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Final Report

Contract, Nonr-2216(06)
NR 307-253

- I. Most of the effort on this contract was devoted to data collection and reduction although three papers were prepared. The field expeditions were coordinated with the Department of Oceanography of the University of Washington and with the Arctic Sciences and Technology Division of the U.S. Navy Electronics Laboratory.
- II. Field Studies Accomplished:
 1. The Barrow tide station was maintained in continuous operation from November, 1959 through October, 1960.
 2. During the Winter - 1960 Transit of the Chukchi Sea by the nuclear submarine SARGO (SSN-583), project personnel carried out an oceanographic program by use of Cessna 180 Aircraft. Seventeen hydrographic stations were occupied between 25 January and 15 May. SARGO recorded a continuous Temperature-Salinity profile through the Bering and Chukchi Seas and the icebreaker USS STATEN ISLAND (AGB-5) occupied hydrographic stations in the northern Bering Sea during this period.
 3. During calendar year 1960, an effort was made to obtain winter, summer and autumn hydrographic data from the waters off the north Alaskan coast. Following the winter program described above (SARGO, STATEN ISLAND, Cessna aircraft operations), USS BURTON ISLAND (AGB-1) and the R/V NATCHIK were staffed by project personnel in cooperation with the University of Washington for the summer program. BURTON ISLAND occupied 38 oceanographic stations, mostly off Mackenzie Bay and in the eastern Beaufort Sea. The NATCHIK obtained useful data near Barrow, but her sampling program was hampered by poor weather and somewhat unfavorable ice conditions. The program was continued during October and November 1960 with project personnel using USCGC NORTHWIND (WAGB-282) in cooperation with the Navy Electronics Laboratory and the University of Washington. This expedition was especially rewarding and 117 oceanographic stations were occupied from Mackenzie Bay to Herald Island and south to Bering Strait.

FEB 18 1963

4. During the spring and summer 1961, field work was cancelled so that Allan Beal could attend the Army Language School at Monterey, California, to study Russian. While this cancellation made it impossible to carry out the sampling program in the lagoons along the Alaskan coast which had been scheduled for April and May 1961, it was felt that the opportunity to learn Russian so that Soviet Arctic literature can be reviewed was one that could not be passed up.

5. During October and November, 1961, project personnel was again in the field on board NORTHWIND. An Electronic Position Indicator controlled bathymetric survey of the western Chukchi Sea was accomplished from 170° W. Longitude west to the Siberian Coast and from Bering Strait to 73° N. Latitude.

6. During August-September, 1962, the bathymetric survey of the western Chukchi Sea carried out in 1961 was extended north and west by Allan Beal. Complete coverage has been obtained to 75° N. Lat., from 169°45' W. Long. to 180° Long., including the area north of Wrangel Island. Additional lines of soundings were obtained as far north as 79°11' N. Lat. USS BURTON ISLAND (AGB-1) was used for this survey. Position control was by Electronic Position Indicator.

III. Data reduction accomplished.

1. Tide records obtained by the Barrow tide station during 1959-60 have been reduced to monthly mean sea level values.

2. The temperature-salinity profiles obtained by the nuclear submarines USS SKATE (SS(N)-578) in 1959 and USS SAPGO (SS(N)-583) in 1960 were reduced by an engineering aid paid from contract funds. Publication of these data is awaiting publication of detailed track charts of these expeditions.

3. All temperature and salinity data from the field expeditions have been reduced and evaluated.

4. The bathymetric survey of the western Chukchi Sea carried out during 1961 has been completed. The additional soundings taken during August and September 1962 are now being incorporated into the previous surveys.

5. A series of tide records from Point Barrow obtained between July 1956 and January 1959 were reduced to twice daily sea level values by IBM 650 computer using Groves' numerical filter. These sea level data have been plotted against local wind data from Barrow and Cape Prince of Wales -- all of which have been plotted against water transport through Bering Strait. For periods of as long as ten days at a time, the Barrow sea level seems to show a relationship to water transport through Bering Strait. Additional wind data from coastal stations in Alaska and Siberia have recently been obtained for use in this analysis. If the additional plots suggest a correlation between daily sea level at Barrow, wind over the Chukchi Sea and water transport through Bering Strait, it is planned to use available autocorrelation programs for computer analyses of these data. Such techniques are often rewarding, but must be used with caution since large blocks of computer time are required.

IV. Results to date.

All data have been reduced at the end of each field expedition at least to the point where results could be evaluated and used in planning the next phase of the field work.

The manuscript on Seasonal Sea Level Variation at Point Barrow was delayed when data from Soviet IGY tide stations became available. This paper has now been rewritten to include the Soviet information as well as certain of the hydrographic data obtained during 1959 and 1960. The Abstract follows:

SEASONAL VARIATION IN SEA LEVEL IN THE ARCTIC OCEAN

by

M. Allan Beal

Abstract: Values for monthly mean sea levels from seven tide stations demonstrate a seasonal variation in the Arctic ranging from 27 cm. to 65 cm. The low stand occurs during late winter, February, March, April, along all the Arctic coasts. The high stand occurs at different times in two distinct regions:

- (1) The Siberian coast, from Murmansk to the Laptev Sea. This region shows highest sea level during winter; November, December and January.
- (2) The East Siberian Sea and the North American Arctic shows highest sea level during late summer; August, September, October.

Hydrographic and atmospheric pressure data from Barrow, Alaska show that specific volume variations in the waters off the north Alaskan coast and seasonal pressure changes explain, almost completely, the seasonal variation recorded at the station. It is suggested that the high in the Murmansk-Laptev Sea region is related to the seasonal sea level variation in the Atlantic. Although direct evidence is lacking, hydrographic and pressure data from the Central Arctic shows that a seasonal variation in sea level may occur well offshore.

A 30 minute paper on "Some Seasonal Variations in the Waters off the North Alaskan Coast" was presented at the Alaskan Science Conference in 1959 by Allan Beal.

A joint paper with Dr. Joe Creager of the University of Washington entitled "Pleistocene Drainage of the Chukchi Sea" is in manuscript. This paper is based on the survey carried out by NORTHWIND during 1960 and survey work by the R/V BROWN BEAR of the University of Washington in the southeastern Chukchi Sea.

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