REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	3/1/99	Final 3/31/94 - 9/30/96

4. TITLE AND SUBTITLE
Deep Water Formation and Circulation in the Arctic Ocean Studeid by Natural & Anthropogenic Tracers

5. FUNDING NUMBERS

6. AUTHOR(S)
P. Schlosser

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Lamont-Doherty Earth Observatory of Columbia University
Route 9W
Palisades, NY 10964-8000

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
The Trustees of Columbia University in the City of NY
Office of Projects & Grants
1210 Amsterdam Ave - MC 2205
New York, NY 10027

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
The view, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

Funds were requested for completion of measurements of tracer samples (tritium, helium isotopes, oxygen isotopes, ^{14}C) from the ARCTIC '91 expedition, as well as for the inter-pretation of these data. Additionally, funds were requested for participation in an icebreaker expedition to the Arctic Ocean originally planned for 1995. This cruise could not be organized. Therefore, the funds were used for sample collection in the framework of the 1994 joint US/Canada Arctic ocean section (AOS 94).

14. SUBJECT TERMS	15. NUMBER OF PAGES
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

Final Project Report

Office of Naval Research

Deep Water Formation and Circulation in the Arctic Ocean Studied by Natural and Anthropogenic Tracers

Award Number N00014-94-1-0507

Peter Schlosser
Principal Investigator

3/31/94 – 9/30/96

1. Background

We requested funds for completion of measurements of tracer samples (tritium, helium isotopes, oxygen isotopes, ^{14}C) from the ARCTIC 91 expedition, as well as for the interpretation of these data. Additionally, funds were requested for participation in an icebreaker expedition to the Arctic Ocean originally planned for 1995. This cruise could not be organized. Therefore, the funds were used for sample collection in the framework of the 1994 joint U.S./Canada Arctic Ocean section (AOS 94).

2. Sample Collection

We collected the proposed number of samples along the AOS 94 section (for geographical position of the stations, see Fig. 1). We obtained good spatial resolution for most of the Canadian Basin. Due to technical problems with the Polar Sea, the sampling resolution in the Makarov Basin is lower than planned.

3. Measurements

The measurements of the samples from the ARCTIC 91 expedition were completed as planned. The data were combined with existing tracer data sets from the Arctic Ocean. The tritium and helium isotope data were measured at the L-DEO Noble Gas Laboratory (NGL). The ^{18}O samples were measured in the stable isotope laboratory of Rick Fairbanks at L-DEO. We obtained a high-quality data set. Finally, the ^{14}C samples were measured at the WHOI AMS facility at a precision of about ±3 to 5‰.

4. Results

The main results of the ARCTIC 91 data set were summarized in the Ph.D. theses of Drs. Dorothea Bauch (Bauch, 1994) and Brenda Ekwurzel (Ekwurzel, 1998). They are related to the following issues:

1. Determination of the fractions and water column inventory of the individual freshwater sources contributing to the Arctic surface waters (river runoff, sea-ice meltwater, Pacific inflow. The results were published in Bauch et al. (1995)

2. Determination of the mean residence times of the surface waters and the Atlantic waters in the Arctic Ocean (Schlosser et al., 1995a,b; Ekwurzel, 1998).

3. Derivation of the mean residence times of Canadian Basin Deep Water (Schlosser et al., 1994, 1997).

Whereas most of the results have been published, the tritium/^{3}He sections will be published in the near future, together with other results summarized in Brenda Ekwurzel's thesis. These results are presently being prepared for publication. We are in the process of finishing three manuscripts for submission to JGR and DSR.

References

Bauch, D. (1994) The distribution of $\delta^{18}O$ in the Arctic Ocean: Implications for freshwater balance of the halocline and the sources of deep and bottom waters. Ph.D. Thesis, University of Heidelberg, February 1994.

Bauch, D., Schlosser, P. and Fairbanks, R.G., 1995. Freshwater balance and the sources of deep and bottom waters in the Arctic Ocean inferred from the distribution of $H_2{}^{18}O$. *Progress in Oceanography*, 35, 53-80.

Ekwurzel, B. 1998. Arctic Ocean water mass circulation and ventilation ages derived from tritium, helium and oxygen-18 tracers. Ph.D. Thesis, Columbia University, May 1998.

Schlosser, P., Kromer, B., Östlund, H.G., Ekwurzel, B., Bönisch, G., Loosli, H.H., and Purtschert, R. 1994. On the distribution of ^{14}C and ^{39}Ar in the Arctic Ocean: implications for deep water formation. *Radiocarbon*, 36, 327-343.

