RP-0-012

A D D R E S S E S

ON THE OCCASION OF THE COMPLETION OF ONE-THIRD

OF A CENTURY OF CONTINUOUS OBSERVATIONS AT THE

CHELTENHAM MAGNETIC OBSERVATORY

OF THE

U. S. COAST AND GEODETIC SURVEY

CHELTENHAM, MARYLAND

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OCTOBER 10, 1934

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G U E S T S O F H O N O R

Dr. John A. Fleming

Dr. J. Bartels

Mr. D. L. Hazard

WELCOME

To Guests at Cheltenham Observatory, Oct. 10, 1934.

By

CAPTAIN R. S. PATTON
Director, U. S. Coast and Geodetic Survey.

My friends-

It is a special pleasure to welcome you here this afternoon, for a special reason with which you will all sympathize; to me this little group of buildings, simple and unpretentious as they are, stands as a physical symbol of one of the finest manifestations of human aspiration. I can say that to such a group as this, because you are here today in direct consequence of the fact that that aspiration is the principal motivating force of your own lives. If these structures are the inanimate symbols, some of you are a part of the living reality of what I have in mind.

The aspiration of which I am thinking is that will to penetrate farther into the unexplored regions of infinite truth, which manifests itself in fundamental scientific research. I can think of no worthier or more inspiring purpose to which one might dedicate himself. For, intrinsically, I think we may envy any man, whatever his material circumstances, whose dominant passion in life is to know truth. And extrinsically, I think that man's principal hope for the future, at least in this temporal, mundane sphere, is to be found in progress in that eternal struggle to bring him into closer and more harmonious relation to his environment, which is one of the objectives of scientific research.

I am not going to elaborate on this idea, or preach you a sermon about it. I mention it at all only because I have sensed that this meeting has an inner significance which lifts it above the plane of a mere pleasant social function. I think such a meeting as this partly would fail in its purpose if it did not enable us to withdraw for a moment to a vantage point from which our view of the

forest was not obscured by the trees. We dare not lose that larger vision. The conduct of scientific research demands the exercise of an infinite patience which remains tolerable only for so long as we have the vision before us. To Mr. Hartnell, for example, who has devoted more than twenty years to the work of the observatory, the task long since would have been unendurable if it ever had become merely a day's work for a day's pay. Gamma as the lonely, isolated ruler of a man's destiny would be monstrous; gamma visioned in her appropriate place in the eternal scheme of things can be beautiful and inspiring.

Our welcome to you today is particularly warm because you have helped us to retain that vision. The stimulating effects of our contacts with you, your problems on which you have enlisted our aid, and conversely, those of our own which you have helped us to solve, all have contributed to that end. We want you to know that we value your friendship and cooperation and that we hope always to give as well as receive. I know Captain Heck will second all that I say along that line. I know you would all like to hear from him, and I hope he will assure you that his practice will be better than my preaching.

Address of Captain N. H. Heck,
Chief, Division of Terrestrial Magnetism & Seismology,
U. S. Coast and Geodetic Survey,
At Cheltenham Magnetic Observatory, October 10, 1934.

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For a third of a century, or three sun spot cycles, the Cheltenham Magnetic Observatory has been in continuous operation, day and night, and this gives sufficient reason to review and exhibit this work and related activities. We welcome all of our guests and especially those of other institutions who have contributed to the work or to whom our activity in this field has contributed useful information.

The keynote of the occasion is informality and I am not going to make a formal address. However, it is essential that certain facts be understood and I am going to try to give you a correct picture.

The plan for a magnetic survey of the United States was prepared in 1899 by Dr. L. A. Bauer, then Inspector of Magnetic Work, Coast and Geodetic Survey. The plan included field observations at every county seat in the United States and the operation of a number of observatories throughout the United States, and the regions under its jurisdiction. Prior to that time observatories had been maintained at Key West, Fla., 1860-66; Madison, Wisconsin, 1876-80; Los Angeles, Calif., 1882-89; San Antonio, Texas, 1890-95 - at the last two with the same Adie instrument you will see in operation today - but all the series were too short to be entirely satisfactory.

