

an array of facts as a trained geologist can gather in the field, and by boldly announcing the conclusions to which the study of these facts has led him. But much more may be made of them than he has yet given us. And we trust he may be encouraged to continue the investigation he has so well begun.

ARCH. GEIKIE

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

The Marine Biological Association

WILL you allow me space to ask all naturalists and lovers of science who intend to become members of the above Association to send their names and subscriptions *without delay* to Mr. Frank Crisp, 6, Old Jewry, London, E.C. The subscription is one guinea annually, or fifteen guineas for life membership. It is highly desirable that intending members should at once enrol themselves, since the first meeting of the Association for the election of officers and council for the year 1884-85, and for the ratification of by-laws, will be held in London at the end of this month, when Prof. Huxley will be nominated as President. Donations, whether large or small, are earnestly solicited. Those who are interested in the natural history of marine plants and animals, and who foresee the immense help to this study which a well-equipped laboratory will afford, are begged not only to give some pecuniary aid to the present enterprise, but to constitute themselves agents of the Association and to do their best to persuade others to contribute to the fund required for building the first biological laboratory on the English coast. It is only by hearty and earnest support of this kind that our object can be realised.

I may add that several naturalists have contributed each 100*l.* to the Association, others 25*l.*, and others less, according to their means and their sympathy with our object. Of the 10,000*l.* required, we have not yet obtained half.

E. RAY LANKESTER,
Secretary (*ad interim*)

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The Equatorial Coudé of the Paris Observatory

IN continuation of my first letter I now proceed to answer M. Lœwy's second letter, as published in your issue of May 15 (p. 52).

M. Lœwy has not, as I said in that former letter, raised a single objection which had not already been anticipated and discussed with the exception of one which I shall treat of further on. The several points in this letter I shall dispose of very shortly.

I. As to the dialyte construction, I have to reply that that particular method of achromatising the objective is not an *essential* feature of this instrument. Whether it be adopted or not is in fact much a question of *cost*. If the purchaser desires to get the largest possible aperture at least expense, then I would make it a dialyte, for, notwithstanding all M. Lœwy says, good work can be and has been done with dialytes. If, however, the most perfect instrument is desired, I would dispense with the dialyte construction, and achromatise the object-glass in the ordinary way, which is quite as applicable to my construction of equatorial as is the dialyte. If I mistake not, the celebrated observer M. Dembowski observed for many years with a dialyte, and spoke highly of it; he says: "*L'achromatisme est excellent*." Again, the present director of the observatory, for whom the first of these instruments is to be made, has worked already with dialytes, and he would not be likely to recommend this construction if his experience agreed with M. Lœwy's. I desire to notice just one further point in this part of M. Lœwy's letter, as it is another example of how his own words (unintentionally, no doubt) confirm my statements. He says (speaking of the limited field of view of dialytes): "But, in order to turn the difficulty, he" (Mr. G.) "suggests that since the field of view

becomes smaller as the instrument becomes larger, we may content ourselves with observing at a central point." I never said this; my words were: "The definition at the edge of the field, however, is not so good as in the ordinary form, but this would not be of so much consequence in large instruments, as the field in such cases is never of great extent." And M. Lœwy himself corroborates this for me when he says: "For the observation of comets I have such an eyepiece, which magnifies fifty times, and has a field of view such that I can observe a degree (*i.e.* with the 12" equatorial *coudé*); for a telescope of 27 inches we might have such an eyepiece with a field of 24 minutes." Thus I have a distinct corroboration from M. Lœwy of what I said above.

2. Writing on the matter of stability, M. Lœwy curiously mixes up stability and accuracy of movement. Now while I claim that I can and will obtain greater stability in my form than exists in M. Lœwy's, I do not claim accuracy of movement, but on this point I propose to say very little at present for several reasons. In the first place, it would hardly be possible to discuss this and put it in an intelligible form to your readers without a careful drawing; secondly, the well-known stability of the instruments which have emanated from my workshops are quite sufficient guarantee that this point is not one likely to be neglected in any of my work; and thirdly, I find it utterly impossible to understand the sentences of M. Lœwy's paper bearing on this point, and if I, though familiar with the proposed construction, fail to understand them, I am hopeless of serving any useful purpose by discussing them in your columns, particularly as few of your readers have ever seen the design of the instrument referred to. M. Lœwy talks of "all movements of transmission being broken at right angles." I do not know what he means, but he omits to tell your readers that, according to my design, in the larger sizes I propose that all movements be effected by two hydraulic cylinders the valves of which are within reach of the observer while sitting in his chair; so that, without more physical exertion than is necessary to open a water-tap, he has full command of all the movements of the great instrument, a pair of vertical scales on the walls of his study giving the approximate position of instrument in R and declination, an arrangement eminently calculated to reduce the work of the observer.

3. Lastly, as to its want of universality. This is distinctly stated in my paper as a disadvantage of my form; but when M. Lœwy asserts that "it is based on a principle which no astronomer can admit, *viz.* that it is superfluous to observe the greater part of the northern heavens," it is evident that M. Lœwy has here gone too far, since that portion of the heavens within 20° of the Pole is only about 6 per cent. of the northern hemisphere. Ask any practical astronomer possessing a moderate-sized equatorial how many hours out of the total number of hours which he has worked in the year has his instrument been pointed to objects within 20° of the Pole, and, with the exception of a few who apply themselves to special work, the great majority will give a reply which will show how very little will be lost by the fact that this instrument cannot command that portion of the heavens. I have myself put this question to many, and with the result above mentioned. On this point I cannot do better perhaps than give an extract from a letter I have just received from the director of one of our public observatories:—"Instruments of large aperture are rarely if ever used for observations where extreme accuracy of measurements is required, such as annual parallax, nor for searching for nor observing comets, except to search along a known track for an expected periodical comet. This your instrument could do well. There is hardly an instrument in existence which is equally well adapted to all kinds of observations. The circumpolar zone of about 20° may be explored by other instruments, but for almost every kind of *systematic* work the remainder of the visible heavens will give plenty to do." The foregoing would be a sufficient answer to a question which M. Lœwy has put directly to me.

He says:—"Permit me to ask Mr. Grubb how he is going to study that part of the heavens which lies between 20° from the zenith and the Polc."

To any one who has seen my paper it will be evident that this point, which in M. Lœwy's letter is put forward as a discovery of his own, was already fully dealt with by me. I said: "The instrument commands the heavens from east to west and from south horizon to about 20° beyond zenith." And again: "As regards this instrument (equatorial *coudé*) I would observe that it possibly possesses an advantage over my form in being absolutely universal."