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CONTENTS

The American Association for the Advancement of Science:
The Navy's Oceanographic Program: DR. AUSTIN H. CLARK 269
The Report of the Committee on Freedom of Teaching in Science: PROFESSOR S. J. HOLMES 276
The Second Annual Association Prize: B. E. L. 277
Scientific Events:
International Annual Tables; The Third Asiatic Expedition of the American Museum; Plans of the New York Academy of Medicine; The Jungle Laboratory of Tropical Biology 279
Scientific Notes and News 281
University and Educational Notes 284
Discussion and Correspondence:
Almshouse Paupers in the United States: PERCY L. CLARK, JR., PROFESSOR RAYMOND PEARL. *An Apparently Overlooked Source Book of Biological History:* GORDON ALEXANDER. *A Perpetual Calendar:* A. L. CANDY. *Quotation Wrongly Credited:* PROFESSOR FRED NEWTON SCOTT 284
Scientific Books:
Meisel's Bibliography of American Natural History: PROFESSOR CHARLES A. KOFOID 287
Laboratory Apparatus and Methods:
A Simple Circulation Pump for Gases: PROFESSOR A. W. C. MENZIES, E. M. COLLINS AND P. L. TYSON 288
Special Articles:
Propagation of Electromagnetic Waves over the Earth: H. W. NICHOLS AND J. C. SCHELLENG. *Carbohydrate Storage in Corn:* LOIS LAMPE AND MARION T. MEYERS 288
The American Association for the Advancement of Science:
Organizations Related to both Zoology and Botany at the Washington Meeting 291
Anthropological Societies at the Washington Meeting 293
The American Psychological Association at Washington 294
Science News x

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THE NAVY'S OCEANOGRAPHIC PROGRAM[1]

THERE is no line of investigation in which so many different forms of science play a part as in the study of the sea.

What is known as oceanography contemplates investigation of the waves and tides and currents and of all the physical and chemical properties of water, both pure and with various substances in solution or suspension. It also includes the study of the erosion of the shore lines and the change in bottom contours as well as of the piling up of sediments, organic and inorganic, on the ocean bottom and of the resulting alteration in the isostatic balance. It further covers the investigation of the evaporation from the surface of the water, and of the circulation of the air above it. And an important part of oceanography is the study of the plants and animals of the sea, of the relationships between them and of the relationships of both to the physical and chemical features, fixed or variable, of the medium in which they live. Oceanographic observations are of value only if we know the exact spot where they were taken. The localities are determined by recourse to applied astronomy and various forms of mathematics.

IMPORTANCE OF THE STUDY OF OCEANOGRAPHY

From the sea each year we draw an enormous quantity of food, mostly in the form of fish, shellfish, crabs and lobsters. In order to conserve these food resources and further to develop them we must know just how these creatures live, what they feed upon, their habits and the habits of their parasites and enemies, and their relation to salinity and temperature.

Other peoples use sea plants and animals far more extensively than we. Millions of their population find a livelihood in reaping harvests of sea organisms unused by us, and millions more on land profit by their labors.

Each year the rivers of the world carry to the sea millions of tons of mud taken from the surface of the land, and millions of tons of salts in solution in their waters. By this continuous process an enormous total weight of soil and salts is being constantly removed from the land areas. The soil, in the form of mud and sand, is dumped upon the ocean bottom, while the dissolved salts increase the weight of ocean water both by their own added weight and by gradually di-

[1] Read at the General Session of the American Association for the Advancement of Science on December 30, 1924.

minishing the amount of evaporation from its surface, thus adding to the ocean's bulk. Much of the dissolved material brought to the sea by rivers goes to form the shells of billions of small creatures which when they die fall upon the ocean floor, covering millions of square miles of bottom.

The continuous subtraction of vast masses of material from the land and their addition to the weight of the ocean basins in which they are very unequally distributed necessitates constant or intermittent readjustments to maintain an equilibrium or condition of isostasy between the land and sea.

