Neanderthals: A Link to Our Future

Elise Diamond

Writer's comment: "Wow—a fifteen-page paper?! That's torture!" Those were my thoughts when Professor McHenry assigned my Ant152 class our term paper. Our assignment was to write a research paper on a hominid fossil of our choice. I decided to do research on a particular Neanderthal skull, Gibraltar 1. I was hoping that since the skull was found almost completely intact, it might be easy to find a lot of information about it. I was SO wrong. It took me eight weeks to do the research for this paper! Although it was a long process, my research skills improved greatly. Once I actually began to write the paper, it started to flow—and not a moment too soon! I particularly enjoyed writing the conclusion. Since I am an anthropology major, I love learning about ancient fossils. However, I also think it is important not only to learn about past events but also to connect them to current situations. Overall, completing this assignment was a rewarding experience. I improved both my researching and writing skills. And, to top it off, I feel like I am approaching expertise on Neanderthals.

—Elise Diamond

Instructor comment: It is a great pleasure to encounter an exceptional student like Elise Diamond. There were over 100 students in Anthropology 152 in the winter of 2004 and some of them were graduate students in Anthropology. All of them had to choose a fossil to describe in their own words (based on an exact replica cast in plaster or fiberglass). They were charged to become the expert on that fossil and write the definitive description, geological context of its discovery, comparative assessment of its place in the human family tree, and assess its significance to our understanding of human evolution. Elise chose to describe the first Neanderthal ever recognized. She used our library resources to read and report on the primary scientific literature on its discovery and geological context. She used her observations of the cast to describe the form and compare it with humans and other fossils. She integrated her own observations with those in the scientific literature. She wrote a lovely essay on the significance of this fossil to the unfolding of our understanding of Neanderthals and their place in human evolution.

—Henry M. McHenry, Anthropology Department

In our ongoing quest for knowledge, we have a certain drive to explore our human origins. Since the nineteenth century, with the discoveries of Neanderthal fossils, this vision has appeared to be attainable. One Neanderthal fossil in particular, Gibraltar 1, is an exceptional model of Neanderthal cranial morphology. By studying this fossil, and analyzing Neanderthal evolutionary history, we may gain insight into our own origins and possibly the fate of our species.

Although the Gibraltar 1 cranium is presently recognized as a very important and relevant fossil in the study of human evolution, it was not always acknowledged as such. The English Captain Brome, a fossil-collecting aficionado, has been credited with the discovery of Gibraltar 1 (Keith, 1912). Captain Brome was in charge of a garrison prison in Spain and illegally employed his prisoners to search for fossils (Tattersal, 1999). Though its value was unfortunately underestimated at the time, the Gibraltar 1 cranium was recovered in 1848 at Forbes' Quarry, on the north face of the Rock of Gibraltar. Lieutenant Flint, under Captain Brome's charge discovered Gibraltar 1, a female adult Neanderthal cranium (Keith, 1912; Johanson, et al., 1996). Dr. Arthur Keith supposes that the location at which Gibraltar 1 was found had once been the floor of a cave because the fossil was found with sandstone, limestone, and cement debris in its nasal and orbit cavities (1925). This debris is similar to that of the debris found on the floor of the Genista cave, located just behind the site of the Gibraltar 1 discovery. Fourteen years later Captain Brome sent the fossil, along with many extinct animal fossils excavated from the Genista cave at Gibraltar, to England for examination.

Two prestigious and highly skilled Englishmen of the time, anatomist George Busk and Dr. Hugh Falconer, both analyzed Gibraltar 1 and were amazed by the human-like cranium. Dr. Falconer noted several distinct features of the cranium which he deemed as unique and sufficient to declare the fossil as a newly discovered form of human, naming it *Homo Calpicus* (Keith, 1912). Incidentally, "Calpicus" comes from "calfe," the ancient name for Gibraltar (Keith, 1912). However, prior to observing the Gibraltar 1 cranium, in 1861 George Busk translated and published Schaaffhausen's description of the first fossil to be classified as a Neanderthal, the Neanderthal 1 skullcap (Tattersal, 1999). Busk noticed that the two fossils shared unique qualities, and concluded that they were of the same species, *Homo neanderthalensis*.

