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July 21, 1994

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Defense Technical Information Center  
Building 5, Cameron Station  
Alexandria, VA 22304-6145

Dear Sir:

In compliance with the reporting requirements of Grant No N00014-92-J-1301, entitled *Acquisition of a Gas Source Mass Spectrometer for Paleoclimatology and Paleooceanography Research*, Principal Investigator William B. Curry, enclosed is a copy of the final report.

*William B. Curry (WBC)*

William B. Curry  
Principal Investigator

WBC/kwb  
Enclosure

This document has been approved  
for public release and sale; its  
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**Final Project Report - ONR Grant N00014-92-J-1301**

**Acquisition of a Gas Source Mass Spectrometer for Paleoclimatology and  
Paleoceanography Research**

**PI - William B. Curry  
Department of Geology and Geophysics  
Woods Hole Oceanographic Institution  
Woods Hole, MA 02543**

**Summary of Completed Project**

The purpose of this award was to partially fund the acquisition of a high-sensitivity, automated mass spectrometer system dedicated to the analysis of carbonate samples. The acquisition was jointly funded by this award, by an award from the National Science Foundation Division of Ocean Sciences and by supporting funds from the Woods Hole Oceanographic Institution. We purchased a Finnigan MAT252 mass spectrometer with an automated carbonate device known as the "Kiel device". The instrument was delivered in December 1992. It was installed in March 1993 and met factory specifications within three weeks. Routine operational use of the system began in March 1993.

The system has been run in a routine fashion for the last 16 months. During that time we have analyzed more than 14,000 samples and standards. The routine precision for  $\delta^{13}\text{C}$  is  $\pm 0.03\text{‰}$  and for  $\delta^{18}\text{O}$  is  $\pm 0.07\text{‰}$  (Figure 1). But precision varies as a function of size. For samples larger than about  $50\ \mu\text{g}$ , precision is excellent and relatively constant. Below  $50\ \mu\text{g}$ , precision degrades. For standards with masses between  $10$  and  $20\ \mu\text{g}$ , precision for  $\delta^{13}\text{C}$  is  $\pm 0.09\text{‰}$  and for  $\delta^{18}\text{O}$  is  $\pm 0.20\text{‰}$  (Figure 2).

Samples analyzed by this instrument have supported research by seven NSF funded researchers, three graduate students and two Summer Student Fellows. We have studied Arctic, North Atlantic, Caribbean, and Indian Ocean sediment cores. In addition the system has been used to study foraminiferal samples collected in sediment traps from the Atlantic and Indian Oceans.

**Publications Supported by this Award**

Keigwin, L. D. and Jones, G. A., 1994. Western North Atlantic evidence for millennial-scale changes in ocean circulation and climate. *Journ. of Geophys. Res.*, v. 99, pp. 12397-12410.

