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[Despatch Abstract.]

Adras Observatory Report.

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21st OCTOBER 1890, No. 706, PUBLIC.

GOVERNMENT OF MADRAS.

PUBLIC DEPARTMENT.

READ—the following papers :—

From J. W. P. MUIR-MACKENZIE, Esq., C.S., Under Secretary to the Government of India, Revenue and Agricultural Department, to the Chief Secretary to the Government of Fort St. George, dated Simla, the 31st May 1890, No. 408—29-8, Meteorology.

I am directed to forward copy of a despatch from Her Majesty's Secretary of State, No. 28 (Records), dated the 29th March last, and of its enclosure, on the subject of the report of the Government Astronomer at Madras for the year 1888, and to request that when the report required of Mr. Pogson is forwarded the Government of India may be favored with the views of His Excellency the Governor of Madras thereon.

ENCLOSURES.

Despatch from Her Majesty's Secretary of State for India, dated London, 27th March 1890, No. 28 (Public Records).

I forward herewith a copy of the Resolutions of the Indian Observatories Committee on the reports of the Government Astronomer at Madras and the Director of the Government Observatory at Colaba for the years 1888 and 1889, respectively, forwarded with your Secretary's letter, No. 9—36-2, dated 29th October, and your Meteorology (R and A) letter, dated 17th September 1889. I desire to call Your Excellency's attention to the opinions expressed in Resolution 1.

2. I request that Mr. Pogson may submit as soon as possible the detailed statement \* required by the Committee, of the staff employed and of the progress of the work of publication of the volumes of Star Observations.

\* See Resolution 2.

*Resolutions of the Indian Observatories Committee passed at their Meeting on 1890, February 27th.*

With reference to the report of the Director of the Madras Observatory for the year 1888—

(1). The Committee regret to find that the publication of the volume of Star Observations at Madras has proceeded so much more slowly than the Astronomer had led the Government to expect, and they would urge that every effort should be made by the Astronomer to hasten the preparation and printing of the succeeding volumes. They consider that the long delay in publication is very discreditable to the Madras Observatory. They also consider it of great importance that the results of the observations of the moon and principal planets should be published as soon as possible, omitting, at least for the present, the observations of minor planets and comets.

(2). The Committee would recommend that the Astronomer should be directed to give more precise statement of the staff employed and of the progress of the work in hand, as from his meagre report, it is difficult to form any definite opinion as to the amount done in the year. All the information given is contained in four lines, and as regards the third volume of the Star

Observations it is confined to the statement that the volume was nearly ready for press, whilst in the report for the year 1886, two years before, it was stated that considerable progress had already been made in its preparation.

(True Copies.)

(Signed) A. R. TUCKER, Registrar,  
Revenue and Agricultural Department.

Reference on No. 1718-C.

Referred to the Government Astronomer for early report.

(Signed) J. F. PRICE,  
Chief Secretary.

13th June 1890.

From N. R. POGSON, Esq., C.I.E., Government Astronomer, to the Chief Secretary to Government, dated Madras, 27th August 1890.

I have the honor to submit my reply with reference to the communication herewith returned, from the Right Honorable the Secretary of State for India, Public Records No. 28, dated 17th March 1890, and the Resolutions of the Indian Observatories Committee passed at their meeting on 1890, February 17th, together with the detailed statements called for therein.

1. The Committee's report commences by expressing regret "that the publication of the volume of Star Observations at Madras has proceeded so much more slowly than the Astronomer had led the Government to expect." This implies that the Astronomer has deceived Government by holding out false promises, which is a most unfair and mistaken assumption. No one can regret, so much as the Astronomer himself the inevitable delay, but it is due to casualties, quite unforeseen and beyond his control. It must not be forgotten that under the extraordinary arrangement of payment by results for the publication of the past observations, such delay means not only disappointment and regret to the Astronomer, but also pecuniary loss, and both Government and the Committee may feel assured that had it been possible, the volume in hand would have been completed and circulated several months back.

2. The Committee next say—"they consider that the long delay in publication is very discreditable to the Madras Observatory,"—i.e., to the Astronomer, and this would be undeniably true had the delay been due to neglect or dilatoriness on his part, but such has most certainly not been the case. Publication of astronomical results was only rendered possible by His Excellency Sir M. E. Grant-Duff so recently as April 1884, and in the same year appeared the small volume of "Telegraphic Longitude Determinations between Madras and eight other stations, made between the years 1870 and 1875." If the Astronomer's hope and intention upon his arrival in India in 1861, of bringing out an annual volume had been feasible, there would never have been any arrears beyond those left by his predecessors; no inconsiderable amount, but chiefly consisting of magnetical and meteorological results between 1841 and 1861. Of these arrears, one volume of Meteorological Observations and another of Magnetical Observations, each containing the hourly records made between 1851 and 1855, were published in 1874 and 1884, respectively.

