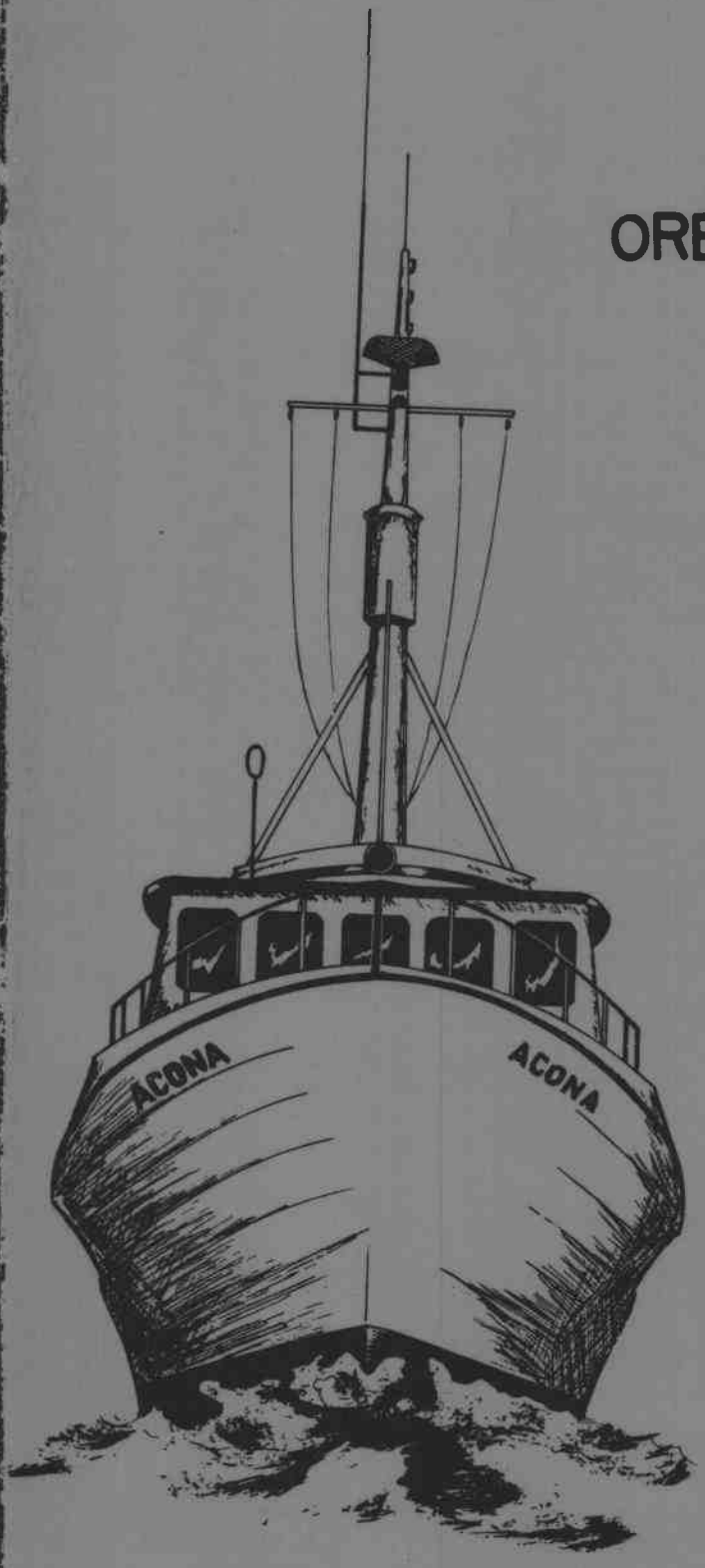
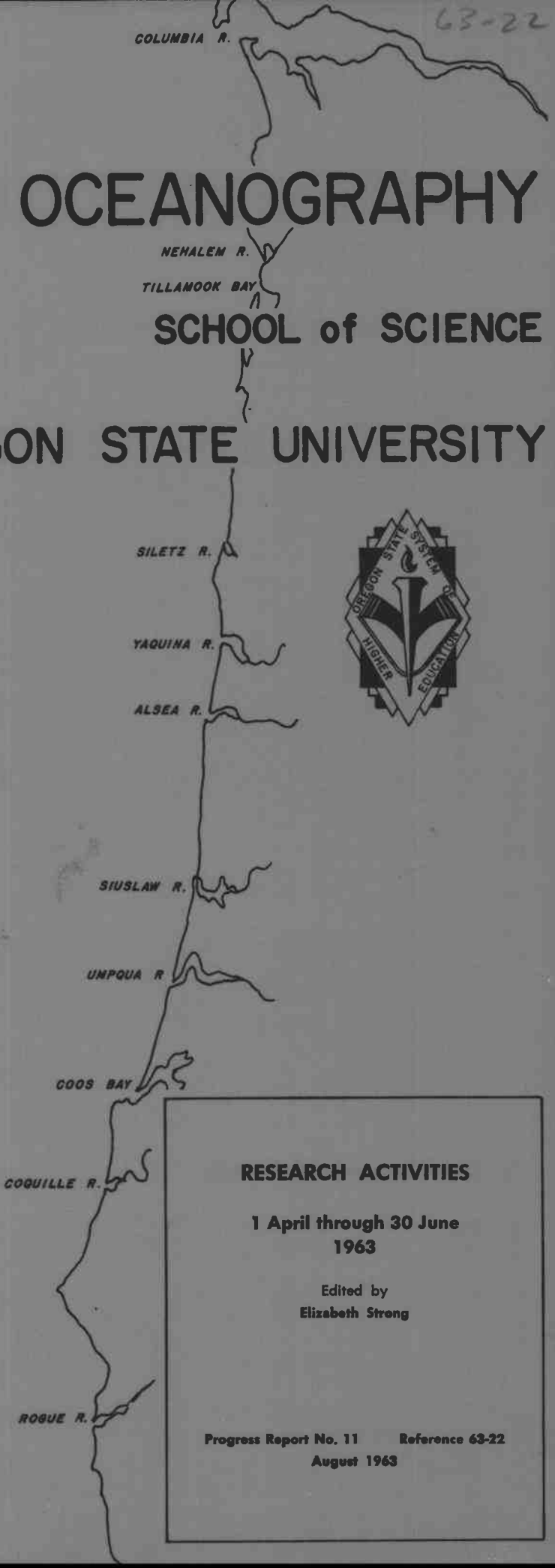
DEPARTMENT of OCEANOGRAPHY

