

Bristol Museum. With characteristic energy he at once set to work, re-tableting, re-arranging, and naming the geological collection, taking care to have gaps in the series filled up, and making the museum really serviceable for purposes of instruction. Six years later, in the early part of 1878, he received the appointment of Assistant Curator of the Woodwardian Museum, Cambridge. He soon made his mark there, as was acknowledged in the following year by the bestowal upon him of the honorary M.A. degree. His indefatigable industry and wide range of acquirements so peculiarly fitted him for this position, that his death must for some time to come be an almost irreparable loss to the University.

Looking over his published papers one cannot but be struck with his versatility. At one time we find him discussing the Rhoetic beds of South Wales, at another dealing with that vexed question of Alpine geology—the position of *Terebratulina diphya*. From Devonian fossils he passes to the description of new species of Oolitic gasteropods, or to the Cretaceous Aporrhaidæ, or to Palæozoic star-fishes. He could enter minutely into the stratigraphy of the Isle of Wight Tertiary strata, and with not less energy and clearness of insight described the microscopic structure of the crystalline rocks of Wales. Well versed in the Continental languages, he kept himself abreast of the foreign progress of his favourite science. Nor were his tastes wholly scientific. He delighted in Piers Ploughman and the Niebelungenlied. What he might have done who may guess? That with his feebleness of constitution he should have been able to accomplish so much, shows how ardent was his love of nature and how indomitable his spirit of inquiry. His devotion to truth and abhorrence of everything savouring of insincerity or sham led him to speak out freely and uncompromisingly. But no one could mistake the honesty of his purpose. A. G.

REMARKS ON AND OBSERVATIONS OF THE METEORIC AURORAL PHENOMENON OF NOVEMBER 17, 1882

THE interesting meteoric phenomenon seen in England during the aurora of November 17 last, has induced me to endeavour to find the true path of that object. Though I have spent much time in applying the method given by Prof. E. Heis in his "Periodischen Sternschnuppen," I have got no farther than the point to which Mr. H. D. Taylor has brought us, the observations being in no way capable of combining. In fact, when seeking the lines of intersection, formed by the different planes of the great circles, wherein the apparent path was seen, with the mean horizon (say the plane of a common map), these lines have but little tendency to converge to the same point. Therefore the method of Mr. Taylor seems to me the most convenient. When the object has followed a straight line, all the places where it was seen passing just before the moon, must lie in a plane containing the true path and the moon. This plane must cut the plane of the map in a straight line. Now the four places where observers saw the meteor before the moon's disc are:—Woodbridge, near Ipswich, Lincoln's Inn Fields (London), Windsor, and Ramsbury, near Hungerford, fulfilling, by no means, the above-mentioned condition. Nevertheless the most probable direction of this line seems to be that accepted by Mr. Taylor, N.E. by E.-S.W. by W. (astronomical), because this is the general direction of the lines of section, given by the great circles, mentioned above. Here it is to be remarked that when the meteor was seen from S.E. to S.W. (as in the case at York), but at some height (here 10°) above the horizon, the intersections of the apparent path with the horizon may lie near E. and W. (here, according to the observation of the meteor passing 6° below the moon, at 12° south of E.). We give here

bearings as seen from the different places, taken directly from the communications, or deduced indirectly from them:—

Street (3° south of Leeds)	S.E.-S.W.
Clifton (Bristol)	E. 18° N.-W. 18° S.
Greenwich	E.N.E.- (?)
Guildown (p. 149)	E.-W. (nearly).
Bedford	S.E.-S.W.
Clevedon (p. 100)	N. 70° E. (?) S. 70° W.
Cambridge	E.-S.S.W.
York (H. D. Taylor)	E. 12° S.-W. 12° N.
Woodbridge	E. 10° N.-W. 10° S.
Windsor	E.-W.
Coopers Hill	?-S.W.
Ramsbury	?
Lincoln's Inn Fields	E.-W.

Now we can add to these English observations¹ two others made in the Netherlands.