The first of the new series of "Meridian Circle Observations of Fixed Stars," containing 5,344 complete positions recorded in the years 1862, 1863 and 1864, was issued in April 1887. A second volume, containing complete positions of 7,133 stars, observed in 1865, 1866 and 1867 was distributed in October 1888, and a third, giving 5,496 more observations, made in 1868, 1869 and 1870 is now just ready for issue. The long delay on this last occasion is attributable to misfortunes of a nature not likely to recur. Illness of the Astronomer during the first-half of 1889 was a serious and most unexpected interruption. The long continued illness of two native Assistants, one of whom died last March and the other has only partially recovered, and the dismissal of another after conviction on a charge of cheating at an examination

(of which he was entirely innocent) caused further unavoidable inconvenience, as may be well imagined when it is borne in mind that the ordinary duties of the establishment, including meteorological records and reductions, code messages to Simla; time signalling five times daily and all minor office work, have to be performed by six natives only. The last and most complete block, to progress was due to the necessary dismantling of the Transit Circle, collimators and sidereal clock, at a few hours' notice, in consequence of the threatened collapse of the roof of the transit room. This occurred last November, and the instrument has since undergone extensive cleaning and repair, before and since its restoration to its usual position. English astronomers who can avail themselves of the services of experienced workmen, superintended by eminent opticians, can form but little notion of what it is to have such duties performed by ordinary native mechanics, who not only require to be shown what is wanted but also how it is to be done, and that the continual personal supervision of the Astronomer is indispensable if the instructions given are ever expected to be faithfully carried out.

3. A few comparisons with the proceedings of other public Observatories may be well made here in reply to this severe censure of the Committee. The Royal Observatory, Cape of Good Hope, during the long period from 1833 to 1870 published only one volume of partially reduced observations made in 1834. Yet the Astronomer received high honors and a liberal private pension in addition to his service claims, and his delay was never pronounced "discreditable." The Williamstown Observatory, started in 1853 and subsequently removed to Melbourne, only commenced its observations of stars for catalogue purposes in 1861 and its first volume appeared in 1869. The Navel Observatory at Washington was started in 1833, but its first observations of stellar positions, dating from August 1838, were not printed before 1856. The second edition of its great catalogue of 10,658 stars, under observation from 1845 to 1877 appeared in 1878. The last volume of the Astronomical Observations made at the Cambridge Observatory, recently published this year, brings up the arrears of that institution to 1869; and many other instances of even greater delay might be adduced of highly esteemed continental observatories. Yet in all these cases the distinguished Directors in charge have had the assistance of able observers of their own nationality, and no one would think of calling them to account for discreditable negligence in regard to the delay of their publications.

4. The Committee "consider it of great importance that the results of the "observations of the moon and principal planets should be published as soon as possible, omitting, at least for the present, the minor planets and comets." In reply to this the Astronomer must remark, that bearing in mind how diligently the moon and the old planets were followed up at Greenwich, the Cape, and numerous other public observatories, he never considered them as any part of his duty, but preferred striking out fresh lines not attempted elsewhere. The moon was certainly observed on 581 nights between 1862 and 1872, but more with a view to correction of the longitude, before there was much hope of its being so far better determined by telegraphic means. Mars was also observed on 178 nights at five oppositions during the same interval, but only to give an approximate ephemeris correction, to aid the reduction of the equatorial observations, made at the special desire of Sir G. B. Airy, then Astronomer Royal, for the correction of the Constant of Solar Parallax. The minor planet and comet observations are far more urgently and more frequently called for and their previous publication is far more desirable. The Committee make no mention of the mass of Variable Star observations, which are, however, more fairly appreciated elsewhere; as evidenced by the generous offer just made of an appropriation of five hundred dollars out of the noble American "Bruce Fund for Advancement of Astronomical Science," by Professor Pickering of Harvard College, the distinguished trustee of the fund, to assist the Madras Astronomer to publish his long buried records of Variable Stars, of the existence of which the Committee do not even seem to be aware.

5. The Committee reasonably complain of the very meagre reports at their disposal to enable them to judge of the amount and nature of the work done. This arises from

the circumstance that the Astronomer has never before been called upon for, or authorized to submit for their information, any detailed report, such as would furnish them with the particulars they desire. Heads of departments, the minor ones especially, are expected to be very brief and to avoid technical details not intelligible or interesting to the general public in their annual administration reports, and these are all the Committee have yet had under their consideration. A totally different style of report should be furnished to the Committee, as soon as possible after the close of each calendar year, and such a report would be just as unsuitable for the annual administration report as that is for the requirements of the Committee.

6. The Committee quote correctly from the Administration Report for 1888, that the third volume, containing the observations made during the years 1868, 1869 and 1870 was also nearly ready for press at the end of 1888. Its printing was not, however, commenced until April 1889. They are mistaken in their reference to the report for 1886, when they say, speaking of this third volume that—"two years before it was stated that considerable progress had already been made in its preparation." This remark referred to the second volume, for 1865, 1866 and 1877, which was published and distributed in October 1888, and not to the third as erroneously supposed by the Committee.

7. The Observatory Staff, about which the Committee naturally desire more definite information, not suitable for an Administration Report, consists of eight individuals. The first of these, the Government Astronomer, who has not only to superintend and control the establishment but has also to turn to as a practical mechanic, optician and electrician, in addition to his astronomical duties, receives as his remuneration Rs. 800 a month; less than half the salary of the Meteorologist to the Government of India or of many officers in the Educational Department. When Colonel J. F. Tennant, R.E., (now Lieutenant-General retired) proposed the establishment of a new Observatory at Simla, in 1873, he set down the commencing salary of its Director at Rs. 2,000 a month.

