PRACTICAL ASTRONOMY IN TASMANIA, AND A PROPOSAL FOR A SCHOOL THEREOF.

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The leading English scientific newspaper "Nature," dated 24th July, 1902 (p. 304), has a paragraph on the present condition of meteorology in Australia. It is worth reading:—

> "We understand from recent Queensland newspapers that it has been determined to abolish the Weather Bureau of that colony as from the 30th ult., and that the services of Mr. C. L. Wragge and his special staff have been dispensed with. In a letter addressed by the Premier of Queensland to the Federal Prime Minister it is pointed out that this apparently retrograde step is owing to the urgent necessity for reducing in every branch of the public service the estimates of expenditure of the State, and that it is one of the "most unfortunate" results of the large deficit in the revenue brought about by drought and other causes. Prior to federation, the Weather Bureau formed part of the Post and Telegraph Department of Queensland, and all telegrams and correspondence passed free. But during the last fifteen months the Federal Government has charged for these communications at the rate of about £4,000 a year, which expense cannot be borne any longer by the Queensland Government. The Premier writes that he feels sure the States in general will welcome any reasonable suggestions for a continuance of the work of the Bureau under federal control. We may, therefore, hope that the existing instruments and stations will be utilised, as far as practicable, in the interest of meteorological science. Truly the Colonies are in this respect following the mother country, and we may soon expect the Empire, so active in neglecting science, to be the laughing stock of civilised peoples."

Our meteorological service has been, as you all know, closely connected with the Queensland one, to the advantage of both.

Apparently it is the federation of the States that has brought about the disastrous check to what is both a commercial and scientific work in this part of the world, and I think you will all agree that it is the Federal Government

which is responsible for helping the various States back to their original efficiency in these matters.

I leave to others the task of defending the utility of meteorological observations, and will immediately proceed to my more special theme; but, before dismissing meteorology, I would like to remind any who may hear or read this paper that *continuity* in meteorological records is essential for their full utility, and it is pennywise and pound foolish to establish such records for a time, then discontinue them, and later undertake them once more.

The meteorological service in this State, as in many other parts of the world, is performed by the same staff as the astronomical service, and it is of this last I wish to speak in full.

I shall not hesitate to repeat what I have already said to the Society two months ago, partly because it refers to a matter that I think the public should, for its own benefit, take seriously to heart, and partly in order to make the present paper complete.

I propose to consider our subject under the following heads:—

(1) Practical astronomy of Tasmania in the past.

(2) The uses and desirabilties of practical astronomy in such a community as ours.

(3) The present.

(4) Proposals as to the future.

I.

Practical Astronomy of Tasmania in the Past.

With regard to the past I propose to say very little, though it would be interesting if somebody could be induced to look thoroughly through the proceedings of this Society and elsewhere to make a proper history of the subject.

Mr. Kingsmill two months ago gave you some account of the official work for the Government performed in the past. I would like to call attention to the other practical astronomical work that has been done here.

We have had two enthusiastic astronomers in our midst, who performed their work merely for the love of it, true amateurs, in the highest sense of the word—Mr. Abbott (died 1883) and Mr. Biggs (died 1901). Each of these had a private observatory, furnished with very fair instruments, and each did useful work. I am sorry to say that, as far as I know, there is no such amateur, with the necessary instruments in the State to-day.

It is of interest to know that what are, I believe, the two most valuable instruments which belonged to those two observers are likely now, after a number of years of idleness, to be put again to useful work.

The transit instrument of Mr. Abbott has recently been acquired by the University by purchase. It has been housed and nearly completely repaired. Its various adjustments in its new home have just been commenced by the students of the University. It is a larger instrument than the Observatory possesses, and it is probable that its performance will be found correspondingly more accurate.

I may say for the benefit of those of my hearers who are not conversant with the technical terms of Astronomy that the chief object of a transit instrument (other than one of the first class, which has additional uses) is to obtain the true time as accurately as it can be obtained. No other instrument is nearly so accurate for this purpose, and the time in all the States of Australia is at present obtained by means of transit instruments.

Mr. Biggs' equatorial telescope was left by him as a bequest to the Royal Society. The Royal Society has recently offered it on loan to the University, and it is at present stored at the University, though not in such a way as to be capable of use. The University has not yet signified its acceptance of the loan, probably because an expense of some £60 will be necessary to house, mount, and repair it. This telescope is an 8¼-inch reflector (Newtonian), and is, therefore, much superior to the equatorial at the Observatory.