Unfortunately, due to the amateur manner in which the Gibraltar 1 cranium was discovered, there were no associated stratigraphic, archaeological, or faunal data collected with it to help to reveal its age (Johanson et al., 1996). However, since it is likely that Gibraltar 1 was found in an area that used to be part of the Genista cave, further exploration of the cave was called for. After examining the faunal remains sent by Captain Brome discovered in the Genista cave, such as *Rhinoceros etruscus*, George Busk and Dr. Falconer noted that they were similar to that of fauna found in association with the Heidelberg mandible from the sands of Mauer in 1907 (Keith, 1912; Klein, 1999). This led scientists to the conclusion that the fauna recovered from the Genista cave were from an early part of the Pleistocene Epoch (Keith, 1912), which was from 1.75mya to 10,000 years ago (Klein, 1999). Thus, it was believed in the most recent years after its discovery that the Gibraltar fossil was possibly over one million years old.

In 1910, additional investigation of the Genista cave, led by Dr. Duckworth of Cambridge University, produced neither supplementary fossils nor tools. However, in other nearby caves Dr. Duckworth found evidence of flints that had been made in a certain fashion as attributed to those of the Mousterian tool culture, which was the industry throughout Europe, Africa, and Asia from 250,000-30,000 years ago (Keith, 1925; Klein, 1999). Regrettably, there can be no current geological study done at the site because the talus, or brecciated deposit in which the fossil was found, was carried off and used by the nearby townspeople (Keith, 1931).

However, modern dating methods, such as luminescence dating, have been employed recently to determine an accurate date for the artifacts found near the Forbes' Quarry site (Schwarcz et al., 2001). Luminescence dating utilizes the concept that naturally occurring solids can trap electron charges due to bombardment of radiation energy produced by decay. During this procedure, light is emitted by stimulated photons, and one can observe the number of trapped electrons released. This number indicates how much time has passed since heat has been absorbed into the artifact originally, at the time that it was being manufactured. At Gibraltar, the materials that were tested using this method were quartz and feldspar, yielding age ranges from 1,000-150,000 years ago (Schwarcz et al., 2001). Presently, the age of the Gibraltar cranium is estimated at 50,000 years old, which is supported by the results of the Luminescence dating (Tattersal, 1999).

The Neanderthals lived roughly 200,000-30,000 years ago, coinciding with the later part of the Pleistocene Epoch. During this time, the

European climate was in a cycle of rising and falling temperatures which changed approximately every 100,000 years (Tattersal, 2002). In 1909, geologists Edward Bruckner and Albert Penick reconstructed the past 1.8 million years of geological events by interpreting evidence of four major glacial periods: Gunz, Mindel, Riss, and Wurm (Tattersal, 1999). In the 1950s, oxygen-isotope analysis was developed and has since been regarded as an innovative approach used for constructing chronologies of geological events (Tattersal, 1999). This method exploits cores taken from the mud that accumulates on seabeds. These cores contain foraminifera, or microorganisms, that record the date on which they were deposited. Oxygen isotopes (^{16}O and ^{18}O) from the surrounding water are absorbed by the foraminifera. During cold periods, the lighter isotope, ^{16}O, evaporates from the surface of the water and gets trapped in ice caps. As a result, the foraminifera absorb higher quantities of ^{18}O. By analyzing the ratio of ^{16}O and ^{18}O isotopes in the foraminifera and the placement of the foraminifera relative to each other, one can determine the chronology of glacial periods (Tattersal, 1999). The remains of ancient beaches near the Rock of Gibraltar are believed to have formed during Oxygen Isotope Stage 5, which lasted from about 127,000-73,000 years ago (Barton et al., 1999). Tattersal (2002) notes that although we do not know the exact dates in which the Neanderthals existed during this unstable period of oscillating climate changes, we do know that the Neanderthals prospered during both the cold and the warm parts of the glacial cycle.

