

is being mounted on the Sheepshanks equatorial for trial. A number of photographs of stars have been taken with the experimental 6-inch object-glass, supplied as a preliminary to the construction of the 13-inch, which is to take part in the construction of the photographic map of the heavens. Only inconclusive results have, however, as yet been obtained. The spectroscopic work has mainly consisted of observations of motion of stars in line of sight. We read:—

"For determination of motions of approach or recession of stars, 236 measures have been made of the displacement of the F line in the spectra of 38 stars, and 18 of the *b* line in the spectra of 8 stars, besides 5 of the *b* line in the spectrum of Saturn's ring, and comparisons with the spectra of the moon, Venus, the sun, or the sky, as a check on the general accuracy of the results. Observations of Algol on three nights during the past year confirm the previous results indicating orbital motion, but further evidence is required to establish the fact. The spectra of  $\gamma$  Cassiopeæ,  $\sigma$  Ceti,  $\beta$  Lyrae, P Cygni, R Cygni, and  $\beta$  Pegasi, have been examined on several occasions, and Comet *c* 1888 has been spectroscopically observed on one night, the spectrum being chiefly continuous. The spectroscopic observations of all kinds are completely reduced."

Photographs of the sun have been taken 182 days in the year ending on May 10, 1889. Indian and Mauritius sun photographs have been received from the Solar Physics Committee as far as 1888 December 31 and December 9 respectively, and it is noted that, by means of photographs from these two places supplementing the Greenwich series, the daily photographic record of the sun's surface is practically complete since the beginning of 1882. For earlier years 118 photographs of the sun taken at Harvard College, Cambridge, U.S.A., between 1874 December 9 and 1875 December 31, and ten photographs taken at Ely, between January 1 and February 25, 1874, have been received from the Solar Physics Committee.

The photographs of the sun for 1888 show that it has been free from spots on 155 days in the year 1888, the longest spotless periods being February 4 to 17, May 24 to June 8, and October 5 to 25. The mean spotted area in 1888 was half that of the preceding year, and corresponded closely to that for 1877, so that the minimum may be expected to occur during the present year. The mean distance of spots from the equator has also diminished to  $7^{\circ}38'$  in 1888, being very little larger than it was in 1878, just before the last minimum, and this is a further indication that the sun-spot minimum is close at hand. The faculæ in 1888 show a diminution in correspondence with that of sun-spots, their area for 1888 being intermediate between those for 1876 and 1877.

Continuous observations of the changes in the three magnetic elements of declination, horizontal force, and vertical force have been photographically recorded.

The following are the principal results for the magnetic elements for 1888:—

Approximate mean declination	... ..	$17^{\circ}40' W.$
Mean horizontal force	... {	$3^m9480$ (in British units).
		$1^m8204$ (in Metric units).
Mean dip	... ..	$67^{\circ}24'26''$ (by 9-inch needles).
		$67^{\circ}25'33''$ (by 6-inch needles).
		$67^{\circ}26'16''$ (by 3-inch needles).

In the year 1888 there were only three days of great magnetic disturbance, but there were also about twenty other days of lesser disturbance, for which tracings of the photographic curves will be published, as well as tracings of the registers on four typical quiet days.

The meteorological results are as follows:—

"The mean temperature of the year 1888 was  $47^{\circ}7'$ , being  $1^{\circ}6'$  below the average of the preceding forty-seven years. The highest air temperature in the shade was  $87^{\circ}7'$  on August 10, and the lowest  $18^{\circ}4'$  on February 2. The mean monthly temperature in 1888 was below the average in all months excepting May, November, and December. In March, April, July, and October it was below the average by  $3^{\circ}6'$ ,  $3^{\circ}6'$ ,  $4^{\circ}4'$ , and  $3^{\circ}9'$  respectively, and in November it was  $4^{\circ}0'$  above the average.

