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THE CAMBRIDGE EAST GREENLAND EXPEDITION 1926
LEADER: MR. J. M. WORDIE

PENDULUM OBSERVATIONS AT SABINE ISLAND

BY

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WITH 4 FIGURES IN THE TEXT

KØBENHAVN
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BIANCO LUNOS BOGTRYKKERI A/S
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The chief work of the Cambridge Expedition to East Greenland in 1926 was to explore, and as far as possible to complete the survey of certain blank sections of the coast-line between the latitudes of 72° and 75° N. This was successfully accomplished, and the general results have been outlined in the Geographical Journal for September 1927.

It was proposed to reach the Greenland coast in the neighbourhood of Sabine Island (Germania Harbour, 74°32′ N.) Our immediate object in visiting the islands was to take advantage of the excellent opportunity which it afforded of making pendulum observations under modern conditions on the spot where General Sabine had carried out his experiments during Clavering's voyage in 1823. The writer had been asked to join the Expedition for survey work, but as he had had experience of pendulum work under Colonel Sir Gerald Lenox-Conyngham, F. R. S., there was every reason for including a determination of gravity in the programme of work. The writer here wishes to express his grateful acknowledgement for the advice and help of Sir Gerald Lenox-Conyngham, both before the Expedition and after its return.

The instrument used was a Stückrath apparatus, which had been in use at the School of Geodesy in Cambridge during the previous three years. The career of these pendulums is not without interest; they were acquired for the "Discovery" Expedition to the Antarctic in 1901, and thus came to be swung at the most southerly station where gravity has been determined. After the return of the "Discovery" the apparatus was deposited in the Science Museum, South Kensington. In 1911 it was lent by the Science Museum to the Survey of Egypt, and determinations of gravity were made at eight stations in Egypt and the Sudan. At the close of these operations the apparatus was returned to the Museum, and in 1922 was lent to the School of Geodesy at Cambridge. In Cambridge it was used to determine the connexion Kew-Cambridge, and a re-determination of the physical constants of the pendulums was also carried out. Through the good offices of Sir Henry Lyons, Director of the Science Museum, the writer was granted permission to take this widely-travelled set of pendulums to the Arctic.

Mr. Wordie's party sailed from Aberdeen on 30th June 1926, and, favoured by exceptional ice conditions, reached Sabine Island on the evening of 12th July. A certain amount of ice was still present in Griper Roads off the shore where Sabine erected his apparatus on his visit in 1823, and where the German expedition of 1870 had also had its winter headquarters. The ice prevented the ship from approaching nearer than about one mile to the east of Germania Harbour.

Sabine left no permanent record on the site of his observing station; but its position can be inferred as having been near the shore a few hundred yards west of the Harbour. In his account ("Experiments to determine the Figure of the Earth", 1825, p. 161) he describes the location as "a perfectly dry spot, which had been the site of an Esquimaux village . . . ." This definitely places his station near or among the remains of three Eskimo winter houses west of the harbour. Not far off, the walls of certain small buildings used as observatories by the Germans are still standing, though roofless. For these reasons the western point of the bay was named Observatory Peninsula by the latter expedition.

Our reconnaissance soon showed that the labour of carrying the heavy apparatus for a distance of over three miles round the head of Germania Harbour would be very great. There was no certainty of being able to bring the ship any nearer, and it was therefore resolved to establish our own station on the east side in a definite and conspicuous position known as Cairn Point. This meant a portage for the apparatus of about a mile along the shore, and the observing tents were erected next day close to the actual point (fig. 1). The site is not far from a well-built wooden hut, still in good condition, put up by a party of four Danes, who wintered there about 1919. The hut, however, was useless as an observatory as it had a wooden floor.

The observations were carried out in two Whymper tents placed facing each other, making an enclosure about 14 ft. by 6 ft. 6 ins., the tents (of 'A' pattern) being 6 ft. 6 ins. high at the peak (fig. 1). This arrangement had been decided on in England, with the proviso that wooden screens might be erected if the sunshine in the tents made for undue inconstancy of temperature. Actually we were greatly favoured by the local weather conditions. During the course of the observations persistent sea-fog kept the range of temperature low, and this was responsible to no small extent for the success of the work.

