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THE INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS

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IN times when there is a tendency to the nationalization of science it is well to realize that there are earth sciences relating to the physics of the earth as a whole —geophysics—which know no national boundaries. Though there are a number of international organizations which deal with these earth sciences from various view-points, there is only one which brings them together and treats them from the view-point of the world as a whole. This is the International Union of Geodesy and Geophysics, which has been in existence since 1919 and which grew out of other organizations which came into existence as early as 1862. This union is made possible through financial support from a large number of countries now numbering 37. In most cases the adhering body is not the government but the national committee on geophysics.

In the case of the United States the situation is somewhat complicated. The National Research Council is the adhering body, but the national committee on geophysics is the American Geophysical Union. The latter as a whole is not part of the National Research Council, but its executive committee, made up of officers, chairmen of certain standing committees and certain ex-officio members from the Research Council itself, constitutes the Committee on Geophysics of the National Research Council.

The International Union of Geodesy and Geophysics is composed of seven associations, which are autonomous in scientific matters. These relate to geodesy, seismology, meteorology, terrestrial magnetism and electricity, physical oceanography, volcanology and scientific hydrology.

The American Geophysical Union is the American branch of the International Union. It has seven sec-

tions and each is a branch of the corresponding association. This dual relationship is very important in the functioning of the respective bodies. The unions themselves deal principally with administration, while the sections and associations are chiefly concerned with scientific matters. There are also in both the national and international unions a number of commissions which deal with subjects related to two or more of the branches. There is an absence of system in the use of the term committee and commission, and for convenience those of a single branch will be called committees and those related to several branches commissions, though this does not exactly conform to practise. It must be remembered that in French, the language of the official statutes, there is but a single word, "Commission."

The International Union must necessarily have close relations with other international organizations, but this can best be brought out in connection with the discussion of the individual associations.

The idea of a union grew out of the international associations in two of the fields which existed before and up to the world war. The Association of Geodesy was formed in Germany in 1862 and continued up to the war with a maximum of 19 adhering nations. As early as 1877 Charles Sanders Peirce attended a conference at Stuttgart, even though the United States had not then adhered. The first official American representative was Cutts in 1886, and later such well-known geodesists as Davidson, Schott, Tittman, Hayford and Bowie, all of the Coast and Geodetic Survey, attended meetings. The Association of Seismology was formed in Germany in 1903 and had as a maximum 23 adhering nations. A number of meetings were attended by Reid, of Johns Hopkins University. Accordingly there has been a long established tradition of American attendance. It should be stated that some of the other associations had their roots in the past, in the case of terrestrial magnetism and electricity as early as 1845, but there was no continuing independent organization.

After the organization of the union in Brussels in 1919, the first general assembly was held in Rome in 1922, the next in Madrid in 1924 and thereafter at three-year intervals in Prague, Stockholm, Lisbon and Edinburgh. At all there has been a large American attendance. At Edinburgh there were 33 delegates and 17 guests from this country. For the meeting in 1939, the National Research Council authorized the American Geophysical Union to extend at Edinburgh an invitation to hold the meeting in Washington, D. C. The invitation was cordially accepted, and the meeting is scheduled for early September of that year.

In this connection some of the precedents established at earlier meetings are of interest. Heads of governments have presided at a general assembly or have given receptions. These have included the King of Italy, the former King Alfonso of Spain, the Crown Prince of Sweden and the President of Portugal. The honorary committees have invariably consisted of high officials and the heads of related scientific organizations. The meetings usually last for ten days, and for some of the associations and commissions there are additional sessions before the first general assembly.

The International Union of Geodesy and Geophysics was established at Brussels in 1919 under the auspices of the International Research Council (now the International Council of Scientific Unions) together with other International Unions of Astronomy, Mathematics, Chemistry and Scientific Radio-telegraphy. The convention governing the union lasted ten years, but by 1932 these had been revised to meet changed conditions.

While the majority of the adhering countries are in Europe, there are members from all parts of the earth, the present number being 37. In the Americas, Canada and a number of the Latin American countries adhere.