"The mean daily motion of the air in 1888 was 296 miles, being 12 miles above the average of the preceding twenty-one years. The greatest daily motion was 790 miles on March 11, and the least 57 miles on December 31. The only recorded pressures exceeding 20 lbs. on the square foot were 31 lbs. on March 11, and 21 lbs. on August 28.

"During the year 1888 Osler's anemometer showed an excess of

about nineteen revolutions of the vane in the positive direction north, east, south, west, north, excluding the turnings which are evidently accidental.

"The number of hours of bright sunshine recorded during 1888 by the Campbell-Stokes sunshine instrument was 1068, which is about 250 hours below the average of the preceding eleven years, after making allowance for difference of the indications with the Campbell and Campbell-Stokes instruments respectively, and it is 333 hours below that of 1887 recorded with the same instrument. The aggregate number of hours during which the sun was above the horizon was 4465, so that the mean proportion of sunshine for the year was 0.239, constant sunshine being represented by 1. A comparison has been made of the records of the Campbell and Campbell-Stokes instruments for the twelve months from 1886 June 1 to 1887 May 31, with the result that the former registered 1256 hours of bright sunshine, while the latter registered 1364. It would appear, therefore, that the indications of the former instrument require to be multiplied by the factor 1.086 to make them comparable with those of the latter.

"The rainfall in 1888 was 27.5 inches, being 2.9 inches above the average of the preceding forty-seven years."

The average daily number of chronometers and deck watches being rated is 212, and the total number received up to May 10, 1889, was 668. The Astronomer-Royal notes that in future the duration of the trial of deck watches will be increased from twelve to sixteen weeks, viz. six weeks in the ordinary temperature of the room, four weeks in the oven (temperature  $80^{\circ}$  to  $85^{\circ}$ ), and finally six weeks in the room.

The Report concluded with a note on the re-determination of the difference of longitude between Greenwich and Paris:—

"Observations were made in four groups of three nights each (or the equivalent in half nights). An English and a French observer were stationed at each end, each with a separate instrument and chronograph, and the pairs of observers were interchanged twice, to eliminate any change in the personal equations during the progress of the work. The pairs of English and French instruments were similar, and the signals as well as the star transits were recorded on similar chronographs. On a full night each observer recorded about forty star transits, reversing his instrument three times, and exchanged signals twice (near the beginning and end of the evening) with his compatriot at the other end of the line, and once with the other observer. At Greenwich the transits were referred to the sidereal standard clock, and comparisons with the large Greenwich chronograph enable the ordinary determinations of clock-error with the transit-circle to be utilized as well as those specially made with the portable transits. With this object transits of clock stars with the transit-circle were usually taken by four observers on each night during the longitude operations. The actual stations were the Front Court of the Royal Observatory and the Observatory of the Service Géographique de l'Armée at Paris, the position of which reference to the Paris Observatory has been accurately determined. Commandants Bassot and Defforges were the French observers, and Mr. Turner and Mr. Lewis the English. The observations lasted from September 23 to November 15, and 18 nights of observation at both stations are available, the two English observers having observed at Greenwich 653 transits of clock stars and 165 of azimuth stars, and at Paris 778 transits of clock stars and 165 of azimuth stars. All of these, as well as the signals exchanged, have been read out from the chronograph registers and the reductions are far advanced. Subsidiary investigations of the value of a revolution of micrometer screw, of intervals of wires, of form of pivots, and of errors of the axis-level have consumed much time, the last-named having been a long and tedious discussion."

The difference in longitude between Greenwich and Dunkerque will be determined this month, and Commandant Defforges also proposes to determine the latitude between these two places.

### THE EARTHQUAKE.

ON the evening of Thursday, May 30, a considerable seismic disturbance was noticed over the English Channel and in the neighbouring districts. Its area cannot yet be precisely determined. It seems to have been felt most strongly in the Channel Islands, but it was also very distinctly noticed over wide districts in the south of England and the north of France. We bring together various facts relating to the earthquake, some of which have been communicated to us by correspondents.