Despite enduring tens of thousands of years in the rubble that was once sheltered by a cave, the Gibraltar 1 fossil is a remarkably complete cranium. Bones that are present in this specimen include the maxilla, frontal bone (although a piece of the left side is missing), zygomatic arches, part of the right mastoid process, external auditory meati, occipital tori, the inion, carotid canal, foramen spinosum, foramen ovale, styloid processes, pterygoid processes of the sphenoid, posterior nasal aperture, part of the hard palate (both sides of the palatine process of the maxilla), temporomandibular joint, and part of the right parietal. Four teeth attached to both sides of the maxilla remain, though they are completely worn down to stumps: I^2, C^1, P^1, andP^2. In his paper published in 1907 geologist W. J. Sollas clarifies the state of the Gibraltar maxilla by remarking that, in addition to the incisors, canines, and premolars mentioned above, the roots of the third right molar are preserved, and the second and third molars of the left side are present in fragments (1907). The following parts have been preserved on the right side of the cranium only: temporal, anterior condylar canal, internal auditory meatus, hypophyseal fossa, dorsum sellae, and the lesser wing of the sphenoid. The main pieces that are missing from this cranium include the mandible, supra-occipital, foramen lacerum, left temporal, left parietal, and the two upper median incisors.

Since the Gibraltar fossil has many unique characteristics, it is worth noting a few of its most prominent features. One that is particularly striking is the shape of the braincase. Although the supra-occipital bone is missing on the fossil, the remaining pieces of the braincase reveal that its shape is somewhat oval, or football-shaped, and positioned low relative to the face. This is in stark contrast to a modern human braincase, which is more circular shaped and pushed upward. Another distinct feature of the Gibraltar fossil is its long face. The length of the face, measured from the nasion to the edge of the maxilla is 74mm. Professor Sollas (1907) estimates that, with the addition of its missing mandible, the real length of the face would be at least 81mm. He also points out that this extraordinary length is quite remarkable because the longest modern human face recorded is 78.4mm. Other unique attributes of the skull include broad and projecting nasal apertures, wide orbits, and very strong supraorbital tori.

Due to the near completeness of the skull, Gibraltar 1 serves as an excellent illustration of many of the cranial morphological differences and similarities among *Homo neanderthalensis* and that of more primitive and derived hominids. *Homo heidelbergensis* is possibly the most recent ancestor of the Neanderthals (Tattersal, 1999). *Homo neanderthalensis* and *Homo heidelbergensis* both share traits such as strong supraorbital tori and facial prognathism. However, the Neanderthal crania have slight derivations of these traits, as shown by Gibraltar 1. Though crania from both taxa have large supraorbital tori, those of Neanderthals are double arched, and those of *Homo heidelbergensis* are not (Klein, 1999). Moreover, *Homo heidelbergensis* crania have substantial overall facial prognathism, whereas Neanderthal crania have only substantial midfacial prognathism (Klein, 1999). The Gibraltar cranium is not an accurate model for comparing cranial capacity between the two taxa, since its cranial capacity has been estimated to be 1230cc (Sollas, 1907), and the average Neanderthal cranial capacity is 1520cc (Klein, 1999). *Homo heidelbergensis* cranial capacity ranges from about 1200 to 1300cc, which is the same size as that of the Gibraltar fossil, but much smaller than that of the average Neanderthal.

The Gibraltar skull differs from that of *Homo sapiens* (modern humans) in a number of ways too. The Gibraltar cranium has wide, large nasal cavities relative to those of modern humans (Boyd, et al., 2003). Compared to the projecting midface of the Gibraltar cranium, modern humans have flatter midfaces, with no prognathism. Another difference between the two is that the Gibraltar cranium has a low, receding forehead, while modern humans have high foreheads (Boyd, et al., 2003). As mentioned earlier, the average Neanderthal cranial capacity is 1520cc, differing from the *Homo sapiens* average of 1350cc. Although the average cranial capacities are substantially different, more important differences between the braincases of the two taxa include their position and shape. The Neanderthal cranial vaults are long and low and globular-shaped, in contrast to the high, round cranial vaults of modern humans (Tattersal, 1999). Moreover, the robust, double-arched supraorbital tori that are exhibited by the Gibraltar cranium are not nearly as strong in modern human crania (Klein, 1999).

