

1866phae.pr.01.1.263

KG
11365
362

P1

Magnetic observations.

1866 Aug 16 to 1868 Feb. 17.

Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1
11	11	11	11	11	11	11	11
42	42	42	42	42	42	42	42
56	56	56	56	56	56	56	56
43	43	43	43	43	43	43	43
13	13	13	13	13	13	13	13

6072 11365-362

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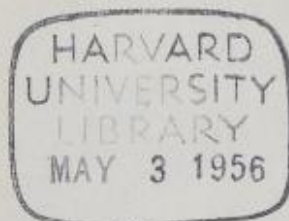
1
3.2

Formula for true circle reading ^{of scale} for zero_n
~~1/2 (Scale + zero)~~

= reading_n verniers $\pm$ (excess of scale reading
 over zero of scale)

150 11365.360,
 Upper or lower sign as scale
 is erect or inverted.

wt	1 div. long magnet	2.44 Aug 15
2		
2	~~1 div. short~~ "	2.45 16
8	"	2.43 Dec 17
		<u>2.43</u>



1	1 div. short magnet	2.92 Aug 16
		~~2.97 Nov 16~~
8		3.07 Nov 16
8		2.98 Dec 17
		<u>3.02</u>

Formula for Magnetic Variations

obsns. from 1708 to 1842

U. S. C. S. Report 1855 *

$$D = +8.553 + .0702(t-1830) + .000720(t-1830)^2$$

for Dip obsns. 1780 to 1855 †

U. S. C. S. Report 1856

$$I = 74.34 - .02840(t-1840) + .002400(t-1840)^2$$

Ephemeris

D

I

1841	+12.135	1867.0	75.32
1842	+12.261	1868.0	75.43

* Superseded by formula in Coast Survey report for 1859
Appendix No. 24.

$$D = +9.65 - 2.78 \cos(1.30 n + 71^\circ) + 0.22 \cos(2.7 n + 220^\circ)$$

+ n counts from 1830

† The dip formula was not to be used after 1858.

Chas. A. Schott

1866 Aug 16 Thursday.

The small transit was taken at about 8½ P.M. to the southern of the two small freestone pillars west of the Observatory, ^{the plate} carefully leveled; (but not the axis, which however was not much inclined) and the following readings made

Corrected M.T.

Readings

9 ^h 30 ^m	Mark on needle in coincidence with mark on arc; or "needle in coincidence".	21° 10'
	Mean	<u>141 12</u> 81 11
9 52.5	Polaris on middle wire	33 41
		<u>153 46</u>
10 1.5	" "	Mean <u>93 43.5</u> 33 40
		<u>153 45</u>
		Mean <u>93.42.5</u>
10 7.4	γ Cassiopeæ on middle wire	72 58
		<u>193 0</u>
		Mean 122 59

1866 Aug 16 Thursday

 $10^h 12^m 3$ β Urs. Min. on middle wire $10^\circ 55'$

$$\begin{array}{r} 130 \ 59 \\ \underline{70 \ 57} \end{array}$$

The same two verniers were read throughout; the other was not, being inconveniently situated too near to one of the supports of the axis.

From these observations we have as the mean reading of the two verniers for true north;

From Polaris	91 48
" γ Cassio.	91 51
" β Urs Min	91 48
Mean	<u>91 49</u>

At about

 $10^h 30^m$ Needle in coincidence 21 6

$$\begin{array}{r} 141 \ 10 \\ \underline{ 81 \ 8} \end{array}$$

The instrument was left out during the night and Friday morning the level being examined

1866 Aug 16 Thursday

3

and found good, the following obsns. were made on terrestrial objects

Tree on horizon

	34	2
	154	7
Mean	94	4.5

House on distant hill
may be denoted by (a)

	11	34
	131	38
Mean	71	36

9^h 30^m Needle in coincidence

	20	40
	~	~

The instrument was then moved to the large round stone to the north; and the plate leveled as before which will always be supposed; after moving the instrument; from this point but the following readings were made with all three verniers on the house, and on a distant church (the one with a high steeple, the northern of the two.) The azimuth of the feet of the instrument was of course changed by the removal.

House

	29	13
	149	11
	269	16

Mean 149 13.3

1866 Aug 16 Thursday

Church

125 29

245 24

365 29

The position of the instruments being
House (a) slightly altered

245 27.3

11 52

131 50

251 56

131 52.7

Church

108 8

228 6

348 9

228 7.7

10^h 30^m A.M. Needle in coin. 20 56

140 52

260 58

140 55.3

The above measurements give
the following results

True E of N } from free stone } 2° 15.5
(a) House W of N } pier. } 20 13.0

Church E of N } from round stone. } 76 1.5

No allowance has been made for parallax
as caused by the removal; but the

direction of the house not being far from
that of the line joining the positions of the
instrument, the parallax is not probably
very large.

Needle w of N

very large.
It will only affect the
aximutte of the nose.

Aug 16 9^h 30^m

10° 38' 0

11 10 30

10 41.0

" 29 30 (only one vermic) 10 9

" 22 30 From obsns. on house 11 10.4

" " " " "March 11 10.9

The transit was then brought into the house and in the afternoon the following obsns. were made from the pier constructed for it south of the west transit pier, on the same tree which was used before

Tree

2 43

122 40

242 47

122 43.3

Needle in coincidence

 $4^h \pm 1^h$

349 34

109 32

249 37

109 34.3

1866 Aug 17. Friday

Also on a house the following points being selected



House (b)	Vernier A	3	7
	C	123	10
	B	243	8
	Mean	123	8.3

Trees	A	2	40
	C	122	43
	B	242	41
	Mean	122	41.3

The verniers will always be read in this order hereafter.

The instrument was left in position and in the evening the following obsns. made on Polaris
Corr. M J

9	12.5	2	39
		122	40
		242	38
		122	39.0

1866 Aug 17 Friday

9 22.5

2 37
122 40
242 38
122 38.3

These ^{last} readings were reexamined and confirmed next day, and the following measured made on the tree and house

Tree

2 40
122 43
242 42
122 41.7

House (b)

3 7
123 10
243 10
123 9.0

From the obsn. of Polaris the mean of the three verniers for true north appears to be

120° 45'.1

Hence

Tree E of N } from stand south 1° 56'.4
House (b) } of west transit pins. 2° 23'.5

Needle W of N
Aug 17. 4^h ± 1^h comparison with 11° 12'.6
Parallax of tree 0° 19'.1

Aug 20. Monday. Obsns. in west transit room, at window north of pier, with dip circle. The inst. was not leveled previously.
 0^h 15^m Reading for house (b) 255 24 vernier A

Approx. Magn. Az. of house being 13 35

The circle was set at

Dip. 1	{	241 49	
		Lower end	Upper end
		73 $\frac{2}{8}$	73 $\frac{2}{8}$
		72 $\frac{6}{8}$	72 $\frac{6}{8}$
		73 $\frac{1}{8}$	73 $\frac{1}{8}$
0 ^h 20 ^m	{	72 $\frac{5}{8}$	72 $\frac{5}{8}$
		72 $\frac{7}{8}$	72 $\frac{7}{8}$

The transit was placed in the position of the dip circle, and the following obsns. made on the vane of a large stone building

A 350 21

C 110 24

B $\frac{230 \quad 22}{110 \quad 22.3}$
 0 43

House (b)

120 49

240 47

120 26.3

From which the azimuth of the vane seems to be W of N $8^{\circ} 0'.5$

The dip circle was now carried to the large round stone west of the observatory leveled, and set $3^{\circ} 12'$ W. of the vane;

1866 Aug 20 Monday

9

and the following obsns. made

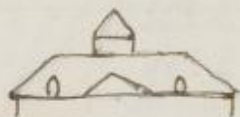
0^h 50^m

Lower end	Upper end
72 $\frac{4}{8}$	72 $\frac{4}{8}$
72 $\frac{6}{8}$	72 $\frac{5}{8}$
71 $\frac{7}{8}$	71 $\frac{6}{8}$
71 $\frac{6}{8}$	71 $\frac{5}{8}$
72 $\frac{2}{8}$	72 $\frac{1}{8}$

The precautions of moving the bracket
and rubbing with the ivory disc were
observed.

Afternoon.

Dip circle pointed to,



barn nearly

in magnetic meridian.

Standing at window N of W. Transit

picks on its own box.

4^h 15^m

72.4	72.5
73.2	73.1
72.5	72.5
73.0	73.0
72.8	72.8

With deflector N

65.7	65.7
64.0	63.9
62.2	62.1
62.2	62.1
63.5	63.4

4 30

1866 Aug 20 Monday

With Deflector N

86.5 86.6

87.9 87.9

4 35

85.8 85.7

86.2 86.286.6 86.6

With Deflectors N & S.

95.4 95.4

96.8 96.8

4 40

96.2 96.1

95.3 95.295.9 95.9

48.3 48.2

48.2 48.2

4 45

47.2 47.1

47.2 47.1

47.7 47.6

Half sum Deflector N

75.0 75.0

" " N & S

71.8 71.8

Half diff. Deflector N

11.6 11.6

" " N & S

24.1 24.2

Inst. moved to round stone, leveled, " and pointed on same barn.

5 h 0 m

72.9	72.8
73.5	73.5
72.9	72.8
71.5	71.4
<u>72.7</u>	<u>72.6</u>

Deflectors N & S.

5 h 5 m

95.3	95.2
95.4	95.4
95.9	95.9
95.8	95.8
<u>95.6</u>	<u>95.6</u>

5 10

48.1	48.0
48.5	48.4
49.4	49.3
<u>47.7</u>	<u>47.5</u>
48.4	48.3

Half sum Deflector N & S

72.0	72.0
------	------

" diff. " "

23.6	23.6
------	------

1866 Aug 20 Monday

12
10^m Transit put on round stone & plate leveled.

Pointed on vane of stone building

292 38

52 42

172 40

52 40.0

Pointed on Church 15 48

135 51

255 49

135 49.3

Pointed back to vane 292 38

52 42

172 40

Observed

Corrected watch time.

52 40.0

Remains

191 46

7 11 15

311 50

71 48

311 48.0

1866 Aug 20 Monday

13

Jupiter

83 52

7 14 47

203 56

323 51

Corr. to watch = $+2^m 40^s$ by comparison at $7^h 20^m$

298 53.0

Turned back on vane,

112 38

bringing the telescope through

232 40

zenith.

352 37

232 38.3

Telescope brought back through zenith.

Polaris

watch time.

7^h 50.3

301 38

61 41

181 40

61 39.7

7 55.5

301 38

61 40

181 41

61 39.7

Turned back to vane; too dark
to see it well with any illum. of

292 38

wires

52 40

172 40

52 39.3

Polaris $8^h 6^m 5$

301 38

61 40

181 42

61 40.0

The mean of the verniers, ^{for true north} from the obsn. of
Polaris appears to be 59 52.3
From that of Venus 59 52
" " Jupiter 59 50.

