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Information from Abroad

1. Marine Science Gets a Big Boost in U.K.

The recently published second annual report of the National Environment Research Council (NERC) makes it clear that the major expansion within its sphere of responsibility is to be in marine science. Of the four Government Research Councils, NERC launched on the steepest growth curve—20 per cent expenditure increase in its first three years (including 1968); in real money its budget will rise from £ 7·7 million and in the current year to £ 10·1 million in 1970 and a substantial part of this will go to marine sciences. The £ 1·5 million currently being spent in this area by NERC will climb to a platanfigure of £ 3·5 million in 1972, thus doubling the national effort over four years. This, explains NERC Secretary, R.J.H. Beverton, is as rapid a growth as is possible, for expansion depends on the availability of good trained people and the development of advanced facilities.

These new facilities include the provision of two computers this year for the National Institute ot Oceanography, one for the Institute itself at Wormley in Surrey and the other to be installed aboard the NIO's oceanographic vessel RRS *Discovery*. An additional marine biology laboratory for the Scottish Marine Biological Association is being set up on the mainland at Oban. A new tool the Council is supporting is the automatic recording deep ocean *moored buoy*. For the immediate future, however, the Council recognizes the urgent need for a second oceanographic ship for work in Continental Shelf Waters.

This ties in with the most spectacular of the Council's projected new facilities, the development of manned submersibles for marine research. Of the four research themes the Council is giving special emphasis to, two relate to inshore waters and all are concerned with problems of sea/land interface. The Institute of Geological Sciences, the body responsible for geological surveying and now under the NERC, is to speed up the geological survey of Britain's Continental Shelf. Recently Dr. Goldon Health of the Council's scientific staff toured a number of American submersible manufacturers and visited the institutions that make research use of these craft. Their value for continental shelf work, and for geology particularly, has impressed the Council.

What is envisaged is a research centred "package", involving capital cost upwards of £ 1 million, which would be a cooperative project with Ministry of Technology, the Royal Navy and possibly the Ministry of Power and other departments involved as potential users or in developing the technology. Such a coordinating body

already exists and has been studying the implications for Britain of under sea exploitation since Mintech's Harwell Conference last April. The Atomic Energy Research Establishment at Harwell is foreseen as the Central laboratory and design authority for the advanced techniques called for by an under water research and exploitation policy. NERC, however, was quite firm about its own role in the two prolonged enterprises : "The function as the prime coordinator of marine scientific research in this country and to encourage the Ministry of Technology to plan the commercial exploitation of the findings of the research".

In identifying its research needs, the Council has gone a considerable way in defining the under-water vessel system required to meet it. The manned underwater research craft will be essentially for work on and above the continental shelf. A depth range of 300 meters and an endurance of 2-3 days would therefore seem adequate. It must have excellent viewing characteristics, and a sample collection facility will be particularly important, especially in its prime role as a bottom geology tool; the design of outside manipulation is, therefore, being given much thought (and Harwell's expertise in remote handling will presumably be useful).

Even a submersible weighing only ten tons will pose formidable problems during its launch and recovery in stormy British Coastal waters Thus the craft is not being considered as an isolated unit, but as an element in an integrated system. This would comprise a specially designed mothership capable of handling a small family of submersibles and conveying them on board to and from the research site. The most promising approach to solving the 'liftout' problem appears to be a ship with a specially designed dry-dock stern which could be flooded or emptied to let the submersible float out or in. NERC favours a double purpose, custom built vessel in the mothership role. When not operating submersible in British Coastal water it would be equipped to work as a deep sea oceanographic vessel to supplement Discovery's cruises. Outline specifications being discussed are over-all length of 60-70 meters and a weight of about 2,000 tonnes. The cost of such a vessel would be about £ 1 million and estimates for submersible fall around the £ 60,000 mark.

