

of the stones may be inferred, as there has been an accumulation of peaty soil of about five feet deep.<sup>1</sup>

From a careful inspection of the stones the author found the number to be forty-eight. (The driver's remark on being asked the number was that they could not be counted over by different people and made the same.) The highest stone is about 16 feet, and the stones forming the circle are next to the central one in height, varying from about 8 feet to 11 feet. The others vary from about 7 feet to about 4 feet.

The longer limb of the cross is composed of two rows of stones placed about 27 feet apart, there being ten stones on the west side and nine on the east side. This is a very distinct feature in the arrangement, as there is thus an avenue leading to the circle. The circle consists of thirteen stones, and the western and eastern cross arms have each a single line of four stones, whilst the southern limb is composed of six stones; the whole with the central stone and one outside and close to the circle makes forty-eight. The general arrangement will be more readily understood from the accompanying plan, which is drawn approximately to scale. From careful observations with a pocket compass, the general bearing of the northern limb was found to be 30° to east of magnetic north; it was also found that, when a line was projected from the flat side of the endmost southern stone, it cut exactly the end stone of the western side of the northern limb; the latter stone measures about 11 feet in height. If the compass variation be estimated at 25° west (the latitude is about 58° 12' north), it appears that the main axis of the group lies about 5° to east of true or polar north. Several of the stones besides the one already mentioned appear to have a *directive* tendency, notably the one next to the circle in the eastern side of the northern limb; this stone, both from its pointed shape and flat form, leads the eye to the centre of the circle. The whole series, indeed, are arranged with their narrow faces pointing in the line of setting; this is easily noticed, as the stones are generally flat, thin, and slab-like. The circle stones have their broadest faces turned to the centre of the circle. The great stone is situated at or near the centre of the circle; it measures about 16 feet in height, with a breadth at bottom of 5 feet, at middle of 4 feet, and upper part 3 feet 6 inches; its thickness is 1 foot; its flat side faces the east. This stone must weigh about six tons.

The general dimensions of the group are as follows:—Extreme length, 128 yards; length of northern limb, 85 yards; diameter of circle, 14 yards (this measurement is in a north and south line; from east to west the measurements gave 13 yards, so that the figure is slightly elliptical); length of southern limb, 29 yards; extreme breadth, 44 yards; length of western arm, 13 yards; length of eastern arm, 18 yards. The whole figure roughly resembles the Iona cross in outline. In or near the centre of the circle there is a hollow, roughly rectangular on plan, measuring about 7 feet long, the breadth at centre being 6 feet, and at ends 5 feet, narrowing, however, at the eastern end, so as to form a kind of channel leading outwards. The sides of this hollow are built of small stones, and four large stones are placed so as to break up the whole into two chambers. The direction of length of this hollow is east and west; the tall central stone already described being situated near to and facing its western end. It is said that a stone cover was found upon this hollow when first discovered. The hill upon which the stones are placed slopes downwards to the north; the ground on which the cross arms are placed is about level.

<sup>1</sup> It is difficult to get reliable data as to the growth of peat-moss, but taking about 200 years to the foot, a depth of 5 feet would infer a period of about 1,000 years since the peat commenced to form. In Black's "Guide" it is stated that the stones rest on a causewayed base. As there was no trace of this at the time of the author's visit, seeing that there was a vegetable growth all around, some data as to rate of growth of the peaty soil might be got, as it is about twenty years since the excavation of the peat took place.

Another circle of tall stones still stands about a mile to eastward, from which it appears that the peat has been recently removed.

From an examination of the stone circles of Arran, the late Dr. Bryce found that stone cists in some cases existed at the centres of the circles, and that the longer lengths of these cists, as also the longer axis of one elliptically-shaped series of stones, were all lying about north and south, or inclining rather to east of north.

In the Smithsonian Report for 1876 there is a description of mounds and lines of stones in Guatemala, the long sides and directions of which were about 5° to west of magnetic north; they vary from 2 feet to 6 feet in height. This would leave, after allowing for the easterly variation of the compass there, a probable direction of 5° or 10° to east of true or polar north. A certain similarity, therefore, appears to exist in the setting out of these groups, with a tendency to a direction east of north.

The country people called the place Callanish, not Callernish, as sometimes given, the meaning of the former name having been defined as "place of assembly for worship," whilst the latter is given as "bleak headland."<sup>2</sup> The title Fir Bhreige, or false men, is sometimes given to the group, from the apparent motion of the stones as the spectator changes his position when viewing them from a distance.