Assuming $59^\circ 52'$ and rejecting the obsn.
on vane in which the inst. was passed through
and also the last one, which was merely fiducial,
zenith, we have

Azimuth of vane on jail, from round stone

W of N. $7^\circ 12'$
(northern of the tower)

Azimuth of church N. from round stone

E of N $75^\circ 57'$

Comparing the first with the azimuth deter-
mined Aug. 20 from window N of W. Trans-
pier, we have for parallax $0^\circ 48' 5$

Comparing: the second with the determination
of Aug 16. we have for parallax of house (a)
on distant hill as seen from southern free
stone pier and from round stone

$0^{\circ} 4'.5$

1866 (27) Jan 30 - 1866 (27) Jan 30

1866 (27) Jan 30 - 1866 (27) Jan 30

1866 (27) Jan 30 - 1866 (27) Jan 30

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1866 (27) Jan 30 - 1866 (27) Jan 30

1867 Jan 14 11^h 30^m A M

Magnetic transit on its stand S. of W. Transit
pier. Plate leveled

House (b) see Aug 17

Vernier A 243 16

B 123 18

C 3 20

11^h 35^m inst. in magn. meridian

228 37

108 40

348 42

12^h 5^m 228 56

108 58

349 0

12^h 35^m 228 43

108 45

348 47

House (b)

243 16

123 18

3 20

1867 Jan 14

Inclination (Face east)

12^h 15^m

Upper	71.3	71.2	71.1	71.2	71.4
Lower	71.3	71.2	71.1	71.2	71.4

Deflections N & S.

45.2	45.0	45.7	46.0	44.6
45.3	45.1	45.8	46.1	44.7

96.3	95.4	96.2	95.7	96.2
96.3	95.5	96.2	95.7	96.2

71.5	72.0	72.0	71.1	71.2
71.5	72.0	72.0	71.2	71.3

12^h 35^m

1867 Jan. 15

79

Declination Inclination (Face east)
House b 11^h 50^m

243 18 71.2 71.8 70.4 71.4 71.1

71.23

123 19 71.3 71.9 70.5 71.5 71.2

3 21

11^h 50^m

228 58 97.1 96.7 96.3 96.0 95.1

96.27

109 0 97.2 96.8 96.3 96.0 95.2

349 1

12^h 10^m

46.3 45.8 45.8 46.0 46.1

46.08

228 48 46.5 45.9 45.9 46.2 46.3

71.18

108 49

348 51 71.0 72.0 71.5 71.1 71.8

71.53

House (b)

71.1 72.1 71.6 71.2 72.9

243 18

12^h 10^m

123 20

~~inst. adjusted for level. S. end of plate raised.~~

33 21

71.7 70.7 71.8 72.9 73.4

72.14

71.8 70.8 71.9 73.0 73.4

Inst. adjusted for level. S. end of plate raised

72.1 71.2 74.6 72.2 72.1

72.48

72.3 71.2 74.7 72.3 72.1

1867 Jan 16

Declination	Inclination
House (6)	11 ^h 50 ^m
243 18	69.1 70.0 70.1 72.7 73.6
123 18	69.2 70.1 70.1 72.7 73.7
3 20	
11 ^h 50 ^m	94.5 95.9 94.8 95.3 95.8
228 48	94.3 95.8 94.8 95.2 95.7
188 50	
348 51	46.7 46.1 46.9 47.0 46.7
12 ^h 8 ^m	46.9 46.2 47.0 47.0 46.8
228 51	
108 53	72.7 72.1 73.3 72.7 72.7
348 54	72.6 72.2 73.3 72.6 72.7
	12 ^h 5 ^m
243 18	
123 19	
3 20	

1867 Feb 19

21

Declination Plate locked Face east.
Inclination (new needle) (B)

House (b)

11^h 50^m

243 16

75.2 74.9 75.0 75.2 74.8

75.06

123 18

75.2 75.0 75.1 75.3 74.9

3 19

Deflectors N & S.

11^h 55^m

99.8 99.8 99.8 99.7 99.8

99.78

228 53

99.8 99.8 99.8 99.7 99.8

108 57

348 58

49.5 49.3 49.5 50.5 49.0

49.66

12^h 10^m

49.7 49.5 49.7 50.7 49.2

228 50

108 52

75.2 74.7 75.6 75.4 73.8

74.97

348 54

75.3 74.7 75.7 75.5 73.8

House (b)

12^h 10^m

243 17

123 18

Half sum of deflectors 74.72

3 20

" diff " " 25.06

Mean house

243 18

needle

228 54

Diff. 14 22

from which D = 12° 0' 5" W

22

1867 Feb 15

Another Needle (A.)

Means

Face East.

11^h 50^m

71.66

71.7	71.9	71.8	71.0	71.9
71.7	71.9	71.8	71.0	71.9

Deflectors N & S.

11^h 50^m

100.60

99.5	101.0	101.5	100.5	100.5
99.5	101.0	101.5	100.5	100.5

229 0

109 3

349 6

45.20

45.1	45.3	45.1	45.1	45.2
45.2	45.3	45.2	45.2	45.3

12^h 15^m

Without deflectors

228 41

108 43

348 46

71.21

71.2	71.4	71.1	71.0	71.3
71.2	71.4	71.1	71.0	71.4

Half sum of deflectors ^{12^h 10^m} 72.90; half diff 27.70

House (b)

Needle B

243 16

123 18

3 19

75.37

75.0	75.7	75.7	75.0	75.6
75.0	75.7	75.7	74.8	75.5

Deflectors N & S.

Half sum of
deflectors74.61
Half diff
25.42

49.19	48.7	49.3	49.3	49.2	49.0
49.19	48.9	49.4	49.5	49.4	49.2
100.03	99.3	100.1	100.0	100.2	100.6
100.03	99.3	100.0	100.0	100.2	100.6

1867 Feb 16

Needle B. A.

Face East.
11^h 40^m

75.6 75.1 75.4 75.4 75.5

75.6 75.1 75.4 75.4 75.5

Deflectors N & S

11^h 45^m

99.3 99.6 99.5 100.1 100.3

229 ~~10~~

99.3 99.6 99.5 100.1 100.3

109
~~349~~ 8349 ~~10~~

49.5 48.7 47.6 50.1 48.5

49.6 48.8 47.7 50.2 48.6

12^h 0^m

Deflectors removed

228 52

74.8 75.5 76.2 76.0 76.5

108 55

74.9 75.4 76.2 76.0 76.5

348 58

12^h 0^m

House (6)

243 14

123 17

3 20

24

1867 Mar 14

Face East.

Needle B.

11^h 45^m

House

243 16

~~243 16~~

76.1 76.5 77.1 75.7 77.2

76.1 76.5 77.1 75.7 77.2

123 18

3 20

98.1 99.3 100.6 100.2 100.0

11^h 45^m

98.1 99.3 100.5 100.2 99.4

228 43

108 45

48.9 49.1 49.6 48.9 49.5

348 47

48.9 49.2 49.7 49.0 49.6

12^h 10^m

228 44

76.7 76.2 76.0 75.7 76.1

108 46

76.6 76.2 76.0 75.7 76.1

348 48

12^h 5^m

House

243 16

123 18

3 20

1867 Mar 15

Face east. Needle B

11^h 50^m

76.5 76.3 76.5 76.5 76.0

76.5 76.3 76.5 76.5 76.0

99.2 99.8 101.0 100.2 99.0

11^h 55^m

99.2 99.7 101.0 100.2 99.0

228 38

108 40

48.8 48.7 48.4 49.2 49.6

348 42

48.8 48.7 48.5 49.2 49.6

12^h 5^m

228 46

76.2 76.0 76.2 76.2 76.4

108 48

76.1 76.0 76.2 76.2 76.3

348 50

12^h 10^m

House

243 16

123 18

3 20

1867 Mar 16

Face east; Needle B.

11^h 50^m11^h 50^m

75.9 75.4 76.6 75.9 76.0

228 38

75.9 75.4 76.6 75.9 76.0

108 40

348 42

99.5 99.0 98.2 100.1 100.8

99.4 99.0 98.2 100.1 100.7

12^h 5^m

228 44

49.6 49.5 49.2 48.2 48.4

108 46

49.7 49.6 49.3 48.3 48.5

348 48

74.7 75.6 74.9 75.7 75.7

House

74.7 75.5 74.9 75.7 75.7

243 16

12^h 5^m

123 18

3 20

1867 Apr 14

27

Face east Needle B

11^h 52^m11^h 50^m

House

243 18

74.8 75.1 75.2 74.8 75.4

74.8 75.1 75.2 74.9 75.4

123 19

3 21

100.4 100.6 100.9 100.7 100.1

11^h 55^m

100.3 100.6 100.9 100.7 100.1

228 37

108 39

47.3 47.0 48.8 49.3 48.9

348 41

47.4 47.2 49.1 49.4 49.0

12^h 8^m

75.4 75.2 76.4 75.8 76.3

228 40

75.4 75.2 76.4 75.7 76.3

108 42

12^h 8^m

348 44

28

1867 Apr 15

Face east. Needle B.

11^h 50^m

75.4 75.5 75.3 75.3 75.2

75.4 75.5 75.3 75.3 75.2

11^h 52^m

228 42

101.2 100.3 99.7 99.6 100.8

108 45

101.2 100.3 99.6 99.6 100.8

348 48

50.4 49.8 48.8 48.9 48.7

12^h 6^m

50.5 49.9 48.9 49.0 48.8

228 41

108 44

76.1 75.3 75.6 75.8 75.1

348 47

76.1 75.3 75.6 75.8 75.1

12^h 5^m

1867 Apr 16

29

Face east Needle B.

11^h 50^m

75.9 75.5 75.6 75.5 76.1

75.9 75.4 75.7 75.5 76.2

11^h 55^m

228 37 99.8 101.2 100.9 100.3 101.0

108 38 99.9 101.2 100.8 100.2 100.9

348 40

48.4 48.5 49.3 49.5 49.4

12^h 9^m

48.5 48.6 49.4 49.6 49.7

228 30

108 31 76.5 75.9 75.4 75.2 75.7

348 34 76.4 76.0 75.3 75.2 75.6

12^h 8^m

House

243 17

123 19

3 20

1867 May 14

2^h 40^m2^h 40^m

On table in library. Face E.

228 35

76.2 76.6 76.7 75.8 75.5

108 38

76.3 76.5 76.7 75.8 75.5

348 40

99.5 100.8 100.8 100.3 100.6

99.5 100.8 100.7 100.2 100.5

3^h 0^m

228 40

47.6 46.2 48.0 48.3 48.6

108 42

47.8 46.3 48.1 48.3 48.7

348 44

Telescope left inclined at 76°

75.9 74.9 75.2 75.1 75.4

House

75.8 74.9 75.1 75.1 75.3

243 14

3^h 0^m

123 17

Telescope horizontal

3 19

76.2 75.2 76.5 76.1 76.2

76.3 75.3 76.5 76.1 76.2

1867 May 15

31

11^h 50^m

228 38 75.9 76.7 75.3 75.5 75.3

108 41 75.9 76.7 75.3 75.5 75.3

348 42

99.3 99.8 100.7 101.6 101.1

99.2 99.7 100.6 101.4 100.9

12^h 5^m

228 37 48.0 47.9 48.7 48.0 47.8

108 40 48.2 47.8 48.8 48.2 47.9

348 42

75.0 75.1 75.0 75.0 75.1

75.0 75.1 75.0 75.0 75.1

12^h 5^m

1867 May 16

11 45

11^h 50^m

228 32 75.7 75.3 75.8 75.5 75.0

108 35 75.6 75.3 75.8 75.5 75.0

348 38

101.3 101.1 101.0 101.2 101.1

12 10 101.3 101.0 101.0 101.1 101.0

228 28

108 31 49.7 49.3 49.9 49.8 49.2

348 34 49.7 49.3 49.9 49.8 49.2

House

75.3 75.9 75.7 76.0 75.9

243 16 75.2 75.9 75.6 76.0 75.9

123 18 12^h 10^m

3 20

1867 June 14 Friday

33

Transit on round stone north of freestone
pier; dip circle on ^{northem} freestone pier.

Both instruments leveled. north
side of transit afterward lowered to avoid parallels
on needle.

