deposited, and increases in relative weight. We are disposed to think that the carbohydrates, and not the albuminoids, must be taken as the true criterion of quality in wheats, and that, judged by this test, the Americans have no need to fear that their wheats are inferior to those of Europe.

The author finds a difficulty (p. 33) in accounting for the small proportion of water in American wheats. Any agriculturist would have been able to tell him that well-developed, thoroughly matured, and well-harvested wheat always contains a less proportion of moisture than wheat in an opposite condition. It is due partly to simple drying, but also to the fact that good wheat is thoroughly filled up with starch cells (carbohydrates), and that there are no fissures left for moisture or air to lurk in. Well-fed meat contains less water than badly-fed meat for the same reason, viz. the thorough filling up of the internal spaces with fat cells. A little attention to the structure of the wheat grain would have enhanced the value of Mr. Richardson's monograph.

The fact that unripened and badly matured wheat is often rich in glutin is well known to chemists, and we are disposed to think that the richness of European wheat in this constituent is partly due to the fact that it is often defectively matured.

After treating exhaustively upon the composition of American wheat, the author proceeds to treat of flour and bread, and lastly of other cereals and maize. The pamphlet certainly repays the trouble of perusal, and indicates the vast pains which is now being taken by the United States Government in order to bring scientific knowledge to bear upon its most important industry. The wheat production of each State is watched with minute care, and the quality of the produce is subjected to analysis. It is gratifying to notice that Canadian wheat is in all respects equal to that grown in the United States.

JOHN WRIGHTSON
College of Agriculture, Downton, Salisbury

THE REMARKABLE SUNSETS

SINCE our last number appeared the view that the recent wonderful sunrise and sunset phenomena have really been due to the terrible eruption of Krakatoa in August last has been confirmed in the most definite manner. Material brought down by rain in Holland and snow in Spain has on microscopic examination proved to be identical with actual products of the eruption brought from Krakatoa in the ordinary manner.

The following letter to the *Times* from Mr. Joseph McPherson, an eminent geologist now in Madrid, must be read in connection with the letter from Holland given below:—"Desirous of obtaining positive proof of the brilliant theory put forth in your columns relative to the cause of the remarkable appearances at sunrise and sunset which have for many days excited public attention, I have this day analysed some fresh-fallen snow with the following results, namely, that I have found crystals of hypersthene, pyroxine, magnetic iron, and volcanic glass, all of which have been found in the analysis lately made at Paris of the volcanic ashes from the eruption of Java."

This being so, every fact connected with the displays instead of losing really gains an additional interest, and now that we know we are in presence of the work of the upper currents each date becomes of great importance.

The extraordinary fact now comes out that before even the lower currents had time to carry the volcanic products to a region so near the eruption as India an upper current from the east had taken them in a straight line *viâ* the Seychelles, Cape Coast Castle, Trinidad, and Panama to Honolulu, in fact very nearly back again to the Straits of Sunda! The 5th of September is now fixed from two sources as the date of the first appearance of the strange phenomena at Honolulu.

Mr. Bishop thus writes to the *Saturday Press* (published at Honolulu, September 22), which has been forwarded to us by the courtesy of the Hawaiian Consul at Glasgow:—

"I first noticed these peculiar appearances on Wednesday the 5th inst. at 7 p.m., so long after sunset that ordinarily no trace of colour remains on the western sky. The sky, from south-west to west, was then covered with a lurid red and dull yellow glow, much resembling that produced by a distant conflagration. This extended to an altitude of 15° or 20°. I continued to distinguish the light till 7.25."

He then proceeds:—

"I would note three peculiarities of the phenomenon, distinguishing it from ordinary sunset reflections, and unlike anything I remember to have observed before: (1) It appears to be a reflection from no cloud or stratum of vapour whatever. (2) The peculiar lurid glow as of a distant conflagration, totally unlike our common sunsets. (3) The very late hour to which the light was observable—long past the usual hour of total cessation of twilight. To this may be added (4) that the centre of brilliancy was more or less to the south of west."

Mr. Bishop at once ascribed the phenomena to Krakatoa dust, and suggested more vivid appearances along the line Honolulu, Ladrones, Manila, Sunda. Of course he knew nothing of the line Panama, Trinidad, Cape Coast Castle, Seychelles, Sunda.

In a subsequent communication Mr. Bishop tells us that the after-glow remained brilliant for some time, being very brilliant on September 30. The haze stratum was visible as a continuous sheet at a height far above that of the highest cirrus, a slight wavy ripple being noticeable in its structure, always perfectly transparent and invisible except under certain conditions. A conspicuous circle of 15° to 20° radius was observed during several days, "a misty, rippled surface of haze, with faint crimson hue, which at the edges of the circle gave a purplish tint against the blue sky."

He states that Capt. Penhallow, of the *Hope*, observed these phenomena in lat. 24° N., 140° 29′ W., on September 18.

The following notes as to the eruption itself we take from the *Straits Times*, as dates and times are mentioned:—

"In the afternoon of Sunday, August 26, a rumbling sound was generally heard at Batavia, coming from the west, like that of far distant thunder varied by strong detonations, the concussion from which shook and rattled doors and windows on all sides . . . especially when on the night between August 26 and 27 these phenomena steadily became more violent until 1 a.m., when a detonation was experienced which brought about such a concussion that the gaslights here were all as it were extinguished at the same moment. Many persons, anxious for their wives and families and for life and limb, hence forbore to sleep and awaited the morning in great excitement. Morning broke, but the sun, instead of shining with that clear brightness which characterises the morning hours in the East, concealed itself, and the whole sky seemed overcast. At 7 a.m. on that day, August 27, the first shower of ashes was noticed here, from which it was inferred that whatever might be the volcano at work in the neighbourhood, the outburst must assuredly be appalling when ashes in showers could be noticed even in distant Batavia. The ash showers fell heavier, and before the hour of midday had struck the whole of Batavia was enveloped in thick darkness. From the lack of sunlight the temperature fell several degrees. People shivered with cold, their discomfort being heightened by anxiety, especially when lamplight had to be used at midday. Like a mountain a great sea wave came rushing on along the whole coast of West Java, forced its way into the rivers, thus causing them instantly to rise several yards and overflow their

