WHP Cruise Summary Information

WOCE section designation	A16S
Expedition designation (EXPOCODE)	318MSAVE5
Chief Scientist(s) and their affiliation	William Smethie, LDGO; Mike McCartney, WHOI
Dates	1989.01.23 – 1989.03.08
Ship	MELVILLE
Ports of call	Cape Town, South Africa to Montevideo, Uruguay
Number of stations	73
Geographic boundaries of the stations	32°16.70''S 50°15.60'W 00°59.10''E 53°58.10''S
Floats and drifters deployed	none
Moorings deployed or recovered	none
Contributing Authors	none listed

WHP Cruise and Data Information

Instructions: Click on items below to locate primary reference(s) or use navigation tools above.

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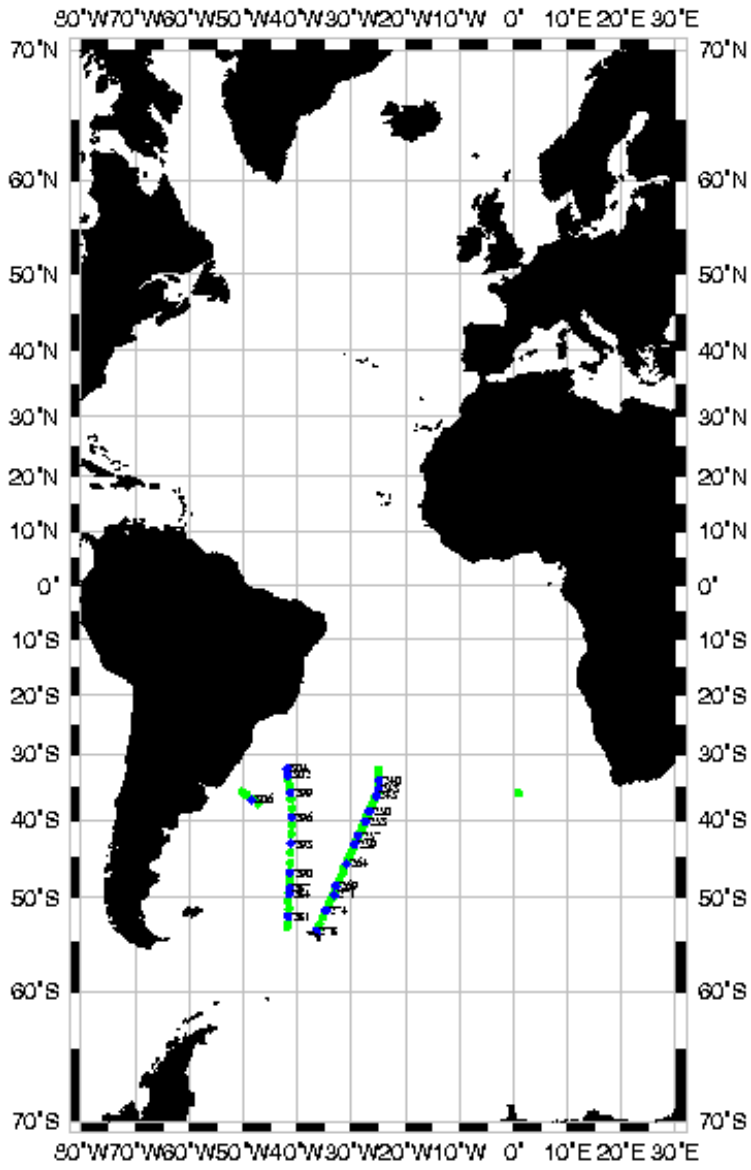
Description of stations	
Description of parameters sampled	
Underway Data Information	
Bathymetry	
XBT and/or XCTD	
	Data Status Notes

Station locations for a16s



(Produced from .SUM files by WHPO)

CRUISE REPORT - A16S

EXPEDITION DESIGNATION: SAVE Leg 5 or HYDROS 3

CHIEF SCIENTIST: William Smethie, LDGO

CO-CHIEF SCIENTIST: Mike McCartney, WHOI

SHIP: R/V Melville

PORTS OF CALL: Cape Town, South Africa to Montevideo, Uruguay

CRUISE DATES: January 23 to March 8, 1989

CRUISE DESCRIPTION

Leg 5 of SAVE (denoted Hydros 3 by Scripps) was carried out on the R/V Melville and was actually a combination of a meridional section across the Argentine Basin at 41°W and a short section perpendicular to the western boundary at about 35°S planned as part of SAVE, and the southern end of a meridional long line in the Atlantic Ocean planned by M. McCartney, L. Talley and M. Tsuchiya that extended from 32.5°S, 25°W to South Georgia Island.