[From *Science Journal*, 1968, **4**, (2): 9]

2. Light Penetration : New Record

Under water observations from five research submarines have revealed that day light penetrates the ocean to depths as great as 700 meters. Horizontal viewing in offshore tropical and subtropical areas ranges from about 6 meters at a depth of 300 meters to almost 60 meters at a 180 meter depth. Such observations could mean that light is available for under sea tasks at depths "really greater than earlier studies indicated", says Roswell F. Busby of the U.S. Naval Oceanographic office's Deep Vehicle Branch. The maximum depth of penetration of natural light apparently was reached by the submersible ALVIN in a dive at Tongue of the ocean in the Bahamas.

[From *Science Journal*, 1968, **4**, (2) : 11]

3. Shocking Shrimps into Trawl Nets

Round the clock fishing for shrimps and prawns may soon become possible using an electric trawl. At present shrimp fleets lie idle half their time on the fishing grounds. Their quarry, brown and pink shrimps, spend the day-light hours surrounded in the mud and can be caught in the trawls only during the night when they emerge to feed.

The U.S. Bureau of Commercial Fisheries' gear research personnel at Panama city, Florida, decided to explore the possibility of using electric shocks to persuade the crustacea to emerge from their mud burrows during the day. The initial trials were rather disappointing, largely because so little was known about the ways in which the crustacea react to electric pulses. Accordingly, a large programme of investigations, both in the laboratory and in the field, was started to answer basic questions about crustacean behaviour.

The researches showed that both the voltage and the rate of the pulses had a considerable influence on the shrimps. The higher the voltage, the higher the animals moved from their resting place. The optimum pulse rate proved to be between four and five pulses per second. The workers were now close to answering such problems as what stimulation was needed to persuade the shrimps to jump high enough within two seconds to be caught by a trawl travelling at 2·5 knots with an electric field about three meters long. They arrived at the general formula of four pulses per second at three volts.

The prototype trawl which was built to this specification comprises four basic components: a power control panel, power cable, electronic pulse generator in an underwater housing and an electrode array. The power is supplied from the control panel via the cable to the pulse generator attached to the trawl. In the generator, the power is converted to direct current and stored in a capacitor and discharged through an electrode array consisting of five electrodes which stretch across the front of the net.

Extensive trials have produced a fair crop of problems, such as shorting out of leads and connection, failure of electrodes to withstand the constant chafing along the sea-bed and most important of all, overheating of the generator circuits because of overloading resulting from the high conductivity of seawater. However, none of these defects seems insuperable and modifications are being made to overcome them. The latest trials, which have yielded good day time catches of shrimps, suggest that electric trawl will become a commercial reality.

[From *Science Journal*, 1968, **4** (2) : 15]

4. Expedition CLIMAX I (Horizon 68-1)

From September 10 to October 15, 1968, the R/V HORIZON will participate in a biology cruise in the North Pacific Central area with John A. McGowan as scientific leader. Shri Gopalakrishnan who has been with the National Institute of Oceanography at the Indian Ocean Biological Centre, Ernakulam as Junior Scientific Assistant is also participating in the cruise.

This is the first of two cruises being planned as an initial attempt to gather the type of samples and data necessary to conduct a comparative study of the species structure of two very stable areas that share the same species, some of whose populations are isolated and some of whose are not. At 27° North, 155° West an intensive programme of replicate sampling of phytoplankton, micro-and macrozooplankton and necton will be carried on. Nutrients, light chlorphyll-phaeophytin, primary productivity and standard hydrographic measures will be made in replicate. To accomplish this, one locale will be staked out with a system of four parachute drogues and the sampling done relative to the drogues for a period of eight to twelve days. Bongo nets and Hardy-Longhurst recorder tows will be made to determine the vertical structure of the zooplankton, pumps and water bottles for the phytoplankton and micro-zooplankton. The main purposes of this intensive replication is to obtain measures of the variability in the order of dominance and in the numerical species structure of phytoplankton, zooplankton and micronecton. The variance associated with the other measures of the environment can be related to aspects of physical stability. Since many of the techniques (both field and laboratory) to be used in this study are relatively new and since this area has not been well studied, we do not expect definitive results from Cruise I. It is designed primarily as an exploratory and training cruise. Ten graduate students will participate; of these, four second year students will be doing work specifically oriented towards their own thesis research but which will fit into the overall objectives of the cruise. The others will be learning techniques and methods.