The Assistant to the Government Astronomer comes next, on only Rs. 150 a month; about half the pay of an ordinary assistant in any leading retail shop, although the only European aid on the establishment—The great need of European help was warmly urged by the Madras Government so long since 1862 and was at once conceded by the Government of India; a German being preferred as likely to be obtainable at a lower rate than an Englishman. In despatch No. 17, dated London, 24th March 1864, this was vetoed by the Secretary of State for India, upon the ground "that as the Observatory had already existed for upwards of seventy years without requiring such aid it could not be necessary." After repeated persistent support on the part of the Government of Madras, a small salary was granted to a son of the Astronomer, who had been working without pay for nearly two years, and after his untimely death, the same was continued to a daughter of the Astronomer for nearly fifteen years. More recently, since Miss Pogson's absorption into the Meteorological Department of India, the grant has been transferred to the Astronomer's wife, a convenient and suitable temporary arrangement which will of course cease when the present Astronomer retires. In Col. Tennant's Simla scheme previously referred to, the salary proposed for his assistant was Rs. 1,000 at starting, rising to Rs. 1,500 a month.

There are also six native Observatory Assistants, on monthly salaries of from Rs. 100 maximum to Rs. 21 minimum, whose duties are multifarious. The first and second assistants have always been the observers with the Meridian Circle, though the third and fourth have shared in taking ordinary time transits since the observations for the Star Catalogue were closed. The four junior native assistants are fully occupied by the meteorological observations and reductions; the daily code telegram to Simla; the regulation of time for the shipping and the public, by semaphore signals at 8 A.M. and 2 P.M., by gun-fire at noon and 8 P.M., by two electrically controlled clocks about 4 miles distant, and by telegraphic time-roll sent all over India at 4 P.M. daily throughout the year. They also copy out any minor drafted official correspondence and local returns, and when time permits, assist their two seniors in the preparation of press-copy for the volumes in hand. As previously mentioned, three of the

junior hands were rendered practically useless during much of the past year; two by long illness, one of whom since died, and a third, a most trustworthy useful man, was removed by imprisonment and subsequent dismissal. New native assistants require tedious training before they can be trusted alone with the most ordinary duties in an astronomical observatory.

8. Progress of the reductions and publication of the Meridian Circle Star Observations of past years from 1862 to 1887 inclusive.

As there are just twenty-six subjects to be explained under this section it will be convenient to employ alphabetical references for each as follows:—

(a) The Working Catalogue of Stars to be observed, contains the dates of all the 51,100 observations of about 5,700 stars, made between 1862 and 1887. This has throughout been the Astronomer's special care. The objects selected for observation comprised all stars visible at Madras down to the 5th magnitude: all stars remarkable for variability, colour, proper motion or any other peculiarity: comparison stars used with the Equatorials; for observations of Mars in opposition; of minor planets and comets; and zero stars for the *Atlas of Telescopic Variable Stars*; a special work of the Astronomer, commenced at Oxford in 1852; continued at Hartwell in 1859 and 1860 and since 1861 at Madras. The working catalogue also comprises as many southern stars between the 6th and 10th magnitudes and more than 120° in Polar distance, as could be recorded, when those first selected were sufficiently determined by a minimum number of five complete observations of each object.

(b) The Observation Note Books.—These are 61 in number, each  $8\frac{1}{2} \times 4\frac{1}{2}$  inches. In them the observations of all objects were entered in pencil by the assistant on duty, and also the means of the seven transit wires and of the six circle microscopes. These books also contain the readings of the eyepiece micrometers; the observations for determination of the line of sight of the collimators, and of the corrections for index or nadir point, inclination, collimation, run and flexure; the run corrections applied, and all notes made by the observers, often very curiously expressed.

(c) The index corrections for each year, extracted from the 61 observation books (b), and tabulated on foolscap forms.

(d) The run corrections for each year, similarly tabulated on foolscap from the note-books (b), with the mean values adopted by each observer during his watch, usually half a month, but longer when one was absent on leave which natives so often require.

(e) Miscellaneous determinations; such as intervals of the transit wires; values of the micrometer screw revolutions; results of observations for personal equation, flexure, &c.

(f) The Folio Day books, containing the complete reduction of all the observations recorded in the note books (b). As far as possible these reductions were ordered to be made throughout by the assistants who took the observations. It was their duty to revise them most scrupulously, but the errors detected by the Astronomer in the course of compilation of the results of the first nine years, up to 1870, were so numerous and tedious as to have retarded publication to less than half the speed hopefully counted upon before they were found out. Of the two observers concerned, one died in 1873 and the other soon after retired on pension and is now imbecile and quite blind.

These original reductions of observations made with the Transit Circle are completed for all the years 1862 to 1887 and furnish the material for the final catalogue of stars. Meridian observations of the moon, Mars, and minor planets are also to be found in these twenty-two folios. They are bound in red cloth, each containing the results of one year's work except the last, which includes the reductions from 1884 to 1887, when completion of the stars previously observed was only required and extension of the working catalogue (a) was avoided as much as possible.

