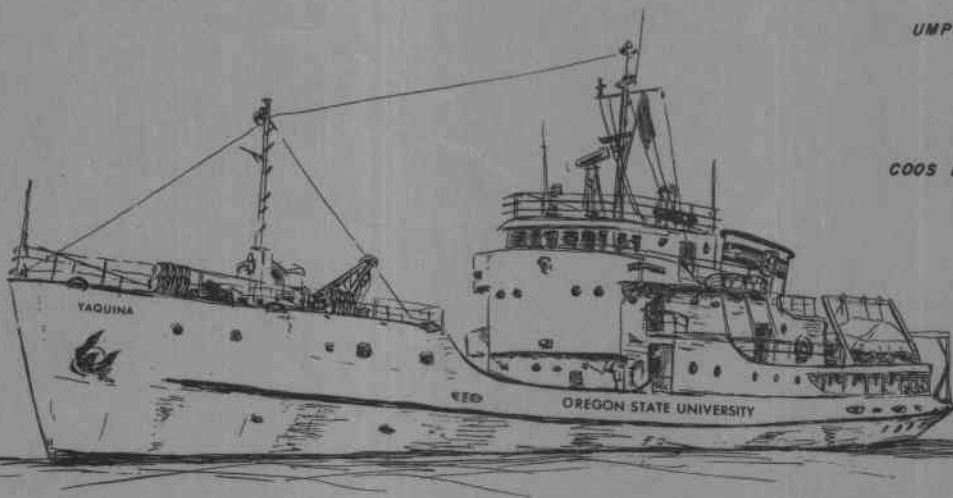
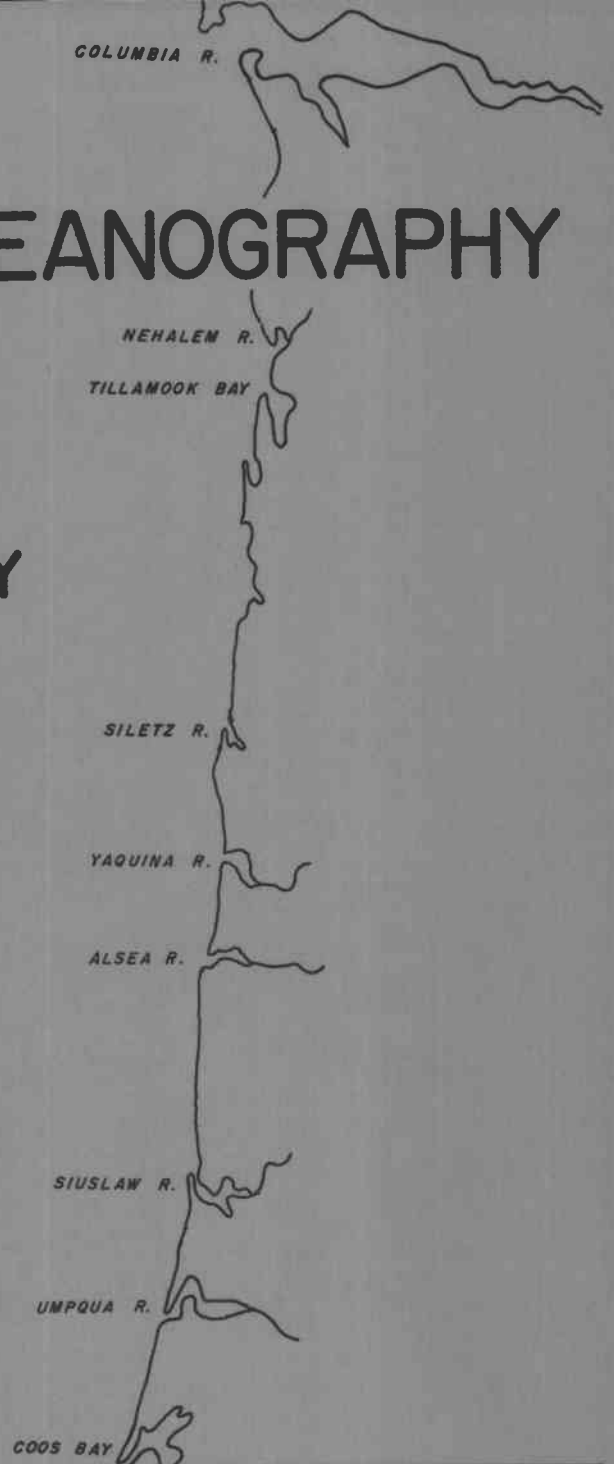


DEPARTMENT of OCEANOGRAPHY

SCHOOL of SCIENCE

OREGON STATE UNIVERSITY



CRUISE REPORT YALOC 66

Description of the cruise of R/V YAQUINA
in the northeastern Pacific Ocean from
20 April to 29 July 1966.

Edited by
Susan Borden

Technical Report 74

Reference 66-10

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September 1966

Department of Oceanography
School of Science
Oregon State University

Wayne V. Burt
Chairman

CRUISE REPORT: YALOC 66

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PERSONNEL

CREW

Howard Albert Linse	Master
Reuben Anthony Loskota	Chief Mate
Jack Robert Rardin	2nd Mate
Archie Lee Gee	A/B
Joseph Edward L. Joyce	A/B
Marshall Melvin Mansfield	A/B
Clarence L. Nelson	A/B - Lim.
Robert Francis Ingersoll	Chief Engineer
Rudolph Joe Buda	1st Asst. Engr.
Wendell Stanley Hall	3rd Asst. Engr.
Robert Stanbrough Fries	Electrician
John Ernest Harmsen	Wiper
* M. L. Lundgren	Wiper
James Joseph Skriver	Wiper
** R. L. Vogt	Wiper
Clifford Le Roy Williams	Cook-Steward
Edward Michael Burchett	Messman
Alton Milo Grover	Messman

* Aboard from Honolulu-Adak

** Newport to Honolulu only

SCIENTIFIC PARTY

Institution	N - H 4/20 - 5/9	Honolulu 5/11 - 5/27	H - A 5/30 - 6/24	A 6/24 6/30	A-K 6/30 - 7/9	K-Kt 7/11 - 7/20	Kt-N 7/20 - 7/30
	Park	Dehlinger	Neshyba	Pattullo			
Robey Banks							
Dennis Barstow							
Richard Couch							
Peter Dehlinger							
James Dodd	SIO						
Henry Donaldson							
Duane Erdmann							
Timothy Francis	SIO						
John Gallagher							
Michael Gemperle							
Joseph Gettrust	U Wisc						
Walter Glooschenko							
Danil R. Hancock							
Donnel E. Hansen		FLIP					
Charles Hoskin	U Alaska						
Alan C. Jones	SIO						
Ronald E. Johnson							
James Kasaloo	U Wisc						
Wilson Latimer							
Allan Marmelstein							
Robert Meyer	U Wisc						
Robert Middleburg							
Stephen Neshyba							
Leo Ocola							
Boyd Olson							
Ha-Song Pak							
Kilho Park							
June Pattullo							
Lee Powell	U Wisc						
George Rieck	Hanford						
Allan Skorpen							
Robert Still							
Elizabeth Strong							
Burt Tanner	U Wisc						
William Unger	U Wisc						
Steven R. Wesman							
Neng-chun Yao							
John Zane	SIO						

KEY:

- N - Newport
- H - Honolulu
- A - Adak
- K - Kodiak
- Kt - Ketchikan

INTRODUCTION

by June G. Pattullo

This report is a description of the first extended oceanographic cruise made by staff of the Department of Oceanography, Oregon State University, aboard the Research Vessel YAQUINA. The purpose is to describe the track made good and the observational programs undertaken for the information of those who may wish to use the data or discuss the results with the scientists concerned.

The cruise was arranged so that the YAQUINA could participate in Mohole investigations off Hawaii. Geophysical, chemical, and hydrographic data were collected en route to Honolulu during May 1966. The leg from Honolulu to Adak made possible collections of samples of deep water for studies of its physical and chemical properties and some experiments to determine productivity. Work near the Aleutian Islands was principally measurement of gravity and magnetism; hydrographic data were also collected. Dredging on a seamount and on the deep sea floor was the major effort in the Gulf of Alaska; hydrographic casts and one otter trawl were also made. A gravity run into Dixon Entrance, several trawls, hydrographic stations, and monitoring the Newport line comprised the work on the leg from Ketchikan to Newport.

The events of the cruise are given in the narrative of the voyage, written by Dr. Park, who was on board for all parts of the cruise, except the Mohole work off Hawaii. A brief summary of the studies made and sampling programs conducted has been written for each area of oceanography by a member of the scientific party who was on board during the last leg of the voyage. These summaries have been kept very brief, and the reader is cautioned that the discussions are by no means comprehensive.

Some results of the hydrographic work analyzed on board ship are included.

YALOC 66 STATISTICS

Total miles travelled 13,642

Hydrographic station data:

Casts to 1500 m or less	81
Casts to deeper than 1500 m	46
Deepest cast	7,300 m

Determinations on board included: temperature, salinity, oxygen, nitrogen, carbon dioxide, phosphate, pH, and alkalinity. Samples for silicates and nitrates were frozen and brought home.