From the adopted plan came the present observatories at Cheltenham, Sitka, and Honolulu. The observatory started at Vieques in 1903 was later moved twice, but care was taken to make the necessary observations to insure a homogeneous series for the region. The Baldwin, Kansas, observatory of the original plan, operated for control of field observations in the middle west, was abandoned and the Tucson, Arizona, Observatory was established in 1909.

In planning for an observatory near Washington, it was realized that in addition to the regular functions it would be necessary to provide a place for

testing and comparing instruments and for carrying on investigations in cooperation with the Washington office.

All these purposes were taken into account in selecting the site and designing the necessary buildings. It was also necessary to find a site free from present and future artificial disturbance, uniformity of magnetic distribution over the area needed, all combined with reasonable accessibility and ease in obtaining supplies. Unfortunate experience at San Antonio, Texas, and at many foreign observatories with the disturbing effects of electric cars made it necessary to give special attention to this consideration.

After much investigation of possible sites the one before us was chosen. It was part of the 800-acre farm of the House of Reformation for colored boys. It is 14 miles southeast of the National Capitol and 1-1/4 miles from the Cheltenham railway station, and a mile from the Crane highway.

As a result of this careful selection no serious difficulties have arisen and the site is today as suitable for magnetic work as when it was chosen. The site is leased from the House of Reformation.

The preparation of plans for the buildings and their erection was assigned to John A. Fleming, then Aid in the bureau and today with us in quite a different capacity. He had numerous unusual problems in operating two sets of recording instruments in the same building but far enough apart to avoid mutual disturbance. No non-magnetic material could be introduced and the building had to be insulated against temperature changes at a time when none of the modern means of accomplishing this were available.

The buildings were begun near the end of 1900 and observations began in April, 1901. Their unbroken continuity (except for a few hours) has in itself made an important contribution to the value of the work. Standards have been maintained during the entire period so that the work of the observatory is known throughout the earth and it is frequently referred to in literature on the

subject.

Personnel is a most important consideration in connection with the records. The observatory was first under the charge of Walter G. Cady, now professor of Physics at Wesleyan University; next followed L. G. Schultz, who later had charge of an observatory of the Argentine Republic and still later returned to the United States to erect the no longer existing magnetic observatory of the Weather Bureau at Mount Weather near Bluemont, Va. Then came W. F. Wallis, now of the staff of the Department of Terrestrial Magnetism, C. I. W., and then J. E. Burbank who did useful early work in the study of microseisms or minute earth tremors. George Hartnell took charge in 1911 and continued to the present year when Lieut. Comdr. Eoline R. Hand was placed in charge, Mr. Hartnell remaining at the observatory to carry on important investigations in instruments and methods. S. G. Townshend, Jr., has been assistant observer continuously since 1903 except for a short period of duty at Baldwin, Kansas.

During the long period of observation, the plant as a whole has had several narrow escapes. A severe bolt of lightning has passed through this highly inflammable variation building without damage except the shattering of a flagpole formerly on the building. A tornado removed part of the roof. The most serious menace developed within the past few years from the activity of an enemy which had no regard for scientific accomplishment. This was the small insect known as the termite. He found the combination of wood and sawdust much to his liking and was well prepared for a comprehensive attack in millions which would soon have rendered the buildings not only unsuited to their purpose but actually unsafe. Emergency and public works funds were made available. The office building which you are now in, was rebuilt, and new foundations were placed under the adjacent variation building. A new comparison and test building replaced a very small one which was moved to another site and which will soon be used for continuous cosmic radiation observations at the request of the Committee of the

Carnegie Institution of Washington which deals with that subject.

The pier arrangements of the various buildings were modified to meet present needs with the advice and assistance of Dr. Fleming and his staff.

Much cooperative work is done here. In 1922 The Association of Terrestrial Magnetism and Electricity of the International Geodetic and Geophysical Union, asked that each country designate an observatory for making measurements to maintain the international magnetic standard. In 1923 the American Geophysical Union asked that this function be performed jointly by the Cheltenham Magnetic Observatory and the Magnetic Laboratory of the Division of Terrestrial Magnetism, Carnegie Institution of Washington. While that organization has the responsibility of establishing the standard and of making international observations to maintain it, it is now necessary to make its observations for the United States almost entirely at Cheltenham, because of the encroachment of the city of Washington on its present site. There are many cooperative observations with the Carnegie Institution of Washington.

