

DATA DOCUMENTATION (NOAA form 24-13)

A. Originator Identification

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2. (none)
3. EN-239 Leg 1 and Leg 2
4. R/V ENDEAVOR
5. Ship
6. USA, USA
7. 7/12/92 - 8/9/92
8. No
9. No
10. (same as 1)
11. WMO squares 7307 and 7207

B. Scientific Content

1. XBT isotherm data: one degree C increments
2. Sea-Bird 911plus CTD data:
pressure (dbar), temperature (deg. C), salinity (psu), oxygen (ml/l), light transmissivity (%), conductivity (S/m), depth (m), potential temperature (deg. C), potential density (for various reference depths), buoyancy frequency (both rad/sec and cph), and data quality
3. Hydrographic data from water samples:
pressure (dbar), depth (m), temperature (°C), salinity (psu), light transmissivity (%), oxygen (ml/l), nitrate (µM), phosphate (µM), silicate (µM).

C. Data format

1. Ascii text files
2. Header, including cruise name, general notes, drop specifics such as location and depth, data column header line, data. The header line and data are all tab delimited.
3. (not applicable)
4. Fritz Stahr, 206-543-7886

D. Instrument Calibration

1. Sea-Bird 911plus T/C pairs both pre- and post-cruise (6/5/92 and 9/9/92).
2. Sea-Bird oxygen sensor pre- and post-cruise (11/10/91 and 9/10/92).
3. Paros Scientific Digiquartz pressure sensor: 4/15/88.
4. Sea Tech Transmissometer: 7/2/92.

SPECIAL NOTES:

The following notes are extracted mostly from the cruise report to which the reader is referred for more detail: T.B. Sanford, et al., 1996, "R/V Endeavor 239: Cruise Report and Preliminary Results", Technical Report, APL-UW TR-9603, April 1996.

A. Files Submitted to NODC:

CTD-01 was a test cast and therefore there are no files for it. CTD-32 and -39 were tow-yos and therefore there are no files being submitted, however they can be made available by special request to the PI. There were no water samples taken on CTD-11, therefore there is no ".BTL" file for it.

B. Equipment:

The Conductivity, Temperature, Depth (CTD) system on Endeavor Cruise 239 consisted of the following components:

- A General Oceanics (GO) water-sampling rosette and frame with twelve 5-liter Niskin bottles (supplied by University of Rhode Island (URI) Tech Services)
- A Sea-Bird Electronics (SBE) CTD, Model 911-plus, with dual pairs of temperature and conductivity sensors and a Paroscientific Digiquartz 10-kpsia pressure sensor in a housing rated to 6800 m (all supplied by APL-UW)
- An SBE Model 23 oxygen sensor, tested and calibrated with the above CTD (supplied by URI)
- A Benthos altimeter, Model 2110 (supplied by the Scripps Ocean Data Facility)
- A SeaTech 25-cm transmissometer, Model TR5025 (supplied by URI Tech Services)
- A D&A Instruments Model OBS-3B optical backscatter (turbidity) sensor (by APL-UW)

The Expendable Bathythermographs (XBTs) used on Endeavor 239 were all Sippican Inc. Model T-7s capable of 760-m depth, although some were dropped in shallower water. The launcher was located aft on the port side and was connected through a Bathy Systems Model SA-810 XBT controller to a URI computer in the main laboratory. Data were stored directly on the hard drive and later archived onto floppy disks.

C. Data Processing:

All electronic CTD systems were checked and calibrated by Sea-Bird Electronics both before and after the cruise. The wet chemistry systems were calibrated by their respective institutions (URI, SIO, and UW).

1) Water Sample Analysis

The water collected in the Niskin bottles on the CTD rosette was analyzed for nutrient, oxygen, salinity and suspended sediment content. Nutrient and oxygen concentrations were measured as quickly as possible by Doug Matsen from the SIO Ocean Data Facility. The oxygen samples were taken from the rosette first, and the nutrient samples second. Shipboard salinity determinations were done by Bill Fanning of URI Marine Technical Services. These were taken from the rosette next. On five particular casts, duplicate salinity samples were taken for analysis at the University of Washington. They were analyzed after the cruise by Kathy Krogsland at the UW School of Oceanography both as a control for shipboard determinations and for comparison with the CTD results. The suspended sediment content was analyzed by Fritz Stahr (APL-UW) by filtering the water remaining in each rosette bottle.

The samples used to determine oxygen concentration were collected and titrated in volume-calibrated, 125-ml iodine-determination flasks. The modified Winkler technique of Carpenter (1965) was used for the analysis. However, instead of using a starch endpoint indicator, a computer-automated system created at SIO determined the endpoint optically. A standardized sodium-thiosulfate solution was titrated into the sample while the light transmittance at 365 nm (UV) was monitored by a detector and PC computer. The computer controlled a Metrohm 665 Dosimat 1.0-ml titration burette and determined the endpoint based on when the transmittance stopped increasing. This system delivered a repeatable and reliable oxygen-concentration value independent of the operator.

