggests that European Nean- dertals may have had hyoids of sim- ilar shape and, by extension, the capacity for articulate speech. Mean- while it is the evidence from both the brain and the vocal tract shows that Neandertals must cer- tainly possessed a fairly sophisticated form of verbal communication which we would consider language.

The First Modern Humans Appear in Europe

Suddenly, between about 35,000 and 30,000 years ago, Neandertals vanished from Europe. Their disappear- ance may have been linked to a new type of hominid which, according to some evidence, had been evolving in the Middle East and sub-Saharan Africa throughout the Upper Paleolithic. These were the earliest members of our own sub- species, Homo sapiens sapiens. They appeared in Europe curiously late, around the time that the skeletal morphology seen in the European fossil hominid record began to change from the Neandertal to the modern human pattern. A few dates are known which date to the time of this transition from Neandertals to modern humans. Once, at Mladé, Moravia (Czech Repub- lic), has yielded the remains of several partial skeletons. The Mladé bones are not fully anatomically modern, but rather have a number of modern human traits mixed with archaic features reminiscent of Ne- andertals, such as a thick, large browridge and protruding occipital area. In the Balkans, at the site of
Is it correct to think that when Neanderthals disappeared they became totally extinct, with no surviving children—totally replaced by the newly arrived *Homo sapiens sapiens*? Or is it perhaps more accurate to ascribe the Neanderthal disappearance to interbreeding with these more modern immigrants until their genes became so completely absorbed that they were no longer recognizable as having come from a Neanderthal stock? This remains one of the major debates of modern paleoanthropology, a debate which will probably continue for some time, given the minimal amount of direct evidence available from the fossil record.

Where modern humans came from, and the nature of their adaptations which permitted them to so quickly replace the Neanderthals, is also under debate. Unlike Neanderthals, limb segment proportions of these early *Homo sapiens* sapiens do not exhibit a cold climate adaptation despite the fact that they inhabited Europe during the coldest interval of the entire Upper Pleistocene. Nor do they exhibit the distinctive, specialized facial features that slowly evolved during the Mid-

Neanderthal or Neandertal?

Neanderthal, as the term is spelled here, is also commonly spelled without the "h." This is because Tal, the German word for valley, was formerly spelled "tal." When changes in German orthography at the turn of the century resulted in the respelling of this word as "tal," the "h" was removed from "Neandertal" by some experts, while the old spelling "Neanderthal" was continued by others. Both spellings of the familiar name are considered equally acceptable by the scientific community, and the use of the "h" in this article simply reflects the preference of the guest editor (who pulled rank on the author). Nevertheless, because the scientific name predates the spelling change, the conventions of taxonomic nomenclature dictate that the "h" must be retained in the scientific name *Homo sapiens neanderthalensis*.

Krapina, Croatia, the faceless brain-case of a child was unearthed at the turn of the century. It, too, presents a mixture of Neanderthal and modern features. Later-in-time central European sites, such as the spectacular cemetery of the Frédoni mammoth hunters in Moravia, demonstrate that Neanderthal characteristics like the occipital bun continued in European populations for thousands of years after the last known Neanderthals disappeared (Fig. 14).

In western Europe, the fossil record at the time of the transition is equally sparse. A very late Neanderthal, who died approximately 20,000 years ago, is known from the site of St. Césaire, France. Although the skull of this individual shows some modern features, including a high forehead and even a chin, the stout, strongly curved bones of the skeleton’s limbs are unmistakably those of a Neanderthal. The next good fossil hominin remains from western Europe belong to the earliest known modern humans from this region: the people buried at the famous site of Cro-Magnon, France, about 30,000 years ago. No fossils are known from the time gap separating St. Césaire and Cro-Magnon in western European fossil deposits, and without a continuous record, it is impossible to know whether some genetic mixing, as was probably occurring in eastern Europe, occurred in the west as well, or whether the Neanderthals of France, Belgium, and Iberia met a more sudden demise due to disease or other factors connected with the arrival of modern humans to their region. One palaeodemographer, Ezra Zubrow, has calculated that it would only take 30 generations, or 1,000 years, for Neanderthal populations to have completely disappeared if the incoming modern humans had even a slight adaptive advantage over them (Zubrow 1989).
MtDNA: The Genetic Data for Human Evolution

The mitochondrion, the organelle responsible for the production of energy within the cell, contains its own genetic material, known as mitochondrial DNA or mtDNA. Unlike the DNA found in the nucleus of the cell, which is inherited from both parents, mtDNA is inherited only from the mother. Thus, it provides a genetic record of an individual’s maternal ancestry.

Due to a high mutation rate and other factors, mtDNA evolves very quickly: five to ten times faster than the DNA of the cell nucleus. This makes it highly suitable for the examination of recent evolutionary events. By estimating the average mutation rate of mtDNA in the laboratory, and comparing the differences found in the mtDNA of living human populations, research first conducted by the late Allan Wilson at UCLA, Berkeley, and his colleagues, and more recently by Mark Stoneking at Pennsylvania State University, suggested that all living humans evolved from an African ancestry—from an African “Eve,” approximately 200,000 years ago. This controversial finding, if correct, would have provided the first non-fossil evidence that modern humans were already living before Neanderthal times. However, the statistical methods used to calculate this divergence time have been strongly questioned, leaving the mtDNA findings to date highly improbable. Future research will doubtless clarify this interesting new line of inquiry into human evolution.

dle and early Upper Pleistocene of Europe, culminating in Neanderthal craniofacial morphology.

Several lines of evidence have recently led to a renewal of the view, originally suggested in the late 1930s, that the European Neanderthals were replaced by modern immigrants from warmer latitudes, such as Africa or the Middle East. New dates for the sites of Skhul and Qafzeh in Israel have suggested that this may be the case. There, early modern human remains actually predate local Neanderthals. This is supported by fossil remains from southern Africa which, if correctly interpreted, suggest the presence of modern humans in that region over 100,000 years ago. However, genetic research which has utilized comparisons of mitochondrial DNA (see box on genetic data) in living human populations to suggest that all modern humans originated in Africa around 200,000 years ago has recently been challenged.

If modern humans did indeed evolve in Africa over 100,000 years ago, then the Neanderthals must be considered unique to Europe and vicinity: a regional specialization which disappeared as the ubiquitous Homo sapiens sapiens steadily moved into their range. In contrast to the views of 19th century prehistorians and our own views of only fifteen years ago, we now recognize that, for much of the past 1 million years, the entire time period since the arrival of hominids in Europe, the region was an evolutionary backwater. More and more evidence now points to a pattern of hominid evolution in Europe which, isolated by climatic extremes, digressed from the course of events elsewhere and resulted in the emergence of the Neanderthals. But the question of whether these archaic Homo sapiens, who survived the rigors of Upper Pleistocene Europe for at least 70,000 years, became totally extinct with the arrival of Homo sapiens sapiens or whether today’s Europeans represent, in part, their living descendants must, for the present, remain unanswered.

Bibliography