In Guernsey four successive vibrations were felt at 8.15 p.m. It is said that the houses in St. Peter-Port trembled for several seconds, and that most of the occupants rushed into the streets. The weather had been very sultry for some hours previously.

The shock was felt not less severely in Jersey, as the two following letters will show. The first, which has been sent to us from the Meteorological Office, is by the correspondent of that Office at Jersey, and is dated St. Aubin's, May 31:—"Last evening, at 8.15 p.m., there was a rather severe shock of earthquake here; in fact, it visited the greater part of the island, as far as I can learn. But what I heard myself was a loud rumbling noise, and everything began to shake and tremble, even the buildings; it so frightened a great many that they ran out of their houses, not knowing what was the matter. It appeared to me to travel from north to south, and lasted for about two to three minutes. The barometer at the time was steady, the wind south-south-west, force 4, and a fine night with a clear starlit sky; this morning the weather was gloomy. There was a mock sun, and afterwards a solar halo, but it has been a fine day, with a deal of cirro clouds moving from a southerly direction and looking very heavy in the westward all day, and at present we have cold nights." The second letter has been sent to us by the Rev. W. Clement Ley, to whom it was written, on May 30, by a friend at St. Helier's, Jersey:—"A series of earthquake waves passed here at 8.14 this evening: I could not be quite sure of the direction, but I think from south-west to north-east. They continued for forty seconds at least. I was in my room at the top of the house, and so felt the full force. The whole room trembled, windows rattled, and at the same time the room swayed gently. Some one at the time ran along the road shrieking, 'Earthquake! earthquake!' I think that this is the most severe shock that has been felt in Jersey for many years."

At Sark, also, the earthquake was noticed. Major R. D. Gibney, writing to us from that island on May 30, says:—"This evening I felt two distinct shocks of earthquake, the whole lasting about three seconds, the direction being from south to north-west. Time (believed to be Greenwich) 8.25 p.m. The night was clear, but the setting sun and angry clouds hanging on the horizon presaged rough weather. The shock or shocks were sufficiently severe to shake furniture and to rattle crockery on shelves in almost every house in the island. A low rumbling noise, somewhat like distant thunder, accompanied the vibrations."

Three sharp shocks were felt on the same evening at Cherbourg, but the time has not been exactly noted. The cornice of the doorway of the Church of the Holy Trinity was thrown to the ground. The earthquake is said to have been distinctly felt at Havre, Granville, Caen, and Rouen; and it is stated that it was also felt in Paris at certain points on the left bank of the Seine.

Correspondents have written on the subject to NATURE and the daily papers from many different parts of the southern coast of England. A writer at Penzance testifies that three or four shocks were felt there at 8.21, the direction being from west to east. Mr. J. M. Hayward, writing to us from Sidmouth, on May 31, says:—"As I was sitting here alone quietly reading yesterday evening, I felt a very decided shock of earthquake, three distinct vibrations, each of which shook my chair to and fro several times, and made the things on the table—a china plate with a small glass of flowers in it—rattle; the last was strong enough to make me put down my paper, take off my glasses, and wonder whether the room would tip over. I immediately made a note of the time, 8.20, but I cannot answer for my clock being exactly right." At Blandford, Dorset, a vibration, which is said to have occurred at 8.18, lasted about ten seconds; and Mr. G. J. Groves states that the glass and china ornaments in the room in which he was sitting rattled audibly. According to the Rev. L. Lester, a distinct shock was felt at Wareham, Dorset, "about a quarter past 8." "It happened," he says, "while we were in church. There was first of all a very slight shock, which caused the roof to crack, as it does sometimes in a strong gale; but immediately after there was one much more severe, strong enough not only to make the roof-timbers crack in a far greater degree, but also to set the lamps in the chancel swinging. Those of the congregation who happened to be sitting in seats attached to the main piers or pillars of the church felt a distinct movement. The direction of the shocks seemed, by the way in which the noise ran along the roof, to be from north-west to south-east." At Poole the shock was so severe that many persons rushed