Vane on alms
house (formerly called
jail)

12^h 0^m Face east needle B.

358 56

75.7 75.1 74.7 75.3 76.3

238 58

75.7 75.1 74.7 75.3 76.3

119 0

12^h 5^m
needle

100.8 100.2 99.7 100.6 99.7

354 58

100.8 100.2 99.7 100.7 99.7

235 0

115 2

49.8 49.0 49.1 50.8 49.2

12^h 15^m

49.8 49.0 49.1 50.8 49.2

354 57

235 0

75.8 75.7 75.3 76.3 75.5

115 1

75.8 75.7 75.3 76.3 75.5

Vane

358 56

238 58

119 0

34

June 15 Saturday

same circumstances as yesterday

Vane	74.8	74.9	75.1	74.9	74.8
30 46					
~~32~~ 42	74.8	74.9	75.1	74.9	74.8
270 48					
~~272~~ 47					
150 50					
~~152~~ 47	100.5	99.7	99.8	100.4	99.8
11 ^h 55 ^m	100.5	99.8	99.9	100.4	99.8
26 34					
266 38	49.5	49.0	48.9	49.8	48.8
146 39	49.5	49.0	49.0	49.9	48.9
12 ^h 5 ^m					
26 43	75.6	75.7	75.3	75.1	75.1
266 48	75.6	75.6	75.3	75.1	75.1
146 49					
Vane					
30 46					
270 48					
150 51					

June 16 Sunday

75

Same circumstances

Vane 75.8 75.5 76.1 76.4 75.8

290 48 75.8 75.5 76.1 76.4 75.8

170 50

50 52 : 100.9 100.5 100.4 101.1 100.8

11^h 50^m : 100.8 100.5 100.5 101.1 100.8

286 46

166 48 : 49.2 49.3 49.3 49.0 49.0

46 50 : 49.2 49.4 49.4 49.1 49.1

12 5

286 45 : 75.8 75.7 76.2 75.2 75.5

166 48 : 75.7 75.7 76.1 75.2 75.5

46 50

Vane

290 45

170 48

50 50

36
 Sunday
 July 14 Monday

12^h 20^m

43 10 S end of needle

283 12

163 14

47 8 Vane

287 10

167 10

42 58 N End of needle 12^h 30^m

283 0

163 1

41 4 S End "

283 6

163 8

N End always used heretofore.

N. End apparently too heavy today
 to be thrown much out of level in obsns.
 and last month, so that plate has

37

100

10. 24

55

422

1919

01 75

10. 11. 1954

cc "S. John" 1888

1890

22

7

685

300

collected Nov. 20, 1903

1891

and the other side of the river

July 15 Monday

11 h 55 m

South end

64 2

304 2

184 4

North end

63 50

303 48

183 50

Vane

67 53

307 55

187 57

63 58

304 0

184 2

63 50

303 50

183 52

July 16 Tuesday

39

11^h 15^m

South end

North end

77 30

77 8

317 31

317 8

197 33

197 10

81 28

321 28

201 30

77 28

77 6

317 28

317 6

197 30

197 8

1867 Aug 14 Wednesday

C. S. Declin. no 5. Set up in room over library and approximately leveled and placed in magnetic meridian by E. Goodfellow. Verniers read for magnetic meridian.

A $174^{\circ} 28'$

B $354^{\circ} 28'$

~~At~~ Stump suspended by four fibres and ~~the~~ magnet placed in it. Scale reads at 11^h 45^m A.M. 9.3 counting from app. left.

12 45 Scale reversed by turning magnet half round its axis.

^{The cross wires} Being off the scale the inst. was moved in azimuth. a little.

Reads 7.8 counting from app. right.

Reversed again

Reads 2.3 " " " left.

moved to read ~~at~~ 6.2 | zero 5.05

Brass plummet suspended.

Dip No 11. placed approximately
in meridian, & leveled, Reads for
meridian $70^{\circ} 0'$

Aug 15 Thursday

6 AM Brass plummet examined
and cap rotated from 1° to 309°
which appears to bring the line of
no torsion into the magnetic meridian

Reads for middle of scale	356	14.5
		~~18.8~~
	355	50.5
	356	39.3
	20	(48.8)
1 div =		2.44

33.5°

42

39.8

53.0

6.5

19.8

33.2

46.5

59.7

13.1

26.4

39.8

13.2

1867 Aug 16 Torsion adjusted.

6 30 A M Scale erect. 7.8 to 12.8 | 10.3
 inverted - 0.8 to + 0.5 | - 0.15
 Zero 5.08

Set on zero; circle reads A

A 176 12.5 B 356 12.5

Mean

h m	Circle Readings	Mean
6 45	4.1 to 5.2	4.6
7 0	4.2 to 4.9	4.6
7 15	4.7 to 5.5	5.1
7 30	4.9 to 5.2	5.0
7 45	5.1 to 5.1	5.1
8 0	5.1 to 5.1	5.1

8 45 4.2 to 7.0 5.6

9 0 5.1 to 6.3 5.7

10 15 7.2 to 7.7 7.5

Torsion circle reads 27°

^{mean} 2.2 turned to 117 0.0 to 4.5

14.2 back 297 13.2 to 15.2

8.2 $10^h 30^m$ forward to 27 6.7 to 9.7

\$

Short magnet.

Scale inverted.

large blob below.) 7.7 11.3 Mean 9.5

erect 21. 23 22

zero 15.8

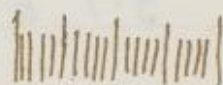
erect 14.0 17.0 15.5

inv. 11.0 19.0 15.0

zero. 15.2

Long magnet scale erect for

Two bubbles in glass.



a black spot

zero 5.1 count from left for scale erect.

Long magnet suspended scale erect

Dernier A $176^{\circ} 2'$ B $356^{\circ} 2' 45''$

Extremes of scale

1 15 P.M. 4.0 10.5 7.3

6.8 8.8 7.8

30 7.5 8.0 7.8

45 7.5 8.2 7.9

2 0 7.6 8.0 7.8

15 7.7 8.2 8.0

30 8.0 8.4 8.2

3 0 8.3 8.3 8.3

Set alt 10.0 A 175 58 B 58

0.0 176 22 22

Temp 72.5 20.0 175 33 33

10.0 175 58 58

1 div = $2' 45''$

Determined as $2' 44''$ Aug ~~15~~

46
Aug 16

The dip having been found $74^{\circ}35'$ with dip circle no 11. the following obsns. were made with the Fox circle previously used, standing on the library table.

Face East. Needle B.

S	77.1	75.0	73.4	76.3	76.2	} 75.60
N	77.2	75.0	73.6	76.2	76.0	

S	76.3	76.3	76.2	76.8	76.0	} 76.29
N	76.2	76.2	76.1	76.8	76.0	

S	75.7	76.2	76.6	76.2	76.1	} 76.14
N	75.7	76.1	76.4	76.3	76.1	

Mean. 76.01

Short magnet suspended scale inverted

Set at 10.0	175	53	53
very indistinct 0.0	175	23	23
20.0	176	21	22
	175	52	52

1 division of scale = 2.92

1867 Aug. 17. The weather having improved, readings of the circle were made on four churches near the S. magnetic meridian Vernier A B

Church no 1. No 1. 176 36 36
 between two hills. 37 37

No 2 177 34 34
 34 34

No 3 177 56 56
 (a large one) 56 57

No 4 178 2 2
 distant 2 2

Aug 18 Sunday

10 15 P.M.

Theodolite moved to window,
leveled and set to read

A	B	Transit of α Pisc. Aust.		
		Chron. 236		
150° 0'	330° 0'	20	31	49.5
151° 15'	331 15'		33	5.5
151° 20'	331 20'		34	21.5

160 0	340 0	21	15	55.5
-------	-------	----	----	------

161 0	341 0	21	20	35.5
-------	-------	----	----	------

15	15	21	45.5
----	----	----	------

30	30	22	56.0
----	----	----	------

Next morning

Church no 1

171	47	351	48
	47		48

no 3

173	7	353	7
	7		7

Mean 1st set $151^{\circ} 15'$ $20^h 33^m 5.5^s$

Corr to Chron $- 2^m 43.7^s$

$20 \quad 30 \quad 21.8$

App α of Fomalhaut $22 \quad 50 \quad 20.7$

$h \quad - 2 \quad 19 \quad 58.9$

App. NPD $-120 \quad 19 \quad 12$

co-lat $47 \quad 37 \quad 11$

2^d set corrected time $21 \quad 29 \quad 2.0$

$h \quad - 1 \quad 31 \quad 18.7$

$\cot az = \sin co-lat \cot NPD \csc h$

$- \cos co-lat \cot h.$

$9.86846 \quad 9.82869 \quad 9.86846 \quad 9.82869$

$9.76702n \quad 9.76702n$

$0.24146n \quad 0.15685n \quad 0.41121n \quad 0.37578n$

$9.87694 \quad 9.98354 \quad 0.04669 \quad 0.20447n$

$.75325 \quad -.96281 \quad 1.11350 \quad -1.60129$

1.71606

2.71479

0.23453

0.43374

$az \quad -30^{\circ} 13.8$

$-20^{\circ} 13.3$

zero of wire $181^{\circ} 28.8$

$181^{\circ} 28.3$

Giving for Church no 1.

$$181^{\circ} 28'5 - 171^{\circ} 47'5 = 9^{\circ} 41'0 \text{ w of S}$$

Sept 3 8 30 P.M

Theodolite brought to window, leveled, & pointed on ϵ Sagittarii.

A

Chron. 236

$$199^{\circ} 245' - 19 \quad 29 \quad 24$$

Clouds prevented further measures

Next morning, pointed on Church no 1.

A

$$174 \quad 40$$

$$40$$

ϵ Sagittarii = 6233 B.A.C.

$$18 \quad 14 \quad 13.04 \quad -34 \quad 26 \quad 56.5$$

$$\text{Prec.}^{+p} 1859 + 3.987 \quad + 1.22$$

$$\begin{array}{r} 17 \\ 27909 \\ 3987 \\ \hline 67779 \end{array}$$

$$\begin{array}{r} 17 \\ 847 \\ 121 \\ \hline 20.57 \end{array}$$

$$1867.0 \mid 18 \quad 15 \quad 20.82 \quad -34 \quad 26 \quad 35.9$$

7.7000 $8.9068n$ 0.6005 $7.4526n$
 1.2493 $0.8192n$ 9.7730 0.9306
 ~~9.7730 0.9306 1.2493 $0.8192n$~~

$+ 7.0000$ $- .69$ $+ 7.0000$ $+ 1.0000$ t_{μ}
 $+ 0.89$ $+ 532$ $+ 2.363$ $- 0.24$ $+ 0.01$

9.3153 8.5449 $0.0946n$ $9.9992n$

$+ 1.12$ $+ .80$ $- 2.008$ $+ 1.88$

$+ 3.67$ $+ 23$ $- 74$ $- 8.51$ $+ 0.5$

$+ 2.961$

$+ 5.30$ (in δ)

$18 \ 15 \ 23.78$ $34 \ 26 \ 30.6 = \text{app place}$

$19 \ 29 \ 2 = \text{corrected chron time.}$

$+ 1 \ 13 \ 38.2 = \text{hour angle}$

9.86846 9.82869

$9.83619n$

0.50059 0.47777

$0.20524n$ 0.30646

1.6041 2.0252

3.6293

$az = + 15 \ 24.2$

$25 \ 5 = 199 \ 45 - 17^h \ 40$

$9^{\circ} \ 40' .8 = \text{azimuth of church.}$

52

Sept 4.