The erection of such circles as that of Callanish has been popularly attributed to the Druids, and according to this theory the Callanish circle would have been a religious meeting-place. Again, it has been supposed that they were tombs of warriors, and may have been erected by the early Norse rovers. Others look upon such groups of stones as places for judicial meetings, which might have been accompanied by religious ceremonies. From some recent scientific investigations at Stonehenge it appears likely that the stones there were erected for astronomical purposes.

The general impression which one gets from standing amongst the Callanish stones is that the long avenue was intended as an approach from the not far distant shore for a large body of people, who would thus converge towards the central circle.

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#### OUR ASTRONOMICAL COLUMN

BIELA'S COMET IN 1879.—There have been suggestions as to sweeping ephemerides for the recovery of one or other portion of the disintegrated comet of Biela in the present year. It is not, however, easy to decide in what manner, or rather upon what assumptions, calculation can be brought to bear with the greatest chance of success. We know that in 1852 the observed positions of the two nuclei were such that they could be accurately connected with similar positions at the preceding appearance in 1846, by the application of the perturbations from known causes in the interim, and it is also certain that neither of the nuclei was in the calculated position at the next return but one in 1866, there having been no chance of finding the comet in 1859, from proximity of its geocentric track to the sun's place. In 1865-6 the comet was diligently sought for in and around the position it should have occupied by the elements of 1852, brought up to 1866 by the application of planetary perturbations during the two revolutions, with some of the most powerful instruments in our observatories, including the refractors at Pulkowa and Copenhagen. D'Arrest, after long search, was convinced that the comet, speaking collectively, could not have passed its perihelion within many days of the time predicted. The conclusion was inevitable that perturbation from some unknown cause must have taken place between 1852 and 1866, and that all clue to the future movement of the comet was for the time lost. In 1872 endeavours to find

<sup>2</sup> See Smith's "Lewiana."

the comet near its old track were equally unsuccessful, and it was not till the grand meteoric shower on the evening of November 27 in that year that further light was thrown upon the subject. As is well known, the meteors of that great shower were found to be moving in an orbit sensibly identical with that of Biela's comet in 1866. Intersecting, or at least passing very near to the earth's orbit on November 27, the comet must have been descending to a perihelion passage a month later, or about December 27<sup>6</sup>; such at least would be the date when the meteoric shower would arrive at its least distance from the sun. In this fact appears the only ground upon which we can now work to obtain an idea of the probable position of the comet in the present year. If we apply Dr. Michez's perturbations from 1852 to 1866 to the late Prof. Hubbard's elaborately-determined elements of the south-following nucleus in 1852 (assumed to be identical with the principal comet in 1846), we find the following orbit for 1866:—

Longitude of perihelion	...	...	109 39 48	} Mean equinox January 27.
"    ascending node	...	...	245 43 42	
Inclination to ecliptic	...	...	12 22 3	
Angle of excentricity	...	...	48 46 19 <sup>35</sup>	
Mean daily motion	...	...	529 <sup>9</sup> 157	
Revolution	...	...	2445 <sup>67</sup> days.	

And bringing up the longitudes to the equinox of 1879 we have the following heliocentric co-ordinates to be combined with the X, Y, Z of the *Nautical Almanac* in the preparation of sweeping-ephemerides on different hypotheses as to time of arrival at perihelion:—

Time from perihelion.	x.	y.	z.
- 50 days	... +0 <sup>8</sup> 145	... +0 <sup>7</sup> 263	... +0 <sup>4</sup> 119
40 "	... 0 <sup>6</sup> 150	... 0 <sup>7</sup> 914	... 0 <sup>3</sup> 316
30 "	... 0 <sup>4</sup> 041	... 0 <sup>8</sup> 379	... 0 <sup>3</sup> 621
20 "	... +0 <sup>1</sup> 755	... 0 <sup>8</sup> 593	... 0 <sup>3</sup> 218
- 10 "	... -0 <sup>0</sup> 562	... 0 <sup>8</sup> 497	... 0 <sup>2</sup> 699
0 "	... 0 <sup>2</sup> 855	... 0 <sup>8</sup> 053	... 0 <sup>2</sup> 070
+ 10 "	... 0 <sup>5</sup> 025	... 0 <sup>7</sup> 261	... 0 <sup>1</sup> 352
20 "	... 0 <sup>6</sup> 990	... 0 <sup>6</sup> 171	... +0 <sup>0</sup> 578
30 "	... 0 <sup>8</sup> 704	... 0 <sup>4</sup> 857	... -0 <sup>0</sup> 218
40 "	... 1 <sup>0</sup> 161	... 0 <sup>3</sup> 397	... 0 <sup>1</sup> 008
+ 50 "	... -1 <sup>1</sup> 379	... +0 <sup>1</sup> 856	... -0 <sup>2</sup> 510

