

Woods Hole Oceanographic Institution

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NOSAMS NATIONAL OCEAN SCIENCES
ACCELERATOR MASS SPECTROMETRY

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Associated Instruments

Overview

The NOSAMS facility provides proven designs for sample-preparation systems and our staff have trained many students, technicians and investigators to use the systems. However, because of limitations sometimes have limited ability to welcome outside investigators into our laboratories. Visitors have used the facility's chromatographic systems to prepare samples for compound analysis. Large numbers of samples can be offered favorable rates and arrangements for preparing 1

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Dr. Li Xu, a specialist skilled in the preparative separation of organic compounds, shown here operating the two-dimensional PCGC in 2004.

Preparative capillary gas-liquid chromatography (PCGC) With the advent of AMS, and the additional efforts at NOSAMS to meet the size requirements, PCGC technology has allowed the development of radiocarbon analysis (CSRA). This technique in which naturally determined in specific organic compounds was developed by our coworkers at WHOI. The PCGC allows recognition and resolution, providing information about processes within the biogeochemical paleoenvironmental conditions that was unavailable using previous methods.

Two-dimensional PCGC

A multi-dimensional PCGC system was installed at NOSAMS in December 1998. This more precise comprehensive two-dimensional system is capable of separating one order of magnitude more compounds than the traditional gas chromatography method. The system

e.g., a homologous series of n-alkanes, are injected repeatedly onto a high-capacity megabore capillary column in the first GC individual molecules. In instances where separations are difficult to effect with one GC, targeted compounds or regions of the c re-injected into the second GC. Finally, up to six specified peaks are isolated in the preparative fraction collector. Even with the resolution and the high capacity of megabore columns, it is still difficult to collect enough sample for a radiocarbon measurement often yield only 20-100 µg C samples. This system provides NOSAMS with a unique and powerful means of isolating and measurement of individual organic compounds isolated from complex natural matrices, e.g., sediments and soils. The ability to repeatedly inject target compounds, and analyze microgram-sized samples has made compound-specific radiocarbon analyses a reality. The technique improves the resolution, and therefore, the power of the technique.



Sean Sylva prepares to use the High Performance Liquid Chromatograph (HPLC) to determine which organic compounds from an *Archaea* bacteria sample (collected at a [Lost City](#) hydrothermal vent) can be isolated and analyzed for ^{14}C .

HPLC - High-performance liquid chromatography

A liquid-chromatographic system was installed at NOSAMS in 2003 to supplement a preparative capillary gas chromatographic system. This instrument is capable of purification, and quantification of various compounds and is not limited by the sample compound.

Elemental analyzer

(> 1% C, > 25 µmol)

To improve processing of samples for total organic carbon (TOC) ^{14}C analysis, we built an automated system for the collection and combustion of organic carbon samples. It is based on a commercial Carlo Erba NA1500 elemental analyzer and in many cases uses a standard closed-tube combustion technique. CO_2 produced during sample combustion in the elemental analyzer is separated and cryogenically trapped. The gas (sample size approximately 500 µg C yield) is transferred cryogenically to a calibrated volume in a modular gas collection manifold. These manifolds are removed and re-connected to the automated graphite reactor vacuum



Al Gagnon operates and maintains The PRISM and Optima mass spectrometers.

Optima Stable Mass Spectrometer

The Optima is the primary stable mass spectrometer used for analyzing a sample. The sample is sent through the vacuum system to a reactor for reduction to graphite.

VG Prism Stable Mass Spectrometer

association with radiocarbon analysis.



Mark Roberts and Josh Burton (Tom Kleindinst)

The Gilson Gas Bench

The Gilson Gas Bench system is coupled with CFAMS' gas ion source and is used for reconnaissance radiocarbon analyses of carbonate samples.

Last updated: July 29, 2015

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