

were at least half a million antelopes in sight at once; and from this it is inferred that the whole "trek" must have included millions. Of course, thousands of head fell to the rifles of the Boer and other hunters; and a brisk trade sprang up in hides and meat. The writer of the paper infers that a migration on such a scale will never be seen again, for the reason that the Springbuck will be unable to recruit their numbers to a sufficient degree.

WE are asked to announce that the second annual dinner of the Association of Old Students of the Central Technical College will be held on Thursday, July 6.

THE *Quarterly Journal of Microscopical Science* contains two papers by Mr. J. E. S. Moore, dealing with his researches on the Molluscs of the great African lakes, especially Tanganyika. In the first paper, which discusses the morphology of the two littoral forms *Tanganyikia* and *Spekia*, the most interesting relates to the ancestry of the terrestrial *Cyclophoridae*. It is suggested that they trace their origin from some fresh-water derivative of the Tanganyika genus *Purpurina*, such as the cretaceous *Pyrgulifera*, which may represent a fresh-water non-halolimnic development of the type. The second paper deals with the truly halolimnic genera *Nassopsis* and *Bythoceras*. In regard to these and allied types, the author makes the following concluding observations. "We have the wonderful similarity of the halolimnic shells now living in Tanganyika to those which have been left fossilised at the bottom of the old Jurassic seas; and, lastly, there are the morphological characters of the halolimnic animals themselves, whereby they become mentally depicted like nothing so much as the incompletely developed embryos of numerous living oceanic types."

A COPY of volume x. of the *Transactions* of the American Pediatric Society, edited by Dr. Floyd M. Crandall, has been received. A number of papers and reports on infantile diseases are contained in the volume, one of the most important being a statement of the results of the Society's collective investigation on infantile scurvy in North America.

"A Select Bibliography of Chemistry" (1492-1892), by Prof. H. Carrington Bolton, was published in 1893. The first supplement of this volume, including words omitted in the previous volume, and bringing the literature of chemistry down to the close of the year 1897, has just been issued as No. 1170 of the Smithsonian Miscellaneous Collections. The sections into which the titles are grouped are: bibliography, dictionaries, history, biography, chemistry (pure and applied), and periodicals, the titles being in each case arranged alphabetically according to authors. The section dealing with alchemy has been dropped. The number of titles in the original volume was 12,031, and the number in the present volume is 5554, making a total of 17,585. Germany comes first in the number of additional titles, with a total of 1461. France follows with 1085 titles, England with 972, and Russia with 581 titles. The next six countries in order of their number of contributions to chemical literature are: Iceland, 434; Sweden, 196; Holland, 191; Denmark, 151; Portugal, 123; Bohemia, 98.

A COMMENDABLE characteristic of the report of the Marlborough College Natural History Society is a collection of anthropometrical particulars referring to boys in the school, obtained by Mr. E. Meyrick. The measurements are a continuation of records published last year. For each boy the information tabulated is his form, age, height, weight, size of chest expanded and contracted, and where possible the increase compared with last year's measures. Information of this kind is of real service to students of physical anthropology. Among

other noteworthy matters in the report is a list of 417 wild flowering plants observed by members of the botanical section, one member, Mr. F. E. Thompson, having obtained no less than 189, a worthy conclusion on his part to a series of botanical observations extending over thirty years. Appended to the usual meteorological statistics for every day of 1898 is a summary of the meteorology of Marlborough for the ten years 1889-1898. In addition, the report contains sectional reports, notes and observations, notes on lectures, and a variety of other information—all instructive and of interest as showing the development of the scientific spirit in a public school.

