

THE TOTAL ECLIPSE OF THE SUN.¹

II.

KIÖ ISLAND, August 8.

A LOVELY morning. The sun remained unclouded till long after eclipse time, giving thereby an additional proof of the advantage to us of the short nights. There is no time either for any considerable reduction of temperature or for the accumulation of any great amount of moisture in the air; hence unclouded sunrises, and the sun strikes hot soon after rising.

The beautiful harbour in which the *Volage* is lying looks its best in early morning, as the face of the nearly vertical cliff, which swarms with bird life, lies nearly west and south, facing eastwards.

I am glad to say that the last adjustments have been made, the last demonstrations given; numerous rehearsals have landed us in the perfection of drill; the parties all know their stations, and all necessary forms

economise the greatest amount of time, two marines stand to Mr. Fowler's right and left, to hand and receive the slides as they are inserted in and drawn out of the camera. The exposures to be made are generally very short, in fact they are all snap-shots with the exception of only two, one of them extending to half a minute.

The plate-holders are ten in number; each is capable of holding five plates, which are exposed by slipping them in turn into the focal image; this operation is controlled by a catch. The hut in which this instrument is housed is one brought out from home; the framework is covered with waterproof canvas so arranged that the roof can be removed at any time for observation. A dark room for photographic work is also attached.

The instrument under the charge of Dr. W. Lockyer is also a prismatic camera, but of 9 inches aperture, and rather differently mounted. The tube carrying the camera, prism and lens is fixed horizontally, and the light is thrown on to the prism by means of a siderostat.

The work intended to be done is to obtain ten photographs in all; two snap-shots, seven with different times of exposure, the greatest amounting to thirty seconds, and lastly, a "dropping" plate. This last-named is intended to be exposed as near as possible ten seconds before the end of totality, and carried through until fifteen seconds after, the plate being moved slowly in the direction at right angles to the length of the spectrum. The object of this motion is to obtain an unbroken record of the changes in the spectrum during this interval of time.

As timekeeper for this instrument Midshipman Bruce has been selected, his duty being to keep Dr. W. Lockyer informed of the time a few seconds previous to totality, and also to note the times and lengths of the exposures made during totality. One of the ship's carpenters, Sullivan, operates with

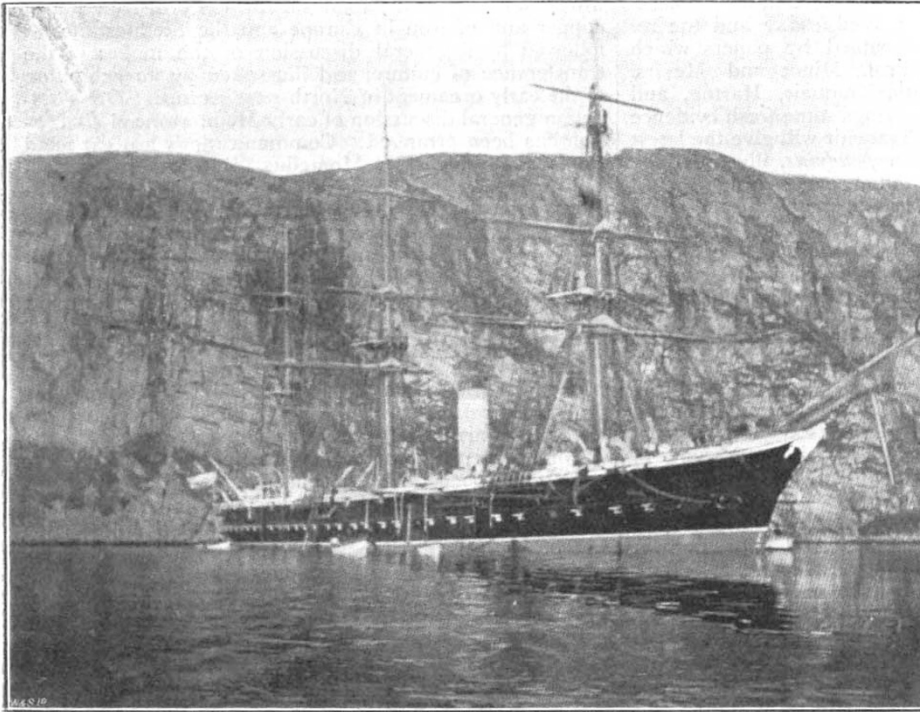


FIG. 5.—The *Volage* at anchor.

have been written out. We are going then to-day to "stand easy," and take some rest in preparation for the fateful to-morrow.