(g) Duplicate Folio Day Books; being copies throughout of the twenty red Folio Day Books (f) of original reductions. These are bound in black cloth for distinction and are reference copies for the Astronomer's special use; no alterations

being made in them by any one else. They have been carefully compared with the red originals (*f*) and are complete for the same twenty-six years. The only difference between the originals (*f*) and these duplicates (*g*) is in the foot notes, which in the former were entered by the native observers in their own peculiar style, but in the latter have been revised and made more intelligible by the Astronomer, direct from the note books (*b*). It is very desirable that these carefully revised fair copies should be ultimately deposited in safe custody in England for future reference, and the opinion of the Committee as to their most suitable destination when done with here is respectfully solicited.

(*h*) Refractions.—These were calculated throughout by means of "*Bessel's Refraction Tables modified and expanded. (Appendix to the Greenwich observations, 1853).*"—on forms uniform in size with those used for (*c*).

(*i*) Star Constants.—The constants for every star observed were computed by the usual formulæ of Bessel, on printed forms,  $9\frac{1}{2} \times 7\frac{1}{2}$  inches, adopting the co-efficients of Professor Peters, (*Numerus constans Nutationis*) and the notation used in the Nautical Almanac. The approximate places assumed for their calculation were near enough for giving reductions to mean position with sufficient accuracy, but not for extracting the precessions from them correct to the fourth decimal in Right Ascension and the third in Polar distance. The Astronomer has therefore to re-calculate, when the "Catalogue of Mean Positions" is in hand, all precessions and many of the secular variations with more precise positions, taken from the Star Ledger (*p*) for the year in which they are required. Those for all stars within  $13^\circ$  of the pole are recomputed for each year of observation; others for some intermediate year, and these are reduced to the required date by means of the secular variations. The Constant Forms fill twenty-six cases, one for each hour of R. A., with two extras for circumpolar stars. Any error detected in one of these forms necessarily involves complete revision of all observations made of the star to which it refers, and these so far have been distressingly numerous and the chief source of delay in the preparation of the past three volumes. Unless worked in duplicate and compared by a third party, so as to prevent collusion, such calculations by natives are unreliable. Whether the similar work of the successors of the two old assistants will prove more accurate remains to be seen.

The proper motions adopted were taken from the two lists of the late Rev. R. Main and one by his successor Mr. E. J. Stone, published in the "*Memoirs of the Royal Astronomical Society*," Volumes 19, 28 and 33. Those for a few southern stars were taken from Mr. Stone's "*Cape Catalogue of Stars for 1880*," and for others not found in these authorities from the most recent Greenwich Catalogue in which they occurred.

(*j*) The Reductions to Mean Position were always computed from the Star Constants (*i*), combined with the A, B, C, D given in the Nautical Almanac, except for stars whose apparent places were given in that work, when they were obtained from it. In these, as in all other calculations, the numbers were carried out to one decimal place beyond that used in the reductions, so as to ensure, as far as possible, arithmetical accuracy in the final figure:—It frequently happens that a discordant observation is rendered satisfactory by the detection of an error in its reduction to mean place.

(*k*) The Adopted Mean Positions of all stars used for Clock and Meridian Corrections, were taken, when given therein, from the Nautical Almanac for the year of observation, without alteration except in one case, viz., 51 (Hev.) Cephei; to the Right Ascension of which a correction of + 2.49 seconds was applied up to the end of 1870. The need of this change was satisfactorily confirmed by the R. A. given in the N. A. for 1871. The adopted positions of Meridian Stars not in the N. A. were brought up from the "*Catalogue of 164 Stars within  $6^\circ$  of the North Pole*" in Vol. XVI of the "*Radcliffe Observations*," by the more exact method of calculation necessary in all such cases.

(*l*) Determinations of the Line of Sight of the Collimators, were extracted from the note books (*b*) on foolscap forms uniform with those used for (*c*).

(*m*) Inclination and Collimation Corrections.—The readings of the eyepiece micrometer for coincidence of the direct and reflected image of the centre wire for determination of the inclination correction; those of the same micrometer upon each collimator, and the deduced inclination and collimation corrections were collated from the note books (*b*). Due account was taken of diurnal aberration and the interval of the centre wire from the mean of the seven in determining the collimation correction. The eyepiece R. A. micrometer was set to the nearest tenth of a revolution so as to keep the correction conveniently small for application.

(*n*) The Meridian Corrections, whenever possible, were found from transits of circumpolar stars above and below the pole. When owing to cloudy weather, only one such transit was available, the observation was combined with that of the lowest standard south star recorded and the place of the polar star was not carried out as an independent determination of its position. The Meridian Corrections thus found are entered in the two Day Books (*f* and *g*). The form for working out these corrections is on foolscap, uniform with (*c*).

(*o*) The Clock Corrections, Rates since last observing night, and proportionally adopted Rates for the night, were similarly collated on forms uniform with (*c*). The mean sidereal time for the mean of the corrections and the adopted rates are entered in both Day Books, in line with the other adopted corrections, before the first observation. The standing order was always to observe four clock stars and more if convenient, but on unfavorable nights three were accepted as sufficient, rather than trusting to an interpolated correction or rejecting the night's work.