The Observations.

The tents were erected on the afternoon of July 13th. A pillar was built at one end; two large blocks of stone found on the shore were carefully bedded in the dry stony ground on cement, and on these a marble slab was placed with a good thickness (about 2 cm) of plaster-of-Paris between



Fig. 1. Observing tents and wireless aerial at Cairn Point, Sabine Island. Germania Bay in the background with clouds down to 600 ft.

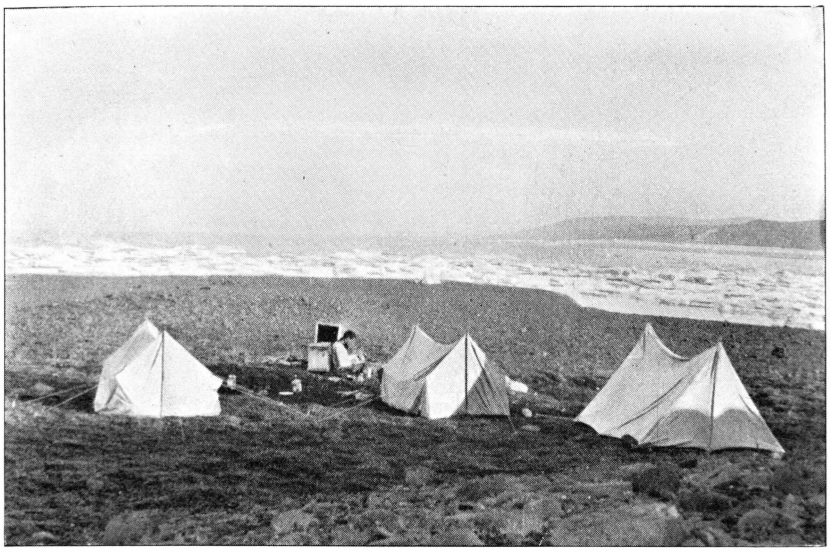

Fig. 2. View of living tents on slopes of Germania Berg. Cairn Point with observing tents in middle distance; Wollaston Foreland on right.

the slab and the blocks. The height was about six inches above ground level. Subsequent sway observations proved that the firmness of the pillar was satisfactory (fig. 3).

At the opposite end of the tent the flash-box was installed together with the chronometer (fig. 4). The latter, No. 12672 by Mercer, was lent by the School of Geodesy at Cambridge. In order to make the condition of the chronometer as free from variation as possible, it was arranged to work the flash-box through a relay; this gave considerable trouble at first, but after two days all was in readiness for the first set of swings. The provision and installation of the wireless set for rating the chronometer was in charge of Dr. M. A. Barnett; his assistance in this and in many other ways was invaluable.

Of the four pendulums, one was to be swung each day, and in order to strengthen the observations without extending the period spent on the island, it was decided to observe through sixteen hours each day from 8 a.m. to 12 midnight. It was considered that, by observing two swings of about seventy minutes' duration in each of the four-hour periods 8^h—12^h, 12^h—16^h, 16^h—20^h and 20^h—24^h, and taking the Bordeaux time signals at 8^h and 20^h together with the Nauen signals at noon and midnight, it would be possible to select independent sets of four swings to which a twelve-hourly clock rate could be applied. The full programme of eight swings was only carried through on one day, however; a rest for the observer in mid-afternoon proved desirable, and so the two sets of observations calculated from Bordeaux and Nauen clock-rates are not quite independent. During observations, sets of twenty coincidences were observed throughout, instead of the usual ten or twelve — again with the object of having as strong a series as possible.

