Anthropology

Stable isotope evidence for increasing dietary breadth in the European mid-Upper Paleolithic

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FROM ABSTRACT

New carbon and nitrogen stable isotope values for human remains dating to the mid-Upper Paleolithic in Europe indicate significant amounts of aquatic (fish, mollusks, and/or birds) foods in some of their diets.

Most of this evidence points to exploitation of inland freshwater aquatic resources in particular.

By contrast, European Neanderthal collagen carbon and nitrogen stable isotope values do not indicate significant use of inland aquatic foods but instead show that they obtained the majority of their protein from terrestrial herbivores.

In agreement with recent zooarcheological analyses, the isotope results indicate shifts toward a more broad-spectrum subsistence economy in inland Europe by the mid-Upper Paleolithic period, probably associated with significant population increases.

THESE AUTHORS ALSO NOTE:

"It is possible to assess the relative proportion of aquatic resources in the diets of prehistoric foragers and coextant animals through analyses of bone collagen carbon (13C) and nitrogen (15N) stable isotope values."

Such isotope data can reflect the proportionality of the kinds of foodstuffs obtained from dietary habitats such as freshwater wetlands, sea coasts, and dry terrestrial landscapes.

By the late Upper Paleolithic period, evidence indicates a substantial broadening of human diets in several regions of the Old World.

Diets consumed by Late Pleistocene humans, 18,000 – 20,000 thousand years ago, was from aquatic habitat animals.

The authors analyzed the collagen extracted from nine modern human skeletons dating to the mid-Upper Paleolithic period in Europe and west-central Asia, and compared it to 5 Neanderthals from the same geographic region.

Marine animal diets are documented from zooarcheological evidence as early as the Middle Paleolithic of the Last Interglacial, about 110 thousand years ago. The scale of this exploitation seems to have increased with time.

Exploitation of fish and other animals from freshwater habitats does not emerge until much later, about 20 thousand years ago.

"Freshwater aquatic resources potentially include fish, certain large-bodied mollusks, and the many waterfowl species that feed on aquatic plants, invertebrates, and small vertebrates (e.g., rails and ducks)."

MATERIALS and METHODS

"Humans who consume significant amounts of aquatic foods will have much higher 15N values than humans who consume only terrestrial plants and herbivores."

"Additionally, marine organisms are more enriched in 13C than terrestrial organisms, such that, in addition to higher 15N values, marine organisms have more positive 13C values."

"Significant consumption of freshwater resources by humans therefore can be indicated by high 15N values and/or more negative 13C values."

RESULTS

The bone collagen 13C and 15N values for the mid-Upper Paleolithic humans indicate significant freshwater aquatic food consumption relative to recent herbivore and aquatic prey values, as well as those of five Neanderthals.

Evidence from the Mesolithic period (<10,000 years ago) of several regions of Europe indicates that aquatic resources were dietary staples.

"Along the Atlantic coast of Europe, there is strong archeological and stable isotope evidence for heavy reliance on marine resources."

"In contrast, the European Neanderthal bone collagen 13C and 15N values indicate diets dominated by terrestrial herbivores."

"All five of the Neanderthal 15N values were most similar to coextant top-level carnivores such as wolves, large felids, and hyenas."

"There is evidence of neither the highly elevated 15N values associated with the consumption of aquatic species for these Neanderthals, nor is there evidence of

the more negative 13C values associated with the consumption of marine protein."

DISCUSSION

The stable isotope data suggest that the exploitation of aquatic resources was limited among inland European Neanderthal populations.

By the mid-Upper Paleolithic, (again, 18,000 – 20,000 years ago), there was relatively heavy use of freshwater aquatic resources in some areas.

This data may testify to the growing importance of aquatic resources by our mid-Upper Paleolithic ancestors.

CONCLUSIONS

"The stable isotope analysis of early modern human skeletal remains documents a significant shift in faunal exploitation patterns by the mid-Upper Paleolithic based on significant use of freshwater aquatic resources, evidence for an increase in dietary breadth."

"This trend is correlated with, and probably interrelated with, elaborations in material culture during the mid-Upper Paleolithic, including lavishly decorated burials, abundant personal ornamentation, ceramic figurines, and textiles of knotted cord."