It is much to be hoped that the University will see its way to accepting the offer, and so secure (let us hope for all time) the benefit to students of observing the wonders of the Heavens, after listening to the dry-as-dust description of them in the lecture room. It is to be remarked also that the students may be expected, with such an opportunity, to add to the knowledge of the human race,and this is no little reason why the offer should be accepted.

I look forward to the time when an Astronomical School of renown shall be firmly established here. Our opportunities in the matter of position are great. Let us not neglect them for petty passing reasons.

While considering practical astronomy in Tasmania in the past, we ought not to omit a reference to the transit of Venus in 1874. The main interests of that transit were, of course, world-wide, but Tasmania (did she but know it) has herself benefited by the visually insignificant fact that in 1874 Venus passed between the earth and the sun, and therefore was visible as a dot on the sun's face. Tasmania's gain is

owing to the fact that on account of her valuable position in the far south, in this matter of finding the sun's distance, as in many other astronomical respects, she was at once seen to be a place where the necessary astronomical observations ought certainly to be made. But the Astronomer Royal of England said "No," for we do not know her longitude sufficiently accurately—and that was true, we *did* not. America came to the rescue. "Why not," said America, "find the longitude accurately?" So they came, found the longitude, observed the transit, and went.

I will not preach here of the importance of knowing the longitude. I will only say that it is a very complicated matter to obtain it, a matter requiring costly instruments, much knowledge, and much painful training, and the result is that we know where we are on this planet.

The result with regard to longitude is that for all time we know the following fact:—We know that a certain piece of masonry (at present in existence in the Barrack Square) is 9m. 25.66s. east of the centre of the transit instrument in Melbourne. The Melbourne longitude is itself in doubt, and I will now read you an extract from a letter I have received from Mr. Baracchi, the Victorian Government Astronomer, on that point:—

> "(1st) The present adopted longitudes of Sydney and Melbourne are:—Sydney, 10h. 4m. 49.44s.; Melbourne, 9h. 39m. 54.00s.
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> "The Nautical Almanac still persists in giving the values adopted by Ellery Russell, and Todd, in their longitude report of 1886. I suppose, as the differences are small, and the values by no means final, it is considered unnecessary to introduce changes at present. In the American Ephemeris the value 9h. 39m. 54.00s. is adopted for Melbourne, and 10h. 4m. 49.54s. for Sydney.
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> "When it will be time to introduce changes in our longitudes, my values of 1895 (Report A.A.A.S., 1895, pp. 185-208) will have to be further reduced, owing to the smaller values obtained for Madras later. I adopted for Madras 5h. 20m. 59.275s. The new and latest determination, gives 5h. 20m. 59.113s. Adding this to former results, with double weight, we obtain 5h. 20m. 59.167s., which, in my opinion is, at present, the best available value for the longitude of Madras, and, as no further measures have been made east of Madras since 1888, the longitudes of Sydney and Melbourne may be considered to be—Sydney, 10h. 4m.

49.33s.; Melbourne, 9h. 39m. 53.93s. (0.04s. was dropped arbitrarily when Zone time was introduced, simply for convenience).

"But I have no intention of altering our longitude at present, for two reasons—(1st) Because the values are by no means final. (2nd) Because there will be probably soon, an opportunity for fresh independent determinations of Australian longitudes via America, and via Cape of Good Hope, through Cocos Island.

"(2nd). The uncertainty of the present longitudes.—On the strength of the new Madras value, I think that the values—Sydney, 10h. 4m. 49.33s.; Melbourne, 9h. 39m. 53.93s.; Hobart, 9h. 49m. 19.59s.; are within 0.7s. for Melbourne and Sydney, and within 0.8s. for Hobart.

"(3rd). The true value of Harkness' position relative to Melbourne.—This value is 9m. 25.66s. (This is the only available value). [Harkness was the chief of the American 1874 transit of Venus Expedition to Tasmania.]

"(4th). Harkness' position.—This is his transit pier."

The piece of masonry in question is really very precious to Tasmania. If she allows it to become undecipherable, she will be put to much expense and much trouble once more to determine her longitude.

Commander Pury-Cust some time ago recommended that this piece of masonry should be suitably inscribed with the record of its meaning. This could be done at a trifling cost, and I believe will be done, but in case there should be hesitation on the part of the public or Ministry, I now make the necessary appeal. The only reason that the Premier has not yet been informed (for he has not) what to put upon the stone is that his advisers (Mr. Kingsmill and myself) have not yet found exactly what the record ought to be.

