to all of which he contributed classical works, as well as widely known text-books.

It may be of some historical interest to recall the peculiar circumstances connected with the publication of the famous memoirs of Professor Gibbs on which his great reputation rests. They were published in the Transactions of the Connecticut Academy of Sciences, which at that time was not connected with Yale University and received no support from it.

Much later Yale decided to grant the Academy $1,500 annually towards its publications, which are now marked as Yale Publications. When Professor Gibbs presented his papers the academy had no regular publication funds, except the annual dues of the members—about 100 at that time.

I was on the publication committee in each case and was president of the academy during most of that period. As I am the only survivor of the committee I take the liberty to refer to the difficulties encountered in publishing those articles.

They were expensive to set up, owing to the complex mathematical formulae. Our funds were small. On nearly every occasion we had to go out and raise a subscription to pay the cost, partly among college men and partly among the business and professional men of New Haven. Long discussions took place as to our ability to print the articles. Two able mathematical professors were on the committee—Loomis and Newton. Both protested that they did not understand Gibbs's papers at all. One insisted that no man ever lived who could except Maxwell and he was dead. Yet we all believed that what Gibbs wrote must be of intrinsic value in his branch of science. Therefore we raised the money and printed each paper as it came in. I remember that on one of these occasions Professor Loomis, as chairman, appointed Professor Newton as one to raise funds. Professor Newton begged off because he had done that duty so many times, but Loomis would not excuse him because he was the most successful, and then in his usual sudden or abrupt way, he adjourned the meeting and seized his cane and tall silk hat to leave the room.

Professor Newton jumped up and said, "Hold on, Professor Loomis, I have something to show you." Then he took from his pocket a subscription blank already prepared and said, "I want you to head the list with $100.00." We all laughed, of course. Professor Loomis looked at us with a broad smile and without a word wrote his name down on the $100.00 page.

Not long after the publication of his papers, Professor Gibbs asked me to request a vote of the academy at a regular meeting as to giving permission to somebody in Germany to reprint his papers there. I told him that it was not necessary, for they were not copyrighted. He rather insisted on a vote. The vote was put and the vote was unanimous in favor of giving permission. Soon afterwards they were printed in several other European countries and finally became text-books in some of the universities.

Whether any other American society would have undertaken to publish those very advanced papers I do not pretend to know, but I think it very doubtful. We knew Gibbs and took his contributions "on faith." Yale University, as such, had no part in it. Most of the Yale scientific professors were members of the academy, but they acted individually for many years. Yale had not then, nor does it now, have any adequate means for publishing the results of the researches of its scientific men, so that their works are widely scattered.

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AN EARTHQUAKE PREDICTION AT HAWAIIAN VOLCANO OBSERVATORY

A PREDICTION of earthquakes was issued by the Hawaiian Volcano Observatory on April 8, 1924, and shocks that verified the prediction were felt over southeastern Hawaii on the 10th and 11th.

As was pointed out by Milne[1] earthquake predictions in a country where shocks are very frequent are almost certain of verification, especially if instrumental records are consulted. An average of seven or eight earthquakes are recorded weekly at Hawaiian Volcano Observatory. Of this number, however, only about five or six per cent. are perceptible. To forecast perceptible shocks and to give approximate time is not so easy as the total number of shocks might indicate.

In Hawaii, as elsewhere, there are a great many people who think that they can sense the coming of earthquakes. While the movement of barometric minima may have a slight effect on the occurrence of earthquakes it does not follow, even in regions of high seismicity, that sultry weather is followed by earthquakes. During the first part of 1924 in Hawaii, for instance, there was a long spell of "earthquake weather," with an unusually small number of earthquakes.

The small shocks that often precede a major one do, however, frequently enable one to make forecasts. Probably all the bona fide predictions mentioned by Milne[1] based on noises, uneasiness of animals or changes in underground water are due to fore shocks.