Cruise II will return to the same area in 1969. Depending on the preliminary results of Cruise I, a similar but more intensive programme of sampling will be carried out. This will be possible because

of the availability of a larger ship (the R/V ARGO) and because of the increased experience and skillof the scientific party. Following this a transect will be made from 27° North along 155° West to 25° South latitude or approximately the centre of the South Pacific Central water mass, where a study similar to Cruise I will be done.

The purpose of these two cruises is to obtain the necessary samples to describe the numerical species structure of all of the trophic levels of a community. Extensive replication of all sampling will be done so that confidence limits may be assigned to each estimate of relative abundance. Expressions of the amount of stability in the species structure should be possible because comparative studies of two isolated areas with very similar fauna will be done. In both areas advection is minimal and physical stability is great. If climax communities exist in the plankton, they should be very well developed in the locales selected. A series of replicate measurements of a wide variety of properties of the physical-chemical environment will also be made, The purpose of these is to provide data for a description, in statistical terms, of the habitat of the community.

Cruise I Observations :

1. Macrozooplankton: Replicate stratified tows at 10 to 12 depths to a maximum depth of 500 m.
2. Microzooplankton : Replicate "continuous" profiles to 150 m with pump and point measures at 10 additional depths to 500 m.
3. Phytoplankton : Replicate "continuous" profiles to 150 m with pump and point measures at 10 additional depths to 400 m.
4. Necton : Replicate stratified trawls 0 to 8 depths to 2,000 m.
5. Surface observations : Sighting and/or collections of birds and mammals, dip netting of squid and fish, night light jigging and surface trawling. Estimates and/or counts of all of these.
6. Chlorophyll and phaeophytin : Replicate "continuous" profiles to 300 m.
7. Primary Productivity : Replicate measures at 10 depths to 300 m.
8. Light : Replicate intensity *vs.* depth curves.
9. T and S: Replicate continuous profiles (TDS) to 1000 m and point measures every 100 m to 2,000 m.
10. NO_2, NO_3, PO_4, SiO_3, O_2 : Replicate "Continuous" profiles to 500 m and point measures every 50 to 1,000 m and every 100 m to 2,000 m.
11. Dissolved plus particulate organic carbon : Replicate vertical point measures to 2,000 m.
12. Capture deep organisms for C^{14} age dating of body carbon.
13. Drogue tracking.

5. STYX Expedition

Sponsored by the National Science Foundation, Office of Naval Research, Atomic Energy Commission and the state of California, the expedition will be starting in April 1968, and ending in December 1968. Scripps Institution of Oceanography will be operating the R/V *Agassiz* in the Central Pacific between the Hawaiian Islands, Samoa Islands and Society Islands. The research as pointed out below will cover several phases of deep sea oceanography.

Phase I — Deep Flow—water characteristics, topography and sediments in the Central Pacific Ocean from April 2, to August 3, 1968.

Phase II — Mid, Pacific seamounts and guyots, their post and present fauna from August 21 to September 20, 1968.

Phase III — Circulation around oceanic islands : from October 22 to November, 1968.

Additional projects will also be carried out along with the above three phases

such as obtaining water samples for detailed Cs^{137} profiles of between 0 to 500 meters, including STD profile to 1,000 meters at each Cs^{137} station, surface collections of Cs^{133} and Cs^{137} along the entire ships track of Leg I to determine the penetration of nuclear fall out and estimate movement of water masses in regions not previously sampled.

Arcer, magnetometer and a gravity core will be taken at one station of Leg I of Phase I for the Joides deep-sea Drilling Programme.

Plankton hauls will be made in areas of special interest along the track. The Magnetometer will be towed along much of the ships track. Bathythemographs (XBT) will be taken over the entire ships track.

There is space on various portions of the expedition for research by other interested group the details of which can be acquired from the expedition-in-charge of Phase I, Walsh, T.W., Ried J.L. and Liebertz, P.J.; Phase II Rosenblatt, R.H. and Newman, W.A., and Phase III Van Dorn, W.G. The expedition will be working under William A. Nierenberg, Director.

