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Hard Times among the Neanderthals

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Although life was difficult, these prehistoric people may not have been as exclusively brutish as usually supposed

Throughout the century that followed the discovery in 1856 of the first recognized human fossil remains in the Neander Valley (*Neanderthal* in German) near Düsseldorf, Germany, the field of human paleontology has been beset with controversies. This has been especially true of interpretations of the Neanderthals, those frequently maligned people who occupied Europe and the Near East from about 100,000 years ago until the appearance of anatomically modern humans about 35,000 years ago.

During the last two decades, however, a number of fossil discoveries, new analyses of previously known remains, and more sophisticated models for interpreting subtle anatomical differences have led to a reevaluation of the Neanderthals and their place in human evolution.

This recent work has shown that the often quoted reconstruction of the Neanderthals as semierect, lumbering caricatures of humanity is inaccurate. It was based on faulty anatomical interpretations that were reinforced by the intellectual biases of the turn of the century. Detailed comparisons of Neanderthal skeletal remains with those of modern humans have shown that there is nothing in Neanderthal anatomy that conclusively indicates locomotor, manipulative, intellectual, or linguistic abilities inferior to those of modern humans. Neanderthals have therefore been added to the same species as ourselves—*Homo sapiens*—although they are usually placed in their own subspecies, *Homo sapiens neanderthalensis*.

Despite these revisions, it is ap-

parent that there are significant anatomical differences between the Neanderthals and present-day humans. If we are to understand the Neanderthals, we must formulate hypotheses as to why they evolved from earlier humans about 100,000 years ago in Europe and the Near East, and why they were suddenly replaced about 35,000 years ago by peoples largely indistinguishable from ourselves. We must determine, therefore, the behavioral significance of the anatomical differences between the Neanderthals and other human groups, since it is patterns of successful behavior that dictate the direction of natural selection for a species.

In the past, behavioral reconstructions of the Neanderthals and other prehistoric humans have been based largely on archeological data. Research has now reached the stage at which behavioral interpretations from the archeological record can be significantly supplemented by analyses of the fossils themselves. These analyses promise to tell us a considerable amount about the ways of the Neanderthals and may eventually help us to determine their evolutionary fate.

One of the most characteristic features of the Neanderthals is the exaggerated massiveness of their trunk and limb bones. All of the preserved bones suggest a strength seldom attained by modern humans. Furthermore, not only is this robustness present among the adult males, as one might expect, but it is also evident in the adult females, adolescents, and even children. The bones themselves reflect this hardness in several ways.

First, the muscle and ligament attachment areas are consistently enlarged and strongly marked. This implies large, highly developed muscles and ligaments capable of generating and sustaining great

mechanical stress. Secondly, since the skeleton must be capable of supporting these levels of stress, which are frequently several times as great as body weight, the enlarged attachments for muscles and ligaments are associated with arm and leg bone shafts that have been reinforced. The shafts of all of the arm and leg bones are modified tubular structures that have to absorb stress from bending and twisting without fracturing. When the habitual load on a bone increases, the bone responds by laying down more bone in those areas under the greatest stress.

In addition, musculature and body momentum generate large forces across the joints. The cartilage, which covers joint surfaces, can be relatively easily overworked to the point where it degenerates, as is indicated by the prevalence of arthritis in joints subjected to significant wear and tear over the years. When the surface area of a joint is increased, the force per unit area of cartilage is reduced, decreasing the pressure on the cartilage.

Most of the robustness of Neanderthal arm bones is seen in muscle and ligament attachments. All of the muscles that go from the trunk or the shoulder blade to the upper end of the arm show massive development. This applies in particular to the muscles responsible for powerful downward movements of

This fossil is part of the Neanderthal skeleton known as Shanidar 1, unearthed in a cave in northern Iraq. The outside of the left eye socket of the skull is flattened instead of rounded, the result of a serious blow.



Diagonal lines on these two arm bones from Shanidar 1 are healed fractures. The bone on the right is normal. That on the left is atrophied and has a pathological tip, caused by either amputation or an improperly healed elbow fracture.

one of arms to rival those of the mightiest blacksmith.

Neanderthal legs are equally massive; their strength is best illustrated in the development of the shafts of the leg bones. Modern human thigh and shin bones possess characteristic shaft shapes adapted to the habitual levels and directions of the stresses acting upon them. The shaft shapes of the Neanderthals are similar to those in modern humans, but the cross-sectional areas of the shafts are much greater. This implies significantly higher levels of stress.

Further evidence of the massiveness of Neanderthal lower limbs is provided by the dimensions of their knee and ankle joints. All of these are larger than in modern humans, especially with respect to the overall lengths of the bones.