banks. Indescribable was the confusion into which prahus, steamboats, and tambangans were thrown in the lower city, and no pen can depict the confusion in old Batavia, resulting in especially the natives and Chinese seeking safety by a general flight. To give some idea of the tidal waves which agitated the sea and rivers, we need only say that at Tanjang Priok, in particular, the water rose ten feet within a few minutes, that it not only wholly overflowed a portion of Lower Batavia quite suddenly, but also bore fully laden prahus of twenty-five lasts and even more capacity ashore like straws. This phenomenon was repeated at 2 p.m., but not so violently. However great was the force exerted by this heavy flow, there came a moment, after it had raged its utmost, when the water in masses of immense height suddenly ebbing away vanished, and left the river beds and sea bottom a while dry. Meanwhile, the thick, heavy, and oppressive atmosphere, charged with sulphurous fumes, began to clear up somewhat in spite of the cold. It became lighter, and by the increasing light people beheld a sight seldom certainly witnessed here in the course of centuries. The streets, or rather the roads, the trees, and the houses, were covered with a wholly white layer of ashes, and presented in the land of the sun a genuine Dutch winter scene. In the meantime, when, later in the day the distant detonations had ceased and rumbles had become fainter, no one had yet the least idea of the havoc wrought by this strange natural phenomenon. By that time Anjer had been flooded and devastated by tidal waves; with few exceptions its inhabitants had been drowned in a moment of time, and on its site in the course of that disastrous Monday nothing but an extensive muddy morass could be seen."

EDITOR

We have received the following communications:—

EARLY in the morning, on December 13, between four and five o'clock, a violent tempest from the north-west arose. The temperature in the course of the morning was rather low, viz. 4° C., and, especially between six and seven, the wind was accompanied by showers of rain, intermingled with hail. This rain was of a peculiar nature, every drop, after having dried up, leaving behind a slight sediment of grayish coloured substance. This was most distinctly to be seen on the panes of windows turned towards the west or the north-west; the spots with which these panes were dotted did not leave the least doubt about their having been caused by the fallen rain.

The streamlets of rain, having evaporated, left on the whole surface of the windows the said grayish matter behind, so that there can be no doubt but the rain itself had conveyed from the upper air the above dust.

The magnificent "cloud-glow" which, on several previous evenings, had also been observed hereabouts, and which has been attributed by meteorologists—with good right, no doubt—to the volcanic ashes due to the catastrophe of Java, made us suppose that the substance observed by us on the windows could not but be of the same origin. We took it for granted that whirlwinds, when the storm set in, had brought the dust down to the lower regions of the atmosphere, where it mingled with the falling rain. Consequently we proceeded to examine microscopically the sediment, in order to compare it with original ash from Krakatoa, which had been sent to the Agricultural Laboratory at Wageningen to have its value as plant-food ascertained. The result of this examination was that both the sediment and the volcanic ash contained (1) small, transparent, glassy particles, (2) brownish, half transparent, somewhat filamentous, little staves, and (3) jet black, sharp-edged, small grains resembling augite. The average size of the particles observed in the sediment was of course much smaller than that of the constituents of the ash. These observations fortify us in our supposition, expressed above, that the ashes of Krakatoa have come down in Holland.

Wageningen, December 14 M. W. BEYERINCK
J. VAN DAM

WITH every spare cranny in NATURE filled with volcanic dust, and the whole discussion in far abler hands than mine, I should be loth to trouble you, were there not one point in connection with the recent optical phenomena which has, as far as I know, escaped observation, and which may possibly be worthy of consideration. I allude to the connection between the sky-glows and the phenomenon commonly known as "*Rayons de Crépuscule*."

To the latter phenomenon I have incidentally had my attention much drawn, having been for many years engaged in a set of cloud observations for a special purpose. This appearance has already been described, and to some extent discussed, in the pages of NATURE and elsewhere. Several other phenomena, some of them occurring while the sun is above the horizon, seem to have been confounded under the same name. That of which I now write consists of red rays converging to a point near the horizon opposite to the sun's position, usually at between fifteen and fifty minutes after the sun has set or before it has risen. On rare occasions I have seen these belts in the evening extending past the zenith so as to converge towards the position of the sun beneath the western horizon. The interspaces of these rays (which, as has long ago been explained by Mr. Lockyer, are the shadows of hills or clouds beyond the visible horizon) are often of a complementary blue-green. The colour of the rays is similar to that reflected at an earlier hour in the evening, or at a later in the morning, from the most elevated cirri. This phenomenon seems to be in itself almost entirely independent of any weather conditions, occurring under utterly diverse states of the atmosphere. It possesses one remarkable characteristic. It is far more common in Europe in the month of November than at any other period of the year, although the prevalent state of our November skies is scarcely such as to favour its visibility. To this characteristic I called the attention of some scientific friends several years ago, amongst whom I may mention the name of Robert H. Scott, F.R.S. I have thought that the "*Rayons de Crépuscule*" were somewhat more common in the years when the November meteors were most abundant. But if this prove to be the rule the exceptions are numerous. There are long periods during which there are no "*Rayons de Crépuscule*," or in which if they occur our view of them is entirely obstructed. I have always supposed that the fall of meteoric dust determines the condensation and congelation of the vapour which exists in those strata from which these red rays are reflected, just as London smoke determines the formation of spherules of fog. The solar rays are thus reflected from ice spiculæ suspended in the atmosphere, rather than, as I understand Prof. Brücke to imply, from the atmosphere itself. Are there any reasons for doubting the possibility of the existence of much water vapour at a far greater elevation than this stratum? This would ordinarily remain in the vapour-state, being above the ordinary range of the *pulverisea* meteorites.

Now the same orange-red glow in the east, from ten to twenty minutes after sunset, by which I have usually been able to predict the appearance of "*Rayons de Crépuscule*," has been almost constantly visible at that hour throughout the present period. Further, this has been followed slightly on one, and vividly on two, of those evenings when the succeeding glow was most remarkable, by the "*Rayons de Crépuscule*" themselves. And the rays of red light emerging on several occasions from the effulgent glow in the west appear to me closely to resemble western continuations of very elevated "*Rayons de Crépuscule*."

Ecce iterum. Here we come back to Krakatoa. Granting the distance to which the vapour and dust were ejected from the bowels of Krakatoa to have been so great that the more rapidly rotating surface of the earth brought Panama under this vapour and dust in the space of less than a week, we have a gigantic pepper-box capable of condensing and congealing vapour which had long remained undisturbed in its serene heights. We do not need to call in the known currents of the atmosphere to explain the dispersion Poleward and therefore eastward of the volcanic matter, gravitation alone accounting for the transmission of the particles down the inclined isobaric planes.