6. British Oceanographic Data Service

The Natural Environment Research Council is to set up a British Oceanographic Data Service at the National Institute of Oceanography, Godalming. The Chairman of the steering committee is Dr. G. Deacon, Director of National Institute of Oceanography. As with many other subjects there is an increasing amount of Data which needs holding in a systematic way. It is hoped that the Centre will use modern methods of Data storage—punched tape, a computer, and so on, and then it will have telex links with other oceanographic and research Institutions.

This will not be the first oceanographic data centre in the world. There is one at Copenhagen run by the International Council for the Exploration of the Sea, and others in Hamburg and Ottawa, for example. The idea now is to have National Data Banks co-ordinating with one another instead of World Centres. There is a small oceanographic data centre in existence in Britain at the moment but this is for Bathythermographic data only and is run by the Ministry of Defence (Navy) Hydrographic Department. The new national centre will cover all oceanographic data from the area of north-east Atlantic and the North Sea down as far as Bay of Biscay. To start with, the centre will collect data on physical oceanography only—temperature and salinity measurements and so on, but eventually it will store and disseminate information in the whole field of oceanography.

[From *Nature*, London-**217**, (5135), (1968)]

7. Deep Sea Drilling Gets Under Way

The *Glomac Challenger*, specially built for Deep Sea Drilling Project, will be most sophisticated vessel of her kind yet constructed. Accurately positioned every two hours through a previously classified satellite navigation system developed for the U.S. Navy, she will use computer controlled dynamic positioning while drilling in up 6,000 meters of water and penetrating sediment thickness of 750 meters.

The drilling project is a joint venture of the Scripps Institution of Oceanography, the Lamont Geological Observatory, the Woods Hole Oceanographic Institution and Miami's Institute of Marine Science. Scripps is to manage the project under an estimated $ 12·6 million grant from the National Science Foundation. Dr. Melvin N.A. Peterson, who is Chief Scientist of the project, stressed recently that the programme is in no sense a replacement for the ill-fated Mohole project to drill through to the Earth's mantle. The deep drilling project will be concerned only with oceanographic sediments and no drills will penetrate more than a meter or two through the hard underlying rock. The philosophy behind the project is to enable comparisons to be made of sedi-

ment cores over a wide area of both the Atlantic and the Pacific.

Perhaps the major scientific interest in the cores taken will concern theories of how the ocean floor shifted with time as a possible consequence of slow moving convection currents within the mantle. The information gathered should be of great use in elucidating the mechanism and dynamics of continental drift. Other projects will be concerned with the history of ocean currents and reversals of the Earth's magnetic field. But while these areas will undoubtedly benefit from the programme, it has no preconceived scientific mission. The object is simply to obtain cores from the most interesting sediments—young and old under the world's oceans and to make them available for subsequent study.

The cores will be divided into 150 cm. lengths and shipped back to research centres on both the East and West coasts of the United States after each of the nine legs involved in the 18 months programme. Initial core studies will be carried out at these centres as quickly as possible with standard procedures used for all cores. These will be essentially superficial studies and their results will be made available immediately. They will have been made on only one longitudinally split half of the core and the other half will then be made available to other scientists wishing to study it in more depth.

The Deep Sea Drilling Project is now ranked as the most ambitious geological programme ever carried out.

[From *Science Journal* **4** (6) : 17]

8. Uranium from the Sea

Research carried out in the last few years in the United Kingdom, at and under the auspices of the Atomic Energy Research Establishment at Harwell, has shown that Uranium can be extracted from sea water. The total Uranium content of the ocean has been estimated to be in the region of 4,000 million tonnes, and the opinion has been expressed that there is no intrinsic reason why some of this should not be extracted from a number of points on the coast lines of the World at a total rate measured in thousands of tons annually.

Previous estimates of the cost of contacting the necessary volume of sea water with a suitable absorber for uranium by means of tidal lagoons indicated that it might be possible to produce uranium within the cost range considered in the ENEA report.