THE additions to the Zoological Society's Gardens during the past week include a Green Monkey (*Cercopithecus callitrichus*, ♀) from West Africa, presented by Dr. H. Strachan; a Rufous Tinamou (*Rhynchotus rufescens*) from Brazil, presented by Mr. Henry Bell; a Common Kingfisher (*Alcedo ispida*) from Ireland, presented by Mr. Ronald Edwards; two Jackdaws (*Corvus monedula*, white var.), European, presented by Mr. Eardley Wilmot B. Holt; two Secretary Vultures (*Serpentarius reptilivorus*) from South Africa, presented by Mr. J. E. Matcham; two Green Turtles (*Chelone mydas*) from the Gulf of Manor, presented by Captain Geo. G. C. Stevenson; two Black-striped Wallabies (*Macropus dorsalis*, ♂ ♀) from New South Wales, two Stonechats (*Pratincola rubicola*) from South of France, two Derbian Parrakeets (*Palaeornis derbyana*) from China (?), a South Albemarle Tortoise (*Testudo vicina*) from South Albemarle Island, deposited; a Musk Duck (*Biziura lobata*) from Australia, three Barbary Turtle Doves (*Turtur risorius*) from Africa, a Tuatera Lizard (*Sphenodon punctatus*) from New Zealand, purchased; two Collared Fruit Bats (*Cynonycteris collaris*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

COMET 1899 a (SWIFT).—

		Ephemeris for 12h. Berlin Mean Time.			
1899.		R.A.	Decl.	Br.	
		h. m. s.			
June 8	...	15 59 12	+ 46° 18' 1"	...	0.88
9	...	48 32	44 39.5	...	
10	...	39 2	43 2.2	...	0.75
11	...	30 32	41 27.2	...	
12	...	22 56	39 54.7	...	0.63
13	...	16 5	38 25.4	...	
14	...	9 57	36 59.3	...	0.53
15	...	15 4 27	35 36.6	...	
16	...	14 59 29	34 17.3	...	0.45
17	...	54 57	33 1.3	...	
18	...	50 51	31 48.7	...	0.38
19	...	47 7	30 39.7	...	
20	...	14 43 45	+29 33.4	...	0.32

Being now almost two months past perihelion, the comet is rapidly becoming less conspicuous. During the week it will pass from Hercules into Bootis, its path being nearly parallel to a string of 4th mag. stars ϕ and χ Hercules, μ , δ and ϵ Bootis.

THE ROYAL OBSERVATORY, GREENWICH.

ON Saturday last (June 3), the Astronomer Royal presented his Annual Report to the Board of Visitors of the Royal Observatory, Greenwich. The weather was all that could be desired, and the large number of guests, numbering among them Prof. Cornu, was able to comfortably inspect the buildings and instruments, which had as usual been thrown open to view.

The following is a brief *résumé* taken from the report:—

Buildings.

The new Observatory building, which has been in progress since 1891, was completed last March, by the addition of the east and west wings. This handsome building provides much needed accommodation for the Observatory staff, for the photo-

graphic records and books of calculations, and for the library, which had long outgrown the rooms hitherto available for it. In the new Observatory building—which is cruciform in shape, having four wings of three stories, with a central tower carrying the Thompson equatorial and dome—the staff occupies the principal floor, the library will be placed in the ground floor of the north, east and west wings, the ground floor of the south wing being fitted up as a workshop, and the upper floor will accommodate the photographic and other records and the stock of publications of the Observatory.

The completion of the new Observatory building, which at three points breaks into the existing boundary fence, makes it desirable that the boundary of the Observatory should be enlarged in order to show off the handsome new building, and a proposal to give effect to this is under the consideration of the Admiralty.

The new Magnetic Pavilion, in an enclosure in Greenwich Park, at a distance of about 350 yards from the Observatory, on the east side, was completed at the end of last September, and the magnetic instruments for absolute determinations have been installed there. The greatest care has been taken to exclude all iron in building the Magnetic Pavilion, and the site has been selected so that there is no suspicion of magnetic disturbance from iron in the neighbourhood. The enclosure also provides a good meteorological station, where the standard thermometers and rain-gauges have been mounted.

Transit Circle.

