meet more often; some support a publication, some have a library and a few have museums.

Many academies divide their membership into the following classification: honorary fellows, fellows, members. Several academies have junior academies, but few provide a separate classification for college students. The Iowa Academy has instituted a new class, "fellow emeritus," for persons who have been fellows for 25 years and because of retirement are no longer financially able to pay their dues. Life memberships are provided by most academies upon payment of an amount of money which is designed to bring the academy sufficient interest to cover the annual dues.

The secretary is the most important officer in the organization. He should hold his position for a period of years.

The executive committee formulates the policies of the academy, and, therefore, its members should be active in academy work. In most academies the officers constitute the executive committee. Section chairmen in some academies also serve on the executive committee.

Some academies meet as a body, while others are divided into sections, the Missouri Academy having 20 sections, and the other academies a lesser number. The interrelations between the branches of science seem to indicate that a simpler arrangement with opportunity for workers in interrelated fields to get together might be a better method of organization.

Most academies meet once a year, but a few meet more frequently. The time for the spring meeting is becoming more and more a problem because of the fact that many other organizations hold spring meetings. Would it be possible for all the academies to set aside a week or a week-end in which the academies would meet? Such an arrangement would serve their common interests and enable academies in adjoining states to meet together.

In the field of intersociety relationships there are many opportunities. The Academy Conference is a step in the right direction, but it has a long way to go. The Academy Conference enables representatives of the academies to meet and discuss common problems. It is desirable that the representatives of the various academies should be continued in that capacity over a period of years. It requires some time to become familiar with the functions of the Academy Conference. If the academies would give their representatives the power to act on inter-academy matters, it would strengthen this body considerably.

It is desirable that other local scientific organizations be invited to accept the advantages which result from affiliation with the academy. If the academy could be made the rallying point for these groups, both the local societies and the academy would profit from these relationships.

The effective academy is one with an active group of officers and continuing secretary, whose executive committee, made up of those officers and the chairmen of the standing committees, is an alert group which adequately directs the work of the academy, not only its internal affairs but also its relations to the state in which it is situated. Further, it should be closely affiliated with the American Association for the Advancement of Science and with any other scientific bodies of its particular locality. Such a group is a potent guiding force wherever it may be found.

S. W. BILSING

COLLEGE STATION, TEXAS

REPORTS

GRANTS FOR RESEARCH OF THE GEOLOGICAL SOCIETY OF AMERICA

TWENTY-NINE grants in support of special research projects were authorized by the council of the Geological Society of America at the April, 1940, meeting, as follows:

George P. Woollard, fellow, National Research Council, Princeton, New Jersey, is starting a gravimeter traverse which is expected to complete a line from Washington, D. C., to Los Angeles. Data on the Washington to Pittsburgh portion of the traverse are already available. The gravimeter has been made available by the Humble Oil and Refining Company. The study should yield knowledge of the fundamental structure of North America comparable to that relative to the structure of island arcs provided by the work of Meinesz and collaborators. It is a study by gravitational, geological and magnetic methods of the deeper parts of the earth's crust and the relations of anomalies to continental structure. The work will continue throughout the coming summer. $3,000.

W. J. Mead, Massachusetts Institute of Technology. Under the cooperative direction of Professors Mead and Robley Evans the question of the reliability and limitations of the helium method of determining the age of rocks will be investigated. Dr. Clark Goodman will continue in immediate charge of the work. Three large masses of igneous rocks will be sampled for age determinations on their various parts and phases. The ultimate objective of the investigation is the establishment of a reliable means of determining the age of igneous rocks and the development of an absolute time scale for the geologic column. $3,300.

Bruce L. Clark, University of California, Berkeley, received an additional sum for the completion of his studies of the Cretaceous and Tertiary Radiolaria of western North America. $100.

