

ganization, Ecological Society of America, Mountain Lake Biological Station "alumni."

(H) American Anthropological Association.

(N) American Dietetic Association, American Physiological Society.

(Nd) American College of Dentists; American Dental Association; International Association for Dental Research, North American Division.

(T) National Association of Science Writers.

(X) American Geophysical Union, Scientific Research Society of America, Sigma Delta Epsilon, Society of the Sigma Xi, United Chapters of Phi Beta Kappa.

Statler-Hilton (1000 rooms), Euclid Avenue at East 12 Street.

AAAS Cooperative Committee on the Teaching of Science and Mathematics, AAAS Section Officers Luncheon.

AAAS Sections C—Chemistry, K—Social and Economic Sciences, L—History and Philosophy of Science, M—Engineering, Np—Pharmaceutical Sciences, O—Agriculture, P—Industrial Science, T—Information and Communication, and U—Statistics.

(K) American Economic Association, American Political Science Association,

American Society of Criminology, American Sociological Association, Metric Association.

(L) Philosophy of Science Association, Society for General Systems Research.

(M) American Society for Metals.

(N) American Psychiatric Association.

(Np) American Association of Colleges of Pharmacy; American College of Apothecaries; American Pharmaceutical Association, Scientific Section; American Society of Hospital Pharmacists; National Association of Boards of Pharmacy.

(O) American Society for Microbiology.

(P) The Institute of Management Sciences.

(T) Society of Technical Writers and Publishers.

(U) American Statistical Association; Biometric Society, Eastern North American Region.

(X) National Science Foundation, Science Organization and Management Program, Office of Economic and Political Studies.

Manger (450 rooms), East 13 and Chester Streets.

AAAS Sections E—Geology and Geography and I—Psychology.

(B) American Meteorological Society.

(E) Association of American Geographers, East Lakes Division; Geological Society of America; National Speleological Society.

Pick-Carter (600 rooms), 1012 Prospect Avenue.

AAAS Academy Conference.

AAAS Sections A—Mathematics, G—Botanical Sciences and Q—Education.

(A) Association for Computing Machinery, National Council of Teachers of Mathematics, Society for Industrial Mathematics.

(G) Botanical Society of America.

(Q) American Educational Research Association, American Nature Study Society, Central Association of Science and Mathematics Teachers, Council for Exceptional Children, National Association of Biology Teachers, National Association for Research in Science Teaching, National Science Teachers Association, Science Service.

The following hotel provides additional convenient sleeping accommodations.

Auditorium (300 rooms), St. Clair Avenue at East 6 Street.

Guests in this hotel should register for the AAAS meeting at the Sheraton-Cleveland.

Meetings

Astronomical Constants

The system of astronomical constants was the subject of a symposium organized by the International Astronomical Union with the cooperation of COSPAR (Committee of the International Council of Scientific Unions for Space Research) and held in Paris 27–31 May 1963. Participating were 27 experts in astronomy, geodesy, and space research, from nine different countries.

The system of constants comprises

about two dozen constants, numerical values of which must be known before the apparent positions and motions of celestial objects (natural or artificial) can be calculated from the general law of gravitation. Among them are the velocity of light; the constants describing the size, shape, and gravitational field of the earth; the constants of precession and nutation, which describe the motion of the earth's axis of rotation in space; the constant of aberration; and the astronomical unit. Numerous

theoretical relations exist among the various constants, such that if the values of eight of them are known, all the others can be derived from them.

Experience has shown that the progress of astronomy is much facilitated if the calculations made in various places and at different times are based upon the same values of the constants, and equally important, if the values of the various constants used are consistent with one another. These criteria, although universally approved, have never been completely satisfied because of continual improvements in both theory and observations which produce refinements in the theoretical relations and in the numerical values.

Among the more important subjects of discussion were the recent contributions of space research to the values of certain constants. Two orders of magnitude appear to have been gained in the precision of the mass ratio of Earth to Moon, one order in the mass ratio of Sun to Venus, and two or three orders in the astronomical unit of dis-

tance, which is nearly the average distance from the earth to the sun. Although some reserve was expressed by the space experts about accepting the new values without further confirmation, the general attitude of the participants was one of confidence.

It was agreed that the conventional values of the constants mentioned and of others, which have been in general use during the past 60 years, are in need of revision, and the executive committee of the International Astronomical Union was requested to appoint a special working group to study the matter and if possible to make specific recommendations to the Union at its next general assembly which will be held at Hamburg in August 1964. The proposed members of the group are D. Brouwer, United States; A. Danjon, France; W. Fricke, Germany; A. A. Mikhailov, U.S.S.R.; and G. A. Wilkins, United Kingdom.