The sun, moon, planets, and fundamental stars have been regularly observed on the meridian as in previous years. The number of observations made from 1898 May 11 to 1899 May 10, was as follows:—

Transits, the separate limbs being counted as one observation	...	...	...	11,764
Determinations of collimation error	...	...	...	298
Determinations of level error	...	...	...	694
Circle observations	...	...	...	10,830
Determinations of nadir point (included in the number of circle observations)	...	...	...	665
Reflection observations of stars (similarly included)	...	...	...	560

The number of stars observed in 1898 was about 5000.

The number of meridian observations in the first three months of 1899 was unusually large, being 1200 more than the average of the three preceding years. The excess was entirely in January and February, for which months the number of observations was double the average number. This unusually large number of observations has caused great pressure on the computing staff in that branch, and it is much to their credit that the reductions have fallen so little behind.

The apparent correction for discordance between the nadir observations and stars obtained by reflection for 1898 was found to be $-0''\cdot36$. The results of recent years are as follows:—

	Mean	Range	
1880-1885	$-0''\cdot34$	from $-0''\cdot29$	to $-0''\cdot45$
1886-1891	$+0''\cdot03$	from $-0''\cdot12$	to $+0''\cdot09$
1892-1898	$-0''\cdot30$	from $-0''\cdot25$	to $-0''\cdot36$

New steel screws for the microscope micrometers were introduced in 1886, and in October 1891 the object-glass was repolished, and a new steel telescope micrometer screw was introduced.

Both microscope and telescope micrometer screws have been examined, but show no errors which would account for this discordance.

The co-latitude of the transit-circle, as found from observations of about 600 stars in 1898, is $38^{\circ} 31' 21''\cdot75$, differing by $-0''\cdot15$ from the adopted value. The effect of Chandler's latitude variation was computed for each of these stars within the limits 10° and 35° N.P.D. The table, which is given in the Report, exhibiting the effect of Chandler's correction to the colatitude on the means of groups arranged for each hour of right ascension, shows how entirely its influence is eliminated from the resulting co-latitude.

The mean error of the moon's tabular place (computed from Hansen's lunar tables with Newcomb's corrections) is $-0''\cdot143$. in R.A. and $+0''\cdot14$ in N.P.D. deduced from 104 observations.

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These are equivalent to an error of $-2''\cdot23$ in longitude and $+0''\cdot21$ in ecliptic north polar distance.

In the last Report, the equivalent error in longitude was $-1''\cdot97$ and $+0''\cdot16$ in ecliptic north polar distance.

From June to December 1898 a new determination of the division errors of the transit-circle was made by Mr. Dyson and Mr. Thackeray. An account of this investigation has been published in the *Memoirs* of the R.A.S., vol. liii., so that we need not refer again to it here.

The New Altazimuth.

After the date of the last Report, it was found that the readings of the several microscopes varied systematically with the direction in which the instrument was swung. As this pointed to a constraint in the axis, several modifications were made in different parts of the instrument. These various changes were not completed till February 23, and since then the observations, both of transits and zenith distances in reversed positions, show a satisfactory accordance.

Among the observations made with this instrument may be mentioned 1017 R.A. observations of the sun, planets and stars, 961 N.P.D. observations of the same bodies, and 20 observations in R.A. and N.P.D. of the moon.

Thompson Equatorial.

The return of the object-glass of the 26-inch refractor on 1898 May 16 is referred to in the last Report. Slight figuring of the outer surface under Sir Howard Grubb's direction was continued till June 8. The object-glass was further tested by photographs taken inside and outside of focus and with diaphragms, and was finally approved in September. The new 30-inch mirror, of slightly shorter focal length (corresponding to the length of the tube), was received from Dr. Common on September 1. Photographs to test the mirror were taken in the principal focus and also in the secondary focus, and it was found to be quite satisfactory.

