On a Determination of the Elements of Terrestrial Magnetism at Halifax, N. S., August, 1904. By Prof. Stephen M. Dixon, M. A., *Dalhousie College, Halifax.*

(Read 21st November, 1904.)

The observations of the Magnetic Elements recorded in this paper were made at Point Pleasant, Halifax, August 25 and 26, 1904. The magnetometer and dip circle used were obtained through Professor C. H. McLeod, from McGill University, the chronometer was lent by Mr. C. G. Shultz and the theodolite by Mr. W. A. Hendry, C. E.

As it is hoped that these observations will be followed by a complete magnetic survey of the Maritime Provinces, and as this is the first time the matter has been brought before the Institute of Science, a brief sketch will be given of the phenomena of Terrestrial Magnetism. In preparing this sketch the writer has borrowed largely from the Magnetic Declination Tables and Isogonic Charts by Dr. L. A. Bauer. The practical importance of one of the elements, usually called by land surveyors the variation of the compass, cannot be overestimated in this province, where those who are interested in land and mine surveying know the trouble that is continually arising on account of the neglect of this very matter. In other countries terrestrial magnetism has been studied in connection with geology and many interesting discoveries have been made. Magnetic surveys have led to the devising of magnetic methods in prospecting for iron ores. To the student in physics and to the astronomer, the subject is equally interesting, on account of the relation of surface changes on the sun to variations in the earth's magnetism. The subject then is of general interest and its importance has been emphasized by the establishment, in December last, by the trustees of Carnegie Institution, of a Department of International Research in Terrestrial Magnetism. Dr. L. A. Bauer, Chief of the Division of Terrestrial Magnetism, U. S. Coast Survey, was appointed to control this department and an annual grant of twenty thousand dollars alloted to carry out the work.

Magnetic Declination.

In Europe the science of terrestrial magnetism began with the discovery of magnetic declination in 1492. In this year Columbus, on his first great voyage, found that except in certain places the compass needle did not point to the pole and that the angle it made with the true meridian varied from place to place. Eighteen years later, in 1510, George Hartmann made the first recorded measurements of magnetic declination on land. At Rome in this year, he found the declination 6° E. and at Nuremburg 10° E. In the succeeding years many observations of declination were made, and in England the first work published on the subject was by William Borough, "A Discours of the Variation," in 1581. In this book the value of the declination at London for 1580 is given as 10° 15′ E. By such observations all over the earth, at sea and on land, the declina ion was noted, and in 1599 Simon Stevin published at Leyden, under the patronage of the Dutch admiral, Count Moritz, a list of magnetic declination determinations. This early interest in magnetic observation has been kept up by the Dutch. At home and in their colonies magnetic work has been carried on energetically, and at the present day the survey of Holland is the most complete in Europe. Dr. L. A. Bauer has published (1) a very complete list of magnetic declination observations made before the year 1600, and points out that the declination over the greater part in Europe in the sixteenth century was east of north.

Dip.

The second element of the earth's magnetism, the inclination or Dip, was discovered by Robert Norman, an instrument

(1) **Magnetic Declination Tables for 1902, by L. A. Bauer.** ***U.S. Coast and Geodetic Survey.***

maker and hydrographer of London. Norman published his discovery in a treatise called "The Newe Attraction," printed in 1581, and gives the value of the dip at London in 1576 as 71° 50′. Norman's discovery had been anticipated by George Hartmann, for in a letter to Count Albert of Prussia, March 4, 1544, in which he recounts his observations of the declination, he mentions that the needle, besides deflecting towards the east, also pointed downwards. Hartmann, however, did not suspend the needle so as to observe the dip correctly and only recorded an amount of 9° instead of about 65°, the value he ought to have found.

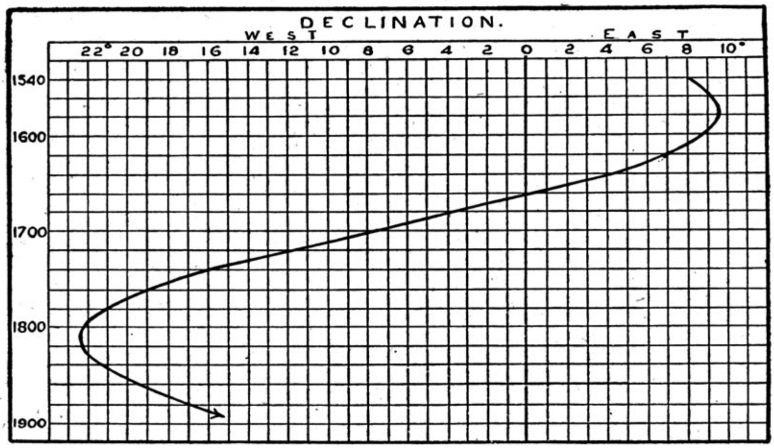
Intensity.