To my theory of ice spiculæ it has been objected that these ought to produce halos. So, whenever the recent phenomena have been most strikingly developed, they have done. Yesterday was the third occasion during this period when, from 2.15 to 2.50 p.m. the sun was surrounded by a remarkable halo, the sky at the time being totally devoid (in the neighbourhood of the halo) of any visible upper clouds whatsoever. Cumuli passing the halo appeared green. The halo was followed by a splendid glow in the evening, and again this morning.

December 15 W. CLEMENT LEY

IF you are not yet suffering from a plethora of letters on this subject, I should like to add a few remarks to those which have been already made.

On Thursday, December 6, I witnessed one of these gorgeous sunsets in company with a friend, from the top of Rusthall Common, near Tunbridge Wells. Like Mr. Rollo Russell, I noticed that the peculiar *lasting* glow came from a lofty stratum of pale, fibrous, nearly transparent cirriform haze, which was almost invisible as the sun set, but afterwards came gradually into view, at first white in colour, and then gradually changing to orange, pink, and finally red, the change to pink occurring at 4.25 and to red at 4.45.

We also observed a strange reactionary effect produced by this glow, viz., that long after the red tints had faded from the ordinary cirrus in the western sky and from some snow-shower cumuli in the east, they were both relighted by the glow which had meanwhile increased in the west.

On Friday, this reflection *on to low clouds all over the sky* from the undoubtedly lofty stratum in the west was more noticeable, and it at once struck me that persons who had not observed the entire process of the extinction of the real reflection of the sun by these clouds, and their subsequent reillumination by reflection from the *upper* glow (as Miss Ley terms it), might erroneously be led to attribute this secondary illumination to their reflection of direct sunlight. On this ground alone, I should be rather inclined to accept with a little hesitation the observation on which Prof. Helmholtz bases his calculation, viz., that the clouds which were illuminated by the sun were 45° *above the horizon two hours after sunset.*

Nothing that I saw on either Thursday or Friday at all favoured such a fact. On the contrary, there was some positive evidence in favour of the reflecting medium being situated at a much more moderate altitude. In the first place, judging by an eye often engaged of late in taking vertical angles with a theodolite, I should say that on both days (when the sky was very clear and the stratum which emitted the glow was unusually well defined) the maximum height of the glow-stratum was not more than from 10° to 12° above the horizon.

Moreover the interval between when the ordinary cirrus ceased to glow and this upper stratum began to glow corresponded very much more with a height of from ten to thirteen miles than with such an enormous height as forty miles.

Miss Ley has, I believe, already calculated the height of the stratum to be thirteen miles, and I think this height is far more probable than one of forty miles. Besides, can we imagine either vapour, or volcanic dust, or a mixture of both, to be capable of remaining in suspension in air of such tenuity as must exist at such an altitude? Moreover, I think it must be admitted that whatever be the cause, whether meteoric dust, or impalpable pumice carried over by the upper anti-trade currents from the Java eruption, the reflection arises from a definite stratum and not merely from an atmosphere filled throughout with such dust. Possibly, as Mr. Edmund Clark suggests, the dust may act as a nucleus for the condensation of any vapour that may exist at such a high level, and it is possible that just as we find certain definite positions at which condensation occurs, and therefore clouds float, at lower altitudes, so there may be some particular height at which condensation is determined in these upper regions, thus accounting for the definiteness of the reflection and the presence of the cirrus haze to which it apparently belongs.

Thus, Dr. Vettin of Berlin has recently shown that the clouds have a marked tendency to float at certain defined levels, which can only be supposed to result from the action of certain physical causes regarding whose nature we are at present entirely ignorant.

The name of the cloud and the corresponding elevation in feet are as follows :—

Name of stratum	Height in feet
Lower cloud	1,600
Cloud	3,800
Cloudlets	7,200
Under cirrus	12,800
Upper cirrus	23,000

Now we see that these heights increase very nearly in a geometrical ratio, with 2 as the common factor, so that we might anticipate a tendency for cloud to be formed (assuming that the empirical relation held good) at an elevation of about 46,000 feet, or a height of nearly nine miles. It would be at least interesting to find that the average height of the reflecting layer in these recent sunsets lay at about this elevation.

Another circumstance which favours the notion that the dust would be carried from the tropics, and float above, and not below, this level is that, while at all lower elevations the polar currents predominate, it is just about this same level that the equatorial or southerly air-currents begin to exceed those which have a northerly component in strength and frequency. Thus, according to Vettin, the following figures represent the relative volumes (?) [1] of air carried by the equatorial and polar currents at different altitudes over Berlin :—

Equatorial	Polar	Height in feet
305	226	From 41,000 feet up to the extreme limits of the atmosphere.
253	228	41,000
206	222	23,000
164	212	12,800
108	131	7,200
92	118	3,800
83	158	1,600

This table, I think, makes it easier to understand how the dust should have been transported over to extra-tropical regions from the neighbourhood of Java, and why it should appear only in the *very high strata.*

E. DOUGLAS ARCHIBALD

GILBERT WHITE of Selborne, in one of his letters (lxv., to the Hon. Daines Barrington), describes the "amazing and portentous phenomena" observed in the summer of 1783. "The sun at noon looked as blank as a clouded moon, and shed a rust-coloured ferruginous light on the ground, particularly lurid and blood-coloured at rising and setting. The country people began to look

[1] I have not the copy of the *Zeitschrift* by me just now, and am only quoting from memory. I cannot therefore be sure whether it is volumes or frequencies. For the purpose in hand either would do equally well.

with a superstitious awe at the red lowering aspect of the sun; and indeed there was reason for the most enlightened person to be apprehensive, for all the while Calabria and part of Sicily were torn and convulsed with earthquakes, and about that juncture a volcano sprang out of the sea off the coast of Norway."

Those who are familiar with the letters and poems of Cowper will remember his references to the same phenomena in that year, as in "The Task," Book ii.—

> "Fires from beneath, and meteors from above
> Portentous, unexampled, unexplained,
> Have kindled beacons in the skies; and th' old
> And crazy earth has had her shaking fits
> More frequent, and foregone her usual rest."

