Development of a bone standard for radiocarbon dating at the A.E. Lalonde AMS Laboratory

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Introduction

Quality control in a radiocarbon (14C) laboratory is critical to ensure that samples have not been contaminated during their journey through the lab from raw material (e.g. bone, antler, wood, peat, pottery, groundwater) to elemental carbon (graphite), which is used for analysis by accelerator mass spectrometry (AMS; see right). Radiocarbon samples must be processed with a very old sample to assess background levels of 14C and a secondary standard to ensure quality control at the younger end of the spectrum. The A.E. Lalonde AMS Laboratory at the University of Ottawa currently uses two background standards for bone (SIRI-B and SIRI-C), but there is no readily available international secondary standard.

We therefore analyzed five samples of a large bowhead whale bone (GSC-3055). Results from two samples at one end and three at the other (see below: A, B) demonstrated internally consistent radiocarbon ages at ~7400 years old. We therefore recommend GSC-3055 as an in-house secondary standard for radiocarbon dating of collagen materials in the future.

Methods

Sampling: The surface of the bone was cleaned before sampling with a saw. The samples were then pulverized a ball mill (bottom right).

Acid-alkali-acid pretreatment (Brock et al., 2010)
- Decalcification: HCl (0.5N, room temp, ~18h)
- Humic acid removal: NaOH (0.1N, room temp, 30 mins)
- Neutralize base and remove CO2 (0.5N room temp, 1h)

Combustion: Samples were combusted using an elemental analyzer (bottom left) connected to an extraction line (bottom right) where the sample is trapped into a breakseal (inset).

Gravitization:
Fe + CO2 + 2H2 → C (graphite) + 2H2O
800°C

AMS measurement: Samples are pressed into targets (below left), loaded into the wheel (bottom right) and analyzed by AMS (top of poster).

Results and discussion

Results from the preliminary analysis of GSC-3055 are promising and suggest that the bone is isotopically homogeneous. The lab will begin to use it as an in-house standard for bone.

But it needs a name! This name will be used to track the sample through the lab and a unique name will make the new standard easy to recognize in scientific literature.

Help name the new secondary bone standard at the A.E. Lalonde AMS lab!

References


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