The third element, the Intensity of the earth's magnetic force, was first measured by William Whiston. In 1720 a prize was offered for the best way of determining longitude at sea. Columbus, in 1592, had first suggested using the lines of equal declination for determining longitudes, but Gilbert, who published his great work "De Magnete" in 1600, proposed to determine longitude by variations in the angle of dip. Whiston, taken with this latter theory, constructed many dip circles, and as a result of his observations, showed how the intensity with which the earth attracted a magnetic needle varied from place to place. As a matter of convenience, it is the horizontal component of the earth's magnetic force that is measured, and the unit in which the measurement is made is called a *gauss*, after the celebrated physicist who first showed how the *absolute* intensity of the earth's magnetism might be found.

Secular Change in Declination.

A magnetic survey of a country aims at making determinations of the three elements at a sufficient number of suitable localities. But when such a survey has been completed, if the value of any one of the elements is compared with that determined at the same place on some previous occasion, a difference in the values will be found, and the assumption of Gilbert of the invariability of 'the variation' will be found untenable. In 1634 Henry Gillibrand made a determination of the declination at Deptford and found it 4° 6′ E, whereas Borough and Norman had noted 11° 15′ E as its value in 1580. Ever since the announcement in 1635 of this discovery, this so called *secular variation* has been carefully studied, but the cause is unknown and Gillibrand's words are still true, "it must all be left to future times to discover."

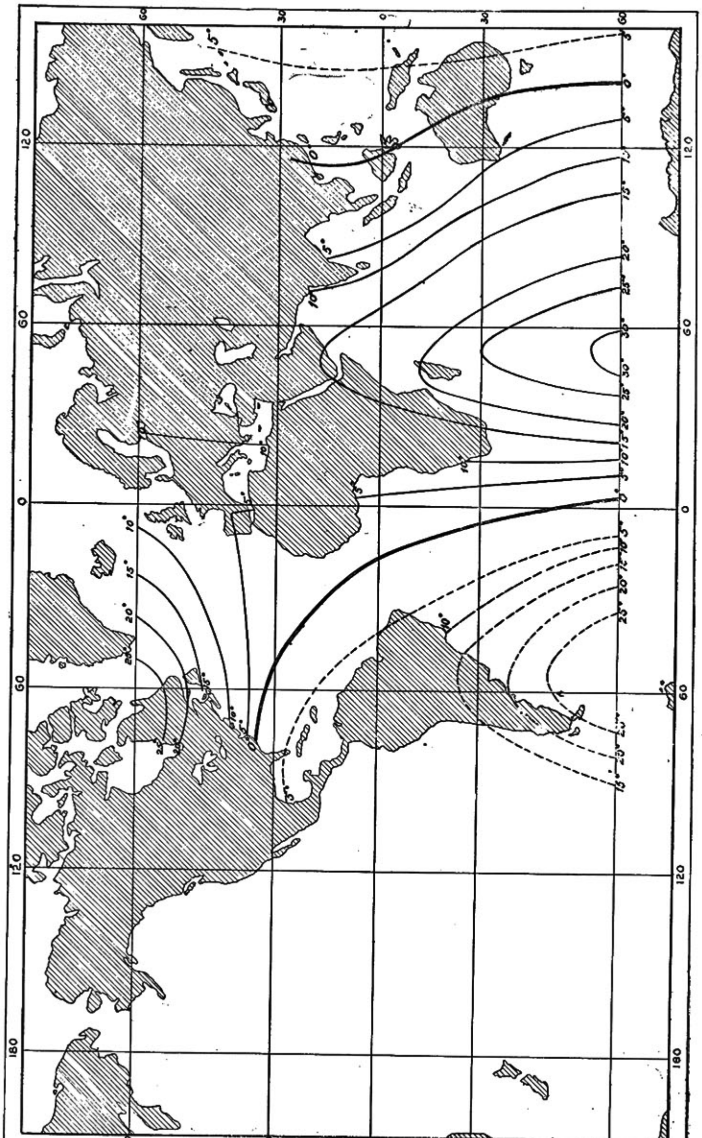
The changes in declination may best be studied by constructing a diagram showing graphically the results of observations at any one place. The curve shown in the figure [1] has been drawn by Schott and represents the changes observed at Paris.