1. Prof T. A. C. Oudemans gives in the *Utrecht Newspaper* (No. 318) the following (translated) description:—"At 6h. 23m. (6h. 2½m. Greenw. T.) a feather-like appearance, resembling in the beginning a brilliant comet, formed suddenly in the eastern part of the heavens, the end being just before Aldebaran. Within two minutes this feather had prolonged itself above Saturn, through the Pegasus quadrature, and south of the three Eagle-stars, the east or following end shortening, while the other or preceding end advanced. . . . When this arch had obtained the length of 90° (which lasted but a few seconds) a separation was made in the middle of its length, where the arch had a breadth of about 3° . This separation had a length of about 10° and a breadth of $\frac{1}{2}^\circ$, and was pointed at the ends. At 6h. 25m. this arch disappeared wholly in the west." Prof. Oudemans says further that the great circle of the apparent path intersected the equator at 110° and 290° of right ascension. This gives me, combined with the position of Aldebaran, a direction in the horizon of E. 20° N.-W. 20° S.

2. Mr. P. Zeeman observed the same phenomenon at at Zonnemaire, near Zierikzee ($51^\circ 42'$ lat. and $57'$ W. Amsterdam). He wrote me the following on November 19 and 24:—"About 6h. 20m. (I saw) a magnificent, splendid white arch, beginning a little north of east, and prolonging itself to south-west, but in the meantime shortening at the east end and disappearing in a very short time." Mr. Zeeman declares in his second letter that this arch went through Aldebaran, and through a Pegasus. This gives me a horizontal bearing of E. 20° N.-W. 20° S., as the observations of Prof. Oudemans gives also.

Thus we find these two Dutch observations (unhappily the sky in Groningen had just, at 6h. 1m. Greenw. T., got cloudy, the aurora being very splendid before) supplement and confirm the greater part of the English observations. Only the phenomenon seems to have been of greater apparent size, and therefore nearer to the observer. The separation by an obscure streak seems not to have been visible in England, perhaps from the change of its relative position.

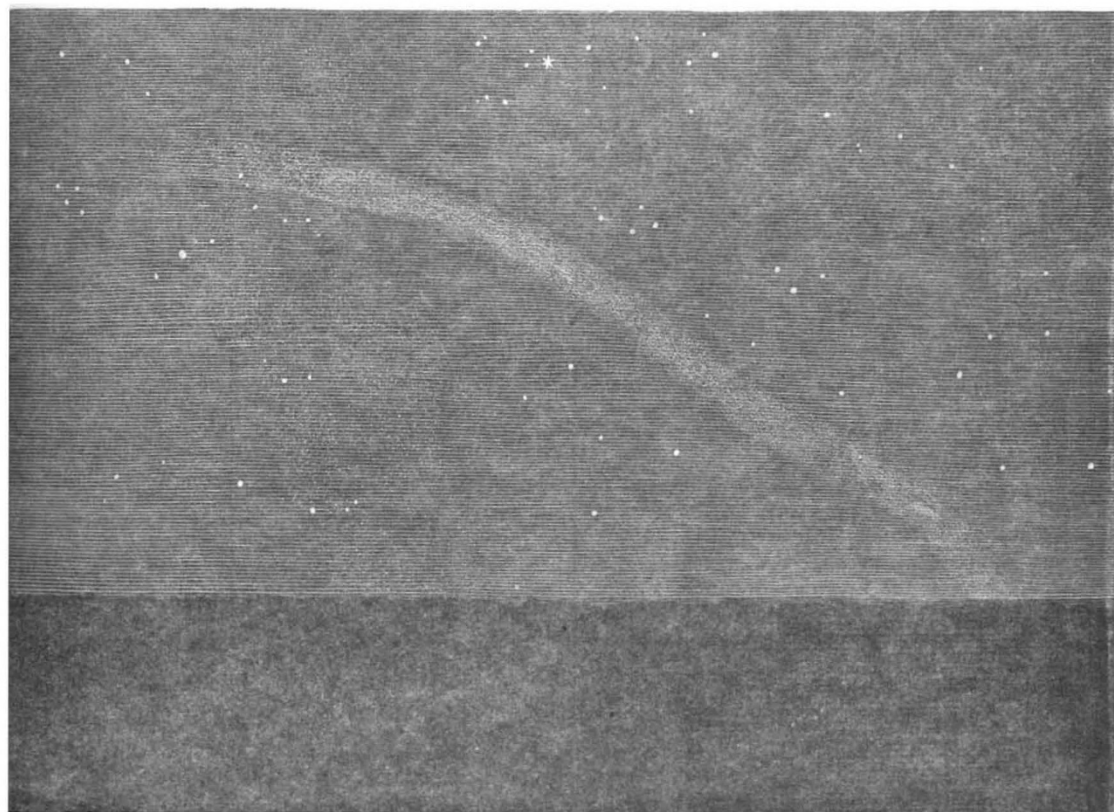
The conclusion to which we come after all, regretting earnestly the want of French observations, is that we have here probably a meteoric object, moving, according to the calculations of Mr. H. D. Taylor (vol. xxvii. p. 140), with great velocity through the upper strata of the atmosphere and at the same time of auroral character, as the spectrum observation of Mr. Rand Capron (vol. xxvii. p. 84), makes out beyond any doubt. The separation and the feather-like forms, observed at Utrecht, make it probable that it was a mass of meteoric dust, passing through our atmosphere like an accumulation of little shooting stars. In this way the phenomenon of November 17 brings a confirmation of my own theory of auroræ, proposed by me in the "Appendice alle Memorie della Società degli Spettroscopisti Italiani," 1878, vol. ii., and received with sympathy

