

International Weddell Sea Oceanographic Expedition—1970

Physical and Chemical Investigations of the Weddell Sea Coastal Current

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From mid-February to mid-March 1970, an oceanographic investigation of the eastern Weddell Sea coastal current was conducted from USCGC *Glacier* as part of the International Weddell Sea Oceanographic Expedition—1970 (see map). The current has been hypothesized as a major component in the formation of Antarctic Bottom Water (Seabrooke, Hufford, and Elder, in press), but only a few observations have been made in it. The IWSOE-70 program consisted of sampling the coastal current at 32 stations using Nansen bottles, a continuous salinity-temperature-depth recording system with a Niskin rosette sampler, and current meters. Water samples were analyzed aboard ship for temperature, salinity, dissolved oxygen, inorganic phosphate, nitrate, nitrite, and silicate. A summary of the oceanographic station activities is given in the table.

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IWSOE-70 oceanographic station summary

Station No.	Position		Nansen Station	Nansen deep	STD	Niskin	Core	Bottom photos	Vertical plankton tow	Chemistry					Depth in meters	Date 1970
	S. Lat.	W. Long.								O ₂	NO ₂	NO ₃	PO ₄	SiO ₃		
#1	74°21.5'	38°18'	X		X	X	X		X	X	X	X	X	512	Feb. 19	
2	76°35.6'	31°45.0'			X	X		X		X	X	X	X	390	Feb. 21	
3	76°50.4'	32°30.0'			X					X	X	X	X	310	Feb. 21	
4	76°55.1'	32°47.5'			X		X			X	X	X	X	322	Feb. 21	
5	77°26.5'	36°01.7'	X		X	X	X	X	X	X	X	X	X	901	Mar. 01	
6	77°34.6'	35°39.9'	X		X	X	X	X	X	X	X	X	X	585	Mar. 03	
7	77°33.0'	35°38.1'			X									575	Mar. 03	
8	76°24.6'	30°36.2'	X			X			X	X	X	X	X	320	Mar. 06	
*9	75°25.5'	26°28.5'			X		X							238	Mar. 07	
10	75°25.5'	26°28.5'	X			X			X	X	X	X	X	235	Mar. 08	
11	75°25.5'	26°28.5'			X									235	Mar. 08	
12	75°25.5'	26°28.5'	X			X		X	X	X	X	X	X	235	Mar. 08	
13	75°25.5'	26°28.5'			X									235	Mar. 08	
14	75°25.5'	26°28.5'	X			X			X	X	X	X	X	235	Mar. 09	
15	75°25.5'	26°28.5'			X									235	Mar. 09	
16	75°25.5'	26°28.5'	X			X			X	X	X	X	X	235	Mar. 09	
17	75°25.5'	26°28.5'			X									235	Mar. 09	
18	74°54.0'	27°14.4'	X		X	X			X	X	X	X	X	410	Mar. 10	
19	74°52.3'	25°47.1'	X		X	X	X	X	X	X	X	X	X	481	Mar. 10	
20	74°28.5'	25°40.6'	X		X	X	X		X	X	X	X	X	506	Mar. 11	
21	73°58.7'	23°39.0'	X		X	X	X		X	X	X	X	X	274	Mar. 11	
22	73°38.0'	23°40.0'	X		X	X	X		X	X	X	X	X	1456	Mar. 11	
23	72°08.2'	24°08.8'	X		X	X	X		X	X	X	X	X	4078	Mar. 12-13	
24	71°14.8'	24°32.0'	X	X		X	X		X	X	X	X	X	4200	Mar. 13-14	
25	70°25.2'	24°33.1'	X		X	X	X		X	X	X	X	X	4279	Mar. 14	
26	69°31.2'	24°57.2'	X			X	X	X	X	X	X	X	X	4572	Mar. 14-15	
27	71°03.3'	13°16.0'	X		X	X			X	X	X	X	X	1920	Mar. 15-16	
28	71°04.0'	12°09.2'			X	X	X		X					1189	Mar. 17	
29	71°10.0'	12°22.7'	X			X								465	Mar. 17	
30	70°57.5'	11°21.6'			X									320	Mar. 17-18	
31	70°21.0'	08°55.0'	X			X	X		X	X	X	X	X	503	Mar. 18	
32	70°20.8'	07°29.8'			X		X							740	Mar. 18	

*Current-meter stations taken at Stations 9 through 18 (Halley Bay).