The objects of the union as set forth in its statutes are: (1) to promote the study of problems relating to the figure and physics of the earth; (2) to initiate and coordinate research which depends on cooperation between different countries and to provide for its scientific discussion and publication; (3) to facilitate particular research such as the comparison of instruments and standards used in different countries. Most countries make reports of their activities in geophysical fields, thus providing a useful history of accomplishment.

The ultimate aim is to foster, through encouragement and assistance, the acquisition of scientific facts regarding the earth, which could not be acquired without cooperative effort.

In addition to the essential administrative and scientific deliberations, no small importance attaches to the establishment of personal contacts which lead to better understanding and more effective cooperation. Opportunity for such contacts is afforded by receptions, social events and trips during and before and after the scientific meetings. Such trips as those provided in Sweden to the north and south of that country and in Portugal to the famous vineyard country and many other places, have given opportunity not only to become better acquainted but to learn at first hand the interesting features of the countries visited.

Association of Geodesy

Since this is the only association which may be said to have had a continuous existence in some form in spite of the war, additional history is of special inter-

est. The last meeting of the old association was held in Hamburg in 1912. When the war came the organization was continued under the name of "Reduced Geodetic Association among Neutral States" by eight neutral countries, including the United States, which withdrew when it entered the war. When the International Union was formed, the Reduced Association devoted its remaining assets to publishing the results of the International Latitude Service and became merged in the new Association of Geodesy.

The association deals with certain questions as a whole, but its main work is done by nineteen committees on such subjects as triangulation, leveling, gravity, etc., twelve of which relate to the earth as a whole or large areas, while the rest relate to specific regions. Some of the more important committees work jointly with the International Astronomical Union and relate to variation of latitude, world longitude net and international time service.

Among the accomplishments have been the encouraging of the gravimetric work at sea of Vening Meinesz, who is now president of the association, and of others using the apparatus which he developed and influencing individual nations to continue the international observatories for the study of variations in latitude. Two of these are in the United States, respectively at Gaithersburg, Maryland, and Ukiah, California. The International Association was unable to find funds for continuance of the various observatories, but all are still in operation. The World Longitude Net with observations in 1926 at 50 stations and in 1933 at 90 also has a geological significance. The Wegener hypothesis of drifting continents has aroused both strong support and violent objection, but the most direct test is to find whether changes in longtitude occur with time, and this can be accomplished only by well-organized special radio determinations.

The principal publications are a quarterly geodetic bulletin, triennial national and special reports, a bibliography and special publications.

Association of Seismology

The old Association of Seismology was inactive during the war, since much of the earlier initiative came from the Central Powers. However, it was at least ten years after the war before its affairs were liquidated. The new organization has had its Central Bureau at Strasbourg under the direction of its secretary, Rothé. The association's functions relate to the location of earthquakes through the interpretations from all seismological observatories, lists of these observatories, securing international agreement on nomenclature and other questions and support of researches of broad character which would otherwise remain undone.

An important activity is partial financial support of the International Seismological Summary, started at Oxford University through the initiative of the Seismological Committee of the British Association for the Advancement of Science. As conditions have changed and especially with the increase in the number of earthquakes that can be located as the result of better instruments, the needed support from the association has grown. At Strasbourg preliminary determinations of earthquake location are made. The publications include: (1) the reports of meetings and all papers presented and (2) a series of special publications in seismology, including the results of research supported by the association.

Association of Meteorology

The Association of Meteorology collaborates extensively with the International Meteorological Organization, which has long been in existence. The membership of the latter is made up of the directors of the official meteorological services of the different countries and selected members of their staffs. In the intervals between meetings the actions of the various commissions and subcommissions of the organization are cleared by the International Meteorological Commission, which is composed exclusively of a selected group of the directors of meteorological services. Since most of these directors are members of the Association of Meteorology, matters of common interest are referred from one organization to the other by informal and occasionally formal communication. This close relationship also makes the members of either group aware of needed action on the part of the other, whether it be in the matter of research work, observation, communication, administration, etc. The relation between the two groups is entirely harmonious and mutually beneficial. While some of the functions might seem to overlap, no serious difficulties are encountered and their work has been found to be mutually inspiring and helpful. The activities of the International Meteorological Organization are broader, since matters of administration and service as well as research are dealt with, whereas the work of the association is founded more particularly on investigation and research. The association also affords means of direct contact with members of other associations with related interests.

