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RADIOCARBON DATING AND ISOTOPIC ANALYSES OF THE HUMAN REMAINS

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Introduction

At the request of Dr. Lawrence Straus, I have examined a sample of human bone from the Bois Laiterie Cave and determined its radiocarbon age and stable isotope content. The sample analyzed was a portion of the foot bone recovered from square V9-B. The human remains are described elsewhere in this volume by Vandenbruaene and Gautier.

Methodology

The bone sample was heavily encrusted with secondary $CaCO_3$ and was found in a cemented breccia. It was presumed to be quite old (Neolithic) and its state of preservation was uncertain. We elected to try to obtain reliable isotopic information on bioapatite carbon, gelatin carbon, and gelatin nitrogen, while preparing the possible bone gelatin for C-14 dating by AMS.

Because of the heavy carbonate cementation, a small portion of the crushed bone was demineralized in dilute HCl without any pretreatment. The amount of carbon evolved as CO_2 was more than 10 times that expected from bioapatite in normal bone (0.9%, Ambrose, 1993; 0.5-0.7% with proper cleaning, our unpublished data). Mass balance calculation indicates that the untreated bone was about 50.7% $CaCO_3$ and the isotopic composition of the contaminant was about -4.8 ‰ (Table 1), characteristic of many limestones.

After pretreatment with 1N acetic acid for 24 hours with periodic evacuation, as developed in our lab, the residual bone yielded 0.79% carbon, with an isotopic composition of -10.6 o/oo, still too much carbon for fully cleaned bioapatite.

With fresh 1N acetic acid added, the pretreatment was continued for 5 more days with periodic pumping. The carbon content of the residual bioapatite was then 0.5% (normal for mammalian bone) with an isotopic composition of -11.3 (normal for a largely herbivorous C_3 diet, Krueger and Sullivan,1984).

Results

All three experiments yielded a substantial amount of collagen after the demineralization. Each was refined to bone gelatin by standard procedures (Longin, 1971) and analyzed for carbon and nitrogen isotopes (results in Tab.1).

Carbon isotopes in gelatin gave essentially the same result in all three experiments, averaging -20.5 ‰ and indicating a 95 to 100% C_3 diet (Krueger and Sullivan, 1984). Nitrogen isotopes in gelatin gave similar results in all three experiments, averaging +8.3 ‰, and indicating some animal protein in the diet (Krueger, 1985). The difference between bioapatite carbon and gelatin carbon is 9.3 ‰ in the fully pretreated sample, indicating a low lipid diet and not enough animal protein to contribute much to energy metabolism (Krueger and Sullivan, 1984). Elemental C/N ranged from 3.1 to 3.2 in the three gelatins, all normal for uncontaminated bone gelatin.

One of the three gelatin preparations was analyzed for its C-14 age by AMS. The sample (GX-21380, Oxford AMS analysis) gave a C-13 corrected age of 9,235 ± 85 C-14 years BP, a result similar to reported results from the early Mesolithic sites at Grottes Margaux, Mallone, des Sarrasins, Autours, and Claminforge.

Conclusions

Three conclusions can be drawn from all these results:

1) The dated human bone from Bois Laiterie Cave is early Mesolithic, at about 9,235 C-14 years BP.
2) The dietary regimen of this individual was largely herbivorous (C_3 plants) with a small amount of animal protein and low lipid content.
3) Despite extreme contamination and/or alteration, reliable isotopic analyses and radiocarbon ages can be obtained with proper and careful preparation and analyses.

Tab.1. Isotopic Results on Bois Laiterie Bone

Pretreatment	None	24 hours	6 days
%C in residue	6.58	0.79	0.50
$\delta^{13}C$ in residue, ‰	- 5.3	- 10.6	- 11.3
% gelatin in residue	n.a.	16.5	35.0
$\delta^{13}C$ gelatin, ‰	- 20.5	- 20.4	- 20.6
$\delta^{15}N$ gelatin, ‰	+ 8.3	+ 8.1	+ 8.6
C/N, elemental (gelatin)	3.1	3.2	3.2

n.a. = not analyzed.

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