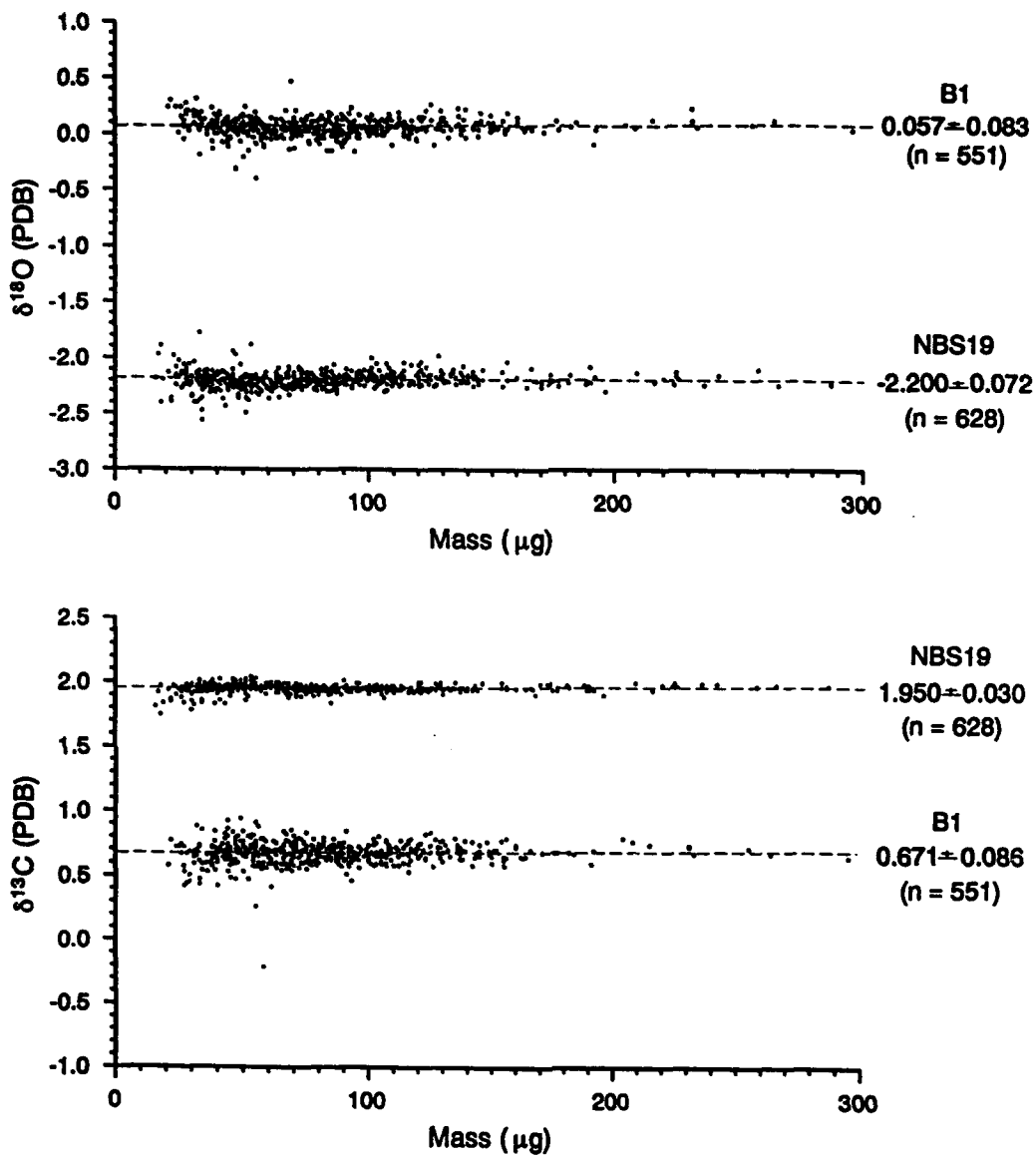
Keigwin, L. D., Curry, W. B., and Lehman, S. J., in review. The climate-deep ocean link during interglacial stage 5. Submitted to *Nature*.

Slowey, N. C. and Curry, W. B., in review. Glacial-interglacial differences in circulation and carbon cycling within the upper western North Atlantic. Submitted to *Paleoceanography*.

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Oppo, D. W., Raymo, M. E., Lohmann, G. P., Mix, A. C., Wright, J. D., and Prell, W. L., in review.  
A  $\delta^{13}\text{C}$  record of Upper North Atlantic Deep Water during the past 2.6 million years. Submitted  
to *Paleoceanography*.

### Standards > 0.8 Volts



**Figure 1.** Isotopic measurements of two standards which are routine analyzed in our mass spectrometer. NBS19 is the standard we use to calibrate our data to PDB. B1 is the standard used by C. Emiliani. We analyze at least three standards of different isotopic composition for every carousel of samples.