Charles L. Camp, University of California, Berkeley, will continue the compilation of a bibliography of vertebrate paleontology for the period 1934 to 1938. The period 1928 to 1933 has already been covered, and a manuscript awaits publication by the society. The new volume is approximately half finished. $1,500.

Chester Stock, California Institute of Technology, will continue his work on Tertiary fossil fish faunas of the Pacific Coast with the assistance of Dr. Lore R. David. The work is an extension of an earlier project and is expected to complete the study. $1,000.

Norman D. Newell, University of Wisconsin, will devote the latter part of the coming summer to a revisitation of the Wind River Mountains and adjoining ranges in western Wyoming to study the stratigraphy and paleontology of the Dinwoody formation. The purpose of the study is to locate the Permo-Triassic boundary and to study the Permian history of the northern Rockies and adjoining parts of the Cordilleran geosyncline. $350.

John T. Hack, Harvard University, will resume his studies of the genesis of certain circular structures in the Hopi Buttes country of Arizona. Dr. Hack has spent several seasons in the district and has discovered 50 or more of these structures, the average diameter of which is 3,000 feet, and which he believes are explosive vents rather than cauldron subsidences as interpreted by other workers. Four to six weeks will be spent in the field during the coming summer. $200.

John A. Allan, University of Alberta, will spend five weeks on a pack train field survey within the eastern slope of the Canadian Rockies in western Alberta. A number of trips into the area have been made in past years, and with the completion of the project contribution will be made to the knowledge of the Rocky Mountain geosyncline. The geological section will be made between latitudes 52° and 53° in the vicinity of the North Saskatchewan valley and will complete a section extending westward from the front thrust at least as far as the Continental Divide. $700.

Arthur D. Howard, New York University, Washington Square, will continue his study of the pediment gaps of the Sacaton Mountains of Arizona. The pediment gaps are low cols in the divide at the heads of the pediment embayments and they have a possible bearing on the origin of the pediments. To date pediment gaps are the only important features associated with pediments which have not been examined critically in the field. Dr. Howard expects to spend four weeks in the field during the coming summer and thereby round out available information on the origin of pediments. $215.

Frank F. Grout, University of Minnesota, will maintain the laboratory for rock analyses of research grade with the assistance of this additional grant to guarantee continued operation. The laboratory contributes to a great variety of fundamental problems such as the composition of the earth's crust, the differentiation and contamination of magmas, diagenesis of sediments and the processes of metamorphism. The laboratory has been aided since October, 1934, has proven to be of inestimable service to petrologic research and is patronized by a large number of research workers. More than 800 analyses have been made. $2,000.

Vladimir J. Okulitch, University of Toronto, will extend his researches on the American Pleospongia from fields already studied in eastern Canada to include the collections at the United States National Museum and the Museum of Comparative Zoology at Harvard. This work will complete the description of the American representatives of this class heretofore practically unknown and will make the material available for comparison with that already described for Australia, Siberia and Europe. $130.

Max Demorest, Sterling fellow, Yale University, will continue work now in progress on field studies of glacial petrofabrics and laboratory research on the physics and deformation of ice. This work has been supported by two previous grants. During the coming summer Dr. Demorest will spend ten weeks at Mt. Rainier making petrofabric determinations of ice orientation and its relation to the various stress conditions found in the glaciers. He will continue his cold storage laboratory experiments at New Haven during the succeeding academic year and through the summer of 1941. The work at New Haven is also supported by a National Research Council fellowship. $1,000.

A. J. Eardley, University of Michigan, will spend a month in Utah to complete geologic mapping in a study of the physiography and structure of the north-central Wasatch Mountains. He will examine the pre-Pennsylvanian and post-Cambrian stratigraphy for the solution of certain fault problems and will contribute further details on the Laramide and Basin Range deformations. $200.

Lincoln Dryden, Bryn Mawr College, will supervise the sampling and heavy mineral analysis of Triassic sediments of the Atlantic Coastal Plain. Professor Dryden has been working on the heavy minerals of the Piedmont and Coastal Plain for several years and will now extend his studies over to the Triassic sediments. Several hundred samples will be analyzed, and it is hoped that the results will contribute to a knowledge of the source of the Coastal Plain and Triassic sediments and to the drainage problems of the region. $300.

