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HON. CHARLES STEWART, *Minister*

W. W. COBY, C.M.G., *Deputy Minister*

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Magnetic Results, 1921-1923

BY

C. A. FRENCH, B.A. AND R. G. MADILL, B.A.

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MAGNETIC RESULTS, 1921-1923

INTRODUCTION

An account of the work accomplished by the Dominion Observatory in connection with the magnetic survey of the Dominion of Canada between 1907 and 1920 is contained in Vol. V, No. 5, of the Publications of the Dominion Observatory. The three magnetic elements, declination, dip and horizontal intensity were observed at points which represented 424 distinct localities, and at these were obtained 216 determinations from which secular variation data were derived. With the exception of twelve, which are along the Canadian National Railway in British Columbia, all the stations are south of latitude 54° and are distributed over the country extending from the Atlantic to the Pacific oceans.

In the present report it is intended to outline briefly the results of the operations of the three seasons 1921-1923. During 1921 field work was confined to certain sections in Eastern Canada where there was a lack of magnetic data. This may be considered as a filling-in process, more of which it is hoped will be done as the survey progresses. During the seasons 1922 and 1923 practically all of the work was done in portions of the country heretofore untouched by this branch. One party operated along the main waterway between Fort St. John on Peace river and Aklavik, which is near the mouth of Mackenzie river, and, in addition, for about one month along the railways in Alberta and Saskatchewan; the other covered portions of northern Saskatchewan and northern Manitoba, touching at points on Hudson bay.

Various organizations have in the past, however, carried on work in the greater part of the country covered by the operations of the two seasons 1922 and 1923. Among others may be mentioned the Carnegie Institution of Washington, and the Meteorological Service of Canada. The former organization occupied a series of stations between The Pas, Manitoba, and the northern boundary of Saskatchewan in 1908, and the latter sent an expedition down Mackenzie river in 1910 and one into Hudson bay in 1912. As a knowledge of secular change is necessary for reducing observations to epoch, as many as possible of the stations of these organizations were re-occupied.

The following summary contains the number of stations occupied during the period 1921-1923, and the approximate region in which those of a particular year are located. In some cases it was deemed advisable to establish two stations in the same locality, particularly where a repeat station did not appear likely to be available for future occupation; the transfer from the old site to the new was thus readily made. In the summary the number of these additional stations is given in the column headed "Secondary," as well as being included in the number representing the total. It sometimes happens, in the course of the work, that the exact position of an old station cannot be definitely located. In such cases it is the rule, if local attraction is suspected, to make tests by observing for declination at a point or points in the immediate vicinity of the station. In the summary no account is taken of these observations.

SUMMARY SHOWING THE NUMBER AND THE DISTRIBUTION OF
MAGNETIC STATIONS, 1921-1923

Year	Number of Stations				Locality
	New	Repeat	Total	Secondary	
1921	39	6	45	2	Territory lying south of latitude 49°·3 and east of longitude 77°·9.
1922	48	1	49	1	Thirty-eight along Peace, Slave and Athabaska rivers, and eleven along the railways in the central part of Alberta and Saskatchewan.
1922	21	4	25	0	Seventeen from The Pas, Man., north to Nueltin lake along the water route in close proximity to the boundary between Manitoba and Saskatchewan, and eight along the Hudson Bay Railway.
1923	22	2	24	4	Northwest Territory between Fort Smith and Aklavik by way of Slave lake and Mackenzie river.
1923	27	0	27	0	These stations are in the northerly part of Manitoba between The Pas and Hudson bay.

INSTRUMENTAL EQUIPMENT

The usual instrumental equipment of the approved type was used throughout. In this were included the following instruments:—

Magnetometers—

- (1) Tesdorpf magnetometer No. 1977, used in 1921.
- (2) Combined magnetometer and dip circle C.I.W. No. 20, the property of the Dominion Observatory, used throughout the seasons 1921-23.
- (3) Combined magnetometer and dip circle C.I.W. No. 19, the property of the Carnegie Institution of Washington. This instrument was loaned for the work of two seasons, 1922-23.

Dip circles—

- (1) Dip circles of combined magnetometer and dip circle No. 20, and combined magnetometer and dip circle No. 19, used during the seasons 1922-23.
- (2) Dover dip circle No. 145, used for determining dip in 1921, and for dip and total intensity in 1922.

Chronometers—

- (1) Half-seconds pocket chronometer Kittle No. 261, used during the seasons 1922-23.
- (2) Pocket watch Nardin No. 9015, used during seasons 1921-23. This beats as an ordinary watch but is capable of producing seconds beats when it is connected with a relay and battery.
- (3) Half-seconds standard chronometer Bond No. 511, used during the seasons 1921-23.
- (4) Half-seconds standard chronometer King No. 2992, used during the seasons 1922-23. This chronometer was loaned by the Carnegie Institution of Washington.

The various types of instruments referred to are doubtless familiar to those interested in the subject of Terrestrial Magnetism, hence a description is not considered necessary. Certain references, however, relative to the description of these, may be found in Publications of the Dominion Observatory, Ottawa, Vol. V, No. 5, pp. 133-134.



FIG. 1. STOPPING FOR LUNCH

On the west coast of Hudson bay, near Port Nelson, the water is generally quite shallow. The distance from the position of the canoe to shore is approximately one mile.



FIG. 2. TRANSPORTATION ON HUDSON BAY RAILWAY
Railway motor lorry on which the magnetic survey party made the trip from
The Pas, Man., to the end of steel, a distance of approximately
330 miles.



FIG. 3. MAGNETIC STATION, YORK FACTORY, MAN.
The site of the magnetic station is indicated roughly by the location of the tent in the foreground.
The buildings are part of those comprising the post of the Hudson's Bay Company
at York Factory.

For determining the correction to the chronometers there was added to the usual equipment of each party in 1923, a wireless receiving set. These sets were constructed in the Department of Naval Service of the Dominion Government. These rendered such service that a set is now considered a necessary part of the equipment in connection with field work. The effectiveness of this piece of apparatus may be inferred from the results at the field stations. As an illustration, the results at Aklavik ($\varphi=68^\circ$, $\lambda=135^\circ$), N.W.T., the farthest north station occupied during the seasons 1922 and 1923, are selected. No attempt was made to receive signals from more than the four stations, Annapolis (NSS), Panama (NBA), San Diego (NPL) and Honolulu (NPM); the wave lengths corresponding to the stations are, respectively, 17140, 7000, 9800 and 12090. The following remarks appear in the records of the comparisons relative to the reception of the signals from the various stations:—

TABLE 1.—NOTES ON RECEPTION OF WIRELESS TIME SIGNALS WITH SMALL PORTABLE RECEIVING SET AT AKLAVIK, N.W.T.

Date 1923	Station	Time (105th Mer.)			Remarks
		h.	m.	s.	
Aug. 15.....	NBA	11	00	00	Signals clear.
" 15.....	NPM	17	00	00	" " , some static.
" 16.....	NSS	10	00	00	" faint.
" 16.....	NPM	17	00	00	" clear, static much in evidence.
" 17.....	NSS	10	00	00	" " but rather faint.
" 17.....	NBA	11	00	00	" " " "
" 18.....	NPL	13	00	00	" " static.
" 20.....	NPL	13	00	00	" " even without amplification.
" 21.....	NSS	10	00	00	" faint.
" 21.....	NPL	13	00	00	" clear.
" 22.....	NSS	10	00	00	" faint.
" 22.....	NPL	13	00	00	" clear.
" 22.....	NPM	17	00	00	" "

In a general way the reception of signals from these four stations at points along the Mackenzie may be summarized as follows:—

Signals from Annapolis (NSS) at 10h were faint, and at 20h were practically inaudible.

Signals from Panama (NBA) were slightly more distinct than those from Annapolis.

Signals from San Diego (NPL) were invariably clear and distinct.

Signals from Honolulu (NPM) were usually clear and distinct.

The wire used for the aerial at stations (magnetic) along Mackenzie river was cotton covered No. 22, the length used being approximately 130 feet. The height of the aerial was usually about 15 feet at one end and varied from 15 feet to 35 feet at the other, the greater heights being possible, or convenient, only when a flagstaff was available. At Aklavik both ends were about 25 feet in height, the masts being of dimensions that the observer and his assistant could easily erect.

The observer working in the vicinity of Hudson bay received signals clearly from Annapolis and Panama at the mouth of Seal river on Hudson bay ($\varphi=59^\circ.1$, $\lambda=94^\circ.8$) with the aerial at a distance of only two feet above the ground.

COMPARISON OF MAGNETIC INSTRUMENTS WITH STANDARDS

In accordance with the usual procedure, the field instruments were compared in the spring and fall, 1921-23, with standard instruments to determine the correction to be applied to reduce observations to the International Magnetic Standard. One series was made in the spring of 1921 at Washington. This was carried out by officers of the Carnegie Institution at the time the C.I.W. magnetometer No. 20 was sent over for minor repairs. In April, 1922, this instrument was compared at Ottawa with the C.I.W. magnetometer No. 19 which was loaned by the Carnegie Institution. This latter instrument was taken as the standard, the correction to this on I.M.S. being known. Magnetometer No. 20 was also compared in May at the standard observatory for Canada which is located at Agincourt, Ontario. This observatory is a branch of the Meteorological Service and is under the directorship of Sir Frederic Stupart. All other comparisons were made, also, at Agincourt.

Tables 2 to 5 contain a summary of the results of the comparisons made between 1921 and 1923.

TABLE 2.—SUMMARY OF RESULTS OF DECLINATION COMPARISONS, 1921-1923

(a) RESULTS OF COMPARISONS OF MAGNETOMETER C. I. W. No. 20

Date	Number of sets	I.M.S.-Mag'r	Mean value for year	Place of comparison
1921, July.....		-0.7	-0.8	Washington. ¹
1921, Nov.....	16	-1.0		Agincourt.
1922, April.....	18 (Wt. 8)	-0.4		Ottawa. ²
1922, May.....	12	-1.5	-0.9	Agincourt.
1922, Nov.....	12	-0.6		"
1923, May.....	20	-0.9	-0.8	"
1923, Oct.....	24	-0.8		"

(b) RESULTS OF COMPARISONS OF MAGNETOMETER, TESDORPF No. 1977

Date	Number of sets	I.M.S.-Mag'r.	Mean value for year	Place of comparison
1921, Aug.....	22 (Wt. 1)	+2.7	+1.6	Ottawa. ³
1921, Nov.....	32 (Wt. 1)	+0.5		Agincourt.

¹ Dominion Observatory magnetometer, C. I. W. No. 20, compared with standard instrument at Washington by the Carnegie Institution after minor repairs were made to the instrument.

² The Dominion Observatory magnetometer, C. I. W. No. 20, was compared with the Carnegie Institution magnetometer, C. I. W. No. 19, the result being obtained by applying the quantity (I. M. S.—C. I. W. No. 19) = -0'.1.

³ The result was obtained by comparison with the D. O. magnetometer, C. I. W. No. 20, and applying the quantity (I. M. S.—C. I. W. No. 20) = -0'.7.

(c) RESULTS OF COMPARISONS OF THE CARNEGIE INSTITUTION MAGNETOMETER, C. I. W. No. 19.

Date	Number of sets	I.M.S.-Mag'r.	Mean value for year	Place of comparison
1922,		-0.1 ¹	-0.4	Washington.
1922, Nov.....	15	-0.7	.....	Agincourt.
1923, May.....	14	-0.4	-0.3	"
1923, Oct.....	24	-0.2	.....	"

TABLE 3.—SUMMARY OF RESULTS OF HORIZONTAL INTENSITY COMPARISONS, 1921-23

(a) RESULTS OF COMPARISONS OF MAGNETOMETER, C. I. W. No. 20

Date	Number of sets	I.M.S.-Mag'r.	Mean value for year	Place of comparison
1921, July.....		-0.00010H	-0.00013H	Washington. ²
1921, Nov.....	5	-0.00016H	.....	Agincourt.
1922, April.....	4	+0.00018H	.....	Ottawa. ³
1922, May.....	4	-0.00051H	-0.00050H	Agincourt.
1922, Nov.....	3	-0.00049H	.....	"
1923, May.....	3	-0.00049H	-0.00048H	"
1923, Oct.....	6	-0.00048H	.....	"

(b) RESULTS OF COMPARISONS OF MAGNETOMETER, TESDORFF No. 1977

Date	Number of sets	I.M.S.-Mag'r.	Mean value for year	Place of comparison
1921, Aug.....	6	-0.00211H	-0.00226H	Ottawa. ⁴
1921, Nov.....	6	-0.00242H	.....	Agincourt.

(c) RESULTS OF COMPARISONS OF THE CARNEGIE INSTITUTION MAGNETOMETER, C. I. W. No. 19

Date	Number of sets	I.M.S.-Mag'r.	Mean value for year	Place of comparison
1922,		-0.00030H ⁵	-0.00070H	Washington.
1922, Nov.....	8	-0.00109H	.....	Agincourt.
1923, May.....	3	-0.00115H	-0.00124H	"
1923, Oct.....	6	-0.00132H	.....	"

¹ The value was furnished by the Carnegie Institution.² Result obtained by the Carnegie Institution.³ Dominion Observatory magnetometer C. I. W. No. 20 was compared with the Carnegie Institution magnetometer C. I. W. No. 19, using the value (I.M.S.—C.I.W. No. 19) = -0.00030H.⁴ The result was obtained by comparison with the D. O. magnetometer C.I.W. No. 20, and applying the quantity (I.M.S.—C.I.W. No. 20) = -0.00010H.⁵ Value furnished by the Carnegie Institution.

TABLE 4.—SUMMARY OF RESULTS OF INCLINATION COMPARISONS, 1921-23

(a) RESULTS OF COMPARISONS OF MAGNETOMETER-DIP CIRCLE C. I. W. No. 20

Date	Number of sets	I.M.S.—No. 20				Place of comparison
		No. 1 of 20	No. 2 of 20	No. 5 of 20	No. 6 of 20	
		'	'	'	'	
1921, June.....	4	-0.5	-0.7	-0.2	+0.1	Washington. ¹
1921, Nov.....	10	+0.3	+0.3	0.0	+1.1	Agincourt.
	Mean.....	-0.1	-0.2	-0.1	+0.6	
1922, May.....	5	+0.6	-0.3	+0.9	+1.5	Agincourt.
1922, Nov.....	6	0.0	-1.0	0.0	+2.0	"
	Mean.....	+0.3	-0.6	+0.4	+1.8	
1923, May.....	6	+0.4	-1.4	-1.1	+2.4	Agincourt.
1923, Oct.....	7	+0.4	-0.1	+0.6	+2.1	"
	Mean.....	+0.4	-0.8	-0.2	+2.2	

(b) RESULTS OF COMPARISONS OF CARNEGIE INSTITUTION MAGNETOMETER-DIP CIRCLE C. I. W. No. 19

Date	Number of sets	I.M.S.—No. 19				Place of comparison
		No. 1 of 19	No. 6 of 19	No. 3 of 20	No. 4 of 20	
		'	'	'	'	
1922,		+1.7	-0.1	+2.1	+0.7	Washington. ¹
1922, Nov.....	6	+3.5	-0.2	+2.8	-1.8	Agincourt.
1923, May.....	6	+2.1	+0.1	+1.4	-1.5	"
1923, Oct.....	9	+5.0	-1.4	+2.0	-0.8	"
	Mean ²	+3.1	-0.4	+2.0	-0.8	

¹ Results were obtained at Washington by the Carnegie Institution.² Mean value adopted for both 1922 and 1923.

TABLE 4.—SUMMARY OF RESULTS OF INCLINATION COMPARISONS, 1921-23 (concluded)

(c) RESULTS OF COMPARISONS OF DOMINION OBSERVATORY DIP CIRCLE DOVER No. 145

Date	Number of sets	I.M.S.—No. 145		Place of comparison
		Needle		
		No. 1	No. 2	
1921, Aug.....	5	+1.2		Ottawa. ¹
1921, Aug.....	11		+0.4	"
1921, Nov.....	10	-0.2	+0.6	Agincourt.
Weighted mean.....		+0.3	+0.5	
1922, May.....	6	+0.2	+0.6	Agincourt.
1922, Oct.....	6	+0.4	+0.7	"
Mean.....		+0.3	+0.6	

TABLE 5.—RESULTS OF OBSERVATIONS FOR THE DETERMINATION OF THE INSTRUMENTAL CONSTANT, LOG C, OF THE D. O. DIP CIRCLE, DOVER No. 145, AT AGINCOURT, 1922

Date, 1922	Inclination	Log. C ²
	° ' "	
May 3.....	74 44.6	9.41207
" 3.....	44.5	222
" 3.....	44.1	190
" 3.....	44.0	222
Mean.....		9.41210
Oct. 30.....	74 44.4	9.41025
" 31.....	47.0	206
" 31.....	46.3	186
" 31.....	47.0	233
" 31.....	46.6	196
Nov. 1.....	45.5	215
Mean.....		9.41177
Weighted mean for season.....		9.41190

¹ These results were obtained by comparison with the D. O. earth inductor Toepfer No. 1911 and applying the quantity (I.M.S.—D. O. No. 1911) = -0'.25, which was determined at Washington in 1915.

² Dover dip circle No. 145 was mounted on pier D of the absolute room of the magnetic observatory. Readings, which were practically simultaneous, were taken on the H- and V- variometers, and the dip circle.

Observers: Dover dip circle No. 145, C. A. French; variometers, R. G. Madill.

It will be noted that there were obtained some rather large differences between various determinations of the same year. As an example the results of Table 2, *a*, show that there was a difference in the mean value of (I.M.S.—C.I.W. No. 20) determined in the year 1922 at Agincourt, amounting to 0'·9, a quantity which is exceedingly large in comparison with the errors in the individual series. The records show that the values of (I.M.S.—C.I.W. No. 20) for the May comparisons lie between -1'·0 and -1'·9, and the values for the November series are included between -0'·3 and -1'·0. From these it is apparent that the difference is not entirely due to errors of observation, that is to say accidental, but is probably, for the most part at least, due to some instrumental change. There are other striking differences to be noted in the tables which admit of no simple explanation. The most conspicuous case is that resulting from the comparisons with Tesdorpf No. 1977. With respect to this particular instrument, however, discordant results have been rather common, and to ascertain the cause of these the Carnegie Institution in 1915 carried out an investigation by making some special test observations. The part of the report dealing with this is as follows: "Because of the range of the results of the declination comparisons at Washington, Ottawa and Agincourt, 1908-1915, special tests and observations were made at Washington in November, 1915, to determine whether there was any impurity in the copper dampers, or the brass of the magnet house, of this instrument. These tests showed that for normal positions of the dampers there is no effect on account of possible magnetic impurity of the metal, even when the suspended magnet is at highest or lowest possible positions in its housing. The variation of the declination correction for magnetometer No. 1977 may have to be ascribed to slight displacements of the reflecting mirror mounted in the hollow magnet, or to the fact that the short suspension bars of the magnet may not invariably take up the same positions in the suspension hook."

There are one or two marked differences in the value (I.M.S.—C.I.W. No. 20) in the intensity comparisons at Agincourt. The comparison in November, 1921, gives a value $-0.00016H$. In May, 1922, the value is $-0.00051H$ indicating, probably, that some instrumental change had taken place. This may be due to a change in the moment of inertia of the intensity magnet. Recent determinations at least tend to justify this conclusion. The following table contains a summary of the values of the instrumental constant $\log \pi^2K$ for temperature 0°C :—

TABLE 6.—RESULTS OF DETERMINATION OF $\log \pi^2K$

Date	$\log \pi^2K$	Determined at
1916.....	2.80651	Washington.
1921, June.....	586 ¹	"
1921, July.....	593 ¹	"
1924, May.....	534	Ottawa.

¹ Values of June and July were determined, respectively, before and after removing cap and refilling cross lines in the magnet.



FIG. 4. LOOKING ACROSS CLEARWATER RIVER

The craft, locally known as a skiff, is equipped with an outboard motor, in which the magnetic survey party made the trip from McMurray to Fitzgerald. Smith portage was then crossed by wagon and Slave river and Great Slave lake by steamer, after which the journey was resumed in the skiff down Mackenzie river to Aklavik, a distance of about 1,000 miles.

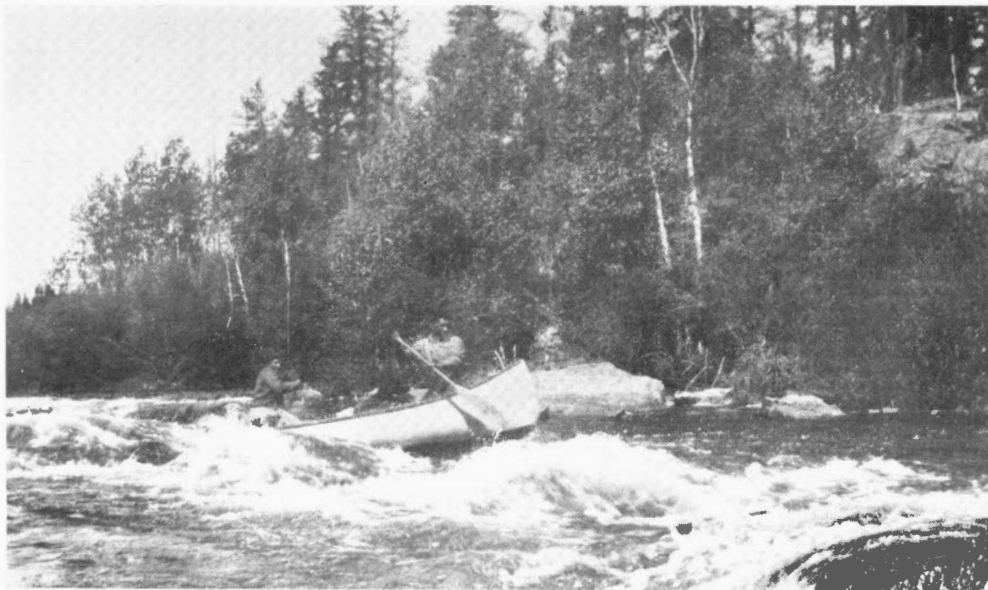


FIG. 5. SHOOTING RAPIDS ON KISSISSING RIVER

One of the numerous rapids encountered by the survey party working in the territory lying adjacent to Hudson bay. As experienced canoe men are always engaged on these expeditions accidents of a serious nature seldom occur.

The change between 1916 and 1921 amounting to 0.00065 in the logarithm of π^2K is such that the horizontal intensities obtained in June, 1921, and computed using the value of π^2K determined in 1916, will give a value too great by a quantity amounting to 0.00076*H*. Between 1921 and 1924¹ a further decrease took place in the value of *K* amounting to 0.00059 in the logarithm of π^2K . By using the value determined in 1921 to reduce results obtained in 1924 the value of the horizontal intensity will be too great by an amount equal to 0.00068*H*. It will be seen that this exceeds the amount required to account for the change in the value of (I.M.S.—C.I.W. No. 20) between 1921 and 1924 by 0.00030*H*. This difference may be ascribed to (1) errors of observation, (2) possible change in the instrument, such as the moment of inertia of the magnet, between October, 1923, and May, 1924, or (3) to a difference in the determined value of the moment of inertia due to employing different inertia bars,² which might give results that are not strictly comparable.

The results in Table 3, *c*, indicate that a change took place in the C.I.W. magnetometer, C.I.W. No. 19, between the time of comparison in Washington in 1922 and the comparison at Agincourt in November, 1922. The two values of (I.M.S.—C.I.W. No. 20) given in Table 3, *a*, can be reconciled only on the assumption that the greater part of this change in C.I.W. No. 19 had taken place as early as April, 1922, or before the comparison at Ottawa in April. The results of (I.M.S.—C.I.W. No. 20) at Washington and Agincourt in 1921 indicate that the adopted values of I.M.S. at the two places are practically identical.

The corrections adopted for a particular instrument and applied to the field observations are represented by the mean values (I.M.S.—Instrument), given in the summary of comparisons. Thus the corrections applied to the field observations taken with magnetometer—dip circle C.I.W. No. 20 during 1921 are $-0'.8$ for declination, $-0.00013H$ for horizontal intensity, and $-0'.1$, $-0'.2$, $-0'.1$ and $+0'.6$ for dips obtained, respectively, with needles No. 1, No. 2, No. 5, and No. 6. The adopted corrections to dip circle C.I.W. No. 19 were derived from the mean of the four series obtained in 1922 and 1923 giving equal weight to each series. These corrections were applied to the observations taken during the seasons 1922 and 1923.

DIP CIRCLE ERRORS

It is known that dip circle errors determined at a base station may not hold for all values of dip. This is evident from the values obtained with the four dip needles, No. 1, No. 2, No. 5 and No. 6, which were used with dip circle No. 20 during the seasons of 1922 and 1923. From a comparison of needle differences it was seen that No. 1 gave values which were high in comparison with the other three needles, especially when the dip was between 78° and 79° , and 81° and 82° . Needle No. 6 also appeared slightly erratic, while No. 2 and No. 5 gave values throughout which were most nearly in accord.

While the results were such that correction values were desirable, any values determined would necessarily depend upon the field observations. The needle differences,

¹ In order to account for the changes in the H-correction for magnetometer C.I.W. No. 20, the moment of inertia was determined in 1924. This being the first determination subsequent to 1921, the results are included in this report.

² Value for 1916 was determined using inertia bars Nos. 19, 27 and 28; in 1921 inertia bar No. 16 was used, and in 1924 inertia bar No. 20, which belongs to the instrument, was used.

No. 1-No. 2, No. 2-No. 5, No. 5-No. 6 and No. 6-No. 1, were tabulated and assembled into nine groups representing dips ranging from 76° to 82° ; included in the results were some observations taken in 1921, as well as practically all those of 1922 and 1923. From these differences relative values of dip for each group with the four needles were determined. Where a value with a particular needle differed decidedly from the other three, this value was assumed to be in error. It was further assumed that the true value was that given by the mean of the other three needles. For groups where there were no outstanding values a mean was determined from the four needles. Differences between the mean value and that given by the individual needle were then determined. These were plotted and curves, somewhat smoothed, were drawn, from which the adopted corrections were taken. These are given in Table 7, and were applied to the observations of 1922 and 1923. During the season of 1921 the needles did not exhibit to any extent the characteristics shown in 1922 and 1923, consequently no corrections, except those determined from comparison with standards, were applied to the results of that year.

This method was also applied to the needles used with C.I.W. dip circle No. 19. The adopted corrections are given in Table 8.

TABLE 7.—ADOPTED CORRECTIONS TO DIP CIRCLE No. 20, 1921-23

I	Needle			
	No. 1	No. 2	No. 5	No. 6
°	'	'	'	'
76·0.....	-0·6	+1·6	+0·6	0·0
·5.....	0·0	+1·6	+0·4	-0·4
77·0.....	+0·4	+1·6	0·0	-1·0
·5.....	+0·5	+1·6	-0·4	-1·7
78·0.....	-0·4	+0·8	-0·6	-0·8
·5.....	-1·6	+0·4	-0·4	+0·2
79·0.....	-1·4	+0·4	+0·1	-0·2
·5.....	-1·2	+0·8	+0·8	-0·9
80·0.....	-1·8	+2·6	+1·2	-1·4
·5.....	-1·2	+2·4	+0·4	-0·8
81·0.....	0·0	0·0	+0·4	-0·6
·5.....	-4·8	0·0	+0·4	-0·6
82·0.....	-3·8	+0·5	+0·4	-0·9

TABLE 8.—ADOPTED CORRECTIONS TO DIP CIRCLE No. 19, 1921-23

I	Needle			
	No. 3	No. 4	No. 6	No. 2
°	'	'	'	'
80·0.....	+0·4	+2·0	+0·2	-0·1
·5.....	-0·3	+1·3	-0·4	-0·3
81·0.....	-0·8	+0·8	-0·4	-1·4
·5.....	-0·3	+0·7	0·0	-1·8
82·0.....	+0·1	+1·8	-0·2	-1·8
·5.....	-0·1	+2·8	+0·2	-1·2
83·0.....	0·0	+3·1	+0·5	-0·4
·5.....	+0·3	+2·8	+0·6	-1·0
84·0.....	+0·3	+1·1	+0·6	-0·9
·5.....	0·0	+1·1	+0·2	-0·1
85·0.....	-0·4	+2·6	-0·6	+0·8

ASTRONOMICAL OBSERVATIONS AND THEIR REDUCTION

The astronomical work consists in making a determination at each place of the latitude, the astronomical meridian and the true bearing of some well-defined object, and the local mean time from which the longitude may be obtained, the chronometer correction on standard time being known.

The method of sun observations was usually employed to determine these quantities, though there were occasions when they were derived solely from star observations. The method of sun observations, as applied to magnetic work, is described in detail in the report¹ covering the operations of the survey from 1907 to 1920. The methods² of deriving the latitude and the azimuth from star observations are explained in text books on spherical astronomy.

Not only was it occasionally of advantage in completing the work at a station to be able to resort to the method of star observations, but throughout the seasons of 1922 and 1923, when it was found convenient to do so, observations were taken on Polaris for the determination of azimuth. The purpose of these observations was, primarily, to make a comparison between the two methods. The method of Polaris consisted in taking four pointings on the star, two with circle left and two with circle right, noting the time of each bisection and the reading of the horizontal circle corresponding thereto, the four constituting a set. As a rule the azimuth, by this method, was derived from two such determinations. To facilitate in the reduction of the observations, the tables given in the American Ephemeris were used.

The results of these observations at all the stations along Mackenzie river where both methods were used are summarized in Table 9. The table includes the morning and afternoon values of the bearing³ of the reference mark and the mean of the two, the bearing determined by the method of Polaris, and the difference between the results obtained by the two methods. The resulting differences determined by the two methods are, considering the type of instrument used, not greater than might be expected, with the possible exception of the two stations, Simpson A and Wrigley B, which give, respectively, $+1' \cdot 4$ and $-1' \cdot 4$. At both these stations (see table) the morning and afternoon values are in good agreement, from which it may be inferred that the discrepancy is probably not entirely due to errors in the sun observations.

The results given in Table 9, therefore, indicate that the method of sun observations for the determination of azimuth is quite satisfactory for purposes of magnetic work. Each method has certain advantages in its favour. With regard to the method of Polaris, the observation is comparatively simple provided it can be taken in the day time. This is possible, even with the type of instrument used on the magnetic survey, though it is necessary to wait until after sundown. The error in the azimuth resulting from a small error in the latitude, say one minute, is practically negligible. The main advantage in using the method of sun observations is in the convenience of observing during the period of the day when the magnetic work is in progress. With the aid of the time signals, which may be obtained daily, it affords a ready means of determining the longitude. An error⁴

¹ Publications of the Dominion Observatory, Vol. V, No. 5, pp. 134-135.

² See also Directions for Magnetic Measurements, by Daniel L. Hazard, pp. 40-52.

³ All bearings are reckoned from north through east from 0° to 360° .

⁴ The effect on azimuth and time of small changes in latitude is discussed in Researches of the Department of Terrestrial Magnetism, Vol. IV, pp. 26-27.

in latitude, however, has an appreciable effect on the azimuth and time. In order to minimize the effect due to an error in latitude, the greatest precaution has been taken throughout the work to secure observations of azimuth both in the forenoon and afternoon, at approximately equal hour angles before and after meridian passage of the sun.

As a number of the magnetic stations, occupied in 1922 and 1923, are near astronomic stations whose positions were accurately determined by the Dominion Observatory, an opportunity was afforded of testing the accuracy of the results of latitude and longitude determined by sun observations with the small portable instrument, used on magnetic work, and a wireless receiving set. The results are given in Table 10; magnetic station values are corrected to correspond to the position of the astronomic station.

TABLE 9.—SUMMARY OF BEARINGS OF REFERENCE MARKS DETERMINED FROM OBSERVATIONS OF SUN AND POLARIS, 1923

Station	Lat.	Bearing ¹ of mark						Difference Polaris —Sun
		Sun			Polaris			
		A.M.	P.M.	Mean				
Providence.....	61 21.4	306 46.6	45.5	306 46.0	306 45.1	— 0.9		
Trout River.....	61 19.2	124 24.4	24.6	124 24.5	124 23.9	— 0.6		
Simpson A.....	61 52.2	314 10.8	11.6	314 11.2	314 10.5	— 0.7		
Simpson B.....	61 52.3	280 33.2	33.2	280 33.2	280 34.6	+ 1.4		
Wrigley, A.....	63 16.3	148 07.0	07.8	148 07.4	148 06.0	— 1.4		
Wrigley, B.....	63 16.3	148 33.0	....	148 33.0	148 33.8	+ 0.8	
Birch Island.....	64 11.2	245 24.2	23.3	245 23.8	245 22.6	— 1.2		
Norman.....	64 54.3	112 19.7	20.6	112 20.2	112 19.6	— 0.6		
T. S. Monument 56 N.....	65 31.4	245 34.2	36.1	245 35.2	245 35.8	+ 0.6		
Good Hope.....	66 15.5	201 56.1	57.7	201 56.9	201 57.0	+ 0.1		
T. S. Monument O 44.....	66 43.8	16 06.8	08.6	16 07.7	16 07.6	— 0.1		
T. S. Monument O 69.....	67 28.2	200 30.1	31.1	200 30.6	200 31.2	+ 0.6		
Arctic Red River.....	67 26.7	242 11.0	13.6	242 12.3	242 12.9	+ 0.6		
McPherson.....	67 26.4	1 29.5	30.9	1 30.2	1 30.6	+ 0.4		
Aklavik.....	68 13.5	155 31.6	32.7	155 32.2	155 32.2	0.0		
Hay River.....	60 51.8	144 35.8	37.6	144 36.7	144 36.6	— 0.1		

¹ Bearings are reckoned from north through east from 0° to 360°.

ASTRONOMICAL OBSERVATIONS AND THEIR REDUCTION

TABLE 10.—SUMMARY OF THE LATITUDE AND LONGITUDE VALUES DETERMINED FROM SUN OBSERVATIONS WITH SMALL PORTABLE INSTRUMENT, AND FROM STAR OBSERVATIONS WITH TRANSIT MICROMETER

Method	Sun Observations		Transit Micrometer	
	Lat.	Long.	Lat.	Long.
Chipewyan.....	58 42.7	111 08.7	58 42.73	111 08.75
Resolution.....	61 10.0	113 40.5	61 10.09	113 40.62
Providence.....	61 21.4	117 39.2	61 21.24	117 39.37
Simpson.....	61 52.2	121 20.0	61 51.66	121 20.67
Norman.....	64 54.1	125 34.4	64 54.01	125 34.23
Good Hope.....	66 15.4	128 37.9	66 15.25	128 38.25
Arctic Red River.....	67 26.7	133 44.2	67 26.62	133 44.25

MAGNETIC WORK

The magnetic work consists in making a determination of the three magnetic elements, declination, dip and horizontal intensity, at each station. In general the methods followed were similar to those outlined in the report¹ covering the work of the period 1907-1920. The main difference was in respect to the determination of declination, which will be explained in the subsequent portion of the report. The observing period of the day was extended somewhat during 1922 and 1923, in order to obtain all the magnetic data possible. The results, which are given on pages 188 to 212, will serve to indicate the extent to which this was carried out.

MAGNETIC OBSERVATORY DATA

As an aid in the reduction of declination observations there have always been available, through the courtesy of Sir Frederic Stupart, Director of the Meteorological Service of Canada, the records of the two magnetic observatories, Agincourt and Meanook. The former is well over 1,100 miles from the nearest point occupied during 1922 and 1923, and the latter is just on the southerly edge of the area covered during these two years. It was therefore considered uncertain to what extent the Meanook data could be made use of for correcting the field observations for diurnal variation and disturbance. As a result it was considered advisable to take special declination observations for the purpose of obtaining the diurnal variation at places remote from the base station Meanook.

PROGRAM OF SPECIAL DECLINATION OBSERVATIONS

According to the program for the season of 1922 each observer was to obtain, if possible, on three days of each month, sufficient observations of declination to indicate the course of the magnetic needle throughout as much of the day as possible. As a rule the day was devoted to taking declination readings at short intervals. At some stations observations were taken at intervals approximating an hour, the period intervening being devoted to other work. In the selection of stations preference was given to places where observations had previously been taken and which would probably be available for future occupation. For the season of 1923 these observations were to be taken, as in 1922, on three days of each month, but with this difference, the 10th, 20th and 30th of the month were selected for the work. There would thus be available the daily variation of magnetic declination for two, and with Meanook records, three distinct and comparatively widely separated points. In view of the conditions that would probably be encountered, it was not expected that the work could be carried out strictly in accordance with the program. The unsettled state of the weather sometimes made observing difficult if not impossible, and occasionally it was found necessary to travel on the day in question. In a few cases magnetic storms were so pronounced that either the observing was discontinued, or the results obtained were later discarded.

METHOD OF DERIVING THE MEAN DECLINATION

The method generally adopted in magnetic surveys is to refer all the results to the mean of the twenty-four hours of the day. This observatory, between 1907 and 1920, adopted the mean of the maximum and minimum² values for the day. The main objection to this is the difficulty of determining when these values occur, especially at certain times

¹ Publications of the Dominion Observatory, Vol. V, No. 5, pp. 136-139.

² Publications of the Dominion Observatory, Vol. V, No. 5, pp. 136-137.

of the year. It was decided, therefore, to make a change in the method of reduction. The adoption of the twenty-four hourly values was considered unsuitable owing to the lack of information respecting the diurnal variation at places remote from the two magnetic observatories, Meanook and Agincourt; furthermore, it was obviously impracticable, if not impossible, to carry out a program of special observations to cover the twenty-four hours where there was but one observer in the party. It was finally decided to adopt the period of the day included between 7h and 18h. The results, therefore, contained in the report are all referred to the period of the day represented by the mean of the hourly values from 7h to 18h. For comparison with results at stations previously occupied it will be necessary to apply a small correction to the values referred to elongation. In Table 11 are given the mean values at a number of field stations referred to the period 7h to 18h, and also the mean of the maximum and minimum values.