So far we have not attempted to appraise the effect upon us of the transference of material from our land area to the ocean basins, nor do we know the percentage of the loss in soil fertility of our farm lands which is recoverable in the bodies of the fish and other creatures caught along our shores.

From the surface of the oceans water vapor constantly is rising which passes to the air above. This water vapor by the winds is carried inland where, condensing in the form of rain, it makes possible the growth of plants and through them of animals. In other words our agricultural and associated industries depend for their existence upon conditions in the seas surrounding us. The rain which nourishes the farmers' wheat and the water which he gives his cows are merely wandering bits of ocean, from which they came and to which they will return after they have served their purpose to the farmer.

Evaporation from the surface of the sea depends on temperature. On a warm day in summer the hot attic of a house is very dry, but the cool cellar damp, for air when cool can not hold nearly so much moisture as it can when warm. It also depends on the salinity or amount of salts contained, for the greater the amount of salts dissolved the less will be the vapor pressure or the amount of water vapor given off.

Regarding the temperatures and salinities of the seas about our coasts we have but little information sufficiently exact for present-day requirements, nor do we understand the details of the seasonal and daily changes.

The climate of our coastal regions is to a very large extent dependent upon conditions in the seas adjacent, upon the great warm ocean currents like the Gulf Stream and Kuro Siwo or upon cold currents coming from the north or flowing upward from the ocean's depths. These all require much more extended study, with much more accurate instruments than have been available heretofore, and with more regard to the details of the contours of the bottoms over which they flow, which are as yet inadequately known.

There are various other features connected with the sea which are of prime importance to the dwellers on the land. But we have said enough to show that the details of the oceanography of the seas surrounding us provide a most inviting field for research and also that whatever aspect of the problem may be studied our people as a whole will benefit.

OCEANOGRAPHY IN ITS RELATION TO GOVERNMENTAL ESTABLISHMENTS OTHER THAN THE NAVY

In order properly to appreciate the navy's plan for cooperative oceanographic work it is necessary first to mention the other branches of the government service which are more or less directly interested in a study of the sea.

First comes the army. The efficient laying and maintenance of cables, a vital factor in communications, is to a large extent dependent on accurate surveys of the contours of the ocean bottom. The operation of the army transport fleet has much to gain from a better knowledge of marine conditions. More accurate knowledge of the relation of the sea to the atmosphere above it would aid our coast defenses.

The Coast Guard is charged with the responsibility of maintaining the international Ice Patrol, a most important duty undertaken with the object of protecting the shipping on the north Atlantic lanes and supported by contributions from the several nations interested. Icebergs and ice in order to be conquered must first be understood, and the ice problem is an important field for research in polar oceanography.

From the nature of its duties the Coast Guard also is concerned with other phases of oceanographic work. In this connection it will be recalled that the first deep water work done by the Fish Commission in 1871 was carried out from the cutter *Moccasin* loaned by the revenue cutter service, now merged with the Coast Guard.

The Coast and Geodetic Survey is vitally interested in all lines of oceanographic work. Especially important is information on the configuration of the ocean bottoms, magnetic and gravity observations, tidal observations on the islands of the ocean and in ports not often visited for which we have as yet insufficient data on which to base accurate tide predictions, temperatures and salinities from the surface to the bottom, and any data which may be obtained in regard to currents, tidal, wind-driven, or resulting from other causes.

Historically it is interesting to recall that the inception of oceanographic work by the government of the United States dates from an order issued by the then director of the Coast Survey, Alexander Dallas Bache, in 1844; and furthermore that it was the Coast Survey, in 1867 under Count Pourtales in the *Corwin*, that first commenced the intensive study of deep water animals, the year before the same work was begun in England in the *Lightning*.