C. A. Schott's curve showing changes in magnetic declination observed at Paris since 1540.

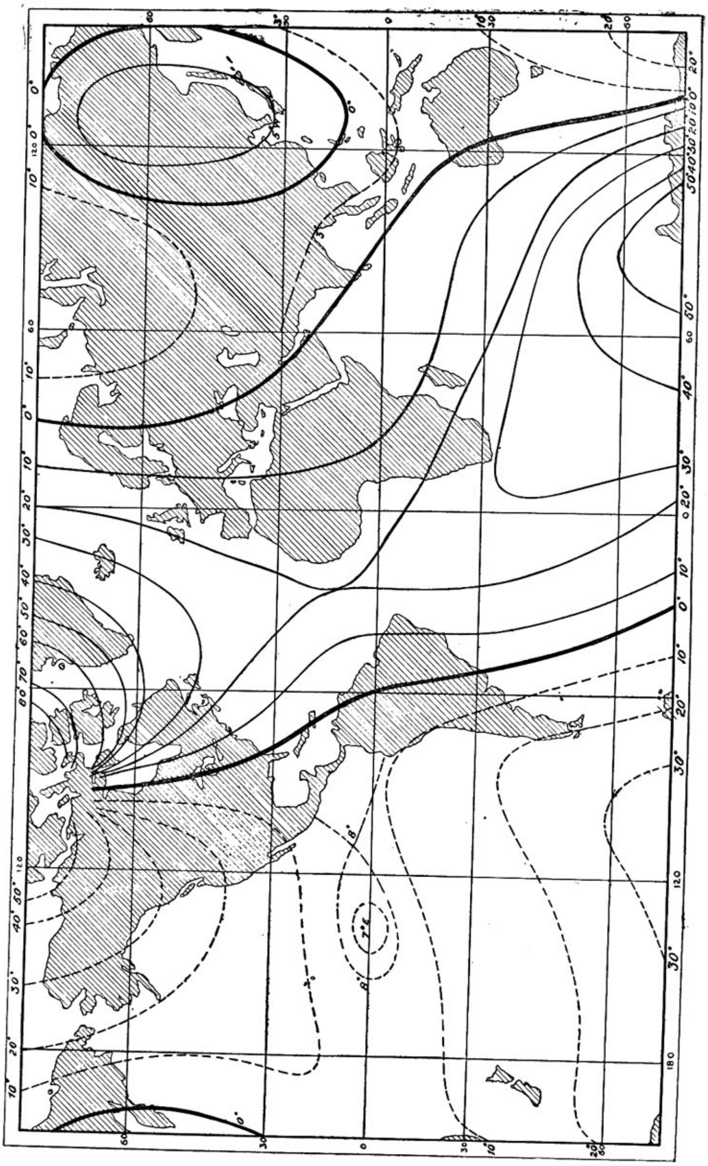
When such curves are drawn for different places their various forms impress us with the difficulty of discovering the laws according to which this secular change takes place, and it is evident that the changes in the other elements must be studied at the same time.

(1) *U. S. Coast and Geodetic Survey*, 1882.



ISOGONIC CHART FOR 1702 (HALLEY).
(Broken Lines indicate Eastern Declination.)

From U. S. Magnetic Declination Tables, 1902.



ISOGONIC CHART FOR 1905 (BRITISH ADMIRALTY).

(Broken Lines indicate Eastern Declination.)

Isogonic Charts.

For practical purposes the secular changes in declination have long been studied. Owing to the use of the compass made in navigation the 'variation charts' must be always up-to-date, as in cloudy weather the seaman depends altogether on them and on his compass. On land the surveyor should be able to find the declination and then running his course by geographical bearings, avoid the trouble such as has already been caused in this province by using the compass without recording 'the variation. Variation charts are made by drawing on them lines passing through places where the declination is the same—isogonic lines. Halley, the celebrated astronomer, was the first to publish these charts, though this method of mapping lines of magnetic declination seems to have been used by Christoforo Borri. Dr. Bauer in 1895 discovered in the British Museum a copy of Halley's first chart, published in 1701, on which were marked the results of Halley's observations taken in the Atlantic on the *Paramour Pink*, a vessel equipped by the British government for the first systematic survey, 1698-1700. In 1702 Halley published a second chart, on which were marked the isogonic lines for the Indian and Pacific oceans. The map on plate 24 gives the isogonic lines as determined by Halley, and on plate 25 are given the isogonic lines for 1905 as computed by the British Admiralty. On tracing these lines in either chart, we notice the two lines of no declination, or agonic lines, which separate places having east from those having west declination. The very irregular distribution of equal values of declination is easily seen, the chart for 1905 showing the remarkable circular agonic line in China.