The Naval Research Laboratory has frequently made use of the favorable magnetic conditions at Cheltenham for various investigations.

The Bureau of Standards from time to time makes precise measurements of our instruments in connection with the work in international standards, it has given assistance in problems relating to magnets and has aided in other ways. In return it makes use of the records of the Cheltenham Observatory to control investigations being carried on in its laboratories.

The uses of Terrestrial Magnetism are too numerous to mention here. The exhibits show that needed information is furnished for all mariners' charts and aviation maps. The Cheltenham records are particularly used in connection with radio transmission problems, the records being duplicated weekly for the benefit of the Bureau of Standards and the research department of one of the large broadcasting companies. Other communication companies and the Naval Research Labora-

tory require similar duplication from time to time. This information is demanded long before we have had time to make use of it ourselves. Cheltenham also furnishes daily the magnetic information for the so-called URSIgram or message giving magnetic, solar and other conditions which may affect radio transmission. The information is compiled by Science Service and broadcasted by the Navy Department. Cheltenham furnishes from time to time, and Tucson, continuously, information of use to geophysical prospectors by magnetic methods.

We have today three special guests and I wish to say a little about each.

Dr. John ... Fleming started his career in magnetic work in the Coast and Geodetic Survey and built this observatory as well as that at Honolulu. In this work he showed the efficiency, zeal, mastery of details and executive ability which have characterized his career ever since. His accomplishments are too numerous to mention. His present important duty as acting director of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington tells the story in itself. He has always shown a cooperative spirit and the close relations of his organization and our bureau in the field of terrestrial magnetism are in itself responsible for much joint accomplishment. He played an important part in the participation of our country in the Second Polar year, not only through the work of his own organization but in obtaining the necessary appropriation which made possible the participation of our bureau and other Government agencies. He is now president of the Association of Terrestrial Magnetism and Electricity of the International Geodetic and Geophysical Union. He also was the loyal assistant of Dr. L. A. Bauer during the years of establishment of the country-wide magnetic work of the Coast and Geodetic Survey, the organization of the Department of Terrestrial Magnetism of the C. I. W. and the development of ocean surveys from the time when Dr. Bauer and our late assistant director, Captain R. L. Faris, established magnetic observations at sea, to the building and extensive voyages of the non-magnetic ship CARNEGIE.

Dr. J. Bartels of Eberswalde, Germany, and research associate of the Carnegie Institution of Washington is present not only as an outstanding figure among world magneticians, but he represents the scientific Germany to which this observatory and magnetic work in general owes so much The method of obtaining the horizontal intensity was developed by Gauss 100 years ago. A little later Weber developed the earth inductor. The large absolute instruments in this building were built in Germany and also the Eschenhagen variometers of which you will see one set not in use, while the others are closed from view today so that the work of the observatory will not stop. Adolf Schmidt has made many contributions which we utilize daily. Dr. Bartels has made and published many important investigations and not the least of his services has been his contributing with Angenheister an important chapter on the magnetic field of the earth to the Handfur Experimentalphysik.

Daniel L. Hazard, senior mathematician and chief magnetician of the Coast and Geodetic Survey entered the service in 1892. He served under Mr. Schott in what was then the Computing Division until 1899 when he entered the magnetic work of the bureau with which he is associated not only in Washington, but in the minds of magneticians all over the earth. He has been almost entirely on office work though he spent about a year on field work in early days, made observations during the solar eclipse of 1900 and instructed officers of the PATTERSON, BLAKE and BACHE in magnetic work. He is perhaps best known for his directions for magnetic measurements which are in use throughout the earth. When a revision was called for some years ago he was asked to make the instructions apply to the southern as well as northern hemisphere, the request coming from international sources. One of his great contributions has been in using his ripe judgment to secure the best values of the magnetic elements when the instruments go wrong. They should not do so, but we are pursuing a very small physical unit, the gamma, and very small instrumental changes make trouble. Little has been lost however,

because of Mr. Hazard's ability to deduce the most probable value. His knowledge of magnetism throughout the United States is profound and he has put the information in systematic and convenient form for all citizens who desire to make use of it.