The Bureau of Fisheries is charged with the in-

vestigation and development of our fisheries resources. So far as its work concerns the sea all information of whatever sort bearing on marine conditions is vitally important to it. Throughout their entire lives sea plants and animals are absolutely dependent on the medium in which they live. They breathe the air in it, they take their food from it, directly or indirectly, and they make their skeletons from substances dissolved in it. Therefore, anything that can be discovered about the physics and chemistry of the ocean, about the bottom contours or about the shape and changes in the shore lines is of importance to this bureau. In fact, it is not conceivable that anything could be found out about the sea that would not have some bearing on the bureau's work.

In its early days, as the U. S. Fish Commission, this bureau did a great deal of oceanographic work in ships loaned for the purpose by the Coast Guard and the Revenue Cutter Service. Later, in 1880, the *Fish Hawk,* still in service, was constructed, and in 1883 the *Albatross,* sold last summer, commenced her notable career during the course of which she worked along the entire western shore of the Atlantic from Newfoundland to the Magellan Straits, the entire eastern shore of the Pacific, in the Bering, Okhotsk and Japan Seas, in the Philippines and the Moluccas and throughout much of Polynesia.

No work has proved of greater value to the people as a whole than the study of geology, which falls within the province of the Geological Survey. But our knowledge of the geological and the geographical features of the earth's surface practically ends at the shore line. The detailed mapping of the topography of the ocean bottom will almost certainly bring to light systems of mountain ridges, terraces, escarpments and benches, old shore lines, uplifts, submarine volcanoes, fault scarps, peneplains, etc., showing deformations of the ocean bottom and indicating much of its history, particularly in later geologic times. It should give us the data from which to reconstruct portions, at least, of the history of the changes in shape, size and depth of the oceanic basins, all of which are determined by deformation and uplifts or subsidences of the land masses which border and underlie these basins. It should furnish information not only regarding former land connections effected through changes of the shore lines or by uplifts of one area or another, but also concerning the changes in the epicontinental seas in regions now submerged; also as to oceanic currents and interoceanic connections in the past by which marine life migrated during one period or another and by which the present distribution of sea life is explained. Detailed knowledge of the ocean bottom should reveal the source and exact location of many of the earthquakes, the positions of which are now but very roughly estimated; and it should bring to light centers of submarine volcanic action in which islands may be in process of building, or perhaps of destruction, and from which tidal waves will travel. The study of the bottom sediments, of their composition and the rate of deposition, has of course an important geologic bearing, and much attention has heretofore been devoted to this in the Geological Survey. Of great interest also to geologists is the relative proportion of the various salts in ocean water; this too has been studied by the Geological Survey.

The Weather Bureau is interested in oceanographic work in much the same manner and to much the same degree as the Geological Survey. There is need for much more precise information on the surface temperatures, especially in certain regions. The relation of the winds and currents, and between the winds at different heights above the sea, requires much more detailed study than has as yet been possible. Tropical cyclones offer interesting problems for investigation, and there are almost innumerable other features of the meteorology of the sea which as yet are by no means fully understood.

The Smithsonian Institution is the legal repository of the collections brought together by the various governmental agencies, these collections being stored in the U. S. National Museum. The material brought back by oceanographic expeditions in the main consists of various forms of plant and animal life, and of samples of the bottom sediments.

The permanent preservation of these specimens is most important. They are the original standards in terms of which sea life is described.

Physical and chemical observations are recorded in terms of definite concepts based on mathematical formulae, on definite chemical reactions, or in some cases in terms of well-known standards carefully preserved somewhere.

At best only a very general concept can be formed of any animal or plant. No description of any species ever was drawn up which proved more than approximately adequate. Any given animal is so complex that it can only be described approximately. Furthermore, no two individual animals are ever quite alike, and often the two sexes differ widely; while all animals pass through various different forms in the course of their life history. Every day or so the disconcerting fact is demonstrated that the available description of some animal or other is vague or lacking in some feature essential to its proper comprehension. With the yearly increase in the number of the plants and animals we know and of the variations and the different forms of each, an increasingly greater number of the earlier descriptions prove

inadequate, and we would be wholly lost were it not possible for us to reexamine the material which served as the foundation for the earlier work.