Bathythermograms: 372

Drift Bottles: 360 total at 30 stations - Newport line out to NH-165 on departure; Newport line from 600 miles offshore to coast; on return.

Pipe dredge hauls: 7

Anchor dredge hauls: 3

Gravity Measurements: 9 lines each 100 miles long over Mendocino Escarpment; 1,000 miles of track in Aleutian across trench and island chain; 2 lines each 300 miles long near Dixon Entrance perpendicular to the coast.

Magnetic profiling: Virtually at all times when the ship was underway.

Nekton: 7 collections with multiple sampling nets.

Zooplankton: 200 meter trawls each night when possible.

Phytoplankton: Primary productivity - three 24-hour stations; surface samples on hydrographic stations Adak to Kodiak.

Benthos: Anchor dredge hauls - 6 Otter trawl hauls - 3

Radiation: Short-wave radiation by recording Eppley pyrheliumeter throughout cruise. Dawn, dusk and noon sea radiation when ship was stopped at those times.

Weather: Continuous recording of sea surface and air temperature, and pressure. Normal weather schedule by bridge personnel.

NARRATIVE OF YALOC 66

by Kilho Park

R/V YAQUINA's first long cruise was undertaken from several motives. Firstly, Oregon State University was requested by the National Science Foundation to join a multi-ship investigation of the Mohole site near Hawaii. Secondly, Dr. Dehlinger wanted to study the gravity and geomagnetism in the areas of the Mendocino Seascarp, across the Aleutian Trench near Adak Island, and in Dixon Entrance near Ketchikan, Alaska. Thirdly, Dr. Pattullo and Dr. Neshyba were keenly interested in the physical oceanography and hydrography of the Northeastern Pacific. Fourthly, Dr. Weyl and Mr. Olson wanted to collect deep-sea temperature data between Hawaii and the Aleutian Islands. Fifthly, biological investigations in the same waters by Dr. Percy (nekton), by Dr. Carey (benthos), and by Dr. Curl (phytoplankton) were desired. Sixthly, Dr. Park's exploratory deep-sea chemical investigations could be advanced.

In the beginning of 1966 a committee, headed by Dr. Dehlinger, began to prepare for the cruise. A 100-day cruise plan was drawn. The cruise track was divided into four legs, and chief scientists were selected for each leg:

- (1) Oregon (20 April) to Hawaii (9 May) - Dr. Park,
- (2) Mohole Project in the Hawaiian waters (10 May to 30 May) -
Dr. Dehlinger,
- (3) Hawaii (31 May) to Aleutians (24 June) - Dr. Neshyba,
- (4) Aleutians (25 June) to Oregon (29 July) - Dr. Pattullo.

First Leg - Newport to Honolulu (20 April - 9 May)

R/V YAQUINA left Newport on the afternoon of 20 April and immediately took 11 hydrographic stations along the regularly monitored east-west line off Newport, 5 to 165 miles off the coast.

At 165 miles off Newport, she headed south to obtain a gravity line along $127^{\circ} 30' W$ to $41^{\circ} N$. Off Cape Mendocino a north-south crossing was made to obtain a gravity pattern across the seascarp from $133^{\circ} W$ to $137^{\circ} W$. Favorable weather prevailed throughout the period of the gravity study.

On May 2 the gravity study was successfully completed and R/V YAQUINA headed straight to Hawaii, taking 16 deep-sea hydrographic

stations en route. A salinity inversion at 400 meters was noticed beginning at 38° N 138° W, and the inversion trend became more pronounced as we approached the Hawaiian Islands. At the same time, a second pH maximum was discovered at 4000 m depth.

On May 4, due to the high air temperature, the oily lubricant contained within the meshes of the hydrographic wire started to seep outward. During the hydrographic casts, when a messenger started to slide down the wire, the lubricant accumulated on the inner wall of the messenger, and the descending motion of the messenger was completely halted. It took over a day to clean the 800 m length of hydrographic wire with diesel oil by hand.

R/V YAQUINA arrived in the Honolulu Harbor on 9 May (10 a. m.) as scheduled.

Second Leg - Mohole Project, Honolulu to Honolulu (10 May - 29 May)

This section of YALOC 66 was a multi-ship geophysics cruise. The participating ships were the YAQUINA, FLIP, and HORIZON from Scripps Institution of Oceanography, and the TERITIC from the University of Hawaii. In addition to OSU's scientific party, Dr. R. Meyer and six members of his crustal seismology group from the University of Wisconsin and four explosion seismologists from Scripps were aboard the YAQUINA.

The primary purpose of the cruise was to gather seismic refraction data in the vicinity of the proposed Mohole drilling site north of Oahu; however, gravity, magnetic, and bathymetric data were also taken.

The YAQUINA's part of the seismic work consisted of placing and picking up the University of Wisconsin's seismic recording buoys (the recording buoys are a fairly new technique for seismic refraction data acquisition) and recording the shots with conventional hydrophones. Besides normal seismic refraction work, the buoy's arrays were used to try to find evidence of velocity anisotropism in the earth's crust.

The YAQUINA also dropped an "on the bottom" seismometer belonging to Scripps. On May 24, this instrument and all the participating ships and buoys recorded a large explosion set off by the Navy off the coast of California over 2,200 miles away.

Preliminary results of the gravity investigations were presented at the Corvallis meeting of the American Geophysical Union in August 1966.

Third Leg - Honolulu to Adak (30 May - 24 June)

R/V YAQUINA departed Hawaii on 30 May, heading toward Adak Island. This part of the cruise was hampered considerably by an unexpected fire in the ship's engine room and by encountering a 50-knot wind for two days near the Aleutian Trench. At 4 a. m. on June 3, a fire started in a crank case of the port-side engine. Within a few minutes the fire was extinguished, but all the available CO₂ fire extinguishers were spent. Thus, the ship had to return to Honolulu. R/V YAQUINA arrived back at Honolulu on 5 June and sailed again for Adak on 6 June.

Numerous scientific projects were to be executed during this leg, but, due to the delay, a number of them were cut short. Nevertheless, we achieved considerable success. Thirty-eight hydrographic stations were occupied. In addition, studies on bioluminescence infra-red back radiation, and phytoplankton productivity were begun. Benthic and pelagic organisms were collected by anchor dredge and midwater trawl. Across the Aleutian Trench a gravity line was made.

As for the humorous side, at one hydrographic station we were suprised to see a Nansen bottle bringing up a stone sample in its thermometer holder! Also, another time we witnessed that raw eggs lowered to 7000 m (700 atmospheres) and brought back to the surface were not crushed!

Over the Aleutian Trench we met the R/V PARAGON of the Bureau of Commercial Fisheries, Seattle.

Fourth Leg - Adak to Oregon (25 June - 29 July)

This leg can be divided into four smaller parts: gravity work near Adak, hydrographic sections between Adak and Kodiak, Kodiak Seamount dredging by the University of Alaska, and the Gulf of Alaska hydrographic study between Kodiak and Ketchikan, including a gravity line into the Dixon Entrance, and finally the combined gravity and hydrographic study between Ketchikan and Newport, Oregon.

During the gravity study over the Aleutian Trench (25-30 June), nine hydrographic stations were made. On 30 June, we returned to Adak for refueling, and we were pleasantly surprised to see two oceanographic ships berthed at the next pier. They were the R/V ROBERT O. CONRAD an AGOR ship of the Columbia University, and KONANMARU of Japan. R/V CONRAD and R/V KONANMARU had been working together on a seismological study. Dr. W. J. Ludwig of Columbia University and Dr. S.

Murauchi of National Science Museum, Tokyo, were the chief scientists on their respective ships.

On June 30, R/V YAQUINA left Adak for Kodiak. En route we occupied 15 hydrographic stations, 5 in the Bering Sea and 10 over the Aleutian Trench. The second storm of the cruise was encountered near Akutan Island and we took refuge in Akutan Bay for a day. On 9 July, R/V YAQUINA arrived in Kodiak for refueling.

Dr. Charles Hoskin of the University of Alaska joined the cruise at Kodiak, and R/V YAQUINA sailed for Kodiak Seamount on 11 July. Pipe dredgings and anchor dredgings for the University of Alaska were successfully completed over and near the Kodiak Seamount; Dr. Hoskin obtained approximately 400 kg of rock samples.

After the Kodiak Seamount study, the ship sailed to the Dixon Entrance, near Ketchikan. En route we occupied eight hydrographic stations and took some otter trawls and mid-water trawls.

A strange thing happened during one hydrographic cast. A messenger got hung on the hydro-cable by the tentacles of a jelly fish and the cast had to be repeated.

R/V YAQUINA arrived in Ketchikan on 20 July to disembark Dr. Hoskin and to obtain a fresh water supply. She sailed for Newport the same day. Uninterrupted gravity lines of approximately 300 miles were made on the way into and out from Dixon Entrance.

Between Ketchikan and Newport, 29 hydrographic casts, 6 Q-casts, 2 otter trawls, and 2 midwater trawls were made. On the 100th day, 29 July 1966, R/V YAQUINA arrived back to her home port, Newport, Oregon.