Ray E. Wilcox, University of Wisconsin, will return to the Yellowstone plateau to continue his study of the origin of mixed rhyolite-basalt rocks already investigated on Gardiner River. Dr. Wilcox will investigate the role of assimilation in the production of the mixed rocks, as well as the possible mixing of simultaneous outpourings of true lavas, and hopes to contribute data on the areal relationships between possible co-existing magma chambers. $500.

Francis Birch, Harvard University, received assistance for his research looking to the determination of the velocity of propagation of shear weaves and rigidity of igneous rocks. This is a laboratory research producing pressure and temperature conditions supposed to exist in a 30-km crust. Pressures up to 10,000 kg/cm^2 and temperatures up to 600° C. will be applied simultaneously. The results of the investigation will contribute toward a solution of the fundamental question of the constitution of the upper layers of the earth. The work is a part of the program of researches in experimental geology and

geophysics at Harvard under the joint guidance of Professors Daly and Bridgman. $3,600.

Charles S. Denny, Dartmouth College, will study glacial deposits in the Hanover-Canaan area, New Hampshire, with view to determining the manner in which the last ice sheet disappeared from that region. A study will be made of the abundant water-laid glacial deposits and dry stream channels on hillsides apparently formed by ice marginal drainage and will throw light upon the current belief that, in Wisconsin deglaciation, down wastage played the leading part. $225.

Frank M. Carpenter, Harvard University, will spend July and August in Perry County, Oklahoma, collecting from the Wellington formation material containing Permian insects. Dr. Carpenter has studied insects from the nearly contemporaneous Elmo limestone of Kansas, but apparently those faunas existed under very different environmental conditions, for the Oklahoma insects are decidedly different. The project will contribute to knowledge of Permian insects and to general problems of Permian stratigraphy. The American Academy of Arts and Sciences will also support the project. $300.

Margaret F. Boos, University of Denver, will investigate the pegmatite dikes and wall rocks associated with various granite plutons of the Front Range in Colorado, specifically the inclusions and replacement minerals. It may be possible to determine which pegmatite dikes belong to each successive plutonic invasion or to determine the waves of replacement, assuming that the dikes were established by the first mineralization and were later modified by solutions moving along the established avenues. $350.

A. K. Miller, State University of Iowa, received an additional sum to aid in completion of a monograph on Ozarkian and Canadian cephalopods initiated by Drs. Ulrich and Foerste. Drs. Miller and Furnish will rephotograph much of the material to be described in the monograph. $400.

Samuel S. Goldich, Agricultural and Mechanical College of Texas, and Morris A. Elms, San Antonio, Texas, will complete the mapping of the geology of the Buck Hill quadrangle of Brewster County, Texas. This includes part of the Davis Mountains, whose structure and petrology are quite complicated. The grant will be used largely for a petrologic and chemical study of a series of basalt, andesite, trachyte and rhyolite flows which, with intercalated ash beds and conglomerate, aggregate over 1,000 feet in thickness. The chemical and petrographic studies will indicate probable relationships and assist in the solution of the stratigraphic and structural problems. $350.

Stanley S. Ballard and John H. Payne, University of Hawaii, will secure improved analytical equipment to continue periodic analyses of solfataric gases at Kilauea volcano, and have gas-collecting equipment in readiness for the next suitable eruption of Mauna Loa and Kilauea. The grantees are respectively assistant professor of physics and assistant professor of chemistry at the University of Hawaii. The program of research has been under way for over three years with regular monthly analyses since September, 1938. The purpose of the research is to obtain a series of reliable analyses of the gases from a well-established solfatara (the "Sulphur Banks" of Kilauea) and to study the possible correlations between such gases and volcanic activity. $450.