Pointed on Fomalhaut

Vernier

Chron. 236

43° 45'

21 12 53.5

46 30

21 25 53

46 45

27 3.5

$$\begin{array}{r} 47 \quad 0 \\ \hline \end{array}$$

$$\begin{array}{r} 28 \quad 17 \\ \hline \end{array}$$

mean 46° 45'

21 27 4.5

also on α Sagittarii

100 0

21 20 38.5

$$\begin{array}{r} 100 \quad 15 \\ \hline \end{array}$$

$$\begin{array}{r} 21 \quad 52.5 \\ \hline \end{array}$$

mean 100 7.5

21 21 15.5

Corr. to Chron. = 28.0

~~Next morning~~ Sept 7, morning
Church no 1. 55 41

41

41

mean

55 41.0

1st obs set on Fornalhaut - 1^h 37^m 55^s.4 - 30° 19' 14"^δ
2^d " " - 1 23 44.4 " " "
" Sag. + 2 33 43.6 - 26° 27' 21"

Fornalhaut

9.86846	9.82869	9.86846	9.82869
9.76703		9.76703	
0.38258	0.34168	0.44695	0.41729
0.01807	0.17037	0.08244	0.24598
1.0425	1.4803	1.2090	1.7619
2.5228		2.9709	
21 37.2		18 36.1	
zero 65 22.2		65 21.1	

σ Sagittarii

9.86846 9.82869

9.69690

0.20650 0.10046

9.77186 9.92915

.59137 .84948

1.44085

34 45.8

zero 65 21.7

mean of all for zero 65 21.7

55 41

azimuth of church

9° 40.7

Sept 4

" "

9° 40.8

Sept 3

" "

9° 41.0

Aug 18

mean

9° 40.8

1867 Sept 16 Monday

Instruments removed to small
magnetic observatory N of dome,
on Sept 14th and plummets suspended,
and plates leveled.

5 45 A M

Long magnet suspended

Vernier A 114 47

B 294 47

Scale supposed to be erect but the
marks are no longer visible.

6^h 20^m oscillating between 3.2 &

19.2

11.2

6 35 7.5 to 12.5 10.0

40 9.5 to 12.8 11.6

7 0 8.5 to 12.5 10.5

20 8.8 to 9.5 9.2

8 0 6.0 to 7.0 6.5

20 4.8 to 6.5 5.6

50 4.8 to 5.2 5.0

Scale inverted

9 0 0.8 to 8.8 4.8

5 3.1 to 7.2 5.1

zero apparently 5.0 as last month.

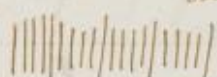
10 30 4.5 to 6.8

Set to 10.0

Vernier A 114 59

B 294 59

~~Sho~~ Both magnets marked on object glass, and glass screwed into tube more firmly
2 P.M. Short magnet scale erect
thus

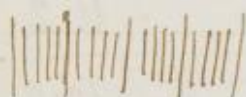


8.0 counting from left

9.0 scale inverted

8.5 = Zero.

Long magnet



scale erect thus

4.5 erect (from left)

5.0 inverted

4.8 = Zero.

Bore removed.

Poplar tree on hill to ENE

A 9.° 3' B 189° 3'
3' 3'

Sept 17 Tuesday

Long magnet scale erect

6 15 AM 6.5 to 12.5 9.5

Vernier A 114 49

B 294 49

30 AM 6.5 to 11.5 9.0

45 8.0 11.5 9.7

7 0 8.7 10.8 9.7

15 7.8 9.3 8.5

30 8.5 9.5 9.0

45 8.1 9.7 8.9

8 0 7.0 7.5 7.2

15 7.3 7.7 7.5

9 0 6.8 7.5 7.1

9 45 steady at 7.0

10 15 6.5 8.0 7.2

set to move between 3.2 & 16.8

Vernier A ¹¹⁴~~294~~ 44

B 294 44

Exps. of Vibration & Deflection.

12 45 Long magnet suspended
Scale erect.

Vernier A 114 49

B 294 49

1 ^h 0 ^m	from 7.8 to 12.2	10.0
30	9.5 to 11.0	10.2
2 0	10.0 to 11.2	10.6
30	10.0 to 12.3	11.2
3 0	7.1 to 15.5	11.3

inverted

1.0 to -2.5 est. -0.8

zero

5.2

Poplar tree 9 1 189 3
2 3

Sept 19
 α Arietis

Chron 236

~~A 14 45 B 194 46~~

~~B 194~~

					hasty observation		
rej.	15	0	195	0	19	39	30.0
A	15	15	195	15	19	41	2.0
				30	19	42	39
				45	19	44	19
16	20	196	0	30	19	45	58
			15	45	19	47	35
					sum	221	33

β Arietis

21	0	201	0	19	52	22
			15		53	57
	30		30		55	29
				sum	161	48

Sept 20 noon.

Poplar 9 1 189 1
1 1
1 1

Vernier α Arctis

Chron 236

15 45

19 44 18.6

corr. to Chron

-1 38.5

T

19 42 40.1

 α

1 59 44.3

h

- 6 17 4.2

9.86846 δ

22 50 6

9.86846 - 9.82869

9.62436

0.00121

8.87285

9.49403

8.70154

31191

05030

36221

-109° 54'.7 = az.

-125° 39'.7 = zero

mean by weights 125° 39'.4

89° 1'.0

polar

116° 38'.4 E of S.

Vernier A	β Arietis	Chron 236
21 15	19 53	56.0
	- 1	38.5
	19 52	17.5
	1 47	21.2
	- 5 55	3.7
	+ 20 9	35

9.86846

9.82869

9.56482

0.00010

8.33346 n

9.43338

8.16215 n

27126

01453

25673

- 104° 23' 9" = az.

125° 38' 9" = zero

magnetic meridian 8^h 50^m Sept 16105 44 S of poplar = 10° 54' 4" ϵ of S.9^h 0^m Sept 17105 52 S of poplar = 10 46.4 ϵ of S.
in room over library 7^h 45^m Aug 16 ϵ - 0 23.5 W of church = 10 4.3 ϵ of S.

147 Sept 20 Friday 27 27

3 P M

Declinometer put on round
stone N W of obsy. and leveled.

Pointed on vane of almshouse

B 147 27 A 327 27

Suspended long magnet
scale erect.

Set on zero

B 323 36 A 143 36

Diff 176 9 176 9 E of vane

Azimuth of vane see 1866 Aug 20

7 12 7 12 W of N.

168 57 E of N = $11^{\circ} 3'$ or

E of S for magnetic meridian.

Wind disturbed needle very much
making it impossible to get more than
this one measure.

1867 June 14	11	10	} from round stone
July 14	11	13	
1866 Aug 16	11	10	

1866 Aug 16 10° 40' from freestone
pier.

Sept 21 Saturday

3 P M

south

Dialinometer placed ~~near~~ north freestone
pier west of obsy; the same used 1866
Aug 16

Set on House as
see 1866 Aug 16

Vernier A 113 40

B 293 40

Set on 5.0 of long magnet scale west

A 303 18

B 123 18

scale inverted A 303 8

B 123 8

mean 303 13

Magnet E of house 129 33

House W of N 20 13

Magnet W of N 10 40

64

Declinometer placed on round stone:

Set on almshouse vane

	A		B	
	31	0	211	0
House (a)	17	55	197	54
6.5 of magnet scale ^{inverted}	207	29	27	29
" " scale erect	207	24	27	24
mean	207	26.5	27	26.5
magnet ^w of vane	3	33.5		
vane W of N	7	12		
magnet W of N	10	45.5		
House (a) W of vane from round stone	13	5.5		
" " W of N	"	"	20	17.5

with dip circle no 11.

Three measurements of dip, also made in the forenoon at round stone & north free stone pier resulting as follows

	Round stone	North pier
Needle A	[73 58]	74 20
B	74 29	74 2
B	74 23	74 14
mean	74 26	74 12

The first is rejected on account of
a large cow chain and stake not
far from the instrument during
the observations.

1867 Oct 14 Monday

Room over library.

Horizontal circle leveled.

Vernier A 20 45

B 200 45

Long magnet; scale erect.

				mean
7	5 ^m A M	5.5	to 8.5	7.0
	15	6.0	8.0	7.0
	30	6.0	7.0	6.5
	45	5.7	6.2	6.0
8	0	5.6	6.0	5.8
	15	5.5	6.0	5.8
	30	5.8	6.0	5.9
	45	5.8	6.0	5.9
9	0	6.0	6.0	6.0
	15	6.0	6.0	6.0
	30	5.9	5.9	5.9
	45	5.7	5.8	5.8
10	0	5.3	5.5	5.4
	30	4.2	4.2	4.2
	scale inverted			
	35	4.0	8.0	6.0

Zero of long magnet

5.1

Pointed on Church no 1.

				mean
Vernier	A	20°	50'	50'
	B	200°	50'	50'
				20 50
				200 50

Exps of vibration

Short magnet scale erect	7.2 to 10.2	8.7
deflector on reject	inverted 3.0 to 6.8	4.9
	Zero	6.8

inverted	5.8 to 9.2	7.5
erect	6.2 to 9.0	7.6

Exps. of Deflection

				mean
1	30	short magnet scale erect	5.7 to 9.2	7.5
Vernier	A	20	38	
	B	200	38	
1	45		6.8 to 9.0	7.9
2	0		7.1 to 8.9	8.0
2	15		7.3 to 8.2	7.7

2	30	7.4 to 8.0	7.7
2	45	7.6 to 8.0	7.8
3	0	8.0 to 8.0	8.0
3	15	7.8 to 8.0	7.9

Short magnet left suspended
all night

Oct 15 Tuesday

6	45	A.M. scale erect	9.2
7	0		9.2
	15		9.1
	30		9.1
8	0		8.9
	15		8.9
	30		8.9
	45		9.0
9	0		9.0
	30		9.1

10 15

8.3

Long magnet suspended
Scale erect

6.5 to 7.7 ^{mean} 7.1

Experiments of vibration.

Cross wires set to 10 mark.

Exps. of Deflection.

12 30 short magnet scale erect ^{mean}
6.7 to 9.5 8.1

Vernier A $20^{\circ} 40'$

B 200 40

1 ^h 0 ^m	7.1 to	8.1	7.6
1 30	7.2	8.0	7.6
2 0	8.0	8.2	8.1
2 30	7.3	7.5	7.4
3 15	8.0	8.2	8.1
3 45	9.0	9.0	9.0

8 15

10.3

Oct 15

10	0	P.M.	10.2
11	30		10.8

Oct 16

5	45	A.M.	9.9
6	30		10.2
7	15		10.0
7	45		9.9
8	0		9.9
8	30		10.0
9	0		9.7
10	30		9.5

Long magnet suspended; set on
 10 mark. Vernier A 20 34
 B 200 34
 Expts. of Vibration.

Long magnet scale erect 9.5
 inv. 0.4
 zero 5.0

circle { Vernier A 21 2 —
 moved } B 201 2

71

~~Short magnet scale erect 7.1~~

set back to 20 34

Short magnet scale inverted 3.5

erect 11.5

zero 7.5

exps. of Deflection.