BIOLOGY

by Henry Donaldson

Three phases of biological studies were carried out on the cruise. These concerned phytoplankton, nekton, and benthos. Most of the phytoplankton work was done at three fixed stations between Hawaii and Adak. At these stations in situ primary productivity measurements were made using light-dark bottles and C^{14} methods. Every two hours while on station, casts were made to determine vertical distribution and diurnal changes in chlorophyll content. Other primary productivity studies and Van Dorn casts were made when the ship stopped to make deep hydro casts.

Nekton samples were collected with Isaacs-Kidd trawls and meter nets. The cod ends of the 10-foot trawl and meter net were adapted to a pressure piston apparatus for opening and closing nets at intervals of 1000-2600 m, 500-1000 m, and 200-500 m. A six-foot trawl and separate meter net sampled the 0-200 m interval. These multiple samplers were used at three stations between Hawaii and Adak, at two stations between Adak and Kodiak, and at two stations between Ketchikan and Newport. Some collections were incomplete. The data from these trawls will be used to determine vertical distribution of species and biomass. Also, as part of the nekton program, 0-200 m 6-foot trawls will be used to determine the zoogeography of species and existence of faunal areas.

The benthic infauna was sampled by an anchor box dredge. Two dredges were taken at each of the fixed stations between Hawaii and Adak; two additional dredge hauls were made between Kodiak and Ketchikan. The epifauna was sampled by three otter trawls made between Ketchikan and Newport. It is hoped that these samples will give some insight into the composition and distribution of the abyssal plain fauna.

CHEMISTRY

by Kilho Park

Deep-Sea Chemical Parameters

Approximately 50 deep hydrographic casts were taken to the sea bottom. Chemical parameters measured were: salinity, oxygen, nitrogen, total carbon dioxide, phosphate, nitrate, silicate, pH, and alkalinity.

We discovered a weak pH-maximum at near 4000 m depth. Tentatively we attribute the existence of this deep maximum to the combined effects of temperature and pressure changes.

Specific alkalinity was calculated to study the calcium carbonate dissolution in the deep waters. Near bottom, the specific alkalinity is about 0.133. A profile showing the percent carbonate saturation along the entire cruise track is being prepared.

Dissolved Gases

In addition to oxygen, both nitrogen and total carbon dioxide concentrations were measured routinely by a gas chromatographic technique. Preliminary analysis indicates that a noticeable discontinuity in the gas content occurs at the Subarctic Boundary between Honolulu and Adak. Surface pH measurements also show a discontinuity at the Boundary. Figure C-1 shows the average surface pH in the Subtropic water was 8.25, while that in the Subarctic was 8.19.

Preformed Nutrients

Basic data to establish the preformed nutrient pattern along the cruise track are being compiled. Approximately 3000 phosphate and 2400 each of nitrate and silicate samples were obtained. Preliminary analysis of preformed phosphate concentration shows that the Subarctic water intruded southward from the north side of the Subarctic Boundary possesses an average preformed phosphate concentration of about $0.8 \mu\text{M}$.

Oxygen-Carbon Dioxide Relationship

In order to understand the changes in oxygen and carbon dioxide concentrations produced by biological and biochemical oxidation, apparent

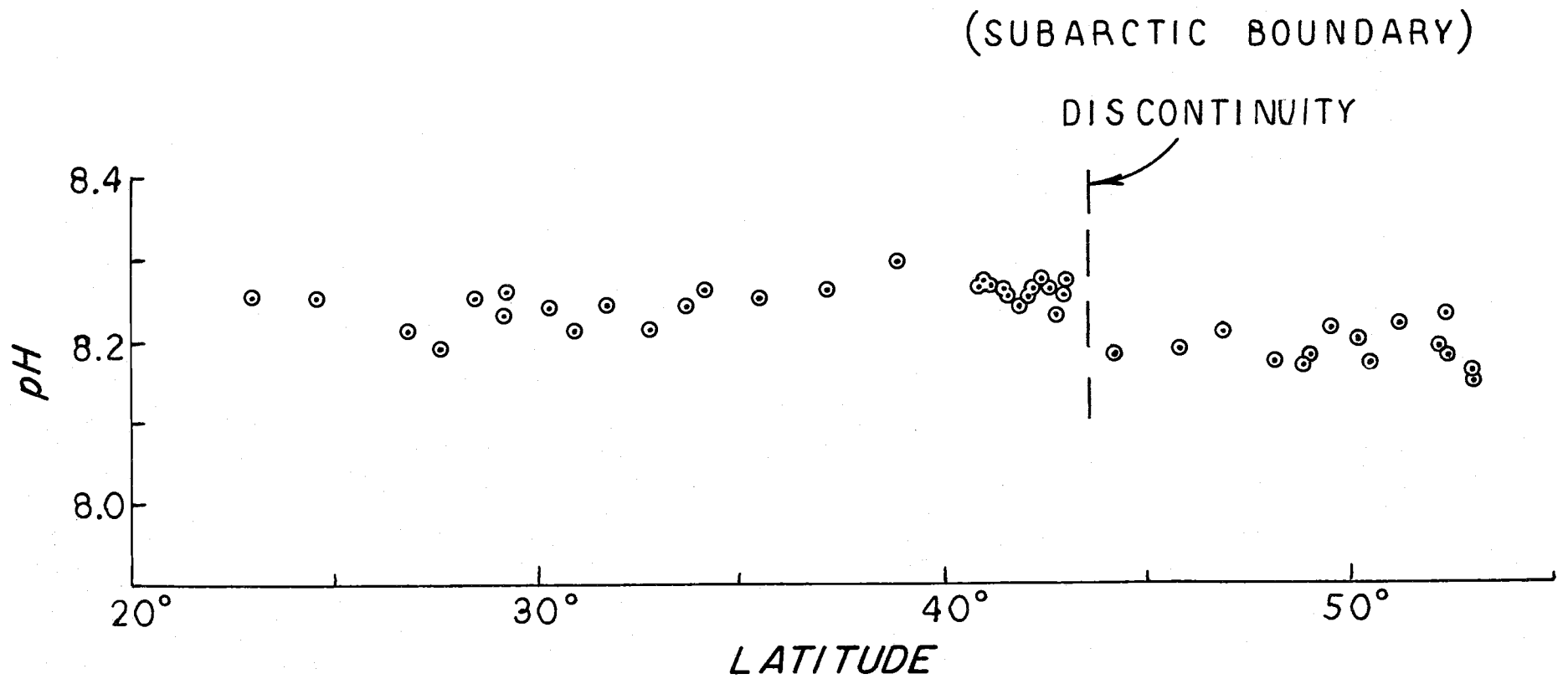


Figure C-1. Surface pH values in the Subtropical water.

oxygen utilization, and percent carbon dioxide saturation are being calculated. With the aid of oxidative and preformed nutrient data, we are obtaining the changes in the ratios of oxygen:carbon:nitrogen (nitrate):phosphate by biological processes.

Chemical Extrema

Along the cruise track we observed the oxygen minimum, pH minimum, and phosphate maximum in the wide range of 200~1200 meters. These extrema occurred in the upper depths over the Aleutian Trench and in the Gulf of Alaska and in the lower depths near Hawaii. The mode of their occurrence and their implication in the vertical mixing of water are being analyzed.

Chemistry of the Aleutian Trench and the Bering Sea near the Aleutian Islands

Approximately 27 hydrographic stations were occupied in this area. Of these, 10 were in the Bering Sea.

In the trench, doming of the chemical extrema was observable along 176° W. Hydrographic implications of the doming phenomenon are being studied.

At some stations in the Bering Sea, we encountered high surface phosphate concentration (1.6 μ M), high specific alkalinity (0.129), and high pH (8.3).

Shipboard Trial of the Conductometric Determination of Alkalinity

The conductometric technique of Park, et al. (1963) was tested at sea, and its result is being compared with the technique of Anderson and Robinson (1946). This method gives us a new way to determine salinity and alkalinity from a single water sample.

Nansen Bottle Problem on the Deep-Sea Hydro Casts

Frequently, we noticed that some Nansen bottles gave erroneous results in conductivity, alkalinity, oxygen, and pH analysis. Both conductivity (salinity) and oxygen decreased while pH and alkalinity increased.

An example is given below:

Station HAH-56

6910	1.81	34.676	3.65	7.87	2.58
7010	1.84	34.675	3.67	7.86	2.57
7110	1.84	<u>34.668</u>	<u>3.52</u>	<u>7.90</u>	<u>2.61</u>
6210	1.86	34.676	3.69	7.85	2.58
		Δ 0.008	0.16	0.04	0.03

We believe that the Nansen bottle used at 7110 m had a faulty Teflon coating and thus oxidation of the metal of the Nansen bottle took place. The coating could be seen hanging in strips from the inner surface.

REFERENCES

- Anderson, D. H. and R. J. Robinson, 1946. Ind. Eng. Chem., Anal. Ed. 18: 767.
- Park, K., M. Oliphant, and H. Freund, 1963. Conductometric determination of alkalinity of sea water. Anal. Chem. 35(10): 1549-1550.