Comparison of one sea area with another is only possible if we know the two have been described in strictly corresponding terms, reducible to the same standards. In biology we never can be sure of this unless we have at hand examples of those standards.

An important function of the National Museum is to secure, through gift, exchange or purchase, as large a series as is possible of sea animals from distant regions described in foreign works which, through comparison with material from other regions and from home waters, will enable us to understand and to interpret the relative conditions in our seas.

The Astrophysical Observatory is concerned with everything bearing upon emanations from the sun and from the other heavenly bodies. It is therefore keenly interested in all information that can be obtained regarding the temperature and other physical features of the ocean water.

It is scarcely necessary to remark that the Shipping Board and Fleet Corporation, and the merchant marine in general, are greatly interested in any work that will reduce the dangers of navigation.

Very many of the bureaus of the government would be greatly aided in carrying on their work by the facilities for transportation and for the assembling of material resulting from naval oceanographic work, especially in various regions not accessible through commercial means of transportation.

The Necessity for Interdepartmental Cooperation

From the foregoing it is evident that any plan contemplating oceanographic research by the navy must be a cooperative plan. Some branches of the government service, as the Coast and Geodetic Survey, the Bureau of Fisheries and the Coast Guard, are at present carrying on important oceanographic work, each along special lines and with special ends in view. There must be no interference with their operations—no demoralizing competition. Other branches of the government service, as the Geological Survey and Weather Bureau, and the National Museum, are not engaged in oceanographic work but are anxious to avail themselves of any opportunity for gathering data from the sea.

The Navy's Early Oceanographic Work

The earliest American achievement in oceanographic research was the publication in 1770 of a chart by Benjamin Franklin on which he showed the course of the Gulf Stream.

With the expansion of our merchant marine in the early eighteen hundreds our interest in the ocean as a whole rapidly increased. In 1807 Congress passed an act authorizing the President to cause the whole of the coast and harbors of the United States, with adjacent islands, to be surveyed and soundings taken, appropriating $50,000 for the purpose. The President entrusted the Secretary of the Treasury with the task of carrying out the provisions of this act. In 1816 Congress reenacted the appropriation, and the Coast Survey came into being.

But a knowledge of the seas of all the world was just as important for our shipping as a knowledge of our coasts and harbors, and the duty of investigating these naturally devolved upon the navy. These investigations followed two main lines, each undertaken with marked success.

The first line consisted in organizing great exploring expeditions which were sent to distant regions. Among these were the United States Exploring Expedition, authorized by Act of Congress in 1836; the exploration and surveys in the valley of the Amazons authorized in 1851; the United States North Pacific Surveying Expedition authorized in 1852; the exploration of the valley of the Rio de la Plata and its tributaries authorized in 1853; Hall's Arctic Expedition, for which Congress made appropriations in 1870; and the *Jeanette* expedition of 1879.

The second line was the less spectacular intensive study of the sea. This was developed almost wholly through the efforts of Matthew Fontaine Maury.

Maury entered the navy as midshipman in 1825 and in a cruise of 4 years' length circumnavigated the globe. In 1836, now a lieutenant, he served as astronomer on the United States Exploring Expedition. In 1839 he met with an accident which made him permanently lame, and was placed in charge of the Depot of Charts and Instruments, which he thoroughly reorganized and out of which have grown the United States Naval Observatory and the Hydrographic Office.

While on his cruise around the world on the *Vincennes* and on subsequent cruises Maury made many observations on the winds and currents, and when in charge of the Hydrographic Office he set himself the task of collecting further data by distributing to ship captains log books especially prepared. So successful was he in this enterprise that in the course of nine years he had collected enough logs to make 200 volumes each with about 2,500 days' observations. One result of this investigation was to show the necessity for combined action on the part of maritime nations in regard to ocean meteorology. This led to an international conference at Brussels in 1853, which resulted in the greatest benefit to navigation. Besides his pioneer work in meteorology, which he was the first to show could be regarded as a science, Maury

made notable contributions to the study of the ocean basins. The first bathymetric chart of the North Atlantic was published by him in 1854.