REDUCTION OF SPECIAL DECLINATION OBSERVATIONS

The declinations derived from the special observations were represented graphically as were all the corresponding observations obtained from Meanook records. The results at a few of the stations are given in Figures 8-14. These were selected as being typical of the results obtained during the two seasons 1922 and 1923. Both field data and Meanook data were plotted against 105th meridian time, thus making it easy to compare visually the results at the two stations. The field results were then corrected for disturbance, which is defined as the difference between the adopted monthly mean value of declination and the value for the day at the same instant. This quantity was determined from the Meanook data on the assumption that it is the same at the field station as at the base station. A comparison of the graphs will show that this is not a legitimate assumption. In general, however, the nearer the location of the station to the base station, which, in this case is Meanook, the smoother are the curves representing the daily variation after the corrections for disturbance have been applied. For distant stations it is doubtful if the results are materially improved by applying these disturbance factors. There were at the most northerly stations distinct movements of the needle which could not be detected on the Meanook magnetograms. The results at Meanook and Norman illustrate the differences between disturbance effects at two distant stations. Where disturbances such as the one encountered at Norman are in evidence observing is usually discontinued. The results at the two stations, obtained on July 20 and 21, 1923, are given in Figure 14. The points on the graphs are not single, instantaneous readings but represent the means of a number of readings. The disturbance was in evidence at the time observing was commenced on the morning of July 20 but subsided, for the most part, about 11h (L.M.T.). If the mean curve is drawn through the values for Norman it will be found that the declination at, or about, 9h exceeds that on the following day by about 30', while the corresponding difference at Meanook amounts to about 6'. The declination on July 21 at Meanook was approximately normal.

A comparison between the values on August 10 at McPherson and Churchill, Figure 12*b*, and Figure 12*c*, shows that the diurnal variation at the two places differs to a marked degree, especially in the afternoon. As the same thing is apparent in the results at Aklavik and York Factory on August 20 one is led to the conclusion that the diurnal variation is

probably quite different for these two localities. The curves at the two field stations both on August 10 and August 20 differ from those at Meanook, the latter occupying a mean position with respect to the other two.

The special observations with the so-called disturbance corrections applied were plotted with respect to local mean time, as, for example in Figure 8 *c*, and a mean curve drawn. From the smooth curves, hourly values were obtained which are given in Table 11. The table contains, in addition to the hourly values of declination, the mean of the twenty-four hourly values at a few stations, the mean of the hourly values for the period 7h to 18h at all the stations, and also the mean of the maximum and minimum at all stations. The differences between the hourly values and the adopted mean for the day, that is for the period 7h to 18h, are given as representing the diurnal variation. The results given in italics are simply to distinguish between the period of the day included between 7h and 18h and the remaining portion of the day.

The problem was to obtain from these results a series of values to correct for diurnal variation observations taken at all stations occupied during the two seasons.

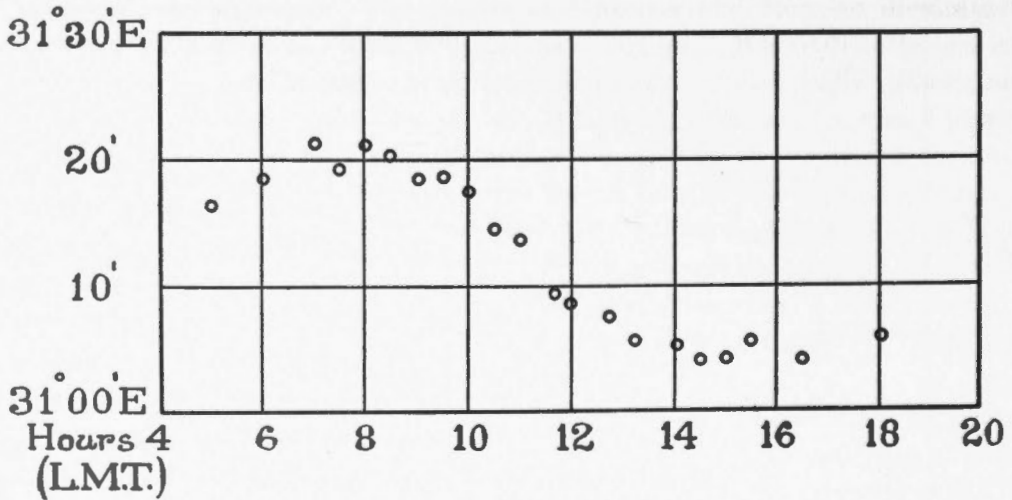
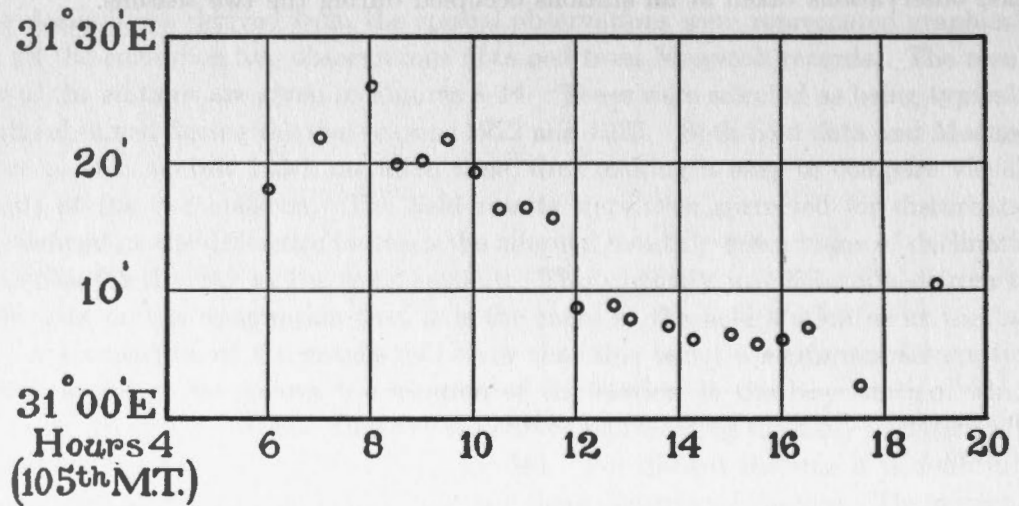
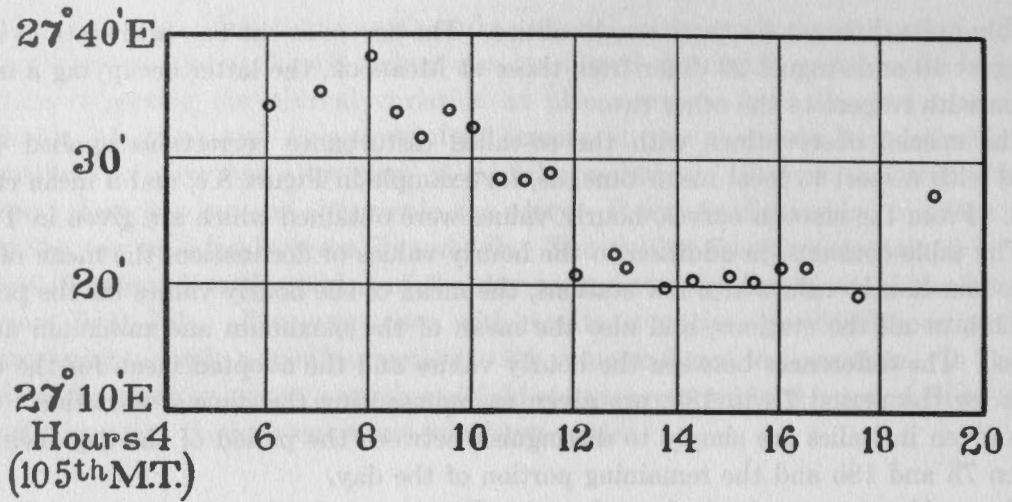


FIG. 8. Magnetic declination: (a) at Meanook; (b) at Fort St. John; (c) at Fort St. John corrected for disturbance.

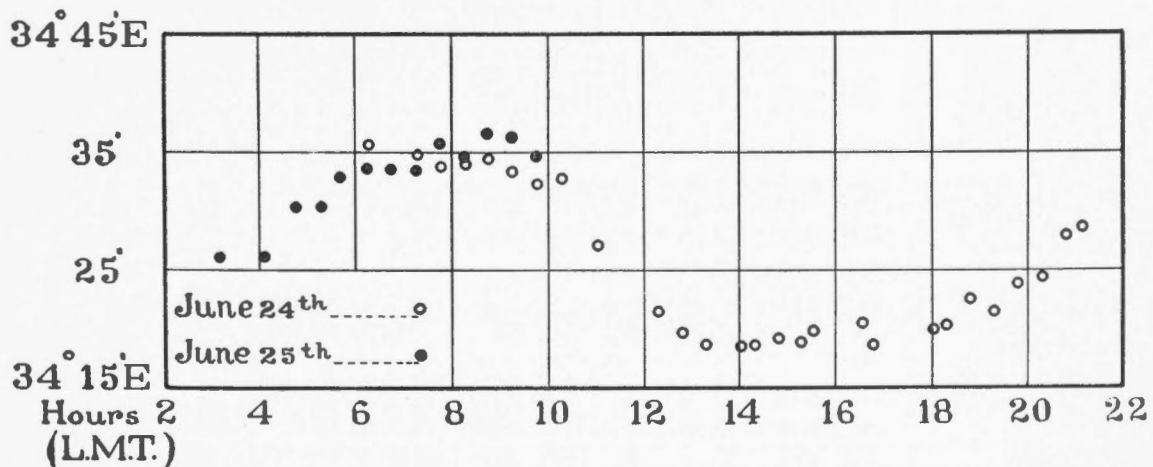
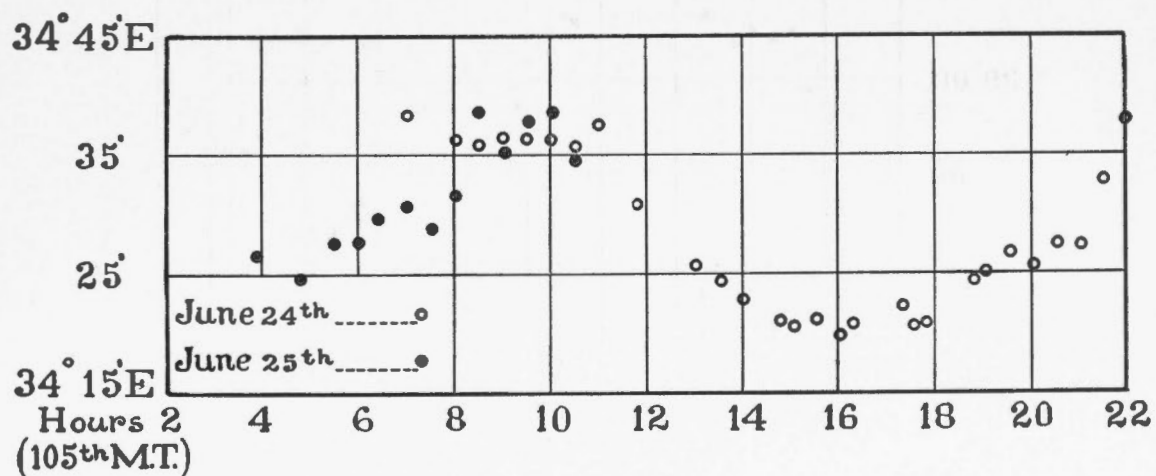
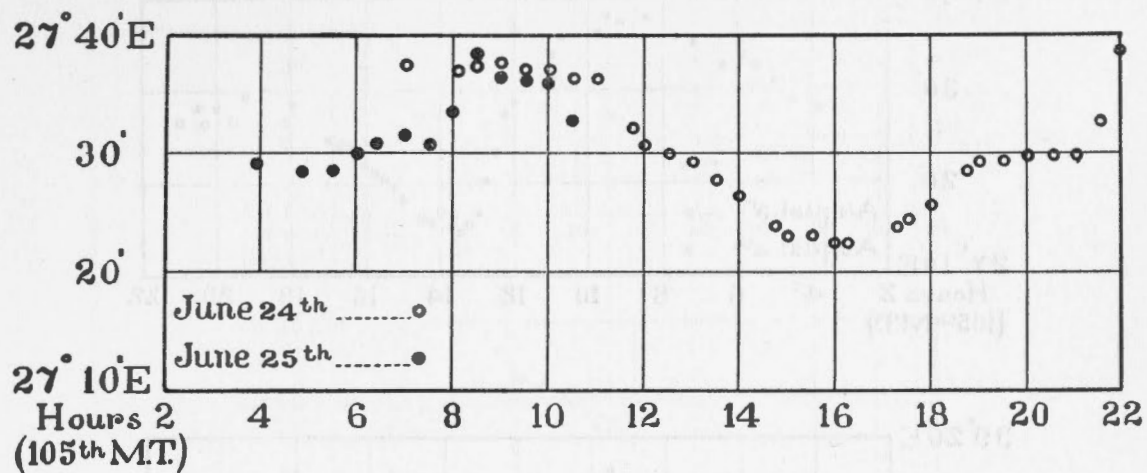


Fig. 9. Magnetic declination: (a) at Meanook; (b) at Fort Vermilion; (c) at Fort Vermilion corrected for disturbance.

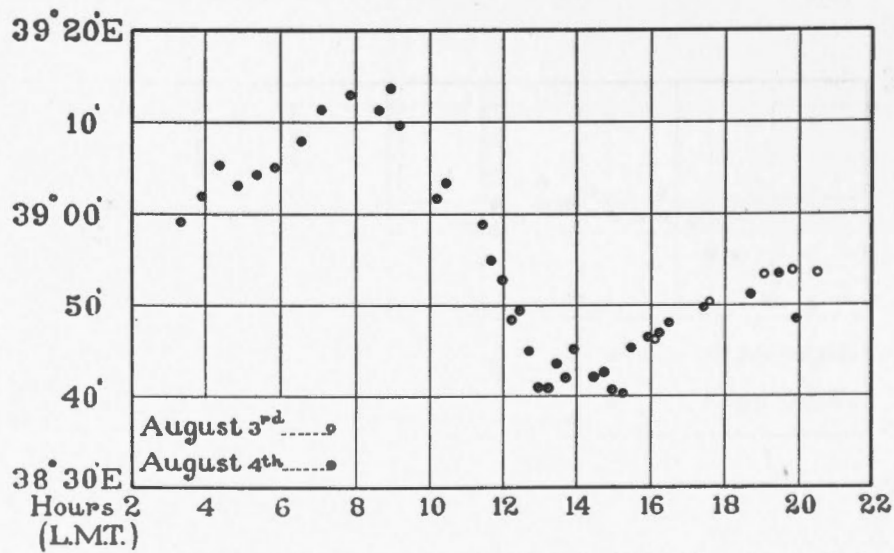
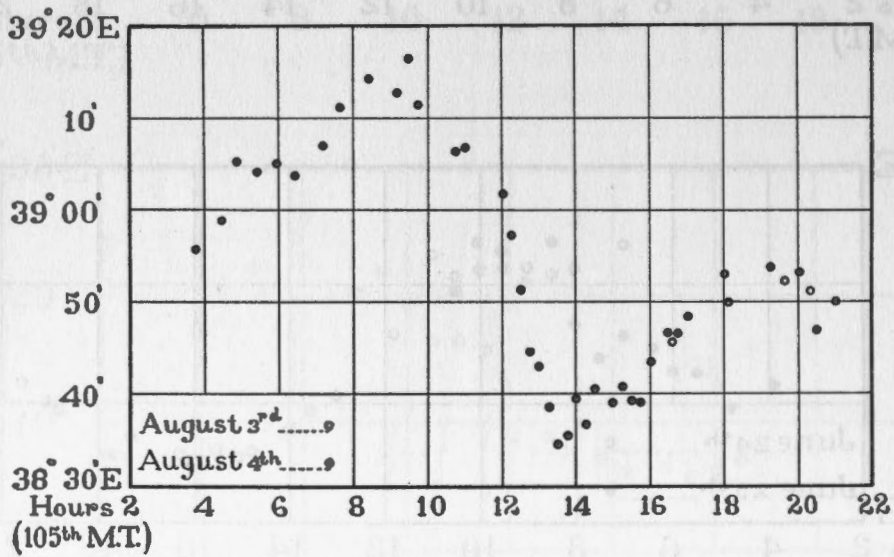
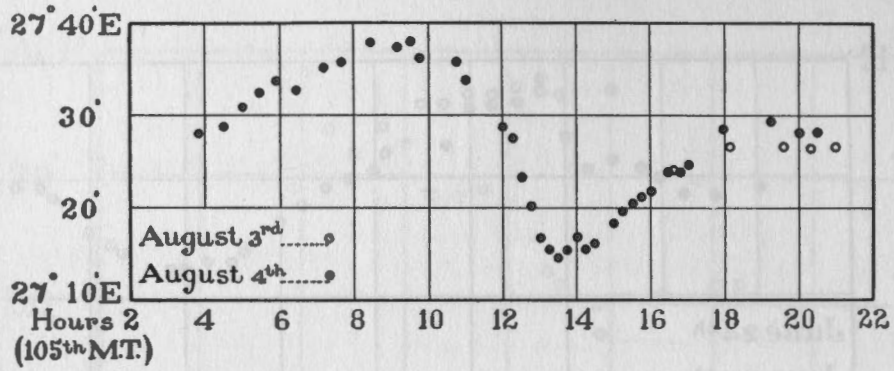


FIG. 10. Magnetic declination: (a) at Meanook; (b) at Resolution B; (c) at Resolution B corrected for disturbance.

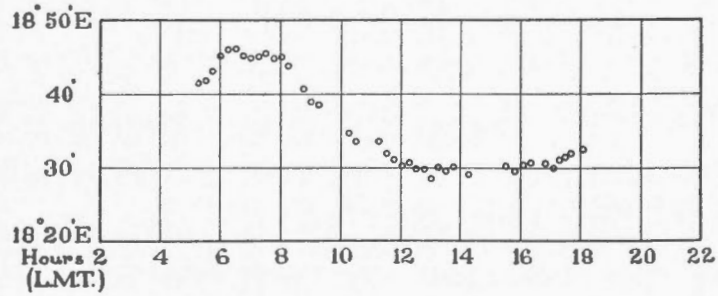
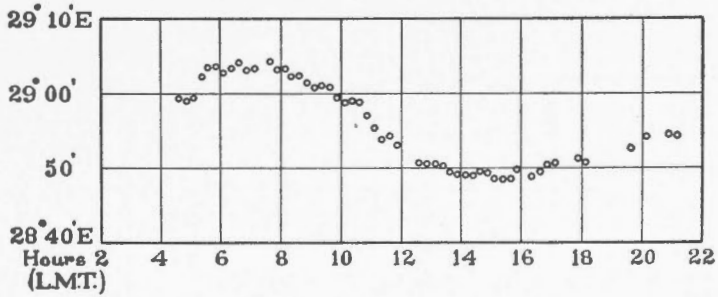
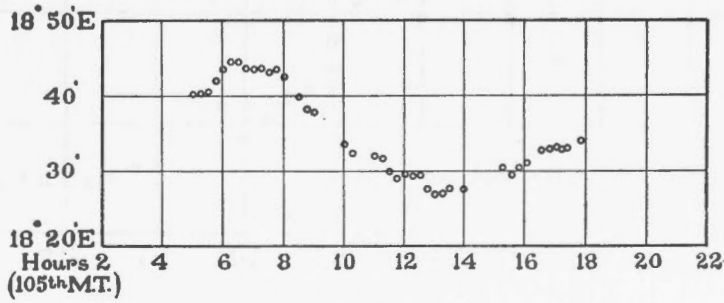
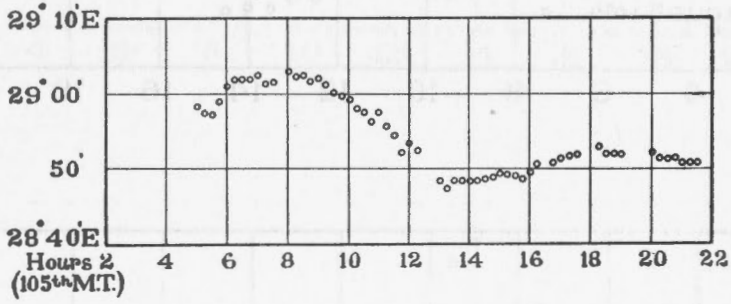
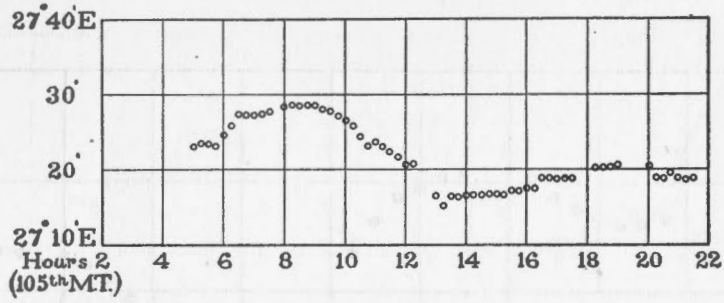


FIG. 11. Magnetic declination: (a) at Meanook; (b) at McMurray; (c) at Kississing lake; (d) at McMurray corrected for disturbance; (e) at Kississing lake corrected for disturbance.

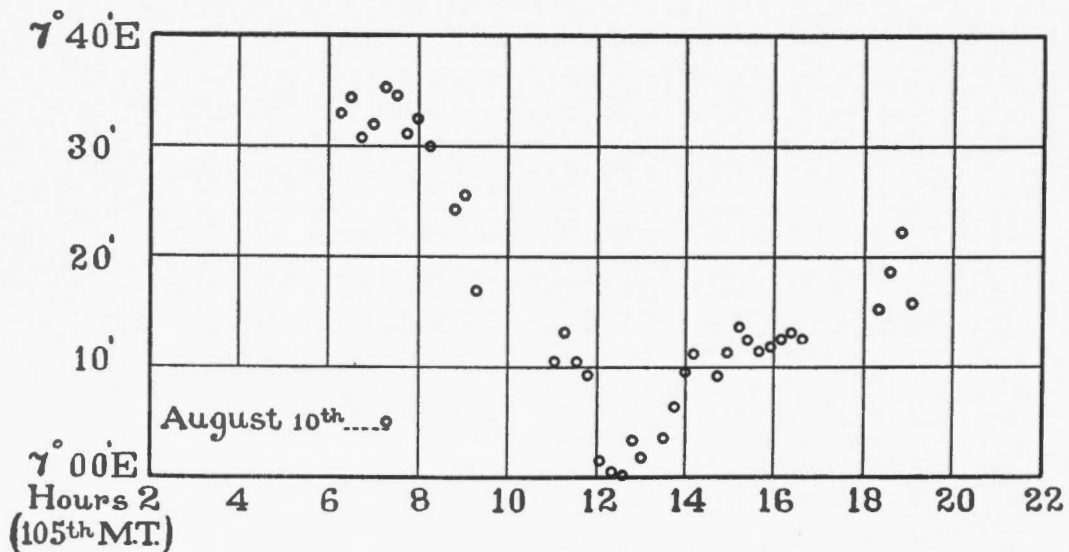
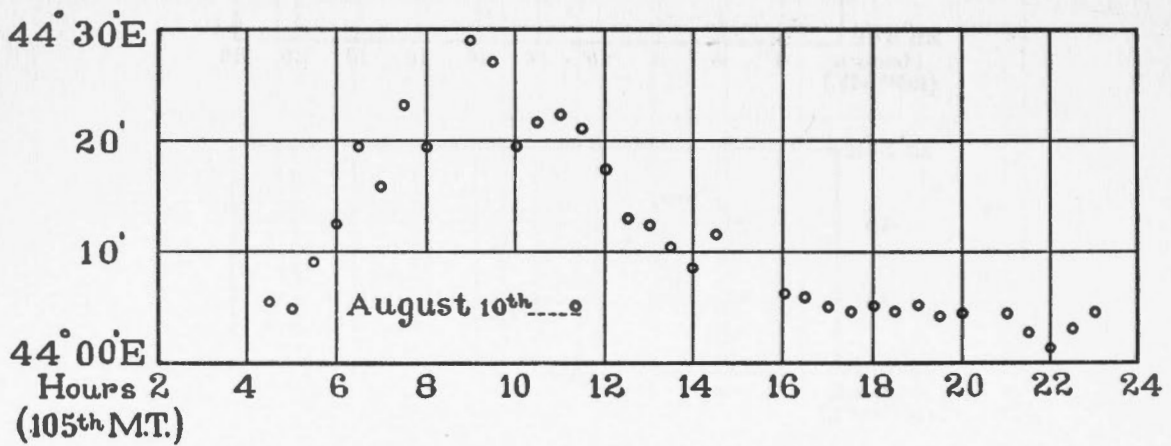
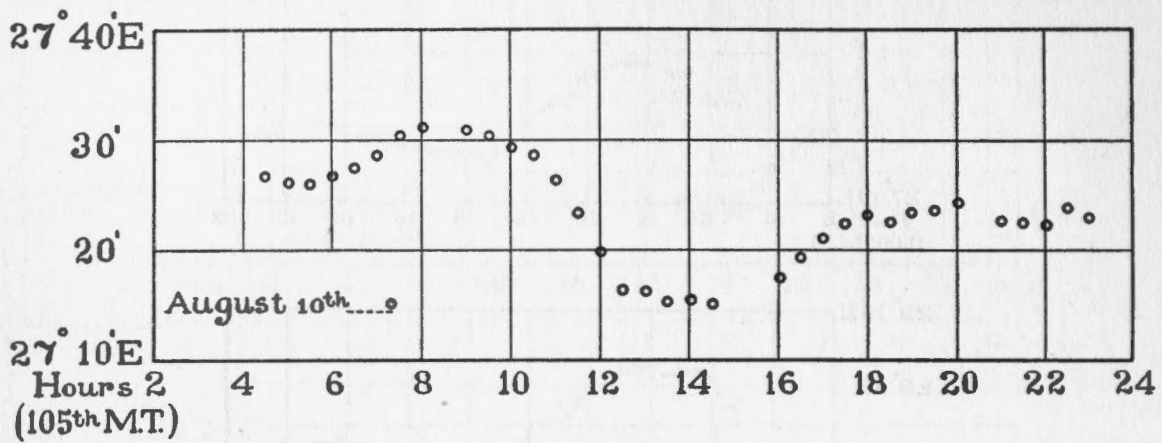


FIG. 12. Magnetic declination: (a) at Meanook; (b) at McPherson; (c) at Churchill.

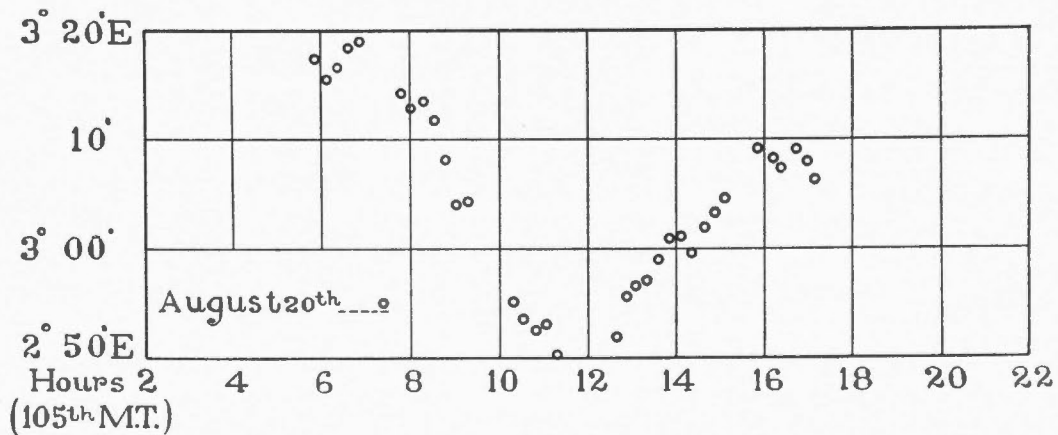
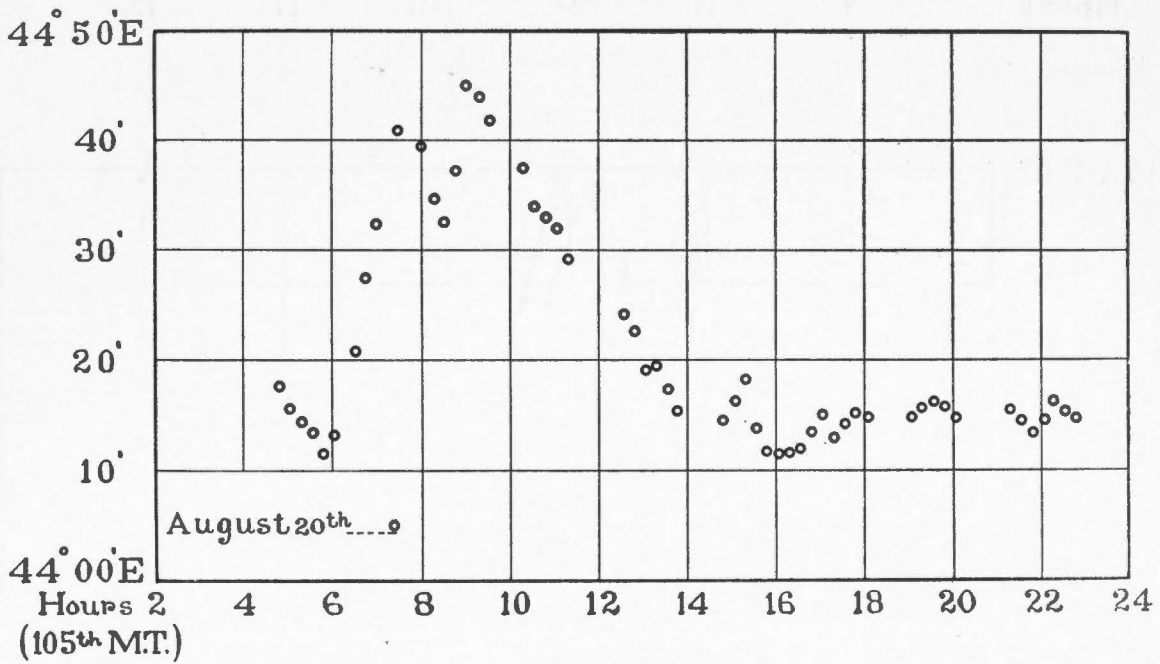
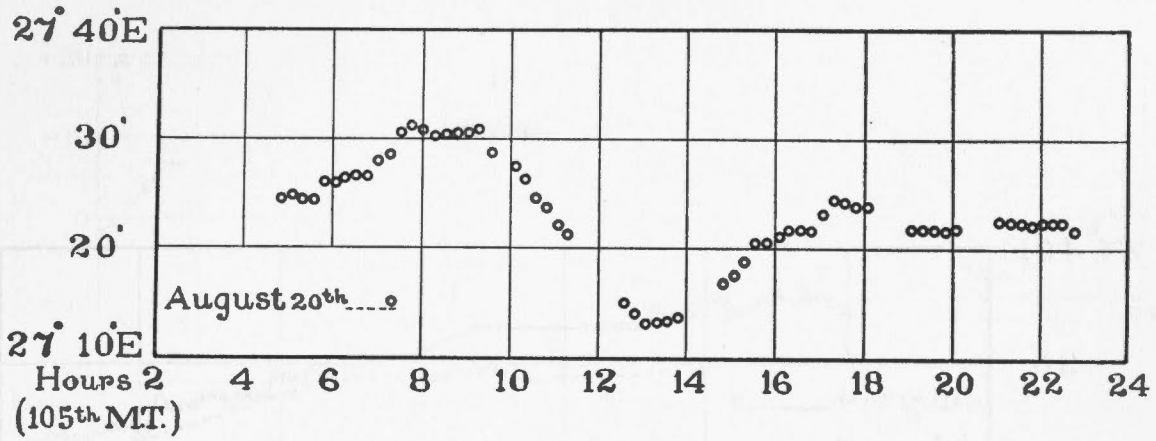


FIG. 13. Magnetic declination: (a) at Meanook; (b) at Aklavik; (c) at York Factory.

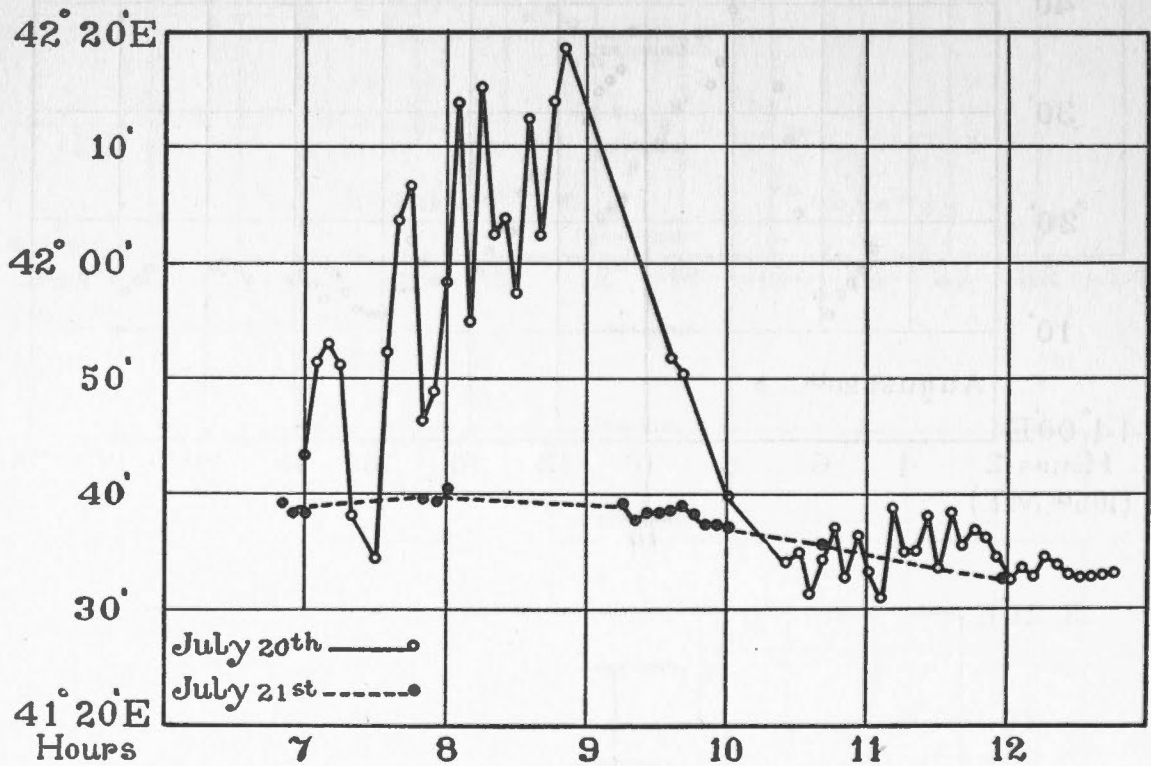
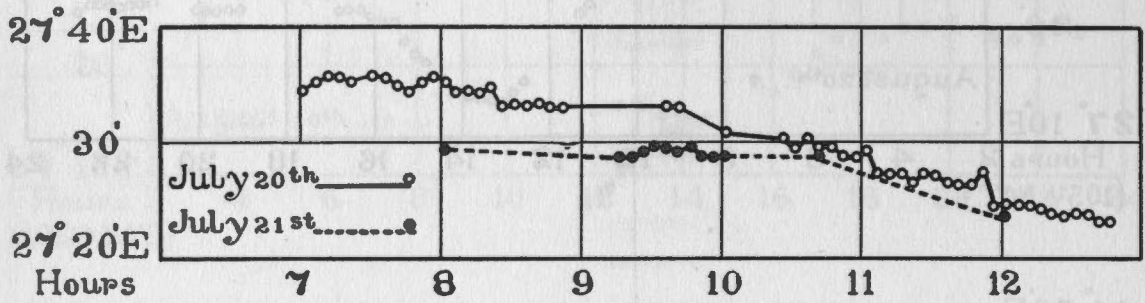


FIG. 14. Magnetic declination: (a) at Meanook; (b) at Norman.