GEOLOGY

by Charles Hoskin

Eight attempts were made to recover bedrock samples from Kodiak Seamount and the wall of the adjacent Aleutian Trench. The sampler used was a pipe dredge, 18 inches in diameter, 4 feet long, with very coarse expanded metal grating closing one end. After the first attempt, a finer expanded metal grate was placed inside the pipe dredge.

Two hauls were made with an anchor dredge. No gear was lost or damaged in these operations, and the recoveries are judged satisfactory. The results of the dredging are summarized below:

Pipe Dredge Hauls

1. Kodiak Seamount - recovered about 50 pounds of cobbles.
2. Kodiak Seamount - recovered three one-inch pebbles. (The weak link on the dredge was broken on recovery, probably due to abrasion by towing.)
3. Kodiak Seamount - recovered about 100 pounds of pebbles and cobbles.
4. Kodiak Seamount - recovered a full dredge of mud and rocks. (The unwashed sample was subsampled, the mud then washed away, and the remaining 50 pounds of pebbles and cobbles saved.)
5. Kodiak Seamount - recovered about 400 pounds of pebbles, cobbles, and boulders.
6. Aleutian Trench - recovered one cobble.
7. Aleutian Trench - recovered a full dredge of mud - no rocks.
8. Aleutian Trench - no sample. (Pipe dredge came up empty. Weak link was not broken.)

Anchor Dredge Hauls

1. Eastern Aleutian Trench - recovered gray sandy mud.
2. Abyssal Plain south of Pratt-Welker Chain - recovered brown, sandy mud. (First attempt recovered only a thin film of mud on the side of the dredge. The anchor dredge was probably full, but washed out on retrieval.)

We crossed over parts of the seamount numerous times during this work. On at least three occasions the PDR indicated depths considerably shallower than any we have previously seen reported for this seamount. The records will be studied and corrected for temperature and depth to see if a formal report of a new depth is warranted.

GEOPHYSICS

by Michael Gemperle

Geophysical investigations carried out on YALOC 66 were as follows: continuous gravity measurement with a La Coste-Romberg sea gravity meter, magnetic profiling with a proton precision magnetometer, bathymetric profiling with an Giffit transceiver and PDR, and refraction shooting over the proposed Mohole site on the Honolulu-Honolulu section of the cruise. See Narrative, Second Leg, for the Mohole work off Honolulu.

Although the geophysical work was performed throughout the entire cruise, three geographic regions, in addition to the Mohole site, were of particular interest. These three regions were the Mendocino Escarpment; the Aleutian Trench, chain, and adjacent Bering Sea; and Dixon Entrance north of the Queen Charlotte Islands. In each of these areas, grids of track lines were made to provide detailed profiles, most of which will be extensions of previous work.

The grid over the Mendocino Escarpment consisted of nine north-south lines, each one hundred miles in length, between longitude 133° W and 137° W. Previous work done over the escarpment was east of 133° W. In the Aleutian area, we made approximately one thousand miles of track lines crossing the trench and the island chain, and extending work into the Bering Sea. These lines lie between longitude 175° W and 180° W. Two lines were run through Dixon Entrance, each perpendicular to the coast and about 300 miles long. The latter lines represent a northern addition to an extensive body of data previously collected over the interface of ocean basin and continent off the western United States and Canada.

During the geophysical work in the three areas mentioned above, exceptionally mild weather was encountered. Therefore, we anticipate that the quality of the data will be excellent.

HYDROGRAPHY

by Ronald E. Johnson

Hawaii to Adak

A total of 38 hydro casts were completed between Hawaii and Adak, Alaska. Of these, 20 had a maximum deep of less than 1500 meters, two were in the range 1500 to 3000m, and 16 had minimum deeps greater than 3000 meters. Initial station spacing was 60 nautical miles; after station 33 and up to station 38, the spacing was 120 nautical miles. This increase between stations was due partially to the delay caused by the engine room emergency of 4 June and partially to the uniform hydrography of the region. However, the Subarctic convergence (or front) located approximately at latitude 40° to 44° N was spanned with 12 hydro casts at a spacing of 30 nautical miles. Sixty nautical-mile spacing was then used until reaching Adak.

Bathythermograph slides were taken in conjunction with the hydrocasts, and also between stations with the ship under way. Between Hawaii and Adak, 255 BT's were logged. This number includes 46 that were obtained on the return trip to Hawaii. After station 38, BT's were taken from the hydro winch while on station only, as a broken gear had caused the BT winch to fail (suitable repairs were made in Adak).

The figures include graphs of the temperature and salinity sections from Hawaii to Adak. The Subarctic convergence can be seen, as well as a lesser convergence further south. In addition, temperature versus salinity graphs for all stations have been plotted as an aid to studies of water mass movement and formation.

Adak to Adak

This short leg provided only nine hydro casts with related bathythermograph traces. These were not positioned to provide depth versus distance graphs as those from the Hawaii to Adak leg, but they did afford the opportunity to study the water masses in the area via the temperature-salinity diagrams.

Adak to Kodiak

With the exception of four stations in the Bering Sea, this leg of the cruise provided a line of stations along the axis of the Aleutian Trench. A total of fifteen casts were made. Nine were less than 1500 meters; the other six were deeper. With the BT winch repaired, 36 BT's were obtained during this leg.

Kodiak to Ketchikan

Eight hydro casts, made between Kodiak and Ketchikan, ran in a line across the Gulf of Alaska. The counterclockwise circulation was readily identified from the salinity and temperature profiles. The section seems to indicate an area of upwelling or mixing near the center of the Gulf. Elsewhere there is a temperature minimum around 100 m and then a temperature maximum at a slightly deeper depth.

The BT traces bear out the above relationship. They indicate that the positive gradients in some of the areas are quite sharp, rising over one-half of a degree centigrade in 25 to 50 meters at a depth of approximately 150 meters. Twenty-six BT traces were recorded for this leg.

Ketchikan to Newport

In addition to the standard stations on the Newport hydro line, 17 stations were completed on this leg. All but one were located in such a manner as to form two lines of stations at right angles to each other. This particular arrangement facilitates the study of the current systems in the region, as well as the associated water mass variation and transport. Again, the usual complement of BT traces were taken.

RADIATION MEASUREMENTS

by Hasong Pak

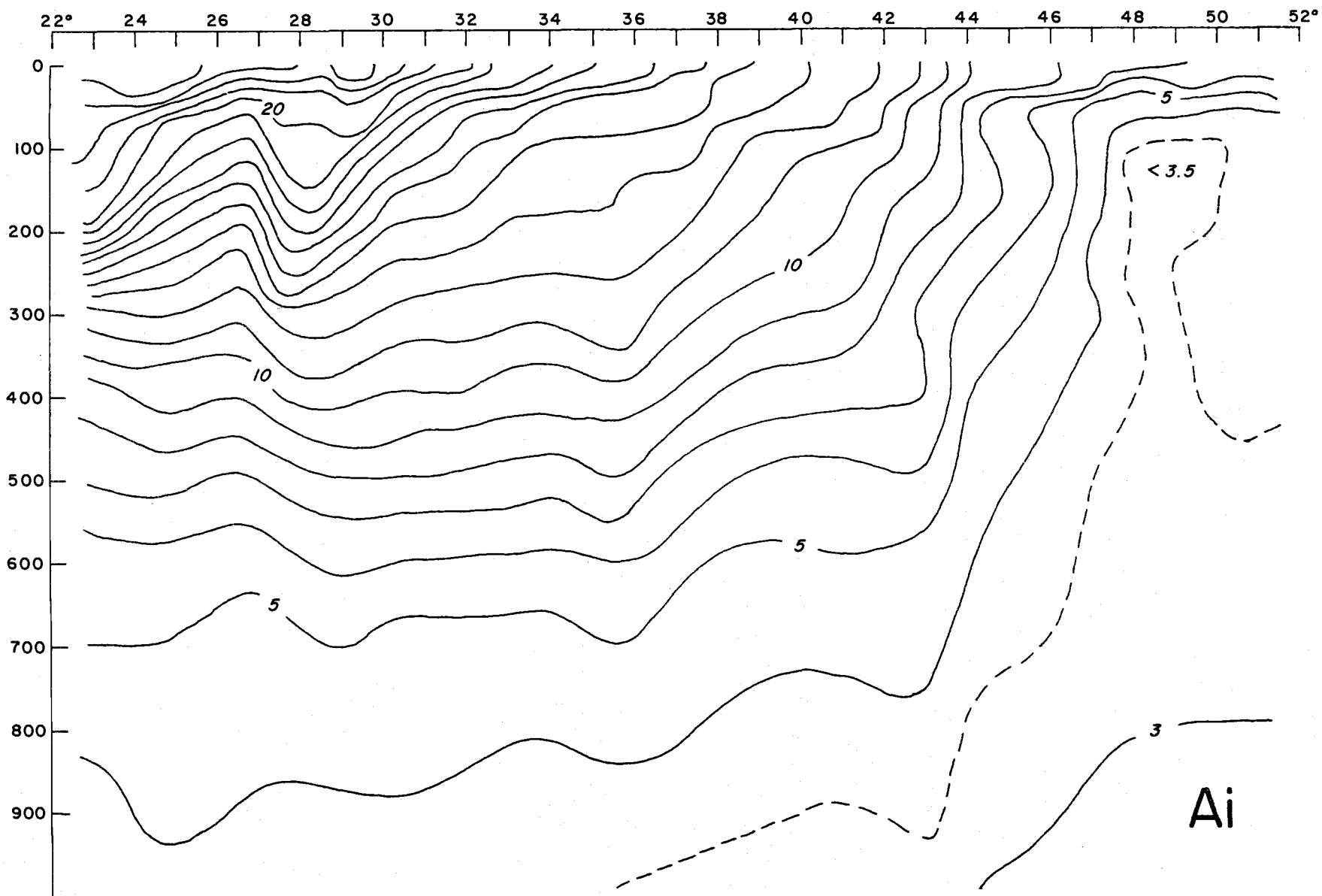
Radiation was measured three times each day: before sunrise, at noon, and after sunset. For these measurements we used a radiometer and a pyrhelimeter in inverted position. The radiometer was hooked to a recorder and a temperature bridge. The readings, when properly processed, will yield net long wave radiation in the absence of sun. The noon readings of the inverted pyrhelimeter will yield reflected short wave radiation. A second pyrhelimeter operated continuously. These records will yield total solar radiation (incoming short wave radiation).