The cruise departed from Capetown on January 23, 1989 at 1400. The first station, a reoccupation of AJAX station 44 at 36°S, 1°E, was taken on January 26. Work began on the 25°W line on February 1 with station 237 taken at 32°30'S, 25°00'W. The southernmost station (278) just north of South Georgia Island was taken on February 17. The station spacing was about 30nm along this line. The section along 41°W (stations 279-304) was occupied between February 18 and March 2 with a station spacing of about 65nm. The portion of the western boundary section outside Uruguay's 200 mile zone (stations 305-308) was taken between March 4 and March 6. Stations inside Uruguay's 200mile zone were taken on the following leg when an Uruguayan observer was on board. The cruise ended in Montevideo on March 8, one day later than scheduled. The one-day delay was caused by a break down of the main engine, which was repaired at sea.

The total number of miles steamed was 5989 and the total number of CTD- rosette stations occupied was 73. These stations were taken using a Neil Brown CTD interfaced to a Scripps Ocean Data Facility rosette equipped with thirty-six 10-liter bottles. At 13 of the stations large volume samples were collected using Gerard barrels. Generally 18 large volume samples were collected between the surface and the bottom. The total steaming time for the cruise was 25 days, 15 hours and the total station time was 17 days, 5 hours. Originally, 81 stations had been planned, but 8 stations were dropped because of time lost during rough weather. Approximately 1.25 days were lost because of slow steaming and greater time required to complete casts in rough weather and an equal amount of time was lost because of equipment failures during rough weather. Most of the equipment failures were Gerard barrels not tripping properly and breaks in the CTD termination.

SHIPBOARD PROGRAMS

Samples collected and analyzed. The core program consisted of XBT and CTD profiles; on board analysis of water samples for salinity, oxygen, nutrients (phosphate, nitrate, nitrite, silica), CFMs, total CO_2, and pCO_2; and collection of samples for shore based analysis for tritium, helium-3, carbon-14, radium-228, radium-226, krypton-85, and argon-39.

Ancillary programs carried out on this leg were transmissometer profiles taken with the CTD profiles, on board analysis and collection of samples for shore based analysis for suspended particulate matter, and collection of samples for shore based analysis for barium, neodynium and total CO_2. Also air samples were collected for C-13 and C-14 measurements in methane.

Rosette sampling

Ten-liter water samples were collected using a dual rosette system that held 36 bottles (12 on an inner rosette and 24 on an outer rosette) interfaced to a CTD. Sampling depths were determined after viewing temperature, salinity, density, oxygen, and percent transmission from the down cast. Generally 36 samples were collected with the bottom samples between 10 and 5m from the bottom.

Samples were drawn from the rosette using the following procedure. A sampling director, nominally one of the co-chiefs, choreographed the draw sequence for all Niskin bottles, and recorded bottle numbers as samples were taken. This was not simply a passive, recording-secretary role; but an interactive, real time scheduling process to minimize total gas sample draw time and maximize efficient use of personnel. The sampling sequence was: a) CFMs, b) Helium-3, c) Oxygen, d) pCO_2, e) TCO_2, f) Tritium, g) Nutrients, h) Salinity, i) Suspended particulates.

However, only oxygen, nutrients and salts were drawn from all bottles on all stations. On 3 stations, neodynium samples were collected after the salinity samples and on 5 stations, barium samples were drawn after salinity. At two stations, vertical profiles of Keeling total CO_2 samples were collected. Two bottles were tripped at each depth where these samples were collected an additional rosette cast at these stations. Keeling CO_2 samples were also collected at the surface every 2.5 of latitude between 32.5°S, 25°W and South Georgia Island.

Sampling started with the bottom bottle (#36), 15-20 minutes after the rosette arrived on deck. On typical stations all gas sampling was completed within 1.5 hours of the time the first bottle was opened and all gas samples were usually drawn within 6 minutes after any particular bottle was opened.