The preparation of this chart had been rendered possible through the ingenuity of Midshipman Brooke, who had devised a simple mechanism for the detachment of the heavy weight by which the sounding line is carried down when it struck the bottom.

After Maury left the navy oceanographic work was largely discontinued, not from any lack of appreciation of its value by the navy or by Congress, but because the fighting ships had entered the period of transition from wooden ships to ironclads and because of the rapid changes being made in the design and the rapid increase in efficiency of marine engines. In this period of transition from wooden sailing ships with engines of low power to steam-driven iron ships the navy naturally had to concentrate all its energies on purely military matters.

It was at this time when the navy was preoccupied in other lines that the detailed study of the ocean's depths was first begun by the Coast Survey and four years later by the Fish Commission in a new form, that of biological oceanography.

When the design and the construction of the fighting ships had reached a period of relative stability the navy again undertook oceanographic work, this time largely in connection with bottom surveys over proposed cable routes.

In the course of these cable surveys a second great advance was made in the method of depth determination. In the early seventies Commander Belknap on the *Tuscarora* first made practical use of fine piano wire in taking soundings instead of slender ropes, by this means saving much time in every operation and much storage space.

THE SONIC SOUNDER

Quite recently there has been developed in the Navy by Dr. H. C. Hayes a most ingenious and extraordinary mechanism by which the depth of water underneath a ship is found by the emission of a sound wave which is echoed from the bottom.

Not only does this method do away with the necessity of handling long lines and heavy weights, difficult in a rough sea, but it makes possible a record of scores of observations where only one was possible before, and in addition the observations are of greater accuracy.

Its practical value has received abundant confirmation on various transatlantic lines, in the preparation of a detailed contour map of the bottom off southern California, in a survey for a new Alaskan cable route and in other operations.

THE CONFERENCE ON OCEANOGRAPHY

With the perfection of this wholly new device there naturally arose a wish for its extensive use in a more detailed and more accurate survey of the sea bottom than has hitherto been possible.

Furthermore a ship equipped with this device and running lines of soundings could at the same time accommodate sufficient men to carry on various other lines of research work connected with the sea and perhaps of more immediate value to the people on the land.

Having in mind the far-reaching possibilities of a broad oceanographic program and the value to the country of Lieutenant Maury's work, Dr. Hayes on February 19, 1923, prepared a letter suggesting the adoption by the navy of a definite plan for oceanographic work, which received the hearty endorsement of all the officers concerned and was approved by the acting secretary of the navy, Colonel Theodore Roosevelt, Jr.

Under his direction a detailed study was made of the subjects requiring investigation for the benefit of the navy and the best means of undertaking this work. The desirability of concentrating, intensifying and extending the research and experimental work carried on by the navy in connection with the various problems presented under the general heading of oceanography had been realized and constantly recommended for a long time, and it was believed that scientific investigation along these lines should no longer be delayed.

After a preliminary study of the general proposition of oceanographic research by the navy Colonel Roosevelt saw that such work by the navy might be of value in collecting data or in making special investigations for other governmental establishments.

With this idea in mind and with a view to ascertaining the possibilities of interdepartmental cooperation in the navy's project he sent a letter on June 2, 1924, to the secretaries of the other departments, the secretary of the Smithsonian Institution, the president of the National Academy of Sciences, the secretary of the National Research Council, the librarian of Congress, the president of the Carnegie Institution, and the chairman of the United States Shipping Board, requesting them to nominate representatives to take part in a general conference on oceanography to be held in the Navy Department on July 1, 1924.

The main object of this conference was to ascertain how best the interests of all the government bureaus could be served through oceanographic research by the navy; how they could all work together and how the navy best could proceed without intruding

into any field properly falling within the sphere of some other agency.

The conference, at which 46 representatives of the government departments and the extra-governmental establishments named were present, was opened by an address by the Honorable Curtis D. Wilbur, the secretary of the navy.