With the 26-inch refractor, twelve successful photographs of Neptune and its satellite have been obtained, using the occulting shutter to screen the planet during the greater part of the long exposure necessary to show the satellite, a series of short intermittent exposures for the planet being given by lifting the arm of the shutter. The results of these observations are given in the *Monthly Notices of the Royal Astronomical Society*, vol. lix., May. Forty-two successful photographs of sixteen double stars have also been obtained, including six of Aldebaran, for which the occulting shutter was used in order to obtain measurable images of Aldebaran and the faint companion, for which a 20m. exposure was required. A few photographs of fields of stars have also been obtained.

With the reflector, thirty-two photographs of the planet Eros were obtained between September 20 and March 31, nine photographs of Neptune and its satellite, four of Comet Brooks, and one of Comet Tuttle. To investigate the distortion of the field, five photographs of the Pleiades have been taken.

With an exposure of an hour, a "fine photograph of the Andromeda nebula has been obtained."

28-inch Refractor.

This instrument has been used throughout the year for microscopic measurements of double stars. Four hundred and ten stars have been measured; 206 of these have their components less than $1''\cdot0$ apart, and 87 less than $0''\cdot5$. The stars the distance apart of which is less than $1''\cdot0$ have been measured on the average on three nights each, and the wider pairs on two and a half nights. The wider pairs measured consist of stars in which there is a considerable difference of magnitude between the components, of third companions to close pairs, and of stars which are of special interest.

A long series of measures of 70 Ophiuchi has been obtained.

Astrographic Equatorial.

During the year ending 1899 May 10, 465 plates have been taken on 120 nights. Of these 78 have been rejected, viz. 34 because the exposure was interfered with by cloud, or because the images were too faint to show 9th magnitude stars with a 20s. exposure; 17 owing to faults in guiding or exposure; 8 on account of wrong setting; and 19 from miscellaneous defects.

The following statement shows the progress made with the photo-mapping of the heavens:—

	For the Chart (Exposure 40m.).	For the Catalogue (Exposures 6m., 3m., and 20s.).
Number of photographs taken ...	256	200
" successful plates ...	211	167
" fields photographed suc- cessfully ...	206	160
Total number of successful fields reported 1898 May 10 ...	828	909
Number of photographs, previously considered successful, rejected during the year ...	7	39
Total number of successful fields obtained to 1899 May 10 ...	1027	1030
Number still to be taken ...	122	119

Of the 122 fields to be photographed, 101 are within 7° of the pole. The photography of this part of the sky was purposely deferred till near the epoch 1900, and has just been begun.

In last year's Report, we mentioned that 166 catalogue plates out of 909—that is, nearly one-fifth of the total number—and 90 chart-plates out of 828, had deteriorated owing, probably, to the effect of damp in the building in which they have to be stored pending the completion of the new physical laboratory.

This year we read that the deterioration of some of the plates has continued, as it was not found practicable to move the photographs into the new Observatory building till March. Besides the plates which have been rejected during the year, as mentioned in the tabular statement above, there are about forty catalogue plates in the zones yet to be measured which should be taken again. The damaged chart-plates have all been copied, and the positives on glass will in any case be available. But it seems advisable that all the damaged plates, whether measured or copied, should be replaced by others, and, as the photo-mapping for the zone allotted to Greenwich is now nearly completed, this work can shortly be taken in hand.

Heliographic Observations.

In the year ending 1899 May 10, photographs of the sun have been taken on 195 days, either with the Dallmeyer or Thompson photo-heliographs. The former, mounted on the terrace roof of the south wing of the physical observatory, was used as the regular instrument for solar photography up to and including 1898 July 27, when the Thompson 9-inch photo-heliograph was substituted for it. The Dallmeyer photo-heliograph was dismantled and placed in the upper floor of the museum on 1898 October 13. Of the photographs taken with either instrument, 394 have been selected for preservation, besides sixteen photographs with double images of the sun, for determination of zero of position-angle. Photographs to supplement the Greenwich series have been received from India and Mauritius up to 1899 January 13.

