

## ON THE NORMAL MAGNETIC ELEMENTS AT THE MAURITIUS MAGNETIC OBSERVATORY.

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During a visit on the *Carnegie* in August, 1911, I had occasion to look into the remarkably disturbed character of the site of the Royal Alfred Observatory at Pamplemousses, Mauritius. Mr. Claxton, while director, had already called attention to the disturbances disclosed by a painstaking and extensive series of declination observations made over an interval of several months at 893 stations, within the area surrounding the old and new sites of the absolute declination observations.<sup>1</sup> The declination at these two sites which were located approximately in a true north-south direction and only 90 feet apart, varied from  $9^{\circ} 15'$ , at the old site, to  $10^{\circ} 35'$ , at the new one; from comparisons made twice a day for one year, the adopted difference between the two sites was found to be,  $1^{\circ} 30'$ . The declinations for standardizing the magnetograph had been made with a Kew magnetometer since 1875 in the old magnetic pavilion where at present the horizontal intensities and dips are still being observed. In 1903 "it was decided to utilize the 12-inch theodolite for more refined observations of declination," the magnet used being that of the Kew declinometer; hence arose the origin of the new pavilion in which declinations are observed daily, in the morning and in the afternoon, near the times of elongation. Declinations with the Kew magnetometer in the old pavilion were discontinued in 1906.

The shore observations of the *Carnegie* required simultaneous comparisons between the instruments for ocean work, the *Carnegie* standard land instruments (C. I. W. magnetometer and an Earth-inductor), and the Observatory instruments (Kew magnetometer and Dover dip circle). It was, accordingly, necessary to select two additional stations besides utilizing the old pavilion; the arrangements in the new pavilion were such that it was not possible to make the declination comparisons there, but instead, they had to be made at the old site again and with the Kew magnetometer. A general examination of the observatory ground quickly showed that it would not be readily possible, owing to the distribution of the exposed magnetic rocks, to select any two points having precisely the same magnetic elements; the two auxiliary stations, used

<sup>1</sup> CLAXTON, T. F. Preliminary report on a survey of magnetic declination near the Royal Alfred Observatory, Mauritius Proc. Roy. Soc. A., vol. 76, 1905, pp. 507-511.

chiefly for the ship instrument comparisons, were accordingly placed in line with the central pier of the old pavilion and the former azimuth mark (azimuth,  $1.3^\circ$  W. of S.), which is about 150 yards distant from the pier, called Station *A*. Station *B* was 6.41 meters south and Station *C*, 48.78 m. south of *A*; Station *D*, used exclusively for dips is the west pier in the old pavilion, this pier being regularly used for the Observatory dip observations. As above stated, the new site for Observatory declinations which we shall call *N*, is 90 feet or 27.4 m. south magnetic of *A*, hence a few feet east of the true north and south line, passing through *A*, *B*, and *C*. The attempt was made to have the magnets of the various instruments used all at the same height above the ground, as nearly as possible, viz., 1.32<sup>m</sup> about at *B* and *C*, and 1.50<sup>m</sup> about at *A* and *D*. The table below gives the approximate magnetic elements and station differences at the above points; west declination is counted as negative, as also south inclination.

Date, 1911	Station	Decl'n (West)	Incl'n (South)	Hor. Int. (C. G. S.)	Observers
Aug. 8, 9, 12	<i>A</i>	-9 24.0	-53 28.9	23329	R. A. Observatory. "Carnegie."
	<i>A</i>	23.4	24.3	28	
Aug. 8-14	<i>A-B</i>	-0 42.9	.....	+ .00175	"Carnegie" and Obs'y. "Carnegie."
	<i>A-C</i>	+0 29.1	.....	- .00223	
	<i>B-C</i>	+1 12.0	- 1 20.0	- .00398	
	<i>D-B</i>	.....	- 1 02.6	.....	
	<i>D-C</i>	.....	- 0 17.4	.....	

In addition, we have from Mr. Claxton's declination observations, as above cited,  $A - N = +1^\circ 30'$ . I have reversed the sign so as to apply the quantity *algebraically* instead of numerically. Hence, there results  $N - B = -2^\circ 03'$ , and  $N - C = -0^\circ 51'$ .

However, Claxton's detailed survey showed even greater differences for points near each other than those above. He detected three well-marked foci,<sup>2</sup> as per table on opposite page.