Loris S. Russell, University of Toronto. The stratigraphy of the interior plains of Canada, under study for many seasons and partly described in the literature, will be rounded out during the coming summer by examination of key areas in western Canada not heretofore studied. Following the field work Professor Russell will prepare a general treatise on the stratigraphy of the region. $450.

Earl Ingerson, Geophysical Laboratory, will make a detailed field study of some of the gold-quartz veins of the Mother Lode of California, including mineral orientation, in an effort to obtain new and more definite information about the mode of emplacement of the veins and their subsequent history. It is hoped to contribute to knowledge of mineral orientation in veins of this type and possibly of the motion of solutions and conditions of pressure obtaining at the time of vein filling. Dr. Ingerson will enjoy full cooperation of Dr. Farmin of the Idaho Maryland Mines Corporation. $600.

Alfred R. Loeblich, Jr., and Helen Tappan Loeblich, University of Chicago, will collect and study foraminiferal material from the Lower Cretaceous Washita group of southern Oklahoma and northern Texas. It is proposed to determine the stratigraphic range and areal distribution of the species of Foraminifera and to study their environmental habitats. Phylogenetic relationships of the Washita Foraminifera to the Upper Cretaceous species of this region and to those of similar age in Europe are to be investigated. $250.

Rousseau H. Flower, University of Cincinnati, will visit museums in Ottawa, Washington, Albany, Cambridge, Chicago and Columbus to study collections of Devonian Nautiloidea and to prepare photographs and descriptions for a monographic treatment of these fossils. $500.

Frank M. Anderson, Berkeley, California, will complete his long-continued investigation of the stratigraphic, lithologic and faunistic features of the Upper Cretaceous sequence in California and Oregon. The project carries forward the grantee's general plan of supplying criteria for emending the past views as to the later Mesozoic on the American west coast, including the later Jurassic, the early Cretaceous, and upper Cretaceous. Paleogeographic data will be contributed. $300.

Robert L. Nichols, Tufts College, will (1) complete his studies of the "Aa flow of Lava Butte, Oregon," will (2) study a fissure about twenty miles long from which more than ten flows have been extruded, and will (3) study flows in the Lava Cast forest of Oregon with particular attention to the position and shape of "lava trees." Several weeks have been spent in these areas in the past, and the purposes of the new studies are to determine the velocity of lava flow from the shape of lava trees and flow mechanism of an aa flow. $280.

H. U. Sverdrup, Scripps Institution of Oceanography, will direct an expedition for the geological exploration of the central Gulf of California. The oceanographic vessel, "E. W. Scripps," will be used for a period of eighty days as a base for investigations of the submarine configuration, sedimentation and current dynamics of the sea floor and reconnaissance study of parts of the surrounding

coast. The primary purpose of the expedition is to obtain information on the developmental stages of what may be a modern geosyncline. The oceanographic work by Roger Revelle and F. P. Shepard will produce data regarding the environment of deposition of the marine Tertiary, especially the Miocene diatomaceous shales, rate of accumulation of diatomaceous muds, causes of the laminations in them and significance of their organic content as a possible source of petroleum, information on the tectonics of the area with possible data bearing on the southward continuation of the San Andreas fault system, and new information on submarine canyons. The land exploration will be carried out by W. S. W. Kew and C. A. Anderson in virtually unexplored territory difficult of access and of unusual interest. Studies of the marine Tertiary and of the thick interbedded volcanics should yield information on the structure and earlier development of the great depositional basin. $2,500.

G. E. Condra, University of Nebraska, with the assistance of M. K. Elias, will continue the photographing and description of his large collections of Pennsylvanian and Permian Bryozoa in the preparation of monographic reports. Through many years Professor Condra has collected systematically through the Mid-Continent region and in New Mexico, Arizona, Utah, Wyoming and South Dakota. He has collected in Russia and studied the collections in Perm, Moscow, Leningrad, Stockholm, Copenhagen and London. The acquisition of material from the Glass Mountains of Texas and from Greenland has made the Nebraska collection the largest in the world. Work is already three quarters complete and will be continued through the remainder of the year. $1,400.