Mrs. Somerville, in her "Physical Geography," traced the origin of these atmospheric phenomena to the great eruption of Skaptar, one of the volcanoes in Iceland, which broke out May 8, and continued till August, sending forth clouds of mingled dust and vapour, which spread over the whole of northern Europe. Mr. Henderson, in his work on Iceland, and Dr. Daubeny in his work on volcanoes, also describe this eruption, and the enormous quantities of volcanic dust sent by it into the atmosphere.

Mr. Norman Lockyer ascribes the recent abnormal sunrise and sunset phenomena to the clouds of volcanic dust from the great eruption of Krakatoa on September 2. The different effect caused by a tropical eruption and one in northern regions would be such as Gilbert White observed, and what we have lately witnessed. In the eruption of 1783 the stratum of dust and vapour must have been at a low level compared with that of 1883. We know in a general way the course of the circulation of the atmosphere, as we do that of the ocean: the flow of currents from the Poles to replace the ascending volume of air in the equatorial zone, which gradually diffuses itself in the upper regions of the atmosphere. But of the direction and velocity of these lofty strata we know little in detail; just as we have variations and unexplained diversions even of oceanic currents, but in the atmosphere to far greater extent. From Humboldt and Arago we have been taught to believe that the pumice and vapour clouds from volcanoes are raised to enormous altitudes, and the dispersion of these may be too irregular to admit of calculating the exact time after a tropical eruption when atmospherical phenomena would appear in particular localities. The fact remains that abnormal atmospheric effects have resulted from the presence in upper regions of the air of pumice dust in unusual quantity.

In some regions of the earth these phenomena have been frequently observed, as on the coasts of Peru, where we would expect a large amount of volcanic dust to be present. In Ellis's "Voyage to the Sandwich Islands," he describes just such appearances as we have been recently seeing. "Towards evening and in early morning I have seen clouds of every hue in different parts of the heavens, and such as I had never seen before: for instance, rich and perfect green, amber, carmine; while the hemisphere round the rising and setting sun has been one blaze of glory." Similar sunlight effects are described by Bishop Heber in his narrative. "Besides tints of crimson, flame-colour, &c., there were large tracts of translucent green in the immediate neighbourhood of the sinking sun, and for some time after sunset; with hues such I have never seen before, except in a prism, and surpassing every effect of paint or glass or gem." These effects were such as aqueous vapour alone could not have produced, and were doubtless due to foreign matter in the upper regions of the atmosphere.

In the meteorological observations of Luke Howard there are several records of similar abnormal sunlight effects when the sky was "deep blood-red after sunset, with hues passing through crimson and a gradation of lighter reds and orange and flame colour." Whether these appearances can be connected with particular volcanic disturbances or not, they seem to have been due to the presence of foreign matter in the upper strata of the air; and there are rarely periods when some volcanic region is not in active eruption.

On more than one evening in December the metallic-green colour of the moon attracted general notice. This was not due to the laws of complementary colour, for it remained when not a vestige of red or crimson could affect the vision. Mr. Edward Whymper states that the peculiar hue recalled to him the same appearance as witnessed by him in South America when the atmosphere was charged with volcanic dust.

JAMES MACAULAY

IN 1880, when travelling in Southern Algeria, I was talking with some colonists about a simoom, when a Frenchman present exclaimed "C'est la première fois que j'ai vu le soleil bleu." Upon interrogation I was assured by the whole company that the sun, seen through the fine dust of a Sahara wind, had a decidedly blue colour. I do not know whether this is always the case when a storm is blowing from the desert; but the fact, even if not a regular one, throws some light upon the East-Indian green sun. It confirms evidently the opinion that the green colour and the remarkable weakness of the sun's light, as observed in India, were due to volcanic dust from Krakatoa. An eruption like that of August must throw up into the highest layers of the atmosphere dust not only in enormous quantities but also of extraordinary fineness. And I see no difficulty in assuming that this dust, transported by air currents over Africa and Europe, was the cause of the "remarkable sunsets," the more so, as the latter phenomenon is evidently a wandering one. At Constantinople the first remarkable sunset was observed on November 20 (splendid), and subsequently we saw the same glow of the heavens in the morning and evening of the first five days of December, though partially masked by clouds. Afterwards the observation was rendered impossible by bad weather.

Constantinople, December 12 DR. BUDDE

I HAVE read with great interest the accounts of the extraordinary sunsets we have had lately. I have watched all the effects most carefully for the last fortnight, and it may be of some interest to you to hear my account. The first time I noticed anything very odd was on the evening of the 24th. I was then calling on a friend who lives on this lake, and it was dark enough to have candles, when on looking up at his studio window I saw three or four masses of cumuli piled up against each other, and all of unusual, or rather I should say unnatural, colour. I said to my friend, "Well, I never saw such a sky or clouds, it is exactly like an old master p cture, like a rich Titian sky." . . . I said this because what *ought* to have been blue sky was quite a rich green, and some of the clouds rich amber, others red brick colour, and others a yellow green. There was a high wind; these clouds were in the north, or nearly opposite the sunset, and very near. I was startled, because I knew some of the colours to be unnatural, especially at that time of day (4.30); it was not a green or an amber I had ever seen, and I have watched the sky very carefully for many years. Then, about a week ago, I saw the same effect again, and on looking round towards the sunset my eye caught the crescent moon; it was of a *pale blue green*. Two evenings before this, I was startled on looking up from my book (and some time after candles had been brought in) to see quite a red glare behind the "Old Man"; as it was almost night, I thought it was some large fire, but on going out I saw that it was merely a glare from the sunset; and more to the east near the horizon there were lurid masses of red cloud very far off

showing through bars of nearer gray cloud. I thought of running into Ruskin's study and telling him to look, and went as far as his door, but then deemed it better not, as the effect was of so lurid and awful a nature, I thought it might put him off his work! My next scene was one morning; finding the room very dark, I suddenly discovered the maid had shut the shutters; I got up to open them, and to my astonishment saw Coniston *Old Man all red*, but with no shadows! I was all the more astonished because it was still much too dark for any light on the "Old Man" at all! and I can assure you it really looked *alarming*. I have of course often seen the mountain red and orange, but never before sunrise. I concluded that this glare was caused by some very bright reflection from the rising sun on the sky above, and bright enough to make the mountains all red. I watched this more or less until nine o'clock, when at last the usual shadows appeared, the mountain getting I suppose some real sunlight. Then my last effects have been two extraordinary after-glows a few evenings ago. It seemed to me that about half an hour before sunset the sun began to shine through some extraordinary vapour capable of being illuminated *very much* more than the ordinary atmosphere, so much so that we had faint *cast* shadows from it on our lawn; there was no sign of the sun or even where he was, as this vapour was so *equally* illuminated. It lasted long; and when candles had been in some time, there was still a band of *intense rose* colour on the western horizon.

