Density of Vegetation. The vegetation, when depleted to a stand of less than 30 per cent., was largely ineffective in the prevention or control of erosion. A 40 per cent. cover sufficed to prevent gully erosion under normal conditions of grazing use in the Boise Region.

Rodents. Rodents were an important factor in contributing to erosion.

Accessibility to Live Stock. Erosion varied directly with the degree to which the vegetation cover was depleted and the surface conditions disturbed by live-stock grazing. This appeared to be far more important than any of the other factors studied.

The results point to the necessity of immediately restoring the plant cover to a density of at least 30 per cent., and initiating improvements in range and live-stock management which will relieve conditions on areas particularly susceptible to erosion. They also indicate the type of more intensive studies needed. Such studies are already under way. A more complete discussion of these results and their significance will be presented later.

FRED G. RENNER

INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION
OGDEN, UTAH

LETTERS OF DR. WILLIAM H. WELCH

AT the request of the trustees of the Johns Hopkins University and Hospital and of the immediate family of Dr. William H. Welch, I have undertaken the preparation of a biography of Dr. Welch. The work on the book is progressing, and I should be very grateful for letters written by him, which can be sent me either in original form or in copy. If the originals are sent they will be copied and then returned promptly by registered mail.

SIMON FLEXNER

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH,
NEW YORK

SOCIETIES AND MEETINGS

THE SEVENTEENTH ANNUAL MEETING OF THE AMERICAN GEOPHYSICAL UNION

THE seventeenth annual general assembly of the American Geophysical Union and the meetings of its seven sections were held on April 30 and May 1 and 2, 1936, at Washington, D. C., in the building of the National Academy of Sciences and the National Research Council.

The scientific session of the general assembly was devoted to a symposium on recent trends in geophysical research and included the following papers: "The Place of Geodesy in Geophysical Research," by William Bowie; "Recent Developments in the Geophysical Study of Oceanic Basins," by R. M. Field; "Trends in Seismological Research," by James B. Macelwane; "Recent Progress in the Physical Interpretation of Synoptic Weather-charts," by E. W. Wollard.

Reports were received from four special committees as follows: (1) On geophysical and geological study of oceanic basins; (2) on geophysical and geological study of continents; (3) on establishment of an American journal of geophysics; and (4) on consideration of desirability and feasibility of inviting the International Union of Geodesy and Geophysics to hold its seventh triennial general assembly in 1939 at Washington, D. C. Reports (1) and (2) will be published in the usual annual volume of *Transactions* of the Union. The executive committee was empowered to further consider reports (3) and (4) and to take action as circumstances may warrant.

An interesting feature of the assembly was the exhibits prepared by the special committee on the geophysical and geological study of continents. The central item was a relief model, constructed to scale, which showed the approximate configuration of the "basement complex" rocks underlying that portion of the United States extending from the Atlantic seaboard to and just beyond the Rocky Mountain Front Ranges. With the irregular blanket of sedimentary rocks removed from the "basement" surface the model made clear the nature, form and interrelation of both the buried and emergent mountain ranges of this region. The relations of the ranges to the profound troughs which flank them and to the more remote dome-shaped uplifts and basin-like depressions were also thus disclosed.

In order to show how "basement structure," as portrayed by the model and by its parent structure contour-map, also finds significant expression and reflection in the areal distribution of surface-sediments, in local variations in the force of gravity, in local variation in magnetic intensities and in regional variations in earth temperature conditions, maps and diagrams were also exhibited in proximity to the structural model as follows: (1) The United States Geological Survey's areal geologic map of the United States; (2) contour-map showing configuration of Pre-Cambrian surface for portion of United States east of Nevada (prepared by R. G. Moss, formerly Eleanor Tatum Long fellow of Cornell University, and now with the Phillips Petroleum Company, and exhibited by courtesy of Mr. Moss and the Geological Society of America); (3) contour-map showing configuration

of surface basement complex beneath portion of United States between Atlantic seaboard and Rocky Mountain Front (compiled by the special committee); (4) gravitational iso-anomaly contour-maps of the Eastern United States, Yellowstone-Black Hills and West Indian regions (compiled for the special committee from United States Coast and Geodetic Survey data by George P. Woollard); (5) geothermal maps showing (a) local temperatures at depths of 5,000 and 10,000 feet in United States and parts of Canada, (b) relation of structure to temperature in Salt Creek Oil Field, and (c) relation of temperature to buried topography in Eastern South Dakota (compiled for the special committee from publications by Darton, Van Orstrand and Spicer by William S. McCabe); and (6) tectonical and geophysical map of Wichita-Arbuckle Region showing relations between geologic structure of a buried mountain system and local variations in gravitational and magnetic forces (as published by A. van Weeldon, World Petroleum Congress Proceedings, v. 1, p. 174, 1933).