(*p*) The Ledgers of Separate Results of each complete Observation were picked out from the original red Day Books (*f*) by the first native assistant, the skeleton form of stars and dates being previously prepared from the entries in the Working Catalogue (*u*). These manuscript ledgers were revised by the Astronomer throughout, by reference to the black Day Books (*g*). The press copy was then made by another assistant, the flexure correction being applied to the Polar Distances, and the proofs were read by the Astronomer. The ledgers are now ready up to 1884 and the press copies up to 1883. Estimated magnitudes of stars less than the 6th magnitude are given in the ledgers, as also the initials of the observers.

(*q*) The Catalogues of Mean Positions for each year are constructed by the Astronomer only. The magnitudes of bright stars included in Prof. Pickering's "*Harvard College Meridian Photometry*" or in Dr. Gould's "*Uranometria Argentina*" were preferred to any estimations of such stars by the assistants, but, for all fainter stars, not found in those works, the mean of their estimations is taken. The values thus found are fairly approximate to the Astronomer's formula, deduced from his unpublished photometric measurements, made between 1853 and 1856, of the circular apertures with which stars, selected from Argelander's Zones and carefully estimated comparison stars of telescopic variables just disappeared. Calling such apertures, expressed in inches and hundredths, "Limit of Vision" the magnitude of any star is given by the formula:—

$$\text{Magnitude} = 9.2 + 5 \cdot \log. (\text{Limit of Vision}).$$

This formula, as also the "*Ephemerides of the Magnitudes of the Minor Planets*," given in the R. A. S. Monthly Notices from 1887 and in the Nautical Almanac Supplements from 1859 to 1866; besides those of the Variable Stars, first given by the present Madras Astronomer from 1857 to 1862, were all based upon the light ratio between successive magnitudes being 2.512 and Prof. Pickering also accepted this very convenient light ratio in commencing his "*Photometric Researches*," detailed in Vol. XI of the "*Annals of the Astronomical Observatory of Harvard College*." The Madras estimates of telescopic stellar magnitudes were made, as nearly as the observers could estimate them, in accordance with this photometric scale.

The Star references, Magnitudes, Mean Right Ascensions and Polar Distances, and the Mean Dates, are all worked out from the original M. S. Ledgers of Separate Results (*p*), and the Precessions, Secular Variations and Proper Motions from the Star Constants (*i*). In taking out these last, for the right hand pages, every mean position is checked by the adopted place used for the calculation of the Star Constants.

and any discrepancies are then inquired into and accounted for. When an error is thus detected all other observations of the star in question are approximately reduced to 1875, within 0.15 in R. A. and the nearest second in P. D., and thus many of the errors in the observations and reductions of subsequent years are corrected in advance, clearing the way for the time when the catalogues of those years reach the stage of publication; and hence the reasonable hope for more rapid progress in future.

The press copy is next prepared by an assistant, and the proof sheets are revised by the Astronomer, reference being then made to the printed sheets of the Separate Results. This precaution pretty effectually exposes any errors made in the previous steps of calculation, as well as in copying out and is a severe check upon the work. The precessions, secular variations and proper motions are again compared with the Star Constants (*i*) and the foot notes are revised.

The Catalogues of Mean Positions are therefore not prepared until the Separate Results for a year are going through the press and are consequently now only up to 1870.

(*r*) The Tables of Instrumental Corrections for each year, are prepared by an assistant; from the Note Books (*b*) for Index and Run, and from the original red Day Books (*f*) for the remaining columns. The proof sheets are checked by the Astronomer by comparison with *c*, *d*, *m*, *n* and *o*. The press copies are ready up to the end of 1883.

(*s*) The Corrections to the Nautical Almanac Stars as given by the Madras Mean Positions, can only be prepared for current volumes, *i.e.*, for three years at a time. They are now up to 1870.

(*t*) The Errata—painfully numerous before the Astronomer had realized the inaccuracy of the old assistants' work—will, it is hoped, be fewer as the more recent reductions reach the ordeal of final revision when under publication. They are jealously watched over by the Astronomer as they turn up.

(*u*) The Introductions of so many astronomical volumes are elaborate scientific treatises, of little interest to those who want the work more than the lucubrations of the writer. These are strictly confined to the matter contained in the volume and are made as brief as possible.

(*v*) The Distribution List, requiring continual small but important alterations, is necessarily the last step before the issue of each volume.

(*w*) The Correction to Assumed Latitude is undoubtedly considerable, probably about 1 second; but its discussion will be much more readily managed when the final Catalogue is undergoing preparation.

(*x*) The Investigation of the Errors of Division of the Circle, is a task, of the accomplishment of which there seems but little hope under present circumstances. With so much work on hand and so small a staff no time has yet been available to attempt it. It is very questionable whether such a work should ever be entrusted to native observers and the Astronomer certainly cannot undertake it alone at the present time.

(*y*) The Final Catalogue for the Epoch 1875.—This will be commenced as soon as possible, most advantageously when the mean positions for the year 1875 are in print; and as every star reduced to the mean Epoch is a step towards its completion, it is by no means improbable that it may be ready for publication very soon after the last of the eight preliminary volumes is completed.

(*z*) Precessions and Secular Variations for 1875, for the final Catalogue.—These may be conveniently proceeded with as soon as the Catalogue itself is taken in hand, but as nearly a quarter of the Star Constants were calculated for the Epoch 1875 this last step may be considered as already well advanced.