SCHOOL of SCIENCE

OREGON STATE UNIVERSITY





RESEARCH ACTIVITIES

1 April through 30 June 1963

Edited by
Elizabeth Strong

Progress Report No. 11 **Reference 63-22**
August 1963

Department of Oceanography
School of Science
Oregon State University

Wayne V. Burt
Chairman

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INTRODUCTION

This report summarizes the research conducted during the second quarter of the calendar year 1963 by the Department of Oceanography, Oregon State University, under contracts with Geophysics Branch of Office of Naval Research, Division of Biology and Medicine of the Atomic Energy Commission, Advanced Research Projects Agency, and Air Force Cambridge Research Laboratory and grants from the Earth Sciences Section and Environmental Biology Division of the National Science Foundation.

PHYSICAL OCEANOGRAPHY

Hydrography of Oregon Coastal Waters - Wyatt, Kujala, Borden

One hydrographic cruise was taken during May and stations were made to 165 miles west of Newport, Coos Bay, and Brookings, Oregon.

Summary of Samples Taken on Hydrographic and Drogue Cruises

Hydrographic casts	52
BT casts	85
Surface temperature and salinity observations	71
Drift bottle releases	744
Midwater trawl tows	17
Plankton tows (Clarke-Bumpus)	8
Chlorophyll (C_{14} samples)	228
Phytoplankton samples	48
Submarine photometer readings	29
Drogue current measurements	7
One-meter net tows	10

Cruises for March and May have been processed and preliminary copies of the data have been distributed. The program to correct reversing thermometer temperatures has been revised to permit a more efficient use of computer time. Oxygen saturation values have been computed for cruises from June 1961 to the present. All previous drift bottle data has also been processed using a newly developed program.

Shore Station Observations - Still and Wyatt

Visits were made to 13 shore stations this quarter to collect accumulated salinity samples and data sheets. Successful predictions of upwelling off Cape Blanco were made possible with the aid of daily wind observations taken at the U.S. Coast Guard lighthouse at Cape Arago. These predictions enabled us to obtain hydrographic observations off Cape Blanco immediately prior to and after the development of the upwelling system.

At the present time, arrangements are being made to obtain daily oxygen, salinity, and temperature observations off Port Orford.

Temperature and Salinity Variability - Denner, Pattullo

Analysis of 1961 data was completed and accepted for Mr. Denner's thesis for the Master of Science degree. Mr. Denner has accepted summer employment at Naval Ordnance Test Station, China Lake, California, and after that will join the staff of the University of Alaska. Analysis of the 1962 data has also been completed. A paper on the results will be submitted for publication shortly.