IWSOE-1970 Piston-Coring Operations

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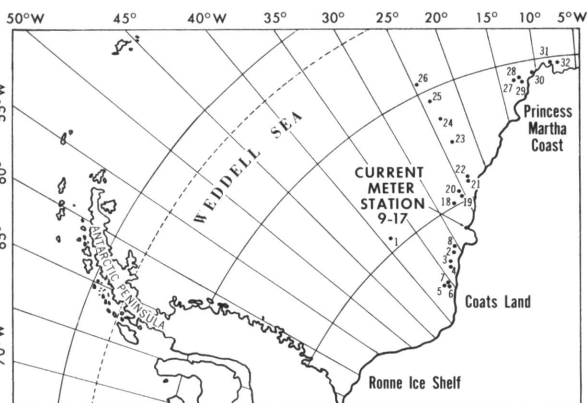
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During the International Weddell Sea Oceanographic Expedition—1970, a total of 20 piston cores was obtained (see map). They averaged 3.28 m in length, with a range of 0.16–6.5 m, and came from depths between 233 and 4,612 m. Six Phleger cores with an average length of 35.5 cm were also obtained. The totals and averages from IWSOE-1969 and 1970 are listed in the table.

The cores were taken with an Alpine Model 205–206 piston corer and labeled by date and station number. The station number, depth, location, and preliminary sediment description were recorded for each core. Plastic core liners containing the sediment were capped, waxed, sealed in tin liners, and placed in the ship's refrigerator for storage. Refrigeration of core material was continuous en route from the Weddell Sea to the Albuquerque storage facility.

Preliminary sediment observations indicate a prevalence of poorly sorted material at depths less than 1,000 m. This material is similar to deposits of the Ross Sea (LeFever *et al.*, 1969). Sediments appear to be better sorted at greater depths. Rock fragments occurring within the samples include basalt, gabbro, granite, gneiss, and schist.

Preliminary microfaunal investigations of bottom samples reveal an abundance of both benthonic and planktonic Foraminifera. The benthonic fauna



IWSOE-1970 station location chart.

Preliminary results indicate that the coastal current existed from the surface to abyssal depths in the eastern Weddell Sea. Over the continental shelf, the current decreases in temperature and increases in salinity as it flows south into the Weddell Sea during the austral summer (Cape Norvegia: 0.0°C ., $<34.0^{\circ}/_{\text{oo}}$; near General Belgrano Station: $>-1.4^{\circ}\text{C}$., $34.59^{\circ}/_{\text{oo}}$). These changes may be due to alteration of the shelf water as it flows south along the extensive ice shelves of the east coast.

The Warm Deep Layer (Deacon, 1963) was detected from the edge of the shelf to a depth of 1,600 m. This water mass is believed to be carried into the Weddell Sea by the Circumpolar Current and to contribute to the coastal current.

The origin of the bottom water in the eastern coastal current is unknown. Temperatures are higher ($>-0.3^{\circ}\text{C}$.) than in the classical definition of the Antarctic Bottom Water (-0.4°C .), and the direction of flow is into the Weddell Sea. Further investigation is necessary to determine the origin of the bottom water.

Water over the continental shelf below 50 m was quite homogeneous in nutrient content from station to station. Phosphate, nitrate, and silicate concentrations were all higher than the winter maxima seen in temperate regions. The nutrient concentrations will be used with the temperature and salinity data to trace the coastal current as it penetrates the southern Weddell Sea. Wide variations in temperature and salinity as well as nutrients in the upper 50 m were due mainly to local ice conditions.

References

- Deacon, G. E. R. 1963. The Southern Ocean. In: *The Sea*, Vol. 2, p. 281–296. John Wiley and Sons, New York.
- Seabrooke, J. M., G. L. Hufford, and R. B. Elder (in press). The Formation of Antarctic Bottom Water in the Weddell Sea.