9. It is most desirable that the Star Catalogue should be completed by the Astronomer who initiated it and who has throughout superintended the observations upon which it depends. Should broken health or enforced retirement compel him to

quit India before this is accomplished, it would be equally advantageous to Government, to him, and to his successor, that he should be allowed to complete the publication of the Catalogue and of his own observations and researches, which would require six more miscellaneous volumes, in England, under the supervision of the Indian Observatories Committee.

ORDER—dated 21st October 1890, No. 706, Public.

A copy of the Government Astronomer's letter will be forwarded to the Government of India with the following letter.

(True Extract.)

J. F. PRICE,  
Chief Secretary.

To

*The Govt. Astronomer*

Exd. T. K. Narayana Aiyangar

Gobt. of {1890} Madras.  
PUBLIC.

Issued

Recd.

Encl.

G.O., 21st October 1890, No. 706.

OCTOBER.

Mr. Pogson, Government  
Astronomer.

Forwarding to the Government of India the report of — with reference to the Resolutions of the Indian Observatories Committee on his report of the Madras Observatory for 1888.

21st OCTOBER 1890, No. 706A, PUBLIC.

PUBLIC DEPARTMENT.

LETTER—from

THE CHIEF SECRETARY TO THE GOVERNMENT OF  
FORT ST. GEORGE,

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,  
REVENUE AND AGRICULTURAL DEPARTMENT.

SIR,

In reply to your letter, No. 408—29-8, under date 31st May 1890, I am directed to enclose a report by Mr. Pogson, the Madras Astronomer, affording full information in regard to his staff and the work in hand.

2. In the opinion of His Excellency the Governor in Council, Mr. Pogson's answer to the strictures of the Indian Observatories Committee is satisfactory, and I am to submit that calls for explanation should precede censure. The Government has all respect for the judgment of the Committee so far as the purely scientific side of any question is concerned, but it is obvious that gentlemen sitting in London cannot arrive at a proper conclusion on details unless these are before them, and the Committee acknowledge that the report on which their remarks were passed did not contain sufficient material to enable them to "form any definite opinion." In these circumstances, His Excellency in Council considers that the severe comments in the Resolution of the Committee might well have been deferred until explanation had been sought and obtained from the Government which Mr. Pogson serves and to which he is responsible.

3. I am directed to say that there is no wish to extenuate the remissness of Mr. Pogson in the past; there is no doubt that he was greatly to blame for not publishing the observations made by his predecessors and himself in a punctual and methodical manner. He was not, however, the only one in fault; and in considering the charges now brought against him by the Committee, it is, I am to observe, only reasonable that the year 1884, when certain difficulties, or what appeared to him to be such, were removed by Government, should be regarded as the starting point. Reckoning from that year, five volumes of observations have been published by Mr. Pogson, and the Government is unable to admit that such a result is to be regarded as "very discreditable" to its Observatory. It is true that there has been an unexpected delay in the issue of the last volume of "Meridian Circle Observations of Fixed Stars," which, I am to add, has reached Government since Mr. Pogson wrote his letter of the 27th August. The cause is, however, sufficiently shown by Mr. Pogson, and His Excellency in Council can confirm the statements in respect to the illness of the Astronomer and the disorganization of the small and not altogether efficient staff.

4. In the fifth paragraph of Mr. Pogson's reply, an error into which the Committee have fallen is pointed out; it seems not improbable that had the facts been understood, the strictures made would not have been penned.

5. In respect to the complaints of the Committee regarding the meagre information supplied to them, the Government considers that the responsibility for this must rest with itself.

The yearly administration report is, as the Astronomer observes, necessarily restricted in length and devoid of technicalities. Instructions should have been given to the Astronomer to prepare an entirely separate report, suitable for submission to the Committee; but the necessity for this was overlooked, and the usual administration report was forwarded to the Government of India without remark, and seems to have been sent to the India Office under cover of your predecessor's letter, dated 29th October 1889.

In future, care will be taken to supply a full and clear report for the information of the Committee, and I am to suggest that the yearly administration report may be simply recorded in the Revenue and Agricultural Department.

6. Next: with reference to the point discussed in the fourth paragraph of Mr. Pogson's letter, I am directed to state that, while the soundness of the advice of the Committee will not be questioned by this Government, it is considered that the order of publication of past results should be left to the discretion of Mr. Pogson. The long experience and high repute of the Government Astronomer afford sufficient guarantee that his views on such a question have, at any rate, much to be said in their favor. The Government, however, founds the present recommendation partly on general grounds and partly on knowledge of Mr. Pogson's idiosyncrasies of character. Mr. Pogson has, for more than thirty years, worked on his own lines, and so long as the observations of the past are published, the Astronomer who has made them appears in some respects the best judge of the order in which they should be brought out. However this may be, the course which will lead to the most rapid and constant publication is, in the opinion of the Governor in Council, the safest to adopt, and he is confident that the most satisfactory results will be obtained from allowing Mr. Pogson absolute freedom in this respect.

