December 29, 1881 ; May 8, 1884 ; and one on "A Coal-dust Explosion," February 17, 1887.

During the ten years ending in 1885, I was engaged from time to time in carrying out experiments with coal-dust: first, with apparatus provided by the Glamorgan Coal Company, Limited, and erected at their Llwynypia Colliery ; secondly, with apparatus purchased by means of Government grants obtained through the Royal Society ; and, thirdly, with apparatus belonging to the Royal Commission on Accidents in Mines.

Before the accounts of my earlier investigations, and the conclusions founded upon them had appeared, the Inspectors of Mines and other mining experts were practically unanimous in attributing the cause of every great colliery explosion to the sudden outburst of a large volume of fire-damp which was supposed to have flooded the workings, become mixed with the air, and, on being ignited in one way or another, produced the various phenomena subsequently observed. This explanation was accepted everywhere as the only one possible ; it was recorded in the official reports of the Inspectors of Mines, and they, as well as the experts of that generation, were irretrievably committed to it.

There was not, figuratively speaking, a ripple of dissent from this mode of explanation upon the placid surface of mining opinion at the moment the coal-dust theory was launched upon it.

At first the new theory was ignored ; then it was scouted ; then it was subjected to scathing criticism ; then it was taken up in a tentative manner by some of the younger and bolder men ; and, lastly, when it was found to be making serious headway, one of the more adventurous spirits suddenly discovered that it was not new after all, for had not Faraday and Lyell and certain French engineers been its real authors ?

Following my lead, first a joint paper, by Messrs. Hall and Clark, was contributed to the North of England Institute, in May 1876, then another by Messrs. Marrecco and Morrison, in 1878, all of whom, with the exception of Mr. Clark, had previously corresponded with me on the subject of explosions ; finally, in the year 1879, after the publication of my articles on "Coal-dust Explosions" in *Iron*, and during the next few years afterwards, a very great army of investigators, headed by Government Commissions in England, France, Prussia, Austria and Saxony, and including the Messrs. Atkinson, entered the field.

Some of these investigators contented themselves with criticism pure and simple ; others, of whom many had neither aptitude nor training for the work, made experiments with small and imperfect apparatus, and, as a consequence, obtained only negative results ; still others were carried away by the side issues ; and only a few, such as the Prussian and Austrian Commissions, and Messrs. Hall and Atkinson, H.M. Inspectors of Mines, did really good and substantial work of an enduring kind.

The facts and conclusions recorded in my earlier papers were freely drawn upon : by some they were generously acknowledged ; by others they were first denounced and then assimilated ; by others they were adopted without acknowledgment ; while some of my experiments, and notably my investigations into the nature of the Fire-damp Cap (*Proc. Roy. Soc.*, March 2, 1876), were repeated with some variations and described as if they were original.

A flood of literature was now poured upon the mining world from every side, embodying opinions of the most conflicting and mystifying character, such as—a mixture of coal-dust and air may take fire but it cannot explode ; coal-dust can only carry flame from one accumulation of fire-damp to another ; a coal-dust flame cannot extend throughout the workings of a mine in the entire absence of fire-damp ; a small proportion of fire-damp must always be present in the air when an explosion takes place ; some kinds of coal-dust are more inflammable than others—and so on, so that amid the din and hurlyburly of the strife the main question of how to put an end to great explosions was almost lost sight of.

But the scene of each successive explosion when viewed under the new light served gradually to dispel the illusions which had fascinated the majority of the investigators for years ; and thus it has come to pass that the new generation of Inspectors of Mines, and those who have been associated with them in investigating the phenomena of explosions, have become convinced, I believe almost to a man, of the soundness of the coal-dust theory ; and that the struggle of contending factions, which was at its height ten or twelve years ago, has gradually subsided, leaving us face to face with a work which still remains to be done, namely, to render the occurrence of a great colliery explosion impossible in the future.

Into the consideration of that problem I do not propose to enter on the present occasion, as I have lately done so in considerable detail in the pages of the *Daily Chronicle* of June 24 of the present year.

W. GALLOWAY.

Cardiff, July 17.

THE AUGUST METEOR SHOWER, 1896.

THE moon being absent from the nocturnal sky during the recent return of the Perseids, encouraged the hope that the shower would be somewhat brilliant ; but the weather is an element of great importance in such observations, and it was by no means favourable during the late display. In the south of England several nights were partly clear near the important time, and on August 10 the firmament at Bristol was almost free from dark cloud ; but the sky was hazy and the stars dim, so that only the brighter meteors were observed.

