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Sea-ice investigations on *Nathaniel B. Palmer:* Cruise 92-2

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In this and accompanying reports (see references), we present preliminary results of studies made on sea ice in the western Weddell Sea, in May and June of 1992 aboard the vessel *Nathaniel B. Palmer.* This work was done to complement the sea ice program during the deployment of Ice Station Weddell #1(ISW) (Ackley and Lytle et al. 1992; Ackley and Lytle 1992). Our principal objective was to obtain some regional depiction of the ice properties and processes over several scales, from microstructural properties, to the variability of ice types, over the length of the track.

Several of the measurement programs were similar to those on ISW, where the ice properties were monitored over a period of four months, and the objective was to examine the evolution of the different sea-ice processes over several months. The measurements aboard the ship will help to expand these time series results to a larger region and to determine how typical or atypical the ice types seen around the camp are of the region.

The shipboard scientific team had ten members as listed in the table. Five members were associated with the Young Scholars Antarctic Research Experience (Darling et al. 1992).

The *Nathaniel B. Palmer* left Punta Arenas, Chile on 22 May entering the ice edge on 24 May; she again left the ice edge on 19 June, arriving back in port on 22 June. About six days were spent recovering the equipment and personnel from the ISW in conjunction with the Russian Icebreaker *Academik Federov.* Data were collected on both the inbound and outbound legs of the cruise and consisted of observations collected both while the ship was stopped at ice stations and while the ship was underway.

The vessel stopped for a total of 14 full ice stations and 1 coring station (see figure of cruise tracks with ice stations). A complete ice station consisted of :

a. The collection of four cores to be used in determining the physical and structural characteristics of ice, biochemical studies of ice and entrapped brine, salinity profiles, and dielectric measurements (Gow et al. 1992).

b. Snow-pit studies in which physical property measurements were made of the snow. Snow temperatures, grain sizes, crystal types, densities, salinities, and dielectric properties were examined as a function of depth in the snow pack (Lytle and Ackley 1992).

c. Snow surface elevation surveys in which the snow elevation above sea level, snow thickness, and ice level measurements were made along 100 meter lines at 0.5 meter spacing. When time permitted, ice thickness holes were drilled at 10 meter increments along the profile lines (Lytle and Ackley 1992).

d. Radar backscatter investigations of snow thickness and snow/ice interface characteristics (Yankielun and Ackley 1992).

With the exception of the radar measurements, these studies were similar to those collected on ISW, and will be compared to extend the detailed snow and ice measurements over a broader region than could be accomplished from the camp. While much of the data is still being analyzed, a few observations can be readily compared.

The ice types seen during the cruise were similar to those monitored for about four months on ISW. The ice types on the camp varied from new thin lead-ice, to medium thick first-year to thick deformed old ice with initial thickness ranging from 0.5 to 4 meters. The ice cores collected on the ship ranged from 0.59 to 2.3 meters, with ice types similar to those sampled on the camp, with the exception of very thick deformed ice. Although we did encounter thick deformed floes, in general we sampled the smoother, thinner sections of the floe in order to examine the growth sequence as reflected in the crystalline texture and other physical properties.

Underway observations: While the *Palmer* was traveling through the ice, several types of data were collected on a regular basis. Although these are not directly comparable to observations collected on ISW, they will be used to extend the detailed ice and snow data collected during the ice stations described above and at ISW over a larger area.

a. A 24-hour record of sea ice observations was maintained from the bridge of the ship. These observations included: total ice

Shipboard scientific team

Ice team personnel	Affiliation	Specialty
A.J. Gow, leader	CRREL	Ice Properties
V.I. Lytle, co-leader	CRREL/Dartmouth	Sea Ice Geophysics
N.E. Yankielun	CRREL/Dartmouth	Sea Ice Electro-magnetics
P. Sullivan	Univ. S.California	Ice Biology
D. Bell	NRL	Sea Ice Geophysics
B. Castillo	Univ. Chicago	NSF Young Scholar
M.N. Darling	Princeton Univ.	NSF Young Scholar
R. Swayzer	Xavier Univ.	NSF Young Scholar
P. Amati	Holliston H.S.	Biology Teacher
J. Cavanaugh	Escondido H.S.	Physics Teacher

concentration, ice types and percent concentration, floe size, ice and snow thickness, and surface topography (Darling et al. 1992). Concurrently with the ice observations, an iceberg log was kept. The size of the iceberg and the distance from the ship was measured using the ship's radar. As many as 73 icebergs were counted within a 44-kilometer radius of the ship. Whenever possible, and if the iceberg was visible, the type of iceberg was recorded, and the height measured using a sextant. Initial analysis of the ice observations indicate that ISW was in a region of old, thick ice, which extends north along the Antarctic Peninsula, splitting into two branches at about 62° S latitude (Darling et al. 1992).

b. Sea-ice algae observations were recorded during daylight hours making a note of the frequency of floes with brown algal layers, the position within the ice of the algae layer, and the ice type of the observed floes. In addition to recording these observations, measurements were made of the algae concentration from ice cores collected on both the camp and the ship (Sullivan et al. 1992).

c. An acoustic sounder was used to measure ridge height and frequency while the ship was underway. The device uses an acoustical transducer to measure the distance from its fixed height on the ship to the surface of the snow (Lytle and Ackley 1991). Using the results from this device, the ridge heights and frequencies can be calculated. The results from this device will be compared to the aerial photographs taken during the ice station (Ackley and Lytle et al. 1992).

d. Visual and infrared satellite imagery were collected by the ship's personnel during the cruise. These AVHRR and Defense Meteorological Satellite Program images will be used in conjunction with ice observations to estimate the percent ice coverage over the Weddell Sea, and to identify regions of high deformation. Individual leads which persist for several days can be identified in these images, and can be used to estimate the variations in drift rate in different regions of the Weddell Sea. In combination with the meteorological data collected onboard, these drift rates will then be compared with the data collected on ISW.

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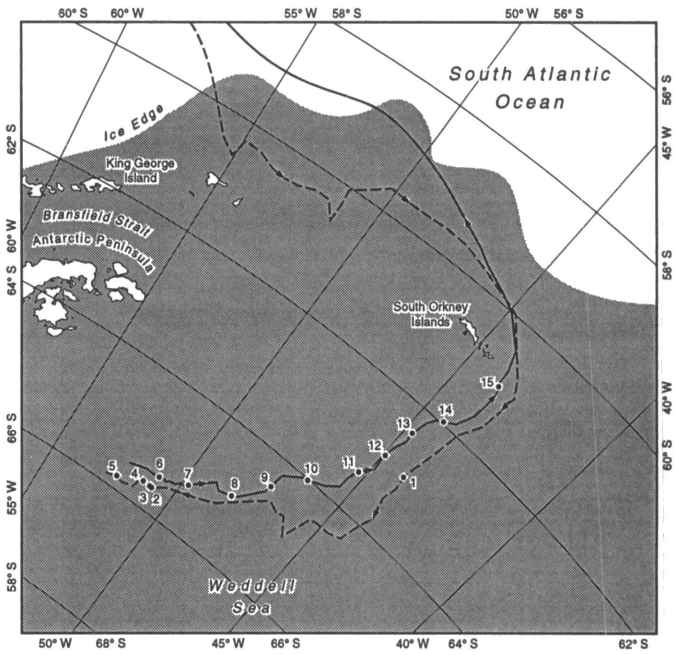

Track of the *Nathaniel B. Palmer* during Cruise 92-2. The ice stations are indicated. Five stations were occupied on the inbound leg and ten stations on the outbound leg.

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