	A	B
Church no 1	20 51	200 51
	51	50
	50	50

Verniers set 20 40

200 40

1 40 8.1

2 0 8.0

2 15 8.1

2 30 8.0

3 0 8.1

3 45 7.7 to 9.3 mean
8.5

12 0 midnight 10.9

Oct 17

10 15 A.M. 4.2 to 12.5 8.4

12 15 6.3 to 7.2 6.8

2 30 7.8 to 9.0 8.4

3 45 R.C. 9.9 to 11.1 10.5

Oct 18

2 ⁰~~30~~ P.M. 9.3 to 9.9 9.6

3 45 11.1 to 11.1 11.1

Oct 19

0 30 A.M. 12.9 to 13.1 13.0

3 0 P.M. 9.2 to 9.6 9.4

1867 Nov. 13

Instruments moved to small magnetic observatory in north of dome and set up on stakes prepared for them.

Torsion plummet suspended,

1867 Nov. 14 Thursday:

Torsion circle adjusted.

Reads 300°

Short magnet suspended;

Scale ~~erect~~. inverted

Wernier A 173 21

B 21

		^{10.0} 8.0	^{12.0} to 10.0	mean	
6	45 AM	~~8.0~~	~~to 10.0~~	~~9.0~~	11.0
7	0	^{10.8} 9.5	^{11.0} to 10.5	~~10.0~~	10.0
7	15	^{11.8} 9.0	^{12.0} to 9.2	~~9.1~~	10.9
7	30	~~8.0~~	~~to 8.2~~	~~8.1~~	11.9
7	45	steady at		~~7.2~~	12.8
8	0	"	"	~~6.8~~	13.2
8	15	"	"	~~6.0~~	14.0

8 30 steady at 15.0

9 5 " " 16.0

11 5 ^{17.1} 0.3 to ^{19.7} 2.9 ^{18.4} ~~18.5~~

Exps. of Deflection.

Vernier A 172 53

B 53

12 0 8.0 to 12.0 10.0 ~~10.0~~

15 ^{7.7} ~~9.3~~ ^{10.7} ~~12.3~~ 9.2 ~~10.8~~

45 ^{7.8} ~~11.0~~ ^{9.0} ~~12.2~~ 8.4 ~~11.6~~

1 0 ^{7.9} ~~11.3~~ ^{8.7} ~~12.1~~ 8.3 ~~11.7~~

15 ^{7.7} ~~11.9~~ ^{8.1} ~~12.3~~ 7.9 ~~12.1~~

30 ^{7.7} ~~12.1~~ ^{7.9} ~~12.3~~ 7.8 ~~12.2~~

45 ^{7.6} ~~12.2~~ ^{7.8} ~~12.4~~ 7.7 ~~12.3~~

2 0 ^{7.5} ~~12.1~~ ^{7.9} ~~12.5~~ 7.7 ~~12.3~~

15 7.5 7.7 7.6

Reversed scale erect

5.8 11.2 8.5

Zero 8.0

Poplar used in Sept. obsns.

Vernier A B

67 12 247 12

12 12

12 12

Exps. of Vibration.

Long magnet suspended scale
erect.

$3^h 10^m$ 9.5

Vernier A 173 0

B 353 0

Nov 15 Friday

11 30 A M 7.3 to 7.7 7.5

set on 10.0

Vernier A 172 53

B 352 53

Exps. of Vibration.

Short magnet suspended, scale erect.

Exps. of Deflection.

short mag. } Vernier A		B
scale exact. }		59'
	172° 59'	mean
1 ^h	0 ^m	8.0
15	7.7 to 8.5	8.1
30	7.7 to 8.1	7.9
45	7.5 to 7.9	7.7
2 0	7.0 to 7.4	7.2

Magnet removed in order
not to disturb dip obsns.

3 15 magnet replaced

" 7.1 to 10.1 8.6

Left suspended over night.

Nov 16 Saturday

6 10 AM	8.2 to 8.6	8.4
6 40	steady at	8.5
7 20	8.7 to 8.9	8.8
7 45	steady at	8.0
8 10	" "	8.1
8 30	8.3 to 8.7	8.5
9 0	steady at	8.2
9 45	" "	8.2

" Vernier A 172 25 20.0

11.8) 34' (2.97

Exps. of Deflection
 Scale Vernier A B

Time 12 ~~5~~

12^h 5^m 8.0 173° 0' 0'

0.0 173 25

4.0 13

8.0 0

12.0 172 47

16.0 35

20.0 23

20.0 23

16.0 35

12.0 47

8.0 59

4.0 173 11

0.0 23

12 30 Set at 172 59

giving for mean.
 12 45 9.7 to 10.5 10.1

1 0 10.3 to 10.9 10.6

78

			mean
1	15	10.1 to 10.3	10.2
	30	steady at	9.9
	45	" "	10.0
2	0	" "	10.2
	15		10.5

	A		B	
Poplar	67	11	247	11
		11		11

Dec 13 Friday

Torsion adjusted, and long
magnet suspended, scale erect.
Room over library.

Dec 14 Saturday

Vernier A 350 44

B 170 44

7 ^h 0 ^m	7.5 to 11.5	9.5
15	8.7 to 11.5	10.1
30	9.4 to 11.2	10.3
7 45		
~~8 0~~	9.1 to 10.0	9.6
8 0	9.3 to 9.9	9.6
8 15	9.7 to 10.1	9.9
30	9.8 to 10.4	10.1
45	9.8 to 10.0	9.9
9 0	9.9 to 10.1	10.0
11 30	expts. of vibration.	9.5

Exps. of Deflection

Short magnet; scale erect			
Verniers 350 380 170' 38.			
12	30	6.9 to 9.1	8.0
	45	8.3 to 9.3	8.8
1	0	8.5 to 9.2	8.8
	15	8.7 to 9.1	8.9
	30	8.8 to 9.0	8.9
	45	8.7 to 8.9	8.8
2	0	8.2 to 8.4	8.3
	15	Steady at	8.1
	30	" "	8.1

The box containing the strong bar magnets used with the dip-circle was found to have been lying about 4 ft. east of the theodolite during the obsns. of today.

Dec 15 Sunday

Church no 3 352 46
 46
 46

Room over library

81

Dec 16 Monday

Vernier A 350 44

B 170 44

Short magnet; scale erect.

5	45	6.0 to 7.0	^{mean} 6.5
6	0	6.5 to 7.1	6.8
	15	7.0 to 7.1	7.0
	30	steadily alt	7.0
	45	6.0 to 7.6	6.8
7	15	6.8 7.1	6.9
	30	6.7 7.1	6.9
	45	7.0 7.2	7.1
8	0	7.0 7.1	7.0
	15	6.9 7.1	7.0
	30	6.2 6.6	6.4 ^{mirror adjusted just before}
	45	6.8 7.3	7.0
9	0	7.0 7.5	7.2
	15	6.8 7.2	7.0
	30	6.6 7.0	6.8
	45	6.2 6.8	6.5

82

10	0	6.0 to 6.3	6.2
	15	6.0 to 6.2	6.1
	30	6.1 to 6.2	6.1
	45	5.9 to 6.1	6.0
11	0	5.7 to 5.9	5.8

Exps. of Deflection

Vernier A 350 38

B 38

12	0	6.0 to 8.0	7.0
	15	7.0 to 8.4	7.7
	30	7.5 to 8.1	7.8
	45	7.7 to 8.1	7.9
1	0	7.8 to 8.1	7.9
	15	7.8 to 8.0	7.9
	30	7.8 to 8.0	7.9
	45	7.9 to 8.0	7.9
2	0	steady at	8.0
	15	6.3 to 11.9	9.1
	30	6.0 to 13.2	9.6
	45	7.9 to 12.3	10.1
3	0	8.0 to 11.9	9.9

Long magnet suspended
scale erect.

Expts. of Vibration,

Dec 17 Tuesday

Vernier A 350 38

B 38

Long magnet scale erect.

5 45 8.5 to 10.9 9.7

6 0 8.8 10.7 9.7

15 9.3 10.3 9.8

30 9.7 10.3 10.0

7 0 10.1 10.3 10.2

15 10.2 10.4 10.3

30 steady at 10.2

8 5 10.8 to 11.0 10.9

15 steady at 10.8

Value of 1 div. of scale.
Long magnet

Div.	Temp.	Vernier	A	mean
0.0	23°	351	4	351 3
5.0		350	52	350 51
10.0		350	40	39.5
15.0		350	27	26.5
20.0		350	14	14.5
				350 38.9

8^h 45^m Zero of scale. Vernier A 350 51

scale erect 5.0 to 6.0 — 5.5

" invert. 0.5 to 7.5 4.0

zero. = 4.8

Church no 1. Vernier A

351 27

27

26

		comp.	$\sigma - c$
+24.1	-	351 3.2	-0.2
+12.1		350 51.0	0.0
+0.6		38.9	+0.6
-12.4		26.8	-0.3
-24.4		14.6	-0.1

value of 1 div. 2.43

Experiments of Vibration.

Long magnet scale inverted.

350' 55 Vernier A.

12	15	1.0 to 12.8	6.9
	30	5.7 to 8.5	7.1
	45	6.0 to 8.0	7.0
1	0	4.0 to 13.5	8.7
	15	6.0 to 11.8	8.9
	30	6.8 to 10.8	8.8

Short magnet suspended
Scale inverted

Vernier	}	7.1 to 8.1	7.6
A 23		scale erect	
350 ~~28~~		7.9 to 11.0	9.3
		Zero =	<u>8.5</u>

Value of 1 div. short magnet (= 2.98)

0.0	350	50	50	50	29.6
		35	36	35.5	15.1
	↓	20	↑	20.5	0.1
		5	6	5.5	-14.9
20.0	349	50	51	50.5	-29.9
				<u>102.0</u>	
				20.4	

Set on 8.5 A = 350° 23'

Exps. of Deflection

Church no 1 351 26

2 26

26

1868 Jan. 2, Thursday

Theodolite brought to clock room
short magnet suspended scale erect.

Long magnet deflecting. ~~xx~~

Experiments for the temperature
coefficient q .

$$r = 1.45^{\text{ft}}$$

Mag.	N. End	Time	Temp.	Scale reading
	$\begin{smallmatrix} E \\ W \end{smallmatrix}$			$\begin{smallmatrix} \text{Vernier A.} \\ 5^{\circ} 24' \end{smallmatrix}$
W	~~W~~	2 20	75	8.9
	W	2 30	75.5	10.4
	E	2 45	73.9	13.0
		2 50	trough containing magnet filled with snow.	

E 3 15 32.8 5 24 15.8

trough filled with warm water

E 3 40 101.0 5 24 16.0
warm water poured out
E 4 0 72.0 5 24 17.4

88

Jan 8 Wednesday
 Theodolite again set up in clock
 room.

$$r = 1.45$$

Vernier A

B

136 35

316 35

afterward moved to

137 57

317 57.5

Mag.	N. End	Time	Temp	Scale
w	E	2 25	73.7	13.4
		2 55	40?	15.0
		3 45	74	16.9

Jan 9 Thursday

 $r = 0.802$

A

B

158 14

338 14

Mag	N End	Time	Temp	Scale
w	E	1 10	70.5	11.3

Magnet covered with
melting snow

1 45 32? 19.0

snow removed

2 5	65.0	20.8
set back to		4.6
snow replaced.		

2 35 32? 10.5

2 50 " 10.5

snow removed

3 20 69.0 8.8

3 45 67.0 13.0

These experiments give by least squares
 change of scale reading for 1^m of time + .105
 " " " 1° of temp - .012

but do not represent the obsns. well

1868

Jan 13 Monday

Theodolite set up in room over library at 3 P.M. & plummet suspended.

