SCIENCE

VOL. 97 FRIDAY, JUNE 25, 1943 No. 2530

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE AMERICAN GEOPHYSICAL UNION

By Dr. J. A. FLEMING

THE American Geophysical Union has to do with those theoretical or applied sciences relating to the earth, its configuration, its structure and the natural forces in operation upon or within it. Since inception in 1919, the Union has gradually developed so that now, with 1,900 members, it is perhaps the principal organization in the United States of America, acting as a clearing house for new thoughts and ideas relating to geophysics.

Sponsored by the National Academy of Sciences through the National Research Council, the executive committee of the union is the committee on geophysics of the council and is the American committee of the International Union of Geodesy and Geophysics. The functions of the union are "to promote the study of problems concerned with the figure and physics of the earth, to initiate and coordinate researches which depend upon international and national cooperation, and to provide for their scientific discussion and publication."

The wide-spread special interests of the eight sections of the union are expressed in the papers presented at the annual meetings, in the regional meetings (often held in cooperation with other scientific organizations) and in the annual "Transactions." Symposia on timely subjects are annual features of the general assemblies.

The fields of the sections of the union are briefly as follows:

(a) *Geodesy:* This section is devoted to large-scale surveying on the earth's surface, dealing particularly with triangulation, leveling and gravimetric surveys. Its objectives are principally determining the shape and size of the earth and adequate mapping of the earth's surface. Borderline subjects are earth-tides and variations of latitude.

(b) *Seismology:* This section is concerned with the solution of problems related to earthquakes and the transmission of vibratory waves through the earth. It deals with the internal constitution and surface structure of the earth which, in turn, find practical use by the geophysical prospector, the foundation engineer, the structural engineer, the geologist, the astronomer and the insurance executive.

(c) *Meteorology:* Meteorology is the scientific study of the physical processes which occur in the atmosphere and of the connected processes of the lithosphere and hydrosphere. It seeks to provide an understanding of the causes of weather and climatic conditions and their changes. These exert a profound influence on the entire course of existence of everything living or inanimate on the earth's surface and in its gaseous envelope. Meteorology is therefore of universal interest, including, as it does, all branches of pure and applied science, technology, agriculture, business, communications and transport, and military and naval strategy and tactics.

(d) *Terrestrial Magnetism and Electricity:* The field of this section is the study of the magnetic and electric phenomena of the earth's interior and atmosphere. Recent developments embrace the vital role of the magnetic and electric properties of the outer atmosphere of cosmic radiation, and of the intimate connection between the electrical and magnetic conditions of the earth and various solar phenomena. The practical utilizations in this field include isomagnetic and isoelectric charts and applications to navigation, wired and wireless communication, determination of subsurface geology and ore-deposits.

(e) *Oceanography:* Covering the greater part of the earth, the sea has a profound effect on man and the world in which he lives. In their interaction with the atmosphere, the oceans exercise a marked influence over climate and vegetation. The configuration of the ocean bottom and the action of tides and currents have an important bearing on maritime activities. Oceanic movements together with the physical and chemical properties of sea water affect marine life and thereby influence fisheries. The sea thus presents a field of research not only for the oceanographer but also for workers in bordering branches of science and in the needs of the world's commerce.

(f) *Volcanology:* The section of volcanology encourages research and the presentation of papers not only in "pure" volcanology but also in many fields such as the study of volcanic and intrusive rocks, relation of ore-deposits to igneous activity and laboratory experiments on processes of volcanism and the formation of igneous rocks and ore-deposits.

(g) *Hydrology:* The section of hydrology deals with the distribution and disposal of precipitation on the land areas of the earth, and as such is a borderline science of interest to agronomists, engineers, foresters, meteorologists, soils technicians, geologists and others, and thus forms a meeting ground for all those who are concerned with any phase of hydrology. Its membership has contributed much in the last decade to theories of precipitation, runoff, infiltration and percolation, movement of flood-waves, soil erosion and the transportation and deposition of sediment, density-currents, the behavior of ground-water, evapo-transpiration, glaciers, the physics of soil moisture and the development of useful techniques for dealing with hydrologic problems.

(h) *Tectonophysics:* The section of tectonophysics coordinates the application of physical methods and geologic and geophysical data to the solution of problems of earth structure, through laboratory experiments, geologic observations and theoretical analyses.

At the twenty-fourth annual meeting in the Hall of Government of George Washington University in Washington, on April 23 and 24, there were 475 registered members and guests. One hundred and four scientific papers and progress-reports were presented.

Nine resolutions were adopted. These relate to (1) precise surveys and maps; (2) essential geophysical observations for duration of the war; (3) implementation of meteorology for war purposes; (4) establishment of more stations in oceanic areas and Antarctica in interest of daily and long-range forecasting; (5) naval time-signal services; (6) adequate post-war program of seismological investigations; (7) practical post-war program in all branches of geophysics; (8) ways and means of providing employment for geophysicists released from war effort during the period of transition from war to peace; and (9) thanks to George Washington University for facilities extended for meeting.