Dissolved nutrient concentrations were determined for nitrate+nitrite, nitrite, phosphate, and silicate using a modified continuous-flow autoanalyzer from SIO. Nitrate+ nitrite was analyzed according to the basic method of Armstrong et al. (1967). Nitrate is reduced to nitrite in a column of copperized cadmium filings and reacted with sulfanilamide and N-(1-naphthyl)ethylenediamine dihydrochloride to form a red azo dye which is analyzed at 542 nm. Nitrite alone is analyzed

without reduction, and the difference between nitrate+ nitrite and nitrite yields the nitrate concentration. The phosphate analysis is a modification of the procedure of Bernhardt and Wilhelms (1967) using dihydrazine sulfate as a reductant. The silicate analysis is a modification of the method of Armstrong et. al. (1967) using stannous chloride as the reductant. Both phosphate and silicate analyses are carried out at 820 nm.

Salinities were determined for each sample using an Autosol 8400A on board the ship. About 1 month after the cruise, a similar model was used at UW to find the salinity of samples returned from casts 15, 20, 30, 31, and 41. These casts were chosen because they were the "calibration" casts where one of the AVP's TC sensor pairs replaced the usual secondary set on the CTD. Comparisons indicate little difference between the values.

In the files labeled "CTD_nn.BTL", the oxygen and nutrient concentration values are recorded along with pressure, depth, temperature, salinity and transmissivity from the SBE 911-plus system for each bottle depth. Each file includes a header section to indicate cruise name, location, etc.

2) CTD Data

The two pairs of temperature and conductivity sensors and an oxygen sensor were mounted on the CTD cage. The temperature measurements were accurate to better than 1 m°C, and the salinity measurements (derived from temperature and conductivity) to better than 0.002 psu. The uncertainty in the pressure measurements was less than 1.5 dbar under all conditions and was less than 0.75 dbar at depth. Precruise calibrations were conducted in June 1992 and postcruise ones in September (except for oxygen sensor #230302 which was not calibrated postcruise). The table below shows the model and serial numbers of the sensors.

Platform	Temperature (Model 3)	Conductivity (Model 4)	Oxygen (Model 23)
CTD 1 (primary)	S/N 843	S/N 484	S/N 230313
CTD 2 (secondary)	S/N 844	S/N 485	
AVP1	S/N 1248	S/N 971	S/N 230303
AVP2	S/N 703	S/N 330	S/N 230302

Both the primary and secondary temperature sensors on the CTD were deemed "unhealthy" during the postcruise calibration. Nordeen Larsen at SBE found that a faulty capacitor in the Model 3 temperature sensors was responsible for their abnormal behavior. In addition, the thermistor in the primary sensor was not properly soldered; fortunately, the only problem was a slow response to temperature changes. The time constant of this sensor was 0.280 s compared with a nominal value of 0.065 s for a healthy sensor. This large time constant is relatively unimportant in the deep ocean, where temperature changes are small over great depths; thus we were able to use the primary sensor with some confidence. The conductivity sensors (S/Ns 484 and 485) were both healthy and normal. The data in all files is from the primary temperature and conductivity sensor pair.

Initial processing was conducted on the ship using the precruise calibration values and SBE's Seasoft program (version 4.010). Later, after postcruise calibration values were available for each sensor, the raw data files were reprocessed using Seasoft version 4.213. The following routines were used (in order): "datsnv" to convert the raw data to engineering units and split off the downcast portion of the file, "wildedit" to remove wild points, "celltm" to make a thermal mass correction for the conductivity cell, "loopedit" to remove sections where the CTD was traveling backwards owing to ship roll, "derive" to derive parameters such as salinity and density, "binavg" to average the data into 2-m bins, and "trans" to make ASCII data files. A significant effort was made to ensure that the postcruise processing accounted for the bottle salinities which were all quite close to the electronically measured salinities.

Processing the SBE oxygen data was done separately from the temperature and salinity data. Because the postcruise calibrations values for the oxygen sensor was so different than the precruise values, the data for each cast was calibrated to the oxygen concentrations derived by titration for that cast. This resulted in a slightly different set of parameters for the Sea-Bird algorithm for each cast, but none of them were extreme relative to nominal values. The mean difference between bottle values and electronic values over each cast was reduced to +/- 0.03 ml/l. The

transmissometer and OBS data were stored with the CTD data because they were connected through the SBE 911-plus system. Transmissometer data has been included in both sets of files, but the OBS data were unusable owing to excessive randomness; none of the expected correlation with the transmissometer was seen.

In the files labeled "CTD_nn.CTD", the pressure, temperature, salinity, oxygen, transmissivity, conductivity, depth, potential temperature, potential density (for various reference depths), buoyancy frequency, and data quality from the SBE 911-plus system are recorded in 2 dbar bins starting at 9 dbar and covering as much of the water column as possible. Each file includes a header section to indicate cruise name, location, etc.

3) XBT Data

In all, 41 XBTs were dropped; all returned good data except two which suffered launching errors. A few of the drops were cut short when the XBT wire became entangled with the TTM2 tow cable. The files labeled "XBT_nn.ISO" contain headers and data on the depth of various isotherms.