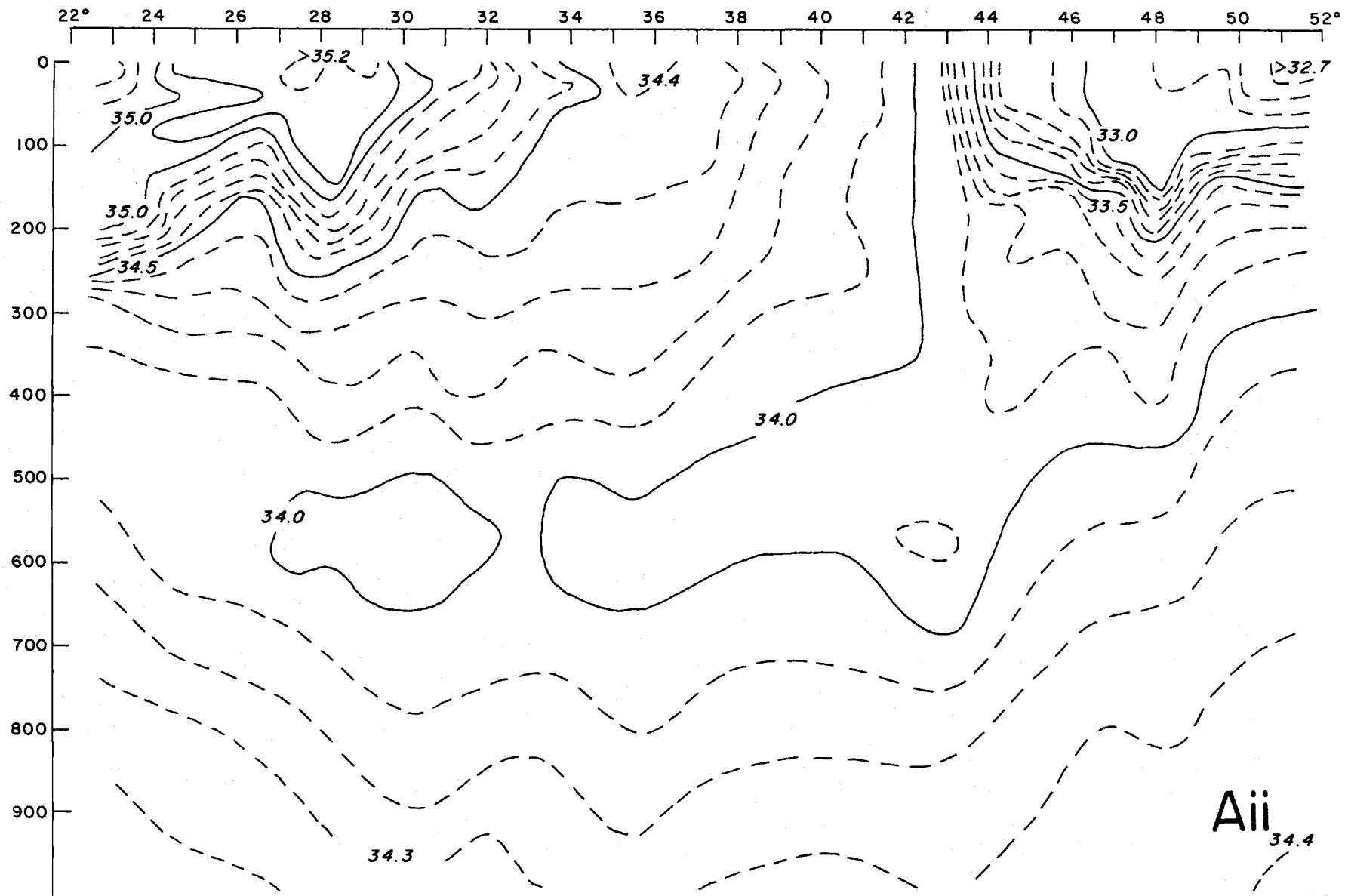
Several of the elements which affect radiation were also measured. These elements included humidity, sea surface temperature, cloud type, and amount of cloud cover.

FIGURE LEGENDS

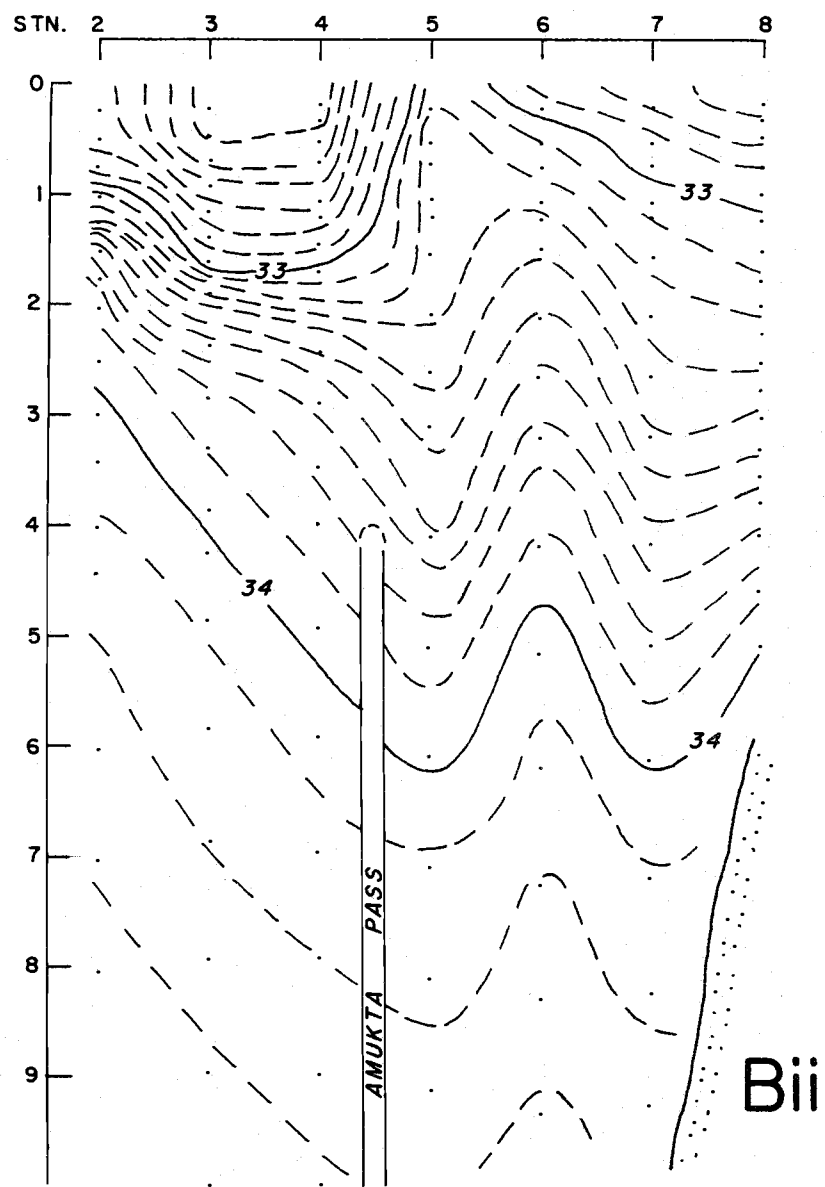
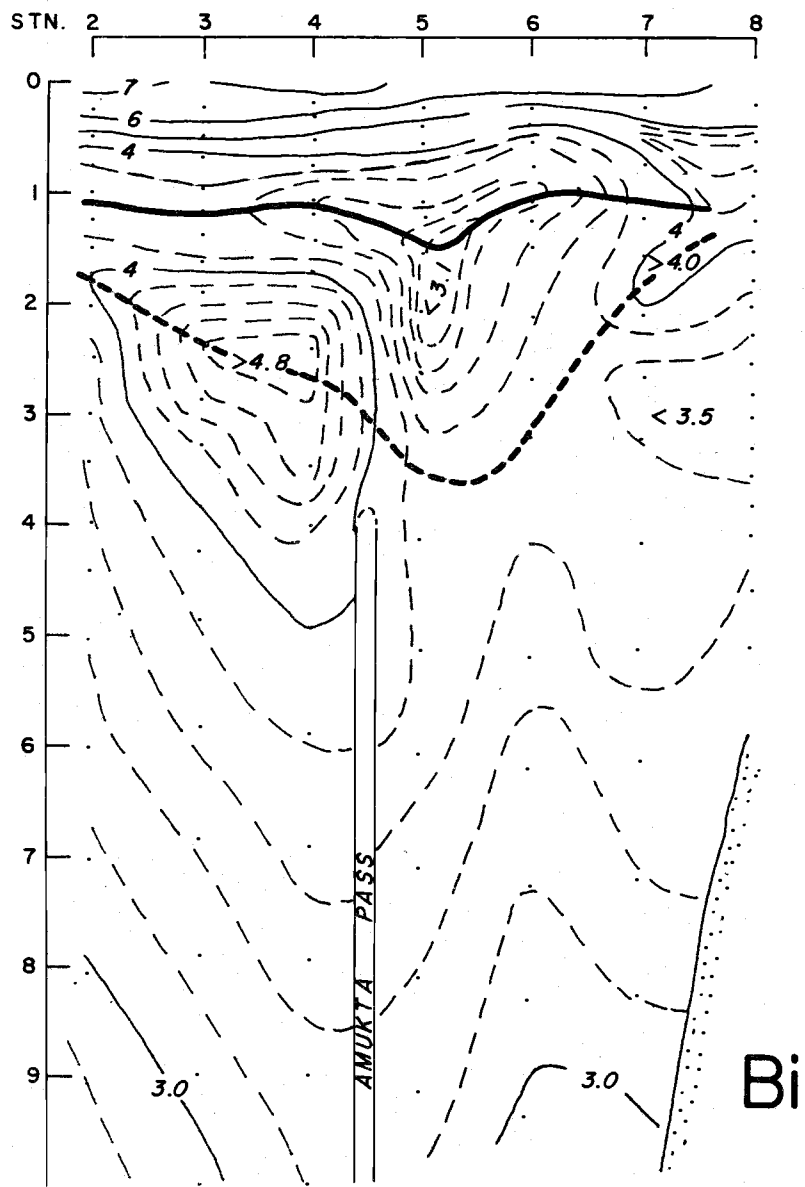
All following figures are cross sections, surface to one thousand meters. Isotherms are labelled in degrees centigrade, isohalines in parts per mille. See track chart for locations.