Work is continuing on laboratory investigations at Harwell and at a coastal laboratory, and the experts propose that this subject should be reviewed again when the results of additional studies and cost estimates become available.

[From *The OECD Observer*, No. **34**, 35]

9. The Submarine Volcanic Eruption and Formation of a Temporary Island at Metis Shoal, Tonga Islands

On 11 December 1967, a submarine volcanic eruption at Metis Shoal built itself above the surface and formed a new, temporary island in the Tonga Archipelago.

On 12 December, the volcanic eruption had the appearance of "an incandescent island about one-half mile long and 150 feet high, glowing cherry red at constant intensity". Above this island, "a dense pillar of steam and smoke ascended to 3,000 feet and at approximately one minute intervals molten lava boulders in irregular parabolic arcs were observed being ejected to a height of 1,000 feet."

By 31 December, after 20 days of supermarine activity, a kidney shaped island about 700-800 meters long, 100-150 meters wide, and 15-20 meters high had been formed.

By this date "the solid eruptions had all but ceased" and "by late January the island began receding". It is estimated that "the island reached maximum size

during the first week of January", and that it disappeared during the first or second week of February. By the end of the third week of February the island was "submerged, with very high breakers on sub-surface rocks". On April 1, the shoal was "completely beneath the water and the only visible sign was a light brown discoloration of the water".

Total eruption activity lasted for approximately 27 days ; wave action then reduced the island to rocky outcrops during the following 18 days and these outcrops disappeared within the next 12 days. In all, from the start of the activity, the island stayed above the surface for a total of 58 days.

[From *Smithsonian Institution Centre for Short-lived Phenomena* : Event Report 15 June, 1968]

10. Fernandina Volcanic Eruption, Galapagos Islands

At 0556 hours GMT on 11 June 1968, the Quito, Ecuador Seismic Station recorded shocks originating in the Galapagos Islands. At 1700 hours local time on the same date, a tremendous explosion occurred on Fernandiana Island. The shock was felt at Puerto Ayora on Santa Cruz, at Villamil on Isabela, and on Floreana; and heard at San Cristobal. The air blast was described by infrasonic detection stations in North America as "stupendous" and "in the multi-megaton range". Infrasonic and microbarographic stations recorded the acoustic waves throughout North and South America and seismic stations recorded continuous tremors in the 5·0 to 5·25 magnitude range. "A mushroom shaped cloud rose high in the sky [to the west of Santa Cruz and at 1745 local time on 11 June a number of further explosions occurred, and the cloud, a spectacular sight in an otherwise cloudless sky, extended to Santa Cruz 150 km away. The diameter of this cloud from Santa Cruz was recorded as : Apex 140°, base 11°. Electrical discharge flashes occurred over the area throughout the night and a fallout of grey volcanic ash [reached Puerto Villamil on Isabela 90 km to the southeast". Continuous seismic activity was recorded during the next few days and on June 19 members of a party from the Santa Cruz Darwin Station reached the rim of the Fernandina Caldera.

During an ascent to the rim of the Caldera continuous tremors were felt. The frequency and violence of these tremors was such that, at a point on the main outer slope of the volcano (685 m alt.) between the six hours 1730 to 2330 hours local time, 56 were counted, each lasting from 2 to 6 seconds, and of these 14 were sufficient to cause rock falls from cones on nearby slopes. Trees were seen to be shuddering as though a strong wind were blowing through their branches. The tremors grew and subsided, rather than being felt as abrupt shocks, giving the impression almost as if the whole island were balanced on a mass of jellylike material. It was found that these movements had caused, and were continuing to cause, the collapse of areas of the inner walls of the Caldera : tremendous falls of rocks occurring at frequent intervals and giving rise to great clouds of dust that filled the crater and overflowed in the direction of the prevailing winds. The sound of the falling rocks was likened to the roar of heavy seas breaking on a rocky beach. A strong wind arose after each fall. Large areas of the edge of the Caldera had fallen into the crater. The existing borders of the caldera were found, in the part visited on the E, to be heavily fissured. In places, cliffs and trees had been dislodged by the tremors. Because of the clouds of dust, it was not possible to see the floor of the crater. The most active was judged to be the SE area of the Caldera where it was known an active centre of fumaroles existed. A large platform, previously lining this part of the crater wall, about midway between the floor and the summit, is believed to have been the site of greatest activity and may itself have largely disintegrated as a result of the explosions and subsequent tremors.