Five of the nine resolutions adopted were on the deaths during the year of the following members: Arthur J. Weed, Roy Jed Colony, Edwin Jay Brown, Christian Huff and Veryl R. Fuller. The other resolutions concerned national progress in geophysics and were as follows:

RESOLUTION ON TOPOGRAPHIC MAPPING

WHEREAS, In practically all phases of geophysical research a knowledge of the terrain is essential, and

WHEREAS, The best modern topographic maps show the terrain in such detail and with such accuracy as is needed for research in geophysics, either for scientific or for commercial purposes, and

WHEREAS, Good topographic maps are of very great value in operations connected with water-power and soil-conservation and in other engineering operations, therefore be it

Resolved, That the American Geophysical Union recommend and urge that the Federal Government complete the topographic mapping of this country in as short a time as practicable, and be it further

Resolved, That copies of this resolution be sent to the President of the United States, to the President of the Senate, to the Speaker of the House of Representatives, and to other Government officials who would either be concerned in carrying on the topographic mapping or who would benefit by its completion.

RESOLUTION ON NAVAL OBSERVATORY TIME-SIGNALS

WHEREAS, Accurate radio time-signals which are now being broadcast by the United States Naval Observatory twenty times daily on a certain frequency and many times daily on other frequencies are essential for seismological and geodetic investigations of special or routine character, and

WHEREAS, A published notice in the *Hydrographic Bulletin* states that the 690-kilocycle time-signal from NAL is to be discontinued on June 1, 1936, a signal which is of special value to many seismologists in the eastern part of the United States, therefore be it

Resolved, That the American Geophysical Union in joint assembly express the greatest appreciation and gratitude for this excellent time-service, and be it further

Resolved, That every reasonable effort be made by the Naval Observatory staff to continue the present schedule of time-signal broadcasts (including the 690-kilocycle signal) and, if possible, to increase it, and be it further

Resolved, That a copy of this resolution be sent to the Secretary of the Navy, to the chief of the Bureau of Navigation, United States Navy, and to the superintendent of the United States Naval Observatory.

RESOLUTION ON FORMS FOR RECORDING OCEANOGRAPHIC OBSERVATIONS

WHEREAS, It is necessary to have appropriate forms on which to record oceanographic observations made at sea and data pertinent thereto, and

WHEREAS, There is at present much diversity in the forms used by different organizations, and

WHEREAS, It is desirable to have definite forms adopted for use by different institutions engaged in oceanographic work, therefore be it

Resolved, That the American Geophysical Union authorize the Section of Oceanography to appoint a Committee to study the problem of forms to be used in recording oceanographic observations at sea and to submit recommendations at the annual meeting of this Section in 1937, and that this Committee be composed of one representative each from the Hydrographic Office of the Navy, the United States Coast and Geodetic Survey, the United States Bureau of Fisheries, the Woods Hole Oceanograpic Institution, the Bingham Oceanographic Foundation of Yale University, the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, the Oceanographic Laboratories of the University of Washington, the Scripps Institution of Oceanography of the University of California, and from such other institutions as should properly be included.

RESOLUTION ON EXTENSION OF HYDROGRAPHIC SURVEYS

WHEREAS, With improved methods of marine surveying developed during the past few years there has been demonstrated the existence of an intricate topography on the floor of the ocean, and

WHEREAS, The extension and amplification of this record requires not only that the zone of the surveys be extended to a greater distance seaward but also that these offshore surveys be carried out in greater detail, and

WHEREAS, The results secured in the last few years show that such surveys will give data of fundamental importance in the interpretation of the history of the Earth, the distribution of animals and plants, and, in fact, all branches of natural science, and

WHEREAS, The increasing use of echo-sounding equipment by the merchant marine makes the charted results of these surveys of value to commerce, therefore be it

Resolved, That the American Geophysical Union express

its hearty appreciation and approval of the work done along this line by all agencies engaged therein, and also its earnest hope that means may be found not only to continue but also greatly to extend it, and be it further

Resolved, That copies of this resolution be sent to the secretaries of the governmental departments concerned.

In the Section of Geodesy 11 papers and reports were presented. Six of these dealt with progress and development of geodetic operations and instruments in Canada, Central America, Mexico and the United States; four related to gravimetric surveys, apparatus and interpretations; one concerned features of the Hawaiian Island Arc.