On the fourth day (19th) the programme was on the point of completion, when at midnight the Nauen signals failed entirely, necessitating another day's work on the 20th. The 21st was used for sway observations (similar observations had been taken on the 15th before swinging the pendulums, and also during the series on the afternoon of July 17th). It has already been mentioned that the weather conditions, namely persistent sea-fog, were sigularly favourable; short bursts of sunshine on the 16th and on the evening of the 20th showed that under direct sun the temperature of the pendulums in the tent would have been considerably disturbed. As it was, the air temperature, through nearly four days, only ranged between 32° Fahr. and 39°, the temperature inside the tent varying from 34°.6, to 43°.8 during a burst of afternoon sunshine. The thermometer in the dummy pendulum varied from 2°.02 C. to 7°.40; the greatest range in any one day being on the first day of observation, namely from 3°.28 C. to 7°.40 C. The variations of

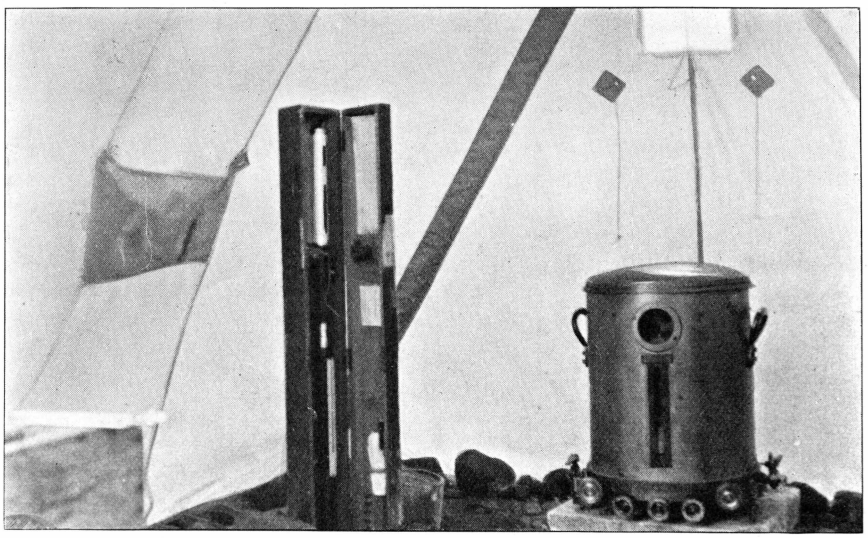

Fig. 3. Pendulum apparatus erected on pillar. Barometer, and wet and dry kulb thermometers on left.

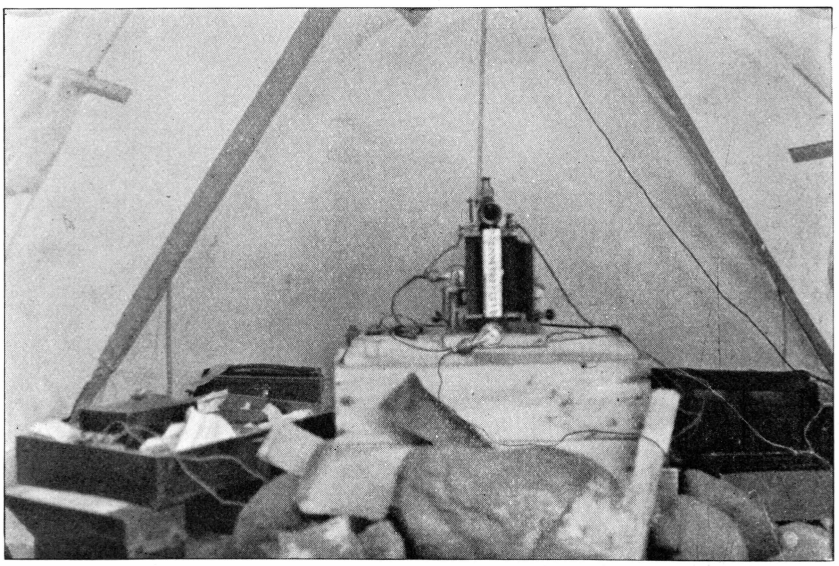

Fig. 4. View of flash-box in centre, wireless set on right, and chronometer and relay in padded box on left.

temperature during the actual swings appear to be no greater than at many Indian observing stations.