Vegetation, probably over the entire island, is covered to varying extent with volcanic ash. Dramatic disturbances must

have occurred to biological communities within the crater. The lake, forming a complex of islands and inlets due to the unevenness of the Caldera floor. was bordered with reeds (*Cyperus ligularis* and *C. anderssonii*) and supported almost certainly the largest population of the endemic Galapagos duck (*Anas bahamensis galapagoensis*) in the archipelago. A count of these ducks on 19 February 1968 indicated their numbering in the order of 2,000 birds (1,929 adults were counted). Large numbers of young must have been in the crater at the time of the eruption.

In addition, other aquatic birds, including the Blacknecked stilt (*Himanotopus mexicanus*) were found in the crater.

On July 4 a party of 7 scientists, including biologists and geophysicists arrived in the Galapagos for a prolonged period to study the effects of the eruption on the physical environment and on the island ecosystem.

11. "World Glory" Oil Spill Durban, South Africa

On 14 June 1968 the oil tanker "World Glory" broke in half in raging seas 90 miles off the coast of Durban, South Africa. 46,000 tons of oil gushed from the broken halves of the tanker when it ruptured and high winds pushed the slick toward the coast, threatening marine biota and wildlife of the St. Lucia Game Reserve.

On 17 June a sixty square mile oil slick approached within 2 miles of the coast and authorities expected it to reach the St. Lucia estuary and affect the marine bottom life, the marine bird populations, the annual sardine shoal migrations, as well as the aquatic life in the St. Lucia estuary.

A massive detergent-spraying operation began on 17 June and by 21 June, the oil had spread from Tongaat in the north to Port Shepstone in the south.

On 23 June it was reported that "the oil slick is about four miles off Durban Bluff and detergent spraying is continuing by the South African Air Force and Oceanographic Institute ships. Two halves of wreck are 47 and 65 miles respectively from Durban and still leaking oil. Fly ash residue from burnt coal is being tried to soak up oil and settle it on the the bottom."

On 24 June aerial reconnaissance reported that "the oil off Durban Bluff had been dispersed effectively by detergent-spraying operations, but the 10 mile by six-mile slick off Umhlali, 30 miles north of Durban, still poses a danger."

On 25 June light films of oil were reported "very close to a bluff between the Durban Whaling Station and Brighton Beach". Eight ships carrying 50 tons of dispersant "attached the slick off Umhlali today".

By 27 June representatives from the South African Council for Scientific and Industrial Research said that "there has not been a single confirmed report of crude oil reaching the shore. The spraying operation has been much more effective than we realized."

Skindivers took 1500 underwater photographs to help scientists check the damage oil slicks may do to sea life along the coast. Photographs were taken of selected habitats between Tongaat in the North and Port Shepstone in the South, a distance of 100 miles. and show details of sea life environments. If the oil strikes, later photographs will enable scientists to make accurate assessments of the damage.

12. Signs of Seasons Dredged from the Deep

In the depths of the sea the temperature and salinity are uniforms and no light ever penetrates. Animals living there would not be expected to show any seasonal variations in their numbers or physiological condition. However, Dr. Amy Schoener, of Harvard University, recently took a series of samples of the sea bottom along a transect from Gay

Head, Massachusetts to Bermuda, dragging the sea bed at depths ranging from 1,100 to 3,800 meters, at various times of year. On checking the population of two species of brittle star (*Ophiura jungmani* and *Ophiomusium lymani*) she unexpectedly found variations dependent on the time of the year (Ecology, Vol. 49, p. 81)

In samples taken during the summer months there were large numbers of young individuals of both species ; but in winter and spring there were proportionately fewer in samples taken at approximately the same depth. Also in two winter samples, individuals of one species displayed well-developed gonads and eggs. In a sample taken during May they did not.