Oceanic Fronts - Pattullo, Collins

Analysis of data on the bathymetry and intensity of the permanent front in offshore waters has been continued. The results are now being written up by Mr. Collins as his master's thesis work.

During the quarter a drogue cruise was operated close to the surface outbreak of the front (see below) and also a special series of density measurements across the front were made shortly before and during the development of upwelling off Brookings, Oregon. These data are presently being analyzed.

Subsurface Current Measurements - Pattullo, Wyatt, Maughan

One drogue cruise was made from 19-21 June. Previous cruises have been 50 miles offshore; this one was operated as closely as feasible to the surface outbreak of the pycnocline (oceanic front). The surface front was observed to lie between five and ten miles from shore (determined from thermograph, BT and hydrographic observations). The drogues were installed 20 miles from shore since the water closer to the coast is less than 200 meters deep.

The ship's radar failed during the cruise so it was not possible to track the drogues with full success. Current measurements were obtained at 10, 30, 60 and 90 meters, and one pair of fixes allows a single short-period estimate of the flow at 120 meters. Flow was to the south, and slightly offshore, for the upper three drogues. Speed decreased with depth. At 120 meters, the single estimate indicated southerly and and slightly onshore flow. Hydrographic observations are adequate for computation of the geostrophic portion of the flow.

The results of the cruises during 1962 were written and accepted as Mr. Maughan's thesis for the Master of Science degree. A paper for publication is in preparation.

Water Masses off the Oregon Coast - Pattullo, Bernhardt

The paper on the initial results is still in preparation. Mrs. Bernhardt completed the analysis of all cruise data to date before terminating with the department as of the end of this quarter.

Heat and Water Budget and Air-Sea Interchanges - Pattullo, Berhnardt, Lane

The broad-scale Pacific Ocean results, incorporating the IGY data, have been described in a paper to be presented at the IGY-IGC Symposium in Los Angeles in August.

An intensive examination of the energy exchange between sea and atmosphere off the Oregon coast has been initiated by Mr. Lane. A marine microbarograph and an Eppley pyrheliometer have been installed on the ACONA to yield data for this study.

Upwelling Studies - Smith, Staff

Considerable interest in various aspects of upwelling has been evidenced by several members of the staff. Mr. Smith has been examining existing theories in an effort to test their applicability to the Oregon coastal situation. In addition to regularly scheduled sampling, special hydrographic and BT sections have been made six times during the latter part of the quarter to provide additional information on the density changes as summer upwelling develops. This work will be coordinated with that of Curl, Park and Pearcy and their students.

Estuarine Studies: Seasonal Variations - McAlister, Blanton

Studies of distribution of properties and their seasonal variations in Oregon estuaries are continuing; particular emphasis has been given to Coos Bay. A report on monthly variations observed in Coos Bay is in preparation. Seasonal variations in circulation patterns have been observed, and are being related to available sources of energy for mixing in the estuary.

Estuarine Studies: Turbulence - McAlister, Blanton

The analysis of direct current measurements collected in Coos Bay is continuing. In this study, autocorrelation analyses of the current observations are being made. Data have been analyzed for fluctuations of periods greater than one minute. The tidal wave in Coos Bay has been studied as a source of energy for the turbulent spectrum observed in the estuary.

GEOLOGICAL OCEANOGRAPHY

Geology of the Oregon Continental Terrace - Byrne, Bushnell, Maloney

Lithology: The sampling program on the continental slope and outer continental shelf off the central coast of Oregon was continued during the quarter. Samples of sediment and rock were obtained from 18 locations on the continental slope by means of a pipe dredge. Sediment

cores up to five feet in length were collected by means of a gravity corer from 13 locations on the shelf and slope and from two positions on the abyssal plain 65 and 75 miles west of Newport.

The analyses of the shelf samples collected between 44°20'N and 45°00'N has been completed, and a report is in the final stages of preparation. Sands texturally and mineralogically similar to the beach sands of the central Oregon coast extend from the shoreline to about the 50-fathom depth contour. Below this depth, the sediments become finer grained, grading into clay-silts in the basins and valleys of the upper continental slope. Topographic highs are generally covered by silty sand consisting primarily of glauconite pellets. The percent organic matter in the sediments increases from essentially zero in the nearshore sands to more than six percent in the finer sediment on the continental slope. Calcium carbonate increases in a similar fashion from zero to nearly three percent, but locally may exceed 17 percent. Sponge spicules and radiolarian skeletons are found in the fine sediments of the continental slope and outer continental shelf, but generally constitute less than three percent of the sediment.