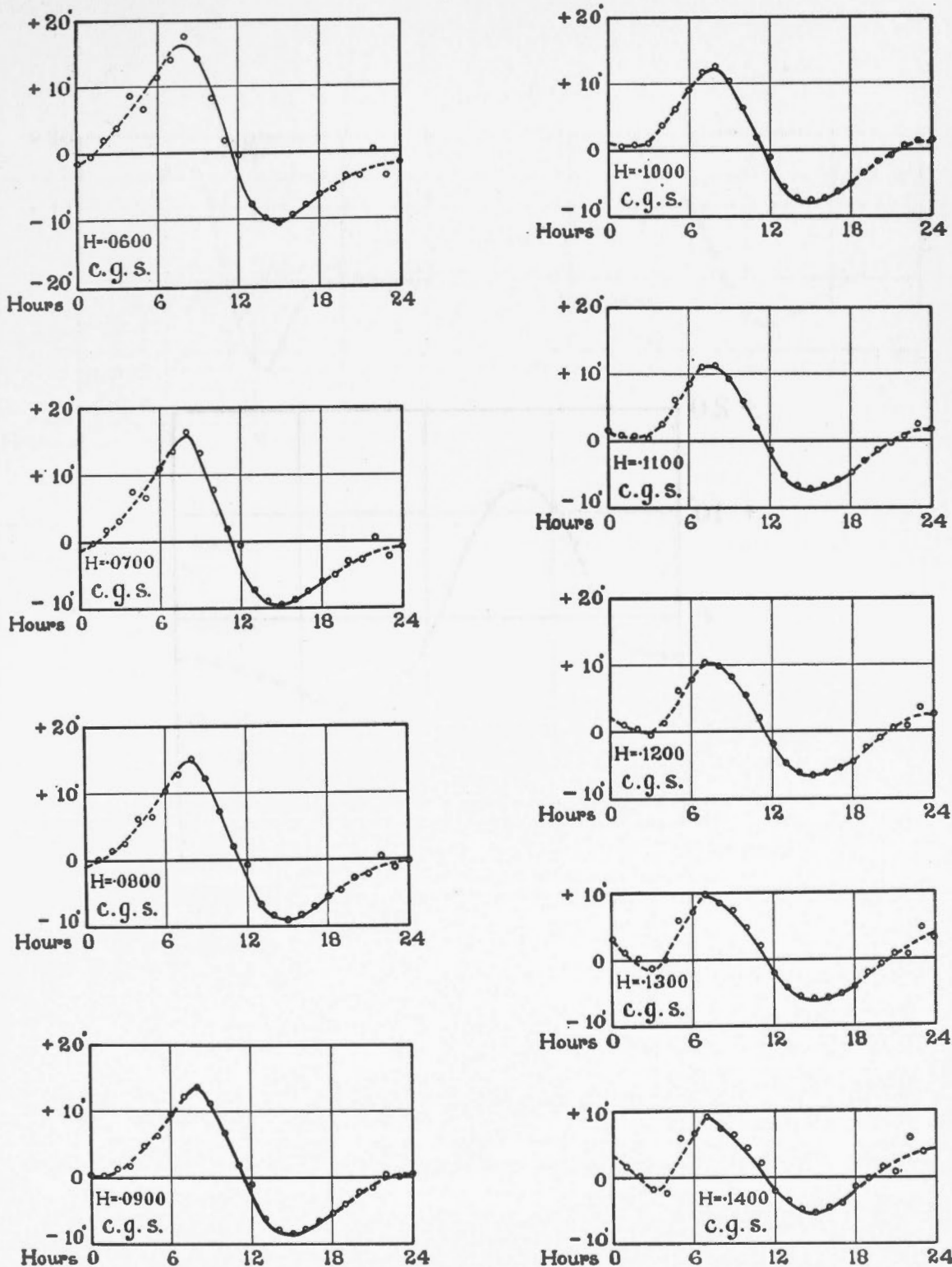


FIG. 15. Diurnal variation of magnetic declination derived from results at stations in Group I corresponding to different values of H.

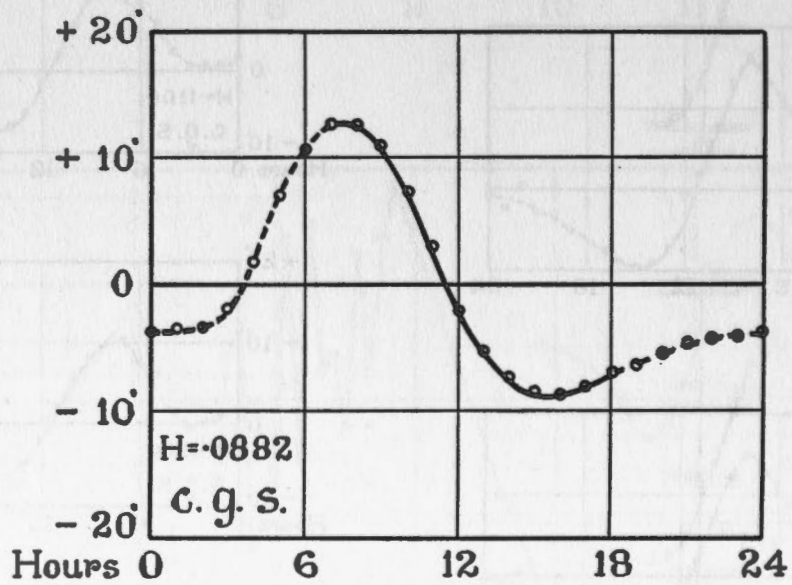


FIG. 16. Diurnal variation of magnetic declination derived from results at stations in Group 2.

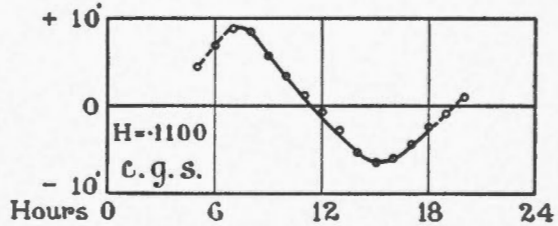
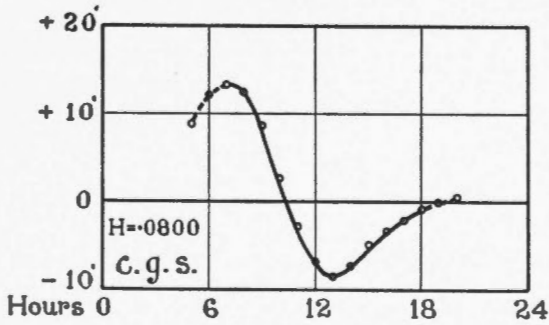
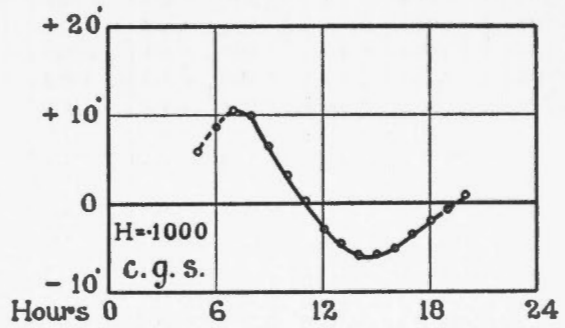
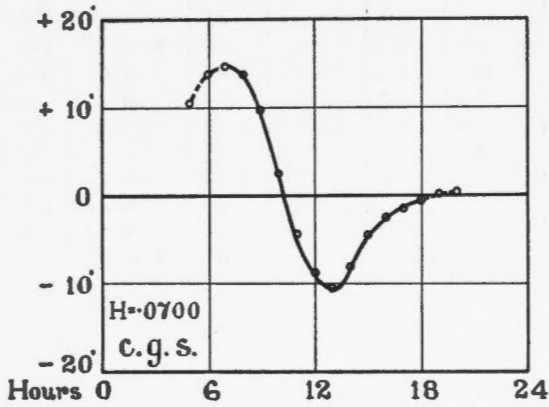
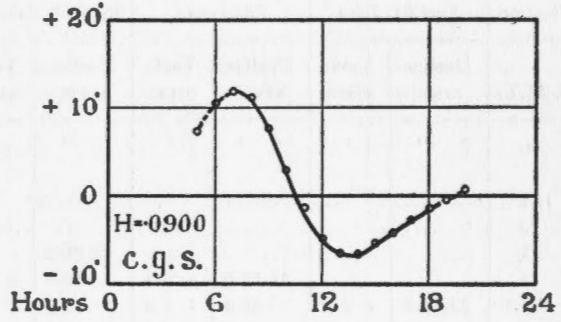
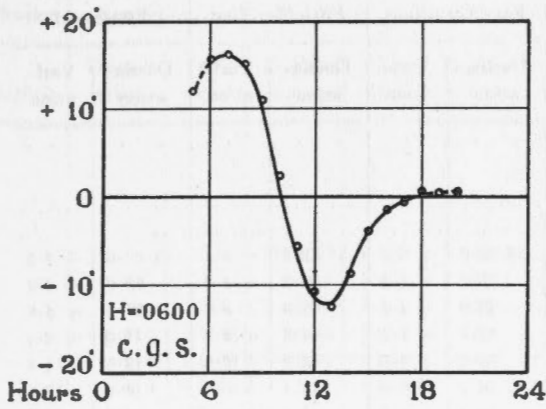


FIG. 17. Diurnal variation of magnetic declination derived from results at stations in Group 3 corresponding to different values of H.

TABLE 11.—RESULTS OF SPECIAL OBSERVATIONS FOR DIURNAL VARIATION OF DECLINATION AT STATIONS OCCUPIED IN 1922-1923

Date	May 23, 1922		May 29-30, 1922		June 9-10, 1922		June 24-25, 1922		July 3-5, 1922		July 22-23, 1922	
Station	Fort St. John		Dunvegan		Brown's Landing		Fort Vermilion		Fifth Meridian		Fitzgerald	
L.M.T.	Declination	Variation	Declination	Variation	Declination	Variation	Declination	Variation	Declination	Variation	Declination	Variation
h.	° ' "	' "	° ' "	' "	° ' "	' "	° ' "	' "	° ' "	' "	° ' "	' "
1												
2												
3					32 24.3	- 0.8	34 25.6	+ 0.5	31 32.2	- 0.5	31 01.0	- 1.2
4			31 18.0	- 0.9	26.5	+ 1.4	27.0	+ 1.7	36.0	+ 3.3	03.6	+ 1.4
5	31 16.3	+ 5.6	21.8	+ 2.9	29.2	+ 4.1	30.0	+ 4.7	42.0	+ 9.3	07.8	+ 5.6
6	18.5	+ 7.8	26.0	+ 7.1	31.9	+ 6.8	32.7	+ 7.4	44.8	+12.1	11.0	+ 8.8
7	20.7	+10.0	27.8	+ 8.9	33.7	+ 8.6	35.0	+ 9.7	45.0	+12.3	13.6	+11.4
8	21.0	+10.3	27.2	+ 8.3	34.7	+ 9.6	36.2	+10.9	43.3	+10.6	14.6	+12.4
9	19.0	+ 8.3	25.4	+ 6.5	34.0	+ 8.9	35.2	+ 9.9	41.4	+ 8.7	12.3	+10.1
10	16.3	+ 5.6	23.0	+ 4.1	31.8	+ 6.7	32.2	+ 6.9	38.6	+ 5.9	09.0	+ 6.8
11	12.6	+ 1.9	20.3	+ 1.4	28.3	+ 3.2	27.2	+ 1.9	35.7	+ 3.0	05.0	+ 2.8
12	09.0	- 1.7	16.8	- 2.1	25.0	- 0.1	22.8	- 2.5	32.2	- 0.5	01.1	- 1.1
13	06.3	- 4.4	14.3	- 4.6	21.6	- 3.5	19.0	- 6.3	29.1	- 3.6	30 57.3	- 4.9
14	05.0	- 5.7	13.3	- 5.6	19.0	- 6.1	18.2	- 7.1	26.3	- 6.4	55.7	- 6.5
15	04.3	- 6.4	13.3	- 5.6	18.0	- 7.1	18.3	- 7.0	24.0	- 8.7	54.3	- 7.9
16	04.0	- 6.7	14.1	- 4.8	17.8	- 7.3	19.0	- 6.3	24.0	- 8.7	54.0	- 8.2
17	04.3	- 6.4	15.5	- 3.4	18.0	- 7.1	19.7	- 5.6	25.4	- 7.3	54.3	- 7.9
18	31 05.6	- 5.1	16.0	- 2.9	19.1	- 6.0	20.7	- 4.6	27.0	- 5.7	55.8	- 6.4
19			16.8	- 2.1	22.0	- 3.1	22.2	- 3.1	28.4	- 4.3	58.1	- 4.1
20			17.7	- 1.2	24.2	- 0.9	25.0	- 0.5	29.3	- 3.4	59.3	- 2.9
21			18.5	- 0.4	25.7	+ 0.6	34 27.3	+ 2.0	31 29.8	- 2.9	31 00.3	- 1.9
22			31 18.5	- 0.4	32 26.2	+ 1.1						
23												
24												
Mean												
1h to 24h												
7h to 18h	31 10.7		31 18.9		32 25.1		34 25.3		31 32.7		31 02.2	
Max. and min...	31 12.5		31 20.6		32 26.2		34 27.2		31 34.5		31 04.3	

TABLE 11.—RESULTS OF SPECIAL OBSERVATIONS FOR DIURNAL VARIATION OF DECLINATION AT STATIONS OCCUPIED IN 1922-1923—(continued)

Date	Aug. 2-3, 1922		Aug. 3-4, 1922		Aug. 17-18, 1922		Sept. 5-6, 1922		June 10, 1923		June 20, 1923	
Station	Resolution, A		Resolution, B		Chipewyan		McMurray		McMurray		Fort Smith	
L.M.T.	Declination	Variation	Declination	Variation	Declination	Variation	Declination	Variation	Declination	Variation	Declination	Variation
h.	° ' "	' "	° ' "	' "	° ' "	' "	° ' "	' "	° ' "	' "	° ' "	' "
1					27 50.6	0.0	28 59.5	+ 0.9				
2					51.0	+ 0.4	59.5	+ 0.9				
3			39 00.7	+ 5.5	52.0	+ 1.4	29 01.0	+ 2.4				
4			01.9	+ 0.7	53.4	+ 2.8	06.0	+ 7.4	28 58.5	+ 3.8		
5			03.3	+ 3.1	55.5	+ 4.9	10.0	+ 11.4	29 00.0	+ 5.3	32 10.0	+ 5.7
6	38 47.0	+ 11.6	05.6	+ 10.4	59.5	+ 3.9	11.8	+ 13.2	02.6	+ 7.9	13.0	+ 3.7
7	51.0	+ 15.6	10.0	+ 14.8	28 02.8	+ 12.2	11.7	+ 13.1	04.6	+ 9.9	18.0	+ 13.7
8	54.0	+ 18.6	13.2	+ 18.0	04.0	+ 13.4	09.0	+ 10.4	04.0	+ 9.3	21.0	+ 16.7
9	50.0	+ 14.6	11.0	+ 15.8	00.7	+ 10.1	07.7	+ 9.1	02.0	+ 7.3	17.0	+ 12.7
10	43.2	+ 7.8	04.8	+ 9.6	27 56.2	+ 5.6	01.5	+ 2.9	28 59.0	+ 4.3	11.0	+ 6.7
11	36.3	+ 0.9	38 58.8	+ 3.6	51.0	+ 0.4	28 57.0	- 1.6	56.0	+ 1.3	06.6	+ 2.3
12	30.0	- 5.4	51.0	- 4.2	46.6	- 4.0	53.7	- 4.9	52.6	- 2.1	02.8	- 1.5
13	27.0	- 8.4	43.6	- 11.6	43.0	- 7.6	52.2	- 6.4	50.2	- 4.5	31 59.8	- 4.5
14	25.2	- 10.2	41.2	- 14.0	42.2	- 8.4	52.2	- 6.4	49.3	- 5.4	57.8	- 6.5
15	24.8	- 10.6	42.2	- 13.0	43.2	- 7.4	53.2	- 5.4	48.7	- 6.0	56.0	- 8.3
16	26.0	- 9.4	46.0	- 9.2	44.6	- 6.0	54.1	- 4.5	49.0	- 5.7	54.6	- 9.7
17	27.7	- 7.7	49.2	- 6.0	45.8	- 4.8	55.0	- 3.6	49.8	- 4.9	53.5	- 10.8
18	30.0	- 5.4	51.0	- 4.2	47.1	- 3.5	56.2	- 2.4	51.0	- 3.7	53.0	- 11.3
19	31.8	- 3.6	52.2	- 3.0	48.0	- 2.6	57.7	- 0.9	52.3	- 2.4	53.0	- 11.3
20	33.7	- 1.7	53.0	- 2.2	49.8	- 0.8	58.7	+ 0.1	53.6	- 1.1	53.2	- 11.1
21	38 36.0	+ 0.6	38 53.6	- 1.6	50.8	+ 0.2	59.8	+ 1.2	28 54.3	- 0.4	31 53.6	- 10.7
22					51.0	+ 0.4	29 00.6	+ 2.0				
23					50.5	- 0.1	01.0	+ 2.4				
24					27 50.2	- 0.4	29 00.3	+ 1.7				
Mean												
1h to 24h					27 51.2		29 00.4					
7h to 18h	38 35.4		38 55.2		50.6		28 58.6		28 54.7		32 04.3	
Max. and min.	38 39.4		38 57.2		27 53.1		29 02.0		28 56.6		32 07.0	

TABLE 11.—RESULTS OF SPECIAL OBSERVATIONS FOR DIURNAL VARIATION OF DECLINATION AT STATIONS OCCUPIED IN 1922-1923—(continued)

Date	June 22-23, 1923		July 20-21, 1923		July 30-31, 1923		Aug. 10, 1923		Aug. 16-22, 1923		May 19-20, 1922	
Station	Fort Smith		Norman		Good Hope		McPherson		Aklavik		Mile 100, H.B.R.	
L.M.T.	Declination	Variation	Declination	Variation	Declination	Variation	Declination	Variation	Declination	Variation	Declination	Variation
h.	° ' "	' "	° ' "	' "	° ' "	' "	° ' "	' "	° ' "	' "	° ' "	' "
1	32 01.3	+ 0.4	41 29.5	+ 0.8	42 37.8	- 1.2	44 04.0	- 7.6	44 15.3	- 5.8	.....	.....
2	02.5	+ 1.6	29.8	+ 1.1	38.4	- 0.6	04.0	- 7.6	14.8	- 6.3	.....	.....
3	06.0	+ 5.1	30.6	+ 1.9	39.7	+ 0.7	06.5	- 5.1	15.6	- 5.5	.....	.....
4	08.7	+ 7.8	33.0	+ 4.3	42.2	+ 3.2	12.5	+ 0.9	20.0	- 1.1	.....	.....
5	09.6	+ 8.7	36.1	+ 7.4	44.8	+ 5.8	18.1	+ 6.5	29.0	+ 7.9	14 55.8	+ 6.4
6	10.2	+ 9.3	38.9	+10.2	46.8	+ 7.8	22.0	+10.4	34.6	+13.5	58.0	+ 8.6
7	10.4	+ 9.5	40.0	+11.3	48.9	+ 9.9	24.2	+12.6	37.8	+16.7	15 00.0	+10.6
8	10.3	+ 9.4	39.3	+10.6	51.2	+12.2	23.0	+11.4	37.4	+16.3	00.1	+10.7
9	09.0	+ 8.1	36.4	+ 7.7	52.3	+13.3	21.0	+ 9.4	34.5	+13.4	14 58.8	+ 9.4
10	06.8	+ 5.9	33.0	+ 4.3	50.1	+11.1	18.2	+ 6.6	28.3	+ 7.2	55.8	+ 6.4
11	03.3	+ 2.4	29.8	+ 1.1	44.6	+ 5.6	14.8	+ 3.2	23.0	+ 1.9	52.5	+ 3.1
12	31 59.7	- 1.2	26.7	- 2.0	37.5	- 1.5	11.3	- 0.3	17.8	- 3.3	48.5	- 0.9
13	56.5	- 4.4	24.1	- 4.6	32.6	- 6.4	08.7	- 2.9	14.3	- 6.8	45.0	- 4.4
14	54.5	- 6.4	22.6	- 6.1	29.8	- 9.2	06.5	- 5.1	11.8	- 9.3	42.3	- 7.1
15	53.8	- 7.1	22.2	- 6.5	29.3	- 9.7	04.2	- 7.4	10.6	-10.5	40.7	- 8.7
16	54.0	- 6.9	22.5	- 6.2	29.5	- 9.5	03.0	- 8.6	10.9	-10.2	41.0	- 8.4
17	55.5	- 5.4	23.3	- 5.4	30.0	- 9.0	02.4	- 9.2	12.8	- 8.3	43.0	- 6.4
18	57.3	- 3.6	24.3	- 4.4	31.6	- 7.4	02.2	- 9.4	14.3	- 6.8	45.0	- 4.4
19	59.0	- 1.9	25.2	- 3.5	33.0	- 6.0	02.2	- 9.4	14.9	- 6.2	47.5	- 1.9
20	32 00.0	- 0.9	26.0	- 3.7	34.7	- 4.3	02.7	- 8.9	15.5	- 5.6	14 50.0	+ 0.6
21	00.6	- 0.3	26.7	- 3.0	35.3	- 3.7	03.7	- 7.9	16.1	- 5.0	.....	.....
22	00.7	- 0.2	27.0	- 1.7	36.0	- 3.0	04.0	- 7.6	16.5	- 4.6	.....	.....
23	00.7	- 0.2	27.8	- 0.9	36.6	- 3.4	04.0	- 7.6	16.1	- 5.0	.....	.....
24	32 01.2	+ 0.3	41 28.5	- 0.2	42 37.2	- 1.8	44 04.0	- 7.6	44 15.7	- 5.4	.....	.....
Mean												
1h to 24h	32 02.2	.....	41 29.3	.....	42 38.7	.....	44 09.5	.....	44 19.9	.....	.....	.....
7h to 18h	00.9	.....	28.7	.....	39.0	.....	11.6	.....	21.1	.....	14 49.4	.....
Max. and min...	32 02.1	.....	41 31.1	.....	42 40.8	.....	44 13.2	.....	44 24.2	.....	14 50.4	.....

TABLE 11.—RESULTS OF SPECIAL OBSERVATIONS FOR DIURNAL VARIATION OF DECLINATION AT STATIONS OCCUPIED IN 1922-1923 (concluded)

Date	June 1, 1922		June 10, 1923		Aug. 10, 1923		Aug. 20, 1923		Sept. 12, 1923		Sept. 20, 1923	
Station	Kettle Rapids		Kississing Lake		Churchill		York Factory		Hayes R. The Rock		Swampy Lake	
L.M.T.	Declination	Variation	Declination	Variation	Declination	Variation	Declination	Variation	Declination	Variation	Declination	Variation
h.	° ' "	' "	° ' "	' "	° ' "	' "	° ' "	' "	° ' "	' "	° ' "	' "
1												
2												
3												
4			18 39.8	+ 5.6								
5	7 15.0	+15.1	40.6	+ 6.4			3 13.0	+ 8.2			9 02.0	+ 4.7
6	18.8	+16.9	43.8	+ 9.6			16.5	+11.7			04.5	+ 7.2
7	20 0	+18.1	46.2	+12.0	7 32.0	+15.4	18.8	+14.0	6 16.7	+10.4	06.4	+ 9.1
8	18.0	+16.1	44.7	+10.5	32.0	+15.4	16.3	+11.5	17.0	+10.7	06.1	+ 8.8
9	13.0	+11.1	39.4	+ 5.2	28.7	+12.1	12.1	+ 7.3	13.2	+ 6.9	03.7	+ 6.4
10	06.0	+ 4.1	35.3	+ 1.1	21.3	+ 4.7	04.0	- 0.8	06.5	+ 0.2	00.4	+ 3.1
11	6 53.6	- 3.3	32.7	- 1.5	14.1	- 2.5	2 57.7	- 7.1	01.6	- 4.7	8 57.0	- 0.3
12	53.2	- 8.7	30.6	- 3.6	08.5	- 8.1	54.8	-10.0	5 58.5	- 7.8	53.0	- 4.3
13	51.8	-10.1	29.4	- 4.8	04.4	-12.2	56.0	- 8.8	58.4	- 7.9	49.7	- 7.6
14	52.8	- 9.1	29.2	- 5.0	06.0	-10.6	3 00.7	- 4.1	6 00.5	- 5.8	48.8	- 8.5
15	54.5	- 7.4	29.5	- 4.7	10.0	- 6.6	03.4	- 1.4	04.0	- 2.3	51.7	- 5.6
16	56.5	- 5.4	30.0	- 4.2	12.8	- 3.8	04.4	- 0.4	05.7	- 0.6	55.0	- 2.3
17	58.3	- 3.6	30.9	- 3.3	14.2	- 2.4	04.7	- 0.1	06.5	+ 0.2	57.3	0.0
18	59.8	- 2.1	18 32.4	- 1.8	15.8	- 0.8	3 04.9	+ 0.1	06.8	+ 0.5	58.3	+ 1.0
19	7 00.2	- 1.7			16.7	+ 0.1			07.1	+ 0.8	58.8	+ 1.5
20	7 00.4	- 1.5			7 17.5	+ 0.9			07.5	+ 1.2	58.9	+ 1.6
21									6 07.8	+ 1.5	58.8	+ 1.5
22											8 58.3	+ 1.0
23												
24												
Mean												
1h to 24h												
7h to 18h	7 01.9		18 34.2		7 16.6		3 04.8		6 06.3		8 57.3	
Max. and min...	7 05.9		18 37.7		7 18.2		3 06.8		6 07.7		8 57.6	

DIURNAL RANGE OF DECLINATION

As a matter of interest the results were examined with a view to determine the relationship between the range of declination and the horizontal force, as well as that between the range of declination at the field station and Meanook for corresponding days. The results confirmed the general law that the range becomes greater as the horizontal intensity decreases. The range on two successive days at the same station may be quite different, however, with practically no change in the horizontal force. The two stations, Resolution and Fort Smith illustrate this. For purposes of comparison stations A and B at Resolution may be considered identical, as the values of the force at the two places are practically the same. The diurnal range values at Meanook for the two days are 15'.2 and 22'.4, while at Resolution they are 28' and 37'; the ranges on the other two days are, at Meanook, 18'.2 and 9'.0, while at Fort Smith they are 30'.0 and 14'.5. These results are given in Table 12. It will be noticed that the ranges at Meanook are practically in the same ratio as at the field stations for corresponding days. From an examination of the results it was found that the relation between the range at Meanook and that at the field station for the same day is approximated by the expression,

$$d = d_m \times \frac{H_m}{H}$$

when d = range at field station, d_m = range at Meanook, H_m = the horizontal force at Meanook and H = horizontal force at the field station. Theoretical values of the range were accordingly computed for the days on which there were special observations. Table 12 contains, in addition to the observed values of the range at Meanook and the field stations, the values of the horizontal force H , at the field stations, the computed value of the range at the field stations and the difference between the computed and observed values of the range. The values adopted for the force at Meanook were .1290 c.g.s. for 1922 and .1288 c.g.s. for 1923. Better agreement might reasonably be expected if the principal phases, maximum and minimum, of the declination occurred simultaneously at the two stations. The greatest easterly (maximum) value of declination occurs, for example, at York Factory approximately 1.4h before the corresponding phenomenon at Meanook, and 2.9h in advance of that at Aklavik.

TABLE 12.—DIURNAL RANGE OF MAGNETIC DECLINATION AT FIELD STATIONS

Station	Date	Hor. Int.	Range of declination			Computed- Observed
			Meanook	Field Station		
				Computed	Observed	
	1922	c.g.s.	'	'	'	'
Fort St. John.....	May 22	.1329	16.6	16.1	17.0	-0.9
Dunvegan.....	" 30	.1272	14.5	14.7	14.5	+0.2
Browns Landing.....	June 9-10	.1215	14.3	15.2	15.2	0.0
Fort Vermilion.....	" 23-24	.1070	15.2	18.3	17.5	+0.8
Fifth Meridian.....	July 3-5	.1022	13.4	16.9	19.6	-2.7
Fitzgerald.....	" 21-22	.0868	10.1	15.0	15.0	0.0
Resolution, A.....	Aug. 2-3	.0858	15.2	22.8	28.0	-5.2
Resolution, B.....	" 3-4	.0858	22.4	33.7	37.0	-3.3
Chipewyan.....	" 17	.0958	13.8	18.6	19.6	-1.0

TABLE 12.—DIURNAL RANGE OF MAGNETIC DECLINATION AT FIELD STATIONS—*Concluded*

Station	Date	Hor. Int.	Range of declination			Computed- Observed
			Meanook	Field Station		
				Computed	Observed	
McMurray.....	Sept. 5-6	·1080	17·2	20·5	24·5	-4·0
Mile 100, H.B.R.....	May 19-20	·1008	15·0	19·2	20·0	-0·8
Kettle Rapids.....	June 1	·0780	18·0	29·8	27·0	+2·8
1923						
Kississing Lake.....	June 10	·0972	12·3	16·3	16·7	-0·4
McMurray.....	" 10	·1082	12·3	14·6	14·5	+0·1
Fort Smith.....	" 20	·0862	18·2	27·2	30·0	-2·8
Fort Smith.....	" 22-23	·0862	9·0	13·4	14·5	-1·1
Norman.....	July 20-21	·0888	12·0	17·4	17·8	-0·4
Good Hope.....	" 30	·0868	12·8	19·0	21·6	-2·6
McPherson.....	Aug. 10	·0912	16·0	22·6	22·0	+0·6
Churchill.....	" 10	·0610	16·0	33·8	28·5	+5·3
Aklavik.....	" 20	·0858	17·5	26·3	27·2	-0·9
York Factory.....	" 20	·0727	17·5	31·0	28·2	+2·8
The Rock.....	Sept. 4	·0842	12·5	19·1	21·5	-2·4
Swampy Lake.....	" 20	·0874	7·8	11·5	16·6	-5·1

DETERMINATION OF DIURNAL VARIATION CORRECTIONS

The problem of deriving corrections for diurnal variation is complicated for various reasons. The only data available, especially in the northern part of the country were obtained during field work; there was also the fact of the apparent difference of the diurnal variation for the same period of the day at stations where the horizontal force values differed by small amounts as in the case of Aklavik and York Factory. It was hoped that the errors in the finally adopted correction values would, to a certain extent, be neutralized when applied to the field data, owing to the precaution taken throughout to secure at each station observations spread over the greater part of the day.

Owing to the apparent difference between the type of diurnal variation in the vicinity of Hudson bay and that along Mackenzie river, while both differed from Meanook, the stations given in Table 11 were grouped as follows:—

Group 1.—Fort St. John, Dunvegan, Browns Landing, Fort Vermilion, Fifth Meridian, Fitzgerald, Fort Smith, Resolution, Chipewyan and McMurray.

Group 2.—Norman, Good Hope, McPherson and Aklavik.

Group 3.—Mile 100 H.B.R., Kettle Rapids, Kississing lake, Churchill, York Factory, The Rock and Swampy lake.

On plotting some of the hourly values of the diurnal variation given in Table 11 with respect to the horizontal force, it was seen that the resulting curve could be approximated by a straight line. It was accordingly assumed that the results for any hour could be represented by the linear expression, $d = d_0 + y (\cdot 1200 - H)$, where d_0 = the value of the variation when the value of H is $\cdot 1200$ c.g.s., and y = change in variation for change of $\cdot 0001$ c.g.s. Observation equations were formed for each hour and the unknowns deter-

mined by least squares. Values were determined for each .01 c.g.s. from .0600 c.g.s. to .1400 c.g.s. for Group 1; from .0600 c.g.s. to .1100 c.g.s. for Group 3; the results for Group 2 were derived by taking the mean of each hour, since the range of force, including all the stations, was small, the limits being .0852 c.g.s. and .0912 c.g.s. and the mean .0882 c.g.s. The results are represented graphically in Figures 23 to 28. From the smoothed curves were obtained the hourly values which are given in Tables 13, 14, and 15.

TABLE 13.—ADOPTED CORRECTIONS FOR DIURNAL VARIATION OF MAGNETIC DECLINATIONS AT FIELD STATIONS

(GROUP 1)

H L.M.T.	.0600	.0700	.0800	.0900	.1000	.1100	.1200	.1300	.1400
h.	'	'	'	'	'	'	'	'	'
1	+ 0.4	+ 0.2	0.0	- 0.2	- 0.4	- 0.8	- 1.0	- 1.5	- 1.3
2	- 1.6	- 1.4	- 0.9	- 0.9	- 0.6	- 0.6	- 0.4	- 0.2	+ 0.1
3	- 4.0	- 3.4	- 2.8	- 2.2	- 1.2	- 0.2	+ 0.6	+ 0.6	+ 1.8
4	- 0.8	- 5.6	- 5.0	- 4.1	- 3.3	- 2.0	- 0.8	- 1.2	+ 0.4
5	- 9.4	- 8.2	- 7.4	- 6.3	- 6.0	- 5.8	- 4.4	- 4.8	- 3.2
6	-12.2	-10.8	-10.4	- 8.0	- 9.0	- 8.4	- 7.8	- 7.8	- 6.6
7	-14.6	-13.4	-13.2	-12.4	-11.5	-10.8	-10.4	- 9.2	- 9.0
8	-15.6	-14.8	-14.4	-13.6	-12.4	-11.2	-10.1	- 9.0	- 8.1
9	-13.8	-12.4	-12.1	-11.0	-10.2	- 9.0	- 8.0	- 7.4	- 6.2
10	- 8.2	- 7.2	- 7.1	- 6.1	- 5.6	- 5.2	- 5.2	- 5.2	- 4.0
11	- 3.0	- 2.1	- 2.0	- 2.2	- 1.9	- 1.7	- 2.0	- 2.0	- 1.4
12	+ 2.2	+ 2.2	+ 2.0	+ 1.6	+ 2.0	+ 2.0	+ 1.6	+ 1.8	+ 2.0
13	+ 7.6	+ 6.7	+ 5.2	+ 5.4	+ 5.4	+ 5.3	+ 4.6	+ 4.2	+ 3.8
14	+ 9.8	+ 9.1	+ 8.2	+ 8.0	+ 7.5	+ 6.8	+ 6.3	+ 5.7	+ 4.4
15	+10.4	+ 9.7	+ 9.1	+ 8.8	+ 7.8	+ 7.2	+ 6.6	+ 6.0	+ 5.2
16	+ 9.4	+ 9.0	+ 8.3	+ 8.0	+ 7.6	+ 6.8	+ 6.4	+ 5.8	+ 5.6
17	+ 7.8	+ 7.5	+ 7.2	+ 6.8	+ 6.4	+ 6.0	+ 5.6	+ 5.2	+ 4.8
18	+ 6.4	+ 6.1	+ 6.0	+ 5.2	+ 5.3	+ 4.8	+ 4.4	+ 4.0	+ 3.8
19	+ 5.0	+ 4.7	+ 4.4	+ 3.9	+ 3.6	+ 3.0	+ 2.4	+ 2.0	+ 1.8
20	+ 3.8	+ 3.4	+ 3.2	+ 2.4	+ 1.8	+ 1.5	+ 1.0	+ 0.6	+ 0.0
21	+ 2.8	+ 2.2	+ 1.8	+ 1.2	+ 0.7	+ 0.3	- 0.3	- 0.8	- 1.4
22	+ 2.4	+ 1.4	+ 0.8	0.0	- 0.4	- 0.4	- 1.0	- 2.0	- 3.2
23	+ 1.8	+ 0.8	+ 0.2	- 0.3	- 1.0	- 1.6	- 2.0	- 2.4	- 4.7
24	+ 1.4	+ 0.5	0.0	- 0.4	- 1.0	- 2.0	- 2.8	- 2.2	- 4.8

TABLE 14.—ADOPTED CORRECTIONS FOR DIURNAL VARIATION OF MAGNETIC DECLINATION AT FIELD STATIONS

(GROUP 2)

L.M.T.		Correction	L.M.T.		Correction
h.		'	h.		'
1.....		+ 3.4	13.....		+ 5.2
2.....		+ 3.4	14.....		+ 7.4
3.....		+ 2.0	15.....		+ 8.5
4.....		- 1.8	16.....		+ 8.6
5.....		- 6.9	17.....		+ 8.0
6.....		-10.5	18.....		+ 7.0
7.....		-12.6	19.....		+ 6.3
8.....		-12.6	20.....		+ 5.4
9.....		-11.0	21.....		+ 4.6
10.....		- 7.3	22.....		+ 4.2
11.....		- 3.0	23.....		+ 4.0
12.....		+ 1.8	24.....		+ 3.8

TABLE 15.—ADOPTED CORRECTIONS FOR DIURNAL VARIATION OF MAGNETIC DECLINATION AT FIELD STATIONS

(GROUP 3)

H L.M.T.						
	.0600	.0700	.0800	.0900	.1000	.1100
h.	'	'	'	'	'	'
5.....	-11.9	-10.4	- 8.9	- 7.3	- 5.8	- 4.3
6.....	-15.6	-13.8	-12.1	-10.3	- 8.6	- 6.8
7.....	-16.1	-14.7	-13.2	-11.8	-10.4	- 8.8
8.....	-15.0	-13.7	-12.4	-11.1	- 9.8	- 8.5
9.....	-10.8	- 9.7	- 8.7	- 7.6	- 6.6	- 5.6
10.....	- 2.2	- 2.4	- 2.6	- 2.8	- 3.1	- 3.3
11.....	+ 5.7	+ 4.2	+ 2.8	+ 1.3	- 0.2	- 1.2
12.....	+10.8	+ 8.8	+ 6.6	+ 4.8	+ 2.8	+ 0.8
13.....	+12.5	+10.5	+ 8.5	+ 6.5	+ 4.5	+ 2.8
14.....	+ 8.8	+ 8.1	+ 7.4	+ 6.7	+ 6.0	+ 5.3
15.....	+ 4.0	+ 4.5	+ 5.0	+ 5.4	+ 6.9	+ 6.4
16.....	+ 1.5	+ 2.4	+ 3.3	+ 4.2	+ 5.1	+ 6.0
17.....	+ 0.6	+ 1.4	+ 2.1	+ 2.8	+ 3.5	+ 4.4
18.....	- 0.4	+ 0.3	+ 0.9	+ 1.5	+ 2.1	+ 2.7
19.....	- 0.3	- 0.1	+ 0.2	+ 0.4	+ 0.7	+ 1.0
20.....	- 0.3	- 0.4	- 0.5	- 0.6	- 0.8	- 0.8

TABLE 16.—ADOPTED CORRECTIONS FOR DIURNAL VARIATION OF MAGNETIC DECLINATION AT FIELD STATIONS, SEPTEMBER AND OCTOBER, 1922, DERIVED FROM MEANOOK DATA

L.M.T.	Correction		L.M.T.	Correction	
	Sept.	Oct.		Sept.	Oct.
1.....	- 1.9	- 1.9	13.....	+ 4.7	+ 3.1
2.....	- 1.3	- 3.5	14.....	+ 4.7	+ 2.7
3.....	- 2.5	- 6.3	15.....	+ 3.7	+ 1.9
4.....	- 5.5	- 5.6	16.....	+ 2.7	+ 1.1
5.....	- 7.5	- 3.9	17.....	+ 1.8	+ 0.1
6.....	- 8.5	- 4.2	18.....	+ 0.3	- 0.6
7.....	- 8.3	- 3.9	19.....	- 0.2	- 1.3
8.....	- 6.8	- 3.3	20.....	- 1.0	- 2.0
9.....	- 4.5	- 3.2	21.....	- 1.8	- 2.5
10.....	- 1.7	- 2.0	22.....	- 2.5	- 2.1
11.....	+ 1.0	+ 1.1	23.....	- 3.3	- 1.0
12.....	+ 3.5	+ 3.0	24.....	- 2.7	- 1.3

TABLE 17.—COMPARISON OF HOURLY VALUES OF DIURNAL VARIATION OF MAGNETIC DECLINATION FOR THE SAME HORIZONTAL FORCE

Force	.1290 c.g.s.		.0882 c.g.s.	
	Table 13	Meanook	Table 13	Table 14
Source				
L.M.T.				
h.				
1.....	+ 1.5	+ 0.7	+ 0.1	- 3.4
2.....	+ 0.2	+ 0.5	+ 0.9	- 3.4
3.....	- 0.6	+ 0.6	+ 2.4	- 2.0
4.....	+ 1.2	+ 1.1	+ 4.4	+ 1.8
5.....	+ 4.8	+ 3.0	+ 6.7	+ 6.9
6.....	+ 7.8	+ 5.8	+ 8.6	+10.5
7.....	+ 9.3	+ 7.3	+12.6	+12.6
8.....	+ 9.1	+ 7.9	+13.8	+12.6
9.....	+ 7.5	+ 7.0	+11.3	+11.0
10.....	+ 5.2	+ 4.8	+ 6.8	+ 7.3
11.....	+ 2.0	+ 2.6	+ 2.2	+ 3.0
12.....	- 1.8	- 1.6	- 1.7	- 1.8
13.....	- 4.2	- 4.1	- 5.4	- 5.2
14.....	- 5.8	- 5.3	- 8.0	- 7.4
15.....	- 6.1	- 5.4	- 8.9	- 8.5
16.....	- 5.9	- 4.8	- 8.1	- 8.6
17.....	- 5.2	- 3.8	- 6.9	- 8.0
18.....	- 4.0	- 2.8	- 5.4	- 7.0
19.....	- 2.0	- 1.6	- 4.0	- 6.3
20.....	- 0.6	- 0.4	- 2.6	- 5.4
21.....	+ 0.8	+ 0.4	- 1.4	- 4.6
22.....	+ 1.9	+ 0.4	- 0.2	- 4.2
23.....	+ 2.4	+ 0.7	0.0	- 4.0
24.....	+ 2.3	+ 0.6	+ 0.1	- 3.8

¹ A plus (+) sign indicates that the north end of the magnet is east of the mean position for the day.