The sway correction was determined on the 14th—15th, on the 17th and on the 21st—22nd of July. The results of the determinations, from nine observations in all, on these three occasions were 38, 36, and 37×10^{-7} seconds. This accordance gives confidence in the stability of the pillar.

It was with feelings of some satisfaction that the sway observations were finished on the 22nd. The remainder of the day, after the mist had cleared, was devoted to longitude observations and to a short survey of the neighbourhood. The longitude series, however, was never completed owing to the sudden onset of a violent storm lasting over the greater part of the next four days.

The writer here wishes to acknowledge the help of Lieut. P. F. White, R. E., in the performance of many necessary but scarcely exciting duties, both during the progress of the observations, and as his companion in camp.

Observations in England.

Before departure, and on return, a series of swings was carried out by the writer in the Pendulum House at Cambridge. Certain features of the results after the return from Greenland prompted the writer to make yet another redetermination of the periods of the pendulums in March—April 1927. The figures of the Sabine Island results and of the several series taken at Cambridge are appended below.

Discussion of the Results.

The four values of "g" at Sabine Island obtained from the separate pendulums are given; — the results from pendulums 38 and 39 may be considered to be stronger than those from 36 and 37; but for other reasons they have all been treated as of equal weight. The mean of the four results gives $g = 982.8885$ cm/sec^2. The correction for height of station above sea-level which was 25 feet, being applied ($= .0024$) gives **$g = 982.891$ at sea-level at Sabine Island, in 74°32′15″ N.**

This value depends on the value of g at Cambridge, which in turn is based on the value at Potsdam. The theoretical value at Sabine Island may be given from Helmert's formula:—

$$\gamma_0 = 978.030\ (1 + 0.005302\ \sin^2 \varphi - 0.000007\ \sin^2 2\varphi).$$

For the latitude 74°32′15″ this gives $\gamma_0 = 982.849$ cm/sec^2. There is therefore a positive anomaly, $+ 0.042$ cm/sec^2, at Sabine Island, which is to be expected in such a situation.

Sabine's result of 1823 may be mentioned here. The difference between "Inner Pendulum Island" — Sabine Island as it is now called — and Mr. Browne's house in London is given as + 1.610 cm/sec^2,[1]) and another series of observations by Sabine gives the difference between g at Mr. Browne's house and at Greenwich at — 0.011 cm/sec^2.[2])

"g" at Greenwich, based on Potsdam = 981.186, so that Sabine's work would give:—

g at Sabine Island = 981.186 — 0.011 + 1.610 = 982.785 cm/sec^2.

The results of the observations of the periods of swing of the Stückrath pendulums are given below.

Periods are in sidereal seconds, reduced to 0° C., 1000 mb. and infinitely small arc.

I. Taken at Cambridge in 1925 for comparison with Kew.
II. At Cambridge before expedition, June 1926.
III. At Cambridge after return, October 1926.
IV. Further series at Cambridge, March—April 1927.

Pendulum	36	37	38	39	Mean
I	—	7920	8197	8430	—
II	0.5087847	7925	8208	8439	0.5088105
III	0.5087854	7979	8228	8470	0.5088133
IV	0.5087879	7982	8230	—	—

IV has been added as a matter of interest; the apparent increase in the period of 36 from October 1926—March 1927 is noteworthy, as being of the same order as that which appears to have occurred between June 1926—October 1926 with the other three pendulums. Attention may also be directed to the slight changes in the same direction suggested by the figures for June 1925 and June 1926. The detailed figures for Sabine Island are appended, together with a summary of the Cambridge observations before and after the expedition on which the determination depends. The Sabine Island figures have been given at some length in order to bring out the method of making a strong series of observations in the shortest possible time; also the temperature and pressure conditions are more likely to be of interest to future workers. The considerable variation of temperature to which the pendulums were exposed was the main factor which made it desirable, in the writer's

[1]) Experiments to determine the Figure of the Earth, 1825.
[2]) Phil. Trans. Roy. Soc., 1829.

opinion, to have as great a number of observations as was practicable in the limited time which could be afforded by the Expedition as a whole.