Topography: Preliminary smooth sheets (scale, 1:50,000) have been completed for the continental slope between 44°10'N and 44°40'N. These charts extend from the 80-fathom contour to longitude 124°55'W. At the present time the charts are undergoing final revision and correction.

Coastal Studies - Byrne, Kulm, Runge

The IBM 1620 computer program designed to determine the statistical parameters of sediments has been made operational and is currently being used by the Departments of Oceanography and Geology.

Mechanical analyses have been completed for the samples of phosphorite sand collected from Santo Domingo Island, Baja California. Preliminary examination of the textural parameters of the sediments suggest that the major concentrations of phosphorite are confined to aeolian deposits, whereas the underlying beach sediments contain a lower percentage of the phosphorite grains. The parameters determined by other workers to distinguish beach and dune deposits were found to be essentially valid and were used in this study.

GEOPHYSICS

Seismic Work at Sea - Berg, Whitcomb

Initial tests have been made with a gas exploder using oxygen and propane as an energy source for the continuous reflection profiler. Reflection studies are continuing in Yaquina Bay. The instrumentation will be used during July 1963 to do initial studies on the continental shelf off Newport.

Seismic Station - Dehlinger, Berg, Chiburis

The seismic station at Corvallis has been operated continuously as a Standard Station.

Equipment consisting of a single vertical seismometer and a visual recorder has been ordered for the new seismic station at Klamath Falls, Oregon. A pier is being constructed in the basement of the new Administration Building of the Oregon Technical Institute for installation of the instrument.

Seismicity of Oregon - Dehlinger, Berg, Chiburis

Seismograms and arrival times for a number of earthquakes occurring since August 1962 in California, Oregon, Washington, Idaho, Montana, and British Columbia have been requested from all relevant seismic stations in the Pacific Northwest. Epicentral locations and origin times for these shocks are being improved, as based on smoother time-distance curve plots. Epicentral distances are being calculated to obtain maximum accuracy. Resultant time-distance curves are being developed, with emphasis on the P_n arrivals. Results so far demonstrate that the P_n velocity in the region between the coastline and Cascade Mountains is 7.5 to 7.6 km/sec, while that east of the Cascades in an easterly direction is 7.9 to 8.0 km/sec. Seismograms from shocks in Idaho and Montana, as recorded at Baker and Pendleton, are being studied to determine P_n velocities traveling westerly across eastern Oregon.

A dissertation proposal is being developed by Mr. Chiburis for seismic investigations of structures in eastern Oregon, including investigations of surface waves (using group and phase velocities) as observed at those stations recording long-period waves and body waves originating from local shocks.

Land Gravity Studies - Berg, Rinehart

Sixteen gravity base stations have been established in Oregon in addition to six gravity base stations previously established by G. Woollard. These stations are distributed uniformly throughout the state and will be used to tie together all gravity data in the state.

Existing data along six profiles extending across the state in an east-west direction have been compiled, and a field program has been formulated to obtain additional data where needed.

A small regional survey is planned for August. Data are being made available by oil companies; field work will supplement these data.

Sea Gravity Studies - Dehlinger, Berg, Rinehart, Jones

During May, 4300 miles of continuous gravity profiling was made off the Oregon coast using the USCGC YOCONA. Included in the data were seven

profiles extending from nearshore to more than a hundred miles off the coast. These profiles will be joined to the land profiles to investigate the continent to ocean transition zone.

Approximately 70 miles of continuous surface-ship gravity data were obtained aboard the ACONA along the gravity range previously established off Newport. Satisfactory data were obtained, but calm waters were required to make measurements.

Gravity Analyses Investigations - Rinehart, Berg, Odegard

Methods of analyses developed or tested during the past year are being used to process gravity data. New methods utilizing a Fourier synthesis of gravity data have been formulated but have not yet been tested.

Thermal Studies - Berg

A thermal probe has been ordered and should be received by July. Heat flow measurements will be started in the fall.

Instrumentation - Bales

A nuclear precession magnetometer is in the final stages of construction. It will be tested at sea during the first week of July.

CHEMICAL OCEANOGRAPHY

Physical Chemistry of Sea Water - Weyl

A critical review of previous work on the physical chemistry of sea water was started. The change of specific conductance of sea water with temperature was reviewed in detail and a preliminary manuscript has been written and distributed.