The results in Table 13, derived from Group 1, were applied as corrections to the observations taken at stations along Peace, Slave and Athabaska rivers in 1922 and 1923. The corrections in Table 14, which were derived from Group 2, were applied to Mackenzie river stations all of which were occupied in 1923, and those in Table 15 were applied to stations in the vicinity of Hudson bay occupied in May, June, July, August and September, 1922 and 1923. The results in Table 16 were applied to observations taken at stations in the vicinity of Meanook in September and October, 1922.

These corrections are, of course, only *average* values. Theoretically, each month should be considered separately, inasmuch as the variation differs from month to month. This was impossible considering the available data. While the corrections may not be strictly applicable in all cases the errors introduced on this account, it is believed, will be small, especially in comparison with the errors due to disturbance effects which, under present conditions, cannot be eliminated.

Table 17 contains the hourly values of the diurnal variation (hourly value—mean of hourly values from 7h to 18h) derived from Table 13 for the force $\cdot 1290$ c.g.s. This force corresponds to that at Meanook. The corresponding Meanook values are also tabulated and represent the average values for June, July and August for the two years. It also contains values obtained from Table 13 corresponding to the force $\cdot 0882$ c.g.s. and the values from Table 14. The results derived from the tables for the force corresponding to that at Meanook are in good agreement with those obtained from the Meanook records especially in view of the fact that the former were determined from field observations. For the force $\cdot 0882$ c.g.s. the results are in good agreement for the period 5h to 17h but for the remaining part of the day the results indicate a change in the diurnal variation which is peculiar, doubtless, to the locality. Another test of the reliability of the correction values may be obtained from a comparison between the mean values for the stations which are given in Table 11 and the mean adopted values for the corresponding stations as given in the summary of the results for all the stations. It is found that, of the twenty-three stations, only three showed differences exceeding $1'$. The stations and amounts are as follows: Fort Smith, $+2' \cdot 4$ on June 20 and $-1' \cdot 0$ on June 22; McPherson, $+1' \cdot 5$; and Churchill, $+1' \cdot 1$.

INCLINATION OBSERVATIONS

Inclination was determined according to the usual method employed when using a dip circle. After levelling the instrument, re-magnetizing the needle and determining the magnetic meridian, the observation is carried on as follows:—

(1) With vertical circle east, face of needle east and A-end of needle up, bisect the upper end of the needle then the lower end and read the circle corresponding to each setting. Repeat the two settings.

(2) Turn instrument through 180° and repeat the observations with circle west and face of needle west, as in (1).

(3) Reverse the needle on the agate planes and, with circle west and face of needle east, observe as in (1).

(4) Turn instrument 180° in azimuth and with circle east observe as in (1).

(5) Reverse the polarity of the needle; the end marked B will now be up.

(6), (7), (8), (9). With B-end of needle up, repeat the observations as in (1), (2), (3) and (4).

The mean of all these readings gives the resulting dip.

It was the rule, however, to observe using the needles in pairs and in such a way that the mean time with each needle was approximately, if not exactly, the same. To do this operations (1) to (4) were carried out with the first needle then (1) to (9), or a complete determination, with the second needle, and finally (5) to (9) with the first needle.

During 1921 inclination observations were taken quite consistently both in the forenoon and afternoon, as in previous years,¹ at about the same times at each station. The adopted value for each station is, therefore, the mean of the forenoon and afternoon determinations. In cases where one observation, only, was obtained a small correction was applied on account of diurnal variation, the correction being obtained from stations occupied before and after the one in question. With regard to the observations of 1922 and 1923 there was not the same uniformity in the method as in previous years; observations were distributed over a greater period of the day, especially in 1922 though not to the same extent in 1923. Disturbance effects contributed to the difficulty of determining satisfactory correction values for this element. From an analysis of the results there is, however, evidence of a diurnal change of inclination. The maximum inclination occurs about 10h and decreases until a minimum is reached about 16h, the magnitude of the change being about, but not exceeding, 3'. The error introduced, however, in the mean value by simply taking the observed values without applying any correction will be small. The maximum error of any observation, if the results were referred, as in previous years, to the mean of observations taken in the forenoon and afternoon, will probably not exceed 1'.5. At most of the stations there was a fairly well distributed number of observations so that the errors on account of diurnal variation will be reduced, and the final result will probably differ very little from that obtained by applying corrections for diurnal variation.

HORIZONTAL INTENSITY OBSERVATIONS

The horizontal intensity was determined according to the usual method.² This involves two operations, oscillations and deflections. The purpose of observing oscillations is to ascertain the time it takes a suspended magnet to complete one vibration. The approximate time of one oscillation is first determined for the purpose of estimating the time of any particular transit. The program as arranged is to observe every fifth transit of the magnet over the centre line of the telescope from 0 to 45, then from n to $n+45$ where n is some multiple of 10; the selection of the number for the beginning of the second part is quite arbitrary, and very seldom exceeds 100. This furnishes ten determinations of n oscillations, from which the time of one oscillation is determined. Corrections for rate, torsion, temperature and induction are applied. The product of the magnetic moment, M , of the magnet and the horizontal component of the earth's intensity, H , is then determined from the fundamental equation:—

$$MH = \frac{\pi^2 K}{T^2}$$

where K = the moment of inertia of the magnet

T = time of one oscillation of the magnet after all corrections have been applied.

¹ Publications of the Dominion Observatory, Vol. V, No. 5, p. 243.

² For reference to the theory and methods of magnetic measurement see Publications of the Dominion Observatory, Vol. V, No. 5, p. 137; Land Magnetic Observations, 1905—10, p. 23, by L. A. Bauer, Carnegie Institution, Washington, D.C.; Directions for Magnetic Measurements, pp. 75-76, by Daniel L. Hazard, Government Printing Office, Washington, D.C., 1911.

Deflections involve the determination of the angle a magnet is turned out of the meridian by the intensity magnet, which is set at a known distance from the suspended magnet. As a rule angles were determined for three distances, though all observations with Tesdorpf magnetometer No. 1977 were taken with the magnet at two distances. From the deflections is determined the ratio of the horizontal force of the earth's magnetism to the magnetic moment of the deflecting magnet, the formula for computing this being:—

$$\frac{H}{M} = \frac{C}{\sin u}$$

where u = the angle of deflection

C = a constant for a constant temperature and a fixed deflection distance, and is equal to

$$\frac{2}{r^3} \left(\frac{1 + \frac{P}{r^2} + \dots}{1 + \frac{2\mu}{r^3}} \right)$$

where P is a constant depending upon the distribution of the magnetism in the intensity magnet; r is the deflection distance and μ the induction factor.

From the two equations, $MH = \frac{\pi^2 K}{T^2}$ and $\frac{H}{M} = \frac{C}{\sin u}$, the value of H may be found.

The mean horizontal intensity result at each station in 1921 was obtained by taking the mean of the morning and afternoon observations. The observations were also taken at approximately the same times at all stations. When only one observation was obtained the observation was corrected for diurnal variation. In the case of observations taken in 1922 and 1923 no corrections were applied. The results showed that the horizontal force increases from morning to afternoon, the average observed range being about 26γ , the minimum value occurring about 10.5h and the maximum about 17h. As the corrections determined from the field observations are necessarily only approximate, and the magnitude comparatively small in comparison with disturbance effects, it was thought not worth while to apply corrections on account of diurnal variation.

DETERMINATION OF TOTAL INTENSITY BY LLOYD'S METHOD

Lloyd's method¹ for determining total intensity with a dip circle was employed at a number of stations during the season of 1922. The formula, $F = C \sqrt{\cos I' \operatorname{cosec} u \operatorname{cosec} u'}$ was used in the computation of results, where F is the total intensity, I' is the angle of dip with the loaded needle, $u' = I - I'$, u is the angle of deflection and C the instrumental constant determined at the base station. The value of the horizontal force is computed from the formula $H = F \sin I$, where I is the inclination and H the horizontal force.

The value of the inclination, I , may be obtained from the deflection observations. This value was not used, however, in the computation. The inclination was determined in every case from observations with the regular dip needles. Observations for total inten-

¹ For reference to the method the following publications, among others, may be mentioned: The Admiralty Manual of Scientific Enquiry, London, 1886, pp. 115, 116; Directions for Magnetic Measurements, by Daniel L. Hazard, Government Printing Office, Washington, D.C., 1911, pp. 21, 22 and 81-85.

sity were carried out in practically the same manner as at the base station when determining the instrumental constant, and in the following order:—

- (1) Dip with needles No. 1 and No. 2, and with B-end of needle down.
- (2) Dip with loaded needle with circle east and face of needle east, circle west and face of needle west, circle west and face of needle east, and finally circle east and face of needle west.
- (3) Deflections with circle east, face of needle east and microscope direct and reversed, circle west, face of needle west and microscope reversed and direct.
- (4) Turn suspended magnet about on its bearings and observe as in (3).
- (5) Dip with loaded needle as in (2).
- (6) With A-end of dip needles No. 1 and No. 2 down, observe as in (1), though in the reverse order.

SUMMARY OF MAGNETIC RESULTS

The custom has prevailed during recent years, in the publication of the magnetic results of the Dominion Observatory, of restricting the magnetic data to include mean values only. The results of 1921 were compiled in accordance with the usual procedure. With regard to the results of the years 1922 and 1923 it was found that discrepancies among the individual values, especially of declination, were much more in evidence after all corrections were applied than among corresponding values obtained in previous years. This was, however, not very surprising in view of the fact that results were obtained in regions of comparatively high magnetic latitude, even extending into those of maximum auroral frequency, where probably there would result a corresponding magnetic disturbance effect. Furthermore, the same uniformity in the methods of observing was not followed as in 1921 and preceding years. In order, therefore, to better demonstrate this phase of the work, as well as to furnish an idea of the accuracy of the results, the decision was reached to present the data somewhat more in detail. Even though uniformity in the publication of the results is sacrificed it was decided to give the data obtained in 1921 as originally intended.

The observations for the period 1921-1923 are grouped according to years. The stations for each year are arranged in order of increasing west longitude. For each station there are given the values of the latitude and longitude, the date, the mean value of the three elements, declination, inclination and horizontal intensity, as well as the instrument number and the observer.

The results for 1922 and 1923 include columns in which are entered local mean times to the nearest 0.1h, followed by a value of the element. Where, for example, four values of time precede a value of declination the inference is that the value given is the mean of observations taken at the times indicated. In some cases there is given the time of beginning and time of ending of what may be either a continuous set of readings at uniform intervals, or a number of sets taken in the ordinary way and distributed fairly uniformly over the interval, followed by a bracketted number. This number indicates either the actual number of sets entering into the result, or the weight to be assigned to the result in deriving a mean value for the station. Inclination values are, at most stations, grouped, but in a slightly different manner. Corresponding to each value representing the time is given one value of inclination. Where such a value is followed by two numbers in the

column headed "needle" the indication is that the value is the mean of two, determined with the respective needles. As in declination results, the number of values of time preceding a horizontal intensity result indicates the number of sets entering into the result.

A mean value for each element at all stations is given in the summary. The results from which the means are derived are weighted in all cases with the exception of the horizontal intensity. It will be noted that certain values of this element are given in italics, indicating that they were derived from total intensity observations by Lloyd's method, and further, were not taken into consideration when deriving the mean. The mean value of the horizontal intensity was, therefore, obtained from values determined with the magnetometer.

The total intensity observations were taken mainly to test the accuracy of the results determined by Lloyd's method under actual field conditions of observing. The results are not entirely satisfactory inasmuch as the program of observing was not arranged so as to eliminate possible disturbance effects. This would have necessitated simultaneous observations with the two instruments. Lloyd's method, however, is supposed under ordinary conditions of observing to yield results which are not equal in accuracy to those obtained with a magnetometer. On the other hand as the magnetic pole is approached, accurate observations with a magnetometer become more difficult. An analysis of the results in the summary reveals discrepancies which are in excess of the combined effect due to diurnal change and error of observation with a magnetometer, yet not large in comparison with possible disturbance effects. The conclusion is reached, however, that the magnetometer gives results, at least so far as the present investigation is concerned, which are superior in accuracy to those obtained with the dip circle by Lloyd's method.

SELECTION AND DESCRIPTIONS OF STATIONS

The usual consideration was given to the selection and description of stations. One of the main things to be considered in the selection of a station is the probable suitability for future observations. The site must also be free from artificial disturbance. Having made the selection the description should be sufficiently complete in order that its recovery at a future date may be readily made. When possible the point is connected by linear measurements to some well-defined and permanent marks, and bearings of some prominent objects, referred to the meridian, are determined. As an additional aid in relocating the station a mark of some kind is left in the ground to indicate the precise point of observation. Frequently a wooden peg is used but it is desirable, when possible, to have material of a more permanent nature such as a brick, a stone or a concrete block.

The general form adopted for the descriptions is: name of station, province in which it is located, year occupied and the general description including details of linear and angular measurements and marking of the station.

In order to obtain the desired number of magnetic stations along the water routes followed during the seasons of 1922 and 1923, many places were selected which were not in the vicinity of villages or towns. On this account they could not be designated according to the usual custom. Nor was it always convenient to select a station at a point which could be readily associated with some natural feature such as a river, or creek, tributary to the main waterway. Fortunately, there were available maps showing the

results of the operations of the Topographical Surveys Branch of the Interior Department. Along Peace river, with the aid of these maps, it was comparatively easy to locate survey lines, such as base lines and lines marking the boundaries of townships at their intersection with the river. This organization has, also, quite recently completed a survey of part if not all, of Slave, Mackenzie and Athabaska rivers. Maps were available for the Slave and part of the Mackenzie at the time the magnetic work was being done along the rivers. Stations were selected in the vicinity of permanent survey monuments and designated so as to correspond to the marking of the monuments. Thus, a station occupied in the vicinity of survey monument which is marked "T 22" is designated "T.S. Monument T 22." Other stations chosen near these survey marks are similarly designated.

In localities where no surveys have been made an effort was always made to select some point that had some distinguishing feature, or was well known locally, so that its recovery would be comparatively easy.

The stations are arranged alphabetically.

MAGNETIC OBSERVATIONS, 1921

Station	Lat.	Long.	Date	Declination	Inclination	Hor. Int.	Instrument		Obs'r.
							Mag'r.	D.C.	
Louisburg.....	45 54.8	59 57.9	Sept. 1, 5	West 26 27.2	73 59.1	15608	20	20	F
Louisburg (Lighthouse Reserve).....	45 54.2	59 57.9	" 3	26 24.8	74 03.2	15532	20	20	F
Sydney.....	46 08.8	60 11.6	Aug. 20-22	25 59.4	74 00.2	15602	20	20	F
Sydney (C.I. station).....	46 08.8	60 11.6	" 22	25 59.2	.....	15586	20	20	F
Ingonish, South Bay.....	46 38.8	60 24.4	" 27-29	25 55.8	74 08.4	15605	20	20	F
Dingwall.....	46 55.0	60 28.5	" 24-26	26 51.4	74 30.2	15245	20	20	F
Grand Narrows.....	45 57.0	60 47.4	Sept. 6, 7	25 42.7	73 54.4	15742	20	20	F
Inverness.....	46 14.5	61 16.7	" 12	26 14.5	74 12.0	15724	20	20	F
Mulgrave, A.....	45 36.3	61 23.3	" 9, 10	24 50.7	73 37.1	16038	20	20	F
Mulgrave, C.....	45 36.3	61 23.3	" 8, 9	24 50.1	73 36.9	16040	20	20	F
Port Hood.....	46 01.0	61 31.7	" 14	25 09.7	74 03.8	15644	20	20	F
Grindstone, Magdalen Islands.....	47 22.4	61 51.1	" 20-23	26 29.4	75 04.2	14768	20	20	F
Amherst, Magdalen Islands.....	47 14.2	61 51.1	" 23, 24	26 51.4	75 02.3	14791	20	20	F
Souris.....	46 21.6	62 14.0	" 26, 27	24 35.0	74 25.4	15444	20	20	F
Pictou.....	45 40.9	62 44.0	" 16, 17	23 54.4	76 12.5	15682	20	20	F
Charlottetown.....	46 14.0	63 07.4	" 28-30	24 28.2	74 43.0	15213	20	20	F
Borden.....	46 15.0	63 40.5	Oct. 5, 6	24 04.7	74 58.9	14951	20	20	F
Summerside.....	46 24.4	63 46.8	" 1	23 47.2	74 58.3	14940	20	20	F
Tignish.....	46 56.4	64 02.2	" 3	24 41.6	75 30.8	14476	20	20	F
Cap des Rosiers.....	48 51.6	64 12.0	" 18-20	26 14.7	76 09.6	13920	20	20	F
Grand River.....	48 24.1	64 29.1	" 13	26 10.4	76 03.7	13978	20	20	F
Gaspé Basin.....	48 49.6	64 30.0	" 14, 15	26 02.8	76 10.7	13918	20	20	F
Magdalen River.....	49 15.3	65 19.8	" 22-25	27 00.8	76 33.4	13676	20	20	F
New Carlisle.....	48 00.5	65 20.5	" 11	25 11.5	75 58.0	14110	20	20	F
Mont Louis.....	49 14.0	65 44.0	" 26, 27	25 56.9	76 42.8	13559	20	20	F
New Richmond.....	48 10.3	65 52.0	" 9, 10	25 48.8	76 15.8	13888	20	20	F
Cape Chat.....	49 06.7	66 41.8	" 28, 29	25 24.1	76 51.4	13399	20	20	F
Matapédia.....	47 58.5	66 57.0	" 7, 8	23 50.2	76 18.4	13870	20	20	F
Matane.....	48 51.7	67 33.4	" 30, 31	25 08.2	76 46.8	13546	20	20	F
Megantic.....	45 35.7	70 52.7	Sept. 12	17 51.8	75 30.3	14799	1977	145	M
Lyster.....	46 22.5	71 36.0	" 18-21	18 17.2	75 54.8	14505	1977	145	M
Sherbrooke, B.....	45 25.5	71 56.8	" 29-						
			Oct. 1	15 34.0	75 14.2	15425	1977	145	M
Victoriaville.....	46 04.3	71 58.0	Sept. 26-28	16 57.8	76 03.8	14334	1977	145	M
Stanstead.....	45 02.4	72 06.4	Oct. 3, 5	15 58.2	74 58.8	15311	1977	145	M
Richmond.....	45 40.5	72 08.0	Sept. 6-9	19 03.5	74 56.8	15513	1977	145	M
Sutton.....	45 06.5	72 35.3	Oct. 8, 9	16 42.5	74 48.5	15599	1977	145	M
St. Johns.....	45 19.1	73 15.2	Sept. 2, 3	15 55.7	75 53.0	14611	1977	145	M
Lacolle.....	45 06.1	73 20.4	Aug. 25, 26	15 31.6	75 47.5	14554	1977	145	M
Huntingdon.....	45 05.6	74 10.3	" 29-31	13 35.8	75 53.8	14723	1977	145	M
Ste. Agathe des Monts	46 04.8	74 17.8	Oct. 13, 14	12 47.7	76 40.2	13695	1977	145	M
Morrisburg.....	44 54.4	75 09.6	Aug. 22-24	13 00.9	75 30.1	15213	1977	145	M
Prescott.....	44 43.4	75 30.0	" 15-20	10 56.4	76 14.7	14338	1977	145	M
Mont Laurier.....	46 33.8	75 30.4	Oct. 17-19	10 30.9	76 32.9	14222	1977	145	M
Ottawa.....	45 23.6	75 43.0	June 13-16	13 49.6	75 38.3	14848	20	20	F
Ottawa.....	45 23.6	75 43.0	Aug. 5-8	13 50.5	75 38.4	14831	20	20	F
Tweed.....	44 30.1	77 18.6	Oct. 25-27	12 27.4	75 32.4	14878	1977	145	M
Coe Hill.....	44 51.3	77 50.2	" 28-30	13 07.4	75 56.2	14650	1977	145	M
Bancroft.....	45 04.7	77 52.4	Nov. 1-3	9 45.7	76 16.5	14366	1977	145	M

MAGNETIC OBSERVATIONS, 1922

Station	Lat.	Long.	Date	Declination				Inclination			Hor. Int.			Mag'r.	D.C.	Obs'r.		
				L.M.T.		Value	L.M.T.	Value	Needle	L.M.T.		Value						
				h.	h.	h.	h.	West °	h.	°		h.	h.				γ	
Ottawa.....	45 23.6	75 43.0	April 25	8.6	to	16.8	(4)	13 56.7	10.8	75 39.4	1, 2			20	20	F		
			" 26						15.9	37.7	5, 6				20	20	F	
			" 26	8.7	to	16.5	(5)	53.6	10.1	39.8	1				20	20	F	
			" 26						15.5	35.1	2				20	20	F	
			" 27	11.1	to	16.3	(8)	52.1					12.1 14.8	14834	20	20	F	
			" 28	9.8	to	14.1	(8)	54.2					10.7 11.7	14814	20	20	F	
			" 28										14.6 15.7	14835	20	20	F	
			" 29	8.2	8.3			55.2					9.3 10.1	14812	20	20	F	
						Mean.....				13 53.9		75 38.2			14824			
			Ottawa.....	45 23.6	75 43.0	Oct. 17	13.6	14.4	15.4	13 57.8	14.9	75 42.2	5, 6	14.0	14813	20	20	F
" 18	8.1	to				16.0	(6)	56.9	9.5	40.8	6, 1	10.3 11.7	14796	20	20	F		
" 18									15.5	39.8	1, 2	14.2 15.0	14814	20	20	F		
" 19	8.1	to				13.7	(5)	57.3	10.4	38.9	2, 5	10.6 11.7	14792	20	20	F		
" 19													13.9	14804	20	20	F
						Mean.....				13 57.2		75 40.4			14803			
Kettle Rapids.....	56 24.0	94 33.0	May 31	17.9	20.1	20.8	....	7 00.5						19	....	M	
			June 1	5.7	6.4	8.5	9.2	05.6	10.6	82 58.5	6				19	19	M	
			" 1	10.2	11.2	12.2	14.4	01.2	11.8	83 01.5	2				19	19	M	
			" 1	15.6	16.6	17.6	18.5	00.4	14.2	82 59.4	3				19	19	M	
			" 1						16.2	58.8	4	17.7	....	07773	19	19	M
			" 3										19.4	07816	19	19	M
			" 4										13.3 14.5	07788				
			Mean.....				7 02.0		82 59.6			07791						
Mile 295, H. B. R.....	56 07.4	95 24.0	June 5	16.8	17.0	17.7	17.9	10 29.1						19	....	M	
			" 6	6.2	6.3	10.0	10.2	23.3	8.4	82 46.4	2, 6	14.3 15.5	07958	19	19	M		

			"	6	13.8 15.9	23.0							19		M
					Mean.....	10 25.6		82 46.4				07958			
Mile 279 (Landing River), H. B. R.....	56 01.7	95 45.0	June	8	11.4 11.6 13.9	10 44.3	14.0	82 43.8	3	18.4		08065	19	19	M
			"	8	18.0 20.9	46.3	14.5	43.0	4				19	19	M
			"	9	7.1	43.9				7.5		07926	19		M
					Mean.....	10 44.9		82 43.4				07996			
Mile 254, H. B. R.....	55 55.1	96 18.0	May	27	7.0 8.5 9.3	12 10.1	7.9	82 08.2	2, 6	10.2 11.1		08570	19	19	M
			"	27	11.6 15.5 17.3	11.6				16.5		08636	19		M
			"	28	9.2 16.5 17.6	10.7	10.1	10.8	3, 4	11.1 15.6		08574	19	19	M
					Mean.....	12 10.8		82 09.5				08585			
Mile 226 (Armstrong Lake), H. B. R.....	55 41.6	96 54.6	June	11	19.6	13 14.0	20.3	82 10.5	3, 4				19	19	M
			"	12	8.8 9.0 10.7 10.9	15.8				9.8 10.3		08554	19	19	M
					Mean.....	13 15.4		82 10.5				08554			
Mile 200, H. B. R.....	55 26.8	97 22.0	May	24	5.5 6.5 7.5 9.4	14 04.3	8.4	81 55.9	2	10.9		08916	19	19	M
			"	24	10.0 11.5 12.5 13.5	13 59.1	9.5	52.7	6	14.2		08911	19	19	M
			"	24	15.4 16.3 17.5 18.5	14 01.3	16.1	50.5	3	18.5		08926	19	19	M
			"	24	19.7	13 58.0	17.1	50.3	4				19	19	M
					Mean.....	14 01.3		81 52.4				08918			
Mile 200, H. B. R.....	55 26.8	97 22.0	June	13	17.0 19.8	14 01.2	19.0	81 47.8	2, 3				19	19	M
			"	14			8.2	51.6	6, 4	9.9 10.6		08910	19	19	M
					Mean.....	14 01.2		81 49.7				08910			
Mile 150, H. B. R.....	55 02.2	98 24.5	May	21	16.2 19.2	14 27.2	17.9	81 20.2	3, 4				19	19	M
			"	22	6.3 6.8 7.4	36.6	8.1	35.8	6, 2	10.5 10.9		09202	19	19	M
			"	22	9.7 11.6	28.8							19		M
					Mean.....	14 31.7		81 28.0				09202			

MAGNETIC OBSERVATIONS, 1922 (continued)

Station	Lat.	Long.	Date	Declination					Inclination			Hor. Int.		Mag'r.	D.C.	Obs'r.	
				L.M.T.				Value	L.M.T.	Value	Needle	L.M.T.	Value				
				h.	h.	h.	h.	East °	h.	°	'	h.	h.				γ
Mile 150, H. B. R.....	55 02.2	98 24.5	June 15	9.6	11.0	13.2	16.0	14 29.0	10.3	81 36.0	3, 6	13.7 14.1	09206	19	19	M	
			" 15					15.4	32.7	2, 4					19	19	M
			Mean.....					14 29.0	81 34.4				09206				
Mile 100, H. B. R.....	54 35.9	99 20.0	May 19	7.7	8.3	13.4	14.4	14 48.2	9.5	80 48.0	3	14.4 17.5	10098	19	19	M	
			" 19	15.4	16.4	18.0	19.6	48.4	15.9	43.8	6			19	19	M	
			" 19						16.8	45.8	6				19	19	M
			" 20	5.2	5.8	6.8	7.8	49.6				6.1 10.5	10017	19		M	
			" 20	8.4	9.6	11.4		51.0							19		M
Mean.....					14 49.2	80 45.9				10058							
Mile 100, H. B. R.....	54 35.9	99 20.0	June 17	9.4	11.2			14 47.4	7.1	80 47.6	4	10.2 10.9	10027	19	19	M	
			" 17						9.0	49.8	3				19	19	M
			" 17						13.5	46.6	4, 2				19	19	M
			Mean.....					14 47.4	80 47.6				10027				
Nueltin Lake Narrows.....	60 10.4	99 44.2	Aug. 17	10.6	12.8	13.4		18 05.6	11.5	84 18 0	3, 6	17.1 18.1	06189	19	19	M	
			" 17	16.3	18.7			17 57.3	19.9	18.6	2, 4				19	19	M
			" 18	7.8	8.6	9.2		18 05.8							19		M
			Mean.....					18 03.6	84 18.3				06189				
Nueltin Lake.....	59 51.6	100 05.2	Aug. 13	6.7	7.6	8.6	9.6	22 18.4						19		M	
			" 13	10.6	11.5	12.5	13.7	15.4							19		M
			" 13	14.6	15.6	16.6	17.6	21 56.0							19		M
			" 13	18.6	19.6			43.6							19		M
			" 14	13.5	14.2	16.4		40.0	15.4	84 39.0	4, 2	17.5		05779	19	19	M
			" 19	16.4				47.4	19.7	39.4	6, 3	17.4 18.5	05827	19	19	M	
Mean.....					22 00.8	84 39.2				05811							

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Mile 42, H. B. R.....	54 13.6	100 30.0	June 18	18.5 18.7	16 36.3	19.5	80 28.8	2, 4	19	19	M		
			" 19	7.5 9.1 9.8	37.2	7.9 8.6	10830	19	M			
				Mean.....	16 36.8	.....	80 28.8	.....	.....	10830			
Husky Portage.....	59 50.5	100 44.0	Aug. 29	7.5 8.2 9.6 10.1	13 53.5	8.8	83 59.4	4	18.9	06609	19	19	M		
			" 29	11.5 13.0 13.5 14.2	45.0	10.8	50.7	2	.....	.....	19	19	M
			" 29	15.7 16.5 17.5 18.3	14 03.2	16.5	42.0	3	.....	.....	19	19	M
			" 29	.....	.....	17.5	46.2	6	.....	.....	19	19	M
			" 30	7.6 9.8	13 47.7	.....	.....	8.5 9.5	06580	19	.....	M	
				Mean.....	13 53.0	.....	83 49.6	.....	.....	06610			
The Pas.....	53 49.9	101 14.0	Oct. 19	13.2 13.9 14.9 16.4	17 52.2	17.1	80 04.0	6, 4	15.4 16.2	10826	19	19	M		
			" 20	8.7 10.4 12.1	47.3	9.7	06.6	2, 3	10.8 11.6	10744	19	19	M		
			" 22	7.1 to 15.0 (7)	53.3	.....	.....	.....	.....	.....	19	.....	M
				Mean.....	17 51.7	.....	80 05.3	.....	.....	10785			
Fort Hall Lake.....	59 28.2	101 17.7	Aug. 3	11.8 13.0 13.1 14.8	21 14.9	16.4	83 40.0	2, 4	18.0 18.9	06780	19	19	M		
			" 3	15.0 17.4 20.0	12.8	.....	.....	.....	.....	.....	19	.....	M
				Mean.....	21 14.0	.....	83 40.0	.....	.....	06780			
Brochet Lake.....	58 32.9	101 21.2	Sept. 8	6.8 to 9.8 (4)	19 41.8	14.2	82 47.4	3, 2	10.7	07896	19	19	M		
			" 8	10.7 to 13.8 (4)	17.2	.....	.....	16.7	07903	19	.....	M	
			" 8	14.5 to 18.1 (4)	15.7	.....	.....	17.6	07945	19	.....	M	
				Mean.....	19 24.9	.....	82 47.4	.....	.....	07915			
Brochet Post.....	57 52.8	101 37.5	July 19	10.0 to 13.6 (7)	20 26.2	.....	.....	.....	.....	.....	19	.....	M
			" 19	14.2 to 20.0 (8)	26.6	19	M	
				Mean.....	20 26.4			
			Sept. 11	14.0 14.1 15.5	20 13.7	11.4	82 43.4	6, 2	14.6 15.2	08016	19	19	M		
			" 12	8.6 8.9 10.5	13.4	.....	.....	.....	.....	.....	19	.....	M
	Mean.....	20 13.6	.....	82 43.4	.....	.....	08016						

MAGNETIC RESULTS, 1921-1923

MAGNETIC OBSERVATIONS, 1922 (continued)

Station	Lat.	Long.	Date	Declination				Inclination			Hor. Int.			Mag'r.	D.C.	Obs'r.	
				L.M.T.				Value	L.M.T.	Value	Needle	L.M.T.					Value
				h.	h.	h.	h.	East ° '	h.	° '		h.	h.				γ
Cochrane River.....	59 02.4	101 45.0	Sept. 4	11.0	12.4	13.0	.....	25 59.7	13.9	83 40.2	6, 4	15.2	15.8	06972	19	19	M
			" 4	14.4	16.1	.....	53.9	.....	.....	.....	.....	.....	.....	.....	19	.....	M
			Mean.....	.....	.....	.....	25 57.4	.....	83 40.2	.....	.....	.....	.....	06972	.....	.....	.....
Beaver Lake.....	54 27.0	102 09.3	Oct. 3	13.9	15.4	17.2	.....	18 51.8	14.6	80 23.7	3, 4	16.6	.....	10441	19	19	M
			" 4	12.8	14.2	16.7	.....	48.4	13.6	27.0	6, 3	16.3	16.6	10386	19	19	M
			Mean.....	.....	.....	.....	18 50.1	.....	80 25.4	.....	.....	.....	.....	10404	.....	.....	.....
Cumberland House.....	53 57.7	102 18.0	Oct. 11	14.0 to 16.9 (4)				18 57.0	.....	.....	.....	15.7	16.5	10554	19	.....	M
			" 12	7.2 to 8.5 (4)				56.2	15.5	80 18.9	2, 4	15.5	16.3	10566	19	19	M
			" 12	10.0	13.6	13.8	15.1	53.0	.....	.....	.....	.....	.....	.....	19	.....	M
			" 13	7.8	7.9	.....	.....	58.8	8.5	19.2	3, 6	.....	.....	.....	19	19	M
			Mean.....	18 55.9	80 19.0	10560
Reindeer Lake.....	56 59.9	102 23.3	Sept. 16	13.0 to 18.2 (6)				21 46.0	14.7	81 57.0	3, 4	17.0	17.7	08806	19	19	M
			" 17	10.1 to 13.8 (6)				46.8	11.3	56.0	2, 4	.....	.....	.....	19	19	M
			Mean.....	21 46.4	81 56.5	08806
Sturgeon-weir River.....	54 55.1	102 34.0	June 29	7.2	7.4	9.3	.....	20 01.0	8.2	80 38.2	2, 6	9.9	11.0	10266	19	19	M
			" 29	11.4	15.8	16.0	.....	19 52.4	14.8	31.0	3, 4	.....	.....	.....	19	19	M
			Mean.....	19 56.7	80 34.6	10266
Pelican Narrows.....	55 07.9	102 53.8	July 2	9.5	11.1	13.7	18.7	20 28.9	10.3	80 43.4	2, 3	16.5	10213	19	19	M
			" 2	14.3	42.8	6, 4	18.1	10180	19	19	M
			" 3	4.7	5.3	35.4	19	..	M
			Mean.....	20 31.1	80 43.1	10196

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Reindeer River.....	55 55.7	102 55.7	July 9	19.1 19.3 20.7 20.8	19 27.0							19		M	
			" 9	4.6 4.9	30.4							19		M	
			Mean.....		19 28.1										
			Sept. 26	9.4 9.5 11.0 12.3	19 33.4	11.4	81 27.8	4.6	10.0	09296	19	19	M		
South Deer Lake.....	56 19.8	103 10.0	" 26	12.6 13.0	32.2						10.6	09295	19	M	
			Mean.....		19 33.0		81 27.8				09296				
			July 12	16.0 16.1 17.2	19 23.7							17.7 18.6	09098	19	M
			Sept. 21	15.4 15.6 16.8	19 26.6									19	M
Frog Portage.....	55 23.9	103 29.3	" 23	16.3	24.4	16.2	81 40.6	3.6	16.7 17.4	09088	19	19	M		
			" 24			9.7	41.6	2.3					19	M	
			Mean.....		19 26.0		81 41.1				09088				
			Sept. 28	10.4 10.6 12.4 12.5	21 00.0	11.3	80 48.6	2.6	14.0 14.6	10060	19	19	M		
Rosetown.....	51 33.8	107 59.7	" 28	12.8 13.2 13.6 14.9	02.3							19		M	
			Mean.....		21 01.2		80 48.6				10060				
			Oct. 10	14.4 15.6 16.6 17.2	22 19.7	16.2	77 00.5	5.6	14.8	13920	20	20	F		
			" 11	7.8 to 11.5 (5)	20.0	9.3	01.5	1.2	10.3 11.2	13909	20	20	F		
Kerrobot.....	51 55.4	109 08.4	" 11	12.0 to 16.6 (5)	21.0	15.0	00.8	1.5	14.1	13931	20	20	F		
			Mean.....		22 20.3		77 00.9				13917				
			Oct. 9	7.8 8.1 9.0 10.0	23 26.8	9.5	77 07.9	5.6	10.3 11.1	13774	20	20	F		
			" 9	11.5 12.0 13.3 13.8	26.0	16.0	07.4	1.2	14.0 14.6	13767	20	20	F		
Cheecham.....	56 17.3	110 50.1	" 9	15.0 15.5 16.4 17.0	26.9							20		F	
			Mean.....		23 26.6		77 07.6				13770				
			Sept. 12	13.6 15.1 16.2	28 22.6	15.8	80 00.2	5.6	14.0 14.8	10794	20	20	F		
			" 13	7.7 to 11.9 (5)	23.5	10.3	00.6	6.1	8.2 9.3	10798	20	20	F		
Cheecham.....	56 17.3	110 50.1	" 13	12.8 to 16.9 (5)	22.5	14.1	79 59.0	1.2	11.1 16.0	10786	20	20	F		
			Mean.....		28 22.9		79 59.9				10793				

MAGNETIC OBSERVATIONS, 1922 (continued)

Station	Lat.	Long.	Date	Declination					Inclination			Hor. Int.			Mag'r.	D.C.	Obs'r.		
				L.M.T.				Value	L.M.T.	Value	Needle	L.M.T.		Value					
				h.	h.	h.	h.	East ° ' "	h.	° ' "		h.	h.	γ					
Pickford.....	55 55.3	110 54.3	Sept. 10	7.8	8.8	10.6	.....	27 39.3	9.8	79 57.2	1, 2	13.3	.....	11128	20	145	F
			" 10	12.3	14.0	15.6	16.4	37.6	14.8	54.9	1, 2	15.3	.....	11120	20	145	F	
			" 11	7.5	to 11.0 (5)			37.6	9.6	56.6	1, 2	8.4	.....	11116	20	20	F	
			" 11	12.3	13.4	14.3	14.9	36.5	13.9	56.2	5, 6	10.4	.....	11088	20	20	F	
			Mean.....					27 37.6	.....	79 56.2	.....	.....	11113				
Chipewyan.....	58 42.7	111 08.8	Aug. 16	7.5	to 17.0 (10)			27 49.7	9.5	81 04.6	1, 2	8.0	10.3	09558	20	20	F		
			" 16							14.5	06.2	2, 5	13.4	15.4	09582	20	20	F
			" 17	6.8	to 12.4 (6)			49.2	.....	.....	.....	8.3	10.8	09561	20	.....	F
			" 17	12.8	to 22.8 (10)			49.9	.....	.....	.....	14.6	16.3	09567	20	.....	F
			" 18	0.7	to 7.6 (4)			50.5	9.0	04.2	5, 6	.....	.....	.....	20	20	F
			" 18	8.1	to 11.1 (4)			49.4	14.0	06.6	1, 2	14.0	.....	09538	20	145	F	
			" 18	12.1	to 18.6 (4)			51.3	15.2	06.6	6, 1	.....	.....	20	20	F	
			Mean.....					27 49.9	.....	81 05.6	.....	.....	09567				
Chipewyan ¹	58 42.7	111 08.8	Aug. 19	8.9	.....				27 51.4	.....	.....	.....	.....	20	.....	F	
			" 19	9.2	.....				50.0	.....	.....	.....	.....	20	.....	F	
			" 19	9.9	.....				47.8	.....	.....	.....	.....	20	.....	F	
Chipewyan, A ²	58 42.7	111 08.8	Aug. 19	8.6	.....				49.4	.....	.....	.....	.....	20	.....	F	
			" 19	9.7	.....				45.8	.....	.....	.....	.....	20	.....	F	
Chipewyan, B ³	58 42.7	111 08.8	" 19	9.5	.....				45.3	.....	.....	.....	.....	20	.....	F	
			" 31	15.6	to 19.1 (4)			28 24.8	17.5	81 13.0	5, 6	16.0	16.7	09518	20	20	F		
Long Island.....	58 07.1	111 21.3	Sept. 1	14.1	to 18.0 (4)			25.2	16.4	11.4	1, 2	14.5	15.3	09530	20	20	F		
			" 2	6.0	to 10.5 (6)			20.1	9.2	14.0	1, 6	8.1	10.2	09508	20	20	F		
			" 2	10.9	to 14.8 (5)			19.9	13.2	13.9	2, 5	.....	.....	.....	20	20	F
			Mean.....					28 22.1	.....	81 13.1	.....	.....	09519				

¹ Tested for local attraction.