But except on land we have little real knowledge of these isogonic lines. "No magnetic data have been obtained on the ocean areas since the advent of iron ships, except from occasional expeditions. Our present lines of equal magnetic declination over these waters depend almost entirely upon data acquired in wooden ships fifty to one hundred years ago." (1) For this reason, part of the programme of the Department of International Research in Terrestrial Magnetism is a magnetic survey of ocean areas. It is probable that very serious errors exist in these charts near the coast lines of the continents. When the declination has been determined at a large number of stations over a small area, the isogonic lines are found to be very irregular and the easy curves drawn on charts merely indicate, as a rule, the general positions of the lines. On the coast of Nova Scotia, on several occasions, shipwrecks have been attributed to an unknown variation of the compass, and it has been stated that the last great disaster at Rockall, when on the 29th of last June the Danish S. S. *Norge* was wrecked and about 600 lives lost, was due to the same cause. In *Nature* of Sept. 15th, Dr. August Krogh, of the University of Copenhagen, calls attention to this fact and publishes letters from two captains who state that they have observed changes in the magnetic declination to an amount of from 9° to 11° in the neighbourhood of Rockall.

Declination and Land Surveys.

The importance to the land surveyor of an accurate knowledge of the magnetic declination and its changes has been already noted. In many cases the value of the declination at the time when a survey has been made has not been recorded, and in some cases, doubtless, the land surveyor has but hazy ideas of the value of the declination and its changes. Much time and money has been already wasted in disputes over old lines, and still the method of describing lines by these magnetic bearings is in use in this province. The author suggests that true north and south lines should be laid down in all the principal towns, so that surveyors might test their compasses and note the changes in declination from time to time in the particular localities in whieh they were working. Such a line was laid down at the University of New Brunswick, Fredericton,

(1) L. A. Bauer. *Terrestrial Magnetism*, March, 1904.

by order of the Surveyor General of New Brunswick in October, 1874. In the year 1898, a magnetic survey of North Carolina was made by the U. S. Coast and Geodetic Survey and the North Carolina Geological Survey. During the survey meridian lines were established in the county towns, and the county commissioners were so impressed with the value of the work that in many cases they paid the field expenses of the survey.

Daily Variations in Declination.

Besides the great secular changes in declination we find several small changes—periodic or irregular. The first of these —the Daily Variation—was discovered in 1722 by Graham who, from a series of several hundred observations made at London, found that the declination varied during the day. The average value of the arc through which the needle swings is about eight minutes, the true declination occurring about 10.30 a. m. and 8 p. m. At Fort Conger in Grinnell Land an extraordinary value of 1° 40′ has been found for the daily variation.

Annual Variation.

The second of the small periodic changes to which the declination is subject, is that known as the Annual Variation, and is found by tabulating the monthly values corrected for the secular changes. The average value for Toronto is about half a minute. There is also a Lunar Variation, but this is even smaller than the annual, being only about 15 seconds from the mean.

Irregular Changes in Declination.

Besides these periodic changes in declination, it has been found that owing to so called magnetic storms, the magnetic needle is often violently affected. In these disturbances the maximum deflections of the needle from the mean position range from about 20′ and a variation of 2° observed at Mantilik in 1896 (1) and an extraordinary deflection of 20° 1′ recorded by

(1) Lat. 64° 53′ .5 N., long. 66° 19′ .5 W.

