stated by an eminent geologist that about 1,500,000,000 years have elapsed since the earliest existing sedimentary rocks were formed. During this period mountains have come and gone, and, in fact, some areas have been mountains and again covered by the oceans several times. The Himalayan mountains now have a maximum elevation of about 28,000 feet, more than 5¼ miles. Tremendous forces have been in operation to cause such great changes in the elevation of the earth's surface and with the changing there has been fracturing, crushing, folding and overturning of the sedimentary rocks, resulting in sudden movements. With these movements have occurred the tremors called earthquakes. If the rock has been very strong the stresses have accumulated to great proportions until the forces have overcome the resistance. The giving way shatters the rocks of the crust and produces a destructive earthquake. Of course, this term destructive must be associated with man and structures made by him. An earthquake could not be called destructive, no matter how intense, if there were no artificial structures within the zone of effective action.

Many of the earthquakes occur at sea, under the bottom of the oceans; these make their occurrence felt by the seismograph records and the great tidal waves which, sweeping across the ocean, rush inland destroying the works of man and human life. At times these tidal waves have torn ships from their moorings and carried them inland, leaving them high and dry when the waters receded.

The great source of energy which changes the elevation of the surface of the earth is gravitation. This force, acting on the water which falls to the ground as rain, sweeps vast quantities of eroded material from the uplands and deposits them along the margins of the continents. The equilibrium of the earth's crust, approximately 60 miles in thickness, is disturbed by this process. The magmatic or subcrustal material is pushed away from the region on which sediments are deposited and is forced by gravitation back towards the region from which the eroded material came. In one case, a portion of the earth's crust is pushed down into regions that are hotter, while in the other case the portions of the crust under areas of erosion are lifted higher to colder regions. In the first case, the material of the crust will be subjected to greater heat and in the second the material will lose heat. In consequence of this, chemical or physical changes will occur which cause an expansion or shrinking of the crustal material. It is these changes which are most effective in the upbuilding of a mountain mass or the sinking of a coast.

While change in density of the earth's material is taking place there will be much yielding of the earth's crust without fracture. But some of the yielding will be sudden, and then there will be an earthquake. Earthquakes are also caused by the sinking of the crust under the overload of sediments. This undoubtedly was the cause of the destructive earthquakes at Charleston, S. C., and New Madrid, Mo. There will be fracture of the earth's material, causing earthquake shocks in regions of erosion, for as the surface material is worn away and the region becomes lighter than normal, the subcrustal material will force up the crust, breaking and crushing strata.

The earthquake is merely a symptom of something more fundamental taking place in the earth's crust. The earthquake is the effect rather than the cause, just as we may say that for a human being the chill is a symptom of malaria rather than the disease itself.

WILLIAM BOWIE

U. S. COAST AND GEODETIC SURVEY

FIRST AWARD OF THE PENROSE MEDAL[1]

BY invitation from the council of the Geological Society of America, the first award of the Penrose Medal by the Society of Economic Geologists was made a special feature of the Geological Society's annual banquet, which was held in Prudence Risley Hall, Cornell University, Ithaca, N. Y., on the evening of December 30, 1924. After the dinner had been served, President Lindgren, of the Geological Society of America, called the diners to order and introduced President Kemp, of the Society of Economic Geologists, who spoke as follows:

A year and a half ago, under the presidency of Mr. J. E. Spurr, the Council of the Society of Economic Geologists passed a resolution to establish a gold medal, to be awarded by the society. A committee was appointed to carry the resolution into effect. On canvassing the situation, the committee learned that Dr. R. A. F. Penrose, Jr., the first president of the society, was ready to supply the die and to establish an endowment with whose income the council might award the medal once in three years. In conference with the committee, it was decided that the award should be made for "exceptionally original work in the earth sciences." In accepting the foundation, the council voted that the name of the "Penrose Medal" should be attached to the award. This year it has become possible to present the Penrose Medal for the first time, and after discussion among those members of the council who could meet together, and after correspondence with members at a distance, the council awarded the medal to Professor Thomas

[1] Presentation address at the first award of the Penrose Medal of the Society of Economic Geologists to Professor Thomas Chrowder Chamberlin.