I take advantage of the pause to continue my notes. I confess I am keenly interested in our now tremendous eclipse party. I will first of all, then, deal with its progress, and especially with the final arrangements made for the larger instruments.

The *personnel* of each fixed instrument is as follows. Mr. Fowler has charge of the 6-inch prismatic camera, and he receives the following assistance.

As timekeeper Sub-Lieut. Beal offered his services, and his duty is to give Mr. Fowler warning some seconds before the commencement of totality, and to record the times of exposure of the fifty plates intended to be used. Roberts, an A.B., acts as exposer, taking off the cap from the prism at given signals. To

the cap in front of the prism, acting on instructions given to him by the observer. Two bluejackets are also employed in handing and replacing the dark slides as they are required.

The whole work of using the integrating spectroscope is left to members of the ship's company. Lieut. Martin has been selected as director, and he has as his assistants Midshipman Woodbridge as "exposer," Midshipman Brendon as timekeeper, and Midshipman Silvertop to keep the sun's image on a small screen for the purpose of correct orientation.

The instrument is set up on a board inclined at the angle representing the altitude of the sun at the time of eclipse, and movable in azimuth by means of a milled-head-driving screw turned by hand. By this means the collimator can be directly pointed towards the sun, which does away with the necessity of using a second siderostat, and this is all the more important because we have not a

¹ Continued from page 400.

second siderostat. The intention is to make three exposures with this instrument.

The whole apparatus is housed in a tent made by the carpenter out of ship's material, spare spars and a sail. The peculiar appearance of the hut has resulted in its being named by the sailors Porcupine Cottage. The hut for the 6-inch, which adjoins it, is called the Town Hall.

With regard to the other branches of work, in some of which the numbers assisting are large, the senior volunteer in each has been made responsible for the preparation and subsequent signing of forms, and representative in general of the party. The Chaplain, the Rev. E. J. Vaughan, whose interest has been unflagging throughout, has been good enough to act as intermediary between these representatives and myself, so that the closest touch has been kept. It was thought desirable that in addition to acting on the general instructions, each party should know the special points on which information is desired. A request for detailed answers to certain questions has been therefore placed in the hands of the head of each section.

I have said that this morning was lovely; yesterday — the 7th — was not by any means a pleasant and bright day, but the rain managed to keep away and allow work to be carried on in the camp, in which the preparation and the rehearsals have been vigorously continued. The first boat leaves the ship at about five each morning, so as to secure drill at eclipse time, and from this time onwards there is a continual passage of boats from ship to camp and back again, as the various observers are released from their work, which goes on incessantly, not only on board among the guns and masts, but in the fjord, in the shape of firing and boat parties, the firing being strongly objected to by the inhabitants of the "loomery," which is hard by.

The birds, which in our stay we have become acquainted with, are of several kinds. Foremost among these is the white seagull, which has its home on the crags and ledges of the cliff to the west of the *Volage*. These birds literally swarm here, but apparently seem to be divided into distinct societies; indeed, on the cliff there are three or four separate "loomeries," and the birds in each of them always keep together and seldom, if ever, intermix with those in others. At apparently fixed times they fly down from their ledges and form a teeming, hurrying, clamorous throng, eddying in front of the face of the cliff. The young birds at the time are just beginning to fly, so the noise is perhaps greater than usual. After we had been here a few days they all became very tame, and swam around the ship. On Starvation Island several young ones were found; these could be easily located by paying attention to the utterances of the parent birds flying overhead, which became louder and louder the nearer the right spot was approached.

The young birds were found always in small pools

between the rocks, generally lying under small bushes of grass overhanging them. The bluejackets, when ashore, caught many in this way, and it was amusing to see these birds walking about the fore-castle as if owners of all they surveyed. An amusing incident occurred on the evening the *Volage* arrived from Vadsö. Lieut. Martin and Sub-Lieut. Beal, on going on board the sailing cutter, found a dead gull in the bottom of the boat; on further examination, no less than 20 to 25 more were found stowed away in the stern. On making inquiries of the bluejackets as to their presence, they replied that they had collected them for supper in case the ship did not arrive that night, as provisions were rather short. The ship, however, did arrive, so that fried gull was not indulged in.

