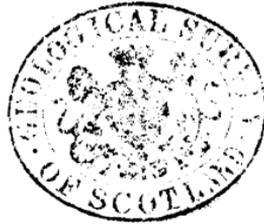


REPORT

OF THE

TWENTY-NINTH MEETING

OF THE



BRITISH ASSOCIATION

FOR THE

ADVANCEMENT OF SCIENCE;

HELD AT ABERDEEN IN SEPTEMBER 1859.

LONDON:

JOHN MURRAY, ALBEMARLE STREET.

1860.

ment of Science, the warm interest which is taken in the United States of America in the success of the measures proposed for the continuation of Magnetic Observatories. Subjoined is the official communication which has since been received :—

*“ To His Royal Highness THE PRINCE CONSORT, President, and to the other Officers of the British Association for the Promotion of Science.*

“ In accordance with the request of the American Association for the Advancement of Science, its officers beg leave to communicate the following resolutions :—

Resolved,—That the American Association for the Advancement of Science regards with great interest the efforts making by the British Association for the Advancement of Science, to induce the re-establishment of the Colonial Magnetic Observatories, for a new series of simultaneous Magnetic and Meteorological observations.

Resolved,—That the Officers of the Association be requested to communicate this resolution to the Officers of the British Association.

“ STEPHEN ALEXANDER, *President.*

“ EDWARD HITCHCOCK, *Vice-President.*

“ W. CHAUVENET, *General Secretary.*

“ JOSEPH LOVERING, *Permanent Secretary.*”

“ Springfield, Mass., August 10, 1859.”

3. The Council has been informed that a deputation has been appointed, and will attend at Aberdeen, to invite the British Association to hold its meeting for 1860 at Oxford, and that invitations will also be presented, for 1861 and following years, from Manchester, Cambridge, and Newcastle-upon-Tyne.

6. The following Report was received from the Kew Committee, and was ordered to be entered on the Minutes.

*Report of the Kew Committee of the British Association for the Advancement of Science for 1858–1859.*

It is with deep regret that the Committee have to report the decease of the late Superintendent of the Observatory, Mr. John Welsh, who died at Falmouth on the 12th of May, where he had removed for a short time for the recovery of his health.

Mr. Welsh's position as a man of science was too well known to require any reference from the Committee, yet they may be permitted to refer to those aspects of it which have come more prominently under their view during the long and pleasant intercourse which has so unhappily come to an untimely termination.

Mr. Welsh entered the Observatory on the 27th of August, 1850, as an assistant to Francis Ronalds, Esq., F.R.S., who for some years had superintended the management as the Honorary Director. Mr. Ronalds retired in 1852 to reside on the Continent, since which time, with the exception of a short interval, Mr. Welsh has been the Superintendent; and the present efficiency and recognized scientific standing of the Observatory may be assumed to be in a great measure due to the zeal and remarkable ability with which he discharged his duties: ingenious in devising new arrangements, laborious and persevering in their execution, he was eminently qualified

to direct and superintend the arrangements of a practical physical observatory.

His knowledge of science in general, but more particularly of Meteorology and Magnetism, was extensive and accurate; in all branches of these sciences he was an eminent authority, having clear and comprehensive views, possessing also a sagacious insight into remoter possibilities.

His zeal for science was signally displayed in the four balloon ascents which he undertook in 1852 with some personal risk, and from which he obtained valuable results (*Phil. Trans.* vol. cxliii. part 3).

Possessed of an amiable disposition, of singular warmth of heart and sincerity of character, his loss as a friend is mourned by all the members of the Committee and by many members of the Association.

The published annual Reports of the British Association, and the Transactions and Proceedings of the Royal Society, contain many valuable contributions of Mr. Welsh, and these alone would entitle him to be placed in the ranks of those to whom the Science of this country must ever be deeply indebted.

Several gentlemen offered themselves as candidates to succeed Mr. Welsh; the Committee, in selecting Mr. Balfour Stewart, who was formerly his Assistant in the Observatory, believe they have appointed a gentleman who is not only competent to fulfil the duty of Superintendent, but who, from the experience he obtained under the direction of Mr. Welsh, is peculiarly fitted for the office.