Greely as observed at Lady Franklin Bay, 1882. A serious effect of these magnetic storms is alluded to in a recent paper by Sir Norman Lockyer, who says, speaking of 'the well marked coincidence' between the variation of magnetic effects and the quantity of spotted area on the sun, "This in later telegraphic days is not merely a pious opinion which does not interest anybody, because when the magnetic changes are very considerable, and the disturbances arrive at a maximum, it is very difficult to get a telegram from London to Brighton." (1) During the great magnetic storm of Oct. 31, 1903, telegraphic communication in Spain was interrupted from morning till midnight. At 3 hrs. 20 min. the cable from Cadiz to Teneriffe was so perturbed that the clerks grounded it to avoid the discharge. This storm at Falmouth, England, was also of exceptional violence, the declination magnet there swinging through an arc of 2° 2′. That there is a connection between disturbances on the sun and magnetic storms is undoubted, but Lord Kelvin, reasoning from the immense amount of electrical energy which the sun would have to give out if it alone were the cause of these disturbances, concludes that great magnetic storms cannot be due entirely to the direct action of the sun.

"The probability is that a solar ray endowed with greater or less energy than ordinarily and of the necessary kind acted as the 'trigger to the gun' to set off mighty electric forces whose presence in the upper regions is becoming more and more manifest every day." (2) Some of the effects of this solar influence have been noted, it is thought, during total eclipses. During the eclipse of May 28, 1900, members of the U. S. Coast and Geodetic Survey noticed a slight magnetic effect which might be attributed in some way to the changes produced in the upper atmosphere when it was shielded from the sun's rays. To try to settle this question, an extensive series of observations were made during the eclipse of May 17, 18, 1901. The obser-

(1) Paper presented to the International Meteorological Committee at Southport, Sept. 11, 1903, by Sir Norman Lockyer, K. C. B.

(2) U. S. Declination Tables for 1902. L. A. Bauer, p. 56.

vations were taken at stations all over the globe, but only three of these were in the belt of totality. The results do not seem conclusive one way or the other. At Karang Sago, the Dutch observers noted a slight change in declination and in horizontal intensity, and at Sawah Loento, the party sent by the Massachusetts Institute of Technology observed a slight decrease of east declination at a time when there is normally an increase. These effects did not extend far outside the belt of totality. On the other hand, nothing particular was noted by the observers at the Mauritius, a station directly on the belt.

It is hoped that further information will be obtained on this interesting question at the total eclipse next August. In this eclipse the belt of totality will pass over part of Labrador and so will be easily accessible. It is evident that observations outside the belt, but not far from it, in Quebec and Nova Scotia, will be of great value.

The Dip and its Variations.

When a magnetic survey is made and the dip is measured in different localities, it is found to vary in value from place to place and from time to time. When the lines of equal dip are plotted, we find them not nearly so irregular as those of equal declination. One of these lines, that of 'no dip', the so called magnetic equator, circles the earth not far from the geographical equator. Along this line the dip needle remains horizontal, and at all places north of it the north pole of the needle points towards the earth, and the south pole of the needle dips down at places south of this line, the dip continually increasing towards the poles. The north magnetic pole is in Boothia Felix, and in 1831 Ross believed that he reached it, the exact position recorded for it being latitude 70° 05′ 17″ N. and 96° 45′ 48″ W. longitude. At this place Ross found that the needle pointed vertically downward. Little was known about the south magnetic pole till quite recently, and the results of the observations of the recent Antartic expedition are awaited with interest.

Captain Scott, of the *Discovery*, the British vessel which took part in this expedition, besides establishing a record for farthest south, latitude 80° 17′, reached a point on the line between the south magnetic pole and the south pole in November 1903. The secular changes in the angle of dip are much less than those in the declination. At London the dip reached a maximum of 74° 42′ in the year 1720, since which time it has continually decreased, being 67° 9′ in 1900. Daily and annual changes in the amount of dip are also noticed.

Changes in the Intensity.

As with the other elements, so the values of the Intensity varies from place to place, and we find that the points where the intensity is greatest are not coincident with the magnetic poles, but that there are two northern "foci of greater magnetic intensity" and two southern. The secular changes in total intensity are small. At London it was ·4791 *gauss* in 1848 and ·4736 in 1880, since when it has been increasing. The daily and annual changes are very small.

Terrestrial Magnetism and Geology.