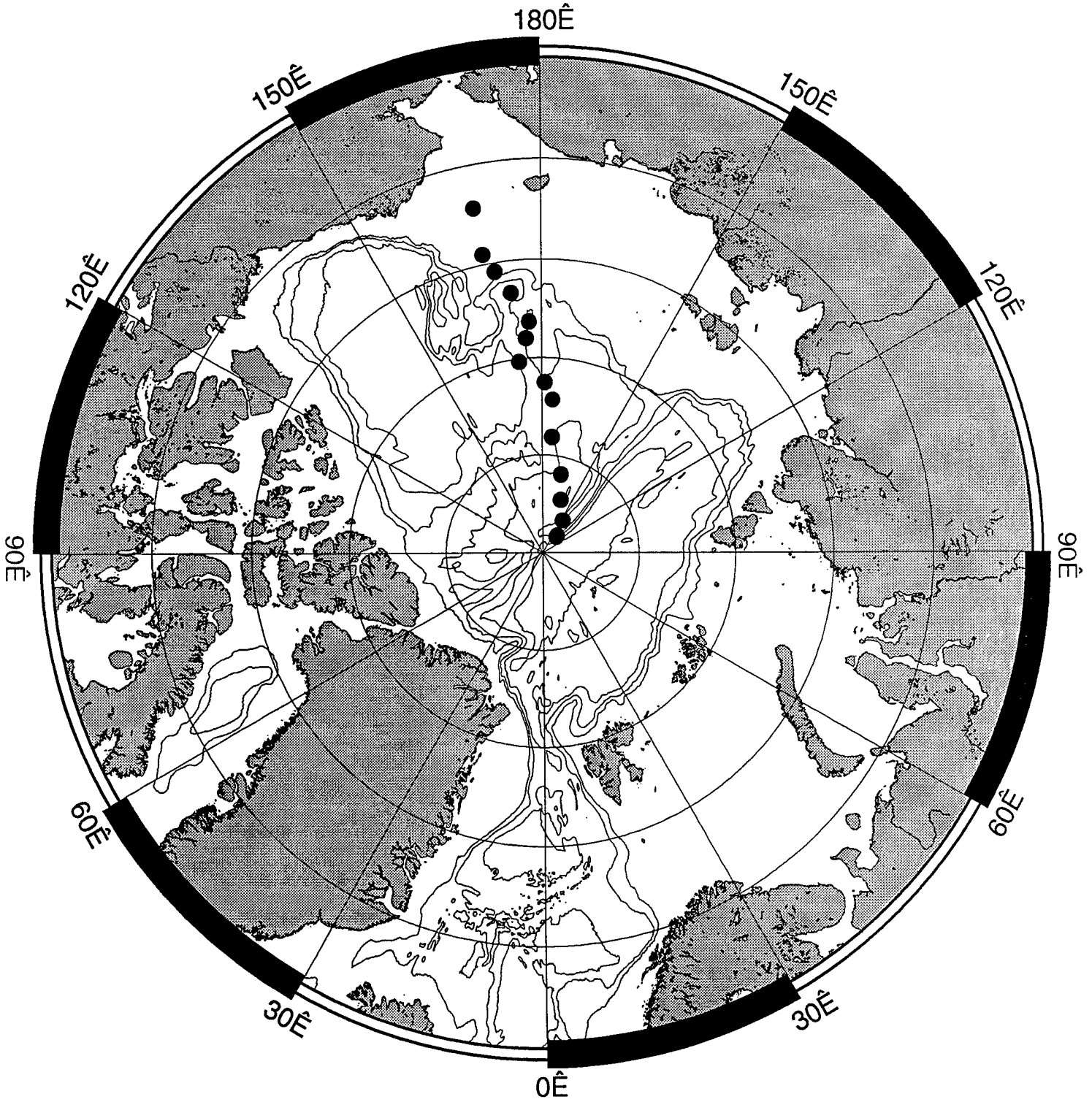
Schlosser, P., Bönisch, G., Kromer, B., Loosli, H.H., Bühler, B., Bayer, R., Bonani, G., Koltermann, K.P., 1995a. Mid 1980s distribution of tritium, ^{3}He, ^{14}C and ^{39}Ar in the Greenland/Norwegian seas and the Nansen Basin of the Arctic Ocean. *Progress in Oceanography*, 35, 1-28.

Schlosser, P., Swift, J., Lewis, D., and Pfirman, S.L., 1995b. The role of the large-scale Arctic Ocean circulation in the transport of contaminants. *Deep Sea Research* II, 42, 1337-1367.

Schlosser, P., Kromer, B., Ekwurzel, B., Bönisch, G., McNichol, A., Schneider, R., von Reden, K., Östlund, H.G., and Swift, J.H., 1997. The first trans-Arctic ^{14}C section: comparison of the mean ages of the deep waters in the Eurasian and Canadian basins of the Arctic Ocean. *Nuclear Instruments and Methods in Physics Research*, B, 123, 431-437.

Figure Caption

Figure 1: Geographical positions of the AOS 94 tracer stations.


180Ê
150Ê
150Ê
120Ê
120Ê
90Ê
90Ê
60Ê
60Ê
30Ê
30Ê
0Ê