"Whatever the interrelationships of these cultural evolutionary processes prove to be, the apparently broader dietary spectrum of the early modern human economy may have rendered humans more resilient to natural pressures and the increasingly packed social environments of Late Pleistocene Europe."

ADDITIONS

According to the Archaeological Institute of America, July 29, 1997, by Mark Rose (Mark Rose, NEANDERTHAL DNA, the Archaeological Institute of America, 1997, http://www.archaeology.org/online/news/dna.html), an analysis of Neanderthal mitochondrial (mtDNA) suggests that "Neanderthals and modern humans diverged from a common ancestor." However, Neanderthals did not become modern human, but rather became extinct.

This research is presented in the July 1997 issue of the journal Cell.

The researchers use mitochondrial DNA rather than from the nuclear DNA because mitochondrial DNA is more abundant than nuclear DNA. [Each cell has one set of nuclear DNA, but each cell has hundreds of mitochondria and copies of mitochondrial DNA]. "In addition, mitochondrial DNA is transmitted

only from the mother so that changes from generation to generation result from mutation alone rather than recombination of the mother and father's DNA."

"The question arises: Were the Neanderthals out-competed by modern humans or killed off by them, or were they absorbed into the population and genetically swamped?" [The above research would suggest that less DHA in Neanderthal diet might have retarded brain development as compared to those ancestors who became modern humans].

The journal Cell research shows that a comparison of Neanderthal mtDNA to modern European mtDNA "suggests that the Neanderthal genetic contribution to modern gene pools, if any, was small."

FROM DAN MURPHY:

A comment in USA Today, May 22, 2001 concerning this article notes:

"Some suggest that the finding supports the idea that marine food helped boost the brainpower of modern humans. Such food is known to contain higher levels of DHA, a fatty acid proven to enhance brain and eye development."

A comment from the Associated Press by Paul Recer, (Seafood Fed Brains of Early Humans: Fish diet gave them boost, study says):

"Early human beings ate lot of fish and seafood 20,000 years ago, a dietary concentration quite different from the red meat preferred by the more primitive Neanderthal."

"Researchers analyzing the chemical characteristics of bones from Neanderthals and from early modem humans in Europe found that fish, shellfish and waterfowl were a major part of the diet of the modem humans, even those who lived inland."

"Other researchers suggest that this finding supports the idea that a concentration on fish as food helped to boost the brain power of modern humans. Such food is known to contain higher levels of DHA, a fatty acid proven to enhance brain and eye development."

Early humans got from 10 percent to 50 percent of their dietary protein from marine foods.

In contrast, an analysis of Neanderthals showed that they dined almost exclusively on red meats.

"Stephen Cunnane, a professor of nutrition at the University of Toronto, called the study 'an important finding' that supports a theory that the brainpower of early humans was boosted by a diet rich in seafood containing DHA."

"We know that DHA was important in the development of the larger brain."

"Human beings may have evolved near the coast, where seafood was plentiful, and then migrated later to the inland African plains and eventually to the rest of the world."

"You don't need a big brain to collect mussels and clams, but living on them gives you the excess energy and nutrients that can be directed toward brain growth."

MORE FROM DAN MURPHY

DHA is a 22-carbon long essential fatty acid that that our body cannot produce. It is called "essential" because humans have to eat it. The best source for DHA is fish.

This article continues to support the concept that the human brain greatly expanded as a consequence of eating fish, with its high concentration of DHA omega-3 essential fatty acid.

Consequently, this article supports the positions from these books and articles we have discussed:

Smart Fats, by Michael Schmidt, 1997

Your Miracle Brain, by Jean Carper, 2000

Eating Well for Optimal Health, by Andrew Weil, 2000

Article 46-00: AHA Scientific Statement; AHA Dietary Guidelines; Revision 2000: A Statement for Healthcare Professionals From the Committee of the American Heart Association, Circulation. 2000;102:2284-2299 (October 31, 2000).

Article 51-00: Lloyd A Horrocks, Young K Yeo, Health Benefits of Docosahexaenoic Acid, Pharmacological Research 1999 Sep;40(3):211-25.

Article 52-00: Calder PC, Immunoregulatory and Anti-Inflammatory Effects of n-3 Polyunsaturated Fatty Acids, Brazilian Journal of Medical and Biological Research, 1998 Apr;31(4):467-90.