Association of Terrestrial Magnetism and Electricity

There was a Magnetic Congress at Cambridge, England, in 1845 under the auspices of the British Association for the Advancement of Science which was attended by Gauss, Lamont and others. Nothing further was done in the way of international organiza-

tion till about 1890, when the formation of an international association was considered. Instead of this, however, in 1891 the International Meteorological Organization organized a Commission of Terrestrial Magnetism and Atmospheric Electricity, which still exists. This came about because much of the work in terrestrial magnetism and associated fields is done in Europe by meteorological services.

Accordingly, when the Association of Terrestrial Magnetism and Electricity was formed, there was a similar problem to that of the Association of Meteorology, and it was solved in much the same manner. Among the members of the commission are many who belong to the association. Cooperation between the two bodies is most effective, and each supplements the work of the other. Certain publications, such as the Magnetic Character of Days (with reference to the degree of magnetic disturbance) are under the auspices of the Meteorological Organization as is also the Second Polar Year Commission (1932–1933), which is still actively engaged in the compilation and interpretation of results. The association deals with the many complex relationships of terrestrial magnetism and other phenomena, and it makes decisions about methods of publication of the results of observation and nomenclature.

The association takes a prominent part in encouraging magnetic surveys of all countries and of the oceans. Its special committees deal with such subjects as secular variation, solar activity and magnetism, magnetic standards and magnetic charts. It has two joint commissions, one with the International Meteorological Organization on methods and codes to describe magnetic storms and the other with the International Union of Radio Telegraphy in the study of the ionosphere.

Its publications include the *Bulletin* series with transactions of the triennial meetings, a quarterly publication on magnetic character of days based on daily ranges at certain observatories and special bulletins.

Association of Physical Oceanography

In no branch of the association's activity is international cooperation more necessary than in that relating to the sea, most of which is common to all nations and belongs to none. The Association of Physical Oceanography functions in much the same manner as the other associations, dealing primarily with those branches of oceanography in which mathematics, physics and chemistry are applied to a scientific study of the sea. Fifteen of the adhering countries have national committees on oceanography which are affiliated with the association.

At the meeting in Edinburgh, preliminary plans were discussed for an international survey of the Gulf Stream in which the research vessels of several nations bordering on the North Atlantic Ocean would participate. A number of committees were appointed to deal with various aspects of oceanography, such as the tide, chemical methods and nomenclature, preparation of standard water, the relation of meteorology to oceanography and gravity at sea.

Prior to 1930 scientific papers were not presented, but at Lisbon and Edinburgh papers dealing with a wide range of subjects in physical and chemical oceanography were presented.

The association is also affiliated with certain other organizations dealing with oceanography, such as the International Hydrographic Bureau, the International Council for the Exploration of the Sea and the International Commission on Oceanography of the Pacific.

Association of Volcanology

The activities of the Association of Volcanology are carried on by a small but active group of nations. The work deals not only with active volcanoes but with the results of earlier volcanic activity. The funds of the association support the *International Volcanological Bulletin* and special investigations in the regions of active volcanoes. The meeting at Edinburgh endorsed efforts to secure reports of submarine volcanic activity, gravimetric surveys in the vicinity of volcanoes and the study of luminous effects accompanying certain volcanic eruptions.

Association of Scientific Hydrology

The administrative work of this association is carried on by the elected officers and an executive committee, with members from each adhering country. Its scientific work is carried on through seven committees which relate to the following subjects: potamology (science of streams); limnology (science of lakes); snow; glaciers; statistical methods; and practical applications. Two committees, those on snow and underground waters, are headed by Americans (Church and Meinzer, respectively).

The two outstanding recent accomplishments of the association are the publication of an annual bibliography of hydrology and the work of the committee on snow. The last represents an outlook on the subject which extends beyond the adhering countries. At the Edinburgh meeting there was a three-day conference on snow and glaciers.