The Gibraltar 1 fossil was discovered at a time when very little was known about Neanderthals, or extinct species of hominids in general, for that matter. By the time the Gibraltar skull was recovered in 1848, only one other Neanderthal fossil, a child's skull from Engis Cave, had been encountered (Johanson, et al., 1996). For the next sixteen years after it was found, Gibraltar 1 remained out of the limelight, its significance unrecognized. In 1856, a skullcap and a few postcranial bones were found in the Feldhofer grotto in the Neander Valley of Germany (Johanson et al., 1996). The skullcap was named Neanderthal 1, and became the type specimen for *Homo neanderthalensis* (Johanson et al., 1996). Finally, years later, George Busk noticed distinct and unique similarities between the Neanderthal 1 skullcap and the Gibraltar 1 cranium and identified the Gibraltar fossil as *Homo neanderthalensis* (Tattersal, 1999). Gibraltar 1 exhibits typical Neanderthal characteristics such as a projecting occipital bone, a suprainiac fossa, and a distinctive crest behind the mastoid process of the temporal bone (Johanson, et al., 1996). According to Albert Santa Luca of Harvard, these characteristics are all part of a suite of traits, which also includes the mastoid tuberosity (rounded protrusion), which are unique to Neanderthals (Tattersal, 1999). Luca studied many different Neanderthal fossils, such as La Chapelle, La Ferrassie, and Spy, and selected these cranial features as unique to Neanderthals (Tattersal, 1999). Fortunately, since Neanderthal crania have distinct autapomorphies, Gibraltar 1 is easily classified as a Neanderthal fossil.

However, there is debate about the placement of the taxon *Homo neanderthalensis* in terms of evolutionary history. Currently, *Homo heidelbergensis* is widely accepted as the most recent ancestor of both *Homo neanderthalensis* and *Homo sapiens* (Tattersal, 1999). Still, there is some dispute regarding the accuracy of this assumption. It has been argued that certain features, such as strong supraorbital tori and facial prognathism, are primitive characteristics that the two share with earlier hominids, and therefore cannot be used to determine which taxon is ancestral to the other (Tattersal, 1999). When attempting to find relationships between two taxa concerning ancestry, shared primitive traits are not helpful. These traits would only confirm that the two taxa share a common ancestor, but does not shed light on the ancestor-descendant sequence. Still, it seems plausible that *Homo heidelbergensis* is the common ancestor of the two because *Homo heidelbergensis* has many primitive features and lacks many specializations which the latter two hominids posses (Tattersal, 1999).

Besides the dispute about the origins of the Neanderthals, there is also much controversy over the relationship between Neanderthals and modern humans. From the late nineteenth century through the early twentieth century, many scientists believed that the Neanderthals were the ancestors of modern humans. In other words, that Neanderthals eventually evolved into modern *Homo sapiens*. In 1912, Dr. Keith published *Ancient Types of Man* in which he proclaimed that full-blown Neanderthals had been around since just before the Pleistocene Epoch, which he estimated to be around 1.5 million years ago. However, it must be noted that at the time that Keith wrote this book, he believed that the Heidelberg mandible, which is now considered to be of the taxon *Homo heidelbergensis*, was of the Neanderthal species. He went on to say that one of his colleagues, Dr. Adloff, proposed that neither the Heidelberg mandible, nor the whole Neanderthal species, should be regarded as remnants of the history of human evolution. Dr. Adloff came to this conclusion after he observed the massive and strangely-shaped roots of the Heidelberg teeth. Dr. Keith disagreed with this assumption and stated that in his opinion the form of the roots in the Heidelberg mandible represent a specialization for chewing hard foods, which disappeared as humans gained more intelligence and produced enough technology so that they did not need this special adaptation any longer. Although Keith was referring to the Heidelberg mandible, and not a *Homo neanderthalensis* fossil, this notion reflects his belief that the unique characteristics of *Homo neanderthalensis* are not enough to disqualify it as a potential ancestor of modern humans. Rather, he believed that the same autapomorphies which most anthropologists today use to distinguish a fossil as *Homo neanderthalensis* are merely special adaptations which disappeared as Neanderthals evolved into modern humans.