It has already been pointed out that there has apparently been an increase in the period of all four pendulums between June and October 1926. This change may possibly be ascribed to the unavoidable disturbance of the pendulums by the rolling of the vessel at sea, or it may be that some unexplained molecular change is in progress which has the effect of increasing the periods of the pendulums. There are some indications that this began at an earlier date (1925). With the object of seeing whether these were really evidence of a progressive change some experiments were carried out at Cambridge in March—April 1927. They show a slight further increase — scarcely more than the probable error of the experiment — in two pendulums out of the three for which results are available; the determination of the period of pendulum 39 (at Cambridge) was unfortunately spoilt by a failure in reception of time signals and it was not possible to prolong the observations.

As regards the general accuracy of the determination the greatest source of uncertainty lies in the change that seems to have taken place in the period of the pendulums. If we assume that the whole of this change took place suddenly, — which is unlikely in view of the great care with which the pendulums were transported — then the uncertainty may amount to 0.005 cm/sec^2. The other observations in 1925 and 1927, however, encourage the belief that the change was a progressive one, and in this case 0.003 cm/sec^2 would be a fair estimate. Reviewing the observations as a whole it would seem reasonable to assume that the above value for "g" at Sabine Island is within .005 c.g.s. units of the real value, and that it indicates a positive gravitational anomaly of between .037 and .047 cm/sec^2 at that point of the coast.

With the improved invar pendulums and apparatus now available it seems unlikely that the Stückrath apparatus and its brass pendulums will be used in future, so that the question of possible changes in the latter is now comparatively unimportant. It is the writer's hope, however, that the work at Sabine Island may be of some utility as showing how a gravity determination may be carried out with a minimum of time, trouble and expense; and, although the probable error of the result is somewhat greater than if the periods of the pendulums had not altered, yet it may stand as a positive value of the Earth's attraction in this northerly region.

Summary of Pendulum Observations at Cambridge before and after the Expedition.

A. Before departure: observed June 12nd—17th, 1926. Two swings in each of periods 8^h—12^h, 20^h—24^h: time signals from Nauen at 24^h.

Pendulum 36. June 15th, 1926.

Uncorrected Period S	Mean Temp. of Pendulum °C.	Mean Pressure mb.	Corrections: sec. × 10^{-7} T.	P.	Arc.	Sway	Clock Rate	Period Corrected to 0° C. and 1000mb
0.5088584	13.695	1002.8	—601	—2	—37	—27	—70	0.5087847
8581	13.705	1003.1	—602	—2	—32	—27	—70	848
8605	14.19	1005.2	—623	—4	—35	—27	—70	846
8616	14.325	1005.5	—628	—4	—38	—27	—70	849
							Mean...	0.5087847

Pendulum 37. June 13rd, 1926.

0.5088692	13.94	995.9	—612	+3	—23	—27	—114	0.5087919
8702	13.92	996.3	—611	+2	—27	—27	—114	7925
8741	14.79	997.2	—648	+2	—25	—27	—114	7929
8749	14.91	997.7	—654	+1	—29	—27	—114	7926
							Mean...	0.5087925

Pendulum 38. June 14th, 1926.

0.5088928	14.26	998.1	—625	+1	—28	—27	—43	0.5088206
8925	14.175	998.5	—622	+1	—29	—27	—43	8205
8940	14.14	999.5	—620	0	—32	—27	—43	8208
8941	14.15	999.1	—621	—1	—35	—27	—43	8214
							Mean...	0.5088208

Pendulum 39. June 16th, 1926.