The Section of Seismology held three sessions jointly with the Eastern Section of the Seismological Society of America. The 22 communications may be classified as follows: Theoretical interpretations and analysis, 8; individual earthquakes and seismic measurements, 4; research in engineering seismology and applications, 3; geology and deep-focus earthquakes, 2; seismic instruments and stations, 3; progress-report for the United States, 1; earthquake activity, 1. Frank Neumann was elected secretary of the Section of Seismology for the three-year term ending June 30, 1939.

The Section of Meteorology heard nine papers bearing on theoretical aspects (2), on long-range forecasting (3), on correlation of solar and meteorological phenomena and upper-air results (3), on eclipse-meteorology (1).

Thirteen communications were received by the Section of Terrestrial Magnetism and Electricity. These were concerned with instrumental matters (3), with magnetic correlation with cosmic-radiation, radio transmission and solar activity phenomena (5), with magnetic anomalies (2), with electric exploration of the troposphere and stratosphere (1), with magnetic perturbations (1), with magnetic diurnal-variation (1). The secretary, besides reporting progress on the British Admiralty's non-magnetic vessel *Research,* submitted brief summaries of progress-reports dealing with magnetic and electric researches by 11 organizations in Canada, Mexico, Peru, Western Australia and the United States, including Alaska, Hawaii and Puerto Rico.

Eleven communications at the meeting of the Section of Oceanography related to progress during the year of five governmental and private organizations doing oceanographic work. Four papers had to do with dynamical oceanography and ocean currents. Two papers gave summaries of explorations of submarine canyons off California and between the Hudson Gorge and Chesapeake Bay.

The following nine papers were discussed at two sessions of the Section of Volcanology: The origin of lamprophyres; slopes of the walls of lunar craters; the solubility of water in magma at high pressure; two African nephelines; volcanological boron compounds; some recent studies of Sierra Nevada Pluton; crystallization of granodiorite magma, Ouray District, Colorado; origin of anorthosite in the Adirondacks and in general; mode of intrusion of Pre-Cambrian granites in central Boulder County, Colorado.

There were four sessions of the Section of Hydrology. The first two were devoted to 19 general papers —five on ground-water, two on stream-channel storage, six on surface-water and surface-runoff, one on glaciers, four on erosion and flood-control, one on evaporation. A symposium on ground-water—arranged by David G. Thompson—occupied all the third session and included eleven communications. At the fourth session the annual reports of the section's nine permanent research committees were received and discussed; these are the committees on (1) snow, (2) glaciers, (3) evaporation, (4) absorption and transpiration, (5) rainfall and runoff, (6) physics of soil-moisture, (7) underground water, (8) dynamics of streams, (9) chemistry of natural waters. L. K. Sherman, J. E. Church and K. H. Beij were elected as chairman, vice-chairman and secretary of the section, respectively, for the three-year term ending June 30, 1939.

The total membership of the Union on May 1, 1936, was 768—a net gain of 156 during the past year. There is wide-spread interest in the coming sixth triennial assembly of the International Union of Geodesy and Geophysics to be held during September, 1936, at Edinburgh, Scotland. Thus far some 30 Americans have arranged to attend and have been designated as delegates—this is by far larger than any American delegation attending any previous general assembly of the International Union.

As in previous years, the proceedings of the year's meetings—including, either in full or in abstract, 131 papers and reports of the seventeenth annual meeting above noted and some 30 papers and reports at the Pacific Coast meeting of the Section of Hydrology held at Pasadena, California, on January 31 and February 1, 1936—will be published by the offset method.

The increase in membership during the year and the notably wide geographic distribution of new members evidence continuing and increasing interest in geophysics. It is felt that no small part of this enlarging appreciation of the value of geophysical research is to be credited to the publication and distribution of the *Transactions* of the Union. That the *Transactions* play important part, both practical and theoretical, in international coordination of American progress in earth physics is shown in favorable comments by geophysicists of many countries. It is to be hoped,

therefore, that the publication of this yearly record of American progress in the geophysical sciences may be adequately maintained not only in the national interest but also because of its value in the stimulation, orientation and coordination of international endeavor in these fields.

JNO. A. FLEMING,
General Secretary

WASHINGTON, D. C.