Carbonate Geochemistry - Weyl

P. E. Cloud's U.S.G.S. Prof Paper 350 on carbonate deposition in the Bahamas has been reviewed for Limnology and Oceanography. The importance of the tidal movement of water, largely ignored by Cloud was pointed out. To develop these ideas in more detail, we are working up quantitatively, a simplified model of the hydrology applicable to the area investigated by Cloud. This study is being done in cooperation with Dr. McAlister, and a joint manuscript will be prepared.

Offshore Chemistry - Park

In addition to salinity and dissolved oxygen analyses, silicate determinations were made for all hydrographic stations occupied off Coos Bay and Brookings and for several hydrographic stations off the mouth of the Columbia River.

An inductive salinometer was installed aboard the ACONA in order to carry out salinity analyses at sea.

Estuarine Chemistry - Matson, Park

Silicate, phosphate, conductivity, pH and dissolved oxygen content of the waters of the Columbia River from Portland to Astoria were analyzed aboard the ACONA in April. The surface river water showed a silicate range from 240 to 250 g-atom/liter, a phosphate range from 0.4 to 1.3 g-atom/liter, a pH range from 7.0 to 7.8, and an oxygen range from 7.6 to 8.6 ml/liter. It was possible to detect silicate-rich river water 40 km off the mouth of the Columbia River at a concentration of 30 g-atom/liter. In agreement with our observations, Stefansson and Richards of the University of Washington, developed a simple mixing model of silicate in the Columbia River plume.

Measurements of the distribution of silicate and phosphate in the Yaquina River and Bay, and in the Alsea River and Bay were made in May.

Comparison of Estuarine and Offshore Chemistry - Park, Frolander

Based on single stations, one 4 km inland in Yaquina Bay and the other 9 km offshore from the mouth of Yaquina Bay, a comparison of seasonal variations in salinity, oxygen and phosphate was made with reference to the phenomenon of upwelling, and meteorological effects. For the years of 1961 and 1962, the variation of the four parameters (salinity, temperature, oxygen, and phosphate) agree quite well with respect to the upwelling phenomenon. Percentage CO_2 and O_2 saturation profiles for off the mouth of Yaquina Bay during August, 1961, were plotted. A preprint to be presented at the Symposium on Large Body Water Quality - The Oceans before the Division of Water and Waste Chemistry, American Chemical Society, September, 1963, has been submitted for publication.

Reliability of Inductive Salinometer - Park, Burt

A summary of a comparison test between the salinometers of the University of Washington and Oregon State University was reported at the American Society of Limnology and Oceanography, Pacific Division Meeting, 18 June 1963. We have started to collect different batches of Copenhagen standard sea water to determine the variation of electrical conductivity for these standards as measured with different salinometers.

Partial Equivalent Electrical Conductance of Salts in Sea Water - Park, Catalfomo, Weyl

The changes in electrical conductance and pH produced by adding 16 different electrolytes to sea water were determined with the inductive salinometer. From the pH change, we have estimated the degree of $Mg\text{-}CO_3^\circ$ complex formation in sea water. From the conductivity change we have calculated the partial equivalent conductances of these 16 electrolytes in sea water, and the percentage contributions of various salts to overall electrical conductivity of sea water. A preprint has been prepared, and some of the results were presented at the American Society of Limnology and Oceanography, Pacific Division Meeting, June 1963.

Gas Chromatographic Analysis of Dissolved Gases in Sea Water - Park

Preliminary laboratory results show that we can separate N_2 and O_2 plus Ar easily, but not CO_2. Shipboard work cannot be started until necessary equipment is purchased.

RADIOCHEMISTRY

Calibration of ND 130A Spectrometer - Osterberg, Larsen, Cutshall

Standard solutions ($\pm$ 5%) from Abbott Laboratories of four radioactive elements were used to calibrate our instrument. Less accurately known standards ($\pm$ 10%) from Oak Ridge of different elements were counted to determine the ratio of photopeak to Compton scatter in the appropriate regions.

Intercalibration checks were made between our spectrometer and instruments at Hanford Laboratories, Oregon State Board of Health in Portland, and Scripps Institution of Oceanography in La Jolla, California. The latter will make possible comparison of our data with those from Southern California, an area of low fallout and far from the influence of the Columbia River effluent.

Calibration of the 5 x 5-inch NaI(Tl) crystal has been completed. Calibration of the 3 x 3-inch NaI(Tl) detector will begin shortly.

The bismuth shield (99.999%) was used 4-15 April. Tests showed that the Bi contributed two peaks to the background spectrum, and therefore increased rather than reduced the background. These peaks will be identified when time permits.