For the year 1898, Greenwich photographs have been selected for measurement on 165 days, and photographs from India and Mauritius (filling up the gaps in the series) on 192 days, making a total of 357 days out of 365 on which photographs are at present available. No photographs have been received from Mauritius of later date than 1898 August 7, and as the eight days which are at present unrepresented are all since that date, it is possible that the record for the year may yet be rendered complete.

The chief incident in the history of the sun's surface, during the period covered by this Report, was the very remarkable temporary revival of activity which set in at the end of July and lasted almost to the middle of November, culminating in the appearance of the great group of September 3-15. Apart from this, the sun's surface has been very quiet during the year, the spots being few, isolated, and small. There have, however, been no such long-continued instances of the entire absence of spots as to suggest that the minimum had been actually reached or is immediately at hand, the number of days without spots for which a record is at present available being 49, as compared with 42 in the previous Report.

Magnetic Observations.

The variations of magnetic declination, horizontal force, and vertical force, and of earth currents, have been registered photographically, and accompanying eye observations of absolute

declination, horizontal force, and dip have been made as in former years.

On the completion of the new Magnetic Pavilion, last September, the Gibson deflection instrument and the Airy dip-circle were mounted there, and regular determinations of magnetic horizontal force and dip have been made there from that time.

The principal results for the magnetic elements for 1898 are as follows:—

Mean declination ...	16° 39'·2 West.
Mean horizontal force ...	{ 3'9878 (in British units). 1'8387 (in Metric units).
Mean dip {	January to June 67° 12'·4 } (with 3-inch needles). October to December 67° 11'·3 }

These results depend on observations on the site of the Magnetic Pavilion, and are free from any disturbing effect of iron. The correction to the declination, as found in the Magnet House, is $-10'·7$, deduced from the observations with the Elliott declinometer, in September and October, and with the new declinometer in the Magnetic Pavilion, the values found with the two instruments being precisely the same.

The question of the protection of the Observatory from disturbance of the magnetic registers by electric railways or tramways in the neighbourhood has caused much anxiety during the past year. A number of such railways are now projected, and the value of the magnetic registers, which have now been carried on continuously for nearly sixty years, will depend entirely on the conditions under which electric traction is used. Steps have been taken, in concert with Prof. Rücker, acting on behalf of Kew Observatory, to have a special clause inserted for the protection of Greenwich and Kew Observatories. This has already been accepted in several cases, and it is hoped that it will be agreed to in others where necessary.

Meteorological Observations.

The mean temperature of the year 1898 was $51^\circ·3$, being $1^\circ·8$ above the average for the fifty years 1841-1890. During the twelve months ending 1899 April 30, the highest daily temperature in the shade recorded in the open stand was $92^\circ·1$ on September 8. The highest reading recorded in the Stevenson screen was $90^\circ·0$ on the same day.

The monthly mean temperatures were in excess of their corresponding averages from August to February (inclusive) to the mean amount of $3^\circ·9$. In December, the excess amounted to $6^\circ·1$, and in September to $4^\circ·9$. In the five remaining months of the year the mean temperatures were below the average values.

The mean daily horizontal movement of the air in the twelve months ending 1899 April 30 was 291 miles, which is ten miles above the average for the preceding thirty-one years. The greatest recorded movement was 950 miles on January 21, and the least 67 miles on March 14. The greatest recorded pressure of the wind was 33 lbs. on the square foot on February 13, and the greatest hourly velocity 53 miles on January 12.

The number of hours of bright sunshine recorded during the twelve months ending 1899 April 30 by the Campbell-Stokes instrument was 1500 out of the 4454 hours during which the sun was above the horizon, so that the mean proportion of sunshine for the year was 0·337, constant sunshine being represented by 1.

The rainfall for the year ending 1899 April 30 was 22·74 inches, being 1·80 inches less than the average of fifty years. The number of rainy days was 158. The rainfall in the month of September amounted to 0·305 inch, being the smallest September rainfall on record in the period 1841-98, with the exception of September 1865, when the rainfall was only 0·16 inch.

Longitude of Killorglin.