At present, Keith's belief that Neanderthals are ancestors to modern humans is not generally accepted. Many different phylogenies have been proposed, but according to Boyd and Silk (2003), there are currently three major ones. University of Michigan anthropologist Milford Wolpoff champions the view that all hominids from the Pleistocene epoch to the present day should be classified as *Homo sapiens* (1999). He explains that *Homo sapiens* originated in Africa at least two million years ago and successfully took over much of the world. Furthermore, this great population distribution allowed for many regional morphological differences to develop; however, a single species was maintained. He points out that many paleoanthropologists tend to classify different species based on variations in morphology, without taking into account natural variations, which occur in every species. Moreover, he states that the Neanderthals are not a separate species from *Homo sapiens*. The Neanderthals were really just Late Pleistocene *Homo sapiens*, which eventually became anatomically modern *Homo sapiens*. Wolpoff strengthens his argument by using data from mtDNA tests, which show that Neanderthal mtDNA differ from that of living people in the same few base pairs that also show differences among living people.

On the other side of the spectrum, many anthropologists separate the Pleistocene hominids into different species. G. Phillip Rightmire of Binghamton University claims that *Homo erectus* originated in Africa, and spread throughout most of the world (1990). Then, at about 800,000 years ago, *Homo erectus* in Africa, the Levant, and Western Eurasia diverged and became *Homo heidelbergensis* (Boyd, et al., 2003). In Europe, *Homo heidelbergensis* gave rise to *Homo neanderthalensis*, while *Homo heidelbergensis* in Africa evolved into *Homo sapiens* (Boyd et al., 2003). In his phylogeny, Rightmire recognizes different hominid species through distinct morphological differences. He maintains that the main differences in morphology between *Homo erectus* and *Homo sapiens* include nasal projection, postorbital constriction, parietal proportions, expression of crests and tori on the vault, occipital flexion, shape of glenoid cavity and tympanic plate. In his view, there are strong enough discrepancies among these hominids to necessitate classification of different species.

Another position on Pleistocene hominid phylogeny is held by Richard Klein. Klein believes that *Homo ergaster* in Africa spread first to East Asia and Australasia and there evolved into *Homo erectus*. Next, *Homo ergaster* populated Western Eurasia, and there gave rise to *Homo neanderthalensis*. At around the same time, *Homo ergaster* in Africa and in the Middle East gave rise to *Homo sapiens*, which eventually replaced all other hominids (1999). In his phylogeny, Klein does not recognize *Homo heidelbergensis* as a distinct species at all. In fact, he implies that all later hominids stem from a common ancestor in Africa, *Homo ergaster*.

While it is interesting to study the many different possible hominid phylogenies that have been proposed, it is also helpful to establish taxonomic classifications of these groups. For example, there still remains the question of how to classify the Neanderthal group. There are some paleoanthropologists who classify the Neanderthals in the subspecies *Homo sapiens neanderthalensis*, very closely related to our own subspecies, *Homo sapiens sapiens* (Tattersal, 1999). This classification implies that modern humans are of the same species as Neanderthals. A species is generally distinguished as a population of sexually reproducing organisms that do not successfully interbreed with individuals of other species (Boyd et al., 2003). The problem with applying this definition to Neanderthals and modern humans is that Neanderthals are an extinct group, and therefore we cannot determine whether or not they are of two different species by this definition alone. Since all that remains of the Neanderthals are fossils, we must rely on comparisons of their morphology with that of our own. Paleoanthropologist Ian Tattersal (1999) maintains that there are enough distinct differences between the two, most notably in the build of their skeletons and in the shape of their skulls, to warrant Neanderthals as a separate species from modern humans. To illustrate his point, he compared the number of morphological differences between brown and black lemurs (two closely related living primate species) with the number of morphological differences between the Neanderthals and modern humans. He found that there are far more differences between the Neanderthals and modern humans than there are of brown and black lemurs.