¹ Will Mr. W. M. Flinders Petrie be so kind as to tell us where we can find the Swedish observation mentioned by him, vol. xxvii. p. 140?

by many of the German and Dutch astronomers; but as it seems little known in England, though referred to by Mr. Rand Capron on p. 64 of his beautiful work, "Auroræ." In this theory most of the properties of auroræ are deduced from cosmic dust entering into the atmosphere of the earth. I take the liberty to direct attention to the unexpected argument, that the brilliant object of November 17, 1882, has brought forth in favour of my "Théorie Cosmique," to which I had already the opportunity to refer in this Journal in my article "On Dust, Fogs, and Clouds" (vol. xxiii. p. 195).

Furthermore, I think that this object is not the only example of such a phenomenon. On November 2, 1871, there was seen in Groningen and several places of Germany a strange, brilliant arch, striped parallel to its well defined sides and changing its curve during its two hours of existence. The beginning of the phenomenon

(of which I gave a description in the Dutch journal *Isis*) was seen by a student, Mr. Gratama, like an elliptic patch of light round the Pleiades. Dr. Vogel, who observed the same arch at Bothkamp, determined its auroral character by the spectrum. Otherwise it resembled very much the bright spur of a gigantic meteor or fireball. Also it disappeared slowly, beginning at the east end, as the illustration shows. A faint aurora, with dark segment, was visible in the north. The height of this arch was calculated by me approximately at 127 kilometres or 79 miles. I think that the only difference between these two feather-like phenomena of November 2, 1871, and of November 17, 1882, consisted in the different apparent velocity and in the greater mass of meteoric dust, forming in the case of November 17, 1882, but a short, and in that of November 2, 1871, a very long train of incandescent matter. It must be remembered here



Auroral Arch, observed November 2, 1871, at Groningen (Netherlands).

that the tails of great fireballs remain visible for half an hour or more (see e.g. the article of Mr. Branfill, vol. xxvii. p. 149). In *NATURE*, vol. xii. p. 330, is to be found a description of similar arches, seen at Fremantle in Australia by Mr. Lefroy, in presence of the moon, which was obscured by one of them.