The development of their limb bones suggests that the Neanderthals frequently generated high levels of mechanical stress in their limbs. Since most mechanical stress in the body is produced by body momentum and muscular contraction, it appears that the Neanderthals led extremely active lives. It is hard to conceive of what could have required such exertion, especially since the maintenance of vigorous muscular activity would have required considerable expenditure of energy. That level of energy expenditure would undoubtedly have been maladaptive had it not been necessary for survival.

The available evidence from the archeological material associated with the Neanderthals is equivocal on this matter. Most of the archeological evidence at Middle Paleolithic sites concerns stone tool technology and hunting activities. After relatively little change in technology

the arm and, to a lesser extent, to muscles that stabilize the shoulder during vigorous movements.

Virtually every major muscle or ligament attachment on the hand bones is clearly marked by a large roughened area or a crest, especially the muscles used in grasping objects. In fact, Neanderthal hand bones frequently have clear bony crests, where on modern human ones it is barely possible to discern

the attachment of the muscle on the dried bone.

In addition, the flattened areas on the ends of the fingers, which provide support for the nail and the pulp of the finger tip, are enormous among the Neanderthals. These areas on the thumb and the index and middle fingers are usually two to three times as large as those of similarly sized modern human hands. The overall impression is

during the Middle Paleolithic (from about 100,000 years to 35,000 years before the present), the advent of the Upper Paleolithic appears to have brought significant technological advances. This transition about 35,000 years ago is approximately coincident with the replacement of the Neanderthals by the earliest anatomically modern humans. However, the evidence for a significant change in hunting patterns is not evident in the animal remains left behind. Yet even if a correlation between the robustness of body build and the level of hunting efficiency could be demonstrated, it would only explain the ruggedness of the Neanderthal males. Since hunting is exclusively or at least predominantly a male activity

among humans, and since Neanderthal females were in all respects as strongly built as the males, an alternative explanation is required for the females.

Some insight into why the Neanderthals consistently possessed such massiveness is provided by a series of partial skeletons of Neanderthals from the Shanidar Cave in northern Iraq. These fossils were excavated between 1953 and 1960 by anthropologist Ralph Solecki of Columbia University and have been studied principally by T. Dale Stewart, an anthropologist at the Smithsonian Institution, and myself. The most remarkable aspect of these skeletons is the number of healed injuries they contain. Four of the six reasonably complete adult

skeletons show evidence of trauma during life.

The identification of traumatic injury in human fossil remains has plagued paleontologists for years. There has been a tendency to consider any form of damage to a fossil as conclusive evidence of prehistoric violence between humans if it resembles the breakage patterns caused by a direct blow with a heavy object. Hence a jaw with the teeth pushed in or a skull with a depressed fracture of the vault would be construed to indicate blows to the head.

The central problem with these interpretations is that they ignore the possibility of damage after death. Bone is relatively fragile, especially as compared with the rock and other sediment in which it is buried during fossilization. Therefore when several feet of sediment cause compression around fossil remains, the fossils will almost always break. In fact, among the innumerable cases of suggested violence between humans cited over the years, there are only a few exceptional examples that cannot be readily explained as the result of natural geologic forces acting after the death and burial of the individual.

One of these examples is the trauma on the left ninth rib of the skeleton of Shanidar 3, a partially healed wound inflicted by a sharp object. The implement cut obliquely across the top of the ninth rib and probably pierced the underlying lung. Shanidar 3 almost certainly suffered a collapsed left lung and died several days or weeks later, probably as a result of secondary complications. This is deduced from the presence of bony spurs and increased density of the bone around the cut.

The position of the wound on



The ankle and big toe of Shanidar 1's right foot show evidence of arthritis, which suggests an injury to those parts. The left foot is normal although incomplete.



The scar on the left ninth rib of Shanidar 3 is a partially healed wound inflicted by a sharp object. This wound is one of the few examples of trauma caused by violence.

the rib, the angle of the incision, and the cleanness of the cut make it highly unlikely that the injury was accidentally inflicted. In fact, the incision is almost exactly what would have resulted if Shanidar 3 had been stabbed in the side by a right-handed adversary in face-to-face conflict. This wound therefore provides conclusive evidence of violence between humans, the only evidence so far found of such violence among the Neanderthals.

In most cases, however, it is impossible to determine from fossilized remains the cause of an individual's death. The instances that can be positively identified as prehistoric traumatic injury are those

in which the injury was inflicted prior to death and some healing took place. Shortly after an injury to bone, whether a cut or a fracture, the damaged bone tissue is resorbed by the body and new bone tissue is laid down around the injured area. As long as irritation persists, new bone is deposited, creating a bulge or spurs of irregular bone extending into the soft tissue. If the irritation ceases, the bone will slowly re-form so as to approximate its previous, normal condition. However, except for superficial injuries or those sustained during early childhood, some trace of damage persists for the life of the individual.