The shag, or green cormorant, abounds also in great numbers. These birds are far from beautiful, and were disliked by everybody. Many of them were too fat to fly properly, and when disturbed they managed to make themselves scarce by flopping over the surface of the water. The reverse was the case with the prettily

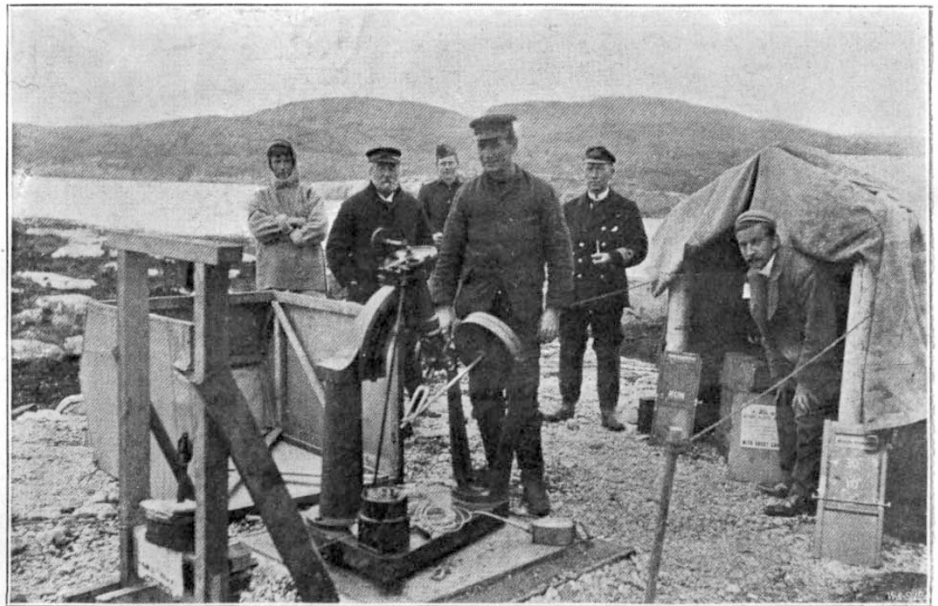


FIG. 6.—The Siderostat and the 9-inch Hut.

marked oyster-catchers; these were always watched with interest, and there were five which greeted the party daily as it landed on Kiö Island. These birds are noted for being very self-possessed, cautious, and deliberate; and any event out of the ordinary arouses their curiosity, and incites them to make closer examination. Of the other birds seen, some were quick-moving sea-swallows, and a few ducks skimming occasionally along the fjord.

On our island, Kiö, there are several Lapps who continually watch our movements. In the small bay on the western shore there is one small hut in which about five, including one woman, live; while generally some of the others encamp in small curiously-looking huts near by; or either sleep in their boats or on skins ashore. In the bay to our south-east, on the other side of the fjord, there is quite a large Lapp encampment, and it is from this that most of our visitors come. The accompanying group shows many of these. This photograph was taken instantaneously, and without any preparation as regards grouping, and shows them as they sat watching us erecting the huts and instruments. At this time

of the year they are generally occupied in fishing, and they sometimes bring up very fine selections of fish to our camp, which are generally bought by the steward for the ship's mess. The peat also on the island had been cut and stacked, so that this also formed at an earlier period of the year part of their daily work.

We are quite out of the world here, and till yesterday had no information as to what the other parties were doing at Vadsö. We knew that the remaining ships of the Training Squadron had arrived on Wednesday, and the booming of salutes from time to time informed us that other men-of-war had arrived. We could get no information concerning the astronomical parties, and no observer could be spared to make inquiries.

But late on Tuesday, when we had finished sketching drill, and were experiencing our only fog, a syren and the quick reply of the ship's bell told us that some vessel was approaching. Shortly afterwards we made out one of the small steamboats which ply from Vadsö to the fjords on the south side; she subsequently came alongside. We saw that Dr. Common and Sir R. Ball were on board,

the same as if the eclipse was taking place, with the exception that no plates were actually exposed. After these general rehearsals the observers at each special instrument were put through their facings. Our visitors seemed to be rather astonished at the great amount of work that will be done if the weather only proves favourable to-morrow.