When a complete survey of the three magnetic elements—declination, dip, and intensity—is made over a considerable area, most interesting geological results are often obtained. The first such survey was that of the British Isles, made in 1836-1838. This survey was repeated in 1857-1862 and again on a great scale in 1884-1892, observations being made at 882 stations. The results of this survey were published by Sir Arthur Rücker in 1896 and one section of his report deals with the "Relation between the Magnetic and Geological Constitution of Great Britain and Ireland." In this report it is shown that where large masses of basalt occurred the north pole of the needle tended to move towards them even from a distance of over 50 miles. Hence, if local attraction is found where no magnetic rocks appear on the surface, it is probably due to concealed masses of magnetic rocks and " the lines which we draw on the surface of a map as those to which the north pole is attracted, may, in fact, roughly represent the ridge lines of concealed masses of magnetic rocks." (1) In all countries such magnetic ridges have been noticed, and geologists now recognize fully the great importance of magnetic work. As an example of this, it may be noted that the magnetic survey of Maryland was inaugurated by the State Geologist, Professor W. B. Clark, and a very large share of the expenses was borne by the Maryland Geological Survey. This survey, which was carried out by Dr. L. A. Bauer (1896-1900) is by far the most complete in America, in fact the only country which has been surveyed with more detail is Holland.

In Japan, a recent magnetic survey has been made (1893-1896) and the three elements have been measured at more than 320 stations well distributed over the Islands. This survey was carried out under the Earthquake Investigation Committee and the results were published this year.(2) The maps have been so arranged that it is possible to compare the distribution of magnetic force with the geological structure of the country.

Magnetic Prospecting for Iron Ores.

Rücker's observations on the assistance to be derived from magnetic surveys in studying the geology of a country, were anticipated in 1843 by Van Wrede, who first saw that magnetic work should furnish valuable information with regard to the location of magnetic deposits. Practically nothing resulted from this till in 1879 Professor Robert Thälen published a paper " On the examination of iron ore deposits by magnetic measurements," and since then much work has been done in this direction in Sweden. In Canada also some valuable work has been done by the Geological Survey and Department of Mines. In the geological report for 1903(3) we find an inter-

(1) A. W. Rücker, Terrestrial Magnetism, vol. iii, p. 42.

(2) A magnetie survery of Japan, epoch 1895. A. Tanakadate. *Journal of the College of Science, Imperial University,* Tokyo, 1904.

(3) *Summary Report of Geological Survey of Canada* for 1903, p. 122.

esting account of the method employed for mapping the Temagami iron ranges. Observations were made of both dip and declination with the Thälen-Tiberg magnetometer and the formation was traced over a distance of 1½ miles, even through swamps where there were no outcrops. In several places the surface was stripped to confirm the observations. This work and a more accurate survey of the north-east iron range were carried on by Mr. Erik Nystrom, assistant to Dr. Haanel, Supintendent of Mines. The first account in English of Thälen's method has been published this year at Ottawa by Dr. Eugene Haanel.(1)

Work of a Magnetic Survey.

Sufficient has been said to show the importance of magnetic surveys. With regard to the work of a complete survey, it will be evident that three seperate undertakings are necessary, first, the determination of the elements at a sufficient number of stations properly situated to furnish reliable information over the whole area; second, the establishment of 'repeat' stations, where the observations can be repeated from time to time so that the secular changes may be noted; and third, the establishment of magnetic observatories so that the diurnal and annual changes may be determined and non-periodic disturbances marked. These observations, except in mining districts, would be of a temporary nature, observations being taken at them only so long as the surrounding district was being surveyed. In Germany such observations have for many years been maintained at some of the chief mines and in these are taken photographic records of changes in the declination so that the mine surveyor may take the exact value of the quantity at the time he is running any line. Several permanent observatories are also needed in Canada, and one of these should be in a suitable position in these provinces. The observatory at Toronto is the oldest(2) in America, having been

(1) On the Location and Examination of Magnetic Ore Deposits by Magnetometric Measurements, by Eugene Haanel, Ph. D.

(2) The Gerard College Observatory, Philadelphia, was the first magnetic observatory in America and was in operation from 1840-1845.

in operation since 1841. In the United States one permanent observatory has been established recently, that at Cheltenham, Md., and the Coast and Geodetic Survey has also in its charge three other well equipped observatories, Sitka in Alaska, Honolulu in Hawaii, and Baldwin in Kansas. The first two rank with the Cheltenham as permanent observatories, the Baldwin observatory being merely a temporary one.(1) Several other permanent observatories are in contemplation.

In the old world, the number of magnetic observations is being continually increased. In a short time there will be eight permanent observatories in France; the Japanese have six in operation at present.