from their houses in alarm. Colonel L. S. Venner, writing from St. Rode, Bournemouth, says that at 8.20 p.m. a shock of earthquake passed through the house, travelling from south to north. "The features of it were a strong quivering of the floor, with an up and down movement, accompanied by a hollow noise underneath, and the shaking of shutters and crockery. An invalid's bed was a good deal oscillated, and a dog on it was alarmed. The shock was not at all violent. The wind, which was cold and fresh from south, became still just before the shock, and then freshened up again. The sky was clear." Mr. J. Grey, also writing from Bournemouth, fixes the time at 8.18. He and three others were in a ground-floor room facing the sea, when they felt two shocks: it seemed as if the floor was upheaving. The servants at the back part of the house did not notice it. At Portsmouth, Havant, and the surrounding district the shock is said to have been felt about 8.25; and at Havant, where articles were visibly moved, there was "considerable alarm." In many parts of the Isle of Wight the earthquake attracted notice, and at Sandown and Shanklin the residents are said to have been "greatly alarmed." Dr. F. M. Burton, the senior curate of Newport, writes:—"We were in church, attending the evensong of Ascension Day. It was about the middle of the sermon, when a tremor passed through the church, apparently from north to south. The roof groaned and cracked; the reading-desk in which I was seated (a solid old oak structure, of 1636) perceptibly and very unpleasantly moved, and the gas standards shook for some minutes after. Our vicar, the archdeacon of the island, and several members of the choir and congregation observed it. One lady (Mrs. Haigh) had the presence of mind to time the shock, which took place about twenty-three minutes past eight. Several people told me next morning that they felt the shock more or less severely in their houses." Writing from St. Laurence, Ventnor, Mr. W. E. Kilburn says:—"A very distinct shock of earthquake occurred here at 8h. 21m. 30s. p.m. The shock was not sufficient to overthrow anything or to stop the clocks; but the long pendulous drops, 8 inches long, of the glass lustres on the solid marble chimney-piece formed admirable seismometers, vibrating freely for twenty minutes afterwards, and showing the direction apparently from the south-west. The aneroid and barometer indicated 29.73 at the time; they were 29.80 at 9 o'clock in the morning. The temperature in the open air was 53° by Casella thermometer, and the wind south-south-west. The duration of the shock was about three seconds." The Rev. A. Conder says that at Bognor there were two severe shocks at 8.20, with an interval of about three seconds between them:—"An invalid in an adjoining house called for assistance, as some one was under her bed lifting it. I distinctly felt the shocks, which caused the window-frames to rattle." At Littlehampton, at 8.22, cranes were seen to swing suddenly, and an oscillation was felt in different parts of the town. At Arundel, while reading on a sofa, Mr. E. Goldsmith suddenly "felt a peculiar movement, and distinctly saw the sofa vibrate for three or four seconds." "At the same time," he says, "the windows shook, not as they had occasionally done during the evening on account of the wind, but with a quite different and more continuous movement. I called to my daughter, who was at the moment in the dining-room, to know what was the matter; but she had only heard the windows shake in the room where she was (but in the same peculiar manner), and had not felt any movement. My little boy, who was in bed upstairs, felt his bed move; and my two little girls, who were going to bed, were quite frightened, and ran down to know if it was an earthquake. The servant with them felt it too. The time was 8.20." At Brighton a distinct shock was felt, especially in the western part of the town; and at Rudgwick, near Horsham, two persons in a room noticed a movement "which caused a rocking of chairs, cracking of woodwork, and the sound of rumbling, apparently exhausting itself to the westward." Captain H. King, R.N., writes to us from Petersfield:—"On the evening of May 30, at 8.20 p.m., I was leaning upon a spring mattress, when I felt it vibrating in a peculiar manner. We could only account for it by an earthquake; and surely enough the newspaper of next day described one at Guernsey, which appears to have been similar to one which I witnessed in Jersey in April 1853." Mrs. Lane, also writing to us from Petersfield, says that she and her children's governess, while sitting together, "were startled by a most peculiar vibration seeming to shake the house, which quivered perceptibly for some seconds."