The longitude of Killorglin, at the head of Dingle Bay, Ireland, was determined in October and November. The station was selected in order to eliminate, as far as possible, the effect of local attraction at Valentia and Waterville, both of which longitude stations are situated between the Atlantic on the west and a mountain mass on the east.

A desire has been expressed by the International Geodetic Association for a re-determination of the longitude of Paris—Greenwich in view of the discordance in the results found by the French and English observers respectively in the two de-

terminations in 1888 and 1893, and the Council of the Paris Observatory have recommended that this work should be undertaken in concert with Greenwich Observatory. As a preliminary to the actual longitude operations, it seems essential that the instruments to be used by both parties of observers should be thoroughly tested at contiguous stations.

SPURIOUS EARTHQUAKES.

IN compiling the seismic record of any country, we are liable to errors from two sources. We cannot help omitting a large number of slight earthquakes, which it is difficult to separate from the countless tremors that are artificially produced. On the other hand, we include a smaller, but still important, number of shocks which are not seismic in their origin, though they simulate earthquakes in many ways. Errors of the former class are, of course, difficult to prevent, though they tend to become less frequent when attention is given to the subject. Those of the latter class may sometimes be eliminated by a study of the different kinds of disturbance which have been, or might be, mistaken for true earthquakes.

The majority of spurious earthquakes in this country are produced by the firing of heavy guns, the bursting of meteorites, and the fall of rocks in underground channels. Explosions and landslips produce disturbances which are at first frequently mistaken for earthquakes, but their real origin cannot fail to be soon discovered and remembered. Perceptible tremors are also produced in buildings by thunder, but it is improbable that permanent errors can thus arise, for the long duration of the sound, in conjunction with the small area affected, provides a simple test. I shall, therefore, confine myself to the first three causes mentioned in this paper.

FIRING OF HEAVY GUNS.

The sound and tremor produced by the firing of heavy guns are sometimes perceived at great distances; but, as I propose to deal with this subject in another paper, I will merely mention here that observations of the sound at distances exceeding one hundred miles are by no means uncommon.

On two or three occasions within the last few years I have been able to trace supposed earthquakes to this source. On the first (January 7, 1890), two shocks were felt in the south-west of Essex at 12.30 and 1.25 p.m. All the places from which I received accounts lie close to a line running north-east from Woolwich, with one exception, in which the direction is north by east. I have no report of the direction of the wind in the immediate neighbourhood, but southerly and south-westerly breezes were generally prevalent over the whole country on that day. Near the boundary of the district affected, the disturbance was supposed to be seismic by observers who felt the Essex earthquake of 1884: somewhat nearer the origin, the sound resembled the report of a heavy gun; while, six miles from Woolwich, the noise and shock were referred without hesitation to their true cause, the discharge of a 110-ton gun at Woolwich at the times mentioned.¹

On May 5-6, 1893, a number of shocks were felt at nearly regular intervals in the Isle of Man. At Douglas, where they were very slight, they were regarded as earthquakes; further south, and at near Castletown, they were described as resembling the reports of heavy guns, but the likeness was not striking enough to raise doubts as to their seismic character when it was once asserted; at the Chickens Lighthouse, off the extreme southern point, the keeper informed me that no earthquakes were felt, but that there must have been some man-of-war practising to the south-south-west; and this, on inquiry at the Admiralty, was found to have been the case, H.M.S. *Neptune*, a first-class battle-ship, having been engaged in heavy-gun practice to the south of the island during the very times when the reported earthquakes were heard and felt.

Tests.—The principal tests by which the true character of these disturbances may be distinguished are the following: (1) When several are noticed on one day, they are of not very unequal intensity, and may occur at nearly regular intervals. (2) The disturbance is apparently communicated through the air. (3) The gradually increasing confidence in one direction with which the shocks are attributed to gun-firing is no doubt the most important test. (4) In many cases, the position of

¹ The supposed earthquake at Chelmsford on January 7 (NATURE, vol. xli, 1890, p. 369).

the disturbed area or the time of occurrence may lead to suspicions regarding the seismic nature of the shocks. (5) If the disturbed area were extensive, a few good time-observations would give a velocity approximating to that of sound-waves in air.