On August 6, during an hour's watch before 10h. 50m., I counted twelve meteors, of which seven were Perseids, with a radiant at 42° + 56°. The shower was evidently pretty active, and the meteors fairly bright, but clouds overspread the sky before 11h., and prevented further observation.

On August 7, in an hour's watch preceding 11h., nine meteors were seen, including about six Perseids, but clouds were very prevalent during the whole time, and effectually obliterated the stars at a later period of the night.

On August 10 the weather was fine, but the atmosphere was not transparent enough to be considered favourable for meteoric work. Haze was spread over the sky, and the fainter stars were obscured. Near the horizon nothing could be discerned. I began watching for meteors at about 9h. 50m. and continued until 14h. 15m. During this interval of 4h. 25m. I saw ninety-eight shooting-stars, of which sixty-nine were Perseids, and twenty-nine belonged to the minor, contemporary showers of the period. I registered the apparent paths of a considerable number of the meteors seen, and while engaged in doing this, must have missed many others which appeared while my attention was diverted from the sky. It is probable that fully one hundred and fifty meteors would have been counted by an observer watching the sky uninterruptedly during the period mentioned. Nearly all the Perseids left streaks, but the meteors generally were not very bright. The radiant point was tolerably well defined, but it was certainly not so definitely marked as I have sometimes seen it. I determined it at different times of the night as follows :—

h. m.	h. m.		° °
9 50	to 11 0	... ...	43 + 57
11 0	to 11 30	... ...	44 + 57
11 30	to 13 0	... ...	46 + 57
13 0	to 13 45	... ...	45 + 59
13 45	to 14 15	... ...	46 + 57

The mean of the five positions being at 45° + 57°, which coincides with the usual place of the radiant on August 10.

On August 11 the heavens were overcast, but on August 12 a beautifully clear sky enabled me to resume observations. I saw fourteen meteors in about an hour and a quarter before 11h. 15m., and of these seven belonged to the Perseid shower. The radiant was at 46° + 57°, but it was imperfectly defined.

On August 14 the firmament was again clear, and I saw nine meteors in three-quarters of an hour before

11h. 10m., of which one only was a Perseid. The shower had evidently become nearly exhausted.

The following conspicuous meteors were recorded on the several nights of observation, and I give their paths in the hope that they have been observed elsewhere.

1896.	Time.	Mag.	Path From	Path To	Length.	Radiant.
			° °	° °	°	° °
Aug. 4	9 46	1	343 +31	335 +10	27	42+56
6	10 6	2	340 +31	337 +58	27	342−12
6	10 6	1	343 +32	328 +10	26	42+56
10	9 54	1	103 +86	202 +79	13	43+57
10	10 39	2	27 +48	355 +39	24	60+48
10	11 24	1	15 +47	9 +43	6	44+57
10	11 39	½	66 +84	210 +81	15	46+57
10	12 6	2	42 +45	44 +39½	6	28+72
10	12 10	2	44½+35	53½+31½	8	23+40
10	12 15	>1	28 +24	24 + 4	20	46+57
10	12 19	2	60½+31½	66 +26½	7	47+42
10	12 46	1	8 +12½	1 − 3	17	46+57
10	13 8	½	633 +63	25 +66	5	45+59
10	13 19	1	23½+20	20½+12½	8	45+59
10	13 22	1	359 +69½	334 +68	9½	45+59
10	14 14	>1	57 +76	225 +77	27	51+31
12	9 24	½	195 +24	199 + 9	15	46+57
12	10 41	2	26 +43½	30 +38	6	331+70
14	9 24	1	265 +22	240½+19	23	356+ 5

On the whole, I regard the display as one much inferior to many observed in past years. Both as regards the number and brilliancy of the meteors there was nothing striking to record. Had the sky proved clearer on August 10, many small meteors would have been visible, which, under the conditions prevailing, were enabled to escape detection; but making every allowance for this, there is no doubt the shower was not a conspicuous one.

As to the displacement of the radiant, which takes place on successive nights, this was indicated from my results on August 6, which gave 42°+ 56° for the position, while on August 10 it was 45°+ 57°, and on August 12, 46°+ 57°. But my observations this year have not been sufficiently extensive for the full and proper re-investigation of this feature, nor is it required, for no good end is served by the frequent re-observation of a fact already well determined.