Several correspondents of the *Times* testify that they felt the



shock in London. Mr. Ernest Myers writes from 31 Inverness Terrace, W. :—"A slight but unmistakable shock was felt here about 8.20 p.m. There was no rattling of windows or other sound. The vibration seemed to be from side to side." Mr. E. W. Haines, of Alexandra Road, St. John's Wood, says :—"The earthquake was distinctly, though slightly, felt here last evening at 8.30." A member of the firm of Yates, Crighton, and Co., of Cannon Street, E.C., while working in their offices on Thursday evening, distinctly felt four shocks just before 8.30. He says :—"It was the more noticeable as our offices are situated in a huge building, on the third floor, and the sensation was just as if the whole block were rocked by the wind from south to north." "C. W. H." writes from the General Post Office :—"Last evening I was sitting in my room, situated in the south-west corner, top story of the General Post Office, when I felt my chair oscillate with a slight tremulous motion, which lasted perhaps four seconds. Thinking it was a slight shock of earthquake, I stood up, and looking at my watch saw the time was 8.20." A person living at West Kensington reports having felt the shock at 8.15. Mr. F. Yates, writing from Park Street, Southwark, S.E., May 31, says :—"Yesterday evening, between 8.20 and 8.25, while sitting in my library at Surbiton, I distinctly felt two light shocks, which I attributed to earthquake. The shocks were also observed by other members of my family."

Mr. J. Lloyd Bozward writes to us from Henwick, Worcester, that the earthquake was perceptible there. While seated in a room on the second floor of his house at about 8.23 p.m. on Thursday, all being still, he felt five distinct tremors in rapid succession, the third being the most notable. "On making immediate inquiries," he says, "I learned that the tremors had not been felt on the other floors, but my son, who happened to be in the basement on the occasion, says that at the time referred to by me he noticed that the flame of a lamp burning on the table suddenly shot up above the top of the glass chimney."

#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Annual Report of the Museums and Lecture Rooms Syndicate, just issued, contains much interesting information about the progress of natural science studies and collections.

Prof. Babington announces that the late Prof. Churchill Babington's extensive herbarium has been presented to the Botanical Museum by his widow, including the typical specimens of lichens described by him. The type collection has been enlarged, and demonstrations in organography and histology are regularly given. Mr. Potter has just returned from Ceylon with a fine collection. A series of germinating seedlings (prepared by Mr. Barber), specimens showing the injuries caused to plants by insects (by Mr. Shipley), and Kny's diagrams, given by Mr. Thiselton Dyer, are among the valuable acquisitions.

Mr. J. W. Clark, Superintendent of the Museum of Comparative Anatomy, reports the gift of a beautiful collection of spiders, with accompanying drawings, by Mr. Warburton; the mounting of the skeleton of *Rhytina gigas*; the deposit of a valuable collection of skulls and bones of Bovidae and Cervidae; by Mrs. Stewart, widow of Surgeon-General L. C. Stewart; Surgeon-General Day has given 357 birdskins from India and Burmah; and Messrs. Cordeaux have given over 100 valuable Indian specimens.

Two parts of the "Morphological Studies" have been issued by Mr. Sedgwick since the last Report. The Elementary Biology Class numbered 167 in the Easter term of 1888, and 139 in the Lent term of 1889. The Morphology Class varied from 77 to 42; with a smaller advanced class.

Prof. Macalister reports the addition of 131 Egyptian skulls, 25 skulls from the Saxon burial-place at Hauxton, and many from that behind St. John's College. The Rev. J. Sanborn, of Lockport, N.Y., has given valuable skulls from a burying-place of the Seneca Indians.

Prof. Roy describes the careful and systematic arrangement he has adopted in his Pathological Laboratory (late the Chemical Laboratory).