Oscar Edward Meinzer—foremost authority of the United States, and perhaps of the world, on ground-water—was awarded the fifth annual William Bowie Medal for distinguished and outstanding contribution to the advancement of cooperative research in fundamental geophysics. His eminent career is singularly established in these high ideals.

J. A. Fleming was reelected general secretary of the union for 1943–1946; J. A. Duerksen was elected secretary of the section of geodesy for 1943–1946; Ernst Cloos, L. L. Nettleton and M. K. Hubbert were elected president, vice-president and secretary, respectively, of the section of tectonophysics for 1943–1946. No other elections were necessary as the terms of all other officers of the union and its sections do not expire until 1944 or later.

During the years 1919 through 1931 funds required for functioning and publications of the union were provided by the National Research Council. During these years the annual grants of the council for the

maintenance expenses varied from $200 to $1,000 and the total additional amount provided by the council in publishing some 1,250 pages of seven volumes of "Transactions" and one special report entitled "Survey of Research Problems in Geophysics" was about $7,600. With the rapid growth and influence of the union it was arranged that annual dues be contributed by each member from 1932 ($2.00 from 1932 and $3.00 since 1937) and the annual total grant from the council was reduced to an average of $400. From 1932 to date the total of annual dues was $30,337, sales of publications yielded $24,802, contributions for special purposes amounted to $7,597, and grants from the National Research Council aggregated $5,692—a grand total of $69,941. During the same interval the publication of some 26 volumes in 12 years of "Transactions" (7,967 pages in a format equivalent to 12,000 pages of the conventional printer's format), of 5 volumes (400 pages) of "Bibliography of Hydrology, United States of America," and of reprints cost $34,787, the cost of maintenance including a paid clerk from 1937 was $22,210, and the total costs of necessary equipment and special-purpose expenditures was $4,628—a grand total of $61,625. Thus on April 24, 1943, there was a reserve of about $8,316 against future maintenance and publication of the "Transactions" of 1943.

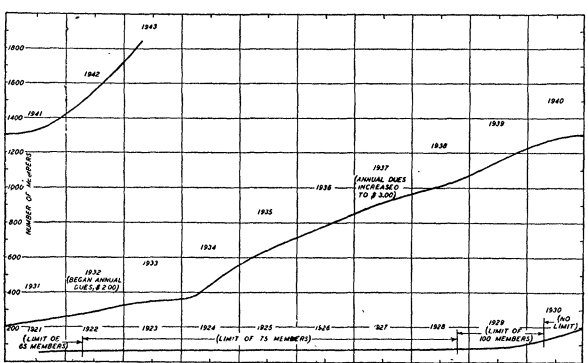

FIG. 1—CURVE OF MEMBERSHIP, NOTING DATES OF INCREASE IN MEMBERSHIP-LIMIT AND ORIGIN AND INCREASE OF ANNUAL DUES, AMERICAN GEOPHYSICAL UNION, 1921-43

This satisfactory performance is the result primarily of the economical methods of offset publication which, with the study of methods of preparing master-copy for direct reproduction, have reduced the total average cost per page for editions of 2,000 to less than one half that of the conventional form of publication in editions of 1,000 only; indeed on a strictly comparable basis of actual content of the page of our "Transactions" and editions of equal number the total cost per page is only one quarter as much. Furthermore, our "Transactions" go free of charge to each member, to a large number of libraries for public reference purposes and to between 300 and 400 of our colleagues in other countries throughout the world.

This brings us to consideration of the union's function in the international aspects of geophysics. We have found means to be represented by delegates at each of the seven triennial assemblies of that body all of which, except the seventh in 1939, were held in European cities. The seventh assembly was held in Washington through the efforts of the American Geophysical Union in cooperation with the Department of State and was judged by our foreign colleagues as one of the most successful of the seven from both points of view of attendance and of scientific discussion. To complete this undertaking the American Geophysical Union found in addition to its own funds some $18,327 to cover expenses of $17,127—over one third was provided by members of the American Geophysical Union and the remainder by generous special grants from the United States Government, the National Research Council, the Geological Society of America and the Carnegie Corporation in almost equal shares of $2,700, after refunds of $300 to each of the three last-named.

It was fortunate indeed that the last assembly, coming as it did almost simultaneously with the outbreak of hostilities, was concluded in the United States. Thus despite the interference since then because of the war with the complete functioning of the International Union of Geodesy and Geophysics, it has been possible, with our colleagues in the United Nations, to preserve a considerable part of the functioning of the international body and thus insure its continuance and its certainty of taking up its important work promptly upon the termination of the war. This has been made possible through the efforts of the officers of the International Union in Great Britain and those in the United States. Of the 33 adhering nations 17 are now Allied or neutral countries and 16 are Axis or Axis-occupied countries. Among American officers are the presidents of the Associations of Seismology and of Terrestrial Magnetism and Electricity, N. H. Heck and J. A. Fleming, and W. D. Lambert is a member of the executive committee of the Association of Geodesy. R. M. Field is chairman of the International Commission on Continental and Oceanic Structure, and J. E. Church is president of the International Commission of Snow. These men have found it possible to carry on and keep alive many of the normal operations concerned. The conditions have not been so favorable in the Associations of Scientific Hydrology and Volcanology since the officers of these associations are in occupied countries; an American, O. E. Meinzer, is chairman of the Commission of Subterranean Waters of the former, and another, T. A. Jaggar, is a vice-president of the latter association. For the Association of Meteorology, the United States is fortunate in having its secretary, Professor J. Bjerknes, in this country so that the interests in meteorology are being followed. For the Association of Oceanography, Dr. J. Proudman, of Liverpool, is secretary so that con-