The choice of a site for a permanent observatory is a very difficult matter. It is very hard to find a convenient locality which will not be invaded sooner or later by electric car lines. And it has been shown by Dr. Edler in 1899, that an observatory must be at least five miles from an electric tram line and that for delicate research work the distance must be twice as great. Of the great European observatories, that of Potsdam alone has been able to carry on its work properly on its original site, and this is owing to a decree of the Emperor, which forbids electric tram lines coming within 16 kils. The other observatories have been already moved or are seeking new sites. It is only a few years since the site of the Toronto observatory had to be changed for the same reason.

The Observations at Point Pleasant, Halifax.

The observations of the elements were made at Point Pleasant as being a station which could be easily occupied again The position was marked by a concrete pillar sunk 4 feet in the ground in which was bedded a copper plug. The observations were taken between 2 a. m. and 4 a. m. on the mornings of August 25, 26, 1904, so that there might be no local disturbance owing to the running of the electric trams.

(1) Magnetic observations of the U. S. Coast and Geodetic Survey, 1902. Bauer and Fleming, Washington. 1903.

A small electric hand lamp was used for reading and for illuminating the cross hairs when determining azimuth.

Results.

The *Declination* was found to be 21° 2′, local time 1 h. 40 m. a. m., Aug. 26, temp. 15° C.

This value has not been corrected for daily variation, the amount being undetermined for Halifax. This correction would be very small, as for all stations south of the 49th parallel it is found that the yearly average diurnal variation is at a minimum at about 2 a. m., being 0′·0 at Madison, Wis., and 0′·5 at Toronto.

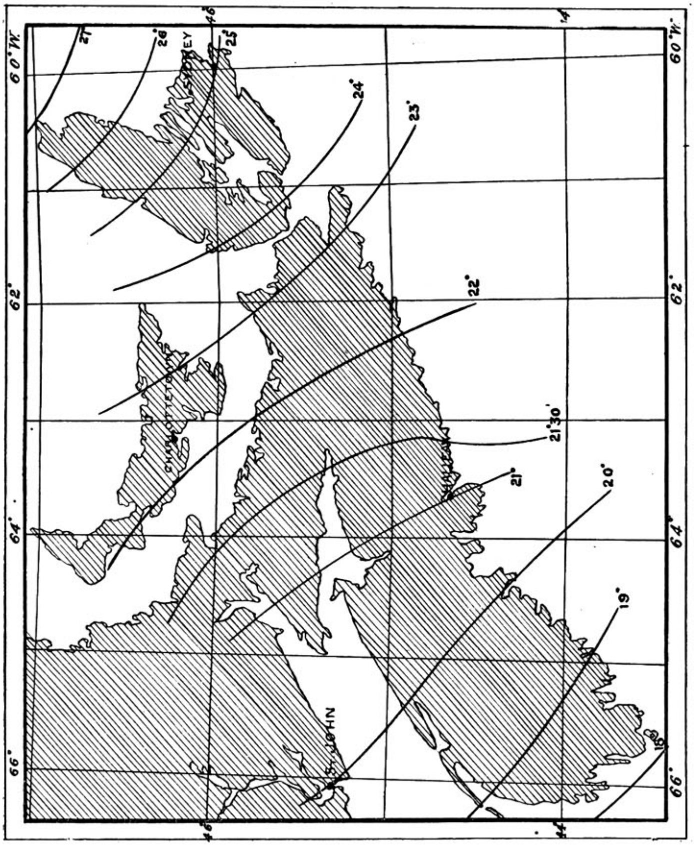
The value of the *Dip* found was 73° 58′; this was the mean of two sets of observations, 74° 00′ and 73° 55′.

The *Horizontal Force* was found to be ·1624, Aug. 25, 1904, local time 3 a. m., mean temp. 13°·8 C.

The *Azimuth* was determined by observations on Polaris, these reductions being made by the tables published in the U. S. " Manual of Instructions " issued by the Commissioner of the General Land Office.

Isogonic Lines in Nova Scotia.

The table below gives values of the declination in the Maritime Provinces collected from various sources and from which the isogonic lines have been sketched on the map in plate 26. It must be remembered that owing to the small number of observations, it has been impossible to obtain more than approximate values for the secular change, and so the reduction of the observed values to the present year is only approximate. No attempt has been made to indicate the local variation, since so few reliable observations have yet been made, and so the curves show no irregularities. The map shows, however, the general direction of the isogonic lines in Nova Scotia and is drawn to point out the very great variation in the value of the declination in the province.