Prof. Hughes once more deplors the long postponement of the new Geological Museum. It certainly is not just to allow the donors of the funds to die out and never see the erection of

the Museum towards which they contributed such large sums. Important additions have been made to the Cambrian and Silurian fossils by Mr. Marr, and many of them have been described and figured by him. Thirty-four figured types from the Inferior Oolite of Dorsetshire have been presented by the Rev. G. F. Whidborne. About 130 slides have been added to the cabinet of microscopical preparations of rocks. Much progress has been made in palaeobotany, and two courses of lectures have been given by the lecturer, Mr. Seward. Mr. Strickland's collection of fossils, numbering 7000 specimens, has been presented by the late Mrs. Strickland.

The new Chemical Laboratory proves to be very satisfactory in working.

The demonstrations in the Cavendish Laboratory were attended by 136 students last Michaelmas term and 144 in the Lent term. Twelve persons have been doing original work in the Laboratory during the year. Some important new apparatus has been acquired.

#### SCIENTIFIC SERIALS.

*Mémoires de la Société d'Anthropologie de Paris*, série ii., tome iv., fasc. 1 (Paris, 1889).—Pre-Columbian ethnography of Venezuela, by Dr. Marcano. The author prefaces his special ethnographical remarks with a short geographical notice of the Venezuelan territory, entering more particularly into the physiological character of the fertile valleys of Aragua and Caracas. The special feature of the landscape in these picturesque regions is the range of low hills locally characterized as "Cerritos," which extend over a large area near the beautiful lake of Valencia, first known to the Spaniards as Lake Tacarigua, and which were regarded by the native Indians as natural features of the soil. It has been discovered, however, by recent explorers, that they are artificial elevations, raised in past ages by some aboriginal Indian race long extinct, whose very name is unknown to the present inhabitants of the district, although the shores and bottom of the lake testify, through their vast accumulations of bones and other *débris*, that the country must have been densely populated at some remote prehistoric period. Dr. Marcano, who devoted several years to the exploration of the Cerritos, near Lake Valencia, has succeeded in laying bare the interiors of twenty of these mounds, which prove to be sepulchral caves filled with bone and other detritus. All present a uniform plan of arrangement, and consist of a central circular walled-in space, containing an enormous mass of whole and fractured bones, and marine and fresh-water shells, with fragments of stone, bone, and wood implements, and sherds of pottery, most of which bear traces of the action of fire. The human remains were deposited in round earthen jars or urns, each of which contained only the separate bones of one body, the skull resting at the base of the vessel, while the sacrum, with the long and the small bones, was laid above it so as to fit into all the available space. The appearance of these bones indicates that the flesh had been detached from the dead body before its interment, but their brittle condition rendered a minute examination impossible in some cases, although Dr. Marcano was able to recover forty crania which admitted of sufficiently exact investigation to warrant the conclusion that they represent two distinct types of brachycephalism. About half of these crania showed signs of deformity, due to artificial pressure over the frontal bones. The most remarkable characteristic was their prognathism, which exceeded that of any skull previously examined by him, although his observations were based on the examination of more than 2000 crania, of which some belonged to New Caledonians, who have hitherto ranked as belonging to the most prognathic race extant. The implements found in the Cerritos caves are nearly identical with those associated with the Neolithic age in Europe, while the animal remains are composed of types belonging to the local terrestrial and aqueous faunas, including the broken skull of a cebus; while so enormous a mass of the bones of a caiman (*Crocodilus bona*, which is peculiar to the Lake of Valencia and its affluents) was found, that it is evident the flesh of this animal must have served as food. A number of detailed craniological tables, and numerous illustrations of the crania and of the curious figurines and idols, the urns, tools, ornaments, and other objects interred with the human bones, add greatly to the value of Dr. Marcano's exhaustive memoir.—The superstitions prevalent in Wales, by M. Maricourt. In this article the author has drawn his materials so indiscriminately from