Chrowder Chamberlin, of Chicago. The president was authorized to invite Professor Chamberlin to come to this meeting in order that the presentation could be made to him in person. Professor Chamberlin accepted the invitation and has come, but we are all inexpressibly grieved that a slight accident has prevented his presence at the dinner this evening, where, at the cordial invitation of the council of the Geological Society of America, it was our plan to give him this token of our profound respect and affection. I will, however, as president of the Society of Economic Geologists, give expression to our thoughts and will then ask Professor Stuart Weller, Dr. Chamberlin's colleague and traveling companion, to accept it in his behalf and convey it to him.

Thomas Chrowder Chamberlin graduated from Beloit College, Wisconsin, in 1866, when Beloit was the largest institution of collegiate grade in the state. As has been the case with so many geologists after leaving college, he taught for two years, remedying thereby the financial inroads of four years of collegiate study, and accumulating the means of further graduate preparation. In the fall of 1868, he entered the University of Michigan and spent a year in the study of the natural sciences, becoming at its close professor of these branches in the State Normal School at Whitewater, Wisconsin. In 1873, he finally squared away on his definite career as a geologist when he received the appointment as professor of geology in Beloit. At the same time, he became assistant state geologist of Wisconsin, and, in 1876, chief geologist of the State Survey, a position which he held, together with his professorship, until 1882. During these years, the familiar green-bound, royal octavo volumes of the Survey were prepared, which are familiar to us all and which are on the shelves of all our university libraries. In them, we find the studies of the gash veins of the Upper Mississippi Valley, which had been productive of lead since the early French colonization, and which continue to supply both this metal and still more important quantities of the later utilized zinc. Professor Chamberlin's studies were detailed and exact; his interpretations, original and interesting. All students of mining geology have read them and know them, but not all are aware that with the printed text went also an atlas of maps of very large scale, in a portfolio of such size as to be the despair of librarians, and to be stored, almost invariably, so remote from the reports as to escape observation. On the large scale maps are plotted all the gash veins known at the time, and in such detail that the charts are of great service to the mining profession even to this day. The contribution is of special interest to the members of the Society of Economic Geologists, and I cite it as the first in a series of outstanding contributions to the earth sciences.

The gash veins appear in the driftless area of Wisconsin, and we may wonder if Professor Chamberlin was attracted to the deposits of the Ice Age by his studies of the driftless area in accordance with the old classic absurdity of lucus a non lucendo; *i.e.*, that a light is a light because it does not shine. At all events, we find his later contributions to glacial geology attracting such attention that a Division of Glacial Geology, of which he was appointed chief, was established in the United States Geological Survey, in 1882, in the third year of the Survey's activity. All familiar with the Survey's history recall at once that the first two directors, Clarence King and Major Powell, were farsighted in selecting for monographic treatment subjects of outstanding interest, such as Lake Bonneville, the Grand Canyon, Eureka, Nevada, the Comstock Lode, Leadville and several more. To these was added, in 1882, the great problem of the past and gone continental ice sheets. A moment's reflection will remind us also that under the investigations of the Division of Glacial Geology, the scattered moraines, eskars, drumlins and deposits of modified drift began to assume systematic relations, and to become amenable to time classifications comparable with the results of stratigraphic work upon the hard rock formations. To Professor Chamberlin's twenty-one years as chief of the Division of Glacial Geology, we owe in the largest degree these striking results.

Meantime, in 1887, he had been called to the presidency of the University of Wisconsin, and had taken up the work inaugurated and carried well along by his predecessor, President Bascom, in making the university truly representative of the great state in which it was situated. For five fruitful years, Dr. Chamberlin held the office and then the establishment of the University of Chicago opened up to him a chair, with true university opportunities, with well-qualified colleagues, and with the *Journal of Geology*. From administration, Dr. Chamberlin turned to instruction and investigation, and again apparently by the principle of contrasts began to direct his attention less to the latest of geological time divisions and more to the remotest of all. With the aid of his colleagues in astronomy and mathematics, he began to formulate a conception for the origin of the solar system and of the other groups of heavenly bodies. In the course of years, the planetesimal hypothesis reached precise expression and took its place in geological literature, on terms of equality with the older conception of the nebular hypothesis. Not only this, but many other contributions were made, resulting from studies which lie in the realm between geology and astronomy.