The temporary chairman, Capt. F. B. Bassett, then traced the events culminating in the conference, and emphasized the importance of oceanographic work.

Dr. George W. Littlehales, the hydrographic engineer of the navy, followed with the keynote address.

The conference then chose as president Captain F. B. Bassett, hydrographer of the navy, and as secretary-general Lieutenant Commander G. E. Brandt, aide to the hydrographer.

A series of addresses by the representatives of the various departments followed, intermingled with discussion of various points, the proceedings being characterized throughout by a keen appreciation on all sides of the value of the work proposed and a remarkable spirit of cooperation.

An executive interim committee was selected to prepare a report for the consideration of the conference.

This committee held two meetings and submitted the following report, which was unanimously adopted.

REPORT OF THE CONFERENCE ON OCEANOGRAPHY TO THE HONORABLE THE SECRETARY OF THE NAVY

General Considerations

The conference is profoundly impressed with the importance of beginning, as soon as possible, a national cooperative program of research in oceanography, having as the principal aim the accomplishment of results of practical economic value.

It is realized:

(1) That five sevenths of the earth's surface is covered with the waters of the ocean.

(2) That the physical conditions of these waters and their circulation largely determine the weather and climate over land areas and, consequently, the productivity of the soil.

(3) That the food and other plant and animal resources of the ocean at present unexploited are enormous.

(4) That these resources have not been fully used by man because of a lack of knowledge of their extent and of practicable means of applying them to economic use.

(5) That indications are that the products of the land will not be able to keep pace with increases in population, thus requiring a greater exploitation of the resources of the sea.

(6) That the first requisite to practical scientific studies in oceanography is a knowledge of the shapes of the ocean basins, the contours of the bottom and the depths of the water in different places.

It is, therefore, the opinion of this conference that a survey and inventory of the resources of the sea, as indicated above, will give results of much practical and scientific value. They may be discussed in the following detail:

Definite Objects

Preliminary to entering upon the details of its recommendations, the conference laid down the following definite objects to be attained:

(1) Discovering, developing and utilizing the resources of the sea.

(2) Facilitating navigation of the sea and of the air and improving communication by radio and by submarine cable.

(3) Promoting the welfare of mankind through scientific discovery and the progress of knowledge.

(4) Safeguarding human life.

Area of Operation

It is the opinion of the conference that investigations promise results of the greatest practical and scientific value if devoted to intensive study of selected regions or problems.

It is recommended that the first work be devoted to the Gulf of Mexico-Caribbean region, and the neighboring parts of the North Atlantic, extended through the Panama Canal into the Pacific; subsequent work to be done in the waters of the North Pacific and North Atlantic Oceans.

Vessels

It is recommended that a naval vessel or vessels be permanently assigned to oceanographic work. Such vessels should, if practicable, have twin screws and low free-board, and must have a large cruising radius. They should have laboratories and sufficient living quarters and cabins comfortably to accommodate the personnel.

While the above requirements are preferred, the conference desires to state that any suitable vessel or vessels that the Navy Department may assign for this purpose will be acceptable.

The cost of putting a vessel in commission being dependent upon the type of vessel assigned, no estimate is made by the conference at this time.

Equipment

It is assumed that the equipment supplied to naval vessels will be furnished, and that the latest type of sonic depth finders and radio will be installed. Certain additional special materials and equipment will be necessary, and for these the committee after a detailed study submits an estimated cost of $50,000.

Personnel

The officers and crew of the vessel should come from the naval personnel. In addition, it is recommended that for the first work the following specially selected scientific personnel be employed:

1 oceanographer,
1 biologist,
1 geologist,
6 or more scientific assistants.

The first three should be men of outstanding attainments, each eminent in his own field of knowledge. The assistants may be drawn from the younger scientists connected with universities, colleges and other institutions. The pay of the above-mentioned scientific personnel, it is expected, will be provided from sources outside of the government. Allowance must be made, however, for subsistence while actually engaged in the field and for travel expenses to and from their homes, estimated at an annual cost of $7,500.