SPECIAL ARTICLES

THE PROTECTIVE ACTION OF RABBIT SERUM FOR VACCINIA VIRUS AT HIGH TEMPERATURES[1]

VACCINIA virus rapidly loses its viability at temperatures higher than 5° C. The desirability of a medium by which its viability could be maintained at higher temperatures over a reasonable length of time has long been recognized. Otten[2] succeeded in preparing a dried calf pulp which, stored in vacuo, kept its potency for many months at tropical temperatures. This method has the distinct disadvantage of not eliminating the bacterial contamination in vaccine prepared from this source. Recently Rivers and Ward,[3] taking advantage of the fact that the vaccine virus cultivated by their method in tissue culture is free from bacterial contaminants, added one part of 30 per cent. gum acacia solution to eleven parts of tissue culture virus; and after rapid drying and sealing in vacuo, they obtained a preparation which withstood a temperature of 37° C. for at least one month. Lloyd and Mahaffy,[4] using Rivers's tissue culture virus, prepared a desiccated virus which had been diluted previously with equal parts of normal horse serum. This material stored at 28° C. showed some diminution of potency during a period of 69 days. Stored at 37° C. it could not be kept at undiminished titre longer than 14 days.

Green[5] has shown that glycerinated vaccine loses its viability completely when stored at 37° C. in about 12 days. It is generally agreed that even at a low temperature glycerine has a deteriorating effect on vaccinia virus. The great advantage in its use has been its bactericidal action on the contaminants necessarily present in fresh calf pulp. In a bacteria-free vaccine, such as can be prepared by cultivating the virus in tissue culture or in the chorio-allantoic membrane of the chick embryo, the use of glycerine is of no distinct advantage. Other suspensoids, preferably of a colloidal nature, which, when used with the calf virus, might possibly act as a culture medium for the accompanying contaminants, might prove to have distinctly more protective action for vaccine virus against high temperatures, provided no contaminants are present.

Vaccine virus cultured in the chorio-allantoic membrane of the chick embryo[6] provides an excellent bacteria-free material for testing the effect of various substances upon the viability of the virus at high temperatures. The following substances were used to prepare suspensions of the virus: 30 per cent. solution of gum acacia, 3 per cent. mucin in saline, sterile egg yolk and normal inactivated rabbit serum. Vaccine suspensions were made with these materials in the proportions of 1 part of the ground membranal lesion, which contained the virus from the 200th generation in this tissue, to 4 parts of the suspensoid. The samples were controlled by making the usual 1 to 4 suspension in 50 per cent. glycerine in .9 per cent. NaCl solution, as well as in .9 per cent. NaCl alone. The different suspensions were put up either in capillary tubes or in 1 cc amounts in sealed ampoules. These were stored at 0°C., 25° C. and 37° C. At weekly intervals the different batches were tested for potency by cutaneous inoculation on the rabbit. Dilutions of 1–10, 1–100, 1–1000 and 1–10,000 of the virus suspensions were inoculated in 0.4 cc amounts over a scarified area of skin 2.5 × 5 cm square. Readings were made on the fourth or fifth day. A freshly prepared vaccine from this source induces by this method a confluent lesion in a dilution of 1–1000 and scattered pustules at 1–10,000.

From these comparative experiments it is found that at room temperature for one month the virus suspended in gum acacia and in mucin produces only a very mild reaction in the rabbit in dilutions of 1–10. A moderate reaction is obtained from the virus suspended in glycerine, in saline and in sterile egg yolk in dilutions of 1–100. After 6 weeks at 25° C. in normal inactivated rabbit serum there was practically no diminution in the titratable potency of the virus. Fresh unheated normal rabbit serum seems to reduce the activity of the virus slightly in the first few hours. This observation is being investigated further.

Stored at 37° C. the virus suspended in mucin and gum acacia had lost its viability completely at the end of two weeks. After 3 weeks at 37° C. the glycerinated virus and that in egg yolk was completely inactive. In saline at this temperature a mild reaction was obtained at the end of three weeks, but the virus was completely inactive after a period of four weeks. These were all tested in dilutions of 1–4.

The vaccine suspended in normal inactivated rabbit

[1] Aided by grants from the Divisions of International Health and of Medical Sciences, Rockefeller Foundation.

[2] H. Otten, *Zeits. f. Hyg.*, 107: 677, 1927.

[3] T. M. Rivers and S. M. Ward, *Jour. Exp. Med.*, 62: 549, 1935.

[4] W. Lloyd and A. F. Mahaffy, *Proc. Soc. Exp. Biol. and Med.*, 33, 154, 1935.

[5] A. B. Green, *Jour. Hyg.*, 8: 536, 1908.

[6] E. W. Goodpasture and G. J. Buddingh, *Am. Jour. Hyg.*, 21: 319, 1935.