If the meteoric cloud of November 27, 1872, was moving in the orbit given above, a revolution counted from December 27<sup>6</sup> in that year will bring us to about September 8, 1879, as the epoch of next perihelion passage. Assuming September 7<sup>5</sup> we should have the following sweeping-line for that date:—

Time from perihelion.	Right ascension.	North declination.	Distance from earth.	Intensity of light.
0 days	... 140 <sup>2</sup>	... 10 <sup>8</sup>	... 1 <sup>66</sup>	... 0 <sup>47</sup>
- 20 "	... 125 <sup>9</sup>	... 17 <sup>4</sup>	... 1 <sup>42</sup>	... 0 <sup>57</sup>

It may, however, be regarded as by no means improbable that the perihelion passage of the body which caused the shower of meteors may take place much later, and a very close and extended search will be required.

Sweeping-ephemerides to the extent desirable would occupy too much space here, but they will be easily prepared in the manner indicated from the above co-ordinates.

It is impossible not to admit the justice of a remark made by M. Otto Struve at the Stockholm meeting of the German Astronomical Society, when urging further attention to this comet: "Kein Comet gebe mehr Ansicht, über die Natur der Cometen im Allgemeinen etwas zu erfahren, als der Biela'sche;" and if due preparation be made this year for an exhaustive examination of the heavens in those regions where it is possible any portion of the comet may be found, further light may be thrown upon what yet appear the mysterious agencies which have affected its constitution and motions.

GEOGRAPHICAL NOTES

In the place of Prof. Geikie's lecture on geographical evolution which was promised for this month, the June number of the Geographical Society's monthly periodical contains the anniversary address by Mr. Markham on the progress of geography. This is followed by a short paper on the "Mardian Hills and the Lower Indravati in the Bustar Dependency," contributed by Capt. T. H. Holdich, R.E., who also furnishes a sketch-map of the region. As regards quantity, at any rate, the geographical notes show a great improvement on previous numbers, and many of them supply information of considerable interest. Attention may be especially called to Mr. Keith Johnston's remarks on the employment of elephants in African travel, and regarding his own movements, Russian topographical labours in the Kirghiz Steppe and in Turkistan, the Russian Trans-Caspian territory, recent topographical survey by the Russians from the Oxus to Herat, new maps of Afghanistan, and a singular cave-formation in Queensland. There is also a good summary of Lieut. Wheeler's survey work in Oregon in 1878, based on an account drawn up by Mr. T. W. Goad, who was himself an active partaker in the work. Under the head of "Proceedings of Foreign Societies," we find a report of the Inter-Oceanic Canal Congress up to May 23. The last thirteen pages of the number are occupied by notes on new books and maps.

MR. J. F. BROMTON, the agent of the China Inland Mission at Kweiyang-fu, in the Kweichow province, recently accompanied Mr. Cameron, on his way from Yunnan to the sea-board, as far as Kweilin-fu, in Kwangsi. Their route lay through the regions occupied by the Miao-tsze, or aboriginal tribes, who are very numerous in the south-east of Kweichow, and practically independent of the Chinese. Mr. Broumton visited a place called Pa-tsia, near which there are many Miao-tsze, but they are very shy and do not mix with the Chinese, only coming to the town on market-days to buy cotton, cloth, salt, &c. Their villages consist of mud cottages, usually hidden among trees and situated in places among the hills, which are difficult of access. From what he saw, Mr. Broumton thinks that the Miao-tsze are thrifty and industrious, for their land seemed well cultivated and the people well clothed. There is another interesting class of people in the Kweichow province, viz., the Tsung-kia-tsze, who, it is thought, originally emigrated from Hunan and Kiangsi, and in course of time intermarried with the Miao-tsze. Now they are a distinct class, speaking a language differing from both the Chinese and the Miao-tsze. Like the latter, they do not bind their girls' feet, and they are described as a sturdy, hardy race and thriving agriculturists.

In the annual statement of the British Museum, just presented to Parliament, we find a report by Mr. Major on the department of maps, charts, plans, and topographical drawings. We do not learn very much as to the nature of the accessions made during the year, but Mr. Major particularises a photographic reproduction of a hydrographical chart on parchment (dated 1385) in the Royal Archives at Florence, comprising the Atlantic as far as Cape Bojador, then the furthest point of geographical discovery southwards, to Syria and the Black Sea, on the east. On this chart, which is earlier by half a century than the effective discovery of the Azores by Diego de Seville and other navigators, we find the islands of San Miguel and Santa Maria laid down, but with an illegible description, while the islands of San Jorge, Fayal, and Pico are described as Insule de Ventura and Columbia, and Terceira is named Insula de Brazi, so called from the Brazil wood with which it abounded, thus preceding its famous namesake in South America by a century and a quarter. The chart bears the following epigraph:—