In conclusion I wish to ask you to use your imagination and to look beyond these strictly utilitarian buildings and instruments to the fact that we are dealing with one of the fundamental and elusive forces of nature. In our geodetic work we measure another fundamental force - gravitation - but this once measured remains the same at the same place. In magnetism we cannot predict today what tomorrow will bring forth. In the struggle for a better understanding of this fundamental earth science the Cheltenham Observatory is in the front line of attack.

BRIEF ADDRESS OF DR. JOHN A. FLEMING.

Captain Patton and Captain Heck have covered the scientific side of the work so I will speak in a more general way.

When this observatory was under construction, I had some difficulty with the workmen from Baltimore, who sometimes failed to return after the week-end. On one occasion, I discharged one of the carpenters for returning on Monday morning in an intoxicated condition. Before leaving, he carefully strewed iron nails over all the foundation of the building. They were all carefully recovered but this illustrates the great care that was taken to keep the building non-magnetic.

My association with magnetic work began under the instruction of Dr. L. A. Bauer at the University of Cincinnati, and my association continued with him until the end of his life. I also had early association with Mr. Hazard, and I remember that a classmate of mine and myself did our best to find errors in his work but always met with no success.

It is a pleasure to me to be able to call attention to the close cooperation that has always existed between the Coast and Geodetic Survey and the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. Dr. Bauer from the first did his best to make the work international in character, and in this and in other ways, he, and I as his successor, have found the work of the Coast and Geodetic Survey indispensable. There has been very important cooperation in the past between the two organizations which has increased especially during the past few years. Plans have been worked out for the future which will greatly increase the results of such cooperation.

BRIEF ADDRESS OF DR. J. BARTELS.

I am very happy to be here today and to extend my heartiest congratulations to the Coast and Geodetic Survey on this anniversary. The notice of the occasion was too short to make it possible to arrange for greetings from the magneticians in Germany and elsewhere across the sea. So you must accept instead my personal good wishes.

One can never quite get rid of the impression that some very special thing is going on in this place. That is, there is something especially distinctive about the earth's magnetism in this vicinity. This is, of course, not true, but rather it is one of the places where instruments are available to record it, and the measurements are made with care.

In extending congratulations on this birthday, I feel that I can best express the views of scientists across the sea by telling you of our gratitude to the U. S. Coast and Geodetic Survey for the careful planning and excellent work extending over so large an area of the earth's surface. We also appreciate the fact that you are not jealously guarding the records by keeping them hidden from everyone, but making them available to all who can profit by them in the form of excellent publications.

BRIEF ADDRESS OF MR. D. L. HAZARD

It is very gratifying to have the Cheltenham Observatory restored to normal operation, after the disturbances incident to repairs and adjustments, and to note the improvements which have been made in buildings and equipment. With the greater opportunity which Mr. Hartnell will now have for study of the theory of the instruments and methods of observing, and with the experimental work to be undertaken with the cooperation of the Department of Terrestrial Magnetism and the Bureau of Standards, further improvements may be expected, giving assurance that the work will go on for many years without disturbance and with increasing efficiency and that the future output will be of even higher grade than the very fine results obtained during the first three sun-spot cycles of its existence.

It is also gratifying to note the increasing recognition of the value of its work, of which this gathering is an evidence.

The study of the earth's magnetism by the Coast and Geodetic Survey, implanted by Hassler and kept growing by Schott for nearly 50 years under semi-arid conditions, took on a new lease of life with the more generous appropriation which was provided in 1899, and branched out and developed rapidly under Bauer's careful planning and forceful initiative. It is now beginning to bear fruit and we can look forward confidently to an increase in the value of the crop with every year of its growth.

1. Group of visitors at Cheltenham Magnetic Observatory, Cheltenham, Maryland, U. S. A., on October 10, 1934. This Observatory has been in continuous operation for 33 years.

2. Interior view of Office building at Cheltenham Magnetic Observatory, Cheltenham, Maryland, U. S. A., on October 10, 1934. In the view are shown several special devices, charts and magnetic instruments which were placed on special exhibit. Non-magnetic stove at the extreme left.