² Station A is 73 feet from main station on line bearing N. 90° 23' West.

³ Station B is 75 feet from main station on line bearing N. 55° 22' West.

T. S. Monument 4E.....	59 12.6	111 22.9	July 15	7.6 8.6 9.5	34 17.3	10.3	81 40.2	1, 2	10.3	.....	08898	20	145	F
			" 15	10.9 12.5 13.7	17.6	14.4	41.3	2, 6	8.1	.....	08903	20	20	F
			" 15	14.7 15.6 16.6	17.0	.....	.....	.....	12.9	.....	08890	20	.....	F
			Mean.....	.....	34 17.3	.....	81 40.8	.....	.....	.....	08896	.....	.....	.....
McMurray.....	56 43.9	111 23.2	Sept. 4	16.3 17.5 18.6	28 57.2	18.0	79 58.3	5, 6	16.6	.....	10820	20	20	F
			" 5	5.8 to 8.8 (5)	29 01.2	9.4	57.8	6, 1	8.4 10.1	.....	10784	20	20	F
			" 5	9.8 to 13.0 (5)	28 59.1	11.0	59.1	1, 2	13.3 15.1	.....	10807	20	20	F
			" 5	13.8 to 22.9 (7)	57.2	14.4	59.0	2, 5	16.6	.....	10818	20	20	F
			" 6	0.7 2.1	57.2	.....	.....	.....	.....	.....	.....	20	.....	F
Mean.....	.....	28 58.5	.....	79 58.6	.....	.....	.....	.....	10803	.....	.....	.....
Poplar Point.....	57 53.9	111 25.4	Aug. 28	7.5 to 12.4 (6)	28 38.8	9.6	80 49.5	1, 2	8.3 10.5	.....	09910	20	20	F
			" 28	13.3 to 17.9 (5)	39.9	15.9	47.3	5, 6	13.6 16.6	.....	09932	20	20	F
			Mean.....	.....	28 39.3	.....	80 48.4	.....	.....	.....	09921	.....	.....	.....
T. S. Monument 18E.....	59 31.5	111 25.8	July 17	13.0 13.4 15.4	29 02.3	.....	.....	.....	.....	.....	.....	20	.....	F
			" 18	9.8 10.8 15.0 15.9	28 59.9	16.9	81 56.1	1, 2	16.9	.....	08724	20	145	F
			" 18	17.7 18.7 19.2 19.7	57.2	.....	.....	.....	15.4 18.2	.....	08728	20	.....	F
			Mean.....	.....	28 59.6	.....	81 56.1	.....	.....	.....	08728	.....	.....	.....
Coronation.....	52 06.5	111 26.8	Oct. 5	13.4 14.9	23 58.4	.....	.....	.....	14.3 14.6	.....	14322	20	.....	F
			" 6	7.3 7.6 8.0 8.7	55.3	9.3	76 34.4	1, 2	10.7 10.9	.....	14276	20	20	F
			" 6	9.7 11.3 12.0 13.3	57.2	15.4	35.4	5, 6	13.6 14.3	.....	14326	20	20	F
			" 6	14.6 15.8 16.0 16.4	56.7	.....	.....	.....	.....	.....	.....	20	.....	F
			Mean.....	23 56.7	76 34.9	14308
T. S. Monument A4.....	58 15.4	111 28.3	Aug. 29	12.7 to 18.2 (6)	28 47.4	15.6	81 16.7	5, 6	13.3 14.1	.....	09442	20	20	F
			" 30	6.7 to 11.0 (6)	45.2	9.6	22.2	1, 2	8.6 16.3	.....	09448	20	20	F
			" 30	12.3 to 17.2 (6)	47.5	15.6	19.3	2, 5	.....	.....	.....	20	20	F
			Mean.....	28 46.7	81 19.4	09445
Fitzgerald.....	59 51.9	111 35.2	July 20	5.9 to 17.2 (12)	31 04.8	8.1	81 56.0	1, 2	7.1 9.3	.....	08625	20	20	F
			" 20	.....	.....	10.2	58.2	2, 5	12.1 13.0	.....	08658	20	20	F
			" 20	.....	.....	14.1	54.2	5 6	15.1	.....	08688	20	20	F
			" 20	16.1	54.0	6, 1	20	.....	F

MAGNETIC OBSERVATIONS, 1922 (continued)

Station	Lat.	Long.	Date	Declination					Inclination			Hor. Int.			Mag'r.	D.C.	Obs'r.	
				L.M.T.				Value	L.M.T.	Value	Needle	L.M.T.		Value				
				h.	h.	h.	h.	° ' "	h.	° ' "		h.	h.	γ				
Fitzgerald.....	59 51.9	111 35.2	July 21	7.6 to 19.6 (13)				02.4				14.4	17.9	08668	20		F	
			" 22	2.6 to 8.6 (7)				00.3				7.7		08666	20		F	
			Mean.....				31 02.8		81 55.6					08657				
			Mean.....				31 02.8		81 55.6						08657			
Philomena.....	55 11.1	111 36.9	Sept. 19	12.2 13.9 14.5 15.9				27 44.6	15.4	78 44.2	5,6	13.3	14.2	12088	20	20	F	
			" 20	6.4 7.4 8.8 10.0				45.8	9.4	46.6	1,2	10.4	11.2	12072	20	20	F	
			" 21	8.1 9.0 10.1				45.0	16.4	46.4	1,6				20	20	F	
			" 21	11.4 15.8 16.8				44.3							20		F	
			Mean.....				27 45.0		78 45.7						12080			
McKay.....	57 11.1	111 37.5	Aug. 24	9.5 to 12.4 (4)				30 03.2	10.0	79 49.3	1,2	10.8		10990	20	20	F	
			" 24	13.3 to 18.7 (5)				03.1	15.3	49.2	2,5	13.9		11029	20	20	F	
			" 24						17.0	47.6	5,6	16.1		11030	20	20	F	
			" 25	6.8 to 9.9 (4)				04.1	9.3	48.2	6,1	8.4		11031	20	20	F	
			" 25	10.7 to 12.3 (3)				03.5							20		F	
Mean.....				30 03.5		79 48.6						11020						
Chenal des Quatre Fourches	58 53.4	111 38.2	July 13	7.6 to 12.6 (6)				33 21.3	9.2	81 28.8	1,5	10.1		09304	20	20	F	
			" 13	14.0 to 19.6 (7)				17.9	13.3	29.0	1,2	13.3		09302	20	145	F	
			" 13									14.4		09293	20		F	
			Mean.....				33 19.5		81 28.9						09298			
Old Fort.....	57 24.6	111 38.4	Aug. 26	12.8 to 17.2 (5)				28 19.7	15.9	79 49.6	5,6	13.3	14.1	11140	20	20	F	
			" 27	6.8 to 12.1 (7)				18.7	9.6	51.5	1,2	8.2	10.3	11134	20	20	F	
			Mean.....				28 19.3		79 50.6						11137			

Fort Smith.....	60 00.6	111 52.0	July 25	7.9 to 11.1 (5)	32 15.4	9.9	81 56.4	1, 2	8.4 10.7	08644	20	20	F
			" 25	12.6 to 17.3 (6)	12.6	13.4	56.6	1, 2	13.4	08641	20	145	F
			" 25			16.2	54.1	2, 5	14.5 16.9	08663	20	20	F
			Mean.....		32 13.9		81 55.7			08654			
Lac la Biche.....	54 46.9	111 57.2	Sept. 15	10.8 to 15.3 (5)	27 21.1	14.6	78 27.9	5, 6	11.4 13.7	12338	20	20	F
			" 16	7.6 to 11.6 (6)	20.8	9.5	28.3	1, 2	10.4 14.3	12358	20	20	F
			" 16	12.8 to 17.1 (5)	20.4	15.6	28.4	1, 2			20	20	F
			" 16			15.6	27.4	5, 6			20	20	F
Mean.....		27 20.8		78 28.0			12348						
Peace Point.....	59 07.3	112 25.4	July 10	12.4 to 19.6 (8)	32 21.5	14.2	81 38.5	1, 2	13.1 15.9	08988	20	20	F
			" 10			18.4	36.8	1, 2	18.4	08012	145	F	
			" 11	6.7 to 11.5 (6)	23.7	10.2	38.4	5, 6	7.9 11.9	08986	20	20	F
			" 11	12.5 to 17.5 (6)	20.9						20		F
Mean.....		32 22.0		81 37.9			08987						
T. S. Monument T 22.....	60 22.1	112 40.6	July 27	13.9 to 17.6 (5)	33 02.0	15.9	81 46.0	5, 6	14.3 16.6	08892	20	20	F
			" 28	6.9 to 8.2 (4)	01.4						20		F
			Mean.....		33 01.7		81 46.0			08892			
Boyle.....	54 35.8	112 48.0	Sept. 23	8.3 to 11.5 (4)	27 40.6	9.8	78 11.4	1, 2	10.7 11.5	12564	20	20	F
			" 23	13.6 to 17.2 (4)	38.6	15.8	08.7	5, 6	14.0 14.7	12594	20	20	F
			" 23			16.8	07.6	6, 1			20	20	F
			" 24	7.9 to 10.8 (6)	39.8						20		F
			" 24	11.6 to 15.3 (6)	38.7						20		F
" 25			9.4	09.8					20		F		
Mean.....		27 39.4		78 09.4			12579						
Jackfish River.....	59 04.4	112 53.8	July 6			19.4	80 53.3	1, 2	19.4	09763	145	F	
			" 7	17.6 to 20.8 (4)	34 25.0					20		F	
			" 8	5.9 to 20.8 (15)	27.8	8.4	51.8	1, 2	7.3 12.6	09754	20	20	F
			" 8			10.6	52.9	2, 5	13.8 16.0	09764	20	20	F
			" 8			14.6	54.6	5, 6	18.2	09768	20	20	F
			" 8			16.7	54.3	6, 1			20	20	F
" 9	3.9 to 8.2 (9)	28.0						20		F			
Mean.....		34 27.5		80 53.4			09761						

MAGNETIC OBSERVATIONS, 1922 (continued)

Station	Lat.	Long.	Date	Declination					Inclination			Hor. Int.			Mag'r.	D.C.	Obs'r.	
				L.M.T.				Value	L.M.T.	Value	Needle	L.M.T.		Value				
				h.	h.	h.	h.	East °	h.	°	'	h.	h.	γ				
Pointe Ennuyeuse.....	60 47.0	113 02.8	July 29	6.7	to	15.5	(7)	33 21.0	9.8	82 23.8	1,2	9.8	.....	08144	20	145	F
			" 29	7.9	11.9	08233	20	F
			" 30	7.5	to	18.5	(12)	21.8	10.0	18.9	1,2	13.9	.....	08289	20	20	F
			" 31	5.5	to	6.5	(3)	16.9	20	F
			Mean.....				33 20.9	82 21.4	08252		
Thorhild.....	54 09.6	113 09.6	Sept. 28	15.4	16.7	.....		27 14.8	17.1	77 50.5	5,6	15.8	16.9	12992	20	20	F
			" 29	7.4	7.8	8.8	.....	15.6	9.1	49.2	1,2	9.8	10.3	12984	20	20	F
			" 29	9.5	10.7		13.6	20	F
			Mean.....				27 14.8	77 49.8	12988		
Old Fort.....	61 12.7	113 11.2	July 31	18.2	19.7	.....		39 40.8	.....	.....	.....	.....	.....	.....	20	.....	F
			Aug. 1	6.7	to	11.6	(6)	50.7	9.9	82 15.6	1,2	8.0	10.5	08326	20	20	F	
			" 1	12.7	to	17.5	(6)	46.9	14.0	13.8	5,6	13.0	14.9	08375	20	20	F	
			" 1	19.0	10.4	1,2	19.0	08439	145	F
			Mean.....				39 47.7	82 13.1	08350		
Twenty-ninth Base Line...	58 46.6	113 19.9	July 5	15.9	to	19.3	(4)	32 25.0	17.1	80 40.1	5,6	16.2	18.8	10044	20	20	F	
			" 6	6.6	to	8.3	(3)	29.6	7.6	41.3	1,2	7.6	.....	09977	20	145	F
			Mean.....				32 27.0	80 40.7	10044		
Bon Accord.....	53 49.8	113 24.9	Sept. 26	16.3	17.6	.....		27 47.7	17.3	77 23.2	5,6	16.6	.....	13432	20	20	F
			" 27	7.5	8.0	8.7	9.6	46.2	9.2	24.4	1,2	9.9	11.2	13404	20	20	F	
			" 27	11.5	13.2	14.4	.....	47.2	.....	.....	.....	.....	.....	13404	20	.....	F
			Mean.....				27 46.9	77 23.8	13411		

Fort Resolution, A.....	61 10-1	113 40-5	Aug.	2	12-8 to 15-4 (4)	38 32-9	14-1	82 01-0	1,2	13-1 15-8	08584	20	20	F	
			"	2	16-2 to 20-4 (4)	36-7	18-6	81 55-8	1,2	18-6	08660	20	145	F	
			"	3	6-7 to 10-5 (5)	38-1	9-6	82 01-9	5,6	7-9 10-3	08562	20	20	F	
			"	3	11-9 to 14-8 (5)	32-8							20		F
					Mean.....			38 35-2		81 59-6			08573		
Fort Resolution, B.....	61 10-2	113 40-5	Aug.	3	16-1 to 20-4 (5)	38 56-0	18-7	82 02-4	2,5	17-9	08587	20	20	F	
			"	4	3-8 to 9-2 (6)	58-2	9-6	01-0	1,6	8-2	08587	20	20	F	
			"	4	10-2 to 14-0 (6)	52-4				14-0	08616	20	20	F	
			"	4	14-4 to 20-0 (6)	53-2				15-9	08586	20		F	
					Mean.....			38 54-9		82 01-7			08594		
Lacombe, A.....	52 27-6	113 45-0	Oct.	3	8-0 8-3 9-4 10-9	25 38-0	8-9	76 24-8	1,2	9-8 10-6	14308	20	20	F	
			"	3	12-8 14-6 15-6 16-1	37-9	15-2	26-0	5,6	13-5 14-3	14346	20	20	F	
					Mean.....			25 38-0		76 25-4			14327		
Fifth Meridian.....	58 39-9	114 00-0	July	3	18-0 19-0 20-8	31 31-5				18-5	10221	20	20	F	
			"	4	6-4 to 21-0 (15)	32-6	10-8	80 24-2	1,2	7-8 11-5	10216	20	20	F	
			"	4			14-0	28-4	1,2	14-0	10188	20	145	F	
			"	4						15-2	10204	20		F	
			"	5	3-3 to 5-8 (5)	34-4							20		F
		Mean.....			31 32-8		80 26-8			10214					
Little Red River Post.....	58 24-6	114 44-9	July	1	7-3 9-5 10-4 10-7	32 34-8	9-0	80 13-0	1,2	7-4 10-0	10490	20	20	F	
			"	1	15-5 17-3 18-5	28-8	15-1	10-9	5,6	17-9	10647	20	20	F	
			"	2	7-1 to 10-1 (5)	32-1	9-7	10-8	1,6	7-6 10-5	10554	20	20	F	
			"	2	11-0 to 15-8 (5)	31-2	14-3	08-1	2,5	15-1	10660	20	20	F	
					Mean.....			32 31-9		80 10-7			10566		
Vermilion Chutes.....	58 21-5	114 56-2	June	27	19-8 20-8	31 11-0	19-1	80 07-0	1,2	18-6 19-1	10644	20	145	F	
			"	28	5-3 5-5	15-0							20		F
					Mean.....			31 13-0		80 07-0					

MAGNETIC OBSERVATIONS, 1922 (continued)

Station	Lat.	Long.	Date	Declination				Inclination			Hor. Int.		Mag'r.	D.C.	Obs'r.				
				L.M.T.		Value	L.M.T.	Value	Needle	L.M.T.	Value								
	° ' "	° ' "		h.	h.	h.	h.	East ° ' "	h.	° ' "		h.	h.	γ					
Wabiskaw River.....	58 21.5	115 18.8	June 26	13.6	to	19.7	(5)	32 16.3	16.4	80 13.0	1, 2	16.4	.....	10432	20	145	F	
			" 26								14.6	18.2	10436	20	.....	F		
			" 27	5.8	to	10.9	(6)	19.3	8.6	13.4	1, 2	7.6	9.7	10426	20	20	F		
			Mean.....					32 17.9	.....	80 13.2	.....	.....	.....	10431			
Fort Vermilion.....	58 24.2	116 00.6	June 22	7.1	to	17.3	(11)	34 26.0	9.0	80 03.0	1, 2	.....	.....	.....	20	20	F
			" 22								12.4	01.6	2, 5	7.9	10.0	10700	20	20	F
			" 22								15.4	01.0	5, 6	14.5	10743	20	20	F
			" 23	5.5	to	12.3	(7)	28.3	20	F	
			" 24	6.3	to	21.3	(29)	25.7	13.7	03.0	6, 1	10.6	14.3	10734	20	20	F		
			" 24								18.6	10750	20	20	F
" 25	3.2	to	9.8	(13)	24.8	.....	.....	.....	.....	.....	.....	.....	20	.....	F		
Mean.....					34 25.9	.....	80 02.2	.....	.....	.....	.....	10727					
Prairie Point.....	58 15.6	116 28.6	June 19	16.9	17.8	18.6	19.7	34 03.9	.....	.....	.....	18.2	.....	11021	20	.....	F
			" 20	13.2	15.4	16.2	.....	04.0	15.8	79 41.0	1, 2	13.8	.....	11003	20	20	F
			" 20	17.2	18.7	19.6	.....	02.5	18.0	39.2	1, 2	18.0	.....	11050	20	145	F
			" 21	5.3	6.2	7.2	7.8	04.2	.....	.....	.....	.....	.....	.....	20	.....	F
Mean.....					34 03.7	.....	79 40.1	.....	.....	.....	.....	11012					
Twenty-seventh Base Line..	58 04.8	116 38.4	June 18	6.7	to	18.7	(10)	34 25.1	9.1	79 30.0	5, 6	17.2	.....	11236	20	20	F	
			" 19	6.1	7.2	8.8	9.5	28.1	8.1	25.0	1, 2	6.8	.....	11212	20	145	F	
			Mean.....					34 26.0	.....	79 27.5	.....	.....	.....	11224			
Carcajou Point.....	57 47.2	117 01.8	June 14	8.0	to	12.3	(6)	32 21.6	9.9	79 16.7	1, 5	14.7	.....	11426	20	20	F	
			" 14	13.0	to	17.6	(5)	21.8	17.1	17.1	2, 6	.....	.....	.....	20	20	F
			" 15	6.7	to	11.5	(6)	21.1	.....	.....	.....	7.6	.....	11450	20	.....	F
			" 15	12.5	to	17.1	(5)	19.8	9.8	14.6	1, 2	9.8	.....	11456	20	145	F	
			" 15								11.6	11422	20	20	F
			" 15								13.4	15.5	1, 2	13.4	11437	145	F

Carcajou Point.....	57 47.2	117 01.8	June 15							14.0		11422	20		F
				Mean.....	32 21.1			79 16.0				11430			
Twenty-fifth Base Line....	57 23.4	117 07.7	June 12	7.4 to 11.3 (5)	30 17.2	9.8	79 04.6	1, 2	8.2			11714	20	20	F
			" 12	12.5 to 17.2 (5)	17.2	16.0	03.4	5, 6	12.0 14.7			11718	20	20	F
				Mean.....	30 17.2			79 04.0				11717			
Whitemud River.....	56 40.1	117 10.2	June 7	18.1 19.6 20.7 21.1	30 48.3								20		F
			" 8	5.5 to 9.8 (5)	47.0	8.0	78 26.5	1	7.3			12299	20	20	F
			" 8	11.0 to 19.2 (8)	47.5	10.4	29.4	1, 2	9.6 11.3			12265	20	20	F
			" 8			15.6	26.8	5, 6	13.8 16.3			12295	20	20	F
			" 8			19.1	27.4	5	18.8			12289	20	20	F
				Mean.....	30 47.5			78 27.7				12285			
Brown's Landing.....	56 58.6	117 14.7	June 9	15.5 to 20.8 (5)	32 24.3	17.5	78 32.0	1, 2	17.5			12236	20	145	F
			" 10	3.3 to 8.5 (5)	24.6	7.8	34.4	1, 2	7.8			12186	20	145	F
			" 10	9.3 to 13.4 (5)	25.9	9.7	38.2	1, 6	11.3			12124	20	20	F
			" 10	14.0 to 19.3 (5)	24.3	15.8	33.2	2, 5	14.6			12160	20	20	F
				Mean.....	32 24.3			78 34.4				12142			
Peace River.....	56 13.8	117 17.5	June 2	7.8 to 15.2 (7)	31 09.7	10.1	78 09.9	1, 2	8.2 10.2			12618	20	145	F
			" 3	7.6 to 13.5 (7)	11.2	9.3	10.0	1, 6	14.6 16.2			12618	20	20	F
			" 3	14.0 to 18.9 (7)	10.0	15.2	07.6	2, 5					20	20	F
			" 5	7.5 to 14.5 (7)	09.2								20		F
				Mean.....	31 10.0			78 09.2				12618			
Griffin Creek.....	56 00.0	117 46.8	May 31	15.6 to 20.3 (5)	31 07.4	18.0	77 37.8	1, 2	15.9 18.7			13062	20	20	F
			June 1	6.0 to 9.2 (5)	05.9	8.1	38.0	1, 2	8.1			13117	20	145	F
				Mean.....	31 06.6			77 37.9				13062			
Dunvegan.....	55 55.5	118 35.2	May 29	19.2 to 21.0 (3)	30 17.8								20		F
			" 30	4.0 to 8.8 (6)	17.5	7.6	78 05.5	1, 2	6.7 8.6			12720	20	20	F
			" 30	9.4 to 13.6 (6)	18.5	9.9	08.0	2, 5	11.7 13.6			12714	20	20	F
			" 30	14.7 to 20.4 (6)	19.6	14.3	07.8	5, 6	15.6 18.2			12715	20	20	F
			" 30			17.4	06.4	6, 1					20		F
				Mean.....	30 18.4			78 06.9				12716			

MAGNETIC OBSERVATIONS, 1922 (concluded)

Station	Lat.	Long.	Date	Declination				Inclination			Hor. Int.		Mag'r.	D.C.	Obs'r.		
				L.M.T.				Value	L.M.T.	Value	Needle	L.M.T.				Value	
	° ' "	° ' "		h.	h.	h.	h.	East ° ' "	h.	° ' "		h.	h.	γ			
Range 6, Township 82.....	56 09.2	118 56.5	May 28	15.1	to	20.8	(9)	30 08.3	17.9	78 15.2	1,2	15.8	16.5	12522	20	20	F
			" 29	5.5	to	8.8	(5)	08.6	7.9	15.7	5,6	7.1	8.7	12535	20	20	F
			Mean.....					30 08.4		78 15.4					12528		
Clear River.....	56 15.5	119 19.6	May 27	4.8	to	12.2	(8)	31 12.8	7.0	77 43.8	5,6	8.1	.....	12973	20	20	F
			" 27	13.1	to	21.0	(8)	12.1	7.0	45.0	1,2	11.3	.....	12952	20	145	F
			" 27	.....	.....	.....	.....	10.3	.....	46.4	1,2	14.1	.....	12999	20	20	F
			" 27	.....	.....	.....	.....	14.8	.....	45.4	1,2	15.7	.....	12975	.....	145	F
Mean.....						31 12.4		77 45.2					12975				
Boundary.....	56 08.5	120 00.0	May 24	13.4	to	20.1	(6)	32 46.8	16.5	77 26.8	2,5	14.0	15.6	13304	20	20	F
			" 25	5.3	to	19.8	(17)	46.7	10.6	26.0	5,6	7.6	9.4	13301	20	20	F
			" 26	5.5	to	9.0	(6)	49.9	.....	.....	.....	.....	.....	.....	20	.....	F
Mean.....						32 47.4		77 26.4					13302				
Fort St. John.....	56 12.5	120 49.0	May 21	13.5	14.5	15.6	17.5	31 10.9	.....	.....	.....	14.0	15.3	13270	20	.....	F
			" 21	.....	.....	.....	.....	16.7	.....	77 20.5	1,2	16.8	.....	13313	.....	145	F
			" 22	3.6	to	16.9	(10)	11.5	10.4	20.0	1,2	5.0	9.2	13259	20	20	F
			" 22	.....	.....	.....	.....	10.4	.....	21.1	1,2	12.9	13.6	13256	20	145	F
" 23	5.0	to	18.0	(10)	11.0	.....	.....	.....	.....	12.1	13.6	13256	20	.....	F		
Mean.....						31 11.2		77 20.5					13260				

MAGNETIC OBSERVATIONS, 1923

Station	Lat.	Long.	Date	Declination				Inclination			Hor. Int.			Mag't.	D.C.	Obs'r.			
				L.M.T.		Value	L.M.T.	Value	Needle	L.M.T.		Value							
				h.	h.	h.	h.	West	h.	°	'	h.	h.				γ		
Ottawa.....	45 23.6	75 43.0	April 27	7.9	to	13.8	(6)	14 02.8	10.5	75 38.0	1, 2	11.3	11.8	14798	20	20	F		
			" 27						15.9	38.0	5, 6	14.3	14.9	14816	20	20	F		
			" 30	7.8	to	13.3	(6)	13 59.0	10.0	40.1	1, 2	10.8	11.5	14775	20	20	F		
			" 30						16.1	38.4	5, 6	14.5	15.2	14813	20	20	F		
			May 1	7.9	to	13.5	(6)	14 01.0	10.2	40.0	1, 2	11.0	12.2	14788	20	20	F		
Ottawa.....	45 23.6	75 43.0	" 1						15.6	36.8	5, 6	13.9	14.5	14823	20	20	F		
			" 2	7.8	to	14.1	(6)	13 57.2											
			" 3	7.7	to	14.6	(6)	14 00.0											
Mean						14 00.0	75 38.6						14802						
Ottawa.....	45 23.6	75 43.0	Oct. 5	8.2	8.8	13.1	13.4	14 03.0	10.1	75 38.2	1, 2	10.9	11.5	14792	20	20	F		
			" 5						15.0	37.6	2, 5	13.4	14.2	14793	20	20	F		
			" 6	8.2	12.5			02.1											
			" 8	8.0	10.1	12.7			04.5	10.6	39.4	5, 6	11.2	11.7	14777	20	20	F	
			" 8						14.8	36.8	6, 1	13.5	14.0	14794	20	20	F		
			" 9	7.9	12.6	13.0			00.8										
Mean						14 02.7	75 38.0						14789						
York Factory.....	57 00.6	92 18.0	Aug. 20	6.7	to	18.0	(11)	3 05.0									19		M
			" 21	9.9	to	17.5	(4)	04.5	16.8	83 19.8	2, 6	10.4	11.0	07252	19	19	M		
			" 21										13.9	14.5	07276	19		M	
			" 27	9.8	to	14.3	(2)	01.6	10.4	22.4	4, 3	11.1	11.6	07243	19	19	M		
			" 27						16.0	18.0	2, 3	14.7	15.2	07316	19	19	M		
Mean						3 04.5	83 20.1						07272						
Port Nelson.....	57 03.1	92 35.9	Aug. 23	16.3	16.8	18.7	19.2	4 28.5									19		M
			" 24	8.2	9.8	11.6			28.2	8.8	83 10.1	2, 3	10.2	11.3	07436	19	19	M	
			" 24	14.0	16.0			30.8	16.7	09.5	4, 6	14.5	15.5	07485	19	19	M		
			Mean						4 28.9	83 09.8						07460			

MAGNETIC RESULTS, 1921-1923

MAGNETIC OBSERVATIONS, 1923 (continued)

Station	Lat.	Long.	Date	Declination				Inclination			Hor. Int.			Mag'r.	D.C.	Obs'r.	
				L.M.T.				Value	L.M.T.	Value	Needle	L.M.T.					Value
				h.	h.	h.	h.	East	h.	°	'	h.	h.				γ
Hayes River.....	56 36.7	92 38.8	Aug. 30	8.9	9.7	10.7	11.5	3 34.6	10.8	83 10.4	4,3	16.4	17.3	07472	19	19	M
			" 30	12.7	to	16.8	(5)	31.9	14.3	10.2	6,2	19.0	.....	07474	19	19	M
			Mean.....					3 33.1	.....	83 10.3	.....	.....	.....	07473			
Shamattawa River.....	56 22.5	92 51.0	Sept. 2	13.8	to	18.6	(6)	4 17.2	.....	.....	.....	16.2	17.1	07413	19	.....	M
			" 3	8.5	9.8	10.8	.....	15.7	11.5	83 16.7	4,6	9.4	10.3	07382	19	19	M
			" 3	12.0	12.6	.....	.....	21.0	13.4	15.2	2,3	.....	.....	.....	19	19	M
			" 4	.....	.....	.....	.....	.....	11.5	15.7	2	9.8	10.4	07386	19	19	M
Mean.....					4 17.5	.....	83 15.9	.....	.....	.....	.....	07394					
Fox River.....	56 03.2	93 17.1	Sept. 7	9.0	10.3	14.0	15.3	6 42.0	11.4	82 35.4	4,3	9.5	10.4	08060	19	19	M
			" 7	16.8	17.4	18.8	19.8	43.2	14.6	36.6	2,6	15.7	16.2	08090	19	19	M
			" 8	16.2	16.9	17.6	18.8	43.2	.....	.....	.....	.....	.....	.....	19	.....	M
Mean.....					6 42.8	.....	82 36.0	.....	.....	.....	.....	08075					
The Rock.....	55 39.8	93 30.8	Sept. 12	8.2	to	21.4	(12)	6 07.1	.....	.....	.....	16.7	.....	07836	19	.....	M
			" 13	6.5	to	17.3	(4)	04.5	11.4	82 49.1	4,6	9.8	10.3	07822	19	19	M
			" 13	.....	.....	.....	.....	.....	14.4	46.8	3,2	16.0	16.8	07835	19	19	M
Mean.....					6 06.4	.....	82 48.0	.....	.....	.....	.....	07830					
Hayes River (First rapids north of Swampy Lake).	55 23.2	93 53.1	Sept. 18	14.7	14.9	.....	.....	5 26.8	10.2	82 20.5	2,6	15.5	16.0	08406	19	19	M
			" 19	8.2	8.4	11.1	11.3	25.9	.....	.....	.....	.....	.....	.....	19	.....	M
			Mean.....					5 26.2	82 20.5	08406		
Swampy Lake.....	55 15.4	94 07.8	Sept. 20	6.5	to	19.8	(14)	8 57.2	.....	.....	.....	10.2	11.1	08729	19	.....	M
			" 21	5.8	9.4	.....	.....	54.4	8.0	82 05.6	3,4	9.8	10.3	08733	19	19	M
			" 21	.....	.....	.....	.....	.....	11.2	07.4	3,2	.....	.....	.....	19	.....	M
Mean.....					8 56.8	.....	82 06.5	.....	.....	.....	.....	08731					

Churchill.....	58 45.7	94 13.2	Aug. 9	16.0	7 11.2	17.9	84 22.4	3, 2	16.5 17.1	06118	19	19	M	
			" 10	7.0 to 19.8 (12)	16.5	19	M
			" 11	8.5 to 14.2 (4)	13.4	10.6	28.1	4, 6	8.6 9.4	06059	19	19	M	
			" 11	14.8	24.6	3, 4	19	M
			Mean.....	7 15.5	.....	84 25.0	.....	.....	.....	06088			
Seal River.....	59 05.0	94 48.3	July 31	9.9 11.7 13.1	8 15.6	16.9	84 24.2	4, 2	10.6 11.4	06089	19	19	M	
			" 31	17.7 18.5 20.4	12.9	19.6	23.6	3, 6	14.0 14.6	06125	19	19	M	
			Aug. 1	6.2 6.7	10.6	8.5	25.8	2, 3	7.2 7.8	06099	19	19	M	
			Mean.....	8 13.3	84 24.5	06104		
Oxford House.....	54 57.8	95 15.6	Sept. 26	11.2 11.6	3 24.9	.....	.....	.....	.....	.....	19	.....	M
			" 27	14.4 16.9	28.1	.....	.....	15.7 16.4	08440	19	.....	M	
			" 28	7.1 8.9 13.8	18.2	11.2	82 31.0	2, 6	9.6 10.4	08222	19	19	M	
			" 28	15.9 17.2	24.8	14.4	30.0	3, 4	16.3 16.8	08271	19	19	M	
			Mean.....	3 23.4	.....	82 30.5	.....	.....	.....	08311			
Great Island.....	58 53.4	96 19.9	July 25	11.5 13.7 14.5 15.5	11 50.4	17.8	84 23.9	6	16.1	06104	19	19	M	
			" 25	17.1 18.3 18.8 20.7	50.3	20.1	26.6	2	16.7	06111	19	19	M	
			" 26	7.6 10.5 11.8	53.1	9.9	25.0	3, 4	8.0	06095	19	19	M	
			" 26	.....	.....	11.2	25.4	.....	8.6	06077	19	19	M
			Mean.....	11 51.1	.....	84 25.2	.....	.....	.....	06097			
Shethnanei Lake.....	58 50.2	97 35.3	July 22	11.3 11.6 13.6	14 24.3	17.3	83 57.5	6, 2	15.0 16.1	06539	19	19	M	
			" 23	8.7 10.2 11.8	27.3	9.5	84 02.9	4, 3	10.9 11.5	06527	19	19	M	
			Mean.....	14 25.8	84 00.2	06533			
Thicket Portage.....	55 18.5	97 39.8	Oct. 11	7.7 10.2	18 52.2	14.3	82 04.0	3, 4	9.0 9.9	08690	19	19	M	
			" 11	13.4 15.0	50.4	.....	.....	.....	15.4	08691	19	19	M
			Mean.....	18 51.3	82 04.0	08690			
Norway House.....	53 59.1	97 49.8	Oct. 4	15.3 16.4 17.6	12 53.0	.....	.....	.....	16.1 16.7	09782	19	.....	M
			" 5	6.6 7.6 8.4 10.4	53.6	11.1	81 01.8	3, 6	9.6 10.0	09802	19	19	M	
			" 5	11.6 12.8 13.9 16.8	53.8	14.6	00.9	2, 4	19	19	M
			Mean.....	12 53.5	81 01.4	09792			

MAGNETIC OBSERVATIONS, 1923 (continued)

Station	Lat.	Long.	Date	Declination				Inclination			Hor. Int.			Mag'r.	D.C.	Obs'r.		
				L.M.T.				Value	L.M.T.	Value	Needle	L.M.T.					Value	
				h.	h.	h.	h.	East °	h.	°	'	h.	h.				γ	
Todoule Lake.....	58 28.3	98 06.3	July 18	6.8	7.0	9.8	10.0	16 05.9	11.0	83 55.1	6,3	7.9	8.6	06658	19	19	M	
			" 18	13.1	14.3	.....	15 56.6	15.5	53.3	2,4	13.4	14.0	06688	19	19	M	
			Mean.....	.....	16 02.8	.....	83 54.2	.....	.....	.....	.....	06673	.....	.....	.....	.....	.....
Missi Falls.....	57 22.1	98 09.1	July 9	13.7	to	20.6	(7)	13 52.1	19.4	82 50.3	4,3	16.0	16.7	07663	19	19	M	
			" 10	6.0	to	9.0	(3)	14 12.4	.....	.....	.....	.....	.....	.....	.....	.....	M
			" 10	9.2	to	13.0	(4)	05.7	M
			" 10	13.2	to	16.9	(4)	03.2	M
			" 10	17.1	to	20.4	(3)	13 54.6	M
			" 11	.....	.....	.....	.....	.....	9.9	58.9	6,2	6.5	7.2	07592	19	19	M
			" 11	.....	.....	.....	.....	.....	.....	.....	.....	8.6	9.2	07651	19	.....	M
Mean.....	.....	14 00.1	.....	82 54.6	.....	.....	.....	.....	.....	07635	.....	.....	.....	.....	.....
Chipewyan Lake.....	57 56.8	98 30.3	July 14	19.2	19.8	20.2	.....	15 35.9	.....	.....	.....	.....	.....	.....	19	.....	M
			" 15	8.6	10.0	11.7	13.7	45.9	17.0	83 17.7	6,4	10.8	11.4	07282	19	19	M	
			" 15	16.2	17.3	18.7	.....	38.7	19.5	18.5	3,2	14.2	14.7	07299	19	19	M
			" 15	20.2	21.4	40.3	M
Mean.....	.....	15 41.6	.....	83 18.1	.....	.....	.....	.....	.....	07290	.....	.....	.....	.....	.....
Southern Indian Lake.....	56 57.4	98 44.5	July 5	9.6	9.8	11.5	11.7	14 55.1	16.2	82 37.7	2,6	10.4	11.2	08007	19	19	M	
			" 5	13.2	14.6	14.7	.....	53.6	16.2	37.9	3,4	13.6	14.2	08019	19	19	M
			Mean.....	.....	14 54.5	.....	82 37.8	.....	.....	.....	.....	08013	.....	.....	.....	.....	.....
Nepishkas Portage.....	56 29.9	99 57.6	July 2	8.3	14.6	16.2	18.0	16 09.4	13.2	82 00.8	2,3	16.7	17.6	08780	19	19	M	
			" 2	20.8	21.3	08.7	20.0	81 58.2	6,4	19	19	M
			" 3	6.5	7.8	.....	.....	10.7	.....	.....	.....	7.0	7.5	08779	19	.....	M
			Mean.....	.....	16 09.6	.....	81 59.5	.....	.....	.....	.....	08780	.....	.....	.....	.....	.....