Large Volume Sampling

Large volume samples (25Cl) were collected for carbon-14, radium-228, krypton-85, and argon-39. These constituents were extracted from the water on board ship and returned to various shore based laboratories for analysis. The water was collected using Gerard barrels (one barrel per sample except for argon-39 which required 6). Also barium samples were collected from the Niskin bottles attached to Gerard barrels. Vertical profiles consisting of 18 samples were obtained by performing two 9-barrel casts. Normally, the deep cast would be performed first, followed by the CTD-rosette cast and the shallow Gerard cast. When Ar-39 samples were collected, 6 Gerard barrels were hung with 10m spacing and lowered to the desired depth.

Underway/XBT Program

XBT casts were usually taken between CTD stations. Where the station spacing was 30nm, one XBT was taken and for greater spacing 2 XBTs were taken. The XBT casts were accompanied by water samples for dissolved oxygen, pCO_2, salinity and nutrients taken from the Melville's clean seawater line.

Bathymetry

Depth was measured continuously along the entire cruise track using a 12KHz precision depth recorder. The raw data was digitized by hand at 5minute intervals and a tape of the reduced data will be produced by the Geological Data Center at Scripps.

The number of the various types of samples collected is summarized in Table 1.

TABLE 1

Parameter	# of samples
discrete salinity	3179
discrete temp.	546
oxygen	2530
nutrients	2517
CFMs	1592
Helium-3	346
Tritium	346
TCO_2	1040
PCO_2	845
suspended part.	369
Keeling $C0_2$ Neodynium	20
Barium	280
C-14	187
Ra-228	237
Kr-85	87
Ar-39	13
XBTs	60

SOME HIGHLIGHTS

Station locations, and vertical sections of potential temperature, salinity, and oxygen along 41°W and between 32°30'S, 25°00'W and South Georgia Island are presented in another section of this report.

The Argentine Basin contains several of the oceans major water masses. Antarctic Intermediate Water (AAIW) is observed in both sections as a salinity minimum. This minimum occurs at about 900m at the northern end of the sections and shoals to the surface at about 50°S.

North Atlantic Deep Water (NADW) is observed as a plume of high salinity, high oxygen, low CFM water extending southward in both sections centered at about 2700-3000m. The NADW mixes with Circumpolar Water (CPW) at higher latitudes and the NADW characteristics are diminished. However, the salinity and oxygen maximum and CFM minimum are observed as far as 50°S in the NADW-CPW mixture. The NADW characteristics are stronger in the 41°W section than the section ending at South Georgia Island indicating mixing between these two water masses as both flow eastward with the Circumpolar Current.

The densest water was observed behind the Falkland Ridge in the South Georgia Basin. This water was cold (-0.15) with a low salinity (34.65- 34.66), high oxygen concentration (5.4-5.6ml/l) and high F-11 concentration (0.3-0.4pmol/kg) and originated in the deep Weddell Sea. Water with these characteristics, but less intense, was also observed north of the Falkland Ridge. Along the 41°W section, cold, low salinity, high oxygen, high CFM water, intermediate in intensity between that observed to the south and the north of the Falkland Ridge, was observed tightly banked against the base of the Ewing Bank. This indicated that this water entered the Argentine basin from the South Georgia Basin by flowing around the western end of the Falkland Ridge and then proceeded to flow westward along southern boundary of the Argentine Basin. There was also a less intense version of this water further north. The occurrence of this water north of the southern edge of the Argentine Basin and to the north of the Falkland Ridge is in agreement with data taken along 47°S on leg 4 which showed the coldest, lowest salinity, highest oxygen, highest CFM deep water to be on the eastern side of the section. This indicates that deep water from the Weddell Sea also enters the Argentine Basin east of the Islas Orcadas Rise, but further analysis and perhaps more stations will be required to determine the specific route this water takes as it flows into the Argentine Basin.

Oceanographic Data Facility
Shipboard Technical Support
Scripps Institution of Oceanography

318MHYDR4
A16c (HYDROS 4, pre-WOCE)
Talley/Tsuchiya

318MSAVE5
A16 (HYDROS3, SAVE5, pre-WOCE)
Smethie/McCartney

32OC202-1
A16 (MCTT - N. Atlantic, pre-WOCE)
McCartney/Talley/Tsuchiya

Data status: public. CTD data do not seem to be available in WHP format except for 32OC202-1, although they are all available at NODC
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sum: no errors for all three
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hyd: no need to sort since Gerard casts are not included
no CFC's, tritium or helium included