In terms of trauma, the most impressive of the Shanidar Neanderthals is the first adult discovered, known as Shanidar 1. This individual suffered a number of injuries, some of which may be related. On the right forehead there are scars from minor surface injuries, probably superficial scalp cuts. The outside of the left eye socket sustained a major blow that partially collapsed that part of the bony cavity, giving it a flat rather than a rounded contour. This injury possibly caused loss of sight in the left eye and pathological alterations of the right side of the body.

Shanidar 1's left arm is largely preserved and fully normal. The right arm, however, consists of a highly atrophied but otherwise normal collarbone and shoulder blade and a highly abnormal upper arm bone shaft. That shaft is atrophied to a fraction of the diameter of the left one but retains most of its original length. Furthermore, the lower end of the right arm bone has a healed fracture of the atrophied shaft and an irregular, pathological tip. The arm was apparently either intentionally amputated just above the elbow or fractured at the elbow and never healed.

This abnormal condition of the right arm does not appear to be a congenital malformation, since the length of the bone is close to the estimated length of the normal left upper arm bone. If, however, the injury to the left eye socket also affected the left side of the brain, directly or indirectly, by disrupting the blood supply to part of the

brain, the result could have been partial paralysis of the right side. Motor and sensory control areas for the right side are located on the left side of the brain, slightly behind the left eye socket. This would explain the atrophy of the whole right arm since loss of nervous stimulation will rapidly lead to atrophy of the affected muscles and bone.

The abnormality of the right arm of Shanidar 1 is paralleled to a lesser extent in the right foot. The right ankle joint shows extensive arthritic degeneration, and one of the major joints of the inner arch of the right foot has been completely reworked by arthritis. The left foot, however, is totally free of pathology. Arthritis from normal stress usually affects both lower limbs equally; this degeneration therefore suggests that the arthritis in the right foot is a secondary result of an injury, perhaps a sprain, that would not otherwise be evident on skeletal remains. This conclusion is supported by a healed fracture of the right fifth instep bone, which makes up a major portion of the outer arch of the foot. These foot pathologies may be tied into the damage to the left side of the skull; partial paralysis of the right side would certainly weaken the leg and make it more susceptible to injury.

The trauma evident on the other Shanidar Neanderthals is relatively minor by comparison. Shanidar 3, the individual who died of the rib wound, suffered debilitating arthritis of the right ankle and neighboring foot joints, but lacks any evidence of pathology on the left foot; this suggests a superficial injury similar to the one sustained by Shanidar 1. Shanidar 4 had a healed broken rib. Shanidar 5 received a transverse blow across the left forehead that left a large scar on the bone but does not appear to have affected the brain.

None of these injuries necessarily provides evidence of deliberate violence among the Neanderthals: all of them could have been accidentally self-inflicted or accidentally caused by another individual. In either case, the impression gained of the Shanidar Neanderthals is of a group of invalids. The crucial variable, however, appears

to be age. All four of these individuals died at relatively advanced ages, probably between 40 and 60 years (estimating the age at death for Neanderthals beyond the age of 25 is extremely difficult); they therefore had considerable time to accumulate the scars of past injuries. Shanidar 2 and 6, the other reasonably complete Shanidar adults, lack evidence of trauma, but they both died young, probably before reaching 30.

Other Neanderthal remains, all from Europe, exhibit the same pattern. Every fairly complete skeleton of an elderly adult shows evidence of traumatic injuries. The original male skeleton from the Neander Valley had a fracture just below the elbow of the left arm, which probably limited movement of that arm for life. The "old man" from La Chapelle-aux-Saints, France, on whom most traditional reconstructions of the Neanderthals have been based, suffered a broken rib. La Ferrassie 1, the old adult male from La Ferrassie, France, sustained a severe injury to the right hip, which may have impaired his mobility.

In addition, several younger specimens and ones of uncertain age show traces of trauma. La Quina 5, the young adult female from La Quina, France, was wounded on her right upper arm. A young adult from Šala, Czechoslovakia, was superficially wounded on the right forehead just above the brow. And an individual of unknown age and sex from the site of Krapina, Yugoslavia, suffered a broken forearm, in which the bones never reunited after the fracture.