The symposium was the 4th international conference to have been devoted to the system of constants; previous ones were held in 1896, 1911, and 1950, all of them in Paris. L'Observatoire de Paris was the host, and the local arrangements were handled by B. Guinot and J. Kovalevsky. The full proceedings will be published in *Bulletin Astronomique*.

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Petroleum Geology

Deep drilling for oil and gas (to depths of 4500 to 7500 meters, or 15,000 to 25,000 feet) is practical, and large amounts of the world's petroleum resources will be found by exploration at these depths. The world's deep petroleum resources were assessed by Ira H. Cram (Continental Oil Company, New York) at the 48th annual meeting of the American Association of Petroleum Geologists in Houston, Texas, 25-28 March. Cram stated that the greatest volume of sediments in the world's deep hunting grounds occur in two areas, the Gulf Coast province of the United States and the Persian Gulf province of the Near East. He emphasized that there are no serious technological or economic problems that cannot be solved, based on experience gained from the few fields in which oil is now obtained from depths of 4500 to 6500 meters (15,000 to 22,000 feet).

We can look forward to hunting for and producing oil and gas from depths of 4500 to 7500 meters, and possibly from 9000 meters (30,000 feet) in the immediate future, as the necessary geologic conditions exist in great quantity throughout many of the world's petroleum provinces.

Carey Croneis (Rice University) in a talk at a general session on geologic researches and scientific manpower stated: "It is a truism, if all too lately recognized, that the more fruitful geological researches today (and tomorrow) depend to an increasing degree on the techniques of the sister sciences and mathematics. So much is this the case that a number of quasigeological 'earth and space science' departments or divisions have been created and others are springing up not only at universities but also in private industrial and governmental research complexes, as well. The pendulum has now swung so far from the geologists per se that these organizations are being staffed to a large degree by non-geologists trained in one of the more fundamental, yet supporting, sciences. The advantages are obvious. The disadvantages, which may be equally great, are as yet only dimly perceived. Despite the paradoxical stigma now attached to the use of the time-honored and appropriately descriptive word 'geology,' the earth science institutes and departments are still chiefly engaged in *geological* researches. In such investigations it is just as shortsighted to expect first-rate results from a staff member who has little or no geological background, as to expect outstanding contributions to stem from the 'geologist' who does not have considerable mastery of at least one of the more basic scientific disciplines. As an additional adverse factor, we see fewer students entering undergraduate geological studies and, if the trend continues, fewer 'genuine' geologists will be available for geological positions in teaching or in industry. In short, the situation feeds on itself. The serious, national problem of scientific and technical manpower inadequacies is also closely involved in the geological research dilemma."

A series of papers on clastic sedimentation contained several significant reports. One on the geologic record of hurricanes by Mahlon M. Ball, Eugene A. Shinn, and Kenneth W. Stockman (Shell Development Company, Houston) was thought-provoking about basic geologic theory, especially with reference to carbonate deposition. The speak-

ers considered a little-thought-of geologic principle, "the principle of catastrophic uniformitarianism." This principle nullifies the previous ideas of many geologists that the geologic record of catastrophic storms is limited. They stated that the passage of hurricane Donna (9-10 September 1960) across south Florida, an area where details of the sea floor before the storm were well known, permitted the recognition of widespread storm effects. The recognition of these storm effects led to the conclusion that a significant part of marine sedimentation records the geologic work of large storms.

Specific effects of the hurricane included formation of large quantities of boulder-size rubble by the action of surf on corals at the Florida platform edge, transportation of all sizes of material away from the open sea toward the platform interior, and stranding of layers of carbonate mud over wide areas of the supratidal flat (above the normal high tide line).

The amount of boulder-size rubble formed by hurricane surf on reefs at the platform edge far exceeded the amount produced by day-to-day processes of coral death and deterioration. Each large storm adds an increment to the building of the rubble accumulations.

The large extent of supratidal flats is due to the ability of storm tides to strand sediment over large areas, the inaccessibility of the flats to processes that could rework their sediment into adjacent marine environments, and the supply of sediments on the flats. The supply is so large that these sediments overwhelm the adjacent marine sediments that compete with them for a place in the geologic record. These factors help explain the existence of large amounts of supratidal sediments in some ancient rocks.

Interesting negative aspects of the hurricane's effects were that mound-type accumulations of muddy sediment were not eroded by storm wave or tidal currents and the sediment-laden waters resulting from the stirring of bottom sediments into suspension by the storm waves and currents did not give rise to effective turbidity currents.

In a symposium on cyclic sedimentation several speakers stressed the idea that many transgressions and regressions (advances and retreats, respectively) of the ocean as recorded in geologic time are not related to eustatic changes in sea level but are due to the shifting of the deltas of major river systems and