Churchill River.....	55 45.8	100 28.6	June 26	15.8 to 21.2 (6)	17 30.4	19.6	81 33.1	2, 6	16.5 17.4	09182	19	19	M	
			" 27	6.3 6.5 8.2 9.9	34.4	7.2	36.5	3, 4	8.6 9.8	09170	19	19	M	
			Mean.....		17 32.0		81 34.8			09176				
Kississing River.....	55 27.4	100 55.5	June 13	10.9 12.9 14.7 16.6	18 11.4	13.9	81 22.3	4, 2			19	19	M	
			" 14	5.5 7.9	11.5	8.6	25.1	6, 3	5.9 6.8	09338	19	19	M	
			Mean.....		18 11.4		81 23.7			09338				
Pukatawagan.....	55 44.5	101 18.2	June 16	16.2 19.8 20.8	18 38.1				16.8 17.6	09338	19		M	
			" 17	12.7 13.5	38.3	16.1	81 26.0	3			19	19	M	
			" 18	10.7 12.4	39.6	15.5	26.6	6, 4	11.2 12.0	09294	19	19	M	
			" 20	11.4 to 19.2 (9)	39.4	10.9	26.4					19	19	M
			Mean.....		18 39.0		81 26.4			09316				
Kississing Lake.....	55 09.7	101 25.4	June 10	5.2 to 9.2 (4)	18 34.3				9.9 10.8	09700	19		M	
			" 10	10.2 to 18.1 (7)	34.3				14.3 15.3	09726	19		M	
			" 11	8.9 to 10.8 (1)	32.0	10.0	81 06.3	2, 3				19	19	M
			" 11		11.3	08.5	6, 4					19	M
			Mean.....		18 34.1		81 07.4			09713				
Baker's Narrows.....	54 40.7	101 39.6	June 6	7.9 8.0 13.7 13.9	20 12.4	9.7	80 39.9	2, 6	10.8 14.3	10114	19	19	M	
			" 6	18.8	10.1	16.3	37.7	3, 4	19.3 20.1	10136	19	19	M	
			" 7	6.2 6.3	12.0							19		M
			Mean.....		20 11.9		80 38.8			10125				
Sturgeon Landing.....	54 16.5	101 49.1	June. 1	16.4	19 12.2						19		M	
			" 2	8.9 13.0 15.3 16.9	11.8	16.2	80 24.2	6, 4	9.8 10.7	10448	19	19	M	
			" 2	.....					14.1 14.6	10455	19		M
			" 3	8.8 10.7 13.7 14.1	12.6	9.7	24.0					19	19	M
			Mean.....		19 12.2		80 24.1			10452				
Cumberland House.....	53 57.7	102 15.1	May 28	9.7 14.9 16.9	18 54.8	13.8	80 18.2	2, 6	15.6 16.4	10572	19	19	M	
			" 29	5.5 9.4 14.7 17.1	56.0				6.0 8.7	10511	19		M	
			" 29	.....					15.4	10596	19		M
			" 30	15.6 16.8	56.9	9.5	23.0	3, 4	16.8	10555	19	19	M	
			" 30		15.0	17.3	2, 3					19	M
			Mean.....		18 55.8		80 19.5			10553				

MAGNETIC OBSERVATIONS, 1923 (continued)

Station	Lat.	Long.	Date	Declination				Inclination			Hor. Int.			Mag'r.	D.C.	Obs'r.	
				L.M.T.				Value	L.M.T.	Value	Needle	L.M.T.					Value
				h.	h.	h.	h.	East ° '	h.	° '		h.	h.				γ
McMurray.....	56 43.9	111 22.1	June 10	4.6	to	10.4	(6)	28 53.7	19.1	79 58.0	5, 6	15.8	16.4	10810	20	20	F
			" 10	10.6	to	16.4	(6)	55.5							20		F
			" 10	16.6	to	20.8	(3)	55.6							20		F
			" 11	7.5				52.5	10.3	58.6	1, 2	7.8	8.4	10810			
			Mean.....					28 54.7		79 58.3				10810			
Fort Smith.....	60 00.6	111 52.4	June 18	13.2	14.7	16.3		32 03.8	10.4	81 56.6	1, 2	13.6	14.4	08618	20	20	F
			" 18						15.8	54.9	5, 6				20	20	F
			" 19	8.1	to	21.0	(10)	01.3	9.2	57.5	1, 2	10.1	11.3	08614	20	20	F
			" 20	5.9	to	20.7	(10)	04.2							20		F
			" 22	7.2	to	22.8	(15)	01.3							20		F
			" 23	2.1	to	9.3	(7)	00.1							20		F
Mean.....						32 01.9		81 56.3				08616					
Hay River.....	60 51.8	115 43.7	Sept. 6	11.6	14.6	16.0	17.1	35 59.8	16.7	81 22.2	5, 6	10.3	15.6	09148	20	20	F
			" 7	7.5	to	11.0	(5)	57.4	9.7	22.6	1, 2	10.6	13.6	09148	20	20	F
			" 7	12.5	to	18.2	(6)	36 00.1	15.4	22.0	2, 5				20	20	F
			" 8	7.4	to	14.1	(5)	35 55.6	10.0	24.2	5, 6				20	20	F
Mean.....						35 58.2		81 22.8				09148					
Hay River (Vale Point)....	60 51.8	115 43.7	Sept. 12	12.5	12.9	14.6	15.5	36 00.2	16.0	81 22.6	5, 6	13.0	14.3	09164	20	20	F
			" 12	16.4	16.9	18.5		02.7							20		F
			Mean.....					36 01.3		81 22.6				09164			
Brabant Harbour.....	61 04.2	116 34.6	June 28	10.0	12.0	13.2	16.8	38 01.6	18.4	81 19.8	5, 6	13.6	14.4	09236	20	20	F
			" 29	7.1	8.2	9.0	10.2	03.4	9.7	21.6	1, 2	10.5	11.2	09232	20	20	F
			" 29	11.4	to	18.8	(6)	03.6							20		F
			Mean.....					38 03.0		81 20.7				09234			

Providence.....	61 21.4	117 39.0	July 2	17.0 19.3 21.1	37 44.1				20.2	09475	20		F	
			" 3	8.1 9.7 10.8 11.6	44.2	10.2	81 07.2	1, 2	8.4 10.2	09468	20	20	F	
			" 3	13.6 to 19.2 (6)	46.0	16.0	04.6	5, 6	14.9	09452	20	20	F	
			Mean.....		37 45.0		81 05.9			09466				
	Trout River.....	61 19.2	119 50.8	July 5	7.5 to 13.6 (8)	37 34.1	9.8	80 38.1	1, 2	10.9 11.3	09882	20	20	F
				" 5	15.1 to 20.5 (6)	38.5	16.4	38.7	5, 6	14.1 14.8	09880	20	20	F
				Mean.....		37 36.0		80 38.4			09871			
				Simpson, A.....	61 52.2	121 20.0	July 7	10.5 to 21.4 (9)	38 15.3	16.7	80 46.0	5, 6	12.7	09750	20	20	F
			" 7						14.5 16.0	09751	20		F	
			" 8	7.6 to 14.6 (7)	16.8	10.0	46.2	1, 2	10.4	09753	20	20	F	
		" 9	8.1 8.5 9.9 10.6	14.6						20		F		
		Mean.....		38 15.7		80 46.1			09751					
Simpson, B ¹	61 52.3	121 21.0	July 9			17.5	80 36.6	2, 5	16.6	09795	20	20	F	
			" 10	1.8 to 3.8 (1)	38 25.2						20		F	
			" 10	9.2 to 13.8 (2)	19.4							20		F
			" 10	14.0 to 18.7 (2)	15.6							20		F
			Mean.....		39 19.0		80 36.6				09795			
North Nahanni River.....	62 17.5	123 21.4	July 12	7.7 8.3 9.0 10.0	38 55.4	9.6	80 26.5	1, 2	10.4 10.9	10009	20	20	F	
			" 12	11.2 11.8 13.0 13.7	39 00.9	16.6	24.5	5, 6	14.8 15.3	10019	20	20	F	
			" 12	14.5 16.0 17.2 18.4	00.6						20		F	
			Mean.....		38 59.0		80 25.5				10014			
Wrigley, A.....	63 16.3	123 36.0	July 14	7.2 to 12.9 (7)	40 10.5	16.8	80 59.6	1, 2	11.1 13.8	09435	20	20	F	
			" 14	13.5 to 20.9 (7)	15.3			14.9		09435	20		F	
			" 16	6.9 to 15.5 (10)	12.9	9.0	81 01.3	5, 6	10.9	09426	20	20	F	
			" 17	9.2	15.9						20		F	
			Mean.....		40 13.0		81 00.4				09433			
Wrigley, B.....	63 16.3	123 36.0	July 16	16.6 to 22.4 (6)	40 19.5	19.9	81 00.0	1, 5	16.9 17.5	09458	20	20	F	
			" 17	2.6 to 5.1 (6)	16.8						20		F	
			" 17	5.6 to 8.2 (6)	12.1						20		F	
			Mean.....		40 16.1		81 00.0				09458			

¹Magnetic storm.

MAGNETIC OBSERVATIONS, 1923 (continued)

Station	Lat.	Long.	Date	Declination				Inclination			Hor. Int.			Mag'r.	D.C.	Obs'r.		
				L.M.T.				Value	L.M.T.	Value	Needle	L.M.T.					Value	
				h.	h.	h.	h.	East	h.	°	'	h.	h.				γ	
Birch Island.....	64 11.2	124 23.4	July 18	7.9	to	13.0	(6)	41 18.5	8.9	81 15.5	1, 2	10.5	.....	09118	20	20	F
			" 18	13.6	to	18.4	(6)	14.6	10.1	14.5	5, 6	14.0	.....	09137	20	20	F
			Mean.....					41 16.6	81 15.0			09128				
Norman.....	64 54.3	125 34.6	July 20	8.7	to	22.7	(14)	41 29.6	.....	.....	.....	.....	.....	.....	20	.....	F
			" 21	3.7	to	8.4	(4)	28.1	10.0	81 25.0	1, 2	11.0	11.6	08889	20	20	F	
			" 21	8.7	to	19.1	(6)	28.3	16.2	28.0	5, 6	13.6	15.3	08873	20	20	F	
			" 21	17.8	27.1	1, 2	20	F
Mean.....					41 29.0	.....	81 26.7	.....			08881						
T. S. Monument 56N.....	65 31.4	127 39.3	July 23	13.5	15.2	17.1	20.4	40 41.8	16.6	81 08.0	1, 2	14.0	14.8	09189	20	20	F	
			" 24	7.6	8.2	8.9	.....	40.1	9.5	10.4	5, 6	10.3	10.9	09185	20	20	F
			" 24	10.0	11.2	12.3	47.8	20	F
			Mean.....					40 43.1	81 09.2			09187				
Good Hope, A.....	66 15.5	128 38.3	July 27	8.2	to	16.7	(8)	41 41.4	10.2	81 39.5	1, 2	10.1	11.8	08682	20	20	F	
			" 27	17.8	18.9	20.6	.....	41.5	16.2	34.9	5, 6	13.8	14.5	08692	20	20	F
			" 28	8.0	41.9	20	F
			" 30	20.3	21.0	21.5	37.7	20	F
Mean.....					41 40.7	.....	81 37.2	.....			08687						
Good Hope, B.....	66 15.2	128 38.3	July 28	8.6	to	13.0	(5)	41 42.9	9.4	81 39.0	1, 2	10.3	10.9	08655	20	20	F	
			" 28	14.0	to	18.6	(5)	34.9	15.0	37.0	5, 6	14.3	15.0	08706	20	20	F	
			" 30	4.5	to	9.0	(10)	38.0	20	F
			" 30	9.5	to	15.0	(10)	39.7	20	F
			" 30	16.0	to	22.2	(10)	38.2	20	F
			" 31	3.0	3.2	4.2	4.5	39.6	20	F
Mean.....					41 38.8	.....	81 38.0	.....			08680						

Sans Sault Rapids.....	65 44.8	128 47.6	July 25	7.7 8.5 9.6	41 27.5	10.3	81 11.0	1, 2	11.4	09222	20	20	F	
			" 25	11.0 13.2 14.3	27.0	16.1	08.4	5, 6	13.9	09243	20	20	F	
			" 25	15.6 17.2 18.6	32.3							20	20	F
			Mean.....		41 28.9		81 09.7				09232			
T. S. Monument O 44.....	66 43.8	129 51.1	Aug. 1	8.4 9.5 10.8	41 59.3	10.1	81 40.5	1, 2	11.2	08596	20	20	F	
			" 1	13.4 14.2 15.0	55.9	16.3	38.0	1, 2	14.6	08594	20	20	F	
			" 1	17.1 18.9 20.2	54.8	16.3	40.8	5, 6				20	20	F
			Mean.....		41 56.7		81 39.8				08595			
T. S. Monument O 69.....	67 28.2	131 14.8	Aug. 4	8.4 to 12.2 (5)	41 41.4	9.9	81 51.6	5, 6	10.7 11.9	08373	20	20	F	
			" 4	13.2 to 16.7 (5)	39.3	15.8	50.8	1, 2	13.6 14.6	08413	20	20	F	
			Mean.....		41 40.4		81 51.2				08393			
			Aug. 6	11.2 to 16.2 (6)	44 59.3	16.7	81 46.6	1, 2	11.4	08530	20	20	F	
Arctic Red River.....	67 26.7	133 44.2	" 6	17.2 to 21.2 (5)	56.8				14.5	08591	20	20	F	
			" 7	7.2 to 10.2 (4)	58.2	9.8	44.2	5, 6	10.6	08554	20	20	F	
			" 7	11.2 to 15.2 (5)	54.6	14.7	42.4	1, 2	13.6	08562	20	20	F	
			" 7	16.2 to 20.2 (5)	57.4							20	20	F
			Mean.....		44 57.3		81 44.3				08559			
			Aug. 11	18.1 19.7	45 05.1								20	20	F
Middle Peel River.....	67 39.2	134 36.1	" 12	7.6 8.4 9.8 10.7	00.8	10.2	81 22.8	1, 2	11.3	08760	20	20	F	
			" 12	13.0 14.0 15.3 16.1	44 58.1	14.6	28.8	5, 6	13.6	08744	20	20	F	
			Mean.....		45 00.6		81 25.8				08752			
			Aug. 9	8.5 to 14.1 (6)	44 10.9	10.4	81 08.7	1, 2	11.2 13.8	09122	20	20	F	
McPherson.....	67 26.4	134 52.6	" 9	15.6 to 20.9 (6)	07.2	16.6	10.1	5, 6	14.5 15.2	09118	20	20	F	
			" 10	2.5 to 12.5 (10)	11.2							20	20	F
			" 10	14.0 to 21.0 (7)	10.5							20	20	F
			Mean.....		44 10.1		81 09.4				09120			

MAGNETIC OBSERVATIONS, 1923 (concluded)

Station	Lat.	Long.	Date	Declination				Inclination			Hor. Int.		Mag'r.	D.C.	Obs'r.	
				L.M.T.				Value	L.M.T.	Value	Needle	L.M.T.				Value
				h.	h.	h.	h.	East °	h.	°	'	h.				h.	γ
Aklavik.....	68 13.5	134 59.7	Aug. 16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
			" 17	5.5 to 21.6 (5)	44 19.3	10.0	36.9	2, 5	10.8 11.5	08576	20	20	F	F	F	F
			" 18	7.3 to 18.6 (9)	21.0	9.1	36.3	6, 1	10.0 10.9	08586	20	20	F	F	F	F
			" 20	3.0 to 20.5 (16)	22.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
			" 21	2.8 to 22.1 (15)	22.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
			" 22	2.9 to 17.5 (10)	20.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
			Mean.....	.....	44 21.2	.....	81 34.8	.....	.....	08584	.....	.....	.....	.....	.....	.....

MAGNETIC STATIONS AND DESCRIPTIONS

Aklavik, N.W.T., 1923.—The station is on the bank of Peel river to the northwest of the group of buildings comprising the settlement. It is 85 feet northwesterly, measured along a survey line, and 8 feet northeasterly from the iron post at the northerly corner of the lot reserved as a hospital site, the property of the Anglican Mission. Observations were taken over a stake $3\frac{1}{2}$ inches in diameter, set flush with the ground and embedded in cement. The chimney on the Hudson's Bay Company's store bears $155^{\circ} 32' \cdot 5$.

Amherst, Magdalen Islands, Que., 1921.—The station is in an open field at the back of Shea's hotel, being 6 feet east and 189 feet north of the northeast corner of the back part of the hotel, 160 feet from the fence along the south side of the field and 80 feet southerly from the edge of the bank along the water's edge. Observations were taken over a stone 2 by 2 inches set flush with the ground. The following true bearings were determined: spire of Catholic church, $259^{\circ} 30' \cdot 8$; top of lighthouse on wharf, $299^{\circ} 01' \cdot 6$; northerly extremity of Entry island, $61^{\circ} 43' \cdot 4$; top of rock at southerly extremity of Entry island, $73^{\circ} 06' \cdot 3$.

Arctic Red River, N.W.T., 1923.—The station is on the Hudson's Bay Company's property, almost in line with the northeast corner of the pier marking the D. O. astronomical station and the west side of a dwelling-house. It is 98.5 feet northwest of the northwest corner of the store, 128.5 feet north of the northwest corner of a dwelling-house, 51.5 feet north of the northeast corner of the astronomical pier, 76.3 feet northeast from the northeast corner of the dwelling-house for visiting Indians, and 34.4 feet northwest of the flagstaff. Observations were taken over a concrete block 7 by 7 inches set flush with the ground. The following true bearings were determined: tree on hill across Arctic Red river, $242^{\circ} 12' \cdot 6$; tip of cross on Mission building, $303^{\circ} 14' \cdot 4$; lobsterstick, $32^{\circ} 04' \cdot 6$.

Baker's Narrows, Athapapuskow lake, Sask., 1923.—The station is at Baker's narrows, on the east side of, and on the most northeasterly point of land at the north end of the narrows. Observations were taken over a cross-mark chiseled in the solid rock of the point. The station is on the summit of the rock that measures 16 by 11 feet, and is 37.5 feet westerly from a brass plug in the rock at the water's edge. This plug bears the inscription "239 T, 1919."

Bancroft, Ont., 1921.—The station is on the exhibition grounds about one-half mile westerly from the C.N.R. depot. It is inside the race track, west of a grove of trees and south of the exhibition buildings; 129.5 feet southerly from the south side of the main building and in line with the westerly side produced; 41 feet southerly and 43.8 feet westerly from the southwesterly corner of a small building, and 41.5 feet northeasterly from a telephone pole at a large rock. The point is marked by a cedar stake 2 by 3 inches and driven flush with the ground. The following true bearings were determined, north gable of white house, $208^{\circ} 29' \cdot 8$; north gable of white house, $178^{\circ} 33' \cdot 3$; north gable of white house, $162^{\circ} 16' \cdot 8$; south gable of judge's box on grand-stand, $311^{\circ} 26' \cdot 3$.

Beaver Lake, Sask., 1922.—The station is on the southwesterly shore of Beaver lake on the northerly side of the first limestone point from the southeasterly entrance to the lake. The point is on the top of a limestone plateau immediately behind the fire-ranger's cabin and just south of the path connecting the cabin with the remainder of the settlement. Observations were taken over a cross-mark chiseled in the rock which was covered with a mound of stones.

Birch Island, N.W.T., 1923.—The station is on the east side of Mackenzie river, opposite Birch island, and on the northerly side of a small creek which is about one mile below T. S. Monument "S 101." It is about 520 feet easterly from the river and 30 feet southerly from the edge of the gravel bank along the creek. A lobster on the edge of the woods to the north bears $341^{\circ} 12' \cdot 7$.

Boundary, Alta. and B.C., 1922.—The station is on the boundary line between Alberta and British Columbia, on the north side of Peace river. It is 148 feet north of the upper part of the bank along the river and 203 feet south of the Interprovincial monument. Observations were taken over a drill hole in the top of a sandstone block 4 by 4 inches set flush with the ground.

Bon Accord, Alta., 1922.—The station is south of the village and about a quarter of a mile southeasterly from the A. & G. W. Railway depot. It is on the easterly edge of a cleared space used for athletic purposes, being 355 feet east of the east side of the street and 322 feet south of the north side of the field. Observations were taken over the intersection of two grooves in the end of a brick set flush with the ground. The following true bearings were determined: insulator on north end of section house, $291^{\circ} 39' \cdot 4$; ornament on north end of depot, $318^{\circ} 38' \cdot 7$; east gable of United Grain Growers' elevator, $320^{\circ} 07' \cdot 4$; cross on front of English church, $11^{\circ} 02' \cdot 1$.

Borden, P.E.I., 1921.—The station is about a quarter of a mile southeasterly from the C.G.R. depot, in a field belonging to Mr. McInnis, the field being the second northerly from the one in which a lighthouse is located. The point is 42 feet northerly from the fence along the south side of the field and 10 feet from the edge of the bank along the shore; it is marked by a small hole in the top of a stone 4 by 4 inches projecting slightly above the surface. The following true bearings were determined: pole on C.G.R. water-tank, $304^{\circ} 03' \cdot 3$; top of lighthouse farthest from the shore, $95^{\circ} 33' \cdot 1$; pole on water-tank on breakwater, $219^{\circ} 09' \cdot 1$.

Boyle, Alta., 1922.—The station is on the school grounds, 112 feet northerly and 94 feet westerly from the northwesterly corner of the school building, 161.5 feet from the front of the grounds and 138 feet north of the north side of the road allowance along the south side. The point is marked by a stake set flush with the ground. The following true bearings were determined: south gable of Mrs. Boyle's house, $261^{\circ} 33' \cdot 5$; right edge of chimney on depot, $334^{\circ} 03' \cdot 0$; northeasterly corner of school building, $95^{\circ} 25' \cdot 0$; southwesterly corner of school building, $109^{\circ} 01' \cdot 0$.

Brabant Harbour (Wrigley Harbour), N.W.T., 1923.—The station is on Brabant island (Wrigley island) and near the point of land on the northeast corner of the island. It is on a slight ridge about 275 feet from the stony portion of the point and 108 feet westerly from the nearer of two lobstersticks near the water's edge on the east side of the island. Observations were taken over a concrete block $6\frac{1}{2}$ by 7 inches set flush with the ground. A lobsterstick on a distant island bears $80^{\circ} 29' \cdot 7$.

Brochet Lake, Man., 1922.—The station is on the northerly bank of Cochrane river at the beginning of the 53-chain portage to Brochet lake. The point is on the portage path to the west of the open ground on the top of the river bank; it is about 30 yards from the water's edge and southeasterly from two large jack pine trees between which the path runs. The station is 17.5 feet from the westerly and 14.5 feet from the easterly

tree. Observations were taken over the centre of a cross chiseled in the top of a grey granite boulder 2 feet square and projecting 8 inches above the ground.

Brochet Post, Man., 1922.—The C. I. station of 1908 was not available owing to the close proximity of a large sheet-iron warehouse. The station of 1922 is on a rocky island across a narrow channel and opposite the Hudson's Bay Company's post, near the northerly end of the island on the level ground about 50 yards from the water's edge. Observations were taken over the centre of a cross-mark chiseled in the top of a granite rock which was covered with a mound of stones. The southwesterly corner of Revillon Freres' store bears $281^{\circ} 12' \cdot 0$.

Browns Landing, Alta., 1922.—The station is on the west bank of Peace river in an open space around what is known as Brown's Landing. It is 6 feet from the edge of the river bank, 45 feet north of the boat landing and 175 feet north of a small creek. Observations were taken over a small hole in the top of a stone set flush with the ground. A temporary reference mark was used.

Cap des Rosiers, Que., 1921.—The station is on the lighthouse reserve in a field west of the lighthouse. It is 141.6 feet easterly from a boundary stone at the northwest corner of the field, 29 feet southerly from the fence on the northerly side of the field and 31 feet from the southerly fence. Observations were taken over a copper bolt set flush with the ground. The following true bearings were determined: spire of Catholic church, $334^{\circ} 04' \cdot 1$; spire on lighthouse, $80^{\circ} 24' \cdot 0$; vertical edge of cliff at water's edge on cape Gaspé, $164^{\circ} 23' \cdot 1$.

Cape Chat, Que., 1921.—The station is on an uncultivated strip of land near the westerly side of an open field adjoining the westerly side of the village and belonging to Mr. Oliver Roy; about 450 feet from the Catholic church, 16 feet from the westerly boundary fence and 132 feet from the northerly boundary fence around the field. Observations were taken over a hole in the top of a cement block 4 by 4 inches set flush with the ground. The following true bearings were determined; rod on tower of school, $298^{\circ} 53' \cdot 5$; tip of ornament on northeast corner of church tower, $311^{\circ} 29' \cdot 0$; spire of church seen in the distance, $69^{\circ} 55' \cdot 3$.

Carcajou Point, Alta., 1922.—The station is on the south bank of Peace river, about three miles above Carcajou point on property belonging to Mr. C. M. Robarts. It is 105.5 feet northerly and 112 feet westerly from the northwesterly corner of Mr. Robart's house. Observations were taken over a willow stake 4 by 4 inches and projecting 6 inches above the surface. The following true bearings were determined: poplar tree across the river, $358^{\circ} 53' \cdot 6$; northeast corner of Mr. Robart's dwelling-house, $158^{\circ} 53' \cdot 6$.

Charlottetown, P.E.I., 1921.—The station is a relocation of the C. I. station of 1908. The observations were made over the middle one of three stones marking the meridian line established by the British Admiralty in Victoria park. The stone is 13 by 14 inches and projects 18 inches above the surface. West of, and in line with the stone marking the south end of the meridian are two additional stones. The point of observation was over the east end of a groove about 2 inches long in the southwest quarter of the stone. The following true bearings were determined: middle of north meridian stone $0^{\circ} 16' \cdot 4$; church spire seen between two chimneys, $49^{\circ} 56' \cdot 3$; church spire, $54^{\circ} 50' \cdot 6$; tip of ornament on tower of city hospital, $70^{\circ} 09' \cdot 4$.

Cheecham, Alta., 1922.—The station is on the west side of the A. & G. W. Railway tracks and is reached by measuring from the semaphore at the north end of the siding a distance of 175 feet along the main line, south, and at this distance turning to the right from the direction of the railway tangent to the south, the angle $98^{\circ} 06' \cdot 0$, thence measuring along this direction a distance of 489 feet to the station. Gable of cabin on east side of tracks bears $71^{\circ} 47' \cdot 2$.

Chenal des Quatre Fourches, Alta., 1922.—The station is on the west bank of Chenal des Quatre Fourches near its junction with Peace river. It is north of the T. S. Monument and approximately on the extension of the line joining the centre of a post marked "B 6 1922," and the middle of a pit, being 37.2 feet from the former. Observations were taken over a stake 3 by 3 inches and projecting 6 inches above the surface.

Chipewyan, Alta., 1922.—The station is probably near the M. S. station of 1910, in the open space between the Hudson's Bay Company's property and the lake. It is 310 feet southwesterly from the flagstaff at the corner of the Hudson's Bay Company's store, 173 feet south and 80 feet west of the southwest corner of the lot where the manager of the Hudson's Bay Company's post lives, and 22.5 feet east of the east side extended of this house. Observations were taken over a drill hole in the top of a stone about 4 by 8 inches set flush with the ground. The following true bearings were determined: cross on dome of Mission school, $267^{\circ} 25' \cdot 1$; cross on spire of Catholic church, $269^{\circ} 37' \cdot 3$; wooden cross on hill, $283^{\circ} 41' \cdot 2$; spire of English church, $304^{\circ} 38' \cdot 5$; Hudson's Bay Company's flagstaff, $67^{\circ} 27' \cdot 3$; lobster on island, $163^{\circ} 16' \cdot 2$.

Chipewyan Lake, Man., 1923.—The station is on the southerly bank of Seal river just at the entrance to Chipewyan lake at a point where there is a sand cut bank, the bank being about 15 feet high. The station is 16 feet westerly from the edge of the bluff at the edge of the river. Observations were taken over a squared spruce stump $4\frac{1}{2}$ by 4 inches and projecting 1.7 feet above ground. A brass screw marks the precise point. The letters "DOMS" were carved on the northeast side of the stump which was painted red.

Churchill, Man., 1923.—The station is near the M. S. station of 1912. It is on Cackle's point, 26 feet southwesterly from the highest part of the beach to the northeast in line with a large boulder in the water to the northeast of the station. It is 104 feet southwesterly from an arrowhead chiseled in the base of the rocky hill and is 95.2 feet southerly from another arrowhead cut in a low rock at high tide mark. These two marks are 54.0 feet apart. Observations were taken over a cross-mark chiseled in the top of a flat granite rock. The base of the southwest standard on the frame of the beacon on Battery point bears $26^{\circ} 12' \cdot 1$.

Churchill River, Man., 1923.—The station is at the bend where the Churchill turns to the north on the way to Granville lake, on the southwest corner of the big island which lies slightly to the northeast of the rocky point on the left bank of the river at the turn. The point is on the top of the rocky cliff on the side of the point to the northwest of the bay in the southwest part of the island. It is 200 feet north of the high-water mark on the point and 8.5 feet west from the edge of the cliff on the west side of the point. This cliff is about 30 feet high and is composed of grey granite. Observations were taken over a cross-mark chiseled in the rock. Several trees nearby are trimmed and some have been removed to allow a clear view of the water.

Clear River, Alta., 1922.—The station is on the third island below Clear river and about 15 miles therefrom, and the second below what is locally known as Rosalie island. It is in an open space near the middle of the south side of the island and about 30 feet north of the edge of the bank along the river. Observations were taken over a hole in the top of a concrete block 6 by 6 inches and projecting 2 inches above the surface.

Cochrane River, Man., 1922.—The station is on the north bank of Cochrane river at the beginning of the first portage leading to Fort Hall. This portage leads over a steep bluff at the river and descends a very steep hill at the lake to the north. The station is on level ground about midway between the bank of the river and the base of the bluff and is about 100 yards westerly from the portage path. Observations were taken over the centre of a cross-mark chiseled in the top of a red granite rock 4 by 5 inches and projecting 2 inches above ground.

Coe Hill, Ont., 1921.—The station is on the Mining Company's property about three-quarters of a mile south from the C.N.R. depot. To reach the station proceed south from the depot along the road which runs to the lake, take the first turn to the right and follow this road into the rocky grounds of the Mining Company. The station is on the rocky summit of a hill to the right of the road and to the northwest of Mr. Ferguson's house, 37.5 feet westerly from a large upturned stump, 87.5 feet easterly from a large granite boulder and 48.5 feet southerly from a maple tree. The point is marked by a stake 2 inches in diameter and projecting 6 inches above the surface. The following true bearings were determined: east gable of Mr. Ferguson's house, $126^{\circ} 18' .5$; west gable of white house in valley, $90^{\circ} 31' .0$; north gable of white house across lake, $87^{\circ} 05' .0$; west gable of white house in valley, $81^{\circ} 32' .0$.

Coronation, Alta., 1922.—The station is north of the town on the agricultural grounds, being 312 feet west and 228 feet north of the southeast corner; 43.3 feet southeasterly from the southerly corner of an enclosure covered with small poplar trees and almost in line with the southwesterly side of the same. Observations were taken over a stake 4 by 4 inches set flush with the ground. The following true bearings were determined: flagstaff on school, $173^{\circ} 10' .2$; tip of town water-tank, $181^{\circ} 49' .0$; spire of Catholic church, $212^{\circ} 24' .0$; pole on judge's stand inside race course, $347^{\circ} 08' .0$.

Cumberland House, Sask., 1922.—The C. I. station of 1908 was reoccupied. It is on the Hudson's Bay Company's reserve, on an open knoll facing Cumberland lake to the north and is between a grove of spruce trees and the lake. The station is 352 feet northwesterly from the northwesterly corner of the Hudson's Bay Company's store and 14 feet northeasterly from the southwesterly side produced, is 79 feet northwesterly from the northwesterly corner of a stone powder-house and 126 feet southwesterly from the southwesterly side produced. Observations were taken over a cross-mark chiseled in the top of a flat granite rock almost flush with the ground. The northwesterly gable of the ice-house bears $119^{\circ} 25' .8$.

Dingwall, N.S., 1921.—The station is on the south side of the harbour on property belonging to Mr. O'Brien. From the station St. Paul's island may be seen in line with the east end of the channel connecting the harbour with the open water outside. The point is about 625 feet east of Mr. O'Brien's fish stage, 45 feet east of a drainage ditch, about 35 feet from the shore line and about 25 feet north of the edge of a clump of spruce trees. Observations were taken over a hole in the top of a cement block 7 by 7 inches and

projecting 2 inches above the ground. The following true bearings were determined: ornament (upper angle) over small window in north end of Mr. MacDonald's house, $217^{\circ} 02' \cdot 5$; south gable of Mr. O'Brien's house, $246^{\circ} 09' \cdot 2$; storm-signal post, $277^{\circ} 40' \cdot 0$.

Dunvegan, Alta., 1922.—The station is about one-half mile east of the ferry crossing on the north bank of Peace river and on lot 4 of the Dunvegan Settlement Survey. It is about 9 feet from the edge of the bank, at the upper level, along the river, 428 feet east of a post on the west side of lot 4 and 84 feet south and 73 feet east of the southeast corner of Mr. Duncan McDonald's house. Observations were taken over a hole in the top of a concrete block 6 by 6 inches set flush with the ground.

Fifth Meridian, Alta., 1922.—The station is on the north side of Peace river, approximately on the centre line of the clearing marking the Fifth meridian; 10 feet from the bank of the river and 53.7 feet south of the centre of witness mound. A birch stake 2 by 2 inches and projecting 12 inches above the surface marks the station.

Fitzgerald, Alta., 1922.—The station is on the grounds of the R.C.M.P., about 500 feet southerly from the most westerly of their houses and about the same distance northeasterly from the Hudson's Bay Company's store. It is near the southwest corner of a small field, being 27 feet north of the bank along the river, 22 feet east of the fence along the west side of the field and 43.5 feet northeast of a tree at the end of the fence along the west side of the field. Observations were taken over a drill hole in the top of a stone about 6 by 7 inches set flush with the ground. The following true bearings were determined: flagstaff on Hudson's Bay Company's store, $217^{\circ} 39' \cdot 9$; flagstaff seen over store, $218^{\circ} 10' \cdot 4$; flagstaff in front of house on R.C.M.P. grounds, $350^{\circ} 48' \cdot 4$; flagstaff large cross on rocky point, $74^{\circ} 49' \cdot 4$.