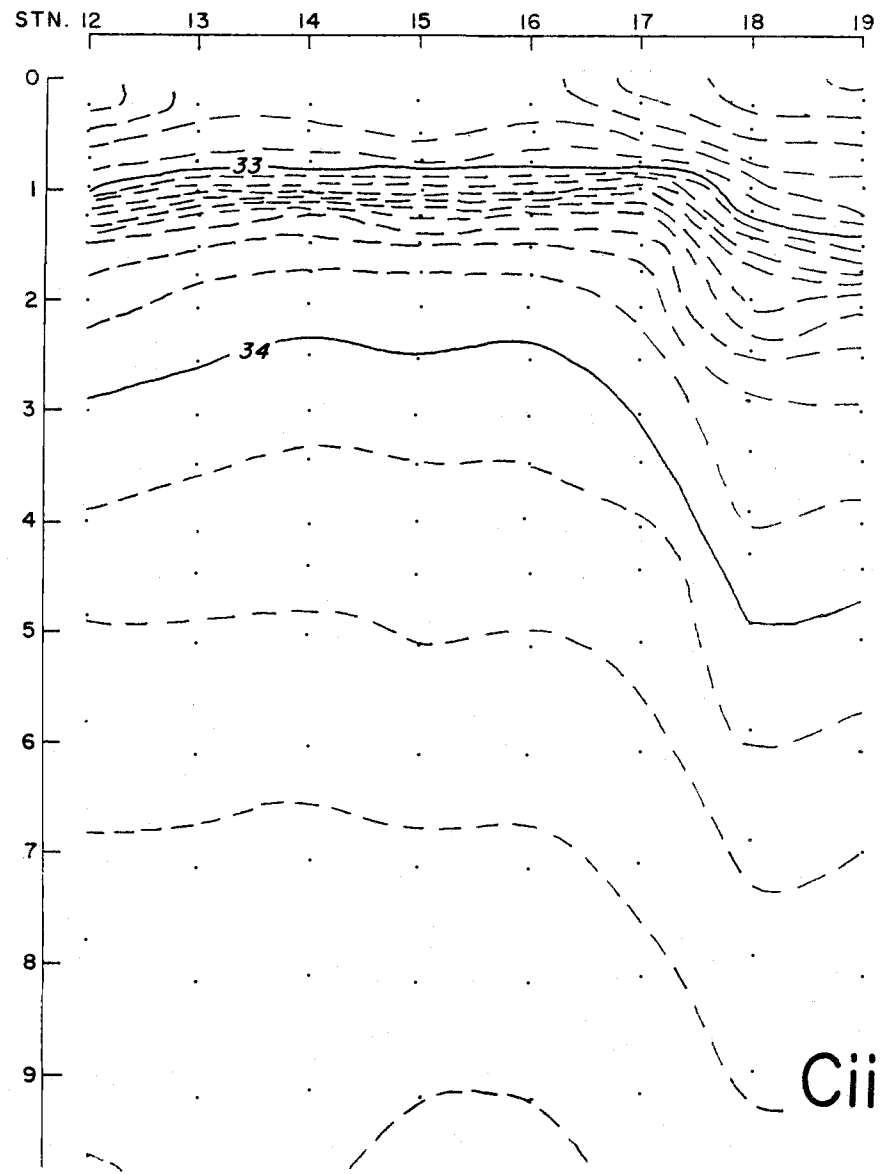
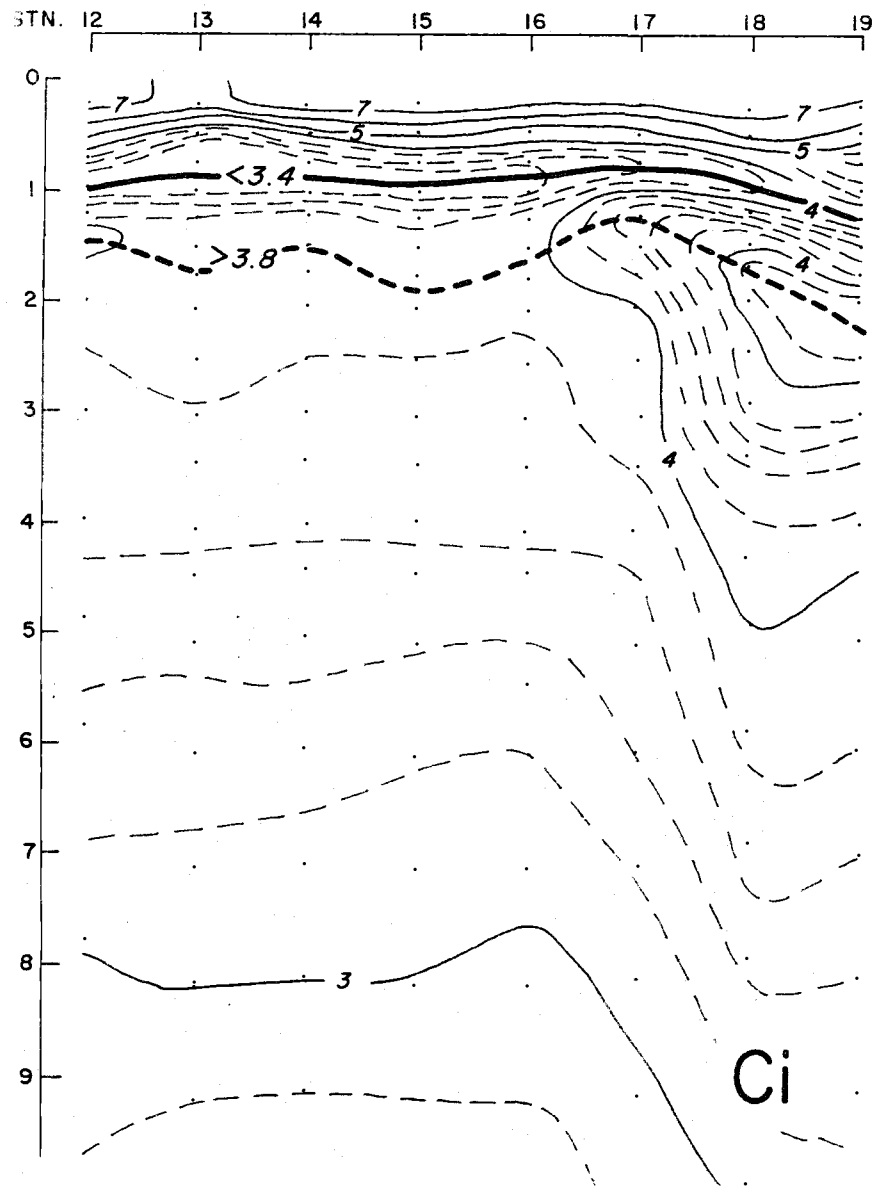
- Ai Temperature distribution, Hawaii to Adak. Depth scale in meters, horizontal scale in degrees of latitude.
- Aii Salinity distribution. Scales and location as in Ai.
- Bi Temperature distribution, Adak to eastern Bering Sea. Heavy solid line, temperature maximum; heavy dashed line, temperature minimum.
- Bii Salinity distribution, same location as Bi.
- Ci Temperature distribution, Aleutians to Kodiak. See legend for Bi.
- Cii Salinity distribution, same location as Ci.
- Di Temperature distribution, Kodiak to southeastern Gulf of Alaska. See legend for Bi.
- Dii Salinity distribution, same location as Di.
- Ei Temperature distribution, southeastern Gulf of Alaska to 165 miles off Oregon coast, via $44^{\circ} 34' N$, $138^{\circ} 30' W$ (station 9). See legend for Bi.
- Eii Salinity distribution, same location as Ei.