0.5089202	14.00	1006.8	—615	—5	—32	—27	—77	0.5088446
9200	14.035	1007.1	—616	—5	—34	—27	—77	8441
9215	14.52	1008.3	—637	—6	—33	—27	—77	8435
9229	14.625	1008.1	—642	—6	—41	—27	—77	8436
							Mean...	0.5088439

B. After return: observed October 18th—26th, 1926. Four swings during period 12^h—24^h: time signals from Nauen at 12^h and 24^h.

Pendulum 36. October 21st, 1926.

0.5088187	7.515	1001.3	—330	—1	—24	—40	+87	0.5087879
8161	7.53	998.1	—331	+1	—24	—40	+87	7854
8172	7.60	997.2	—334	+2	—28	—40	+87	7859
8137	7.65	996.9	—336	+2	—28	—40	+87	7822
							Mean...	0.5087854

Pendulum 37. October 22nd, 1926.

Uncorrected Period S	Mean Temp. of Pendulum °C.	Mean Presure mb	T	Corrections P. Arc. Sway sec. x 10^{-7}			Clock Rate	Period Corrected to 0 °C. and 1000 mb.
0.5088296	7.03	996.8	—308	+2	—24	—40	+82	0.5088008
8323	7.36	996.9	—323	+2	—27	—40	+82	8017
8240	7.60	997.2	—334	+2	—29	—40	+82	7921
8300	7.80	998.0	—343	+1	—30	—40	+82	7970
							Mean...	[1] 0.5087979
Pendulum 38. October 23rd, 1926.								
0.5088536	7.00	999.6	—307	0	—8	—40	+40	0.5088221
8556	7.18	999.9	—315	0	—15	—40	+40	8226
8573	7.39	1000.0	—324	0	—17	—40	+40	8232
8573	7.44	1000.1	—327	0	—15	—40	+40	8231
							Mean...	0.5088228
Pendulum 39. October 25th, 1926.								
0.5088783	6.745	986.5	—296	+9	—27	—40	+42	0.5088471
8788	7.03	984.7	—308	+10	—16	—40	+42	8476
8805	7.39	986.4	—324	+9	—16	—40	+42	8476
8802	7.59	991.7	—334	+5	—16	—40	+42	8459
							Mean...	0.5088470

Summary of Pendulum Observations at Sabine Island.

Pendulum 36. July 18th, 1926.

	G. M. T. Epoch of Swing h m h m	Uncorrected Period Seconds	Mean Temp. of Pm. °C.	Mean Press. mb.	Corrections. T. P. Arc. Sway Sec. × 10^{-7}				Period corrected for all except Clock Rate to 0°C. and 1000 mb. Sec.
I.....	9.22—10.20	0.5083890	4.06	1004.3	—178	—3	—13	—37	0.5083659
II.....	10.44—11.36	3935	4.55	1004.5	200	3	12	37	3685
III.....	12.27—13.42	3929	5.08	1004.4	223	3	10	37	3656
IV.....	17.23—18.17	3959	5.85	1003.0	257	2	12	37	3652
V.....	18.34—19.27	3960	5.75	1002.7	252	2	13	37	3656
VI.....	20.57—22.14	3893	4.83	1002.0	212	1	11	37	3632
VII.....	22.26—23.28	3851	4.16	1002.0	183	1	12	37	3618

	Correction sec. × 10^{-7}
Clock Rate: from Bordeaux, 8^h—20^h +0.10 seconds	—12
— Nauen, 12^h—24^h +0.00 —	0
Mean calculated rate:	
over 8^h—12^h period: = +0.01 seconds per day	—1
— 20^h—24^h — = +0.06 — - -	—4

[1] In this set the clock appears to have behaved irregularly. The mean, however, is corroborated by the March 1927 observations, using another clock and giving 0.5087982.

Corrected period of Swing:

A. using Bordeaux signals and observations I, II, IV, V 0.5083651
B. using Nauen signals and observations III, IV, V, VII 0.5083645
C. using combined clock rates over periods 8^h—12^h, 20^h—24^h and observations I, II, VI, VII 0.5083646

Note on "Combined Clock Rate". The clock rate over these periods 8^h—12^h and 20^h—24^h was obtained by interpolation from the values given by the previous days signals, those of the day in question and those of the next day; each set of signals twelve hours apart gives a clock rate for that interval. By plotting a curve through these values a clock rate for any intermediate interval could be estimated and used as above. In the case of pendulum 37 the reception of signals on the previous day (15th) had been imperfect.