It has long been known that internal stresses of the earth are often shown at the surface by either

[1] Milne, "Earthquakes," pp. 301–310.

vertical or horizontal movements or by both. Lawson in his paper, "The prediction of earthquakes," draws his deductions mainly from measured horizontal movements in California. Over a large part of any region where there is a change in the vertical there usually is a deflection of the plumb line. Exceedingly small deflections can be measured from the tilting of sensitive pendulums. Jaggar[2] has shown the connection between tilt at Hawaiian Volcano Observatory and fluctuations in the lava column of Halemaumau. It is probably less reliable to make earthquake predictions from the tilt records of one station on the brink of an active volcano than from the records of a station more remote from a volcanic vent. So far at the Hawaiian Volcano Observatory there have been no measurements of horizontal movements. Steps were taken by Dr. Jaggar in cooperation with the U. S. Geological Survey to locate accurately several points near the volcano so that both horizontal and vertical movements might be detected. Tilt is also measured at Kealakakua, Kona, where a seismograph is maintained by the Hawaiian Volcano Research Association. It is a part of the program of this observatory to extend tilt measurements to other parts of the island. The amount of movement on the island of Hawaii is so great that it is possible to supplement the continuous records of a few stations by occasional measurements of accumulated tilts at other places with a precise level.

It is presumably not incorrect to say that if the movements, either vertical or horizontal, or both, that are occurring in probably all seismic regions of the world could be measured continuously few serious earthquakes would be likely to occur unheralded.

At the Hawaiian Volcano Observatory, on the north brink of Kilauea crater, there was a southerly tilt during most of March. On March 29 a northerly tilt set in that continued until the evening of April 2. From April 3 to April 8 there was a southerly tilt amounting to about six seconds of arc. The tilt accumulation of six seconds in such a period of time is by no means uncommon, especially during times of rapid changes in the lava level in the fire pit, half of the above amount sometimes occurring in one day. With these rapid fluctuations of the molten lava and large tilts there are, as a rule, but few perceptible earthquakes. During the period in question, however, there was no molten lava in the fire pit. At times of little or no tilt whether there be lava in the pit or not there are but very few local shocks. The connection between tilt and earthquakes at such times has long been noticed here.

[2] Jaggar, T. A., *Bull. Seis. Soc. Amer.*, Vol. 10, No. 4, Dec., 1920.

Accordingly, on April 8 the following statement was sent to Hawaiian newspapers: "There is strong likelihood of one or more perceptible earthquakes within a few days." At 10:46 P. M. April 10 an earthquake occurred that was felt all over southeastern Hawaii, and the following day at 11:24 A. M. another shock of a little less intensity occurred.

R. H. FINCH

VOLCANO HOUSE, HAWAII,
MAY 1, 1924

A NEW FORMATIONAL NAME

IN 1912 I described in the Journal of the Academy of Natural Science of Philadelphia (pp. 23–112, pls. 5–13), the occurrence of true basal Eocene beds on the Island of Soldado, off the southwestern coast of Trinidad, in the Boca de Serpiente, and I described and figured the fossils.

This fauna, which is that of bed No. 2 of the Soldado section, showed extremely interesting analogies on the one hand with the northern fauna of the Midway, basal Eocene of Alabama, and on the other hand with the southern basal Eocene of Pernambuco, Brazil.

The subsequent work of various geologists in the Antillean and northern South American field has strengthened and corroborated the age of this Soldado horizon, which has been traced upon the mainland of Trinidad. Beds of similar age are also on the Island of Margarita.[1]

But the Soldado horizon has become historic as the first discovery of the true basal Eocene in the entire Antillean and northern South American region. It is fitting that it should receive a distinctive name, and I propose that it should be known as The Soldado Formation and stand as the type of northern South American and of Antillean basal Eocene deposits.

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QUOTATIONS

THE ENCOURAGEMENT OF BASIC RESEARCH

THE National Union of Scientific Workers has issued a report on the encouragement of basic research, in which it discusses the value of research to the community, the motives of research workers, the financial encouragement they should receive, and the obligations of their work. The views expressed in this report are of peculiar interest because they represent the opinions of people actually engaged in scientific investigations, who are themselves familiar, therefore,

[1] Maury, *American Journal of Science*, in press.