We gathered from Sir R. Ball that all the arrangements at Vadsö were nearly complete, and that Dr. Copeland's 40-foot tube was already in position.

The time arrangements have to be somewhat complicated, for the reason that it is desirable to begin the exposures with the prismatic cameras ten seconds before totality. We have then, if possible, to make a correction should the *Nautical Almanac* times be slightly out. The Admiralty authorities were good enough to put on board at Portsmouth a first-rate chronometer for our special use, and Lieut. Martin and Sub-Lieut. Beal have been unremitting in their endeavours, by taking sights and noting rates, to give us G.M.T. within a small fraction of a second.

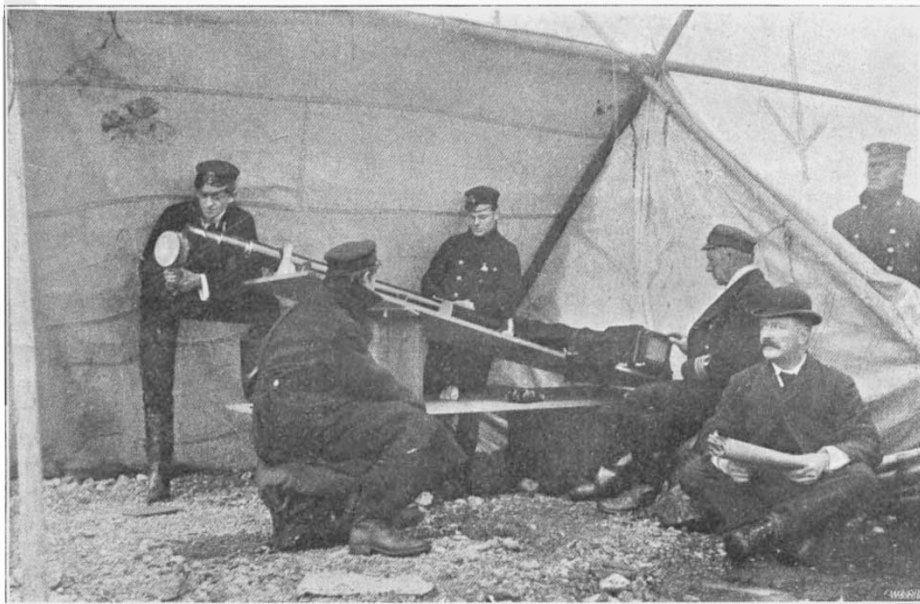


FIG. 7.—The Integrating Spectroscopic Camera.

and I hailed them from the poop. Captain King Hall hospitably invited them on board, but the invitation was declined owing to the weather conditions, which were not improving, and the lateness of the hour. They had still to run twelve miles to reach Vadsö.

Captain King Hall invited Dr. Common, Sir R. Ball, and Mr. Downing to come over from Vadsö yesterday to lunch and see our camp. Dr. Common was too busy in setting up and adjusting his instruments, but Sir Robert Ball and a small party paid the ship a visit. We had previously arranged that the final dress rehearsals should take place in the afternoon, so our visitors were just in time to see the drill gone through. All timekeepers, chronometer, stop-watches, and deck-watches were ready. Each man was at his appointed post; the sketchers stood to the west of the camp on the higher ground; the disc observers were blindfolded and in their places, while each of the other instruments was attended by its full staff. These rehearsals must appear very curious to those unacquainted with eclipse work, and certainly our visitors saw the very perfection of drill. The routine gone through was exactly

Before totality we have two chances of checking the *Nautical Almanac* times; by observing the first contact spectroscopically, and, failing this and more doubtfully, by observing the crescent when it covers an arc of 180° ; this, it has been calculated, should occur 7m. 10s. before totality. It has been arranged that after the first contact the true G.M.T. will be called out from time to time as required, and also each minute before totality, corrected, if necessary, in the way I have already stated. In this way the special timekeepers of the prismatic cameras will be able to begin their work at the right moment before the general signal for totality, "Go," is given.

I am sorry to say that the eclipse-clock has broken down; the ship's armourer has vastly improved its going, but it has received some damage, so that I cannot rely on it. It is not good for a clock to be used only once in five years or so! So we fall back on stop-watches; and here I must state my obligations to Mr. Tripplin for the loan of a fine chronograph, which makes our stock complete, and enables us to feel certain that at one station or another the exact duration of totality will be caught.