Mr. Stewart entered on his duties on the 1st of July last. He reports that he found all the Assistants discharging their respective duties. Mr. Chambers was assiduously attending to the Magnetical, and Mr. Beckley to the Mechanical Department of the Observatory. Mr. Magrath had charge of the Meteorological verifications, and Mr. Whipple he found of much use in the general work of the Observatory.

During the past year, in the Magnetical Department, Constants have been determined for a Unifilar Magnetometer belonging to Dr. Pegado, of Lisbon, and also the temperature correction and induction coefficient for its accompanying magnet.

A Dip Circle belonging to Padre Secchi, *For. Mem. R.S.*, and Astronomer at Rome, as also one belonging to Prof. Hansteen, have been compared with the Kew instrument, adjustments made for the determination of total force by Dr. Lloyd's method, and observations made at the Observatory as a base station.

Temperature corrections and induction coefficients have been obtained for magnets  $R_2$  and  $R_6$  belonging to General Sabine.

Dr. Bergsma, of Utrecht, has received instructions in the use of Magnetical Instruments at the Observatory.

An extensive series of dip observations, and also periodical determinations of Magnetic force and declination, have been made: and a Manual of Instructions, for the use of the Instruments adopted for those purposes at the Kew Observatory, has been drawn up and printed at the expense of the Admiralty, by whom 250 copies have been presented to the Observatory.

The Committee think it right to mention, that the magnetical work, the details of which have now been given, was executed in the absence of Mr. Welsh by Mr. Chambers, in a manner very creditable to his intelligence and industry, and satisfactory to the Committee.

The Self-recording Magnetometers have continued in constant operation; their instrumental coefficients were determined by Mr. Welsh. The death of this gentleman prevented his completing the Report called for at the last

Meeting of the Association on the Self-recording Magnetical apparatus at the Observatory; but the Report is in progress of completion by Mr. Stewart, and will be printed in the next volume of the Transactions of the Association.

An instrument has been devised at the Observatory for tabulating the values of the magnetic elements from the curves given by the Magnetographs. As the staff of Assistants at the Observatory is not sufficiently large to undertake these tabulations, General Sabine has undertaken to have the results tabulated at Woolwich for every hour; but the instrument is capable of furnishing data for much smaller intervals, and may under special circumstances be thus used.

The observations connected with the Magnetic Survey made in Scotland by Mr. Welsh, are in progress of reduction by Mr. Stewart, and the result will be presented as a report to the present meeting.

Self-recording Magnetic Instruments designed for the first of the Colonial Observatories which have been proposed to Her Majesty's Government have been completed by Mr. Adie, from drawings prepared by Mr. Beckley from the design of the late Mr. Welsh, and are set up in a wooden house erected near the Observatory, for the purpose of affording an opportunity to the proposed Magnetical observers to be instructed in the use of the Self-recording Instruments.

Since the last meeting of the Association the unfortunate death of Mr. Welsh has retarded the experiments with the Photoheliograph, but from time to time they have been gone on with, at first by Mr. Chambers, who obtained some very fair results, and latterly by Mr. Beckley, as his other duties have permitted; and in order that they might be prosecuted more continuously, the Committee have fitted up a Photographic room in close contiguity to the instrument. This addition to the photographic establishment has been attended with the most promising results; and the Committee have satisfaction in reporting that the difficulties which have hitherto presented themselves in the way of a daily photographic record of the sun, appear to be almost entirely surmounted. Since the erection of the photographic room, Mr. Beckley has been enabled to make a series of experiments, and has turned his attention to the exact determination of the chemical focus of the Photoheliograph, which there was reason to suspect did not correspond precisely with the visual focus; for although the chromatic aberrations of the object-glass had been specially corrected in order to obtain that result, the secondary glass, which magnified the image, was not so corrected. It has been found, after repeated trials, that the best photographic definition is obtained when the sensitized plate is situated from  $\frac{1}{10}$ th to  $\frac{1}{8}$ th of an inch beyond the visual focus in the case of a 4-inch picture; and that when this adjustment is made, beautiful pictures are obtained of the sun 4 inches in diameter, which still bear magnifying with a lens of low power, and show considerable detail on the sun's surfaces besides the spots, which are well defined.

Mr. De la Rue, by combining two pictures obtained by the Photoheliograph at an interval of three days, has produced a stereoscopic image of our luminary which presents to the mind the idea of sphericity.