tinuity of the association's activities is assured. Professor E. Rothé, secretary of the Association of Seismology, died in 1942. President D. la Cour, of the International Union, died on May 19, 1942; under the circumstances, it has not been possible to arrange for the election of a successor, but the general functioning of the union has been maintained through its general secretary, H. St. J. L. Winterbotham.

The general session of the twenty-fourth annual meeting of the American Geophysical Union on the afternoon of April 24 was devoted to a conference on the projected program of the International Commission on Continental and Oceanic Structure. This commission was formed at Edinburgh in 1936 with the instruction to devise, stimulate and sponsor geophysical-geological studies of crustal structure on a world scale, in extension and in support of the similar but less extensive studies made by some of the national organizations adhering to the International Union of Geodesy and Geophysics. Briefly, these may be summarized as follows: (1) Nature and causes of regional magnetic patterns and anomalies; (2) nature, distribution and dynamic causes of regional and gravitational anomalies; (3) nature and causes of regional and temporary variations in radio transmission and reception; (4) nature and dynamic causes of crustal deformation-patterns such as may control regional occurrence or non-occurrence of valuable mineral resources; (5) relation between possible cosmic cycles or rhythms and possible prediction of long-period rhythms as affecting climate and weather; (6) relations of relative climate, hydrology and soils. New authority has been given by General Secretary Winterbotham of the International Union for expenses of the International Commission in the furtherance of its objectives by providing $1,000 proportioned according to the contributions of the several adhering nations. The members of this commission are R. M. Field (*Chairman*); J. A. Fleming (*Secretary*); A. Angenheister, B. Helland-Hansen, O. T. Jones, Harold Jeffreys and F. A. Vening Meinesz. It has been suggested that there be added to the commission Messrs. H. U. Sverdrup, B. Gutenberg and H. H. Hess.

The American Geophysical Union has made free distribution of some 300 to 400 copies of its "Transactions" each year to members abroad of the International Union of Geodesy and Geophysics. Because of restrictions caused by the war, this distribution has been considerably curtailed since 1939, but the union is holding about 200 to 300 copies of each volume for subsequent distribution when opportunity permits.

In the field of snow the avalanche film, which was received from Switzerland through the Swiss Legation last year by President Church, of the International Commission of Snow, has been most valuable, especially in connection with war studies and training concerned with transportation and snow and avalanche conditions.

J. A. Fleming, as a vice-president of the International Union of Geodesy and Geophysics, has continued as the representative of the International Union charged with the deposits of funds of that union in this country. The only expenditures during the year on account of this fund have been $198.70 to the American Geophysical Union to cover the share of the Association of Scientific Hydrology in the expense of the publication of the "Bibliography of Hydrology of the United States of America" for 1940 and $100 to Chairman Field for preliminary expenses of the International Commission on Continental and Oceanic Structure. The payment of the dues of the United States for adherence to the union was authorized for the last year in the amount of $3,920.40 but, because of a blunder, the check for this amount was sent to London and arrangements are now under way for the return of these dues through the American Embassy in London so that the amount may be deposited with other funds of the union with the Riggs National Bank of Washington. The balance on April 24, 1943, in the account at the Riggs National Bank is $6,432.52. With the receipt from England of the last year's dues above referred to, the balance available will be about $10,350—the balance of contribution for adherence of the United States for the calendar years 1939, 1940 and 1941.

The American Geophysical Union has made every endeavor in the past year to increase the coordination and collaboration of interests, especially with the geophysicists of the Western Hemisphere and, as indicated above, to maintain a considerable part of the continuity of the functions of the International Union of Geodesy and Geophysics, thus protecting for the future international relations so essential to geophysical investigations. A recent quotation from a prominent geophysicist of California may be apt in this connection: "The Union, in my opinion, is to be congratulated for having the vision and courage to proceed with the (24th) annual meeting. The Nation needs more, not less, scientific endeavor."

In these days of total war, as never before, responsibility for continued attainment of geophysical knowledge falls with particular directness upon Americans. Now as never before, American scientists personally benefit by affiliation with their fellow specialists and co-workers, since the individual worker is under a great hardship. Now as never before, scientists in general of the Western Hemisphere need to affiliate and play their part not only in the immediate problems of applications to war-effort—to which the geophysicist is contributing effectively—but in the rehabilitation of international relations and endeavors particularly necessary to investigation of earth physics.