## Standards

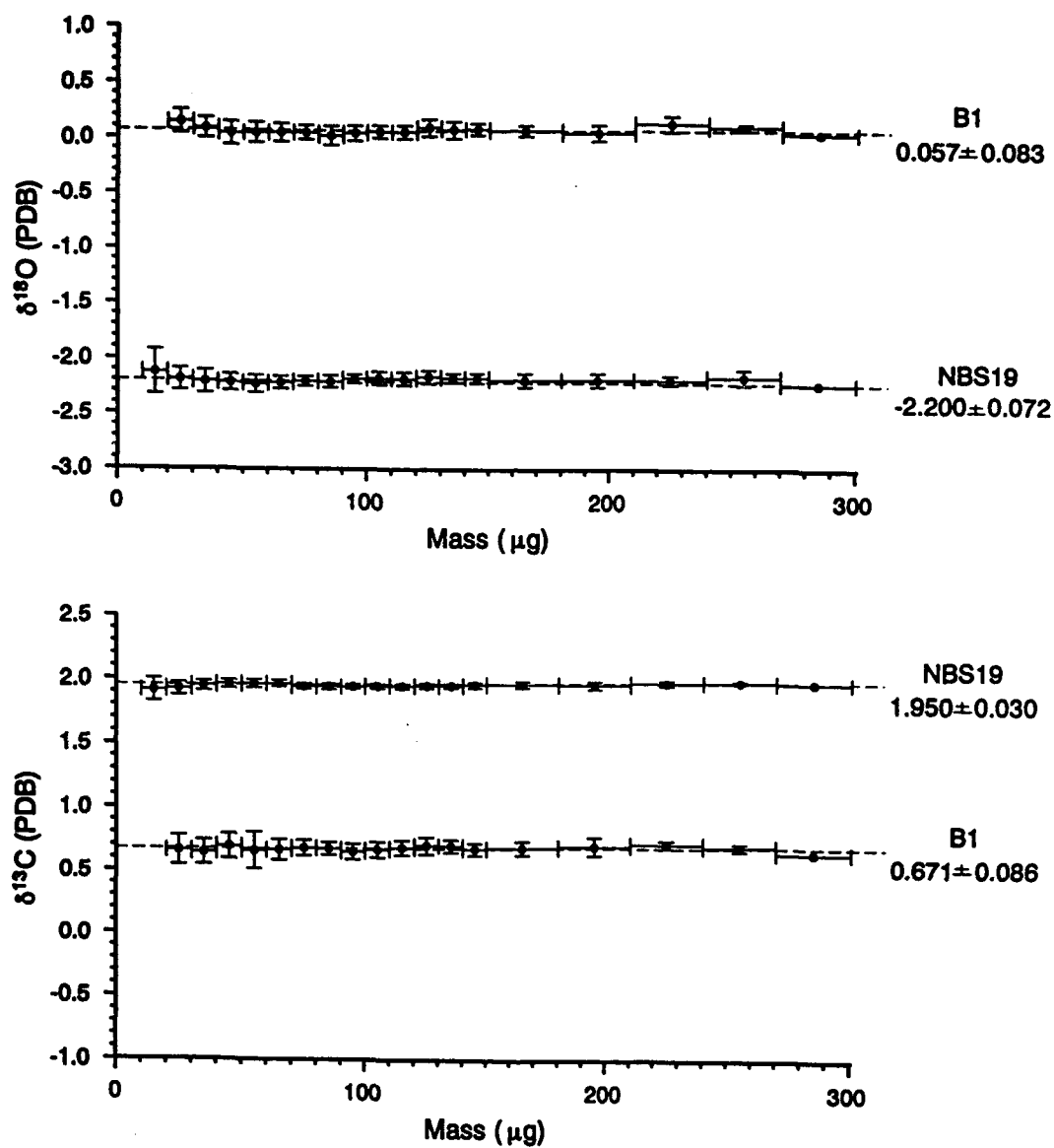


Figure 2. Precision of isotopic analyses for standards, binned within specific mass intervals. For masses greater than 50  $\mu\text{g}$ , precision is excellent and constant. Below that size precision degrades; for the mass interval 10 to 20  $\mu\text{g}$ , precision for  $\delta^{13}\text{C}$  is  $\pm 0.0\%$  and for  $\delta^{18}\text{O}$  is  $\pm 0.2\%$ .