7. In conclusion, I am directed to invite attention to the last paragraph of the Astronomer's letter. Mr. Pogson is now aged 61 years, and his tenure of appointment has been extended to the end of March next. The Government is not at present prepared to state whether any further extension is likely, but in view of Mr. Pogson's advancing years, his early retirement is certainly probable. His Excellency in Council would, I am to say, be glad to accede to the suggestion that Mr. Pogson should be permitted, after retirement, to complete the publication of the Star Catalogue and the observations made during his directorship of the Madras Observatory. In the event of this proposal receiving the sanction of the Secretary of State, I am to add that this Government would recommend the continued payment of the honorarium now allowed to Mr. Pogson on completion of each volume of observations, at the cost of Provincial revenues.

I have the honor to be,

Sir,

Your most obedient servant,

FORT ST. GEORGE,  
21st October 1890.

J. F. PRICE,  
*Chief Secretary.*

Exd. T. K. Narayana Aiyangar.

1890.  
PUBLIC DEPARTMENT.

From the Government of  
Fort St. George.

Issued

Recd.

Encl.

Letter, 21st Oct. 1890, No. 706A.

OCTOBER.

Mr. Pogson, Government  
Astronomer.

Addressing the Government of India on the subject of Mr. Pogson's letter replying to the Resolutions of the Indian Observatories Committee on the Madras Observatory report for 1888.

4TH NOVEMBER 1890, Nos. 740, 741, PUBLIC.

GOVERNMENT OF MADRAS.

PUBLIC DEPARTMENT.

READ—the following paper:—

From N. R. POGSON, Esq., C.I.E., Government Astronomer, to the Chief Secretary to Government, dated Madras, 13th October 1890.

I have the honor to submit my brief report upon the proceedings of the Madras Observatory during the year 1889, with regret that it is so long behind time. The inevitable interruptions arising from necessary repairs of the buildings and chief instruments, referred to in the report, are not yet quite over, and everything else has had to suffer in consequence.

ENCLOSURE.

ADMINISTRATION Report upon the Madras Observatory for the year 1889.

The year 1889 was one of serious interruptions to the general routine of the Observatory work and to the publications in hand. In last year's report it was stated that the distribution of the second volume of the new series of "*Madras Meridian Circle Observations, 1865, 1866 and 1867*," was commenced in December, and that the third volume, comprising the star observations made in 1868, 1869 and 1870, was nearly ready for press. Owing to severe illness of the Astronomer during the first quarter of the year, the distribution of the second volume and the completion of the press copy for the third were unavoidably delayed; the former task being out of hand early in February, but the printing of the third volume not being commenced until April. Long illness of two assistants, one of whom since died, and the disabling of another by his prosecution on a charge of collusion in an examination fraud, for which he was subsequently convicted and dismissed the service, were also inevitable sources of further delay. In November the imminent collapse of the roof of the transit circle room required the immediate dismantling of the instrument and the almost complete suspension of all other duties, except the time signals and meteorological records, for some months following, while the buildings and the instrument were undergoing thorough repair and renovation. In consequence of this unfortunate combination of disasters, the printing of the third volume was only half through at the end of the year, with a certain prospect of its being most vexatiously retarded during a considerable part of the following year, until the repairs and remounting of the transit circle were out of hand.

2. *Observations.*—The ordinary time determinations were made with the transit circle until November 16th, and afterwards with a small transit instrument by Dolland. The only works attempted with the equatorials were, the observation of an occultation of Jupiter on April 20th; observations on four nights in July and August of a comet, discovered by Professor Davidson, of San Francisco, and an unsuccessful search for the planet Vera in October, when probably too faint for the largest instrument available at Madras. The smaller instruments described in the reports for 1885 and 1886 were all in fair order, but the chief instruments required thorough cleaning before they could be pronounced fit for work. The transit circle has been in constant use since 1862; the Troughton and Simms equatorial since 1866, and the smaller one, by Lerebours and Secretans, since 1846; and without complete dismantling and renovation it cannot be expected that they can now be in efficient working order. The time has arrived when all three must be taken in hand, but the task is a very formidable one and will be a source of inevitable delay to publication and all other pursuits until completed.

3. *Madras Mean Time.*—This is communicated several times daily to the Madras public and to the shipping in a variety of ways, besides a daily time roll to the Government Telegraph Office at 4 P.M., which is passed on throughout India to Government telegraph stations, with sufficient accuracy for all ordinary purposes. The Fort time-gun is the chief and most trustworthy of the local signals. It was fired with unerring accuracy at noon and 8 P.M. on 717 occasions out of 730 in 1889, making a percentage 98½ correct signals—the highest yet attained since its electrical discharge was first undertaken in 1870. Yet an insignificant

semaphore, for which nobody is immediately responsible, seems to find more favor with the shipping. Electrical currents leave the Observatory hourly without fail, and those at 8 A.M. and 2 P.M. should drop the semaphore, but its failures are too frequent, and, under existing circumstances, its performance cannot be checked from the Observatory. Two sympathetic clocks—one over the Custom House and another inside the hall of the General Post Office—are under electrical control from the Observatory and work satisfactorily; though the former, owing to its inevitable exposure to sunshine and sea-air, requires far more frequent oiling and cleaning than the other, which is well sheltered and therefore less liable to stoppages; a third similar clock, placed on the north side of the Public Works Office at Chépák, was going throughout the year, but not under electrical control, being simply wound and adjusted weekly and hence holding no claim as a public time regulator. An excellent clock over Messrs. P. Orr and Sons' establishment in the Mount Road was also regulated by means of hourly signals from the Madras Observatory.