Radioanalysis of Seawater - Osterberg, Cutshall, Larsen

A cruise extending from Astoria through the estuary and 45 miles out to

sea was made in April. Surface sea water from 45, 35, 25, 15, and 5 miles off Astoria was filtered, and filters and filtrate were analyzed for gamma-emitters. Euphausiids were taken in trawls from the same area. Ionic zinc-65 was measured in samples collected 25 miles offshore, while the filters showed a peak due to Zn^{65} out to 45 miles. Sufficient euphausiids for radioanalysis were obtained 25 and 45 miles off Astoria, and Zn^{65} was found in both samples.

Chemistry of Cr^{51} in Natural Waters - Cutshall, Park, Osterberg

Chelating and anion exchange resins and various precipitation techniques have been used as concentrators of chromium-51. While all are quite successful in the estuary, the detection of chromium-51 in the filtrate from surface seawater becomes increasingly difficult with distance from the mouth of the river. One sample from 45 miles off Newport, yielded detectable quantities of Cr^{51}. These tentative results seem to confirm laboratory experiments of Curl and Osterberg, which suggest that Cr^{51} exists as a radiocolloid in seawater. This study will continue and will form a nucleus for the research requirement in Mr. Cutshall's Ph.D. program in Chemical Oceanography.

Radioanalysis of Oceanic Materials - Osterberg, Larsen, Cutshall

A. Nekton (28 samples*) with Dr. Pearcy

Radioactivity of plankton collected from discrete depths down to 1000 m is being measured. Samples from deeper trawls generally possess less radioactivity, but there may be diurnal differences. When sample size permits, the radioactivity of similar organisms from different depths are being compared.

B. Benthos (25 samples*) with Drs. Carey and McCauley

Radioanalyses of benthic organisms show the penetration of fission products into bottom dwellers at depths down to 2800 m. The appearance of Zr^{95}-Nb^{95} at this depth suggests rapid vertical transport. A paper (Osterberg, Carey and Curl), which discusses the implications of this observation, is being prepared.

C. Filter samples (River, 36; ocean and estuary, 28; rain, 17*)

Particulate material trapped on membrane filters, through which water from various sources has been passed, has been analyzed for gamma emitters. The filtrate has, in many cases, been treated with exchange resins to concentrate the ionic portion.

D. Resins (15 samples*)

Mr. Cutshall is using these in his thesis studies.

* Some samples were counted more than once.

E. Estuary (20 samples*)

Two otter trawl samples were taken in the Columbia River estuary. Levels of radioactivity are sufficiently high to make short counting times feasible, and to allow comparisons between the levels of radioactivity in different parts of the same animals.

F. Miscellaneous (12 samples)

This category includes scrapings of rust from inside our pump, sections of hose (for adsorbed radionuclides), materials suspended in the rivers for adsorption studies, various uranium samples, etc.

G. Standards and backgrounds

About one-third of our effort was directed to the counting of standards for calibrating the instrument and a study of the variation in background. Samples counted on our instrument were also counted on the 5 x 5-inch crystal at Hanford Laboratories. We find very similar efficiency factors for the two detectors.

*Some samples were counted more than once.

Trace Element Analysis by Neutron Activation - Osterberg, Larsen, Cutshall

The two samples of plankton irradiated at Hanford are still too "hot" to count. The two similar samples sent to Washington State University have been analyzed. Tentative results are encouraging, and further tests will be made.

BIOLOGICAL OCEANOGRAPHY

Plankton Inventories at Yaquina Bay - Frolander

Sampling program: Regular sampling is being continued at Yaquina Bay for the study of properties of coastal estuaries. Zooplankton samples and measurements of temperature, salinity and oxygen were taken at four stations in the bay. Twenty-eight pairs of zooplankton samples were taken with quantitative #6 mesh and #12 mesh nets; temperature, salinity, and oxygen measurements were made at surface and bottom to accompany each pair of quantitative zooplankton samples.

Forty water samples were collected for phosphate analysis by the chemical oceanographers.

Volumetric analysis: Analysis by vacuum displacement method is being continued on zooplankton samples from Yaquina Bay (#6 and #12 mesh samples collected February to May 1962).

Accessioning: The accessioning and cataloguing of zooplankton samples is completed through June 1963.

Analyses of Physical-Chemical Data - Frolander

Temperature, salinity and oxygen measurements made in conjunction with the Yaquina Bay zooplankton sampling program have been analyzed and oxygen values derived.

A paper is in preparation on the seasonal and spatial characterization of the water mass in Yaquina Bay as related to coastal upwelling in 1960.