Mr. McDonald, of the Observatory, first informed me of the special nature of the observations, which were made by the American Transit of Venus Expedition, and led me to recognise the meaning of the three marks left by them in the Barrack Square. He has also lent those stereoscopic photographs of the instruments and position used, which are now in your hands. I should like to enter into more detail about the transit operations, but I have not time.

Two students of the University (Mr. McDonald and Mr. Kay) have lately found by surveying with instruments lent by Mr. Walker (an old student and present graduate),

that the Harkness position and the present Observatory are situated relatively thus:—

Present Hobart Observatory relative to the transit of Venus (transit instrument) pier.

Lat. 3.61″ S., Lon. 0.051 s. W.

The present (1902) revised position of our Observatory is therefore

Lat. 42° 53′ 28.2″ S., Lon. 9h. 49m. 19.54 s. E.,

whereas in recent years the adopted values have been

Lat. 42° 53′ 28.3″ S., Lon. 9h. 49min. 19.76 s. E

II.

The Uses and Desirabilities of Practical Astronomy in such a Community as Ours.

I will now repeat and correct my remarks of two months ago. I said then that the keeping of time was so necessary for an island State such as Tasmania that it was imperative to know the time as accurately as possible. This I still believe. I also said (in the deputation of this Society to the Premier) that a first-class Observatory kept time to 1/100 of a second. This I said in ignorance. It is not so. Of this, more directly.

It is imperative to know the time as accurately as possible for this reason: Mariners depend upon the time for their position. I could say how they know their position North or South of the Equator by direct observations with the sextant, but this would occupy too much time, and I will only speak of how they determine their position East or West of some ascertained spot. They do this by means of their chronometers and sextant observations. If ocean mariners had a say in colonial politics, they would undoubtedly say, "Please give us time correctly; chronometers are excellent in their way, but their indications depend ultimately on observations of the stars, and these observations can only be properly carried out at fixed Observatories."

The rate of chronometers at sea is of the utmost importance, not only to mariners, but to the general public who travel by sea, for an error in the rate of one second in two days may mean an error of ten seconds in 20 days, and an error of 10s. in the chronometer may mean nearly three statute miles' error in position.

Is Tasmania a place where time should be kept accurately? I have no hesitation in answering "Yes." Tasmania has a port where steamers from South Africa call on their way to distant ports; other steamers call which are destined for a long voyage (say, starting from Sydney), after staying for a time at Hobart. It is absolutely necessary

that we should be able to give them the same time as they received in Sydney, for if they receive it from us, they can ascertain their chronometers' rates at sea, and they cannot obtain these rates otherwise.

I have said before, and I say again, that it is in extreme cases sometimes necessary to know the time to one second, in order to make the necessary provision that means all the difference between life and death to many souls.

With regard to this question of keeping time, I again quote from Mr. Baracchi's letter, and you will see that I was wrong in saying that in a first-class observatory an accuracy of 1/100 of a second was attainable:—

> "(5th). Whether an accuracy of ∪.01s. is attained in time keeping at this Observatory.—In time determinations, we aim at an accuracy of 0.01s., but I do not think we attain it often. I can't say whether we ever attain it. Under the best conditions in regard to atmosphere, instrument and observer, with a complete set of observations, viz., from six to ten standard clock stars, and from two to four azimuth stars, the clock error at the middle time of the observations can be determined probably within 0.03s.; greater accuracy is possibly attained on occasions, but is uncertain. Changes in personal equation are the disturbing causes.
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> "In ordinary time-keeping, viz., dropping of time signal at 1 p.m., and rating chronometers for the shipping, in all of which cases we *have* to *rely* on the rate of the standard clock for several hours, the uncertainty is much greater and the limit of accuracy that we can depend upon with safety is 0.1s."

I should also here like to read a quotation from Mr. Morton's paper in the Papers and Proceedings of the Royal Society for 1900-1901 (p. 122), and another from the paper by Mr. Abbott, to which Mr. Morton's paper directed me:—

> "In May, 1865, the attention of the Society was directed to the necessity of some method of establishing a time signal which should give the time regularly, so as to be available for the whole of Tasmania. The first duty of fixing a time signal was soon after undertaken by Colonel Chesney, who arranged for three guns to be fired at 4 p.m. on the first Thursday in every month, or, if that day proved wet, they were fired on the first fine day following."

[Quotations from "Time Signals," by Abbott, May, 1865, p. 45.]