Commissions Relating to Two or More Associations

The Commission on Raz de Marees (unusual sea-waves) is supported by the Associations of Seismology, Oceanography, Meteorology and Volcanology. The commission publishes all available information in re-

gard to these phenomena and inaugurates studies in regard to them.

COMMISSION ON CONTINENTAL AND OCEANIC STRUCTURE

This commission is concerned with the study and exploration of the structure of the crust of the earth, especially through geophysical methods and techniques. Since a large part of the crust is covered by the sea, the commission is at present chiefly concerned with the promotion of the study of the suboceanic crust, which is possible only by geophysical methods. The ultimate aim is to make it possible for the geologist to compare what he learns in this way with what he thinks he has learned on land through the application of all available methods. The problem is too large for any private or public venture of any one nation, so the purpose of the commission is to encourage international cooperation. An American, Field, is president of this commission.

For the union as a whole and for associations, Americans have held presidencies as follows: Union, Bowie, 1933–36; Geodesy, Bowie, 1919–33; Terrestrial Magnetism and Electricity, Bauer, 1927–30, and Fleming, 1930–39; Seismology, Heck, 1936–39. Bauer was secretary of Magnetism, 1919–1927. Vice-presidencies have been held by seven Americans, and numerous others have served on executive and special committees.

The officers of the union for the Washington meeting will be D. LaCour, of Denmark, president, and H. St. J. Winterbotham, of Great Britain, secretary general. The Washington meeting will be similar to those held in Europe. During the ten days which it will last there will be at least two general assemblies, meetings of associations and their committees and of their joint commissions. These official duties will be interspersed with suitable entertainment and visits to the many activities related to geophysics as well as objects of more general interest in or near the National Capitol. Plans have been made for more extended trips before and after the meeting which would give an opportunity to see some of the extended geophysical activities of the country. At the proper time a complete announcement will appear in SCIENCE.

THE JUBILEE MEETING OF THE INDIAN SCIENCE CONGRESS

By Professor R. R. GATES
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THE invitation from the Indian Science Congress Association to over fifty British scientists as well as others from overseas and from foreign countries, to take part in the twenty-fifth session meeting at Calcutta, from January 3 to 9, led to a meeting which was unique in many features. The British party, numbering over a hundred in all, landed at Bombay on December 17. After two days of receptions, dinners, lectures and sightseeing, the party left by a special train in which the members lived during a long tour ending at Calcutta on January 2. A detour southward was made first to the native state of Hyderabad, where the party were guests of the Nizam. Two days were spent in the city of Hyderabad and surrounding country, where the Osmania Mohammedan University, still in process of construction, was visited. The Golconda fort, on a hill 400 feet high, is a grim medieval stronghold built to contain a large population. At Daulatabad another remarkable hill fort was seen, with passages hewn out of solid basalt. Seventeen miles from Aurangabad, the party proceeded by car to view the temples carved out of the basalt caves in the hillsides at Ellora, and farther to the north the beautiful colored frescoes in the Buddhist caves at Ajanta, dating from about 200 B.C. to 600 A.D.

The next stop, at Sanchi in Bhopal, was to see the collection of Buddhist stupas on a hilltop above the river Betwa. These are probably the oldest buildings in India, some dating from the time of Asoka in the third century B.C. They are still visited by pilgrims from China and Japan. In a day at Agra the Taj Mahal, the fort of Akbar, the palace and museum were seen. Delhi and vicinity, where Christmas was spent, contains endless monumental relics of the Mogul period, as well as the great government buildings of New Delhi and the Imperial Institute of Agricultural Research, where much work for Indian agriculture is being done.

Dehra Dun was next visited, where the Forest Research Institute is probably the largest of its kind in the world. Here can be seen a great display of Indian timbers (botany section) and the fungal (mycology section) and insect pests (entomology section). Also methods of testing timbers, as well as a utilization plant where such processes as paper-making from bamboo and the impregnation of whole logs with "ascu" as a preservative instead of creosote are carried out. A motor journey up the mountains to Mussoorie on a ridge at an altitude of 6,600 feet in the foothills of the Himalayas afforded a magnificent view of the plains below and the distant snowy range of the Himalayas to the northward.