This leads us to a question, touched by Mr. Backhouse, *NATURE*, vol. xxvii. p. 198, that of the halos seen in Siberia (by Von Wrangel, I believe), when an auroral beam was in front of the moon. I watched in vain if such an event should perhaps occur November 17 last, but Mr. Zeeman, whom I have cited above, seems to have been so happy as to have seen a white and bright auroral cloud floating over the moon's disc at 5h. 47 (local time), giving the common interference phenomena. It is unnecessary to remark, that these phenomena can be formed by all kinds of dust, formed of nearly equal

particles, and that they in no way require ice-particles. On my inquiry why the observer could decide that it was not a common cloud, he brought forward the following arguments:—(1) Its great brightness; (2) its transparency to the starlight; (3) its very great velocity, unusual in common clouds.

Returning to the meteoric phenomena, visible simultaneously with auroræ, it seems that such phenomena were seen during the marvellous aurora of January 7, 1831, described in *Poggendorff's Annalen* of the same year. We read (p. 440) that Bergrath Senff, in Colberg, at 6.30 o'clock, saw above the west horizon a bright yellow streak, rising upward with a common cloud-velocity, passing at 30° N. Zen. D., and forming an arch from W. to E., beginning to disappear from the west end, almost at the same moment that it reached the east horizon. At p. 458 we see that Prof. Rudberg, at Upsala,

December 7, 1830, saw a very bright patch of double the dimensions of the moon's disc, moving with great velocity behind the common auroral beams. Further, Prof. Bischoff, in Burgbrohl (p. 461), observed, on the occasion of the aurora of January 7, 1831, a moving cloud as bright as the milky way, from E. to W., in five minutes. Prof. Moll saw, in Utrecht a similar object, rising from N.E., through the Pleiades, to S.E. (S.W.?). Similar observations are to be found during the same aurora, p. 471 (one advancing arch), p. 472 (four similar arches, and a dark streak).

In several articles on the aurora of November 17, 1882, the height of auroræ is spoken of. Mr. W. M. F. P. (p. 173) says that the strange object observed is *physically impossible* to auroral nature, because of its height of about 170 miles. It was already observed by Mr. Backhouse that auroræ are often observed at very great heights. The same is also the case with shooting stars. I take the liberty to refer once again to an article of mine in this journal entitled "The Height of the Aurora," where I refer to the beautiful determinations by Prof. Heis and Dr. Flögel, published in the *Zeitschrift der Oesterr. Gesellsch. f. Meteor.*, vii. p. 73. The heights were found from 10 to 100 geogr. miles (46 to 461 Engl. miles). Dr. Sophus Tromholt found, besides apparent low heights of some auroræ in Norway, the height of that of March 17, 1880, to be 17 geogr. miles ("Wochenschrift redigirt," von Dr. H. J. Klein, 1880, p. 172). Prof. Galle of Breslau calculated by his method, described in the *Zeitschr. f. Met.*, vii. p. 73, and in the *Astr. Nachrichten*, Bd. 79, No. 1882, 40 to 60 geogr. miles, and I found for the great aurora of May 13, 1862, 59 geogr. miles.

H. J. H. GRONEMAN

Groningen (Netherlands), January 14

NOTES

THE Council of the Institution of Civil Engineers have arranged for the delivery at the Institution of a series of six lectures, on the Applications of Electricity, on the following Thursday evenings, at 8 o'clock:—February 15—The Progress of Telegraphy, by Mr. W. H. Preece, F.R.S., M.Inst. C.E. March 1—Telephones, by Sir Frederick Bramwell, F.R.S., V.P.Inst. C.E. March 15—The Electrical Transmission and Storage of Power, by Dr. C. William Siemens, F.R.S., M.Inst. C.E. April 5—Some Points in Electric Lighting, by Dr. J. Hopkinson, F.R.S., M.Inst. C.E. April 19—Electricity applied to Explosive Purposes, by Prof. F. A. Abel, C.B., F.R.S., Hon. M.Inst. C.E. May 3—Electrical Units of Measurement, by Sir W. Thomson, F.R.S., M.Inst. C.E. This is an excellent step which the enterprising Institution has taken, and we are sure will be productive of good both to science and to engineering.