ARTHUR SEVERN

Brantwood, Coniston, Lancashire, December 9

THIS atmospheric phenomenon still continues morning and evening to excite admiration. Its effects, however, on the colour of the sky disappear at an earlier hour than has hitherto been the case; on the morning of Wednesday, the 5th inst., the southern heavens were resplendent with richest and most brilliant colours, to attempt the description of which would be somewhat puzzling. It seems as if of late the grandest displays occur before sunrise. The afternoon effects were remarkable less for richness of coloration than for the lustre of the light which arose in the west after sunset and for the predominance over the whole sky of opalescent white colours. The reflection of the light on church towers and buildings brought out the architecture in strong and startling relief. There was, however, at 4.15 p.m. a colour display, and on this occasion the moon for a short time was again changed to a hue of emerald green. On the 6th, before sunrise, the phenomenon reappeared in a mantle of lurid red colour. The display passed through the usual changes of colour and disappeared when the sun rose. In the afternoon the glow at 4 p.m. reappeared, followed by the usual brilliant radiance; the colours were, however, sea-greens, opaline whites, and bright grays till 4.30 p.m., when a blood-red colour overspread the western sky. The glow faded sooner than usual. The morning of the 7th though splendid was less grand in character than the display of the previous morning. At 4 p.m. a rosy hue suffused a few light clouds that rested on the sky. At 4.15 pearly whites and mauves and grays prevailed. Just at this time an irregularly shaped vaporous mass of an exquisite tint of lake formed in the west 45° above the horizon, and gradually spread to a point near the horizon. At 4.30 the usual orange-coloured arc appeared in the west, and for a few moments the light emitted was almost dazzling. The display was somewhat evanescent. On the 8th, before sunrise, the sky was enriched with various hues of red, carmine, green, and yellow. At 3 p.m. there was a detached cloud canopy coloured with a deep rose, but changing to an orange hue; 5 p.m. dense cloud canopy with red radiance visible through the clouds. On the 9th a dense cloud canopy shut out observation. At 4 p.m. a bright yellow glare coloured the horizon of the western sky. This was followed by the orange-coloured radiance, but the display was fugitive. The morning and afternoon of the 10th were unfavourable for observation owing to a dense cloud canopy, but a yellow-coloured light in the sky was perceptible. On the 11th the sky before sunrise was brilliant with colours pink, blood-red, yellow, and green. At 8 a.m. for a few moments the sun appeared of a green colour. This afternoon's effects were very beautiful. At 3 p.m. a yellow glow prevailed: this gave way to a remarkable streak of a vivid green colour extending along the horizon from north-west to south-west; above this was a vaporous mass reaching to within a few degrees of the zenith. Beyond this mass and overspreading the zenith the colour was mauve. In the eastern sky the colours were reds, mauves, and blues. This evening the moon again shone with a green light. The glowing arc of orange-coloured radiance which evening after evening shone in the western horizon seems to have ceased to be apparent here. The effects of the splendid sky coloration in causing the flame of gas lamps to appear white, or rather in fact to resemble the electric light—noticed by Mr. Sydney Hodges at Ealing—was at this place a striking feature of the displays. A destructive hurricane from the north-west set in at 11 p.m. on the 11th inst., and was of greater violence than any that has occurred here from that point for these forty years. The night was moonlight, with flying scud. In the night, between one and two o'clock a.m., during the height of the hurricane, the phenomenon of paraselene or mock moon was visible. The false disk was well defined, equalled the moon in size, but was less brilliant, and was some 4° or 5° from the true moon; prismatic halos were visible during the night. The wind blew in terrific gusts, striking houses and buildings almost with the force of a battering ram. Before sunrise on the 12th a red glare suffused the sky, and at half-past eight a.m. the sun appeared of a dark green colour, and remained of this colour for several minutes. The violence of the hurricane subsided towards four a.m. During the lulls of the storm there were on one or two occasions tremors that I could not connect with the vibration of the house from the effect of the wind, and which seemed to me to be earth tremors. In the afternoon the glow appeared in the west in the shape of a mass of a luminous yellow body some 25° above the horizon, which sank gradually below the horizon, and left a clear sky. On the morning of the 13th the only colour visible was a deep yellow, and that colour prevailed in the vicinity of the sun throughout the day. Thermometer again rose to 50°, barometer falling. In the afternoon of that day, cloud obscuration shut out observation.

December 14.—At sunrise, owing to the denseness of the prevailing cloud canopy, observation was not possible. At 10 a.m. the canopy broke up and dispersed, and, except along the eastern horizon, the sky became blue and clear. At 11 a.m. a broad, colourless stream of remarkable moving vapour or cloud haze, and rayed, nebulous cirri of a very filmy structure, issued from a point occupied by a few clouds of the stratus type on the western horizon, and travelled across the zenith eastwards. The motion of the vapour and cirri was rather fast as it swept across the sky. The quick-changing forms were most astonishing, some being of a leaf structure, some pointed rays, some curled, others horizontal bars. The forms of both haze and cirri were most fantastic. The stream continued to flow till after 2 p.m. I have never before observed anything like it. At 3.15 p.m. there was a wide-spreading green sky space about 20° in altitude on the western horizon. Above it gradually in the clear sky, a rich russet glow, with no definite outline, became developed, and continued to prevail. A 4 p.m. a pink glow coloured some clouds resting on the western sky and flushed the entire horizon. Towards 5 p.m. the russet colour gave way to a smoky yellow tint, and soon afterwards the light disappeared. Cloud-forms during the day took the most weird and fantastic forms. Imagining that the phenomenon was on the wane, I was surprised

to witness a display so brilliant and imposing. On this day the thermometer rose to 54°. At 8 p.m. there was a rather broad band of green light round the disk of the moon. It seemed to me that neither the sun nor the moon during the days and nights of the 12th, 13th, 14th, and 15th gave the usual light.

December 15.—The sunrise this morning was of a most impressive character. From just before sunrise till 8 a.m. the eastern sky was flushed with blood-red colour. At 8 a.m. the sun again shone with a most beautiful green light for a few minutes. The room in which the observations were made has two windows, one facing east, the other south, and the marvellous spectacle was witnessed of a flood of crimson glare filling the east window, while through the south window poured a volume of dazzling green light. This afternoon there was a thick cloud canopy, and rain fell, but a yellow glare penetrated the clouds on the south and west. At 4 p.m. through a cloud rent could be seen the bright pink, russet green, and yellow colours of the glow. The thermometer registered 44°.