THE BURSTING OF METEORITES.

The explosive bursting of meteorites is one of the commonest causes of spurious earthquakes. The mistake in such cases, it is probable, arises not so much from any close similarity between the two phenomena, as from the exclusion in the minds of the reporters of all artificial causes, and the consequent inference of a seismic origin. The explosion of a large meteor, weighing one or several tons, on entering the atmosphere is heard, according to the late Prof. H. A. Newton, for "a hundred miles around, shaking the air and the houses over the whole region like an earthquake." (NATURE, vol. xxxiv., 1886, p. 533). Many such cases might be quoted, and a very large number must be known to those who have made a special study of the subject, but the following are probably sufficient for the present purpose.

West of England Meteorite, January 25, 1894.—At an early stage of its flight, this meteor, according to Mr. Denning, passed over Chester at a height of fifty-eight miles. It travelled in a direction from N.N.W. to S.S.E., passing almost over Droitwich and Worcester, at a height of about twenty-three miles, and disappearing with an explosion when about sixteen miles above a point four miles north of Ashchurch (near Tewkesbury). Two minutes after its disappearance three detonations were heard at Worcester, "the last being of exceptional violence, shaking buildings and causing the earth to vibrate." At Brinscombe (near Stroud), about a minute or a minute and a half after its disappearance, "there came (apparently from the north-east) a series of explosions, which sounded . . . like a number of field-pieces fired in rapid succession, followed by a volley of musketry." One of the most interesting observations from the present point of view is that made by an observer at Parkfields (near Ross). "A slight earthquake," he says, "was felt here. . . . I heard a loud rumbling noise like an explosion, lasting two or three seconds, which I took for thunder. A young lady who had just gone up to her room tells me that there were two slight shocks, the motion being similar to that of a steamer at sea. . . . I am informed that it was accompanied by a lurid light, which lasted some time, and that objects at a considerable distance were plainly visible. The night was dark and cloudy, with some rain." The recorded observations are too few in number to determine the boundaries of the sound-area and disturbed area, but a perceptible tremor was felt at Alvechurch (near Redditch), which is thirty-nine miles from Ross, and the sound was heard at Alvechurch and Brinscombe, places which are forty-four miles apart.¹

Central England Meteorite, November 20, 1887.—At about 8.20 a.m. a loud sound, accompanied in many cases by a distinct trembling or shaking of houses, was heard over a large area, chiefly in the counties of Cambridge, Bedford, Hertford, Buckingham, Oxford and Berkshire. Many observers at once attributed the phenomena to an earthquake, and Mr. H. G. Fordham, who has made a careful study of them,² commenced his inquiries under that impression. It soon appeared, however, that the disturbance proceeded from the air rather than from the ground, and this fact, together with the actual observation of a meteor at the time mentioned, placed its true origin beyond doubt.

The accompanying map is, in part, a reproduction of that prepared by Mr. Fordham; but my object being somewhat different from his, I have added some details and omitted others. Every place where the sound was heard without any mention being made of an accompanying tremor is denoted by a small cross. If the concussion was strong enough to make doors, windows, and other loose objects rattle, the place of observation is shown by a large dot; if the tremor only is mentioned, without any other indication of its intensity, it is marked by a small dot. The sound-area as thus drawn is about 105 miles in length and nearly forty miles in breadth.

From the grouping of the places, where the sound was especially loud and definite, Mr. Fordham believes that the track of the meteorite would probably be best defined by a line drawn from Barrington (near Cambridge) to Wantage. Assuming this line

¹ NATURE, vol. xlix., 1894, pp. 324-325; *The Times*, January 20, 31, 1894.

² The meteorite of November 20, 1887.—*Hertfordshire Nat. Hist. Soc. Trans.*, vol. v., 1888, pp. 33-62.