In another study done by Marcia S. Ponce de Leon and Christopher P.E. Zollikofer, sophisticated technology such as geometric morphometric methods (GMM) was used to recognize and conceive of complex patterns of anatomical changes during ontogeny (2001). The study examined eleven immature and five adult Neanderthal specimens, including the Gibraltar 1 skull, as well as one adult, one adolescent, and one three-year old modern human specimen, approximately 100,000 years old. By using GMM, the forms of the specimens were expressed by the spatial configurations of three-dimensional anatomical landmarks. These three-dimensional graphic representations were then put on computers. Next, the fossils were reconstructed on the computers by using virtual reality tools. Deformities of the fossils, such as missing parts, were filled-in with mirror-imaged counterparts. The results of the analysis showed that important morphological differences between Neanderthals and modern humans, such as pronounced basicranial flexion at the spheno-occipital synchondrosis, are evident in both immature and adult individuals. This finding indicates that the traits which are unique within these two groups are due to genetic differences and supports the theory that *Homo neanderthalensis* and *Homo sapiens* are different species.

In addition to examining morphological differences in Neanderthal and modern human specimens, comparing DNA sequences can also reveal the relationship between the two taxa. Matthias Krings et al. extracted DNA from a Neanderthal specimen found in western Germany in 1856, and compared it to DNA from 2051 modern humans and 59 common chimpanzees (1997). During the DNA analysis, 27 nucleotide differences were observed in the Neanderthal mtDNA sequence when compared to that of the modern humans. However, of the 27, 25 are among the 225 that vary in at least one of the human sequences, and one of the remaining two varies among chimpanzees (Krings et al., 1997). The Neanderthal sequence was then compared to 994 contemporary human mitochondrial lineages from people all over the world. This analysis yielded results which show that these modern human sequences differ among themselves by an average of 8.0 +/- 3.1 (range 1–24) substitutions, modern humans and Neanderthals differ by an average of 27.2 +/-2.2 (range 22–36) substitutions, and modern humans and chimpanzees differ by an average of 55.0 +/-3.0 (range 46–67) substitutions (Krings et al., 1997). Thus, the differences between modern humans and Neanderthals are about three times as much as those between modern humans, but half as much as those between modern humans and chimpanzees. The scientists then compared the Neanderthal sequence to those of modern humans from various different lineages. The results were that the Neanderthal differs from the European lineages by 28.2 +/-1.9 substitutions, from the African lineages by 27.7 +/-2.2 substitutions, from the Asian lineages by 27.7 +/-2.1 substitutions, from the American lineages by 27.4 +/-1.8, and from the Australian/Oceanic lineages by 28.3 +/-3.7 substitutions (Krings et al, 1997). These findings suggest that the Neanderthals differ from all modern humans in relatively similar amounts. What is more, they show that European Neanderthals are not any more closely related to modern Europeans than they are to modern humans of different regions. Therefore, according to these results, European Neanderthals are not ancestors of European modern humans. Hence, based on current knowledge of Neanderthal and modern human morphology, classifications of extant species, as well as genetic evidence, most paleoanthropologists classify Neanderthals as their own subspecies, *Homo neanderthalensis*.

If the Neanderthals were not our ancestors, then what were they? Perhaps they represent a lost lineage which diverged from our ancestor, *Homo ergaster*. If so, then what led to their eventual extinction? Why did *Homo sapiens* persevere, while *Homo neanderthalensis* died out?