December 16.—The glare was visible this morning, but no colour other than smoky yellow was visible. Afternoon the glare very powerful, but at 3.45 pale yellow was the only colour. This, however, prevailed in the west, but extended round the whole horizon. The spoked ray feature, however, was greatly developed.

The steel coloured radiance which glowed in the western sky at 3.30 p.m. at the time of closing my letter was followed from 4 till shortly after 5 p.m. by the fiery glare which has been a marked feature of the red sky displays during their prevalence. The sky effects were much the same as on the previous afternoon, except that the nebulous matter was traversed by fan-shaped pointed rays, and its structure presented a billowy appearance.

December 17.—Glare at sunrise as on other mornings of late, the coloration less grand and brilliant. During the morning a stream of filmy cirri issuing from the point in the heavens occupied by the sun and travelling across the zenith till after midday. 3.30 p.m.—Steel coloured glare, followed at 4 p.m. by the development of the usual fiery glow in the western sky, traces of which remained till 6 p.m.

In the "Notes" in NATURE for the 6th inst. (p. 135) is a record of a fall, on the night of Nov. 17, at Storelvdal, Norway, of layers of gray and black dust. This was the day of the date of a fall of discoloured rain near Worcester. Recent accounts announce the visibility of the phenomenon in America, where its cause is ascribed to meteoric dust. Reports of falls of ashes on land and shipboard tend rather to strengthen the volcanic dust theory. According to the "Annals of Philosophy," vol. ii., the sun appeared of a blue colour in April of the year 1821 in England. It seems from other sources that there were in February of that year a violent volcanic eruption in the island of Bourbon, and in June of the previous year a destructive outbreak in Gunung Api.

Worcester, December 17 J. LL. BOZWARD

THE following observations of the remarkable "glow" that has lately been attracting such universal attention at sunrise and sunset may be of use for comparison with similar phenomena observed in other parts of the world. They relate to the phenomenon as observed at sunrise on those occasions when the atmospheric conditions and other circumstances have been favourable for obtaining good observations, though I may state that, even when cloudy, and no clear blue sky visible, the red glow has frequently made itself apparent through the clouds.

December 4.—6.40 a.m. The whole eastern sky between the east-north-east and south-west, for an altitude of 15°, was of a pale pink; at 7.15 it had increased in altitude to 45°, and near the horizon was of a deep crimson. At 7.30 it began to fade away, changing to a yellowish pink, and at 7.45 it had disappeared, excepting a slight crimson haze having an altitude of about 10°, and confined to that portion of the horizon at which the sun was about to make his appearance.

December 12.—6.30 a.m. A narrow belt of brilliant crimson clouds about 5° wide skirted the horizon between the north-east and south-south-east; at 7 it had considerably decreased in brilliancy, and reached an altitude of 15°, and at 7.30 it had become of one uniform pink colour, and now reached the great altitude of 60°. It now began gradually to fade away, changing to a yellowish pink, and rapidly decreasing in altitude until by 7.45 it had entirely disappeared, leaving a clear blue sky, which at 7.50 became tinged with the ordinary sunrise tints.

December 13.—6.50 a.m. A bright yellow glow having an altitude of 15°, appeared on the horizon, extending from the east-north-east to the south-east; at 7.20 it had increased in altitude to 60°, the upper portion being of a pink colour, giving to the blue sky immediately adjoining a sickly green tint. At 7.50 the pink glow near the zenith had disappeared, and the yellow glow near the horizon had changed to pink; it had now decreased in altitude to 10°, and extended no further than between the east and south-east points of the horizon. As the sun rose above the horizon it again changed to yellow.

December 17.—7.15 a.m. The clouds which up to this time had overcast the sky cleared away, although a very brilliant display of the "glow" was to be seen. The entire eastern sky between the east-north-east and south-south-east for an altitude of 75° was of a beautiful pink, excepting immediately on the horizon, where it was yellow. At 7.45 the glow disappeared, leaving a clear blue sky until 7.55, when the usual sunrise tints made their appearance.

From the foregoing remarks it will be seen that the "glow" in this locality has generally made its appearance 1h. 20m. before sunrise, and excepting in one instance (December 4) it has disappeared ten minutes before the sun has made his appearance above the horizon.

Dalston, E, December 18 B. J. HOPKINS

I HAVE observed the "after-glow" here (Madrid) since November 30, when it first came under my notice. The effect was particularly fine on the 2nd inst., the atmosphere being perfectly clear, and the moon (new, two and a half hours behind the sun) quite brilliant, as also the stars. At 4.24 (Madrid time) the sun went down, and we had a fine, but not unusual, golden sunset effect which lasted about fifteen minutes. At 5 the sky was gradually lit up again, say 100 miles north and south of sun point on the horizon, and some 45° of arc above, the colour varying from pink-red to crimson, less intense on high, but with a defined semicircular boundary against blue sky, which at this period assumed a *greenish* tint, as did also the moon without losing her brilliancy. But I did not observe any "streaks of Polar auroral light," mentioned in Mr. Bozward's letter; the crimson fan (shall I say?) was uniform, and maintained its intensity till six o'clock, though it gradually receded; the moon at the same time recovering her silvery appearance; and at 6.15, that is one hour and forty minutes after sunset, all was over. At 6 p.m. the barometer (4-inch height aneroid by Ladd) marked 705·50 mm. (say 27·80 inches; Madrid is 655 metres above the sea), and the thermometer (Casella, K.O., No. 9538), sheltered, 4 metres above ground, stood at 10° Cent.