My intention is before totality, in case we miss the first contact, to set one of the stop-watches going when the crescent covers as near as may be 180° of arc; this will give us time to correct the *Nautical Almanac* if necessary. Another will be handed to our two excellent timekeepers to replace the eclipse clock.

Two things have been strongly impressed upon me in my eclipse experience. The first is always to arrange the work so that everybody can have 30 seconds in which to observe the phenomena of the eclipse with the naked eye; the second, to take out no case which weighs more than 50 or 60 lb.

The importance of the first was forced upon me in 1871, when Captain Bailey, who travelled 400 miles to our camp to help us, and volunteered to act as timekeeper, turned his back resolutely on the eclipse and saw absolutely nothing of it, because in the preliminary drills he found he had a difficulty in picking up the time again when once he looked away from the face of his chronometer.

This time then we have a relay of timekeepers, one replacing the other at "60 seconds more"; this signal is given by both. The one who gives the time has his back to the sun, the other will see what he can. At my signal, "Go," depending upon the final disappearance of the photosphere as seen in a 3 $\frac{3}{4}$ with neutral tinted glass, the timekeeper first on duty is to sing out "105 seconds" and give the time every 5 seconds, "100 seconds," "95 seconds more," and so on.

The question of lamps during the eclipse is settled in the following way. If the sky be quite clear, some will certainly be wanted for the timekeepers in the huts, and for reading the fine graduations of the delicate chemical thermometers which I have brought with me. But if the sky be not clear, then others may be wanted too. So Captain King Hall has arranged to have ten lamps, each in charge of a bluejacket, in reserve, in the middle of the camp, so that anybody who wants one has only to say so to be immediately supplied.

A guard of five marines has remained permanently at the camp during our stay. They are generally dressed in most arctic-looking costumes known as "lammy suits." These are nothing more than a pair of trousers and jacket (with a hood), made out of ship's blankets, worn over the ordinary dress; they were invented, I believe, by the sailors when they made a long stay at Spitzbergen. They seem to be grand clothes for a camp, and in fact one of the marines seems to be seldom out of his—he appears to revel in the warmth it gives. Besides acting as guard to the camp, the marines are useful in many other respects; for instance, in addition to signalling for us, they are very good cooks, and all our cocoa, soups, meat, &c., brought from the ship, only needs to be handed over to them to be served up in our tent in a very appetising condition.

Since the eclipse begins so early on the morrow, arrangements have been made that a few of us should sleep in the camp to-night, and thus come under their special care; the ship's company will come over in the morning.

J. NORMAN LOCKYER.

(To be continued.)

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PROFESSOR A. H. GREEN, F.R.S.

GEOLOGICAL science has sustained a very serious loss in the death of Alexander Henry Green, Professor of Geology in the University of Oxford. He was born at Maidstone on October 10, 1832, and after receiving his early education at the grammar school at Ashby-de-la-Zouch, he entered Gonville and Caius College, Cambridge. There he gained the place of sixth wrangler in 1855, and was elected a fellow of his college. Although mathematics had gained for him his high position in the University examination, yet geology had taken some hold of him. His interest in the subject had been awakened in Leicestershire, and the eloquent teachings of Sedgwick had further attracted him to the science.

In 1861 he obtained the appointment of Assistant Geologist on the Geological Survey of Great Britain, and was engaged for some years in mapping portions of the



FIG. 8.—Our Lapp Visitors.

midland counties, near Aylesbury, Buckingham, and to the east of Banbury. Three years later his memoir on the geology of the country around Banbury was published; and although since then some modifications have been made in the grouping of the oolites, his careful statement of facts rendered the work of permanent value. Leaving these regions of lias and oolites and glacial drifts, he was transferred to the carboniferous districts of Derbyshire and South Yorkshire. Here he laboured for a number of years, practically superintending the survey of the great coal-field, and training several junior geologists to assist in the work. In the end he produced, with the aid of his colleagues, the large and exhaustive memoir on the Yorkshire coal-field, published by the Geological Survey. In 1875 he resigned his post on this survey on being appointed Professor of Geology in the Yorkshire College at Leeds. Ultimately he became