The usual minor showers were visible; indeed, there appears to be very little doubt that the great majority of meteor radiants are manifested annually without any great change in their visible strength. Certain showers vary more than others, but many of the differences observed are due to the alteration in the conditions under which they are presented from year to year. In 1893 there was a strong shower of Cygnids observed contemporaneously with the Perseids, but the former was but slightly seen this year, for I recorded only two of its meteors. I registered meteors from radiants at 31°+ 20°, 28°+ 72°, 60°+ 48°, 331°+ 70°, 356°+ 5°, which have been noticed in preceding years, and are among the best assured positions of the August epoch. Feeble showers of this character are extremely numerous, and require long watches before an observer can satisfactorily determine their radiants. Some of them fall so near together that they cannot be disassociated unless the observations are very numerous and accurate.

I observed no fireballs during the recent return of Perseids; but Mr. Blakeley, of Dewsbury, reports that he saw meteors as brilliant as Venus on August 10, at 11.40 and 12.16, both Perseids.

The Rev. S. J. Johnson, of Bridport, writes me that he observed a good many bright meteors this year. One of the finest appeared on August 10, 9h. 50m., travelling from ϵ Cassiopeiæ to a point 7° west of β in the same constellation. Two second magnitude meteors were seen within fifteen seconds of each other at about 10h. 6½m. on the same night, which were also observed at Bristol. Their heights at beginning were 64 and 65 miles, and at ending 46 and 52 miles respectively. They were both Perseids.

Mr. Blakeley, of Dewsbury, saw about thirty-five Perseids between 11h. and 12h. 30m. on August 10, and the paths seemed to give a sharply-defined radiant at the usual maximum position.

Mr. S. H. R. Salmon, of Croydon, saw, on August 10, 20 meteors (15 Perseids) between 9h. 10m. and 10h., and 18 meteors (16 Perseids) between 10h. 10m. and 11h. The sky was perfectly clear.

Mr. D. Booth, of Leeds, on August 11, saw eighteen meteors in the forty-five minutes from 10h. to 10h. 45m., and found the Perseid radiant at 47½° + 58½°.

W. F. DENNING.

THE LIVERPOOL MEETING OF THE BRITISH ASSOCIATION.

III.

IT is possible now to forecast to some considerable extent the work of the various Sections from the information already received from presidents, recorders, and authors.

In Section A (Physics), Prof. J. J. Thomson's opening address will deal, we believe, with (1) the teaching of physics; (2) the kathode and Röntgen rays; (3) the passage of electricity through a gas; and (4) the movement of the ether. Friday will be devoted in this Section chiefly to phenomena connected with the Röntgen rays; and on Saturday the Section will divide into the two departments of mathematical physics and meteorology.

In Section B (Chemistry) the address of the President (Dr. Ludwig Mond) will deal with the development of the industrial manufacture of chlorine. Technical papers will probably occupy a large portion of Friday's sitting, including a report, by Prof. Bedson, on the composition of coal. On Monday, Prof. Ramsay will read a paper on helium, and there will be a number of other communications on helium and argon. On the same day, a paper will be read on the synthesis of the elements. It is hoped that this will lead to a discussion, to which several have promised to contribute. Other matters of interest will be an exhibition of photographs of explosions in various gaseous mixtures, by Prof. Dixon, and the report of the Committee on science teaching in elementary schools, which will be followed by a paper on science teaching in girls' schools, from Miss Walters.

It is hoped that the numerous chemical works in the neighbourhood may prove attractive to the members of the Section, and arrangements are being made for members of the Section to visit several of the most interesting works on special afternoons.

Mr. Marr's address to Section C (Geology) will be devoted to recent advance in stratigraphical geology. He will notice at some length the imperfection of the geological record, especially in the earliest times. He will advocate the continuance of that work in detail which has been the cause of our best discoveries in the past. Doubt will be thrown upon the advantage of too rigid an adherence to uniformitarianism. Lastly, he will discuss the advantage of geology as an instrument of education. In the work of the Section, more prominence than usual will be given to the reports of the research committees, several of which are likely to lead to considerable discussion. The excavations at Hoxne have been successful in proving the relation of Palæolithic man to the glacial epoch, besides yielding new evidence as to alternations