Pendulum 37. July 16th, 1926.

	G. M. T. Epoch of Swing h m h m	Uncorrected Period Seconds	Mean Temp. of Pm. °C.	Mean Press. mb.	Corrections. T. P. Arc. Sway Sec. × 10^{-7}				Perriod corrected for all except Clock Rate. to 0°C. and 1000 mb. sec.
I.....	8.57—10.17	0.5083899	3.42	1003.1	—150	—2	— 9	—37	0.5083701
II	10.24—11.42	3946	3.82	1003.2	168	2	10	37	3729
III.....	13.02—14.10	4040	4.80	1003.3	211	2	11	37	3779
IV.....	16.57—18.06	4060	5.76	1003.1	253	2	12	37	3756
V	18.12—19.23	4076	6.43	1003.0	282	2	14	37	3741
VI.....	21.14—22.16	4131	7.31	1003.3	321	2	15	37	3756
VII	22.25—23.38	4112	6.91	1003.4	303	2	14	37	3756

	Corresponding clock-rate correction. sec. × 10^{-7}
Clock Rate: from Bordeaux, 8^h—20^h —0.25 seconds	+ 29
— Nauen, 12^h—24^h —0.03 —	+ 4
Mean calculated rate:	
over 8^h—12^h period: = —0.60[1]) seconds per day.....	+ 35
— 20^h—24^h — = —0.05 — - -	+ 3

[1]) This clock-rate is approximate, and the result dependent on it has therefore less weight than the other two.

Corrected period of Swing:

A. using Bordeaux signals and observations I, II, IV, V 0.5083761
B. using Nauen signals and observations III, IV, V, VII 0.5083762
C. using combined clock rates over periods 8^h—12^h, 20^h—24^h and observations I, II, VI, VII ..... 0.5083755[1])

Pendulum 38. July 17th, 1926.

	G. M. T. Epoch of Swing h m h m	Uncorrected Period Seconds	Mean Temp. of Pm. °C.	Mean Press. mb.	Corrections. T. P. Arc. Sway Sec. × 10^{-7}				Period corrected for all except Clock Rate to 0°C. and 1000 mb. sec.
I.....	9.17—10.22	0.5084270	4.43	1003.1	—195	—2	—10	—37	0.5084026
II	10.27—11.44	4252	4.22	1003.0	185	2	8	37	4020
III.....	12.38—14.15	4241	3.79	1002.8	167	2	10	37	4025
IV.....	14.27—15.32	4264	3.87	1002.6	170	2	12	37	4043
V	17.33—18.28	4259	4.21	1002.4	185	2	11	37	4024
VI.....	18.38—19.30	4242	3.96	1002.5	174	2	9	37	4020
VII	21.05—22.11	4181	2.94	1002.8	129	2	11	37	4002
VIII	22.23—23.27	4166	2.54	1002.8	113	2	11	37	4003

	Corresponding clock-rate correction. sec. × 10^{-7}
Clock Rate: from Bordeaux, 8^h—20^h —0.13 seconds	+16
— Nauen, 12^h—24^h —0.07 —	+ 8

Note that, with the extra observation during the day, two wholly independent series may be taken.

Corrected period of Swing:

A. using Bordeaux signals and observations I, II, V, VI 0.5084038
B. using Nauen signals and observations III, IV, VII, VIII 0.5084026

Pendulum 39. July 19th and 20th, 1926.

