

Woods Hole Oceanographic Institution

NATIONAL OCEAN SCIENCES
ACCELERATOR MASS SPECTROMETRY[Home](#)[About NOSAMS](#)[Client Services](#)[Education](#)[Research](#)[News](#)[Contact](#)[Client Services](#)[Fees](#)[Turnaround](#)[Sample Preparation Information](#)[Sample Types](#)[Processes](#)[Sample Preparation](#)[Organic Carbon](#)[Inorganic Carbon](#)[Other](#)[Online Sample Submission](#)[Radiocarbon Data & Calculations](#)[Research Initiatives](#)[Organic Carbon](#)

On this page:

[Overview](#)[Bone Collagen](#)[Charcoal](#)[Compound-specific](#)[Dissolved Organic Carbon](#)[Plant/wood](#)[Sediment \(total organic\)](#)[Aerosols \(total organic\)](#)[Other - Textiles, black carbon etc.](#)[Pre-processing](#)

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Dana Gerlach prepares to transfer an aliquot of Primary Standard Oxalic Acid CO₂ to a graphite reactor. (Woods Hole Oceanographic Institution)

[Overview](#)

If you are submitting organic carbon sample types such as plant, wood or charcoal, it is important to properly clean and separate any non-plant, wood or charcoal type material from the sample. The process provided in our labs will remove inorganic carbon and leaves behind the acid-insoluble residue. It will not remove other organic contaminants like sediment OC or quartz grains included with the sample. It's obviously best to date clean, pure materials rather than a mixture of components.

using a tool like a wet "picking" brush or tweezers under microscopic or magnified eye components.

If extraneous material is included with your submitted sample that contains organic carbon can potentially be contaminated by younger or older carbon. For example, modern carbon levels where sediments are collected can contribute modern contamination.



Extracted bone collagen in a glass tube. The collagen will be weighed and combusted. (Woods Hole Oceanographic Institution)

Bone Collagen

Approximately 0.5 gram of bone material is required to extract enough collagen for an approximate since conditions for preservation vary and generally, the older the bone. Due to the labor-intensity of the extraction, if an inadequate amount of collagen is obtained we will bill for partial processing up to the point of the collagen extraction.

Currently we are sending our bone samples to an outside specialist for the extraction and combust the collagen and convert to graphite here in our Sample Prep Lab. The collagen is referred to as EDTA (ethylenediaminetetra-acetic acid). It takes generally no more than and we try our best to keep the total turnaround time to a minimum, but in some cases can take longer. For instance, if the bone is poorly preserved or contains a lot of humic acid may take a few weeks longer than the average turnaround. Process used [Organic C](#)



A charcoal sample submitted for AMS analysis. (Woods Hole Oceanographic Institution)

Charcoal

The carbon content of charcoal can vary significantly. However, under good conditions, 40% is a reasonable carbon by weight, therefore approximately 1 milligram of clean charcoal in good condition should suffice for AMS. Often, charcoal becomes broken and disseminated in surrounding soil matrixes. Separation or purification can be as simple as scraping away the outer surfaces, but if disseminated, can be performed by gently cleaning a wet "picking" brush under a microscopic or magnifier to collect the charcoal fragments. Then, if further cleaning is needed, sonicate samples with distilled water and carefully draw off the supernate. Repeat until clean. Dry, weigh and submit. If a mixture of disseminated material is submitted, then the mixture will be combusted; our procedures do not separate fragments of charcoal.

mobile phases of organic carbon (fulvic and humic acids) and any inorganic carbon.

If you request small sample analysis, keep in mind that the transfer of material, the pre-treatment of charcoal, and in-line stable $\delta^{13}\text{C}$ analysis will further reduce the available carbon. You may request to forego pretreatment and assume a $\delta^{13}\text{C}$ value in order to conserve carbon. Process used [Organic Combustion](#).

Compound-specific

These are typically collected by submitters with a PCGC, or preparative capillary gas chromatographic system (supplemented system). Compound-specific samples are usually small samples (less than 100 $\mu\text{g C}$) requiring a solvent transfer to a combustor. Such small samples were initially developed at NOSAMS specifically to aid the development of compound-specific radiocarbon analysis of fatty acids, sterols, plant waxes, lignin phenols, PAHs, PCBs, and lipids.