On the 3rd inst. the effect was somewhat different, owing to slight haziness, coupled with delicate ripples of cirrus above, a few streaks of heavy cloud down on horizon, and slight breeze from south-west; but the

whole phenomenon on the 4th inst. was the most instructive. These are my notes:—

4.34 p.m. sundown; usual sunset effect, golden; massive horizontal streaks of neutral tint cloud, from 5° to 20° above horizon, with intervals, coloured Indian red; cirrus above light crimson. 4.50, all over, clouds no longer illuminated, sky on horizon dull yellow. 5 p.m., yellow band turned *pale green; low clouds remaining quite dark* (not illuminated), upper transparent cirrus pink or light purple, *gradually* fading off into blue atmosphere, which remained *decidedly blue* although the moon and haze circle round her (= four moon diameters) were decidedly *greenish*. 5.15, purple fan receded or contracted somewhat, and more crimson in colour; green tint on horizon fainter. 5.25, upper purple tint quite gone; light down on horizon bright red like conflagration (or iron heated to redness); moon greenish; *heavy cloud streaks quite dark;* and here I will say that although I noticed in Madrid a very slight breeze from north-west, *all* clouds remained to all appearance perfectly stationary from beginning to end. 5.35, at this moment the lower clouds (say to 20° above horizon) were *reilluminated as at sunset* from beneath (Indian red), after remaining forty-five minutes in total shade. At 5.45 this new illumination began to fade, and the red glow on the horizon had risen somewhat, and was dusky. 5.50, only a few red streaks under the clouds; glow as before, apparently more intense, owing to increasing darkness. 6.0, glow dull, and low down on horizon, nearly all on the north side of the sun's setting point. 6.15, all over. Barometer 702 mm. (say 27·65 in.); thermometer 12° C.

Since December 1 the whole phenomenon, without losing intensity, has become reduced in extent, *i.e.* the fan of light (so to speak) is getting smaller, especially in the direction of its length on the horizon. Yesterday (5th) I noticed the same *reillumination* of cloud; to-day we had heavy clouds and rain at the time, and barometer 699 mm. and thermometer 6° 5 at six. F. GILLMAN

Quintana 26 (Barrio Arguelles), Madrid, Dec. 6

THERE has been a very fine "glow" this evening, with the delicate rose tint which is so unusual. I observed the bands at C and D very strongly marked, and also a faint band at about *a*, and another about half way between C and D. This is the best marked evening glow that we have had here since about the end of last week.

Dublin, December 14 J. P. O'REILLY

SIGNOR DENZA, Director of the Central Observatory at Moncalieri, writes that these sunsets were seen from November 25 to December 1, and again from December 4 to December 7, throughout the whole of Italy from the Alps to the extremity of Calabria, and everywhere with great intensity. A vast number of reports have been received at the Central Observatory, generally to the same effect. So vivid was the glow, that by many observers it was taken for an aurora borealis, the prevailing colours oscillating between red and deep orange, and afterwards passing through all the tints to the most delicate pink. During the evenings of November 28 and 29 nearly the whole sky was lit up, and the phenomenon was followed first by storms, fogs, and rain, and later on by snow. Observed with the spectroscope, the light presented nothing but the usual absorption lines of the vapour of water, but very intense. Before dawn and after sunset the zodiacal light was seen very distinctly.

Numerous letters have appeared in the *Times* on the sunsets during the past week:—

MR. G. J. SYMONS sends the following extract from the Meteorological Report from Adelaide Observatory, South Australia, for October, 1883:—"On every clear evening during this month, and the last fortnight of September, a peculiar phenomenon has been apparent in the western sky. Shortly after sunset a red glow will make its appearance, at an altitude of about 50°, being very faint at first, but as the brightness of the sky near the horizon dies away with the receding sun, the red glow will expand downwards, becoming at the same time more brilliant, until at last the whole western sky will be lit up with a beautiful light, varying in colour from a delicate pink to a most intense scarlet, and the spectacle presents a most brilliant appearance. The upper part will then gradually fade away until the colour is noticeable only 7° or 8° above the horizon, at which time the light is at about its brightest. Afterwards, a secondary glow will sometimes make its appearance at an altitude of about 50°, and gradually spread downwards until the sky is again lit up. In the secondary phenomenon the colours are generally more delicate. The whole thing will fade away about 8 p.m. This phenomenon has been noticed all over the south-eastern portion of this continent, from Port Augusta (lat. 32° S.) to Melbourne; and in India the sun has at times presented a most peculiar appearance, being green at rising, then gradually changing to a blue at noon, and inversely from noon to sunset. Various theories have been started to account for the phenomena."

COL. STUART-WORTLEY states that in 1862 he spent a year in South Italy on purpose to study the formation of clouds by the aid of photography. "During that time I spent some time at Naples while the great eruption of that year was going on, and was struck with the unusual colours of the sunsets during and after the eruptions. I still have photographs of both sunrises and sunsets indorsed with memoranda as to unusual and exceptional colours." Four years ago, while sailing in the Pacific, Col. Stuart-Wortley was much struck with the fact that very frequently the whole vault of heaven was overspread with magnificent and glorious colouring, and that in the higher regions of the air colours were found that were never seen at the horizon or below a certain height. "Now, this exceptional magnificence and peculiarity of colouring only occurs in certain latitudes and in well-defined belts, and I venture to suggest that, seen in the light now thrown on the subject by Mr. Norman Lockyer and others, the constant stream of volcanic matter thrown out by the great volcanoes in the mountain ranges of South America, and possibly from elsewhere, form an almost permanent stratum of floating matter, carried in certain directions and kept in certain positions by alternating currents in the higher regions of the air, and that to this stratum of volcanic matter much of the exceptional colouring found to be associated with sunrises and sunsets in portions of the Southern Pacific Ocean is due."

MR. W. H. PREECE writes:—"I think I can add one link to Mr. Lockyer's chain of reasoning. If we assume that the mass of volcanic matter projected with such force into the atmosphere in the Straits of Sunda was highly electrified, then it must have been electrified with the same sign as that of the earth—viz. negative. Therefore, when the force of projection had exhausted itself, the cloud of matter would be subject to two other forces besides gravity—the repulsion of the electrified earth, and the self-repulsion of each particle of electrified dust. The first would determine the tenuity of the cloud, for the lighter the particles the further they would be repelled, and the heavier the particles the quicker they would descend. It is quite possible to conceive that they might be so minute and so highly electrified as to reach the utmost confines of our atmosphere, where they would remain as long as they remained electrified. The second repulsive force would cause the particles to spread out continuously in a horizontal plane until they would cover an area determined only by their quantity. When we take into consideration the movements of the atmosphere and the rotation of the earth, I see no reason to doubt that an immense cloud of highly electrified matter, projected into the atmosphere in Java, could spread itself in

the higher regions of the atmosphere over an area equal to that of Europe. That this is not fanciful is proved by the behaviour of smoke. I have often watched when at sea, on a still, calm day, the black smoke of some passing steamer rise to some determined height, and then gradually spread itself at an equal and constant distance from the sea like a great flat pall. I have also seen on land the smoke from some manufacturing shaft blown gently by the wind follow the curves of the land, remaining always at the same distance from the ground, but gradually spreading outwards in every direction. I have also seen two lines of smoke refuse to coalesce, but repelling each other exactly as they ought if they were similarly electrified. That smoke is, therefore, negatively electrified I firmly believe, though I have never tested it. Now, that this wonderful atmospheric disturbance was accompanied by extraordinary electrical disturbance was shown, not only by Capt. Watson's observations near the spot, but by Prof. Smith's records at Madras, and hence it requires no great stretch of the imagination to conceive electricity playing a great part in the recent gorgeous display of atmospheric effects."