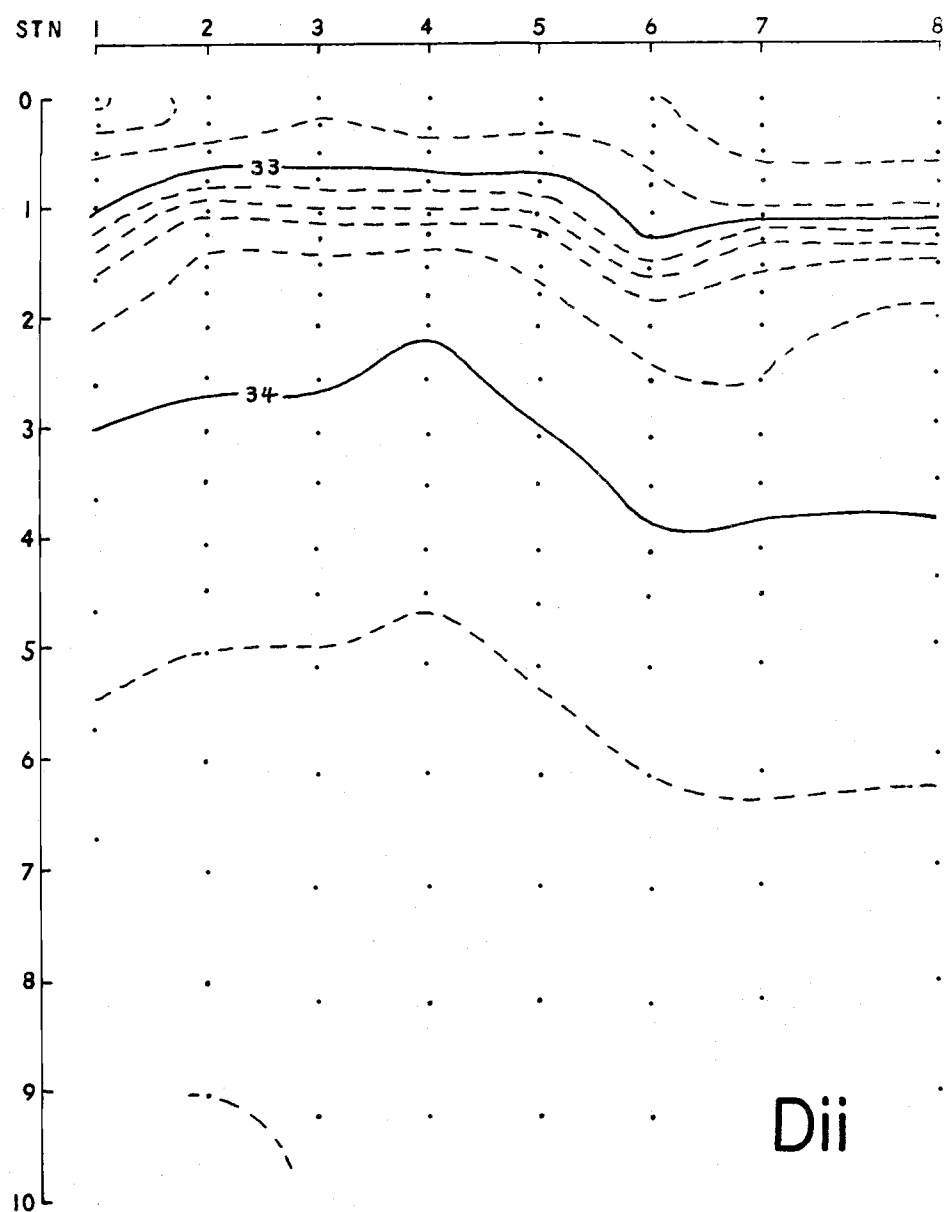
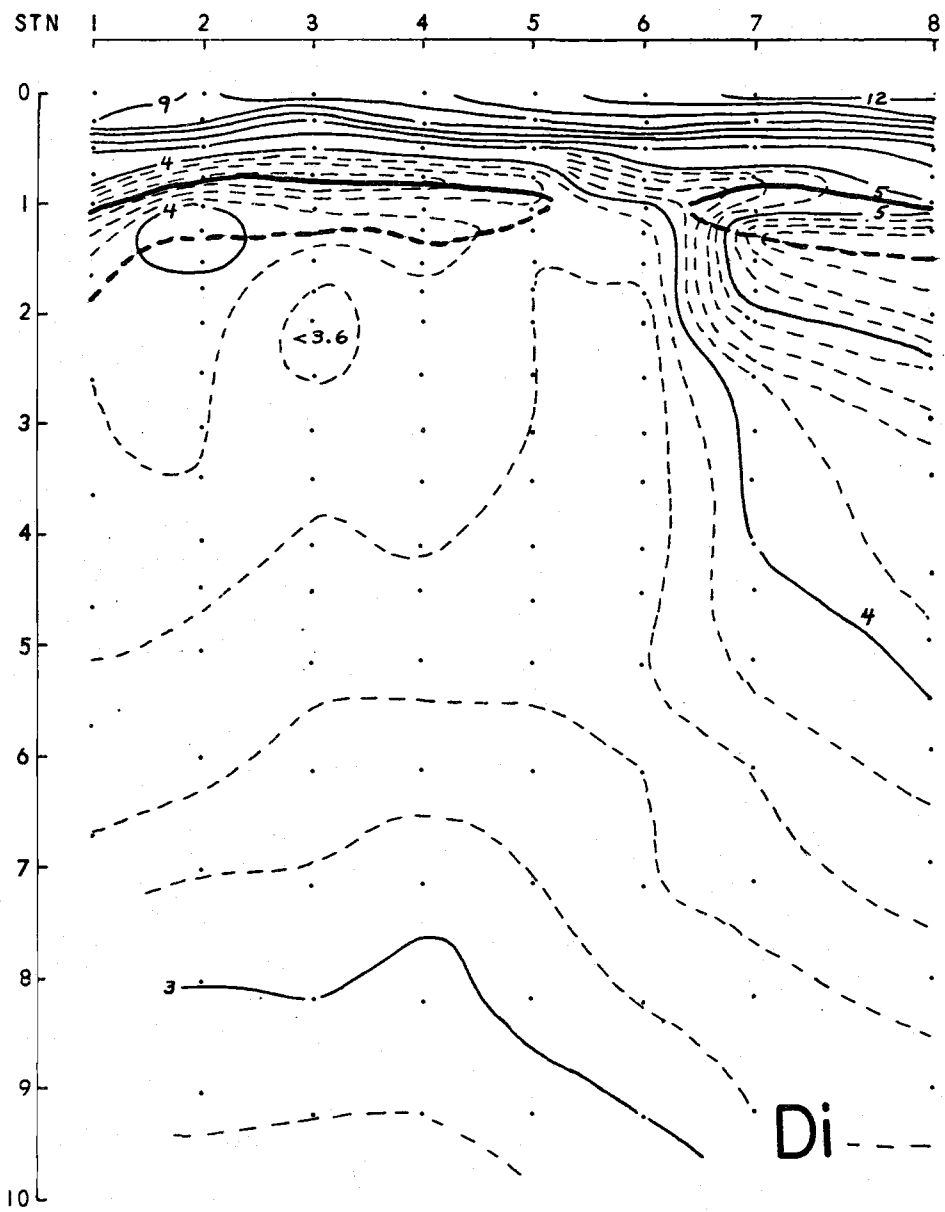