Side by side with these essays came others in the fundamental principles for the classification of geologic time, and most notably arguments favoring the successive diastrophic upheavals as the events which marked off the eras and periods from one another. These contributions constitute a fourth group to be mentioned on an equal footing with the other three cited.

In summary, I may, therefore, select from the long series of contributions which Professor Chamberlin has made to our science the four which may be described, in accordance with the phraseology on the medal, as "outstanding contributions to the earth sciences":

(1) The contributions on the lead and zinc veins of the Upper Mississippi Valley.

(2) The contributions on the Ice Age.

(3) The contributions on the Planetesimal Hypothesis and on the subjects which lie along the borderland between geology and astronomy.

(4) The contributions on Diastrophism as a principle in the subdivision of geological time.

Not alone for these, however, do we award the Penrose Medal. It is, also, an expression of the deep affection and respect with which Professor Chamberlin is universally regarded by geologists, at home and abroad.

SCIENTIFIC EVENTS

THE BRITISH ANTHROPOLOGICAL INSTITUTE

The Royal Anthropological Institute, according to the *British Medical Journal,* has been promised a substantial grant, from the trustees of the Carnegie United Kingdom Trust, for the development of its library. This grant has been made by the trustees in pursuance of their policy of linking up special libraries with the General Library for Students. By an arrangement with the Royal Anthropological Institute, the books and periodicals in the library of the latter, except such as are rare or irreplaceable, will become available to the general public who make application for the loan of books through the central library. The central library will thus be relieved of the necessity of buying such books, and at the same time will have the benefit of the expert knowledge and guidance of the officials of the institute. As the institute's library includes a wide range of periodicals, some of which are not elsewhere accessible in this country, these facilities should be of considerable advantage to students who are not in a position to obtain access to anthropological literature through other channels. Mr. C. G. Seligman, president of the Royal Anthropological Institute, states that the council of the institute is influenced by a desire that its facilities for the study of man should become more widely known. The council holds that knowledge of the racial affinities, ways of thought and social organization of the primitive peoples of the British Empire can not be too widely extended among the general public, if only to bring about a fuller appreciation of the importance of the study of anthropology in helping to solve the difficulties of administration among backward peoples. In spite of the grant made by the Carnegie trust and the sums subscribed by its fellows, the institute is still far from being in a position to undertake the whole of the work that it is its duty to perform. He therefore appeals, not only to those whose interest in anthropology is academic, but also to those who realize that a sound knowledge of ethnology is an essential factor in the equipment of colonial administrators. It is on the knowledge which the latter may acquire that the well-being and security of colonial possessions depend. For the British Empire, the problem of the government of native races exists on a scale much greater than for any other power.

THE ADMINISTRATION OF PATENTS BY COLUMBIA UNIVERSITY

Columbia University will hereafter be prepared to take over patents arising from discoveries made in its own laboratories. Sanction of the Board of Trustees has been obtained for the plan. To take care of cases arising from this ruling, an Administrative Board of University Patents has been established, with the following members:

President Nicholas Murray Butler; Treasurer Frederick A. Goetze; Frederick Coykendall and Archibald Douglas, trustees; Walter I. Slichter, professor of electrical engineering; Ralph H. McKee, professor of chemical engineering; Frederick T. van Beuren, associate dean of the medical school; Thomas Ewing and Dr. Milton C. Whitaker, former professor of chemical engineering.

The trustees acted upon the recommendation of the Committee on Education,

that while no university officer should be under compulsion to assign to the university any patent that might be issued to him for a discovery of his own, even if that discovery were made in the university's laboratories, nevertheless the university should be prepared to accept the assignment of such patents in cases where that action approves itself to the judgment of a competent university authority.

Members of this board in handling the inventions so patented may

make arrangements on such terms and in such way as they may approve for the use, manufacture, sale, or other disposition thereof, or of rights therein, with power to arrange for the use or division of the proceeds thereof.