

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. Jaggar² 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.

with the difficulties which attend this mode of life, with the misconceptions entertained about it and with the defects that follow from lack of organization. The National Union of Scientific Workers is not a trade union designed to protect a particular section of the community. It exists to further a cause which all scientists have at heart, and to voice the opinions of a valuable band of citizens who have been too long inarticulate.

The motives of research workers are, speaking generally, as mixed and as commonplace as those of their neighbors. It is well to recognize this fact, and to discard the illusion that the research worker necessarily pursues a lofty course inspired by an ideal superior to that which moves the remainder of mankind. One of the most powerful motives of the research worker is undoubtedly a desire for knowledge for its own sake; but mere love of knowledge, unaccompanied by any other motive, is seldom sufficient to lead to the laborious investigation imposed by research. The desire for reputation, not to be confused with base ambitions towards notoriety, is a worthy motive in research workers; many of them have enjoyed the companionship of older scientists, whose approval they look for as a gratifying reward. The expectation of being able to publish an important piece of research, and thereby earning a position in the ranks of some learned society, determines the choice of a way of life for many younger scientists. In medical science the pecuniary rewards of research work are not, and are never likely to be, as substantial as those of the practicing physician or surgeon, but the atmosphere of the laboratory offers attractions unknown in the busy consulting room or operating theater; such attractions are leisure to think, freedom from interruption and free play for the imagination. Among motives we have to reckon also with a desire for some more responsible post, such as a professorship, with its attendant intellectual status and greater security.

It is interesting to notice that when discussing the financial encouragement which should be given to research the National Union of Scientific Workers unsparingly condemns the system of patents, prizes and special grants for successful work. Payment by results is an impossible method for research work, because, as experience has shown, the most fruitful work has often been some fundamental inquiry into a scientific problem which seemed to offer very little prospect of practical gain. To dictate a practical objective would hamper much useful investigation. Moreover, it is extremely difficult justly to apportion credit for a discovery. The individual to whom the coveted distinction is ascribed has sometimes done little more than add the final stone to a building whose foundations have been laid and whose walls

have been built by a host of workers of whom the world never hears. On the other hand, indirect encouragement by means of special grants for apparatus and assistance in publication of results is approved as a satisfactory method of financial encouragement.

It is recognized that some scientists can only do the best kind of research work when completely free from all other duties, such as teaching or routine work. Provision must be made for workers of this temperament, and they must be guaranteed a salary sufficient to enable them to be secure from financial anxieties. Other research workers prefer to combine some routine work with their experimental studies, and these are most happily employed in some university or hospital appointment, which enables them to spend part of their day in teaching and the other part in research.

The National Union of Scientific Workers is wise in insisting on the value of research to the community, for this is an aspect of the research question often unnoticed. Apart from the store which research workers add to the knowledge of the country, the inclusion of men and women with the research type of mind should be sought after in every community. Open-mindedness and breadth of view are developed by the search for truth, and the whole community benefits directly by the presence within it of such intellectually active citizens, who contribute qualities that can not be conferred in the same measure by any other intellectual occupation.—*The British Medical Journal*.

SCIENTIFIC BOOKS

Food Products. By HENRY C. SHERMAN. 2nd Edition, Revised and Enlarged. The Macmillan Company, New York, 1924, VII plus 687.

THE years immediately preceding the first edition of H. C. Sherman's "Food Products" had witnessed a great increase of interest in food problems and a corresponding increase in knowledge of food composition and likewise a rapid development of the important subjects of food sanitation and legislation. Out of the greatly augmented subject-matter then available a clearly written and very inclusive book was produced which has proved of great value in every way to teachers and students as well as a handy and convenient reference book for the general public. A feature of this book and of the new edition is the lists of references following each of the chapters, which makes it possible for the user to locate readily material which supplements and extends the chapter content.

The new volume is a logical development of its predecessor. The experience of the last ten years and