APPROXIMATE POSITIONS OF LINES OF EQUAL DECLINATION IN NOVA SCOTIA IN THE YEAR 1904.

Table showing recent determinations and computations of Magnetic Declination in the Maritime Provinces.

Lon. W.		Lat. N.		Date.	Declination.		Recorder.	Notes.
°	′	°	′		°	′		
60	00	45	55	1900	24	45	B. A. Chart	Decreasing slightly.
60	12	46	09	1896	24	53	G. R. Putnam*......	
60	12	47	26	1900	27	25	"	
60	23	46	17	1857	24	40	J. H. Orlebar*	
60	25	46	05	1857	24	45	"	
60	47	45	33	1881	24	15	B. A. Chart	Decreasing 1′ annually.
61	00	45	25	1881	24	00	"	" "
61	00	45	08	1900	23	20	"	Stationary.
61	01	45	30	1881	23	26	S. W. Very*	
61	20	46	40	1892	25	50	B. A. Chart	Stationary.
61	20	45	40	1881	24	10	"	Decreasing 1′ annually.
61	40	45	08	1902	22	40	E. R. Faribault	
61	41	45	11	1904	22	45	B. A. Chart	Slightly decreasing.
61	50	47	15	1833	22	36	H. W. Bayfield*	
62	25	44	44	1904	21	50	B. A. Chart	Stationary.
62	33	46	11	1843	21	58	H. W. Bayfield*	
62	40	44	40	1892	22	00	B. A. Chart	
62	40	45	42	1841	20	19	H. W. Bayfield* ...	
62	53	44	33	1892	21	45	B. A. Chart	
63	08	46	14	1898	23	40	Nfd. Survey*	
63	20	45	15	1892	21	00	B. A. Chart	Stationary.
63	20	44	30	1893	21	30	"	"
63	20	46	30	1845	21	45	H. W. Bayfield*	
63	22	44	42	1900	21	24	W. B. Dawson*	
63	36	44	47	1881	21	01	"	
63	43	16	34	1845	21	00	H. W. Bayfield*	
63	43	46	15	1840	20	18	" ...	
63	48	46	24	1841	20	12	"	
63	50	46	10	1841	20	00	"	
63	53	44	52	1901	21	07	E. R. Faribault ...	
64	00	45	30	1900	21	25	B. A. Chart	Stationary.
64	03	46	48	1845	21	10	H. W. Bayfield*	
64	05	44	18	1904	20	00	B. A. Chart	Stationary.
64	08	45	00	1881	20	42	S. W. Very*	
64	20	44	20	1902	20	00	E. R. Faribault	
64	23	46	15	1839	19	59	H. W. Bayfield*	
64	24	44	04	1904	19	30	B. A. Chart	Stationary.
64	40	45	03	1900	20	30	"	"
64	43	47	45	1838	21	43	H. W. Bayfield*	
64	43	43	50	1904	19	00	B. A. Chart	Stationary.
64	49	46	43	1839	19	50	H. W. Bayfield*	
65	00	43	10	1904	18	10	B. A. Chart	Increasing 1′ annually.
65	00	45	50	1900	19	40	"	Stationary.
65	04	47	06	1857	21	24	J. H. Orlebar*	
65	10	43	35	1904	18	35	B. A. Chart	Stationary.
65	31	44	44	1881	19	27	S. W. Very*	
65	35	44	53	1886	20	15	B. A. Chart	Increasing 1½′ annually.
65	40	43	45	1895	17	55	"	Stationary.
65	40	45	30	1838	16	38	J. Wilkinson........	
65	53	43	35	1838	18	05	"	Increasing 1′ annually.
66	00	45	15	1859	18	16	P. F. Shortland*..	
66	00	44	24	1881	18	43	S. W. Very*	
66	00	45	00	1895	19	00	B. A. Chart	Stationary.
66	03	45	14	1866	19	23	J. H. Orlebar*	
66	07	43	50	1881	17	49	S. W. Very	
66	10	44	35	1904	19	10	B. A. Chart	
66	30	44	35	1897	19	49	S. M. Dixon	
66	38	45	16	1790	14	00	N. B Land Office ...	
66	38	45	16	1879	19	53	Brydone Jack	
66	38	45	16	1892	20	00	S. M. Dixon	
67	30	47	00	1875	21	00	N. B. Land Office...	

* From Tables of Magnetic Declinations, by L. A. Bauer.