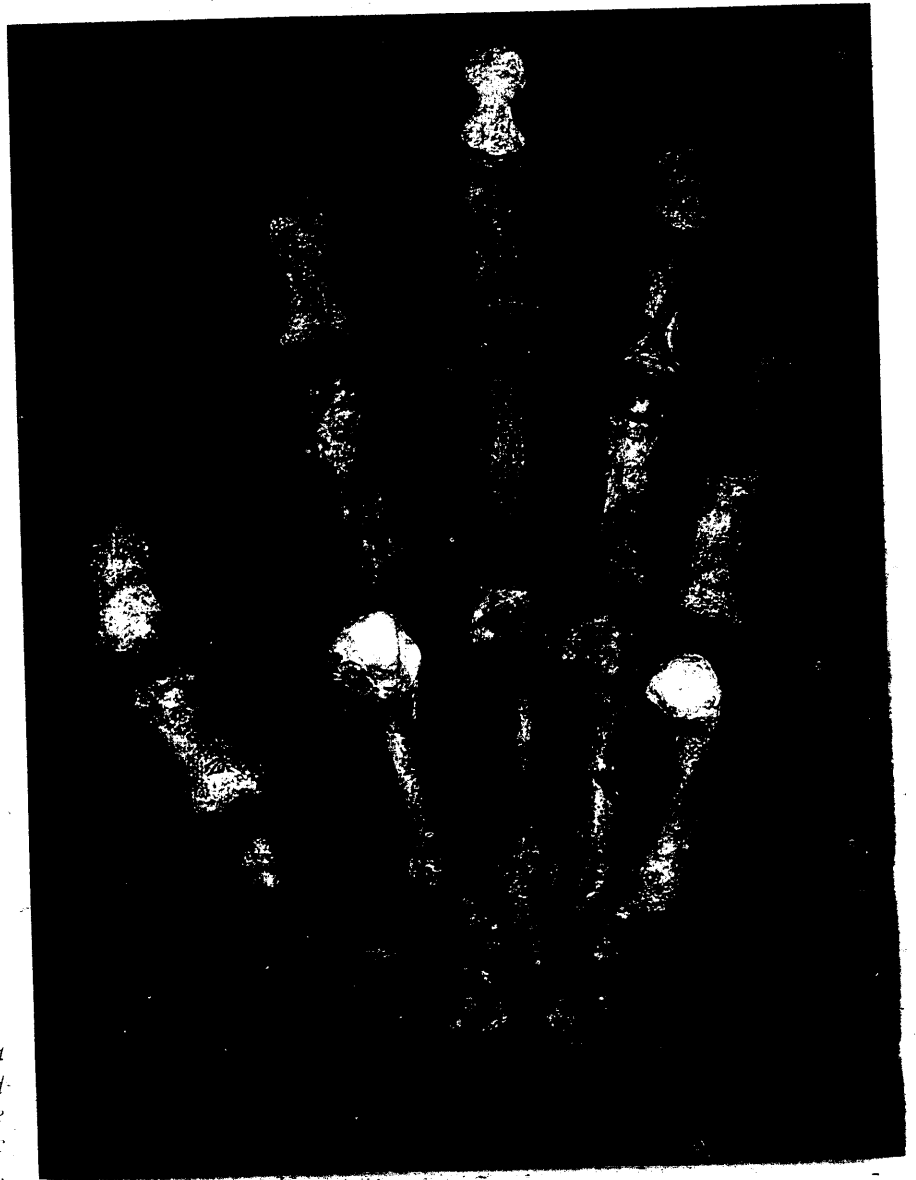
This evidence suggests several things. First, life for the Neanderthals was rigorous. If they lived through childhood and early adulthood, they did so bearing the scars of a harsh and dangerous life. Fur-

thermore, this incidence of trauma correlates with the massiveness of the Neanderthals: a life style that so consistently involved injury would have required considerable strength and fortitude for survival.

There is, however, another, more optimistic side to this. The presence of so many injuries in a prehistoric human group, many of which were debilitating and sustained years before death, shows that individuals were taken care of long after their economic usefulness to the social group had ceased. It is perhaps no accident that among the Neanderthals, for the first time in human history, people lived to a comparatively old age. We also find among the Neanderthals the first intentional burials of

the dead, some of which involved offerings. Despite the hardships of their life style, the Neanderthals apparently had a deep-seated respect and concern for each other.

Taken together, these different pieces of information paint a picture of life among the Neanderthals that, while harsh and dangerous, was not without personal security. Certainly the hardships the Neanderthals endured were beyond those commonly experienced by modern peoples. Yet they provide the first evidence in the prehistoric record of human caring and respect as well as of violence between individuals. Perhaps for these reasons, despite their physical appearance, the Neanderthals should be considered the first modern humans. □



The right hand of Shanidar 4 demonstrates the enlarged finger tips and strong muscle markings characteristic of Neanderthal hands.