Separating "us" from "them": Neanderthal and modern human behavior

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Neanderthals have always been treated like the poor relation in the human family. From the recognition of the first partial skeleton from Feldhofer, Germany, in 1856, Neanderthals made scientists uneasy. Initially they were viewed as too physically apelike to fit into *Homo sapiens* and too brutishly primitive to have been capable of modern human behavior (1). Now, new information on Neanderthal adaptations has come from Gibraltar, an island where an adult Neanderthal cranium and pieces of a Neanderthal child's skull were found previously. As reported in this issue of PNAS, evidence from Vanguard and Gorham's caves indicates that Neanderthals used unexpectedly modern and complex subsistence strategies (2).

Analyses in the last 20 years have depicted Neanderthals as a powerfully built, archaic hominin specialized to hunt and scavenge large, dangerous prey in cold habitats (3–5). The high frequency and distribution of fractures among Neanderthals matched injuries among professional rodeo riders (6), who interact regularly with large, dangerous animals. Similarly, the left–right asymmetry of arm bones in Neanderthals probably reflected spear thrusting (rather than throwing) to kill prey (7). Finlayson, an author of the current PNAS article (8), recently suggested that the postcranial morphology of Neanderthals was an adaptation for high mobility and close-contact hunting, not to cold. He showed that Neanderthals spread eastward into the Northern European Plain only during warmer intervals, countering interpretations that Neanderthals lived under Arctic conditions.

This revised interpretation concurs with analyses of the feet of early modern humans and Neanderthals (10). Substantial shoes protect the feet, producing a decline in the robustness of foot bones after hominins start wearing shoes regularly. Comparisons indicate that both modern humans and Neanderthals went barefoot or wore light footwear only irregularly before ≈28,000 years B.P. (before present). Barefoot hominins would have had great difficulties in boreal regions with permafrost.

Careful mapping of the distribution of all sites bearing Neanderthal fossils onto bioclimatic zones (10) identified Neanderthals' core area—the region inhabited continuously by Neanderthals from their first appearance onward—as southwestern France, Spain, Italy, and the western Mediterranean. This core area had Mediterranean and sub-Mediterranean climates and also served as Neanderthals' final refugium once modern humans appeared in Europe.

Fig. 1. Selected Mousterian tools from Gorham's Cave, Gibraltar. These tools show the small size and technique typical of the Mousterian industry made by Neanderthals. In addition, they are made of a variety of raw materials including flint and red chert. (Reproduced with permission from the Natural History Museum.)

One such refugium, where Neanderthals survived until ≈28,000 years B.P., was Gibraltar. An international team led by Christopher Stringer, Clive Finlayson, Nick Barton, and Yolanda Férnandez-Jalvo excavated and analyzed >1,367 fossil specimens and hundreds of marine mollusk shells from levels of Gorham's and Vanguard caves. The lower levels bore animal fossils and hundreds of Mousterian tools (Fig. 1), a commonly accepted indicator of Neanderthal presence. These levels were compared with an additional 1,240 fossils recovered from a more recent level of Gorham's Cave, where shells, bones, and Upper Paleolithic tools indicated modern human occupation.

Importantly, marine mammals, fish, and mollusks were systematically exploited by both Neanderthals and modern humans throughout the stratigraphic sequences at these caves. Hominins clearly obtained, transported, and processed the fat-rich marine resources. Nearly half of the fossils from Vanguard Cave and 31% of the fossils from Gorham's Cave show cutmarks (Fig. 2), percussion marks, or signs of deliberate exposure to heat to facilitate bone breakage and marrow removal, whereas carnivore-caused damage is an order of magnitude less common. The results strongly suggest that these hominins regularly enjoyed primary access to dead animals, although beached dolphins may have been scavenged.

Another significant point is that all specimens of the land and marine mammals were immature, providing proof that the site was used seasonally to hunt for vulnerable young.

Neanderthals at these sites exploited marine resources and a broad range of terrestrial resources, ranging from rabbit—the most abundant species (by number of individual specimens) in Gorham's Cave at both levels—to red deer and, in Gorham's Cave, rhinoceros. Even small game were used intensively, as indicated by stone tool cutmarks consistent with butchery or filleting, breakage to extract marrow, and human gnawing. Small scale marine resources, in the form of mollusks, were also used at these sites.

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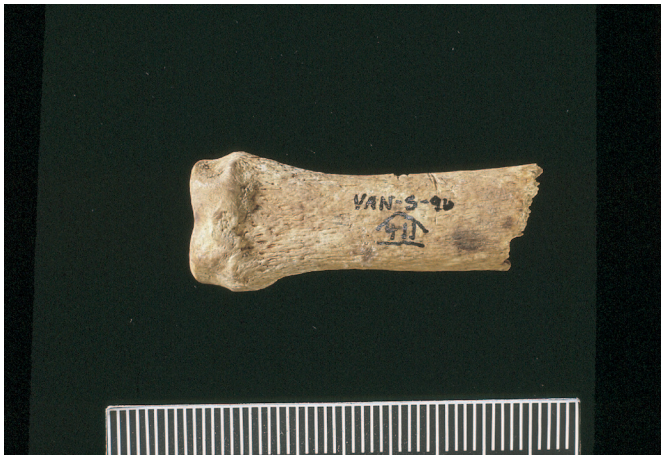

Fig. 2. The shaft of this seal phalanx shows cutmarks made by a stone tool, confirming that a hominin processed this animal. Seasonal use of marine resources (seals, dolphins, fish, and mollusks) is unexpected among Neanderthals. (Reproduced with permission from the National History Museum.)

Thus, these excavations have yielded excellent evidence of four behaviors usually cited as hallmarks of modern human behavior: the exploitation of a wide range of terrestrial resources; the exploitation of marine resources; the use of small scale resources; and seasonality or scheduling in the use of resources (11–13). That modern human subsistence behaviors would show up among archaic humans like Neanderthals, even as late as ≈28,000 B.P., is startling.

Paleoanthropologists currently debate whether any set of attributes of material culture can distinguish between modern and archaic human behavior (14, 15). In particular, McBrearty and Brooks (14) challenge the paradigm that there was an abrupt "human revolution" ≈40,000 years ago in Europe that marked the invasion of modern humans and the onset of modern behavior (but see ref. 16 for another view).

In Gibraltar, Neanderthals and modern humans apparently shared similar or identical "modern" subsistence practices at ≈28,000, yet Neanderthals were clearly outside of the range of morphological and genetic variability of modern humans (1–4, 17–19).

If behavior did not separate "us" (modern humans) from "them" (Neanderthals), what did?

Why did Neanderthals go extinct if they and modern humans used similar subsistence strategies in Gibraltar?

Answers to these questions are likely to be elusive. But more research into carefully chosen, meticulously excavated, and thoughtfully analyzed sites may be one way to begin to find them.

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