Under Mr. De la Rue's direction, Mr. Beckley is making special experiments having for their object the determination of the kind of sensitive surface best suited for obtaining perfect pictures; for it has been found that the plates are more liable to stains of the various kinds, known to photographers, under the circumstance of exposure to intense sun-light, than they would be if employed in taking ordinary pictures in the camera.

Now that the photographic apparatus has been brought to a workable state, Mr. De la Rue and Mr. Carrington, joint Secretaries of the Astrono-

mical Society, propose to devote their attention to the best means of registering and reducing the results obtained by the instrument, provided the funds which may be necessary are placed at their disposal.

The difficulties which have stood in the way of bringing the Photoheliograph into an efficient state of work, were such as required no ordinary degree of perseverance to surmount; and the Committee have therefore the greater satisfaction in reporting that these have been overcome, in so far as to render the Photoheliograph a valuable recording instrument:—the minor improvements still contemplated have for their object the production of pictures as free as possible from the spots and blemishes to which all photographs are liable, and sun pictures in particular.

It was mentioned in the last Report that Mr. Beckley had suggested certain modifications of his anemometer. He was requested to prepare a description of this instrument, which description was published in the last volume (page 306) of the Reports of the Association.

The verifications of Meteorological Instruments have been continued on the usual plan.

The following have been verified from the 1st of July 1858 to the 1st of August 1859:—

	Baro- meters.	Thermo- meters.	Hydro- meters.
For the Admiralty . . . . .	78	120	
For the Board of Trade . . . . .	76	474	80
For Opticians and others . . . . .	<u>33</u>	<u>317</u>	<u>12</u>
Total . . . . .	187	911	92

An application having been made by Colonel Sykes for the instruments used by Mr. Welsh in his Balloon ascents, these were got ready and their corrections determined. The instruments, consisting of one barometer, two Regnault's hygrometers with attached thermometers, eleven separate thermometers, three vacuum tubes obtained from Dr. Miller, and a polarimeter, with their respective fittings, were delivered to Colonel Sykes, and are now in charge of the Balloon Committee.

On the 21st of May, 1859, the Chairman of this Committee addressed a letter to the Secretary of the Admiralty, stating that by the direction of the Committee he had been desired to acquaint the Lords of the Admiralty that the Austrian frigate 'Novara,' which left Europe on a voyage of circumnavigation and scientific research, was furnished with scientific instruments from the Kew Observatory, that her officers received instruction for their use from Mr. Welsh and his assistants, and that several communications had been received from the 'Novara.' This vessel has since arrived.

The following correspondence has taken place between Senhor da Silva of Lisbon and General Sabine.

"Lisbon, July 11th, 1859.

"SIR,—Having succeeded Dr. Pegado in the direction of the Meteorological Observatory at Lisbon, I shall be very happy if I can assist in, or promote the important operations connected with magnetism that England is about to undertake.

"But previous to promising you on my part, I am desirous of knowing—

"1st. If it will be possible to instruct a Portuguese official at Kew.

"2nd. If the English Government would be disposed to interest that of Portugal in this scientific expedition.

"3rd. To whom we ought to apply in order to complete our collection of

Magnetic Instruments, having already an Inclinator of Barrow, a Declinator of Jones, and a Unifilar of the same maker.

“Finally, to solicit you to aid us with your excellent counsel, of which we are in want.

“You will please pardon my having taken this liberty of addressing you, but wishing to serve science to the utmost of my power, I trust that you will favour me with your aid.

“Accept the assurance of my high consideration and respect.

“I have the honour to be, Sir,

“Your obedient Servant,

(Signed) “J. A. DA SILVA.”

“*Major-General Sabine, Woolwich.*”

“13 Ashley Place, London, S.W.

“SIR,—I beg to acknowledge the receipt of your letter. I am authorized by the Committee of the Directors of the Kew Observatory to say, that it will give them great pleasure to afford every facility for instruction and practice, both in the self-recording magnetic instruments and also in those designed for absolute determinations, to an officer who may be sent by you for that purpose; and should you desire to have any instruments made in England similar to those in use at Kew, the Committee will be most happy to superintend their construction, verify them, and send them out. In regard to an application from our Government to yours, I am unable at present to say anything, inasmuch as the decision upon the establishment of our own proposed observatories will not be taken until the autumn: the restoration of peace is a favourable event.