Oceanic Zooplankton Samples - Frolander

Records of all zooplankton samples collected from the ocean by the Department have been brought up to date (filed on index cards, checked, and catalogued). These include samples collected by Clarke-Bumpus nets since April 1961, half-meter and one-meter net samples since April 1960, dip net--night light samples since July 1961.

Herring Feeding Habits - Frolander, Russell

Young stages and near adult stages of herring have been taken successfully by various fishing methods in a herring feeding habit study but intermediate size fish, 40-70 mm size, have proved difficult to capture. An experimental Fyke net has been installed in a suitable bay location in an attempt to obtain the intermediate size fish. Preliminary results indicate that the fish are missing the net. Side wings and a lead netting are to be installed to serve to guide fish to the net.

Energy and Element Transfer at Lower Trophic Levels - Small, Curl, Cross

Experiments with Calanus cristatus grazing on Skeletonema costatum labelled with Cr^{51} have been performed under controlled conditions. Also, further evaluation of direct Cr^{51} uptake from solution by C. cristatus is underway. The aquastat is nearing completion. Calibration of the spectrometer for Zn^{65}, and use of this isotope in experiments will begin.

Species Associations of Pelagic Copepods - Cross, Small

Work is being continued on the distribution of copepods off the Oregon coast. Species counts and a literature survey are now in progress.

Phytoplankton Ecology - Curl, Small, Verity, Trione

Five in situ experiments were conducted at NH-25. Forty-six samples from these stations were analyzed for productivity by the C^{14} method. Fifteen

samples were collected for the study of photosynthetic pigments and five for analysis of species composition. Ambient illumination and light attenuation with depth measurements were made on all in situ cruises. A pyreheliometer has been installed aboard the ACONA.

A total of 213 pigment samples and 43 preserved samples, plus concurrent light measurements, were taken on one hydrographic cruise this quarter.

Phytoplankton Physiology - Curl, Small, Trione, Davey

The "aquastat" is almost complete, lacking placement of the glass bottom and heat sources and sinks.

Additional nutrient enrichment cultures have been prepared from samples obtained on hydrographic cruises.

Oceanic Nekton Studies - Pearcy, Laurs, Hubbard

Collections with the modified six-foot Isaacs-Kidd midwater trawl were continued off the Oregon coast. These included 14 samples to 200 meters along the east-west hydrographic station lines and 21 collections using the Lamont multiple plankton sampler as a codend opening-closing unit for the midwater trawl. Meter net tows are now being taken simultaneously with the 200-meter midwater trawl samples on all hydrographic cruises.

Modifications of the midwater trawl have permitted preliminary estimates of the vertical distribution of small nektonic animals at three depth intervals during day and night periods, thus providing data on diurnal differences in catches.

Distributional analyses of cephalopods, fishes, and prawns continues.

Macroplankton Studies - Renshaw, Hebard, Hubbard, Pearcy

The quantitative meter net program has progressed to the point where samples from all desired depths are being taken. A total of 26 samples have been taken with the nets operating at 66% efficiency. Improvements on the design of the cable clamps and "kite" depressor have aided the sampling technique and eliminated most of the sampling problems.

At the present time, the euphausiids, chaetognaths, siphonophores, medusae, salps, and copepods are being analyzed for vertical and seasonal distribution.

Distribution of Pelagic Organisms as Related to Upwelling - Laurs, Pearcy

A study of the biological effects of upwelling, initiated in June 1962, is being continued. On the May hydrographic cruise, special lines of stations were run (repeated stations on the regular Brookings line and

lines of stations 10 miles to the north and south) to take advantage of the before-and-after upwelling situation. Ten oblique tows to 200 meters were made with a quarter-inch mesh Isaacs-Kidd midwater trawl and a one-meter "0" mesh plankton net. Filtrations using millipore filters were made for phytoplankton data. Water samples for nutrient analysis (PO_4 and SiO_2) were frozen aboard ship.

Analysis of the data is presently underway.

Benthic Studies - Carey, McCauley, Hancock, Kirk

Three cruises this quarter yielded 17 quantitative anchor dredge samples and 10 otter trawl samples. Fifty of the 52 anchor dredge samples collected to date have been sorted into major groups. Identification and analysis of the collections continues. The otter trawl collections have been sorted and most of the crustaceans, molluscs, and echinoderms identified. Trawling has proved successful to depths of 2800 meters.

The invertebrate collection now contains 1692 items, 802 of which have been identified. Of these items 1279 were collected off Oregon and the remainder from the Chukchi Sea. Those identified represent 219 species.