Fort Hall Lake, Man., 1922.—The station is on the southerly end of the long portage into Cashmere lake, on the summit of a hill about 30 feet high rising from the water's edge and to the west of the beginning of the portage path. Observations were taken over a cross-mark chiseled in the top of a red granite boulder 2 feet by 2.5 feet by one foot high. This is the only red granite boulder in the vicinity.

Fort St. John, B.C., 1922.—The station is on the Hudson's Bay Company's property and about 350 feet west of the most westerly one of the group of houses comprising the post. It is 35.3 feet east of a fence and 283 feet easterly from the most southerly of two iron posts marking the westerly limit of the Hudson's Bay Company's property. Observations were taken over the top of a concrete block 6 by 6 inches set flush with the ground. The following true bearings were determined: upper window in end of house across Peace river, $133^{\circ} 12' \cdot 3$; southerly one of two iron posts on west side of Hudson's Bay Company's property, $298^{\circ} 53' \cdot 5$; northerly post, $316^{\circ} 35' \cdot 3$.

Fort Smith, N.W.T., 1923.—The station is a relocation of the D. O. station of 1922, and an approximate relocation of the M. S. station of 1910. It is 111 feet northwesterly from the corner of the Hudson's Bay Company's warehouse and 133 feet northeasterly from the corner of the house used by employees of the company and about 45 feet south of the edge of the bank; further, it is 14.5 feet east of the east line of the house and 61 feet west of the west line of the warehouse. Observations were taken over a concrete block 4 by 4 inches set flush with the ground. The following true bearings were determined: northeast corner of Hudson's Bay Company's warehouse, $134^{\circ} 21' \cdot 9$; west edge of flagstaff in grounds of Hudson's Bay Company, $184^{\circ} 13' \cdot 4$; west edge of chimney on Hudson's

Bay Company's cook house, $197^{\circ} 33'.8$; cross in cemetery, $265^{\circ} 31'.4$; bottom of chimney on house near cemetery, $279^{\circ} 31'.4$; bottom of flagstaff, $280^{\circ} 21'.4$.

Fort Vermilion, Alta., 1922.—The station is in a small open space on the south side of the island opposite Fort Vermilion. It is west of the ferry landing, almost in line with the south edge of the cable tower and 194.5 feet west of the southwest corner of the same. Observations were taken over a birch stake 4 by 4 inches and projecting above the surface. The following true bearings were determined: flagstaff on office of Hudson's Bay Company, $118^{\circ} 47'.9$; north gable of dwelling-house of Hudson's Bay Company's post manager, $128^{\circ} 07'.9$; cross on tower of Catholic church, $172^{\circ} 49'.2$.

Fox River, Man., 1923.—The station is about 200 yards easterly from the junction of Hayes and Fox rivers, on the north side of the Hayes. It is to the west of the spruce trees at the summit of the bank and in a grove of poplar, 11 feet northwesterly from the edge of the bluff. The point is marked by a spruce stake 2.5 inches in diameter and projecting one foot above the ground.

Frog Portage, Sask., 1922.—The station is an approximate relocation of the C. I. station of 1908. It is on the south bank of Churchill river, east of Frog rapids and east of the portage path; it is 26.2 feet northeasterly from the northeast corner of a large grey granite boulder, the most easterly one east of the portage path, and about 15 yards southerly from the bank of the river. Observations were taken over the point of an arrowhead chiseled in the top of a grey granite triangular-shaped rock, measuring 9 inches to a side, projecting 4 inches above the ground.

Gaspé Basin, Que., 1921.—The station is in an open field belonging to Mr. B. F. Patterson, on the hillside northeast of Mr. Patterson's house and northwest of the Methodist church. It is about 575 feet north of the main road along the shore, 140 feet west of the fence on the east side of the property and 78 feet west of the fence around a small cultivated field. From the station the road running over the hill south of the pulp mill across the harbour may be seen between two smokestacks on the mill. Observations were taken over a small hole in the top of a cement block 5 by 5 inches and projecting slightly above the ground. The following true bearings were determined: top of dome on centre of house near mill, $97^{\circ} 17'.1$; bottom of flagstaff in front of house near mill, $97^{\circ} 18'.8$.

Good Hope, A, N.W.T., 1923.—The station is near the monument marking the northwest corner of lot 7 of Good Hope Settlement Survey, this lot being the property of the Hudson's Bay Company. It is 13.5 feet southeasterly from a stake at the corner of the lot, 64 feet west of a row of posts intended for a fence line and 91 feet northwesterly from the northwesterly corner of the Hudson's Bay Company's storehouse. Observations were taken over a concrete block 7 by 7 inches set flush with the ground. The following true bearings were determined: cross on spire of Catholic church, $201^{\circ} 57'.0$; cross on tower of Catholic Mission building, $205^{\circ} 15'.0$.

Good Hope, B, N.W.T., 1923.—The station is on the property of the Catholic Mission about one-quarter of a mile south of station A and on the westerly pier of the observatory building used by Mr. Bibby of the Meteorological Service for magnetic observations during the seasons 1921-1922. A distant reference mark used for balloon ascension observations and seen through the door of the building and over a post a short distance from the building bears $87^{\circ} 24'.0$.

Grand Narrows, N.S., 1921.—The station is on property belonging to Senator M. J. O'Brien, in the first field on the west side of the road leading from the C.G.R. depot southerly along the shore and is about 1,200 feet south of McNeil's hotel. The point is near the northwest corner of the field, being 35 feet south of the fence along the north end of the field and 9 feet east of a tree at the edge of the bank along the shore. Observations were taken over a hole in the top of a stone 2 by 2 inches set flush with the ground. The spire of the Catholic church in Iona bears $332^{\circ} 57' \cdot 4$.

Grand River, Que., 1921.—The station is about one-half mile southwest of the railway depot. It is on property belonging to the Banque Nationale and near the rear of the lot on which the bank building stands, being 57 feet east of the west fence, 46.5 feet south of the north fence and 38 feet west of the east fence. The point is marked by a stake 2 inches in diameter set flush with the ground. The following true bearings were determined: bottom of large cross in field near lighthouse, $227^{\circ} 25' \cdot 9$; top of cross on tower of convent, $266^{\circ} 26' \cdot 7$; bottom of pole on manse, $276^{\circ} 42' \cdot 9$; white vertical strip on northwest corner of main part of manse, $280^{\circ} 03' \cdot 9$.

Great Island, Seal River, Man., 1923.—The station is on the east side of a small round island which lies one-quarter of a mile to the southeast of Great island and is the only island in this direction. This small island is in a bay in the south bank of the river at the junction of the two branches, one branch running from the west and one from the north, both running easterly when united. The island is rocky and is covered with a mound of sand grown over with moss and sparsely wooded. Observations were taken over a cross-mark chiseled in the top of a triangular-shaped granite boulder 3 by 2.5 feet and projecting one foot above the surface. The rock is 22 feet westerly from the edge of the bank.

Griffin Creek, Alta., 1922.—The station is about 3 miles below Griffin creek, also about the same distance below the intersection of the 21st base line and Peace river, near the south side and near the west end of the first island below Griffin creek. It is about 75 feet north of the edge of the willows along the shore and about 135 feet northeasterly from the edge of the gravel exposure. Observations were taken over a small hole in the top of a flat stone about 12 by 12 inches set flush with the ground.

Grindstone, Magdalen Islands, Que., 1921.—The station is near the edge of the bank along the shore, in an open field belonging to Mr. McLean, the field being the third west of the one in which are located the buildings of the Eastern Canada Fisheries, Limited. The point is 365 feet west of the east side of the field and slightly south of the line joining the inner extremities of two inlets; it is 25 feet west of the edge of the easterly one and 46 feet east of the edge of the westerly one and is 19 feet northerly from the edge of a third. Observations were taken over a drill hole in the top of a stone the diagonals of which are 2 and 3 inches, set flush with the ground. The following true bearings were determined: Geodetic Survey of Canada pier on hill, $290^{\circ} 45' \cdot 8$; spire of English church, $303^{\circ} 10' \cdot 8$; spire of Catholic church in House Harbour, $51^{\circ} 02' \cdot 9$; southerly extremity of Alright island, $73^{\circ} 52' \cdot 4$; northerly extremity of Entry island, $124^{\circ} 20' \cdot 9$.

Hay River, N.W.T., 1923.—The station is north of the village in an open space along the bank of Hay river. It is 65.4 feet northerly from a fence along the northerly side of a garden which is adjacent to and north of the lot on which is located the Catholic church, 49.8 feet westerly from the iron post at a survey monument and 60 feet northeasterly

from a concrete block approximately 16 by 17 inches. Observations were taken over a hole in the top of a concrete block 9 by 10 inches set flush with the ground. The following true bearings were determined: spire of Catholic church, $131^{\circ} 20' \cdot 4$; northerly gable of bell-tower on Anglican Mission school, $134^{\circ} 34' \cdot 2$; flagstaff on residence of Anglican Mission, $138^{\circ} 17' \cdot 6$; chimney on house, $144^{\circ} 36' \cdot 6$.

Hay River (Vale Point), N.W.T., 1923.—The station is on an island, on the part known as Vale Point, across the river from Hay River. It is 107 feet easterly from the northeasterly corner of the tower supporting the north range-light and about 49 feet from the edge of a growth of trees along the shore. Observations were taken over a hole in the top of a concrete block 7 by 8 inches set flush with the ground. The following true bearings were determined: magnetic station at Hay River, $127^{\circ} 29' \cdot 0$; spire of Catholic church, $127^{\circ} 56' \cdot 0$; north gable of bell tower on Mission school, $129^{\circ} 58' \cdot 3$; base of flagstaff in front of Hudson's Bay Company's store, $132^{\circ} 45' \cdot 0$.

Hayes River, Man., 1923.—The station is on the easterly bank of Hayes river, about 9 miles southerly from the junction of Hayes and Pennycutaway rivers and about 17 miles northerly from the junction of Hayes and Shamattawa rivers. The station is at the edge of the bush at high ice-mark and is about 100 yards from the water's edge (low water). There are shoals and gravel bars exposed in the river at low water and the westerly bank is composed of a very high clay bank. The station is marked by a tamarack stake 2 by 2.5 inches painted yellow and projecting 6 inches above ground. A small lobstick is at the station.

Hayes River (First rapids north of Swampy lake), Man., 1923.—The station is south of the first large rapids north of Swampy lake. It is on the southeast bank of the river where the river turns to the north. The station is on the top of the bank in a grove of spruce, pine, poplar and birch, and is 17 feet from the edge of the bluff in an easterly direction. A cutting was made to the water and a lobstick was made. The point is marked by a cartridge shell in the top of a birch stake 3 inches in diameter projecting 6 inches above the ground and painted yellow.

Huntingdon, Que., 1921.—The station is in the Exhibition grounds southeast of and on the opposite side of Chateauguay river from the town. It is near the southwesterly corner of the grounds in line with the westerly side of the band stand and is also in line with the southerly side of the most northerly of two cattle sheds; it is 94.5 feet south of the southwest corner of the band stand, 188 feet west of the southwest corner of the cattle shed, 149 feet north of the south side of the grounds and 173.2 feet east of the sheds along the west side of the grounds. Observations were taken over a cedar stake driven flush with the ground. The following true bearings were determined: spire of Methodist church, $258^{\circ} 36' \cdot 8$; tip of spire on Anglican church, $273^{\circ} 50' \cdot 8$; tip of cross on Catholic church, $331^{\circ} 07' \cdot 8$; tip of ornament on red brick house, $35^{\circ} 14' \cdot 8$.

Husky Portage, Man., 1922.—The C. I. station of 1908 was reoccupied. It is near the southerly end of the portage to Putahow lake on the northeast bank of the river on the top of a sandy hill which rises about 30 feet above the water's edge and east of the portage path. The station is 20.8 feet southerly from a large grey granite boulder projecting 3 feet above ground and is 10.2 feet northerly from the edge of the bluff. Observations were taken over the centre of a cross-mark chiseled in the top of a grey granite rock about 6 by 12 inches and projecting 3 inches above the surface.

Ingonish, South Bay, N.S., 1921.—The station is in a pasture field which is adjacent to the north side of the harbour and the west side of the road leading to the wharf. The field is owned by Mr. Peters. The station is opposite and in front of a dwelling-house owned by Mr. Jerry Curtis; it is 90 feet south of the north fence, 37 feet east of the west fence, 56 feet north of the south fence and about 375 feet west of the fence on the east side of the field. Observations were taken over a small hole in the top of a cement block 5 by 5 inches set flush with the ground. The following true bearings were determined: west gable of fish stage, $149^{\circ} 49' \cdot 9$; top of lighthouse near wharf, $149^{\circ} 54' \cdot 4$; southeast corner of Mr. Young's house, $260^{\circ} 45' \cdot 4$; northwest corner of Peters' hotel, $24^{\circ} 05' \cdot 1$; vertical edge of rock on Middle Head point, $62^{\circ} 50' \cdot 9$; top of rocky prominence near shore line on cape Smoke, $109^{\circ} 55' \cdot 9$.

Inverness, N.S., 1921.—The station is in an open field lying between the railway tracks and the shore. From the station the north tower of the Catholic church appears over the middle of the town hall, also slightly to the right of the north chimney on the depot. It is 900 feet west of the west limit of the railway right-of-way. Observations were taken over a drill hole in the top of a stone 4 by 4 inches set flush with the ground. The following true bearings were determined: lighthouse on Margaree island, $15^{\circ} 15' \cdot 9$; spire on north tower of Presbyterian church, $104^{\circ} 48' \cdot 2$; tip of south tower of Presbyterian church, $105^{\circ} 37' \cdot 8$; cross on middle of front of Catholic church, $115^{\circ} 45' \cdot 7$.

Jackfish River, Alta., 1922.—The station is on the north side of Jackfish river and on the west side of Peace river. It is south of a group of buildings comprising the trading post of Pierce and Boisvert, being 155 feet south and 19 feet west of the southwest corner of a building used as a dwelling-house and store. Observations were taken over a stake 3 by 3 inches set so as to project 3 inches above the surface.

Kerrobot, Sask., 1922.—The station is about three-eighths of a mile southerly from the C.P.R. depot. It is on the extension of a street, which is approximately midway between the high school and the standpipe, and almost in line with the row of telephone poles along the southwesterly side of the street; it is about 1,260 feet southeasterly from the southeasterly side, extended, of the public school building, and about 960 feet from the first street southeasterly from the public school and 174 feet northwesterly from a street line. Observations were taken over the intersection of two grooves in the end of a brick set flush with the ground. The following true bearings were determined: cross on Catholic church, $309^{\circ} 32' \cdot 2$; left edge of chimney on high school, $330^{\circ} 17' \cdot 8$; flagstaff on public school, $354^{\circ} 19' \cdot 2$; pole on C.P.R. water-tank, $5^{\circ} 46' \cdot 2$; chimney on house near railway crossing, $101^{\circ} 12' \cdot 9$.

Kettle Rapids, Man., 1922.—The station is on the south bank of Nelson river about one-quarter of a mile west from the railway bridge over the rapids. It is on the first point of land jutting into the rapids and forming the western arm of a small bay. Observations were taken over the centre of a cross-mark chiseled in the top of a flat granite rock flush with the ground. The northwest corner of a building formerly used as a hospital bears $97^{\circ} 36' \cdot 1$.

Kississing (or Cold) Lake, Man., 1923.—The station is on the easterly side of the first island to the north of the narrows between the small and the large parts of Kississing lake. These narrows are called "Gis-chi-wa-pow" (Greatest narrows). The station is

47 feet west from the water's edge. Observations were taken over a cross-mark chiseled in the top of a large flat grey granite rock flush with the ground.

Kississing (or Cold) River, Man., 1923.—The station is south of the falls and north of the beginning of the portage path at the last portage on the way to Churchill river. It is on the top of the rock forming the east bank of the river, the rock being about 7 feet in height, and is about half-way between the beginning of the portage path and the falls. The point is 12 feet easterly from the edge of the rock at the water. Observations were taken over a cross-mark cut in the rock and covered with a mound of stones.

Lac la Biche, Alta., 1922.—The station is near the street passing along the southerly side of The Inn, and on the shore of lac la Biche. It is 60 feet westerly and 25 feet southerly from the southwesterly corner of the fence around the hotel grounds. Observations were taken over the intersection of two grooves in the top of a brick set flush with the ground. The following true bearings were determined: pipe on chimney of house near lake shore, $66^{\circ} 35' \cdot 1$; northwesterly corner of hotel, $98^{\circ} 24' \cdot 8$; southeasterly corner of hotel, $116^{\circ} 08' \cdot 1$.

Lacolle, Que., 1921.—The station is in a field belonging to Mr. Masters, at the north-east angle formed by the intersection of the Burlington and the Montreal-New York roads, the field being about 200 yards west of the D. & H. Ry. tracks and about 400 yards north of the C.N.R. tracks. It is on a knoll about 60 yards north of the Burlington road. This knoll is rocky and partially overgrown with hawthorn bushes. The point is in line with the summits of two rocks in a north-south direction, being 8.3 feet south of the northerly rock and 8.5 feet north of the southerly one; it is also 16.5 feet from the summit of the most westerly outcrop. Observations were taken over a stake set flush with the ground. The following true bearings were determined: south gable of white house across D. & H. railway tracks, $36^{\circ} 33' \cdot 9$; tip of semaphore at extreme left of C.N.R. tracks, $137^{\circ} 39' \cdot 9$; right edge of chimney on C.N.R. depot, $232^{\circ} 55' \cdot 9$; tip of pole on tank of cheese factory, $256^{\circ} 43' \cdot 9$; tip of pole on Lacolle house, $332^{\circ} 00' \cdot 9$.

Lacombe, A., Alta., 1922.—The station is a relocation of the station of 1911, which was reoccupied in 1919. It is on the agricultural grounds to the southwest of the town, 138 feet north of the south fence, 460 feet west of the fence along the east side of the grounds, 160 feet east of the southeast corner of an exhibit building and 240 feet south of the southeast corner of the grandstand. It is in line with the east end of the grandstand and also in line with the south end of the exhibit building. A stake 1 by 1 inch set flush with the ground marks the point. The following true bearings were determined: flagstaff on school, $38^{\circ} 49' \cdot 8$; tip of spire on St. Andrew's church, $45^{\circ} 20' \cdot 7$; pole on bank of Montreal, $58^{\circ} 48' \cdot 3$.

Little Red River Post, Alta., 1922.—The station is near the mouth of Mikkwa river on property belonging to the Hudson's Bay Company and is southeast of the post buildings. The precise point is 20 feet east and 95 feet south of the southeast corner of the Hudson's Bay Company's store and warehouse and is marked by a stake 2 by 2 inches projecting 2 inches above the surface. The following true bearings were determined: window in east side of house across Peace river, $303^{\circ} 59' \cdot 3$; southwest corner of Hudson's Bay Company's house, $351^{\circ} 21' \cdot 0$; northeast corner of house, $354^{\circ} 43' \cdot 3$.

Long Island, Athabaska river, Alta., 1923.—The station is on the east bank of Athabaska river in a clearing almost opposite the north end of what is locally known as Long

island. It is approximately two miles north of the 27th base line. The precise point is 12 feet from the edge of the bank, 30 feet west and 144 feet south of the southwest corner of a log cabin. Observations were taken over a stake 4 by 4 inches projecting 3 inches above the surface.

Louisburg, N.S., 1921.—The station is on the northerly slope of Slattery head, about one mile south of the S. & L. R. depot and about one-quarter of a mile southwesterly from the wharf. It is near two small excavations, being 22.4 feet from the southwesterly corner of one and 55.0 feet from the southeasterly corner of the other, 186 feet easterly from the easterly line of a bridge over the narrows between the harbour and a small bay and about 60 feet from the water's edge. Observations were taken over a small hole in the top of a stone 4 by 5 inches set flush with the ground and embedded in cement. The following true bearings were determined: spire of Presbyterian church, $23^{\circ} 04' .5$; cross on English church, $27^{\circ} 42' .3$; spire of Methodist church, $34^{\circ} 48' .8$.

Louisburg (Lighthouse Reserve), N.S., 1921.—The station is 240.5 feet northwesterly from the westerly corner of the fog alarm building and in line with the southwesterly side. Observations were taken over a hole in the top of a stone 4 by 5 inches projecting 2 inches above the surface and embedded in cement. The following true bearings were determined: north corner of fog alarm building, $142^{\circ} 04' .9$; easterly extremity of Middle Oaks island, $188^{\circ} 44' .7$; lighthouse on west side of harbour, $256^{\circ} 13' .0$; spire of Catholic church across harbour, $273^{\circ} 17' .8$.

Lyster, Que., 1921.—The station is about one mile from the C.N.R. depot and on the opposite, or south, side of Bécancour river. It is in a pasture field which is adjacent to the west side of the Richmond road; it is 616.5 feet west of the fence along the road, 92.5 feet north of the south fence of the field and 15.5 feet south of the bank of the river. The point is marked by a stake 2 inches in diameter and driven flush with the ground. The following true bearings were determined: tip of spire of Catholic church, $79^{\circ} 57' .2$; base of pole on white house with metal roof, $40^{\circ} 29' .2$; base of pole on water tank, $306^{\circ} 25' .2$; base of cross on school, $287^{\circ} 46' .2$; base of lightning-rod on farm house, $124^{\circ} 14' .2$.

Magdalen River, Que., 1921.—The station is northwesterly from the group of houses comprising the village, on a ridge lying between Magdalen river and St. Lawrence river. It is about 1,190 feet westerly from the westerly fence around a field in which is located an old saw-mill, 180 feet easterly from the grassy extremity of the ridge and near the westerly side of the roadway leading to the edge of Magdalen river. Observations were taken over a hole in the top of a cement block 7 by 7 inches projecting 3 inches above the ground. The top of the post is marked "D. O. 1921." The following true bearings were determined: weather-vane on lighthouse, $336^{\circ} 03' .6$; top of cross on point near lighthouse, $341^{\circ} 53' .1$; vertical edge of rock near village, $90^{\circ} 30' .6$.

Matapedia, Que., 1921.—The station of 1920 and previous years was reoccupied. It is on the north bank of Restigouche river on property belonging to the Fishing club; it is 497 feet south and 9 feet east of the southeast corner of the Restigouche hotel and 39.5 feet easterly from the base of a large elm tree. A line joining the station and the cross on the tower of the Catholic church passes about $1\frac{1}{2}$ feet south of this tree. The point is marked by a cement block 5 by 5 inches set flush with the ground. The following true bearings were determined: north gable of house on west bank of Restigouche river,

195° 41'·3; tip of cross on tower of Catholic church, 281° 16'·5; southwest corner of Restigouche hotel, 343° 49'·1; northeast corner of Restigouche hotel, 353° 13'·1.

Malane, Que., 1921.—The station is about 350 feet north and 450 feet west of the railway depot in an open field which is reached by a private road passing along the north side of the Imperial Oil Company's property. It is near the upper edge of a steep incline just west of a clump of trees and 17·5 feet south of the north boundary fence. Observations were taken over a cement block 4 by 4 inches set flush with the ground. The following true bearings were determined: spire of Catholic church, 60° 20'·8; tip of post office tower, 87° 29'·1; cross on top of dome of brick building, 90° 56'·6.

McKay, Alta., 1922.—The station is near the upper edge of the slope along Athabaska river, 282 feet southeasterly from the southeasterly corner of the Hudson's Bay Company's store and 8·5 feet northerly and 89 feet easterly from the northeasterly corner of a small log house. Observations were taken over a stake 4 by 4 inches projecting 12 inches above ground. The following true bearings were determined: window in north side of house across river, 160° 31'·5; northeast corner of Hudson's Bay Company's store, 9° 57'·4; south gable of Hudson's Bay Company's dwelling-house, 13° 34'·1; flagstaff seen almost over north gable of house, 15° 38'·9.

McMurray, Alta., 1923.—The station is a relocation of the D. O. station of 1922. It is on property belonging to the Hudson's Bay Company, near the junction of Athabaska and Clearwater rivers. It is 178 feet west of the fence along the east side of the property, 26 feet north and 49 feet east of the northeast corner of a garden, 469 feet north and 160 feet east of the northeast corner of a dwelling-house for the post manager of the Hudson's Bay Company, and 241 feet east of the bank along the east side of Athabaska river. Observations were taken over a sandstone rock about 4 by 6 inches set in a depression about 2 feet in diameter and projecting 3 inches above the ground. The following true bearings were determined: flagstaff on street and near east end of town, 131° 36'·7; north gable of Union Bank building, 147° 45'·0; southeast corner of Hudson's Bay Company's house, 231° 05'·2; northwest corner of house, 235° 49'·2; base of flagstaff near house, 242° 32'·7; gable of house across river, 289° 08'·0.

McPherson, N.W.T., 1923.—The station is near the southwest corner of the Hudson's Bay Company's property and near the edge of the bank, at the upper level, on the east side of Peel river. It is 91 feet west and 56 feet south of the southwest corner of Hudson's Bay Company's warehouse and 112 feet north and 28 feet west of the northwest corner of the Anglican Mission dwelling-house. Observations were taken over a stake 4 inches in diameter projecting 6 inches above the surface. The following true bearings were determined: northwest corner of Hudson's Bay Company's store, 35° 23'·6; southeast corner of warehouse, 81° 43'·6; townsite survey post at southwest corner of cemetery, 185° 22'·6.

Megantic, Que., 1921.—The station is near the D. O. station of 1907, in the village of Agnes across Chaudiere river from Megantic. It is near the southwesterly corner of a field on the westerly side of the road, the field being the property of a lumber company and containing two mills. The point is 58·5 feet westerly from the D. O. station of 1907, which was found to be in a vegetable garden; it is 72 feet westerly from the east fence and 45 feet northerly from the south fence of the field and about 100 feet from the southeasterly corner of the nearer saw-mill. Observations were taken over a cedar stake 2 by 4 inches driven flush with the ground. The following true bearings were determined:

pole on ventilator of red barn, $81^{\circ} 18' \cdot 7$; centre of cross on Catholic school, $272^{\circ} 06' \cdot 7$; tip of spire of Catholic church, $327^{\circ} 11' \cdot 7$; base of pole on school in Megantic, $329^{\circ} 56' \cdot 7$; base of pole on C.P.R. water tank, $348^{\circ} 38' \cdot 7$.

Middle Peel River, N.W.T., 1923.—The station is at the first forks of the river above T. S. Monument O 111 on a bank at the southeast angle formed by the bend in the river. It is 30 feet east of the upper edge of the bank on the west and 8 feet south of the bank on the north.

Mile 42, H.B.R., Man., 1922.—The station is on the northwesterly side of the track and about 150 yards from it, in front of the hut used by the fire rangers and between a grove of trees and the lake. The point is 22 feet from the water's edge and is 6 feet easterly from the trail leading to the boat landing. Observations were taken over the centre of the top of a fir stake 2 by 3 inches projecting 4 inches above ground.

Mile 100, H.B.R., Man., 1922.—The station is in a clearing in the woods north-easterly from mile 100. To reach the station proceed northeasterly along the track from the milepost, which is at a trestle, and midway between the 7th and 8th telephone poles from the pole holding the mile-board, turn to the north and proceed along a trail which enters the woods at this point. At a distance of 175 paces from the track a line cut through the woods and running northeasterly and southwesterly is reached. Proceed southwesterly along this line 42 paces to the station. The point is 22 feet from the edge of the woods in a clearing which contains the partial remains of two log stables and a cabin. Observations were taken over the centre of the top of a tamarack stake 3 inches square projecting 1 foot above the surface. This stake is 1.7 feet northerly from a stake marked "T. P."

Mile 149, H.B.R., Man., 1922.—The station is at a siding between mile 149 and mile 150, in a clearing on the northwesterly side of the track containing two log cabins used during construction. The point is in line with the easterly side of the cabin nearer the track and 69 feet northerly from its northeast corner and is 48 feet easterly from the northeast corner of the cabin nearer the back of the clearing. Observations were taken over the centre of the top of a fir stake 2 inches square projecting 6 inches above the ground.

Mile 200, H.B.R., Man., 1922.—The station is about one-quarter of a mile south-easterly from the siding at mile 200, on the south side of the track. The point is about 100 yards from the track along a trail leading to Trout lake, at a fork in the trail about 50 yards south from a cabin which is on the east side of the trail and formerly used by fishermen. Observations were taken over the centre of the top of a fir stake 2 inches square projecting 6 inches above the ground.

Mile 226, H.B.R. (Armstrong Lake), Man., 1922.—The station is on the northeasterly side of Armstrong lake and northwesterly from the track. It is north of a small bay and is about 250 yards from the track along a walk made of poles leading to two cabins. The point is about 50 feet north from the edge of the small bay, 59.5 feet northeasterly from the easterly corner and in line with the southeasterly side of the cabin nearer the lake, 7 feet from the edge of the walk measured along the same line and is about 150 feet south-easterly from the cabin to the northwest. Observations were taken over the centre of the top of a fir stake 2.5 inches square driven flush with the ground.

Mile 254, H.B.R., Man., 1922.—The station is in the centre of a clearing in the jack pine on a sandy ridge to the north of the track and is about 100 paces northerly from the second switch, travelling northeast. The point is marked by a spruce stake 3 inches in diameter projecting 9 inches above the ground and surrounded by a heap of stones.

Mile 279, H.B.R. (Landing River), Man., 1922.—The station is on a knoll on the south bank of Landing river and northwesterly from the track. The point is 71.5 feet westerly from the southwesterly corner of a cabin formerly occupied by railroad engineers. Immediately opposite the knoll and on the south side of the tracks are three cabins tenanted by Mr. Hawkins, a trader. The station is marked by a fir stake 2.5 inches square driven flush with the ground.

Mile 295, H.B.R., Man., 1922.—The station is westerly from the bridge that crosses a creek at about mile 295.5. There is a pump-house at this creek. The station is about 85 paces northwesterly from the track on the summit of a clay bank about 90 paces long at the top. This clay ridge is the only suitable place for observing as it is surrounded by muskeg. The point is marked by a copper rivet in the top of a spruce stake 1.5 inches square projecting 8 inches above the ground.

Missi Falls, Man., 1923.—The station is at the westerly end of the portage at Missi falls on Churchill river and is 26 feet from the edge of the bank at the landing. Observations were taken over the squared stump of a birch tree 3 by 4 inches, projecting 2 feet above the surface, the precise point being marked by a 32-cartridge shell in the top of the stump. The stump was painted red and in the northeast side were carved the letters "DOMS."

Mont Laurier, Que., 1921.—The station is about one mile from the C.P.R. depot on the opposite side of Lievre river, in a field owned by Mr. Alex and on the top of a hill on which are a large wooden cross and a band stand. The two structures can be seen from any part of the town. The point is 43.8 feet west and 1.4 feet south of the northwest corner of the band-stand and 41.8 feet northeast of the base of the cross. The point is marked by a cedar stake 2 by 2 inches driven flush with the ground. The following true bearings were determined: tip of cross on Catholic church, $159^{\circ} 48' .5$, east gable of red brick house, $202^{\circ} 40' .5$; tip of cross on school, $141^{\circ} 04' .0$; tip of ornament on red brick building north of river, $99^{\circ} 24' .5$.

Mont Louis, Que., 1921.—The station is on the grounds around the dwelling-house occupied by Mr. Allan G. Cameron who is in charge of the Seigniorie. It is 149 feet north and 35 feet west of the northeast corner of a dwelling-house, 40.5 feet south of the north fence and 190 feet west of the east fence around the property. Observations were taken over the intersection of two grooves in the top of a slate stone set flush with the ground and embedded in cement. The following true bearings were determined: spire of Catholic church, $95^{\circ} 17' .9$; rod on tower of school, $101^{\circ} 32' .9$.

Morrisburg, Ont., 1921.—The station is in the exhibition grounds about one-half mile north of the main street of the town. It is about midway between the east and the west inside fences of the race course, 79.5 feet north and 62.2 feet west of the northwest corner of the poultry building and 145 feet north of the south side of the grounds. Observations were taken over a cedar stake 2 inches in diameter driven flush with the ground. The following true bearings were determined: east gable of white house, $266^{\circ} 19' .6$; left edge

of chimney on C.N.R. freight shed, $315^{\circ} 03' \cdot 6$; spire of Presbyterian church, $155^{\circ} 04' \cdot 6$; base of pole on high school, $163^{\circ} 16' \cdot 6$; tip of cross on Anglican church, $197^{\circ} 19' \cdot 6$.

Mulgrave, A., N.S., 1921.—The station is approximately a relocation of the station of 1907. It is about 180 feet northerly from station C occupied in 1912 and estimated at that time to be much nearer to station A. It is approximately on the centre line of the street, extended, which passes the south side of the Seaside hotel and is 850 feet from the front of the same. Observations were taken over a hole in the top of a stone 3 by 4 inches projecting 2 inches above the ground. The following true bearings were determined: spire of Catholic church, $6^{\circ} 46' \cdot 5$; spire of church in Hawkesbury, $62^{\circ} 30' \cdot 7$; spire of Presbyterian church, $71^{\circ} 42' \cdot 8$; spire of Methodist church, $83^{\circ} 38' \cdot 2$.

Mulgrave, C, N.S., 1921.—The station occupied in 1912 as an auxiliary station was reoccupied. It is on property belonging to Mr. Isaacson and near the northeast corner; 18.5 feet south of the north fence and 91 feet west of the east fence. Observations were taken over a stone 2 by 2 inches set flush with the ground. The following true bearings were determined: spire of Catholic church, $5^{\circ} 03' \cdot 8$; spire of Methodist church, $58^{\circ} 30' \cdot 1$; spire of church in Hawkesbury, $61^{\circ} 13' \cdot 6$; spire of English church, $99^{\circ} 17' \cdot 9$.

Nepishkas Portage, Man., 1923.—The station is on the westerly end of the portage and southerly from the top of the falls, on Churchill river. The point is on the landing place, 9 feet northerly from the edge of the landing and 16 feet easterly from the water's edge.

New Carlisle, Que., 1921.—The station is in the grounds around the public school. It is 2.5 feet west and 291 feet north of the northwest corner of the school building, 85 feet east of the fence on the west side of the grounds and 49 feet south of the north fence. Observations were taken over the intersection of two grooves in the top of a brick set flush with the ground. The following true bearings were determined: northeast corner of school, $155^{\circ} 28' \cdot 4$; northwest corner of school, $168^{\circ} 33' \cdot 6$; vertical strip (centre) of gothic window on north side of house, $169^{\circ} 55' \cdot 4$.

New Richmond, Que., 1921.—The station is about 500 feet northerly from the railway depot, on property belonging to Mr. Peter Cyr and on the summit of a ridge in the second field westerly from the railway right-of-way. The point is 21 feet from the easterly fence around the field and is marked by a stake 2 inches in diameter set flush with the ground. The following true bearings were determined: gable of gothic window on depot, $171^{\circ} 46' \cdot 9$; chimney on house near shore, $185^{\circ} 33' \cdot 9$; pole on front of store, $196^{\circ} 12' \cdot 9$.

Norman, N.W.T., 1923.—The station is on lot 9 of the Settlement Survey, the lot being adjacent to and on the west side of the R.C.M.P. grounds. It is 8 feet west and 187 feet south of the iron post at the northwest corner of lot 10 and the northeast corner of lot 9, 64 feet south and 18 feet west of the southwest corner of a dwelling-house occupied by members of the police staff. Observations were taken over a hole in a concrete block 7 by 8 inches set flush with the ground. The following true bearings were determined: spire of Catholic church, $93^{\circ} 12' \cdot 1$; cross on Catholic Mission dwelling-house, $102^{\circ} 28' \cdot 9$; chimney on house to north of the Hudson's Bay Company's buildings, $112^{\circ} 19' \cdot 9$; Hudson's Bay Company's flagstaff, $117^{\circ} 05' \cdot 9$; Lamson's flagstaff, $129^{\circ} 00' \cdot 6$.

North Nahanni River, N.W.T., 1923.—The station is on the northerly side of Mackenzie river and slightly down stream from a point opposite the mouth of North Nahanni river. It is on the upper edge of a portion of rocky shore line extending about one-quarter

of a mile, and is 36.5 feet westerly from the post at T. S. Monument S 35. Observations were taken over a hole in the top of a concrete post 6 by 7 inches projecting about 3 inches above the surface. A tree on the top of a conspicuous conical-shaped peak of a distant range of mountains and seen over the westerly end of the nearer range bears $252^{\circ} 18' 0$.

Norway House, Man., 1923.—The station is in close proximity to the C. I. station of 1908. It is on the rocky point south of and across the bay from the Hudson's Bay Company's post, and is on the summit of a rocky mound to the east of the intersection of the paths across the point. Observations were taken over the centre of a cross-mark chiseled in the rock. The following true bearings were determined: apex of Belanger monument, $15^{\circ} 51' 5$; north upper corner of main entrance to Hudson's Bay Company's post, $19^{\circ} 55' 9$; east upper corner of store, $35^{\circ} 46' 8$; north gable of house across narrows, $230^{\circ} 56' 6$, centre of flagpole at base, $16^{\circ} 12' 7$.

Nueltin Lake, Man., 1922.—The station is on a point in Nueltin lake across the bay from the mouth of Willow river. The location on this point is where Inspector D. E. Simons of Revillon Freres established a trading post in 1922. The station is directly behind the post and about 100 yards from the edge of the bluff. Observations were taken over the centre of a cross-mark chiseled in the top of a grey granite rock 7 inches square projecting 1.5 inches above the ground. The station is surrounded by a fence 8 feet square and 2 feet high.