Training is available for the PCGC technique. Compound-specific samples may be prepared and isolated by NOSAMS staff with your request. ([contact NOSAMS](#)) Process used [Organic Combustion](#).

Dissolved Organic Carbon

Analysis of Dissolved Organic Carbon (DOC) by UV extraction of CO_2 is available in our Sample Prep Lab. Typically investigate sample prior to submission (pH of $\sim 2.5 \pm 0.3$) or they send the samples frozen to the facility. Unless prior arrangements and approvals are provided, remaining sample and the containers will be disposed of after analysis.

The rate of sample analysis for DOC is one per day so expect longer turnaround times than for other processes. Samples containing less than 100 micrograms of carbon will be analyzed only by arrangement with the staff chemist (amcnichol@whoi.edu).



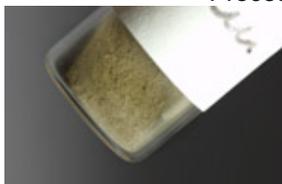
Leaves in a vial
for AMS.
(Woods Hole
Oceanographic
Institution)

Plant/wood

Clean all non-plant/wood material from the sample using distilled water and thoroughly dry in a low temperature oven. Place in a clean, labeled vial. A general rule-of-thumb is to estimate 40% carbon by weight for plant/wood or 10% for wood. Some carbon is potentially lost due to pre-treatment of plant/wood which involves the base extraction of mobile humic and fulvic acids and removal of inorganic carbon. If stable isotope analysis is requested, we will take approximately a 10% split of the sample for analysis.

If the sample is clean and in good condition, you could estimate that a regular-sized sample would weigh a minimum of 100 mg.

Process used [Organic Combustion](#).



Sediment sample.
Carbonates will be
removed and the
organic carbon
component analyzed
with AMS. (Woods Hole
Oceanographic
Institution)

Sediment (total organic)

The organic carbon content of sediments vary considerably. We must know the measured % organic carbon content of the sediment to estimate the amount of carbon to be analyzed.

much sample is required for AMS analysis. Too much material may cause the combustion tube to overheat and the sample material will result in an insufficient amount for AMS analysis. Please indicate on the submittal form whether the sample is %OC or not. If not, we can determine it during analysis.

Sediment (Corg) samples typically undergo the acid pretreatment only, to remove inorganic carbon by vapor-phase acidification when requested. If your sediment contains plant material like peat, then we will treat it as plant/wood samples to remove any mobile humic or fulvic components. If the sediment contains organic matter, please indicate your preference for acid only or an acid-base-acid series of leaches on the submittal form. Submit dry sediment samples in well-labeled, clean glass or plastic containers. We assume samples submitted are dry and grind sediment samples prior to submission to ensure homogeneity. Process used:

Aerosols (total organic)

Particulates collected on quartz filters can be combusted at high temperature (850 deg C) together with the sample. If pyrex filters must be reduced (550 deg C) which could result in incomplete combustion of total organic carbon. Please provide the carbon load for us to assess how much of the sample/filter to pack into a combustion tube. It's best to receive the filters flat rather than packed in containers. Past clients have used cleaned/baked aluminum foil to double wrap the sample and filter, freeze and send to us. Pre-freeze for one hour before using. Aerosols are kept cool and dry to avoid bacterial growth.

Other - Textiles, black carbon etc.

Please contact us regarding the particulars of other types to determine handling and fees. Process used [Organic Combustion](#). When is pre-processing required for organic carbon samples?

The key distinction is between "ready-to-burn" and all other organic carbon samples. If a sample requires only mechanical or chemical pre-treatment before submission to a combustion system, it's "ready to burn." If it requires pre-treatment, the higher fee is applied.

A typical example of chemical pre-treatment is the acid-base-acid extraction used to remove carbonates and organic acids from natural materials (wood, charcoal). Upon request, vapor-phase acidification is also available.

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