RECAPITULATION OF COST

Special equipment and supplies (first year)	$50,000
Subsistence and travel for scientific personnel	7,500
Total estimated cost	$57,500

SCIENTIFIC PROBLEMS TO BE TAKEN UP

The shapes, contours and depths of the ocean basins.

Distribution of temperatures, densities and salinities on the surface and in the depths of the oceans, together with the periodic or other changes which occur.

Evaporation and precipitation (rain, fog, snow) over sea and land areas.

The distribution and periodic changes in atmospheric pressures and winds.

The ocean currents and the vertical circulation of ocean waters.

The chemistry of sea-water, the hydrogen-ion concentration and the sources and distribution of nitrogen, etc., in the sea.

Changes in the size and shape of the bottoms of the seas, such as shifting of shore lines, warping of the margins of the continents and submarine upheavals and dislocations.

Nature and composition of the formations of the sea bottom.

Previous land connections and changes in existing connections between continents.

Areas and features of submarine volcanism and earthquake movement.

Sedimentation.

The penetration and diffusion of light in sea water under various conditions and its bearing on plant and animal life.

The distribution of the intensity of gravity.

The distribution, relative abundance and interrelations of the various forms of plant and animal life.

Visibility under different conditions of the atmosphere.

Height, length and velocity of ocean waves.

Location and extent of fields of static and of electromagnetic disturbances and investigations of other forms of atmospheric electricity.

PRACTICAL AND ECONOMIC RESULTS TO BE DERIVED FROM THE SCIENTIFIC INVESTIGATIONS

New fishing banks, when developed, will add to the welfare of mankind. Scientific methods applied to the development and use of fisheries resources will increase production and insure permanency.

A full understanding of the climate and the developing of better means of predicting weather conditions, particularly the periods of rainfall and drought and their duration, will enable better control of the agricultural production of the land.

The solution of weather problems affecting navigation of the sea and of the air.

A full knowledge of the ocean and tidal currents and of the drift of icebergs will better safeguard shipping and be of value to fishermen in their operations.

A knowledge of ocean depths and bottom contours will aid navigation and fishing and will indicate the most economical and advantageous cable routes.

Knowledge of sedimentation and of the action of tides, winds and waves will aid effective and economical construction and maintenance of navigational channels and harbor works.

Greater knowledge of the profiles and velocities of waves will lead to better design of ships to secure the necessary strength.

Additional knowledge of the density of waters in all parts of the oceans will lead to a clearer understanding of ocean currents, a higher precision in sonic depth sounding and the more accurate design of underwater devices.

Knowledge of the visibility over all parts of the oceans will aid navigation and the design of observing apparatus.

The location of deposits of oil, ores and other resources of economic importance.

The improvement of radio communication and the reduction in the cost of operating radio stations.

The improvement in the radio compass stations and other practical aids to safe navigation of ships and of aircraft.

DISPOSITION OF SPECIMENS

Specimens of scientific importance will be transferred to the U. S. National Museum for study, exchange or other disposition as mutually agreed upon by the Navy and the museum.

PUBLICATION

The publication of data collected and the results of analyses and interpretations will be under such regulations as the Secretary of the Navy may prescribe.

PERMANENCY

The recommendations embodied in this report are based upon the expectation that research in oceanography will take a permanent place among the activities of the Navy.

SONIC DEPTH FINDER CHART

There being now at hand a ready means of rapidly determining ocean depths in the sonic depth finder invented by Dr. Harvey C. Hayes and developed by the U. S. Navy, it is urged that vessels fitted with the sonic depth finder undertake the preparation of a detailed chart of the Gulf of Mexico-Caribbean area showing the contours of the bottom. This chart should be available when the oceanographic researches begin.

NAME

The conference recommends that this oceanographic undertaking be known as the Maury U. S. Naval Oceanographic Research, in honor of Lieutenant Matthew Fontaine Maury, U. S. Navy, whose pioneer work in practically all branches of oceanography entitles him to this distinction. It is further recommended that the major ship that is assigned to this work be named the U. S. S. *Tanner* in honor of Commander Zera L. Tanner, U. S. Navy, whose long-continued oceanographic work has contributed much to the advance of this science.