That it is highly desirable in the interests of science to establish a practical School of Astronomy in Tasmania is illustrated by the discussions which arose in connection with the Leake Bequest. The whole of those discussions have a most direct bearing on our present position. The Leake Bequest of £10,000 purported to establish a School of Astronomy, but, unfortunately, the money proved not available for that purpose. At the same time, the possibilities led to a discussion of the suitability of Hobart for astronomical work, and I will now read extracts from the proceedings of the Royal Society of 1892:—

[Quotations from "Leake School of Astronomy," by Russell, p. 26, and from letter by Waterhouse, p. xiv.]

III.

Practical Astronomy in the Present.

Practical astronomy in Tasmania in the present, I am sorry to say, consists solely of what the Government is prepared to believe is useful; that is to say, it consists of keeping time for the whole island by the transit instrument at the Observatory. As accurate time is kept as it is possible to keep by such means, and it is telegraphed every day to very many points in Tasmania automatically from the Observatory clock. The ball—that is, the mariners' signal—is not, but undoubtedly should be, dropped automatically. There is no standard clock in the Observatory, and the public of Tasmania depends on the charity of two private citizens for their clock service.

Not even surveyors (unless lately) make practical astronomical observations in order to determine their meridian. I remember some years ago being rather surprised at a well known surveyor's evident delight in finding a new (to him) and very accurate (compared with his old compass method) means of determining his meridian. This struck me, and still strikes me as something pathetic. I cannot help thinking that if we would allow ourselves a little more outside enlightenment, we might save ourselves a great deal of expense and worry, if only in litigation.

IV.

Proposals Concerning Practical Astronomy in the Future.

In what I have now to say, I would ask you to remember Mr. Russell's remarks in connection with the Leake Bequest, which you have just heard. The advantages of combining the teaching of practical astronomy to students with observing are there properly emphasised.

Probably, if what I have now to propose should be adopted, such a School of Astronomy as Mr. Russell anticipated, would grow up, even without the inestimable advantage of a bequest of £10,000, and such a school would be a great benefit to the whole of Australia.

The Meteorological Department is over-worked, undermanned, and under-paid. It is inevitable that under these conditions some of its work is not as efficiently performed as it would be were its resources adequate.

My proposal is that that department be relieved of the astronomical work, but let it be most clearly understood that I, for one, will not counsel any such re-arrangement of duties if a single penny be as a consequence diverted from the Meteorological Department.

I propose that, leaving the pecuniary position of the department precisely as it is at the present, the whole astronomical work be forthwith handed over to the University. It may be asked how this is to be done, since the University finds difficulty in performing its present duties efficiently.

I will now make certain definite suggestions for the effecting of this scheme. The suggestions are definite, rather because I want a practical discussion here and elsewhere to be raised, than because of their intrinsic merit.

Let those who are competent pull the suggestions to pieces as much as they like, so long as the main object is kept in view, namely, the high desirability of laying the foundation of a really valuable School of Astronomy in Tasmania. Such a school (there are many in the United States) would be a benefit and a credit to the whole of the Commonwealth, and it would also be a benefit to the world at large.

I would submit then to your consideration the following suggestions:—

(a) No funds to be diverted from the Meteorological Department.

(b) The Meteorological Headquarters to remain in the Barrack Square, as at present, even if the Square be altered, as lately suggested by the Minister of Lands.

(c) The Government astronomical work to be handed over to the University on certain conditions.

(d) All the astronomical instruments to be transferred to the University grounds, and re-erected there, at the cost of the Government.

(e) Loan of the Transit Instrument in the possession of the Melbourne Observatory, which for many years was lent to Adelaide, to be asked for.

(f) Automatic connection between the Observatory clock and the time ball to be established by Government.

(g) Proper clocks to be provided by the Government.

(h) The University to grant site of new Observatory, and site of a residence for a new officer.

(i) The new officer to have the following duties:—

(a) Observing time for the island.

(b) Teaching in the University, astronomy, surveying, practical physics, and such parts of the mining course as it is possible and desirable for him to do.

(j) The salary of the new officer to be £350 a year, of which the Government provide £150 and the University £200.

(N.B.—The Observer would have to reside at the University. He might perhaps live in the house at present occupied by Professor Williams. If he lived rent free, the University's contribution to his salary should perhaps be only £175.)

In conclusion, let me say that the University is faced with the unpleasant reality that it cannot continue to teach what it professes to teach without the appointment of some such officer. I am recommending merely that his appointment be seized as the opportunity of starting what in the future may be of inestimable value to the whole world—the establishment of an efficient School of Astronomy, in a high southern latitude, and in a climate peculiarly suitable for astronomical work.