Marine Trematode Studies - McCauley

A new lepocreadiid trematode was described from the intestine of a deep sea macrourid fish, Coryphaenoides sp. captured from the bottom in 2800 meters of water, 65 miles west of Newport, Oregon. No trematode has previously been taken from so great a depth.

Benthic Radioecology - Carey, McCauley, Osterberg, Larsen, Cutshall

Twenty-two samples representing 11 species have been analyzed in the 512-channel gamma-ray spectrometer. Seventeen additional samples are in final stages of preparation for analysis. To date, 3 species of holothurians, 2 echinoids, 7 asteroids, 1 gastropod, 1 brachiopod, and 2 decapods have been found and identified in sufficient numbers in otter trawl samples for radioanalysis. Adequate numbers of animals and levels of radioactivity for this project have been shown to exist along the Newport station line off the Oregon coast to depths of 2800 meters.

Benthic Animal-Sediment Relationships - Carey, Hancock, Maloney

Analysis of the sediments has been initiated. Frozen samples from anchor dredge hauls are presently undergoing analysis for particle size, total carbon, and organic carbon.

Marine Microbiology - Morita

An obligate marine pseudomonad, designated as MP-1, was isolated from the

north Pacific Ocean and was found to be a unique obligate psychrophile. Growth was obtained from -1°C (lowest tested) to 20°C, with optimal growth between 15° to 16°C. The growth rate at 15°C was found to be very rapid under maximal aeration conditions. Viability of this bacterium was destroyed by heating at 28.8°C for 6.25 hours and reversible damage occurred at 28.8°C in 1.25 hours.

Another psychrophilic marine bacterium was found to have a maximum growth temperature of 30°C. Its malic dehydrogenase was found to be thermolabile at 30°C. The heating of whole cells gave an apparent effect of increasing malic dehydrogenase activity. Lysis of the cells permitted the enzyme to function at its full potential but rendered the enzyme more sensitive to heat denaturation. The studies performed on this organism indicated that heating to 35°C brings about damage to the cell permeability as well as the denaturation of the enzyme. Further studies have shown that malic dehydrogenase when denatured at 30°C was reversible, with a maximum renaturation occurring when the denatured enzyme was slowly cooled in the presence of mercaptoethanol, reduced nicotinamide adenine dinucleotide and malate.

STAFF

Two OSU staff members, Dr. Giles W. Maloof, Assistant Professor of Mathematics, and Mr. Solon A. Stone, Assistant Professor of Electrical Engineering, will be working with the Geophysics Research Group for the summer and plan to continue working for the Department on a part-time basis during the academic year. Dr. Maloof, whose specialty is applied mathematics, is currently working on a topic concerning head-wave transmission. Professor Stone has a special interest in control systems; he is working on a problem concerning the propagation of surface waves.

Mr. B. R. Jones came to Oregon State from Texas A and M for the summer to operate the surface-ship gravity meter at sea and to make measurements for a meter calibration test at land based stations between Vancouver, B. C., and San Jose, California.

PUBLICATIONS AND PAPERS

Publications

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Dehlinger, P., R. G. Bowen, E. F. Chiburis, and W. H. Westfall, 1963. Investigation of the Earthquake of November 5, 1962, North of Portland. The Ore Bin, 25(4):53-68, April 1963.

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Wyatt, Bruce, 1963. A short-tailed albatross sighted off the Oregon coast. The Condor, 65(2):163.

Papers Submitted

Berg, Joseph W. (with K. L. Cook and Daniel Lum). Seismic and gravity profile across the Northern Wasatch Trench, Utah. Geophysics.

Berg, Joseph W. (with K. L. Cook, M. O. Halverson, and J. C. Stepp). Regional gravity survey of the northern Great Salt Lake Desert, and adjacent area in Utah, Nevada, and Idaho. Geol. Soc. Amer. Bull.

Berg, Joseph W. Seismic refraction profiles, Narragansett Bay, Rhode Island. (for publication in the Geol. Soc. Amer. Bull.).

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12 April	John M. Crawford, Soc. of Exploration Geophysicists. "Case History of an Exploration Method--Vibroseis."
17 May	Francis A. Richards, University of Washington. "A Stoichiometric Model of the Oxidation of Organic Matter in the Sea."
28 May	Alan J. and Eve Southward, Marine Biological Association, Plymouth, England. "Recent Biological Oceanography at Plymouth."
28 June	Unnsteinn Stefansson, Atvinnudeild Haskolans, Reykjavik, Iceland (Visiting Professor, University of Washington). "Nutrient Relationships off the Oregon and Washington Coasts."