MR. ERNEST H. GLAISHER, B.A., Trinity College, Cambridge, has been appointed Curator of the British Guiana Museum, George Town, Demerara.

MR. W. H. WHITE, one of the Chief Constructors to the Navy, has resigned his position to take up a managerial appointment in the firm of Sir Joseph Whitworth.

AN interesting boring through the chalk is now about to be resumed at Southampton. At the last meeting of the British Association a paper by Mr. T. W. Shore and Mr. E. Westlake on the Artesian well on Southampton Common was read in the Geological Section. The Town Council has now accepted a tender for continuing the boring which was abandoned in 1851, after a depth of 1317 feet had been reached. The boring was then passing through the lower chalk or chalk marl, and we believe it is now intended to continue it to the Lower Greensand. The

well at the bottom of which the boring commences is 563 feet deep, and this was reopened last week, after having been closed for thirty-two years. Some observations on the temperature of the water were at once made by Mr. T. W. Shore and Mr. J. Blount Thomas, of Southampton, for the Underground Temperature Committee of the British Association. By means of a heavy elongated sinking weight and a registering windlass, a thermometer was passed down the bore shaft to a depth of 1210 feet, when it was stopped by chalk mud. An outer case which was attached to the sinking weight was much scratched in passing through the Upper Chalk. A temperature of 71° 9 F. was registered at the bottom, that of the outer air being 49° F.

THE City of Neuchatel celebrated in the beginning of the present month the fiftieth anniversary of the foundation of its Natural History Society. The leader among its founders, who first met for the purpose on December 6, 1832, was Louis Agassiz.

THE biennial Hunterian oration will be delivered on Wednesday, February 14, at three o'clock, by the President of the College of Surgeons, Mr. Spencer Wells, in the theatre of that institution. The biennial festival will be given in the library the same evening, to which the president and vice-presidents have, as usual, invited several distinguished visitors.

THE Pontifical Academy of the Nuovi Lincei have appointed a Committee to take steps for the erection of a monument in Rome to the late eminent astronomer, Father Secchi. The monument will be of a meteorological character. The sculptor Prinzi has already made a model which combines convenience for arranging the meteorological apparatus with features recalling the work of Father Secchi. The statue of the astronomer crowns the monument, and among other emblematical figures will be one of Meteorology holding in one hand a gigantic barometer, which can be seen from a great distance, and another of Physics holding up to view an equally large thermometer.

THE rumour that the fragments of the unfortunate Mr. Powell's balloon have been found in the Sierra del Pedroso, in the far south of Spain, is too vague and incredible to deserve much attention.

AT the meeting of the Essex Field Club, to be held on Saturday evening next, January 27, the attention of the members and the public generally will be directed to the Bill about to be introduced into Parliament for the construction of a line of railway from Chingford to High Beach. In January, 1881, the Club, in conjunction with other Natural History Societies in and around London, strongly protested against any portion of Epping Forest being occupied by a Railway or other Company, to the prejudice of the provisions of the Epping Forest Act, and certainly no sufficient arguments or expressions of public opinion have since been brought forward in favour of the scheme. It is believed that the proposed line is quite unnecessary, as no part of the forest is more than two miles from a railway station, and moreover a railway and its concomitants could not fail to destroy the chief interest and charm of the district—its seclusion and naturalness; qualities of inestimable value so near a large city.

THE following papers are set down for reading at the meetings of the Society of Arts during the part of the Session after Christmas:—At the Ordinary Meetings—W. K. Burton, The Sanitary Inspection of Houses; General Rundall, The Suez Canal; Prof. Thorold Rogers, M.P., Ensilage in the United States; Sir Frederick Bramwell, F.R.S., Some Points in the Practice of the American Patent Office; J. H. Evans, The Modern Lathe; A. J. Hopkins, The History of the Pianoforte; Prof. George Forbes, The Electrical Transmission of Power;