Claxton also gives the values of horizontal intensity observed at seven stations in this locality, the mean result being 0.2207; the minimum is .1969, the maximum .2439, and the mean of these two values .2204. The mean dip for nine stations is  $-53^\circ 27'$ ; the minimum is  $50^\circ 21'$ , the maximum  $58^\circ 34'$ , and the mean of

<sup>2</sup> Cf. Ref. 1, p. 509.

the two, 54° 28'. It will be noted that, except for the dip, the mean of highest and lowest observed values agrees closely with the mean for all stations.

Mr. A. Walter, the present director, in 1899 observed the magnetic declination at 24 stations in different parts of the volcanic island of Mauritius, the values ranging from 7° 20' W to 11° 35' W and the mean of all being 9° 25' W. The horizontal intensities were obtained at 12 stations, the results varying from .2163 to .2455, and the mean of all being .2310; the dips at six stations

Focus	Phase	Rectang'r Co-ord. from old pillar (A)		Declination reduced to constant mag'rph reading (West)	Distance between maximum and minimum (feet)	Mean gradient, maximum to minimum 1° in
		South (feet)	East (feet)			
1	Maximum...	+16.3	+24.7	0 /	11.4	1.9 feet
	Minimum...	+18.3	+13.5	-10 45		
	Mean.....			- 4 56		
				- 7 50		
2	Maximum...	+51.4	-13.7	-13 45	8.5	1.1 feet
	Minimum...	+53.4	-22.0	- 6 20		
	Mean.....			-10 02		
3	Maximum...	-34.3	+95.6	-12 50	23.5	4.6 feet
	Minimum...	+38.0	+72.6	7 45		
	Mean.....			-10 18		
Mean of all.....				- 9 23.5	} for about Jan. 1, 1905.	
Mean of lowest minimum (4°56') and highest maximum (13°45')				- 9 20.5		

ranged from 54° 24' to 55° 29', and the mean of all was 55° 04' (South).

Comparing Claxton's results on the Observatory site with those made at various points on the island by Walter, the extremely interesting fact is revealed that, within the region of the old and new declination piers, but 90 feet distant from one another, it is possible not only to get all the values of the magnetic elements obtained over the Island, but even to transcend them.

The observations made aboard the *Carnegie* in the vicinity of Mauritius will serve to throw further light upon what the values

of the magnetic declination might be at the Royal Alfred Observatory did the local disturbances not exist. Summarizing the available data and referring them all to 1911.6 with the aid of the continuous observatory observations, the table below is derived:

No.	Date	Latitude South	Longitude E. of Gr	Magnetic Elements			Remarks
				Decl'n	Incl'n	Hor. Int.	
1	1905.0	20 05.6	57 33.2	-9 24	-53 27	.2207	Mean results of Claxton survey. Reduction, <sup>3</sup> to 1911.6. Reduced to 1911.6
	1911.6			- 11	+ 26	-.0034	
2	1899.5	20 17	57 34	-9 25	-55 04	.2310	Mean results of Walter survey. Reduction, <sup>3</sup> to 1911.6. Reduced to 1911.6
	1911.6			+ 9	+ 48	-.0059	
3	1911.6	20 05.6	57 33.2	-9 24.0	-53 28.9	.23329	R. A. Obs'y inst'ts. C. I. W. instru'ts. } "Carnegie" sea observations.
	4	1911.6	20 05.6	57 33.2	-9 23.4	53 24.3	
5	1911.6	20 35	57 54	-9.1	.....	.....	}
6	1911.6	20 04	57 29	-9.5	54.0	.228	

Nos. 3 and 4 should be regarded as preliminary values.

No. 6 in above table is the mean of several observations made in the harbor about four to six miles almost due west of the Observatory; the declination values vary from about 9°.2 West to 9°.8 West, thus indicating the presence of local disturbances. This site has been used at times for getting compass deviations from ship swings, *e. g.*, by H. M. S. *Sealark*, in 1905.

It would appear from the above exhibit that the declination as observed on the old observatory pier (A) comes very close to what the undisturbed value would be. It is therefore fortunate that the results obtained at the new site (N) which, as found by Claxton, are on the average about 1° 30' greater numerically, have all been referred to the old site before publication.

As far as the present data would enable one to judge, the Observatory published dips may be about one-half degree lower and the horizontal intensities about 0.005 C. G. S. higher than the undisturbed values would be; however, further data will be required.

*On board the Carnegie,*  
*Colombo, Sept. 8, 1911.*

<sup>3</sup> In getting these, the values obtained with the Observatory instruments alone in 1911.6 were used, *viz.*: No. 3.