Nueltin Lake Narrows, N.W.T., 1922.—The station is in the barren grounds on the narrows connecting the southern expansion of Nueltin lake with the northern part and is about 3 miles from the southern entrance to the narrows. This entrance is not plainly marked at a distance but is about one-half mile northeasterly from the large sand cut-bank on a point at the northwestern corner of the southern part of the lake. This bank is the only one in this part of the lake. The station is at a very swift part of the narrows just before it opens to the northern part of the lake, this location being specially marked by two huge granite boulders on the northerly bank, one rectangular and the other irregular in shape. The station is 40.5 feet southerly from the southerly part of the irregular boulder and 20 feet northerly from the edge of the bank of the narrows. Observations were taken over the centre of a cross-mark chiseled in the top of a grey granite rock, triangular in shape and 3 feet to a side, and covered with a mound of stones.

Old Fort, Athabaska River, Alta., 1922.—The station is on the site locally known as Old Fort. It is on elevated land about 150 feet north of a creek, and on the east side of Athabaska river, 22 feet east of the edge of the bank along the river and 31.5 feet northeasterly from a lone poplar tree on the upper edge of the bank. Observations were taken over a stake 4 by 4 inches projecting 12 inches above the surface.

Old Fort, Slave River, N.W.T., 1922.—The station is opposite Old Fort, on the east bank of Slave river and about one-quarter of a mile below a channel. It is 48.5 feet southerly from the post of the T. S. Monument R 13 and 10 feet from the edge of the bank along the river. A stake 3 by 3 inches projecting 12 inches above the surface marks the point.

Ottawa, Ont., 1923.—Observations were taken as usual on the south pier of the observing hut which is on the grounds of the Dominion Observatory.

Oxford House, Man., 1923.—The station is on the Hudson's Bay Company's land and westerly from their enclosure. It is in line with the Hudson's Bay Company's flag-

pole and the northeast corner of a lean-to at the warehouse; it is also in line with the north side of the picket fence around a grave and 25 feet easterly from its northeast corner, and is 121.5 feet westerly from the first post to the north of the gate in the fence of the enclosure. The point is marked by a cartridge shell in the top of a stake 3 by 4 inches projecting 4 inches above the ground. The following true bearings were determined: north gable of Rev. Atkinson's house, $175^{\circ} 29' \cdot 6$; west gable of warehouse at landing, $26^{\circ} 22' \cdot 1$; north gable of Sullivan's house, $230^{\circ} 41' \cdot 3$; east gable of forestry hut, $269^{\circ} 38' \cdot 3$.

Peace Point, Alta., 1922.—The station is in an open space east of the enclosure which is in front of the steamer landing. It is 36.5 feet north and 39.6 feet east of the southeast corner of the enclosure, the corner being 108.5 feet east of a flagstaff, which is on the line of the south fence. Observations were taken over a stake 3 by 3 inches projecting 4 inches above the surface.

Peace River, Alta., 1922.—The station is about three-quarters of a mile south of the Dominion Observatory latitude and longitude station, on the R.C.M.P. grounds. It is just north of the enclosure in which are located the administration buildings. It is 44.8 feet north of the fence along the north side of the enclosure, and 115 feet east of the fence along the west side of the property. The point is marked by the intersection of two grooves in the end of a brick set flush with the ground. The following true bearings were determined: tip of ventilator on barn, $159^{\circ} 23' \cdot 3$; west gable of the office building, $168^{\circ} 56' \cdot 3$, southwest corner of the roof of verandah of nearest house, $188^{\circ} 03' \cdot 8$.

Pelican Narrows, Sask., 1922.—The station is an approximate relocation of the C. I. station of 1908. It is to the southeast of the Hudson's Bay Company's store, on a hill locally known as Treaty Hill. The point is on the westerly part of the summit, about 7 paces northeasterly from where the flagpole formerly stood, and just south of the path over the hill. Observations were taken over the centre of a cross-mark chiseled in the top of a flat granite rock about 7 inches each way. The south edge of the cross on the Catholic church bears $272^{\circ} 07' \cdot 1$.

Philomena, Alta., 1922.—The station is on partially cleared ground north of the A. & G.W.R. tracks. The station is determined by measuring west from the semaphore at the east end of the siding a distance of 342.5 feet, thence turning to the right from the direction of the railway tangent to the west, the angle $72^{\circ} 51' \cdot 0$ and measuring along this direction from the middle of the main line a distance of 496 feet to the station. Observations were taken over a stake 4 inches in diameter projecting 6 inches above the ground.

Pickford, Alta., 1922.—The station is on a sandy ridge on the west side of the A. & G.W.R. tracks. It is in sec. 8, tp. 80, rge. 6 W. of the 4th mer., 126 feet north of the south side of the section and 295 feet west of the middle of the main line of the railway. Observations were taken over a stake 4 by 4 inches projecting 4 inches above the ground.

Pictou, N.S., 1921.—The station is north of the town in an open field belonging to Mr. Adamson. It is 85.6 feet west of the west side of Palmerston street and 36 feet south of the south side of Louisa street, and is approximately a relocation of the D. O. station of 1907. The point is not marked. The following true bearings were determined: window in side of white barn across the bay, $121^{\circ} 32' \cdot 2$; left corner of tower on school, $135^{\circ} 11' \cdot 8$; spire of English church, $174^{\circ} 18' \cdot 5$.

Point Ennuyeuse, N.W.T., 1922.—The station is on the north side of Slave river almost opposite the portage across Ennuyeuse point and across the river from T. S. Monument R 3. It is near the westerly end of a portion of the rocky shore line which is only a few hundred yards in extent. To the west of the station and along the shore line are a few boulders and some gravel. The station is about 12 feet north of the edge of the bank and is marked by a drill hole in the top of a sandstone rock 6 by 8 inches projecting 4 inches above the ground. The land around the open space on which the station is located is overgrown with poplar and willow.

Poplar Point, Alta., 1922.—The station is southeasterly from the group of houses on the point, 15 feet northeasterly from the bank along the river, and 68.5 feet southerly from the southerly corner of the most easterly house of the group. Observations were taken over the intersection of two grooves in the top of a triangular-shaped stone projecting about 3 inches above the ground, the edges of the stone at the top being about 6 inches in length. The following true bearings were determined: gable of log cabin near river, $305^{\circ} 47' .9$; gable of Hudson's Bay Company's store, $309^{\circ} 17' .8$; gable of house across river, $300^{\circ} 18' .4$.

Port Hood, N.S., 1921.—The station is about one mile north of the railway on the MacPherson estate. It is in an open field at the rear of Mr. D. J. McKay's lot in line with the south end of the convent which is on the west, or opposite, side of the main road. The point is 126 feet north of the south side of the field, 304 feet east of the east side of the road and 154 feet east of the rear end of Mr. McKay's lot. Observations were taken over a drill hole in a small stone set flush with the ground. The following true bearings were determined: spire of Methodist church, $175^{\circ} 32' .0$; pole on tower of academy, $182^{\circ} 14' .6$; east gable of Catholic church, $229^{\circ} 46' .0$; top of cross on convent, $254^{\circ} 01' .9$.

Port Nelson, Man., 1923.—The station is to the west of the group of buildings comprising the town, and northwesterly from the beginning of the bridge to the island, on a sandy patch to the north of the railway grade. The station is 95.0 feet southerly from the edge of the ditch and 198.5 feet northerly from a telegraph pole on the south side of the grade and in line with this pole and the centre of the third span, from the mainland, of the bridge. The point is marked by a fir stake 3 inches square projecting 4 inches above the ground. The following true bearings were determined: upper southwest corner of bridge at island, $146^{\circ} 07' .6$; upper northeast corner of bridge at island, $102^{\circ} 52' .0$; west edge at roof of large smokestack on building, $65^{\circ} 12' .2$; base of R.C.M.P. flagstaff, $40^{\circ} 40' .6$; upper northwest corner of pier to west of island, $188^{\circ} 34' .4$.

Prairie Point, Alta., 1922.—The station is near the NE. cor. of SE. $\frac{1}{4}$ sec. 6, tp. 107, rge. 15, W. 5th mer., on property belonging to Mr. Sheridan Lawrence. It is south of the ranch buildings, 23.8 feet almost due south from the post marking the middle of the east side of sec. 6, 6.0 feet northerly from the bank along the river and 38.8 feet southerly from the wire fence along the side of a cultivated field. A birch stake 2 by 2 inches projecting 3 inches above the surface marks the point.

Prescott, Ont., 1921.—The station is in the exhibition grounds to the north of the town. It is in a depression between the grandstand and the main exhibit building, 39 feet north and 96.8 feet west of the northwest corner of the grandstand. Observations were taken over a stake 2 inches in diameter driven flush with the ground. The following

true bearings were determined: spire of Anglican church, $160^{\circ} 49' \cdot 0$; right edge of town water-tank, $169^{\circ} 06' \cdot 0$; pole on top of C.N.R. water-tank, $190^{\circ} 30' \cdot 5$; east gable of vault across road, $217^{\circ} 34' \cdot 0$; spire of church in Ogdensburg, $134^{\circ} 56' \cdot 0$; cross on separate school, $151^{\circ} 42' \cdot 0$.

Providence, N.W.T., 1923.—The station is an approximate relocation of the M. S. station of 1910, on the north bank of Mackenzie river. It is on vacant land between the Hudson's Bay Company's property and the Catholic Mission property. It is 20 feet north and 139 feet west of the southwest corner of the fence around the Hudson's Bay Company's property, and 3 feet south and 150 feet east of the southeast corner of the Mission property. Observations were taken over a stake set flush with the ground. The following true bearings were determined: top of spire on Catholic church, $306^{\circ} 45' \cdot 6$; Hudson's Bay Company's flagstaff, $146^{\circ} 56' \cdot 0$; Mission flagstaff, $291^{\circ} 38' \cdot 6$; tip of spire on Mission school, $298^{\circ} 40' \cdot 6$.

Pukatawagan, Man., 1923.—The station is on property of Revillon Freres, on a peninsula which is an island at high water, and to the north of the buildings. The station is on the summit of the peninsula, about 25 feet above the lake. Observations were taken over a cross-mark cut in the top of a grey granite rock, flat on top and measuring 7 by 9 inches. This rock is just east of a path over the summit.

Rge. 6, Tp. 82, Sec. 30, Alta., 1922.—The station is near the southwest corner of sec. 30, tp. 82, rge. 6, W. 6th mer., in an open space on the left bank of Peace river, and about 1,200 feet southerly from the intersection of the bank of the river and the line between rge. 6 and rge. 7. The station is just above a rocky point, about 22 feet from the edge of the bank along the river, and is marked by a stone 4 by 6 inches projecting 4 inches above the surface. A temporary reference mark was used.

Reindeer Lake (Opapaskawseck Island), Sask., 1922.—The station is on the east side of Opapaskawseck island which is about midway between Where-the-Beaver-are and Halfway islands. This island is on the west side of the yolk-boat channel to Halfway island and is composed of granite partially overgrown with jack pine and aspen. The station is south of a large bay on the east side of the island and is about 50 yards from the water's edge to the east. Observations were taken over the centre of a cross-mark chiseled in the solid granite and covered with a mound of stones.

Reindeer River, Sask., 1922.—The station is on the northerly end of a rocky island in the middle of Reindeer river. The island is the second south of the big bend in the river southeast of Steep Hill portage, and is the first in the middle of the river going south after turning this bend. The station is on solid rock, 67 feet southerly from the northerly end and 40 feet easterly from the westerly side of the island. Observations were taken over the centre of a cross-mark chiseled in the rock which was covered with a mound of stones.

Resolution, A, N.W.T., 1922.—The station is approximately a relocation of the M. S. station of 1910. It is in a small field belonging to the Hudson's Bay Company and lying to the west of the buildings comprising the post, and on a waste piece of land extending diagonally across the south end of the field. It is 36 feet east of the east side produced, of the Catholic church, 244 feet north of the south fence which is in line with the Fort Resolution Trading Company's store, 67.3 feet from the fence along the westerly side of the field and 45.8 feet southwesterly from a log building. The point is marked by a

stake 3 by 3 inches set flush with the ground. The following true bearings were determined: northwest corner of Hudson's Bay Company's dwelling-house for post manager, $140^{\circ} 19' \cdot 9$; west gable of store house, $152^{\circ} 12' \cdot 9$; Hudson's Bay Company's flagstaff, $164^{\circ} 36' \cdot 0$; cross on tower of Catholic church, $229^{\circ} 28' \cdot 0$; gable of house occupied by Lamson's post manager, $344^{\circ} 45' \cdot 5$.

Resolution, B, N.W.T., 1922.—The station is about 450 feet northeasterly from station A, in an open space to the north of a garden around the house occupied by the Hudson's Bay Company's post manager. It is 400 feet north of a fence along the north side of the Hudson's Bay Company's store, 70 feet north and 10 feet west of the northwest corner of a garden, and about 330 feet westerly and 126 feet southerly from the southwesterly corner of a lot on which is located the Catholic Mission buildings. The point is marked by a stake 3 by 3 inches set flush with the ground. The following true bearings were determined: cross on front of Catholic Mission residence, $65^{\circ} 07' \cdot 9$; cross on dome of school, $71^{\circ} 00' \cdot 7$; chimney on Hudson's Bay Company's house, $209^{\circ} 21' \cdot 9$; cross on tower of Catholic church, $250^{\circ} 30' \cdot 4$; ornament on north end of Catholic church, $253^{\circ} 09' \cdot 4$.

Richmond, Que., 1921.—The station is about three-quarters of a mile easterly from the C.N.R. depot in a pasture field owned by Miss Gouin. It is about 900 feet northeasterly from the gate at the entrance to a lane leading along the southeasterly side of the property to the pasture field; it is 49.5 feet northwesterly from the wire fence on the southeasterly side of the field, 89.5 feet northeasterly from the corner of the wire fence and in line with the wire fence along the northwesterly side of the lane, and about 180 feet southerly from the base of a high rocky ridge. The point is marked by a stake 2 by 2 inches set flush with the ground. The following true bearings were determined: cross on Catholic church, $285^{\circ} 51' \cdot 3$; tip of spire on church across river, $221^{\circ} 56' \cdot 8$; spire of Methodist church, $209^{\circ} 57' \cdot 8$; base of lightning-rod on ventilator on centre of barn, $152^{\circ} 07' \cdot 8$; south gable of red brick house, $93^{\circ} 44' \cdot 8$.

Rosetown, Sask., 1922.—The station is on the fair grounds, in line with the west side of the easterly one of two exhibit buildings and 196.5 feet north of the northwest corner of the same; it is 135 feet east of the east side of the entrance to the grounds and 277 feet north of the fence along the south side of the grounds. A stake 2 by 4 inches set flush with the ground marks the point. The following true bearings were determined: north gable of Presbyterian church, $160^{\circ} 04' \cdot 5$; spire of English church, $171^{\circ} 05' \cdot 9$; flagstaff on high school, $185^{\circ} 21' \cdot 0$; left edge of chimney on C.P.R. depot, $353^{\circ} 01' \cdot 2$; south gable of Ogilvie's elevator, $26^{\circ} 17' \cdot 2$.

Ste. Agathe des Monts, Que., 1921.—The station is about three-quarters of a mile north of the C.P.R. depot. To reach the station take the road running northerly on the opposite side of the tracks from the depot, and continue along this road through a swamp until the first cross-road is reached. The station is on the summit of a low hill at the northeasterly angle of the intersection of the roads, being 148.5 feet from the north side of the road on the south and 178 feet from the east side of the road on the west. It is approximately at the intersection of the diagonals of a rough square formed by four large stones, 21.3 feet from the stone to the north, 26.9 feet from the stone to the south and 23.9 feet and 17.4 feet from the stones to the west and to the east, respectively. Observations were taken over a stone about 2 by 4 inches set flush with the ground. The following true

bearings were determined: south gable of house in valley, $60^{\circ} 48' \cdot 8$; cross on Catholic church, $192^{\circ} 28' \cdot 8$; tip of northeast gable on Sanatorium, $233^{\circ} 28' \cdot 8$.

St. Johns, Que., 1921.—The station is on the exhibition grounds on the southwest edge of the city. It is in the southeastern corner of the grounds, opposite the entrance gate, 69 feet north of the south fence and 100 feet west of the east fence of the grounds. The point is marked by a stake 2 by 4 inches set flush with the ground. The following true bearings were determined: base of pole on C.N.R. water-tank, $46^{\circ} 43' \cdot 7$; tip of cross on church, $28^{\circ} 20' \cdot 7$; top of ball on city water-tank, $26^{\circ} 41' \cdot 7$; base of pole on exhibition building, $358^{\circ} 34' \cdot 7$.

Sans Sault Rapids, N.W.T., 1923.—The station is at the northwesterly corner of the first island below Sans Sault rapids. It is just north of the northerly edge of a growth of spruce trees and almost at the high-water level, and 78 feet north of a lobsterstick.

Seal River, Man., 1923.—The station is just above high-tide line on the first point of land in Hudson bay from the mouth of Seal river; it is on the westerly side of a bay and northeasterly from the rapids. The station is in a bunch of willow about 100 yards from high-tide mark on the point. Observations were taken over a cross-mark chiseled in the top of a flat rock flush with the ground. The rock was marked, "D O M S 15."

Shamattawa River, Man., 1923.—The station is on the summit of the bluff at the junction of Hayes and Shamattawa rivers. The point is about 20 feet above the water, 24 feet north of the edge of the bluff on the Shamattawa, 46 feet westerly from the bluff on the Hayes, and is southeast from a big spruce tree. The point is marked by a cartridge shell in the top of a tamarack stake 2 by 2 inches projecting 8 inches above ground.

Sherbrooke, B, Que., 1921.—The D. O. station of 1920 was reoccupied. To reach the station proceed along Rue Conseil, passing the large Catholic church on the right, also two shirt factories, and turn to the north along the road in front of the second of these factories. Six hundred yards from Rue Conseil the road turns east leading up a slope to a farm house. The station is situated at this corner of the level field in front of the shirt factories, being 18 feet westerly from the west side of the north-south road, 69.5 feet southerly from the south side of the east-west road and 81.5 feet southerly from the wire fence along the north side of the field. The point is marked by a stake 2 by 2 inches driven flush with the ground. The following true bearings were determined: right edge of chimney on south side of frame house on hill to north, $32^{\circ} 46' \cdot 4$; cross on spire of Catholic church, $232^{\circ} 39' \cdot 4$; tip of cross on hospital, $256^{\circ} 01' \cdot 4$; base of pole on exhibition building, $282^{\circ} 42' \cdot 4$; base of pole on club house, $327^{\circ} 19' \cdot 4$.

Shethnanei Lake, Man., 1923.—The station is about one-quarter of a mile northerly from the outlet of Shethnanei lake on the right bank of Seal river. The point is on the top of a sand ridge which is covered with spruce, is marked by a cutting to the water and a lobsterstick, and is about 100 yards from and about 30 feet above the water. Observations were taken over a cross-mark cut in the top of a red granite boulder 2.2 by 1.2 feet projecting 9 inches above ground.

Simpson, A, N.W.T., 1923.—The station is near the M. S. station of 1910, on the left bank of Liard river and in front of the Hudson's Bay Company's buildings. It is in line with the north side of the Hudson's Bay Company's warehouse and 51.5 feet east of the fence along the front of their property, and is 10 feet from the edge of the bank along the river. Observations were taken over a hole in the top of a concrete block 6 by

7 inches set flush with the ground. The following true bearings were determined: door in side of house near water's edge across Mackenzie river, $51^{\circ} 37' \cdot 8$; chimney on house to southeast, $151^{\circ} 13' \cdot 7$; cross on tower of Catholic church, $305^{\circ} 47' \cdot 8$; spire of English church, $314^{\circ} 10' \cdot 8$; tip of sun dial on pier marking the D. O. astronomical station in the grounds of the Hudson's Bay Company, $246^{\circ} 12' \cdot 8$.

Simpson, B, N.W.T., 1923.—The station is on the road allowance along the river bank and about one-half mile northwesterly from station A. It is in front of lot 23 of the Settlement Survey and is 240 feet, on a course bearing N. $96^{\circ} 55' \cdot 6$ E., from the post at the corner of lots 23 and 25, and is about the same distance southerly from the saw-mill which is on lot 25. The following true bearings were determined: gable of most southerly house in grounds of the Indian Agency, $261^{\circ} 39' \cdot 7$; southerly gable of second house, $272^{\circ} 43' \cdot 7$; corner of lots 23 and 25, $276^{\circ} 55' \cdot 6$; chimney on third house, $280^{\circ} 33' \cdot 9$.

Souris, P.E.I., 1921.—The station is at the extreme westerly end of the town on an open space between the road and the beach, being about 2,550 feet west of the post office and about 525 feet northerly from the produced line of the north side of the street passing the post office. It is 81 feet westerly from the fence along the east side of the road, 10 feet from the edge of the bank and 23.2 feet northerly from a stone 5 by 6 inches having a drill hole in the top set flush with the ground. Observations were taken over the hole in the top of a stone 6 by 6 inches set flush with the ground. The spire of the Catholic church bears $79^{\circ} 52' \cdot 1$.

South Deer Lake, Sask., 1922.—The station is on the Hudson's Bay Company's reserve and about 20 yards westerly from the C. I. station of 1908. It is at the easterly edge of the base of a rocky bluff and on the rise of ground to the north of the Hudson's Bay Company's store. Observations were taken over the centre of a cross-mark chiseled in the top of a grey granite rock almost flush with the ground. The southwest corner of Revillon Freres' store bears $35^{\circ} 39' \cdot 0$.

Southern Indian Lake, Man., 1923.—The station is on the flat rock at the north-western extremity of a point on the east shore of Southern Indian lake, this being the first point that has a high cut-bank on its southerly side, travelling north. The point is marked by a cross chiseled in the solid granite and covered with a mound of stones. The station is between the bank and the water and may be submerged at high water.

Stanstead, Que., 1921.—The station is in the exhibition grounds to the east of the village. It is in the enclosure inside the race-track, 80 feet southerly from the inside of the track and 216 feet easterly from the easterly end of the grandstand produced. Observations were taken over a large granite boulder which projects about 6 inches above the ground and is a rough triangle in shape. The following true bearings were determined: pole on Stanstead college, $249^{\circ} 19' \cdot 2$; cross on spire of Anglican church, $272^{\circ} 11' \cdot 2$; tip of spire of Methodist church, $267^{\circ} 08' \cdot 2$; cross on separate school, $276^{\circ} 02' \cdot 2$; cross on Catholic church, $314^{\circ} 20' \cdot 2$.

Sturgeon Landing, Sask., 1923.—The station is on the beach on the easterly side of the mouth of Sturgeon river, to the south of the buildings and to the west of the Ross Navigation Company's wharf. It is almost in line with the southerly pier across the river, 147 feet from the water's edge measured along this direction and 18 feet south from a slight rise in the ground at the R. N. Company's woodpiles, and is southeasterly from their warehouse. Observations were taken over a cross-mark cut in the easterly

side of the top of a red granite boulder 1.5 by 1.2 feet projecting 6 inches above the surface. The south gable of a white house bears $349^{\circ} 20' .7$.

Sturgeon-weir River, Sask., 1922.—The station is on the first island in Sturgeon-weir river north of Birch portage. The point is on the north end of the island on the northerly part of the summit of the granite rock which rises to form a dome about 15 feet above the elevation of the island. Observations were taken over the centre of a cross-mark chiseled in the granite rock. The mark was covered with a mound of stones.

Summerside, P.E.I., 1921.—The station is on the northwesterly edge of the town on the exhibition grounds, inside the race-course and almost on the centre line produced, of the street running east from the gate on the east side of the grounds. It is 290.5 feet west of the gate on the east side of the grounds, 197 feet west of the fence along the inside of the race-course on the east, 100.8 feet east of the fence along the inside of the race-course on the west, and 101.5 feet from the southeasterly corner of the judge's stand. The point is not marked. The following true bearings were determined: spire of Catholic church, $113^{\circ} 17' .7$; spire of Methodist church, $120^{\circ} 24' .8$; spire of Presbyterian church, $133^{\circ} 04' .8$.

Sutton, Que., 1921.—The station is on the northerly slope of Sutton mountain, about one-half mile south of the town. It is in a rocky pasture field just beyond the southerly boundary fence of a small open field which is about one-quarter of a mile east of the first north-south road to the west of the creek where it crosses the main street of the town, and south of the first east-west road south of the main street, and opposite a farm house. The station is 74 feet west of the wire fence along a portion of the west side of the open field, 64.5 feet south of part of the south boundary fence and 72.5 feet northeast of a large boulder. Observations were taken over a stake 2 by 2 inches driven flush with the ground. The following true bearings were determined: spire of Catholic church, $326^{\circ} 21' .6$; spire of Methodist church, $329^{\circ} 01' .1$.

Swampy Lake, Man., 1923.—The station is on the left bank of Hayes river about 1.5 miles below the last portage to Swampy lake and about one-half mile from the lake. It is on the east end of the summit of the first high bluff east of the portage and is about 100 yards east of a cabin. It is 20 feet north from the edge of the bluff and the same distance east of the bush. The point is marked by a cartridge shell in the top of a birch stake $3\frac{1}{2}$ by $3\frac{1}{2}$ inches painted yellow and projecting 9 inches above the ground.

Sydney, B, N.S., 1921.—The station of 1920 was reoccupied. It is northwest of the town in Victoria park, near the foot of the slope on the northwestern side of the highest point of ground in the western portion of the park. It is approximately 100 feet northwest of the station of 1912, or the C. I. station occupied first in 1905, and near the inner edge of a race-course; it is 220 feet easterly from an electric light post on which is a reflector, 278 feet southerly from the iron house near the signal mast and 131 feet south-easterly from a row of willow trees along the northerly side of the race-track. The point is marked by a drill hole in the top of a granite post 4 by 4 inches set flush with the ground. The following true bearings were determined: tip of pole near iron works, $69^{\circ} 36' .3$; spire of Catholic church, $126^{\circ} 33' .7$; spire of old stone church on esplanade, $147^{\circ} 26' .4$.

Sydney, C, N.S., 1921.—Station C is approximately a relocation of the C. I. station of 1909, and the D. O. station of subsequent years. It is 102.3 feet on a line bearing N. $133^{\circ} 19' .3$ E. from the station of 1920. The point is marked by an irregular shaped

stone placed there probably by an observer of the McMillan Arctic exploration party. The following true bearings were determined: spire of Catholic church, $126^{\circ} 18' \cdot 0$; spire of old church on esplanade, $148^{\circ} 17' \cdot 5$; church spire seen over steel plant, $33^{\circ} 07' \cdot 3$; pole on water-tank near steel plant, $66^{\circ} 39' \cdot 8$.

Tadoule Lake, Man., 1923.—The station is at the southeasterly end of Tadoule lake about four miles northeasterly from the long rapids into the lake. It is on the first sand-bank running northwest and southeast on the mainland after entering the lake. The ruins of an Indian village can be seen on this ridge. Observations were taken over a red granite boulder, the most northeasterly one of a boulder path just beyond the entrance to a long narrow bay. The boulder is 30 feet southerly from the edge of the bank at the water. A cross-mark chiseled in the rock marks the precise point.

The Pas, Man., 1922.—The D. O. station of 1919, which is a relocation of the C. I. station of 1908 was reoccupied. It is in the yard of the mission residence on an island about one-eighth of a mile down Saskatchewan river from the church of England and 100 feet from the mainland. The observations were taken over a cross filed in the gnomon of the sundial of Sir John Franklin. The sundial is mounted on a piece of oak fixed to the top of a post 9 inches in diameter projecting 2 feet 4 inches above the ground. The following true bearings were determined: west upper corner of third cement pier of bridge from north shore of river, $357^{\circ} 55' \cdot 4$; pole on tower of hospital, $113^{\circ} 51' \cdot 5$.

The Rock, Man., 1923.—The station is on the left bank of Hayes river, on the first point of land below the rapids, in a grove of poplar. The station is 53 feet southwesterly from a small creek and 10 feet northerly from the edge of the river bank. It is marked by a tamarack stake $2\frac{3}{4}$ inches in diameter projecting 5 inches above the ground.

Thicket Portage, Man., 1923.—The station is on Landing lake on the south end of the portage to Mile 185, H.B.R. It is on the point to the southeast of the small bay where the portage begins and about 100 yards distant. There is a small bay to the east of the station with a cabin on the east side of the bay. The station is on the extremity of a grey granite rock, 36 feet north from the edge of the bank to the south and 67 feet west from a landing place at the east end of the point. Observations were taken over the centre of a cross-mark chiseled in the rock.

Thorhild, Alta., 1922.—The station is on the grounds around the school, in S.E. $\frac{1}{4}$ sec. 6, tp. 60, rge. 21, W. 4th mer. It is in line with the west side of the school building and 99 feet from the southwest corner, 317 feet south of the north side of the grounds and 106 feet west of the east side. The point is marked by a stake set flush with the ground. The following true bearings were determined: insulator on telegraph pole, $44^{\circ} 40' \cdot 3$; east gable of hotel, $68^{\circ} 43' \cdot 8$; southeast corner of Jardy's store, $84^{\circ} 07' \cdot 8$.

Tignish, P.E.I., 1921.—The station is in a small opening in the grove of small trees along the north side of the grounds around the Presbyterian church about one-quarter of a mile south of the railway tracks. It is 124 feet east and 26 feet north of the northeast corner of the church, 69.5 feet north of the fence along the south side of the grounds and 47.5 feet west of the fence on the east side. Observations were taken over the drill hole in the top of a brick set flush with the ground. The following true bearings were determined: right edge of chimney on north end of house, $232^{\circ} 51' \cdot 2$; southeast corner of church, $233^{\circ} 36' \cdot 8$; northwest corner of church, $251^{\circ} 00' \cdot 4$.

Trout River, N.W.T., 1923.—The station is on the point at the confluence of Trout and MacKenzie rivers, being on the south side of the Mackenzie and on the west side of the Trout, and almost at the edge of the high-water mark. It is about 50 feet southerly from the northerly edge of a growth of willow along the Mackenzie and about the same distance westerly from the easterly edge of some poplar trees along the Trout. Observations were taken over a small hole in the top of a concrete block 6 by 8 inches projecting 2 inches above the ground.

T. S. Monument A 4, Alta., 1922.—The station is on the south bank of Athabaska river, being 135 feet east from the post at the T. S. Monument A 4, 28 feet from the bank along the bed of a creek, and 20 feet south of the bank along the river. Observations were taken over a stake 4 by 4 inches projecting 6 inches above the ground.

T. S. Monument 4 E, Alta., 1922.—The station is in a clearing on the edge of the bank along Slave river, being 43.5 feet westerly from the post of the T. S. Monument 4 E, and 6 feet north of the edge of the bank along the river. The point is marked by a stake 3 inches in diameter projecting 10 inches above the surface.

T. S. Monument 18 E, Alta., 1922.—The station is on the east side of Slave river and south of a creek; 27.2 feet southwesterly from the southwesterly corner of the most easterly pit and 27.7 feet from the post of the T. S. monument. The station is marked by a stake 2 by 2 inches projecting 6 inches above the surface.

T. S. Monument 56 N, N.W.T., 1923.—The station is on the right bank of Mackenzie river near the T. S. Monument 56 N. It is about 300 feet east from the edge of a ridge which terminates at the confluence of a creek and the river. Observations were taken over a hole in the top of a concrete block 7 by 8 inches set flush with the ground, the block being 20 feet southwesterly from the iron post at Monument 56 N.

T. S. Monument O 44, N.W.T., 1923.—The station is almost due north of the iron post at the T. S. Monument O 44, and almost in line with the post and the centre of the mound. Observations were taken over a concrete block 7 by 7 inches projecting about 2 inches above the ground. The block is 20.2 feet from the iron post.

T. S. Monument O 69, N.W.T., 1923.—The station is supposedly near the T. S. Monument O 69, and about 5 miles above Thunder river. It is on the east side of a creek (not marked on the map) on the right bank of Mackenzie river and opposite a low-lying island. The precise point is about 450 feet east of the middle of the creek, about 100 feet north of the shore line of the Mackenzie, on the hillside and 100 feet southwesterly from a trapper's cabin. Observations were taken over a concrete block 6 by 7 inches projecting 3 inches above the surface.

T. S. Monument T 22, Alta., 1922.—The station is near the edge of the north bank of Slave river, at the south end of a clearing which is about 12 feet wide and extends about 130 feet into the woods. At the north end of this clearing is located the T. S. Monument T 22. The station is 121 feet south from the post and 12 feet from the bank along the river. Observations were taken over a stake 2 inches in diameter projecting 12 inches above the surface.

Tweed, Ont., 1921.—The station is in the exhibition grounds across Moira river from the town, near the northeast corner of the grounds and inside the race-track. It is 99 feet west of the inside of the race-track on the east, 57 feet southwest from a large elm tree and 12 feet west of a line joining the north end of a hitching-rail and the elm tree.

The point is marked by a cedar stake 2 by 2 inches driven flush with the ground. The following true bearings were determined: tip of ornament on tank to east of grounds, $97^{\circ} 32' .4$; base of pole on C.P.R. water-tank, $197^{\circ} 48' .4$; base of pole on exhibition building, $229^{\circ} 22' .9$; north gable of grandstand, $237^{\circ} 37' .4$; tip of northeast gable of elevator, $244^{\circ} 30' .4$.

Twenty-fifth Base Line, Alta., 1922.—The station is almost in the middle of the clearing marking the 25th base line, on the west side of Peace river, about 35 feet west from the edge of the bank and 10 feet west of the edge of a sunken portion of the bank. The point is marked by a birch stake 4 by 4 inches projecting 8 inches above the surface.

Twenty-seventh Base Line, Alta., 1922.—The station is slightly south of the middle of the clearing marking the 27th base line, near the westerly extremity of an island in Peace river; this island is located in tps. 104 and 105, also in rges. 16 and 17, west of the 5th mer. Observations were taken over a birch stake 4 by 4 inches projecting 14 inches above the surface, the stake being 276 feet west of a witness mound, 75 feet east of the edge of the bank along the river and 20 feet south of the edge of the bank. A picket in the centre of the witness mound bears $89^{\circ} 00' .4$.

Twenty-ninth Base Line, Alta., 1922.—The station is on the southeasterly side of Peace river and on the centre line of the 29th base line, 15 feet from the edge of the bank on the west and 11 feet from the edge of the bank on the north. Observations were taken over a stake 2 by 2 inches projecting 8 inches above the ground.

Vermilion Chutes, Alta., 1922.—The station is near the east side of a clearing at the steamer landing and about 150 feet from Peace river. It is 54 feet southeast of the southeast corner of a log stable and 63 feet southwest of the southwest corner of another log building. A blaze on a large poplar tree on the river bank bears $33^{\circ} 02' .5$.

Victoriaville, Que., 1921.—The station is about one mile east of the C.N.R. depot, in the exhibition grounds and directly behind the town water-tank. It is 46 feet north of the northwest corner of the main exhibition building and in line with the west side produced, 35 feet southerly from a cattle shed and 60 feet west from the rail fence on the east side of the grounds. The point is marked by a stake 2 by 2 inches driven flush with the ground. The following true bearings were determined: spire of Catholic church, $261^{\circ} 51' .7$; cross on cupola on large brick building, $280^{\circ} 12' .7$; east gable of red brick house, $322^{\circ} 11' .7$; tip of ornament on town water-tank, $344^{\circ} 42' .7$.

Wabiskaw River, Alta., 1922.—The station is on the north bank of Peace river and opposite the mouth of Wabiskaw river. From the station the eastern end of an island in the Wabiskaw may be seen over the point of land at the southwest angle formed by the Peace and the Wabiskaw. The station is 28 feet southwesterly from the corner of an abandoned log cabin, and 25 feet north of the bank along the river. A stake 4 by 4 inches projecting 16 inches above the surface marks the station.

Whitemud River, Alta., 1922.—The station is on the north bank of Whitemud river at its confluence with Peace river, being approximately in line with a portion of the west bank of the Peace just above the Whitemud. It is 18 feet from the edge of the bank along the Whitemud. Observations were taken over a small hole in the top of a stone about 5 by 7 inches projecting 3 inches above the surface.

Wrigley, A, N.W.T., 1923.—The station is near the river bank and on the front of lot 4 of the Settlement plan; this lot is the property of the Northern Trading Company. Observations were taken over a hole in the top of a concrete block 7 by 7 inches set flush with the ground. The station is in line with the south side of a small garden at the north-east corner of lot 4 and 50 feet south from the southeast corner of a garden, and also in line with the north end of the Northern Trading Company's store. The following true bearings were determined: spire of Catholic church, $342^{\circ} 32' \cdot 4$; tree on hillside to south-east, $148^{\circ} 06' \cdot 7$; bottom of Hudson's Bay Company's flagstaff, $345^{\circ} 17' \cdot 1$; vertical edge of rock near summit of mountain, $2^{\circ} 52' \cdot 1$.

Wrigley, B, N.W.T., 1923.—The station is approximately a relocation of the M. S. station of 1910, though now rather unfavourably located. It is in front of the Hudson's Bay Company's house occupied by the post manager, being 42.7 feet northerly from the southeast corner of the same, 125.8 feet northerly from the northeasterly corner of a store, 29 feet northwesterly from the base of a post supporting a sun-dial and 40 feet easterly from the southeasterly corner of a house in course of construction. The point is marked by a stake 2 by 2 inches set flush with the ground. The following true bearings were determined: spire of Catholic church, $345^{\circ} 02' \cdot 5$; vertical edge of rock on east side, near top, of mountain, $3^{\circ} 22' \cdot 5$; top of mountain, $113^{\circ} 40' \cdot 0$; tree on hillside, $148^{\circ} 33' \cdot 4$; bottom of Northern Trading Company's flagstaff, $160^{\circ} 39' \cdot 4$.

York Factory, Man., 1923.—The station is on the grounds of the Hudson's Bay Company, inside the enclosure between the buildings and the river. It is in line with the west side of the office and 114.0 feet southerly from its southwest corner and 80.5 feet northerly, measured along the same line, from the fence towards the river; it is 94 feet westerly from the fence to the east, at the board walk, and 80 feet westerly and 22 feet northerly from the centre of the base of the flagstaff. The point is marked by a cartridge shell in the top of an elm stake 4 by 4 inches projecting 10 inches above the ground.