

superjacent strata, which are most regularly superposed (as seen in the accompanying section) to a depth of more than 15 feet. This complete regularity of superposition in the strata of the gravel-pits of Moulin-Quignon has, I understand, been already verified by numerous experienced geologists, whose testimony upon such a point is of far higher value than mine; but it is so obvious that I cannot imagine the least doubt to remain in the mind of any intelligent observer who may visit the locality and examine its condition for himself, of the jaw having been imbedded in the lowest stratum before the deposition of the superincumbent layers.

I have further to point out, that as the gravel-bed of Moulin-Quignon is about 100 feet above the present level of the river, it corresponds in position with the *upper* gravel of St. Acheul, not with the *lower* gravel of Menchecourt. If, therefore, we accept the conclusions of Mr. Prestwich as to the relative ages of these gravels, this human jaw was buried in the *very oldest* portion of the *earliest* of these fluviatile deposits, and therefore dates back to the very remotest period at which we have at present any evidence of the existence of Man.

Believe me, dear Mr. President,

Yours faithfully,

WILLIAM B. CARPENTER.

April 23, 1863.

Major-General SABINE, President, in the Chair.

The Right Hon. Sir Edmund Walker Head was admitted into the Society.

The following communications were read :—

- I. "On the Diurnal Inequalities of Terrestrial Magnetism, as deduced from observations made at the Royal Observatory, Greenwich, from 1841 to 1857." By GEORGE BIDDELL AIRY, F.R.S., Astronomer Royal. Received April 8, 1863.

(Abstract.)

The author describes this paper as one of the class which gives the epitomized results of long series of voluminous observations and laborious calculations, of which the fundamental details have been

printed in works specially devoted to these subjects. It exhibits in curves the diurnal inequalities of terrestrial magnetism, as obtained by the use of instruments essentially the same, through the whole period of seventeen years, during the last ten years of which the magnetic indications have been automatically recorded by photographic self-registration, on a system which has been continued to the present time, and is still to be continued.

From the last months of 1840 to the end of 1847, the observations were made by eye, every two hours. From the beginning of 1848, for the declination and horizontal force magnetometers, and from the beginning of 1849, for the vertical force magnetometer, the magnetic indications are recorded by Mr. Brooke's photographic apparatus.

In preparing the reductions of the magnetic records from 1848 to 1857 (which are printed in the "Results of Magnetical and Meteorological Observations for 1859," bound in the volume of 'Greenwich Observations,' 1859, and also issued separately), the days of unusual magnetic disturbance had been separated from the rest, and the reductions applied to the mass so diminished. For unity of plan, it appeared expedient to follow the same course for the reductions from 1841 to 1847. In consequence of this, the numbers which are used here differ in some cases by small quantities from those printed in the 'Greenwich Magnetical Observations from 1841 to 1847.' The numbers in the reductions from 1848 to 1857 are adopted without change.

The author remarks that, taking the number of omitted days as a rough measure of the amount of magnetic disturbance, there is no appearance of decennial cycle in their recurrence, and no distinct relation to the magnitude of diurnal changes.

The author then proceeds to the description of the curves. The first four sheets contain the curves in which the horizontal abscissa represents the declination at each hour as compared with the mean for the twenty-four hours and the vertical ordinate represents the horizontal force at each hour as compared with the mean for the twenty-four hours. On the different sheets the days are differently grouped, thus:—On sheet I. all the observations at each nominal hour throughout the year are combined; this sheet contains the separate curves for 1841, 1842, 1843, 1844, 1845, 1846, 1847. On sheet II. similar curves are formed for 1848, 1849, 1850, 1851,

1852, 1853, 1854, 1855, 1856, 1857. On sheet III. all the observations at each nominal hour through all the months January from 1841 to 1847 are combined to form the January curve; all those through the months February to form the February curve, and so on. On sheet IV. similar month-curves are formed from the period 1848 to 1857. It is remarked that the origin of coordinates necessarily represents the mean declination and mean horizontal force in each month.

The author then points out that the means for each month are themselves subject to an annual inequality, which can be ascertained with little difficulty. The values of these inequalities are exhibited, for declination and horizontal force, separately for the period 1841–1847 and for the period 1848–1857; those in the first period far exceed in magnitude those in the second (as holds also with regard to all the diurnal inequalities).

If we wished to exhibit the hourly state of magnetism, as referred to the mean state given by the supposition of uniform secular change of normal magnetism, we ought to apply these quantities with sign changed, to the origin of coordinates in each curve, in order to form a new origin of coordinates. For the year-curves, the numbers destroy each other, and no new origin of coordinates is produced; for the month-curves, however, they shift the origin materially. The author does not perceive that any facility for theoretical reference or other advantage is gained by this step.

On examining the year-curves, it is seen that from 1841 to 1848 their magnitude very slowly increases, with a small change of form, but from 1848 to 1857 their magnitude very rapidly diminishes, with a great change of form. Some great cosmical change seems to have come upon the earth, particularly affecting terrestrial magnetism. On comparing these year-curves with the month-curves, especially with those for the period 1848–1857, it appears that the change of the year-curves from 1848 to 1857 nearly resembles that of the month-curves from summer to winter; and the author points out as a possible step to a physical explanation of the change from 1848 to 1857, that the magnetic action of the sun upon the earth's southern hemisphere may have remained nearly unaltered, while that on the northern hemisphere may have undergone a great diminution.

The author then alludes to the curves representing the hourly

state of vertical force, as referred to the mean on each day. The force is here represented by a simple ordinate. The grouping is made by years and by months in the same manner as for the curves already mentioned. The month-curves of the two periods (1841–1847 and 1848–1857) differ, in the magnitude and change of magnitude of the ordinates, and in the place and change of place of node. The year-curves of the two periods have some very remarkable differences. From 1847 to 1849 the magnitude of the ordinates increases sensibly; from 1849 to 1850 still more; it then remains nearly stationary. In 1846 the descending node is at $11\frac{3}{4}^h$ nearly; in 1847 it is at 9^h nearly; in 1849 at 7^h nearly; in 1850 at 5^h ; in 1851 at 4^h ; and there it continues with little alteration. It is important to observe that, though the instrument was changed in 1848, the change in the place of the node did not then occur suddenly; it had begun with the old instrument, and continued to advance gradually for several years with the new instrument. The author states that he had verified the correctness of the node in the first period from other observations, but he had not succeeded in finding observations corresponding in date with those of the latter period.

The paper is followed by eight sheets of curves, as follows:—

I. *Diurnal Curves of combination of Declination and Horizontal Force.*

- (1) Mean of all the days in each year (separately), 1841–1847.
- (2) Mean of all the days in each year (separately), 1848–1857.
- (3) Mean of all the days in the aggregate of the same nominal months (separately) through the period 1841–1847.
- (4) Mean of all the days in the aggregate of the same nominal months (separately) through the period 1848–1857.

II. *Diurnal Curves of Vertical Force.*

- (5) Mean of all the days in each year (separately), 1841–1847.
- (6) Mean of all the days in each year (separately), 1849–1857.
- (7) Mean of all the days in the aggregate of the same nominal months (separately) through the period 1841–1847.
- (8) Mean of all the days in the aggregate of the same nominal months (separately) through the period 1849–1857.