12 P.M. Torsion adjusted and short magnet suspended, scale inverted.

Vernier A 175 55 B 355 55

Jan 14 Tuesday

				mean
5	15	A.M.	steady at	12.3
	30		12.1 to 13.0	12.5
	45		12.8 13.2	13.0
6	0		12.8 13.2	13.0
	15		12.7 13.1	12.9
	30		12.4 12.8	12.6
	45		12.9 13.1	13.0
7	0		12.8 13.0	12.9
	30		12.6 13.0	12.8
8	0		12.4 to 13.0	12.7

10^h 15^m

Church no 1. Vernier A 176 35

35

35

Exps. of Deflection. } short magnet
scale inverted

11^h 30^m 3.0 to 13.0 8.0

45 5.0 to 11.2 8.1

12 0 6.0 to 9.7 7.8

15 5.0 to 8.0 6.5

30 6.0 to 8.0 7.0

45 3.2 to 11.8 7.5

1 0 2.0 to 14.5 8.2

Long magnet suspended, scale inverted.

Exps. of Vibration

Scale inverted 10.0

" erect - 1.5

Zero 4.3

92

Jan 15 Wednesday

Morning elongation not observed.

Exps. of vibration.
Short magnet suspended

Scale inverted

7.8 to 8.2 8.0

Scale erect

6.2 to 10.2 8.2

Zero = 8.1

Short magnet scale erect

Vernier A $175^{\circ} 37'$ B $355^{\circ} 38'$ 11^h 30^m 6.2 to 10.2, mean 8.2

45 7.3 to 8.8 8.0

12 0

15 6.1 to 10.9 8.5

30 6.4 to 10.0 8.2

45 3.5 to 12.1 7.8

1 0 4.0 to 9.0 6.5

Exps. of Deflection.

Jan 16 Thursday

Morning elongation not observed

Vernier A 175 30.5 B 355 30.5
short magnet scale erect

11	45	steady at	8.0
12	0	7.7 to 8.1	7.9
12	15	steady at	7.8
12	30	" "	8.0
12	45	7.9 to 8.1	8.0
1	0	7.9 to 8.1	8.0
1	¹⁵ ~~30~~	8.1 to 9.8	9.0
1	30	8.2 to 9.0	8.6
1	45	8.3 to 9.1	8.7
2	0	4.0 to 10.8	7.4

Expts. of Deflection

" " Vibration

Church no 1 Vernier A 176 34
34
34

Jan 28 Tuesday

Short magnet suspended in
clock room.

Long magnet deflecting. $r = 1.00^{\text{ft}}$
Vernier A B

		352	43.5	172	44
Mag	N End	Time	Temp.	Scale	
w	w	1 ^h 40 ^m	70.0	4.5	
		2 0	70.7	16.3	
		set back to	"	1.5	
Vernier		353 ^A 29	173 ^B	29	
		$(\frac{45'}{14.8} = 3'.04)$			
		2 40	68.9	12.9	
		3 10	67.3	18.2	
		set back to		14.4	
Vernier		353 ^A 40	173 ^B	40	
		$(\frac{11'}{3.8} = 2'.89)$			
		3 40	66.3	15.5	

Jan 29 Wednesday

Experiments repeated.

Long mag. deflection $r = 1.00^{\text{ft}}$

A

B

$1^{\circ} 7'.5$

181 $7'.5$

Mag	N End	Time	Temp	Scale
w	w	$10^{\text{h}} 30^{\text{m}}$	64.5	2.0
		11 0	67.2	10.9
		set back to		1.5

$1^{\circ} 36'$

181 36

$$\left(\frac{28.5}{9.4} = 3.03\right)$$

11	30	67.1	8.6
12	0	67.0	12.5
12	30	68.0	13.4
1	0	69.5	15.5
1	30	70.8	16.1
2	0	70.7	18.5
2	30		19.2

set back to 70.7 9.2
 $\left(\frac{30}{10} = 3.0\right)$ $2^{\circ} 6'$ 182° 6'

2	35		8.5
2	45	71.2	7.6
3	0	72.3	7.0
3	15	73.0	6.8
3	30	74.0	6.6

Trough containing magnet filled with snow

3	45	34.0	6.8
4	0	38.6	8.2
4	15	54.0?	8.2
4	30	49.0	7.5

4	5	4	6	26	30	53	58
73	5	74	5	74	28	74	56
			74	8			
POLARITY OF MARKED END <i>N</i>							
CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
0	1 0	1 0	1 0	1 0	1 0	1 0	1 0
75	2 6	75	24	73	55	75	10
			27		74		13
			28		3		13

library.
pended.

erved.
ads 340°

9.7
8.9
8.0
7.1
6.6
5.8
3.8

96

Trough

75	4	75	26	74	74	56	74	0	75	12
Resulting Dip:										
Observer, GMS										

Feb 13 Thursday

Theodolite set up in room over library.
Leveled, and plummets suspended.

Feb 14 Friday

Morning elongation not observed.

Torsion circle adjusted; reads 340°

Expts of Vibration.

Short magnet; scale erect.

Vernier A

B

57° q'

237° q'

12	0	9.3 to 10.1	9.7
	15	8.8 . 9.0	8.9
	30	7.9 . 8.1	8.0
	45	7.0 . 7.2	7.1
1	0	6.5 . 6.7	6.6
	15	steady	5.8
	30	2.4 . 5.2	3.8

98

1	45	2.5 to 4.0	3.2
2	0	3.8 to 7.0	5.8 ⁴
2	15	4.2 to 6.2	5.2
	30	4.0 to 5.2	4.6
	45	4.0 to 4.8	4.4
		set on	8.0

Vernier A B
56 58 236 58

Exps. of Deflection.

Vernier A B
56 59 236 59
4 0 7.0 to 9.0 8.0

Pointed on Church no 1.

Vernier A B
56 44 236 44

set back to

56 59 236 59

4^h 30^m 6.2 to 12.0 9.1

Magnet left suspended.

Feb 15 Saturday

5 30	A M steady at	4.3
5 45	4.3 to 4.7	4.5
6 0	4.8 to 5.0	4.9
6 15	4.5 to 4.7	4.6
6 30	steady at	4.9
6 45	" "	4.9
7 0	" "	5.1
7 15	" "	5.2
7 30	5.0 to 5.2	5.1
7 45	" "	5.1
8 0	5.1 to 5.5	5.3
8 15	steady at	5.2
8 30	" "	5.1

scale inverted

8 35		
8 45	new	$\frac{6.7}{5.9}$
		6.6

scale erect

8 50	7.8 to 13.0	10.4 ?
		<u>8.5</u>

Zero

8 55 8.0 to 11.3 9.6

scale inverted

9 0 5.5 to 7.0 6.2

zero 7.9

11 0 steady at 12.0

11 5 scale erect 3.0 to 5.6 4.3

zero 8.2

Exps. of Deflection A

11 55 Church no 1 56 40

40

40

Vernier A B

56 40

236 40

Short magnet; scale erect.

12 0 6.0 to 10.0 8.0

15 7.0 to 10.0 8.5

30 7.4 to 9.0 8.2

bore containing dip needles removed; when only
~~45 11.0 to 12.5 8.2~~

lying in opposite directions
 two are in, it does not affect the magnet, but

the third produces a sensible disturbance.

The dip obsns. being in progress only two were in

1866phae.prj...363.

during the ~~obs.~~ obsno. today, and lying in
opposite directions; but the removal of needle B
probably gave rise to the disturbance yesterday at 1^h
~~12 45 7.4 to 9.0 8.2~~ 30^m

(Needle B lies in the opposite direction
from A & C.) This cause may have initiated
a good many of the obsno. in this room.

12	45	7.4 to 9.0	8.2
1	0	5.7 to 11.1	8.4
1	15	7.0 to 10.0	8.5
1	30	5.0 to 11.8	8.4
1	45	6.2 to 10.2	8.2
2	0	7.1 to 9.9	8.5
2	15	8.0 to 9.5	8.7
2	30	2.2 to 14.1	8.2
2	45	4.6 to 12.0	8.3

Object glass of long magnet removed
to be cleaned, and replaced.

Long magnet; scale inverted.

2	55	5.1 to 8.8	7.0
---	----	------------	-----

scale erect

3	0	6.0 to 2.0	1.0
zero			4.0

Exps. of Vibration

Vernier A B

56 14 236 13

Long magnet scale erect

3 30 . . 5.5 to 13.5 9.5

Left suspended. E

1868 Feb 17 Monday

Morning elongation not observed.

Vernier A Exps. of Vibration B

56 58 236 58

Short magnet scale erect.

12	15	7.4 to ^{9.2} ~~8.2~~	8.3 ~~8.1~~
	30	7.8 to 9.0	8.4
	45	7.8 to 8.2	8.0
1	0	7.7 to 8.1	7.9
	15	7.2 to 7.7	7.5
	30	7.5 to 7.9	7.7

Exps. of Deflection

scale inv. 6.0 to 8.0 7.0

" erect 7.8 to 9.2 8.5

7.8

Murch no 6/2 56 41

41

no 3. hel 58. 0

Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
79 41	1 0	45 1 0	1 0	72 56	1 0	73 13	1 0
		42	42	73 10	1 0		13

MAGNETIC DIP.

Station, Round Stone

Date, 1867 Sept 21

Dip Circle No.

Needle No. *A*

POLARITY OF MARKED END S							
CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
73 37	73 36	72 30	72 31	74 10	74 13	73 51	73 53
37	36	31	32	10	14	51	55
73 36	72 31	74 12	73 53				
+ 3	- 62	73 33		+ 39		+ 20	
POLARITY OF MARKED END N							
CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
74 6	74 8	76 15	76 15	73 18	73 18	73 51	73 50
6	9	15	15	18	18	50	50
74 7	76 15	73 18	73 50				
- 15	74 22	64					
Resulting Dip:				73 58			

Observer, GMS

cow chain and pole too near during this set.

MAGNETIC DIP.

Station, *N Pier*Date, *1867 Sept 21*Dip Circle No. *11*Needle No. *B*POLARITY OF MARKED END *N*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
73	15	15	73	55	59	73	15
15	15	54	59	15	15	57	0

73 15 73 57 73 15 74 58
 73 51

POLARITY OF MARKED END *S*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
75	0	3	74	15	15	73	51
0	3	15	15	51	53	73	44

75 2 74 15 73 52 73 45
 74 14

Resulting Dip:

*74 2*Observer, *SMS*

MAGNETIC DIP.

Station, *Round Stone*Date, *Sept 21*Dip Circle No. *11*Needle No. *B*POLARITY OF MARKED END *S*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
73	20	21	74	6	10	74	29
20	20	5	9	28	30	74	35

73 20 74 7 74 29 74 36
 74 8

POLARITY OF MARKED END *N*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
75	10	14	75	20	20	74	23
10	15	20	20	23	25	74	24

75 12 75 20 74 24 74 24
 74 50

Resulting Dip:

*74 29*Observer, *SMS*

MAGNETIC DIP.

Station, *N pier*Date, *1867 Sept 21*

Dip Circle No.

Needle No. *A*POLARITY OF MARKED END *N*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
73 24	25	73 54	56	76 45	49	75 27	30
24	26	54	56	45	49	27	30
73 25		73 55		76 47		75 28	
		74 54					

POLARITY OF MARKED END *S*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
74 18	20	74 13	15	73 42	45	72 49	46
18	20	14	15	41	45	46	46
74 19		74 14		73 43		72 47	
+ 33		73 46					
Resulting Dip:		74 20					

Observer, *GMS*

MAGNETIC DIP.

Station,

Room over library

Date,

1867 Oct 16

Dip Circle No.

11

Needle No.

B

position of
axis 2.

POLARITY OF MARKED END

N

CIRCLE EAST.

CIRCLE WEST.

Face East.

Face West.

Face East.

Face West.

S.

N.

S.