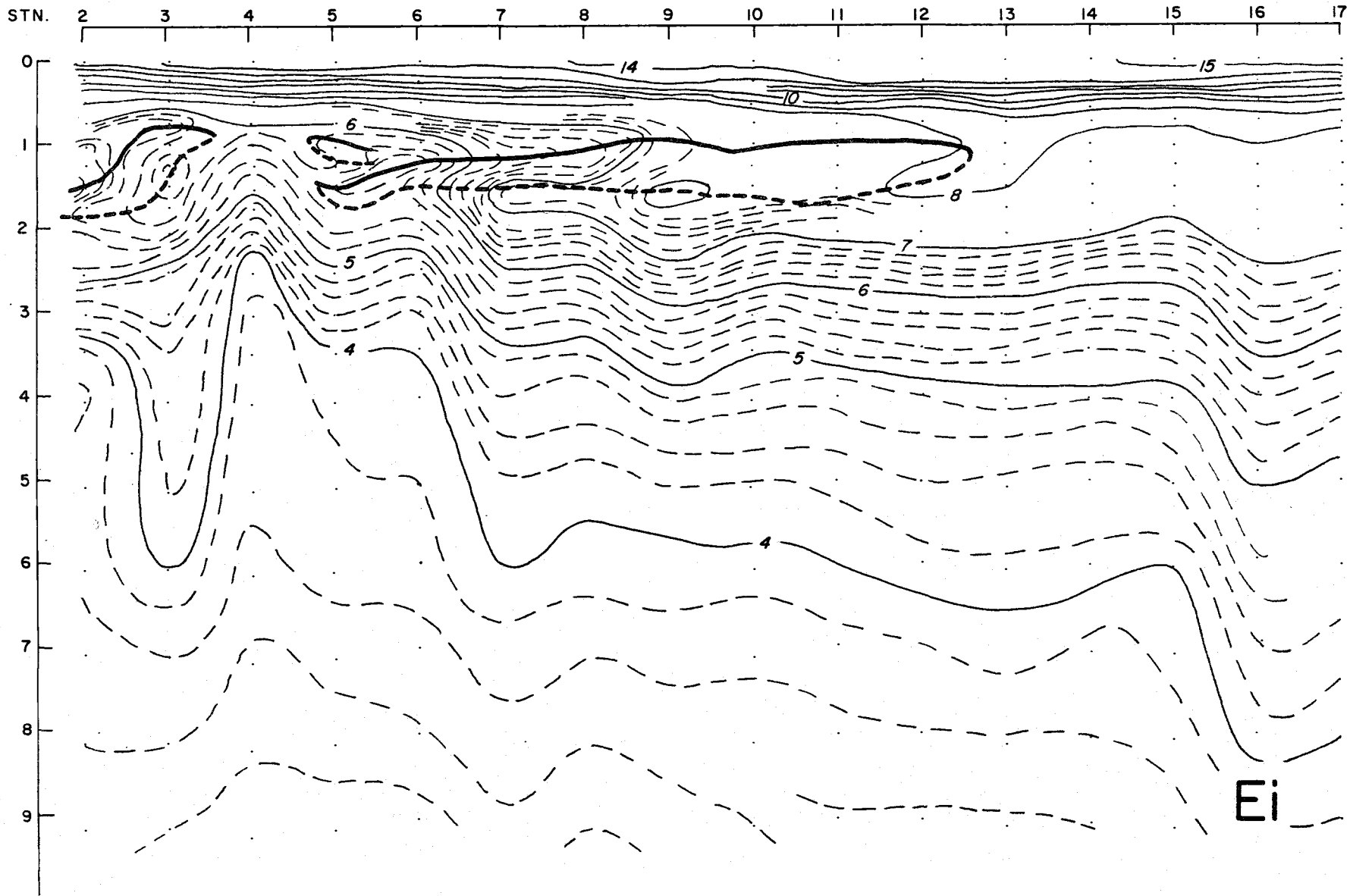


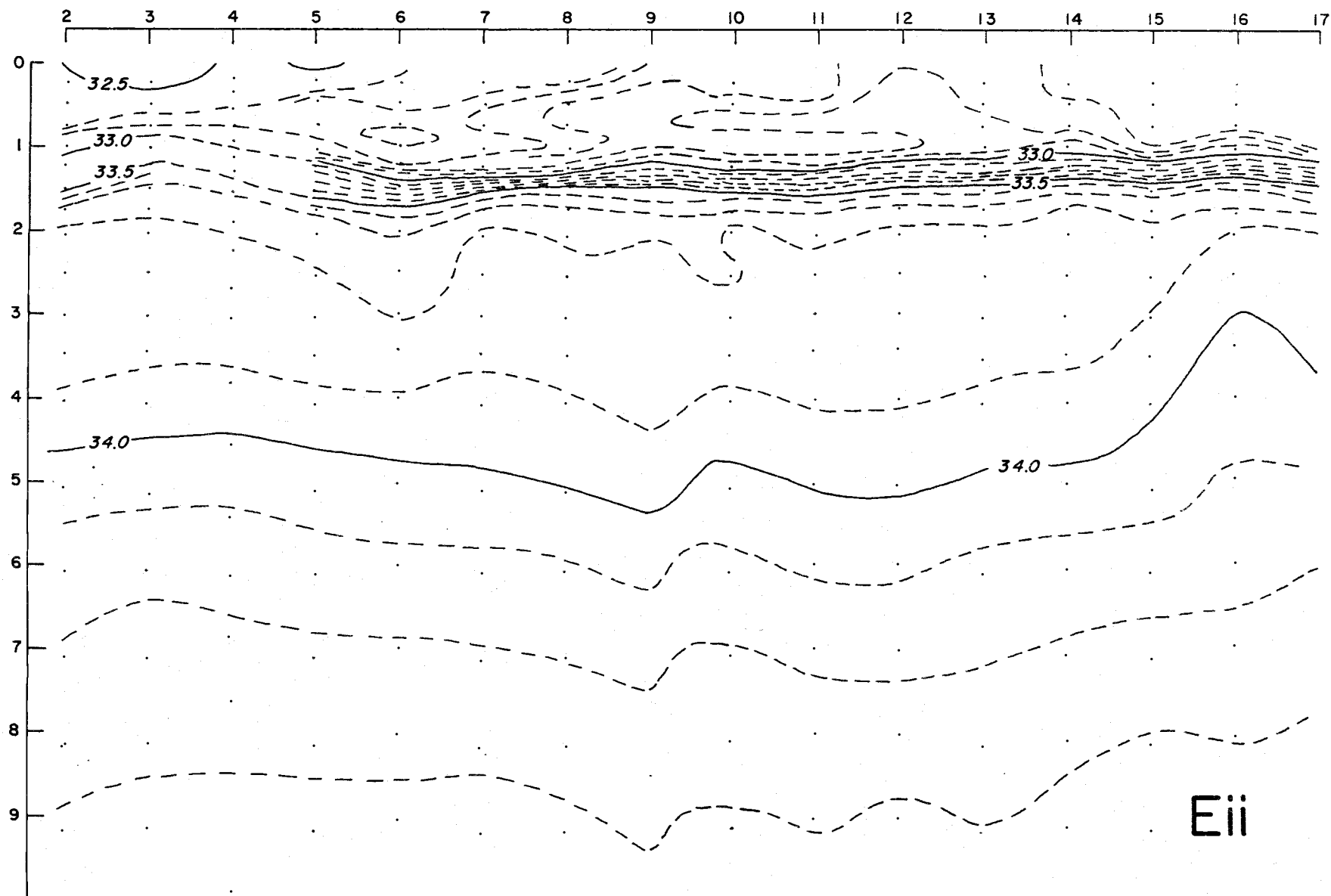
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13. ABSTRACT On 20 April 1966 the Oregon State University Research Vessel YAQUINA left port on a 100-day, 13,600 nautical mile voyage from Newport, Oregon, to Honolulu, Adak, Kodiak, Ketchikan and return. The cruise was arranged so that the YAQUINA could participate in Mohole investigations off Hawaii. Geophysical, chemical, and hydrographic data were collected en route to Honolulu during May 1966. The leg from Honolulu to Adak made possible collections of samples of deep water for studies of its physical and chemical properties and some experiments to determine productivity. Work near the Aleutian Islands was principally measurement of gravity and magnetism; hydrographic data were also collected. Dredging on a seamount and on the deep sea floor was the major effort in the Gulf of Alaska; hydrographic casts and one otter trawl were also made. A gravity run into Dixon Entrance, several trawls, hydrographic stations, and monitoring the Newport line comprised the work on the leg from Ketchikan to Newport. The events of the cruise are given in the narrative of the voyage, written by Dr. Park, who was on board for all parts of the cruise, except the Mohole work off Hawaii. A brief summary of the studies made and sampling programs conducted has been written for each area of oceanography by a member of the scientific party			

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(2) Northeastern Pacific Ocean						
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(6) Geophysics						
(7) Hydrography						
(8) Radiation						
(9) 1966						
(10) Mohole site						
<p><u>Abstract</u> (continued from Page 1)</p> <p>who was on board during the last leg of the voyage. These summaries have been kept very brief, and the reader is cautioned that the discussions are by no means comprehensive.</p> <p>Some results of the hydrographic work analyzed on board ship are included.</p>						