One hypothesis is that competition by *Homo sapiens* caused the Neanderthals to go extinct. When two groups inhabit the same region and have similar dietary needs, there is bound to be some competition for resources. Many paleoanthropologists agree with this idea; however, there is even disagreement about the specifics of the *Homo sapiens* takeover. Ian Tattersal believes that an important factor in the race for resources was intelligence. While *Homo sapiens* in the fossil record show signs of creativity, symbolism, and a complex understanding of their environment, these attributes are somewhat lacking in Neanderthals (1999). As there are limited resources in a given region, the group which can adapt better to its environment and be more resourceful will be successful. At the same time, the other group will find it harder to make a living, and will therefore either be forced to relocate or will die out. This hypothesis is very plausible since this sort of competition can be observed among all living species today. On the other hand, archaeologist John Shea has a much more violent explanation for what happened. He envisions a world where modern humans and Neanderthals battled against each other for resources, and with superior wits and weapons, modern humans wiped out the Neanderthals (Alper, 2003). Skeptics of this idea point out that there is no clear archaeological evidence of competition of this kind by Neanderthals and early modern humans (Shea, 2003). Still, the competition hypothesis maintains credibility because it encompasses the natural competition that is inherent within every species in the world.

Another idea that has been expressed by some paleoanthropologists is that the harsh climate did the Neanderthals in. The archaeological record shows that about 45,000 years ago the Neanderthals and earliest modern humans in Europe had similar technology (Mayell, 2004). According to geologist Jerry van Andel, 45,000 years ago the temperatures in Europe were very mild, and vegetation and big game animals were plentiful (Mayell, 2004). As the temperatures became colder, the vegetation disappeared, and the herbivores moved south to find food. Both the Neanderthals and the early humans followed the animals south. In their new environment, which was mostly barren land, it was much harder to hunt for food. People could no longer sneak up on their prey to catch them, and animals did not travel in big herds. Modern humans were able to adapt to this new environment by developing sophisticated tools and trade networks, by using natural resources in more ingenious ways (Mayell, 2004). However, the Neanderthals did not cope with the new habitat as successfully and eventually disappeared This hypothesis is similar to the competition hypothesis in that while both groups strived to adapt to their environment, modern humans were more resourceful, and in the end, more successful.

On the other hand, some people think that the Neanderthals were much more intelligent and resourceful than they are generally given credit for. Dr. Myra Shackley views the Neanderthals as intelligent and cooperative people, as well as skilled hunters (1980). In her opinion, it does not seem probable that the Neanderthals would survive in such harsh conditions for thousands of years, only to eventually die out. She considers the possibility that Neanderthals still exist today. In her book *Neanderthal Man* (1980) Shackley alludes to many cases, some legends, others more recent, where people have encountered human-like creatures that are not of our kind. One example from her book takes place in the region Dzungaria of China. In this area, there have been many reports of small creatures that “trade” with the locals by leaving skins at appointed places and taking away the items left there. What is more, this area contains numerous Mousterian artifacts, which are a type of tool technology generally associated with Neanderthals (Shackely, 1980). While this hypothesis may attract some people, most experts are highly doubtful that there are still Neanderthals living today.

The truth is that we may never solve the mystery of what became of the Neanderthals. Certainly, at the present time, expert scientists are divided on this issue. The lack of physical support for many of the hypotheses that have been proposed is unnerving; without adequate evidence in the fossil or archaeological records, it is hard to either prove or to disprove a practical hypothesis. Still, there is something to be learned from fossils such as Gibraltar 1 and from the Neanderthals in general. We, *Homo sapiens*, modern humans, are not the zenith of evolution. Rather, we are merely a step on the ladder of evolution. The Neanderthals inhabited much of the world for thousands of years. They were toolmakers, expert hunters, and endured harsh conditions. Yet we are here today, and they are not. This thought is quite humbling and should give us an appreciation for changes that can occur in the world over a large span of time. It should also alert us to the fact that *Homo sapiens* will not be in existence forever. Our species has not always existed nor will it continue to eternally. At some point in the distant future, our species may die out due to lack of resources or lack of ability to adapt to an ever-changing environment, just as countless other species have. Ironically, as "advanced" humans, we are also the first species ever to have developed the technology to be able to completely obliterate our species and the entire world we live in. The message is simple; although we might like to think otherwise, we are not sheltered from the reach of evolution.

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