“I beg you, Sir, to be assured that it will at all times give me great pleasure to be of any use to your Observatory in my power.

“I have the honour to be, Sir,

“Your obedient Servant,

(Signed) “EDWARD SABINE.”

“*Senhor J. A. da Silva,*  
*Observatorio Meteorologico, Lisbon.*”

The following Resolution was passed by the General Committee at the last Meeting of the Association at Leeds:—

“That the consideration of the Kew Committee be requested to the best means of removing the difficulty which is now experienced by Officers proceeding on Government Expeditions and by other Scientific travellers, in procuring instruments for determinations of Geographical Position, of the most approved portable construction, and properly verified. That the interest of Geographical Science would be materially advanced by similar measures being taken by the Kew Committee in respect to such Instruments, to those which have proved so beneficial in the case of Magnetical and Meteorological Instruments.”

The Committee are strongly impressed with the importance of the preceding recommendation, and would have great satisfaction in giving their best attention to the subject, but the works they have in hand are already beyond the pecuniary means placed at their disposal, and the Committee are unwilling to impair the credit which the Kew Observatory is obtaining by undertaking more than the income enables them to accomplish effectively.

The Committee finding that in future they will not require more than one half of the land attached to the Observatory, for which an annual rent of £21 is paid, notice to that effect has been given to Mr. Fuller.

In the last Annual Report to the Council at Leeds, the Committee suggested "that the time had arrived when strenuous exertions should be made to obtain such an amount of pecuniary aid as would ensure the efficient working of a practical physical observatory;" and they also stated "that the probable future expenditure could not be fairly estimated under £800 per annum." At that time the Committee contemplated the engagement of a photographic assistant, and also some other arrangements which they were compelled to forego, as it will be seen, by the financial statement annexed to this Report, that the expenditure of the past year exceeded the income by the sum of £106 2s. 1d., the amount of the former being £675 14s. 8d., while the total income was only £569 12s. 7d., £69 12s. 7d. having been received for the verification of instruments: this source of income is year by year decreasing, as explained in a former Report, in consequence of the Government departments being now nearly supplied with standard meteorological instruments.

The Committee, in presenting this Report, have to repeat their former suggestions, that means should be taken to obtain effectual pecuniary aid for the support of an establishment which has for so many years laboriously and effectually carried out those scientific objects for which it was founded, more particularly since the appointment of a salaried superintendent, assisted by a competent staff, whose individual services have always been obtained at the most moderate scale of remuneration.

Kew Observatory, Aug. 29, 1859.

JOHN P. GASSIOT, *Chairman.*

*Accounts of the Kew Committee of the British Association from September 22, 1858 to September 14, 1859.*

RECEIPTS.		PAYMENTS.	
£	s. d.	£	s. d.
Balance from last account	114 11 9	To late Superintendent, three qrs. salary...	150 0 0
Received from the General Treasurer	500 0 0	B. Stewart, one quarter ending Oct. 1, 1859	50 0 0
" for the verification of Instruments—	£ s. d.	C. Chambers, one year, ending Oct. 6...	100 0 0
from the Board of Trade	46 3 0	J. V. Magrath, one year, ending Aug. 14	70 0 0
from Opticians	23 9 7	R. Beekley, 51 weeks, ending Sept. 12, at 35s.....	89 5 0
	69 12 7	G. Whipple, 15 weeks, ending Jan. 3, } at 10s.....	7 10 0
		Ditto, 36 weeks, ending Sept. 12, at 12s.	21 12 0
			488 7 0
		Apparatus, Materials, Tools, &c. ....	37 9 4
		Ironmonger, Carpenter, and Mason.....	17 12 2
		Printing, Stationery, Books, and Postage..	5 7 1
		Coals and Gas .....	54 0 0
		House Expenses, Chandlery, &c.....	19 11 11
		Porterage and petty expenses .....	8 2 2
		Rent of Land.....	10 10 0
		Furnishing Assistants' Rooms .....	34 15 0
		Balance in hand .....	8 9 8
			£684 4 4

I have examined the account and compared it with the vouchers presented to me, and find that the Balance in hand is Eight Pounds Nine Shillings and Eightpence.

*2nd Sept., 1859.*

R. HUTTON.