N.

S.

N.

S.

N.

71	5	3	77	18	20	71	52	48	78	19	13
	5	3		16	20		52	48		19	13

71

4

77

18

71

50

78

16

74

37

POLARITY OF MARKED END

S N

CIRCLE WEST.

CIRCLE EAST.

Face West.

Face East.

Face West.

Face East.

S.

N.

S.

N.

S.

N.

S.

N.

71	51	45	78	21	15	70	55	71	5	76	15	30
	52	45		21	15		55		5		15	30
71	48		78	18		71	0			76	22	

74

22

Resulting Dip:

74 30

Observer,

GMS

MAGNETIC DIP.

Station,

Date,

Dip Circle No.

Needle No.

POLARITY OF MARKED END

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
○	/	○	/	○	/	○	/

POLARITY OF MARKED END

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
○	/	○	/	○	/	○	/

Resulting Dip:

Observer,

MAGNETIC DIP.

Station,

Date,

Dip Circle No.

Needle No.

POLARITY OF MARKED END

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
○	/	○	/	○	/	○	/

POLARITY OF MARKED END

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
○	/	○	/	○	/	○	/

Resulting Dip:

Observer,

MAGNETIC DIP.

Station, *Room over library* Date, *1867 Oct 16*Dip Circle No. *11*Needle No. *A* position of axis *2.*

POLARITY OF MARKED END

N

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
73 47	46	74 31	35	74 32	26	75 45	39
47	46	31	35	32	26	45	39
73	46	74	33	74	29	75	42
		74	37				

POLARITY OF MARKED END

S

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
75 5	0	75 31	21	73 31	41	73 41	39
5	0	32	22	31	41	41	39
75	2	75	26	73	36	73	40
		74	26				

Resulting Dip:

*74 32*Observer, *G M S*

MAGNETIC DIP.

Station, *Small mag. obsy.* Date, *1867 Nov 15*Dip Circle No. *11*Needle No. *A* (*axis 10*)POLARITY OF MARKED END *S*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
73 58	56	73 39	42	74 40	45	72 58	73 5
58	56	39	42	40	45	58	5
73 57		73 40		74 42		73 2	
			73 50				

POLARITY OF MARKED END *N*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
76 25	29	73 37	37	75 57	57	73 10	14
25	29	37	37	57	56	10	14
76 27		73 37		75 57		73 12	
			74 48				

Resulting Dip:

*74 19*Observer, *GMS*

MAGNETIC DIP.

Station, *Small mag. obsy.* Date, *1867 Nov 15*Dip Circle No. *11*Needle No. *B (axis 1)*POLARITY OF MARKED END *S*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
74 4	6	71 25	30	74 23	21	72 26	29
4	6	25	30	23	21	26	29
74 5		71 28		74 22		72 28	
		73		6			

POLARITY OF MARKED END

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
76 47	45	74 32	25	75 9	21	73 5	6
47	45	32	25	9	21	5	6
76	46	74	28	75	15	73	5
		74		54			

Resulting Dip :

*74 0*Observer, *G M S*

MAGNETIC DIP.

Station, *Small mag. obsy*Date, *1867 Nov 16*Dip Circle No. *11* *Harv. Coll*Needle No. *A (axis 2)*POLARITY OF MARKED END *N*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
73 31	30	73 30	30	74 35	37	75 5	3
31	30	30	30	35	37	5	3
73 30		73 30		74 36		75 4	
		74 10					

POLARITY OF MARKED END *S*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
74 15	17	75 0	0	73 43	47	73 43	43
15	17	0	0	43	46	43	43
74 16		75 0		73 45		73 43	
		74 11					

Resulting Dip: *74 10*Observer, *GMS*

MAGNETIC DIP.

Station, *Small mag obsy* Date, *1867 Nov 16*Dip Circle No. *11*Needle No. *B axis 2,*

POLARITY OF MARKED END <i>N</i>							
CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
70 44	40	77 0	6	71 4	0	77 30	28
44	40	0	6	4	0	30	28
70 42		77 3		71 2		77 29	
		74		4			
POLARITY OF MARKED END <i>S</i>							
CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
77 15	17	72 0	5	75 49	48	70 30	30
17	17	0	5	48	46	30	30
77 16		72 2		75 48		70 30	
		73		54			
Resulting Dip:				73 59			

Observer, *S M S*

MAGNETIC DIP.

Station, *Obs. Harv. Coll.*Date, *1867 Dec 14*Dip Circle No. *11*Needle No. *C**Axis 0*POLARITY OF MARKED END *N*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
73 12	15	72 43	42	74 35	44	74 1	1
12	15	43	42	35	44	1	1
73 14		72 42		74 40		74 1	
		73 39					

POLARITY OF MARKED END *S*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
○	○	○	○	○	○	○	○
76 15	15	75 18	18	75 10	18	74 30	31
15	15	18	18	10	16	29	30
76 15		75 18		75 14		74 30	
		75 19					
Resulting Dip:		74 29					

Observer, *G M S*

MAGNETIC DIP.

Station, *Obs. Harv. Coll.*

Date, *1867 Dec 14*

Dip Circle No. *11*

Room over library

Needle No. *A*

Axis 0

POLARITY OF MARKED END **S**

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
73 35	35	73 40	41	75 36	36	76 48	45
35	35	39	40	37	36	47	44
73 35	73 40	75 36	76 46				
	74	54					

POLARITY OF MARKED END **N**

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
74 54	50	75 28	25	73 38	40	75 3	3
54	50	27	25	37	39	2	2
74 52	75 26	73 38	75 2				
	74	44					

Resulting Dip: *74 49*

Observer, *GMS*

MAGNETIC DIP.

Station, *H.C. Oby (Room over lib)* Date, *1867 Dec 16*Dip Circle No. *11*Needle No. *C Axis 1*POLARITY OF MARKED END *S*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
○ / ○	○ / ○	○ / ○	○ / ○	○ / ○	○ / ○	○ / ○	○ / ○
<i>75 3</i>	<i>1</i>	<i>74 14</i>	<i>21</i>	<i>75 28</i>	<i>24</i>	<i>75 30</i>	<i>33</i>
<i>3</i>	<i>1</i>	<i>14</i>	<i>21</i>	<i>28</i>	<i>24</i>	<i>30</i>	<i>33</i>
<i>75 2</i>		<i>74 18</i>		<i>75 26</i>		<i>75 32</i>	
		<i>75 4</i>					

POLARITY OF MARKED END *N*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
○ / ○	○ / ○	○ / ○	○ / ○	○ / ○	○ / ○	○ / ○	○ / ○
<i>74 25</i>	<i>25</i>	<i>74 41</i>	<i>46</i>	<i>73 23</i>	<i>22</i>	<i>72 28</i>	<i>33</i>
<i>25</i>	<i>25</i>	<i>41</i>	<i>46</i>	<i>22</i>	<i>22</i>	<i>28</i>	<i>33</i>
<i>74 25</i>		<i>74 44</i>		<i>73 22</i>		<i>72 30</i>	
		<i>73 45</i>					

Resulting Dip:

*74 24*Observer, *G M S*

MAGNETIC DIP.

Station, *H. C. Obsy. Room over lib.* Date, *1867 Dec 17*Dip Circle No. *11*Needle No. *C Axis 2*POLARITY OF MARKED END *N*

CIRCLE EAST.				CIRCLE WEST.			
Face East. <i>West</i>		Face West. <i>East</i>		Face East. <i>West</i>		Face West. <i>East</i>	
S.	N.	S.	N.	S.	N.	S.	N.
72 17	17	73 41	44	71 48	48	74 10	5
17	17	41	44	46	47	10	6
72 17		73 42		71 47		74 8	
		72		59			

POLARITY OF MARKED END *S*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
76 46	44	75 15	3	75 7	14	73 56	55
45	43	15	3	7	14	56	55
76 44		75 9		75 10		73 56	
		75		15			

Resulting Dip: *74 7*Observer, *GMS*

MAGNETIC DIP.

Station, *H.C. Obsy (Room over lib.)* Date, *1867 Dec 17*
Dip Circle No. *11* Needle No. *A 2*

POLARITY OF MARKED END *S*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
○ /	○ /	○ /	○ /	○ /	○ /	○ /	○ /
<i>73 23</i>	<i>17</i>	<i>73 50</i>	<i>52</i>	<i>74 51</i>	<i>51</i>	<i>74 52</i>	<i>55</i>
<i>22</i>	<i>17</i>	<i>50</i>	<i>52</i>	<i>51</i>	<i>51</i>	<i>52</i>	<i>55</i>
<i>73 20</i>		<i>73 51</i>		<i>74 51</i>		<i>74 54</i>	
		<i>74</i>	<i>14</i>				

POLARITY OF MARKED END *N*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
○ /	○ /	○ /	○ /	○ /	○ /	○ /	○ /
<i>76 16</i>	<i>16</i>	<i>75 44</i>	<i>32</i>	<i>73 25</i>	<i>25</i>	<i>73 58</i>	<i>74 2</i>
<i>16</i>	<i>16</i>	<i>44</i>	<i>32</i>	<i>25</i>	<i>25</i>	<i>58</i>	<i>2</i>
<i>76 16</i>		<i>75 38</i>		<i>73 25</i>		<i>74 0</i>	
		<i>74</i>	<i>50</i>				

Resulting Dip: *74 32*

Observer, *G M S*

MAGNETIC DIP.

Station, *H. G. Obsy (room over lib.)* Date, *1868 Jan 14*Dip Circle No. *11*Needle No. *A (Axis 0)*POLARITY OF MARKED END *N*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
74 40	38	74 5	5	75 49	54	75 16	15
39	38	5	5	49	54	16	15
74 39		74 5		75 52		75 15	
		74	58				

POLARITY OF MARKED END *S*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
74 40	40	75 45	45	71 40	40	76 0	76 0
40	40	44	44	39	39	75 58	75 58
74 40		75 44		71 40		75 59	
		74	31				

Resulting Dip:

*74 40*Observer, *G M S*

MAGNETIC DIP.

Station, *H. C. Obsy. Room over lib* Date, *1868 Jan 14*

Dip Circle No. *11*

Needle No. *6 (Axis 0)*

POLARITY OF MARKED END *S*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
0 /	0 /	0 /	0 /	0 /	0 /	0 /	0 /
<i>73 23</i>	<i>23</i>	<i>75 6</i>	<i>13</i>	<i>75 25</i>	<i>28</i>	<i>76 22</i>	<i>28</i>
<i>22</i>	<i>22</i>	<i>6</i>	<i>13</i>	<i>25</i>	<i>28</i>	<i>22</i>	<i>28</i>
<i>73 22</i>		<i>75 10</i>		<i>75 26</i>		<i>76 25</i>	
		<i>75</i>		<i>6</i>			

POLARITY OF MARKED END *N*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
0 /	0 /	0 /	0 /	0 /	0 /	0 /	0 /
<i>73 50</i>	<i>50</i>	<i>74 30</i>	<i>30</i>	<i>72 42</i>	<i>42</i>	<i>74 17</i>	<i>28</i>
<i>50</i>	<i>50</i>	<i>30</i>	<i>30</i>	<i>41</i>	<i>41</i>	<i>17</i>	<i>28</i>
<i>73 50</i>		<i>74 30</i>		<i>72 42</i>		<i>74 22</i>	
		<i>73</i>		<i>51</i>			
Resulting Dip:				<i>74 28</i>			

Observer, *GMS*

MAGNETIC DIP.