SPECIAL ARTICLES

THE SUSCEPTIBILITY OF CHICKS TO DIPHTHERIA BACILLI AND TOXIN

IN 1884 Loeffler[1] described the effect of introducing virulent diphtheria bacilli into various birds and animals. Guinea pigs and rabbits were found to be especially susceptible. Later workers abundantly confirmed the latter findings of Loeffler, and these two animals were adopted, to the virtual exclusion of all others, in the study of diphtheria. From the work of Behring, Erlich and others upon measurements of toxin and antitoxin, the 250-gram guinea pig became the standard for such purposes and remains so to-day.

Among other tests made by Loeffler were those on several species of birds. Of thirteen finch-like birds or canaries inoculated intramuscularly with different strains of diphtheria bacilli, all died and at autopsy the organisms were found in large numbers in the tissues immediately surrounding the site of inoculation. All but one of eleven pigeons inoculated by various routes also succumbed to the infection. The effect of inoculating chickens ("fowls") intratracheally was less definite, although membrane-formation in some was observed. In 1899 Salter[2] reported that typical diphtheria bacilli were pathogenic for sparrows, finches, yellow-hammers and the thrush, on the basis of a small number of observations. The studies of Loeffler and Salter on birds were apparently never pursued further.

While retesting the pathogenicity of the diphtheria group of organisms for various species of birds and animals, it was noted that 7-day-old chicks regularly succumbed, following subcutaneous or intraperitoneal inoculation of strains of *Corynebacterium diphtheriae* known to be virulent for rabbits. Subsequent studies showed that death of the chicks rarely followed the inoculation of rabbit-avirulent diphtheria bacilli or diphtheroids. Moreover, as little as one guinea-pig-M.L.D. of diphtheria toxin regularly killed the chicks, while a high degree of protection was afforded by a previous injection of diphtheria antitoxin. Brief details of these experiments follow.

The cultures of *C. diphtheriae* were isolated during the course of local and nation-wide surveys, in which over 2,000 strains of diphtheria bacilli[3,4] were obtained from healthy carriers and persons with diphtheria. All these strains had previously been examined in this laboratory, and tested for virulence by the intracutaneous method in rabbits, developed by Fraser and Weld.[5] Strains referred to in this study will be designated as "virulent" or "avirulent" on the basis of that test. The organisms used in the experiments described in this paper were incubated for 48 hours in infusion-broth; 0.5 cc being the usual dose.

In a preliminary experiment, week-old White Leghorn or Barred Plymouth Rocks were inoculated subcutaneously in the back near the insertion of the right wing with six different strains of virulent organisms, among which were strains of the gravis, mitis and intermediate types. Of eighteen chicks inoculated, all died within 48 hours, regardless of type of organisms or breed of chick used. Six chicks, previously injected intraperitoneally with 100 units of diphtheria antitoxin, when inoculated with the same six virulent cultures, survived with no evident illness. Likewise, four chicks inoculated with four different strains of avirulent *C. diphtheriae* remained well.

[1] F. Loeffler, *Mitth. a. d. k. Gsndhtsamte.*, 2: 421–99, 1884.

[2] A. Salter, *Trans. Jenner Inst. Prev. Med.*, London, 2 s: 113, 1899.

[3] W. H. Frost, M. Frobisher, Jr., V. A. Van Volkenburgh and M. Levin, *Am. Jour. Hygiene*, 24: 568–586, 1936.

[4] M. Frobisher, Jr., *Supplement to Am. Jour. Pub. Health*, 30: 28–35, No. 3, 1940.

[5] D. T. Fraser and C. B. Weld, *Trans. Roy. Soc. Canada*, (Sect. V) 20: 343, 1926.