Her evidence clearly suggests that a period of increased reproductive activity occurs from time to time in these species and the problem now arises explaining it. It may, for example, be a response to a hitherto undetected periodic increase in the nutrient content. The increase could be synchronized with plankton population increases, or 'blooms', followed by the gradual sinking of dead organisms. This suggestion is borne out by one brittle star, samples of which, in the same month and year, from shallower depths had more large individuals than deeper samples. The nutrients in this case presumably reached the shallower ones first.

Alternatively, the food supply may be non-seasonal, in which case it would be advantageous for these, and other species, to stagger their breeding so that energy resources are not drastically depleted at one particular time. One species would be breeding but not feeding, while another would be feeding up so as to obtain sufficient raw materials and energy to produce eggs.

[From *New Scientist*, 18 July 1968, 143].

13. Support for Soviet Mantle Theory

A team of Soviet Oceanographers has just returned from a three month exploration of the Indian Ocean with evidence supporting their theory that the Earth's mantle emerges at the surface in regions of rifts, or deep ravines splitting the central ocean ranges. "We charted the canyon running along the oceanic range more exactly", reported Dr. G. Udintsev, Head of the expedition on board the research vessel *Academician Khurchatov* when she docked recently at Kaliningrad "It turned out that it does not run in one continuous line but consists of a system of ravines in echelon structure, inclined at an angle to the axis of the range itself. This is an important amendment to earlier maps."

Udintsev said there was great tectonic activity in the rift zone. 487 earthquakes were recorded in three days. During the expedition, the *Academician Khurchatov* worked in conjunction with another Soviet Research vessel the *Vityaz*. This made it possible to study the structure in the depths of the earth in large sections upto 120 km long. The rift zone was found to be a complex mosaic, consisting of blocks of the crust and mantle. The mantle blocks were more active seismically and produced more heat.

[From *Science Journal, 3, 9*]

14. Australian Fisheries—Research Programmes

Tuna tagging is not the only pursuit of the CSIRO Division of Fisheries and Oceanography. According to two important schemes initiated this year, laboratories are constructed, one in western Australia and one in Queensland, to house teams engaged in cooperative research programmes – Each will be financed by the Government concerned. The Western Australian laboratory will be built in Perth to study in particular the physiology and behaviour of crayfish. The Queensland Government has agreed to build a laboratory near Brisbane and the research team will undertake a general study of the biology of the main prawn species in southern Queensland waters. As in the case of the Western Australian crayfish, physiological and ecological research will be aimed at improving techniques of study of natural

populations and to investigate possibilities of resources manipulation.

Several other research programmes sponsored by the division are in progress. For example, an atlas is being prepared of water conditions around Australia using nearly 20,000 observations of surface temperature and salinity. Work has continued on the processing and interpretation of accumulated data on tuna and Australian salmon, and data are being collected on the development and distribution of the species of crayfish, prawns and bottom organisms. An investigation of the occurrence of the sperm whales off Western Australia has shown that there has been an overall decrease of between 20 and 40 per cent since 1962. Five cruises were made by oceanographers during the year and deep sea investigations in conjunction with onshore laboratory studies of various aspects of oceanographic methodology were continued. New work in biochemistry, hydrology, physics and physical chemistry are undertaken to supplement existing information and the amount of dissolved organic matter produced by phytoplankton during photosynthesis was measured during a cruise in eastern Indian Ocean in June 1966.

The division received assistance from many sources, during the year. Ships collected oceanographic information, fishermen tagged fish and canneries provided information on tuna, salmon and crayfish measurements.

[From *Nature*, London **216** : 424]

15. The Sea Invades Alaskan Canal

An unexpectedly cold, high-salinity and low-oxygen intrusion of deep ocean water into the southern Lynn canal, off Point Retreat Alaska, has been discovered by Scientist of the U.S. Bureau of Commercial Fisheries. Apparently the influx takes place every year, from about July to September.

The mechanism allowing intrusion of deep ocean water in the southern Alaskan fiords is not understood, but there are two possible theories, according to Harry R. Rietze, Regional Bureau Director at Juneau.