CONTINUING ADVISORY COMMITTEE

It is recommended that, in order to carry the project through the initial stages, to properly present this case to the Navy Department, the Budget and the Committees of Congress, and to develop the organization of the first cruise, provided funds and ships are available, the Secretary of the Navy appoint a continuing advisory committee consisting of representatives of governmental and other institutions interested in the investigations to be undertaken, and that Captain F. B. Bassett, U. S. Navy, and Lieutenant-Commander George E. Brandt, U. S. Navy, respectively, be the chairman and secretary of this committee.

The continuing advisory committee recommended by the conference was immediately appointed by the Secretary of the Navy.

CONCLUSION

No plan for broad cooperative work which has been proposed in recent years offers such possibilities of benefit to all as the Navy's plan for oceanographic work. No precedent is involved in its adoption, for in times of peace oceanographic studies heretofore have always been an important part of the Navy's duties.

With these closing words I commend the plan to you as most worthy of your consideration and support.

AUSTIN H. CLARK

SMITHSONIAN INSTITUTION,
WASHINGTON, D. C.

THE REPORT OF THE COMMITTEE ON FREEDOM OF TEACHING IN SCIENCE

THE American Association of University Professors, at its recent meeting in Washington, endorsed the appended statement of Committee M on "Freedom of Teaching in Science." This committee was formed on account of efforts which have been made to suppress the teaching of doctrines which incurred the disapproval of some organized groups. It can not be denied that a private institution is within its legal rights if it does not tolerate any of its members who do not believe that the world is flat, although such a policy might be inimical to progress and suicidal in the long run for the institution itself. It is, however, a different matter when a public institution becomes guilty of a similar policy of suppression in regard to any sort of theoretical question.

The situation that has arisen in America has been commented upon with some amusement by several writers abroad as a very anomalous development among a people who do so much talking about liberty. It indeed seems necessary to call attention to some fundamental principles by which the people of a democracy should be guided in the toleration of opinions. It is for this purpose that the following statement was formulated.

S. J. HOLMES

The Statement of the Committee

The last few years have witnessed a revival of the spirit of intolerance which has asserted itself especially in the opposition to the teaching of evolution. Attempts have been made to secure the passage of laws forbidding such teaching in state-supported institutions of learning, and teachers of biology in a number of colleges have been dismissed on account of their promulgation of evolutionary doctrines. These occurrences have aroused in the teaching profession, and also in the general public, considerable concern over the maintenance of that freedom of thought and speech which Americans have regarded as one of their most valued possessions. Recent events have demonstrated that public opinion in several parts of the United States is considerably less enlightened than had commonly been supposed, and manifestations of intolerance which we had generally come to believe were no longer possible have been of not infrequent occurrence. There are, in the opinion of the Committee on Freedom of Teaching in Science, certain general principles by which we should be guided in regard not only to the teaching of evolutionary theory, but in all other fields of inquiry. Notwithstanding the fact that the doctrine of evolution in some form is accepted by practically all competent investigators in every branch of biological science, it is not so much for this reason that the attempts to suppress the teaching of evolution should be condemned as the fact that such attempts strike a blow at the fundamental principle of freedom in teaching and research. Opposition to the teaching of evolutionary theory is based mainly on ignorance and groundless fears. But the worst feature of the opposition is not that it is unscientific, but that it is un-American.

It is, we believe, a principle to be rigidly adhered to that the decision as to what is taught as true, or what should be presented as theory in science or in any other field of learning, should be determined not by a popular vote nor by the activities of minorities who are persuaded that certain doctrines are inconsistent with their beliefs, but by the teachers and investigators in their respective fields. It would be absurd for the laity to attempt to dictate to the teachers of medical science what should and what should not be taught as facts in colleges of medicine. Teachers and investigators may teach doctrines in