	G. M. T. Epoch of Swing h m h m	Uncorrected Period Seconds	Mean Temp. of Pm. °C.	Mean Press. mb.	Corrections. T. P. Arc. Sway Sec. × 10^{-7}				Period corrected for all except Clock Rate to 0°C. and 1000 mb. sec.
July 19th									
I.....	9.16—10.11	0.5084385	2.13	1000.9	— 93	—1	—11	—37	0.5082443
II	10.37—11.30	4407	2.45	1000.9	107	0	14	37	4249
III.....	17.10—18.02	4468	4.48	1001.2	197	1	13	37	4220
IV.....	18.10—19.04	4464	4.55	1001.3	200	1	10	37	4216
July 20th									
I.....	12.44—13.55	0.5084448	4.12	1005.8	—181	—4	— 8	—37	0.5084218
II	17.21—18.20	4445	4.33	1007.0	190	5	11	37	4202
III.....	18.36—19.32	4419	4.06	1007.4	178	5	11	37	4188
IV.....	22.28—23.42	4476	4.87	1008.2	213	5	11	37	4210

[1]) This clock-rate is approximate, and the result dependent on it has therefore less weight than the other two.

		Corresponding clock-rate correction sec. $\times 10^{-7}$
Clock Rate: from Bordeaux, 8^h—20^h on 19th	—0.02 sec.	+ 2
— Nauen, 12^h—24^h - 20th	—0.20 -	+ 24

Corrected period of Swing:

A. using Bordeaux signals on 19th	0.5084234
B. using Nauen signals on 20th	0.5084228

Mean Results from Pendulum 36 and 37.

	(36)	(37)
A. "Bordeaux" results over 8^h—12^h, 16^h—20^h for pendulums 36 and 37: all in seconds $\times 10^{-7}$	0.5083651	0.5083761
B. "Nauen" results over 12^h—14^h, 16^h—20^h, and 22^h—24^h	0.5083645	0.5083762
C. Combined clock rates applied over periods 8^h—12^h, 20^h—24^h	0.5083646	0.5083755
Giving equal weight to each of these results except the last for pendulum 37 which depends on a less accurate value of the clock rate:— we have		
Final results for pendulums 36 and 37	*0.5083647*	*0.5083760*

Mean Results from Pendulums 38 and 39.

	(38)	(39)
A. "Bordeaux" results over 8^h—12^h, 16^h—20^h for pendulums 38 and 39	0.5084038	0.5084234
B. "Nauen" results over 12^h—16^h, 20^h—24^h, for (38), and over 12^h—14^h, 16^h—20^h, and 22^h—24^h, for (39)	0.5084026	0.5084228
Giving equal weight to each result, we have		
Final results for pendulums 38 and 39	*0.5084032*	*0.5084231*

The A and B results for pendulums 38 and 39 are wholly independent of each other. It seems reasonable to give them greater weight (in calculating the final value for "g") as the semi-independent results for pendulums 36 and 37, but in view of the variation in the period of the pendulums before and after the expedition, this course has not been followed. It is of interest to note that the application of the Nauen clock rate to the 12^h—14^h, 16^h—20^h and 22^h—24^h observations for pendulum 38 gives exactly the same result as that obtained above.

Conclusion: Final Reduction of the Pendulums, and Values of "ǵ" at Sabine Island.

Adopted value of "g" at Cambridge = 981.266 cm/sec^2 whence Value for "ǵ" at Sabine Island = $981.266 \times (S_0/S_1)^2$.

Pendulum.	June 1926 Cambridge	July 1926 Sabine Is. S_1	Oct. 1926 Cambridge	Mean Period Cambridge S_0	Reduced Value Sabine Island "ǵ"
36	0.5087847	.5083647	.5087854	.5087850	982.889
37	7925	3760	7979	7952	.885
38	8208	4032	8228	8218	.883
39	8439	4231	8470	8455	.897
				Mean...	982.8885
Height above sea-level 25 feet:				Correction...	.0024

Mean Value of "ǵ" at Sabine Island..... 982.891 cm/sec^2

Reduced to sea-level, the station being on "Cairn Point" on the east side of Germania Haven in 74°32′15″ N. The probable error of the mean figure, based on the four results,is $\pm$· 0021 cm/sec^2.