IN reference to Mr. Preece's letter, Mr. Crookes writes:—"In a paper read before the Royal Society in 1879 I showed that at a rarefaction of the millionth of an atmosphere two pieces of electrified gold leaf repelled one another at a considerable angle for thirteen months without loss of charge. Therefore at a rarefaction of a millionth (corresponding to a height above the earth's surface of about sixty-two miles) air is a perfect non-conductor of statical electricity, without interfering with the mutual repulsion of similarly electrified particles. When we bear in mind that the specific gravity of gold is five or six times that of the rock whose disruption formed the dust in question, and that the size of the individual particles of dust is certainly many thousand times smaller than my gold leaves, there is every reason to believe that electrified dust, once projected fifty or sixty miles above the earth's surface, might remain there for many years."

BISHOP BROMBY, writing to the *Times*, says that in a letter from a member of his family at Hobart, Tasmania, the writer speaks admiringly of "the loveliest after-glow which was spread over the sky on the other side of the water where the sun had set." This was written on October 12 by one who was ignorant that similar phenomena had been observed in other parts of the world.

ANOTHER correspondent of the *Times* states that in a letter dated "Duem, September 24, 1883," Hicks Pasha wrote:—"By the way, have you in England noticed a large black spot on the sun? To-day, when it rose, it was of a pale green colour, and we saw through our glasses an immense black spot on the lower half of it. What does this portend? I feel sure there must be some notice of it in the papers in England."

SHERIFF RAMPINI of Lerwick, Shetland, writes that the sunsets have been observed in these northern islands.

MR. G. F. BURDER of Clifton sends the following extract from a letter from a passenger travelling from San Francisco to Sydney, three days after leaving Honolulu. The writer says:—"On Wednesday, September 5, we witnessed a most curious phenomenon. The sun set perfectly blue, and next morning it rose a flaming ball of blue The blue light was reflected in our cabins."

ON November 30, at 4 p.m., another remarkable sunset was observed in Stockholm. A correspondent states that the western sky became covered with an intense purple after-glow, having the appearance of an enormous distant conflagration, which nearly reached the zenith, and lasted for an hour, even after it was dark, and the stars were visible. On the morning of December 1 a similar intense light was observed at sunrise. The colour was, however, then more yellow. The phenomena have also been observed in the north of Sweden, in Gothenburg, in Christiania, and in Copenhagen.

THE KRAKATOA AIR-WAVE

ON Thursday last Mr. R. H. Scott communicated a paper to the Royal Society giving a map and tabular statements concerning certain barometric disturbances observed towards the end of August last.

The obvious correspondence of the forms and times of occurrence of the barometric disturbances, described in Mr. Scott's paper, at once suggested to General Strachey that they were due to a common origin, and the great volcanic eruption at Krakatoa in the Straits of Sunda appeared to supply a probable efficient cause. General Strachey therefore took up the question from this point of view, and at the same meeting communicated a paper, of which the following is an abstract:—

"Any shock of sufficient violence might be expected to produce an atmospheric wave, advancing from the place where it was caused in a circular form round the globe, at first expanding until it had got half round the earth, and then again contracting till it was again concentrated at the antipodes, from which again it would be thrown back, and so pass backwards and forwards till it was obliterated. It might have been expected that such a wave would travel with the velocity of sound, being probably of the same nature as that which causes sound, though the vibrations had not the peculiar character that affects our organs of hearing. It has, however, been suggested to me that the wave may rather have had the character of a solitary wave produced in a liquid, the velocity of which in the air would not materially differ from that of sound.[1]

"A rough examination of the facts at first made known by the observations recorded in Great Britain indicated that there was *primâ facie* strong evidence in support of this view, and that the phenomena would be approximately explained by the passage round the earth of a series of waves travelling at the rate of about 700 miles an hour in opposite directions from the place where the volcanic eruption occurred. The records since procured from other places, and the more careful examination of the facts, have quite confirmed this conclusion.

"Although we may expect to obtain additional data from other parts of the globe, which will make the investigation of this somewhat remarkable phenomenon more complete, yet those we now have are sufficient to justify an attempt being made to bring the more important facts before the Royal Society without further delay.

"The following table shows the stations from which the records have been received of which use has been made in this discussion, with certain particulars of their geographical position, and of their distances measured on great circles, from Krakatoa, the place of eruption:—

Place	Longitude	Latitude	Distance from Krakatoa, measured on a great circle	
			From west to east.	From east to west.
	° ′	° ′	° ′	° ′
Toronto	W. 79 15	N. 43 40	142 15	217 45
Valencia	,, 10 18	,, 51 55	249 31	110 29
Coimbra	,, 8 24	,, 40 13	247 58	112 2
Armagh	,, 6 39	,, 54 21	252 17	107 43
Falmouth	,, 5 4	,, 50 9	252 15	107 45
Glasgow	,, 4 18	,, 55 53	253 57	106 3
Stonyhurst	,, 2 28	,, 53 51	254 34	105 26
Aberdeen	,, 2 6	,, 57 10	255 25	104 35
Kew	,, 0 19	,, 51 28	255 27	104 33
Greenwich	,, 0 0	,, 51 29	255 39	104 21
Paris	E. 2 20	,, 48 50	256 49	103 11
Brussels	,, 4 20	,, 50 51	258 17	101 43
St. Petersburg	,, 30 20	,, 59 56	272 3	87 57
Krakatoa	,, 105 22	S. 6 9		

[1] The log of a surveying ship at the north of Borneo, since received, shows that the explosions were heard there on the morning of August 27, at a distance of 1200 miles from the volcano; and it has been also stated that these sounds were heard in Ceylon, at a distance of about 2000 miles.—R.S.