One is that normal southeasterly winds may relax easing the shoreward transfer of surface waters along the coast and allowing the upwelling of deep water into coastal inlets such as Lynn Canal. The other possibility is that water runoff from the land, which is greatest during July and August, strengthens estuarine circulation and seawater flow on the surface, and thereby permits greater intrusion of colder water from the ocean below.

[From *Science News*, **94** (1) : 13]

16. Computer Studies Salmon

A computer is being used by Salford University in Manchester, England, in a three year study to find out why salmon migrate to freshwater rivers. Besides studying the salmon in general, the project aims at discovering what biological and other factors in individual rivers affect their salmon populations.

Batteries of electronic instruments have been installed near weirs in the Lune river in Lancashire, and the Kent and Leven rivers are expected to be added in the future. The instruments record the rivers flow rate and volume, temperature, level, turbidity, colour silt content, dissolved oxygen, conductivity and acidity, plus air temperature, wind speed and direction, humidity, barometric pressure and the amounts of light falling on the river at the different data points.

The researches hope to find, among other things, what effects various urban or industrial uses of the water will have on the salmon runs. Influences at sea may also be analyzable. The Danes, for example, are netting large quantities of salmon off Greeland, and the computer may help evaluate the effect of this on the population returning to British rivers.

[From *Science News* **94** (1) : 13]

17. Scripps' 'Argo' Uses Computer and Satellites on Global Cruise

A sea-going computer and a satellite navigation system are being used by the

research vessel *Argo*, which departed San Diego, California, March 7 on a year-long, 61,000 mile, scientific exploration. She will cruise the Pacific, Indian and Atlantic Oceans for the Scripps Institution of Oceanography, University of California at San Diego. Dr. William A. Nierenberg, Director of Scripps described the cruise as "primarily a deep-sea, geological geophysical exploration of the World Ocean. This expedition marks the first time that calculations of a ship's position at sea will be obtained automatically, using the vessel's speed and direction in conjunction with data received from the satellite, all being fed directly to the computer, to establish her position and thus improve the scientist's knowledge of the exact locations where data are being taken.

Dr. Robert L. Fisher, associate research geologist at Scripps, is in overall incharge of the expedition called "Circe". Dr. Fisher said, "this computer will be used for geophysical and oceanographic data compilation and data reduction throughout the expedition. The satellite navigation system's ship board receiver will be installed at Penang, Malaysia. and will function during the remainder of the cruise. Rapid, frequent, precise fixing will permit on-the-spot revision and modification of investigations to take advantage, immediately, of knowledge just gained. Formerly, gaps or omissions—which can be easily remedied with the ship in the area—might not become apparent until months after a cruise was completed and the data analyzed.

The Computer

The IBM 1800 has a 32,000-word core storage capacity with a cycle time of two microseconds (millionths of a second). It is directly connected to the ship's scientific instruments and can gather information from them at up to 8 million bits a record.

The Satellites

The ship's navigator will be aided by 3 Navy satellites. The satellites will be orbiting roughly a north-south course 600 nautical miles above the earth every 80 minutes and transmit signals to the shipboard receiver. This system will enable the navigator to determine his position precisely in any weather even substantially better than a tenth of a mile. This is much more accurate than the conventional celestial 'fix' or listening to land-based LORAN stations. Dr. Fisher emphasized that such accuracy will be especially helpful in the Bay of Bengal, which is cloud-covered much of the time during the northeast monsoon season. Other electronic aids to navigation are not available there. *Argo* will be in the bay 6 of the 12 months.

What Scientists Seek

Expedition scientists will investigate "Ocean bottom topography", magnetic patterns, heat flow, thickness of sediments in ocean basins and along continental shelves, distribution and types of hard rock, chemical properties of sediments and the water above them, and variations in the earth's magnetic field near the magnetic equator. Hydrographic casts will be made bathythermographic observations collected and biological tows completed".

The expedition's scientists and graduate students represent the U.S., Great Britain, Canada, Australia, Columbia, France, The Netherlands, and South Africa.

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