4. *Meteorology*.—The Madras Meteorological register was continued in the form adopted since the year 1861, and the results were communicated to the Meteorological Reporter, Madras, besides being published in a Supplement of the *Fort St. George Gazette*, and in the two leading local newspapers. Weather telegrams were despatched to Simla about 8½ A.M. daily throughout the year.

The meteorological records during 1889 showed a great deficiency of healthy wind and rainfall. The former only averaged 148 miles per day instead of 172 miles, while the rain was 6 inches below the 75 year mean of 49·5 inches, and would have been much less but for an unexpected downpour of 12 inches towards the end of December. No cyclone visited Madras, though three distant ones had a marked effect upon the weather in November and December.

5. *Madras Observatory Publications in store at the end of 1889*.—No change occurring in this list since 1888, its reprinting is unnecessary until after the issue of the next volume in hand.

6. *Service Books*.—These are in order as required.

ORDER—dated 4th November 1890, No. 740, Public.

Recorded.

2. The report was received more than four months after the date on which it was due.

(True Extract.)

J. F. PRICE,  
*Chief Secretary.*

To the Government Astronomer.

ENDORSEMENT—dated 4th November 1890, No. 741, Public.

Copy to the Government of India, Department of Revenue and Agriculture.

J. F. PRICE,  
*Chief Secretary.*

Gobt. of {1890} Madras.  
PUBLIC.

Issued

Recd.

Encl.

G.O., &c., 4th November 1890,  
Nos. 740, 741.

NOVEMBER.

Madras Observatory.

Recording the Administration Report on the —  
for 1889.

Public

Sept.

[Note  
Read Nos. & dates & in the  
last case print & 5 of the  
Astronomer's letter of 27 August  
last.]

Read again

G.O. No. 186 Public, 7 Feb/88  
" " 706 Public, 21 Oct/90  
" " 740 Public, 4 Nov/90

IN ORDER 27 Nov. 90. No. 816.

The Jamb. Astronomer will  
be requested to <sup>annually</sup> submit  
a report such as that  
described in the <sup>last clause of the</sup> 5th  
paragraph of his letter  
of 27<sup>th</sup> August 1890, for  
the Indian Observatory  
Committee.

2. The report will relate  
to the preceding calendar  
year & should reach  
Jamb. not later than  
1<sup>st</sup> March.

The first to be submitted  
will be that for 1890.

S  
15 Nov.

24/5  
23/11/90

Jamb. Astronomer despo g/f  
12/12/90 15/11

1  
XX  
*Observatory report*

27TH NOVEMBER 1890, No. 816, PUBLIC.

GOVERNMENT OF MADRAS.

PUBLIC DEPARTMENT.

READ—again the following papers :—

G.O., dated 17th February 1888, No. 186, Public.

G.O., dated 21st October 1890, No. 706, Public.

Read—the following :—

Extract of letter from the Government Astronomer, dated 27th August 1890.

Para. 5. The Committee reasonably complain of the very meagre reports at their disposal to enable them to judge of the amount and nature of the work done. This arises from the circumstance that the Astronomer has never before been called upon for, or authorized to submit for their information, any detailed report, such as would furnish them with the particulars they desire. Heads of departments, the minor ones especially, are expected to be very brief and to avoid technical details not intelligible or interesting to the general public in their annual administration reports, and these are all the Committee have yet had under their consideration. A totally different style of report should be furnished to the Committee, as soon as possible after the close of each calendar year, and such a report would be just as unsuitable for the annual administration report as that is for the requirements of the Committee.

G.O., dated 4th November 1890, No. 740, Public.

ORDER—dated 27th November 1890, No. 816, Public.

The Government Astronomer will be requested to submit annually a report such as that described in the last clause of the fifth paragraph of his letter, dated 27th August 1890, for the Indian Observatories Committee.

2. The report will relate to the preceding calendar year and should reach Government not later than 1st March. The first to be submitted will be that for 1890.

(True Extract.)

To the Government Astronomer.

Chief Secretary.

Exd. P. L. Pereira.

*Hell.*

*Mr.*

*1890*

*C. 20/11*

*R. 26/11*

Govt. of {1890} Madras  
PUBLIC.

Issued

Recd.

Encl.

G.O., 27th Nov. 1890, No. 816.

NOVEMBER.

Madras Observatory Report.

Instructing the Government Astronomer regarding the submission annually of a report for the Indian Observatories Committee.

BACK PAPER, No.

OF 18

ORDER OF GOVERNMENT

FURTHER PAPER, No. 1782

OF 1891

No. 186. 877<sup>th</sup> Feby 88 - 97

" 706 87 21<sup>st</sup> Oct 90 - 97

" 740 87 4<sup>th</sup> Nov. 90 - 97

Print extract - paras of the  
Govt. action order's letter  
of 27<sup>th</sup> Augt. 1890.

ENCLOSURES.

CURRENT No.

STATEMENT WITH DITTO.

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46 - 15-12-90-