Station, *H.C. Oby (Room over lib.)* Date, *1868 Jan 15*

Dip Circle No. *11*

Needle No. *A (Acis 1.)*

POLARITY OF MARKED END *S*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
73 33	36	71 18	7	74 50	55	73 5	15
32	36	18	7	50	55	5	15
73 34		71 4		74 52		73 10	
		73 10					

POLARITY OF MARKED END *N*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
76 23	22	74 4	9	72 25	32	72 45	45
23	22	4	9	25	32	45	45
76 22		74 6		74 28		72 45	
		74 25					

Resulting Dip: *73 48*

Observer, *G M S*

MAGNETIC DIP.

Station, ^{Obsy} N. C. (Room over lib.) Date, 1868 Jan 15
 Dip Circle No. 11 Needle No. 6 (Axis 1)

POLARITY OF MARKED END

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
0	/	0	/	0	/	0	/
72 37	40	72 58	73 0	72 15	20	73 45	50
37	40	58	0	15	20	45	50
72 38		72 59		72 18		73 48	
		72	56				

POLARITY OF MARKED END

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
0	/	0	/	0	/	0	/
75 35	35	75 39	41	73 33	40	75 40	45
35	35	39	41	33	39	40	45
75 35		75 40		73 36		75 42	
		75	8				
Resulting Dip:		73 2					

Observer, G M S

MAGNETIC DIP.

Station, *H. L. Oboe. (Room over lib.)* Date, *1868 Jan 16*Dip Circle No. *11*Needle No. *C (axis 2)*POLARITY OF MARKED END *S*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
75 0	75 0	73 7	14	76 10	5	76 8	15
0	0	7	14	10	5	8	15
75	0	73	10	76	8	76	12
		75	8				

POLARITY OF MARKED END *N*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
75 41	41	74 34	37	73 15	18	71 56	72 3
41	41	34	37	15	18	56	2
75	41	74	36	73	16	71	59
		73	53				

Resulting Dip:

*74 30*Observer, *S M S*

MAGNETIC DIP.

Station, *H.C. Oby. (Room over lib.)* Date, *1868 Jan 16*Dip Circle No. *11*Needle No. *A (axis 2)*POLARITY OF MARKED END *N*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
76 18	18	73 33	36	74 20	20	76 30	35
18	18	33	36	20	20	30	35
76	18	73	34	74	20	76	32
		75		11			

POLARITY OF MARKED END *S*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
74 15	14	75 0	55	71 46	51	73 1	72 59
15	14	0	55	46	51	1	59
74	14	74	58	71	48	73	0
		73		30			

Resulting Dip: *74 20*Observer, *G M S*

MAGNETIC DIP.

Station, *H. C. Oley Room over Lib* Date, *1868 Feb 15*
 Dip Circle No. *11* Needle No. *C Axis 1*

POLARITY OF MARKED END <i>S.</i>					
CIRCLE EAST.			CIRCLE WEST.		
Face East.		Face West.	Face East.		Face West.
S.	N.	S. N.	S.	N.	S. N.
75 8	11 73 23	30	75 47	47 74 3	10
3	23 30	30	47	47	10
75 10	73 27		75	47	6
	74 38				

POLARITY OF MARKED END <i>N</i>					
CIRCLE WEST.			CIRCLE E.		
Face West.		Face East.	Face West.		Face East.
S.	N.	S. N.	S.	N.	S. N.
74 27	32 75 8	15	73 19	19 71 30	44
27	32 8	15	19	19 30	44
74 30	75 12		73 19	71 37	
	73 40				
Resulting Dip: <i>74 9</i>					
Observer, <i>GMS</i>					

MAGNETIC DIP.

Station, *N. E. City* *Down over hill* Date, *1868 Feb 15*
 Dip Circle No. *11* Needle No. *13* *Axis 1.*

POLARITY OF MARKED END *N*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
0	1	0	1	0	1	0	1
73	30	30	75	46	51	47	35
30	30	46	51	35	35	77	6
				6	15		
				35			
73	30	75	48	74	35	77	10
				75	16		

POLARITY OF MARKED END *S*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
0	1	0	1	0	1	0	1
72	15	17	75	49	54	72	4
15	17	49	54	4	4	73	8
				4	8		
72	16	75	52	72	4	73	8
				73	20		

Resulting Dip:

74 18

Observer, *G M S*

MAGNETIC DIP.

Station, *H. C. Bdy. Room over lib.* Date, *1868 Feb 17*
 Dip Circle No. *11* Needle No. *13 (Axis 2)*

POLARITY OF MARKED END <i>S</i>			
CIRCLE EAST.		CIRCLE WEST.	
Face East.		Face West.	
S.	N.	S.	N.
76 42 41	40 70 39	77 37 37	40 39
76	40	70	38
		74	
		77	4
		72	39
		72	37
		37	41
		37	41

POLARITY OF MARKED END <i>N</i>			
CIRCLE WEST.		CIRCLE EAST.	
Face West.		Face East.	
S.	N.	S.	N.
78 26 26	30 71 30	77 30 30	37 37
78	28	71	8
		74	
		77	34
		70	39
		70	38
		38	40
		38	40

Resulting Dip: *74 21*

Observer, *SMS*

MAGNETIC DIP.

Station, *H. L. Osgood Room over lib.* Date, *1868 Feb 17*
 Dip Circle No. *11* Needle No. *6 (No. 2)*

POLARITY OF MARKED END *N*

CIRCLE EAST.				CIRCLE WEST.			
Face East.		Face West.		Face East.		Face West.	
S.	N.	S.	N.	S.	N.	S.	N.
73 30	36 36	71 49	49 49	74 15	19 19	73 45	43 43
73	33	71	49	74	17	73	44
				73	21		

POLARITY OF MARKED END *S*

CIRCLE WEST.				CIRCLE EAST.			
Face West.		Face East.		Face West.		Face East.	
S.	N.	S.	N.	S.	N.	S.	N.
79 41	45 45	75 42	42 42	72 56	73 10	73 13	13 13
77	43	75	42	73	3	73	13
				74		55	
Resulting Dip: <i>74</i>				<i>8</i>			

Observer, *G. M. S.*

set on 8.0 of scale (each.)

HORIZONTAL INTENSITY.

Deflections with Theodolite Magnetometer.

Station, *W. L. O'By (Room over Lib.)* Date, *1868 Feb 14*
Long Mag. deflecting at right angles to Mag. *Short* suspended.

Distance $r = 1' 44 2$ ft. $\log =$

Magnet.	North end.	CIRCLE READINGS.				CIRCLE READINGS.			
		No.	A	B	Mean.	No.	A	B	Mean.
E.	1		° 59	' 6	' 6		°	'	'
W.									
E.									
E.									

Undelected 56 58 236 58
Set on 8.0 of scale (evid)

HORIZONTAL INTENSITY.

Deflections with Theodolite Magnetometer.

Station, H.C. Bay (from 0-1-1 (H.)) Date, 1868 Feb 14

Mag. deflecting at right angles to Mag. short suspended.

Distance $r = 1.000$ ft. log. =

Magnet.	North end	CIRCLE READINGS.				CIRCLE READINGS.			
		No.	A	B	Mean.	No.	A	B	Mean.
East.	E.	1	0 63	13	1		0 1	1	1
	W.								
	E.	3							
	W.					4	50	48	48
	E.	5	63	12	12				
	W.								
Mean									
West.	W.	24	63	7	7				
	E.								
	W.					34	50	42	42
	E.	64		8	8				
	W.								
	W.								
Mean									

Mag. E., $2u =$		Logarithms.
" W., " =		
Mean		
$u =$		
Beginning, Time $2^h 5^m$ Temp. 26.5	$\frac{1}{2}$	
Ending, " $3^h 10^m$ " 37.8	r^2	
	Sin. u	
	m	
	X	
		9.69897

Observer, GMS.

9.69897

Sept 16	6	40	104	47	+16.5	115	3.5	125	39.4	10	35.9
17	7	0		49	+12.0		1.0				38.4
	3	6		49	+14.8		3.8				35.6
Nov 14	76	0	173	21	~~6.0~~	173	~~1.5~~	183	49.4	10	32.4
	11	5			~~31.2~~	172	~~49.8~~				59.6
	12	0	172	53	-6.0	172	47.0			11	2.4
15	1	0		59	0.6		59.0			10	50.4
16	7	45			0.0		59.0			10	50.4
	1	0			+7.8	173	6.8			10	42.6

Extreme Declination.

Date	Time	Circle	Correction	Zero			
Aug 16	7 0	196	12.5	+1.0	196	13.5	186
	3 0	196	2.0	+7.8	9.8	~~182~~	17.3
							10
							3.8
Oct 14	7 5	20	45	+4.9	39.9	30	30.8
	10 30		45	-1.9	43.1		9
	3.0		38	+0.0	38.0		
							4.9
							4.7
							52.8
15	6 45			+2.4	40.4		50.4
	3 45		40	+3.0	43.0		47.8
16	6 30		40	+4.4	44.4		46.4
	3 45		40	+1.5	41.5		49.3
Dec 14	7 0	350	44	+11.5	350	55.5	1. 7.4
	1 30		38	+4.2	42.2		10 11.9
	5 45		44	-3.0	41.0		25.2
	2 45		34	-2.2	42.2		26.4

Arimuths.

Church no 1,	9	40.8	~~0~~ E
2	8	43.3	
3	8	21.1	
4	8	15.3	

Poplar 116 38.4 E

Extreme declinations.

~~Aug 16~~ Room over lib.

Circle		scale - zero							
Aug 16 M	176	12.5	-0.5	I	+1.2	176	13.7	186	17.5
A	176	2	+3.2	E	+7.8	176	9.8		10°
Sept 16 M	114	47	+6.5	E	+15.9	115	2.9	125	40.4
17 M	114	49	+4.5	E	+11.0	115	0.0		10
A	114	49	+5.8	E	+14.2	115	3.2		37.5
Oct 14 M	20	45	+2.5	E	+6.2	20	51.2	11	40.4
A		38	0.0	E	0.0	20	38		38.2
15 M		38	+1.0		+2.4	20	40.4		42.2
A		40	0.0			20	40		9
16 M		40	+2.8		+6.2	20	46.2		28.6
A		40							29.0
									32.8

Aug 16 176

49
73

176 12.5 + 0.2 176 13.3 1

176 2 + 7.8 176 9.8

351 26.7

7.7

350 38

10 28

64

1926
19522220
976

19650

350 38

Nov 14

106 10 - 6.0	106 4.0	10 34.4
" ~~10~~ ~~2~~ - ~~18.4~~ ^{31.2}	105 ~~51.6~~ ^{38.8}	10 59.6
105 42 + 1.2	105 43.2	10 55.2

Nov 15

105 49 - 1.5	105 47.5	10 50.9
105 48 - 2.4	105 45.6	10 52.8

Nov 16

105 48 + 2.4	105 50.4
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Sept 17

105 48 + 11.0	105 59.0	10 39.4
" + 15.3	106 3.3	

16

105 48 + 15.6	106 3.6	10 35.0
105 48 + 0.0	105 48.0	

Long Short

1 2.4 3.0

2 4.9

3 7.3 2c.

4 9.7

5 12.2

6 14.6

7 17.0

8 19.4

9 21.9

10 24.3

28	Jan	14° 31' 25' 28'
29	Feb	25 21 16
34	Mar	32 34 35
39	Apr	40 35 43
39	May	36 36 46
14 32		
2 24		
12 8	June 8	3° 58' 67' 61'

278	53	4	2
243	18	7	12
14	25	11	14
7	23		
17	2		

12 8

POLARITY OF MARKED END S

73 21

73 33

71 49

74 71

72 10