habits. He established a fish-farm on his own estate, and watched over it for many years. He divides his subject into five parts. In the first place, he discusses the fish supply of Bengal, and in doing so shows that the supply is frequently not equal to the demand—a fact due chiefly to the absence of skilled fishermen. And so it happens that at various seasons breeding and unmatured fish are brought to market to meet the demand. The second chapter treats of the best food for fish; the third of hatching and breeding, and the proper precautions to be taken at those times. The fourth part deals with the question from a commercial and speculative point of view. A little capital, the author says, if wisely invested in pisciculture and in fisheries produces a greater return than in any other industry; for while, as Prof. Huxley says, an acre of land will produce in the year a ton of grain or two or three hundredweight of meat, the same extent of water in a good fishing-ground will yield a greater weight of fish in a week. The author begs of his countrymen to pay attention to this much neglected subject; he puts his practical experience before them, and thinks, that in a country like Bengal, where fish forms a large portion of the dietary of the people, it is a pity that more is not known of this subject. One of the most valuable portions of this little work is the fifth, in which he gives a scientific description and classification of almost all the known fish in the waters of Bengal, with their Bengalee equivalents.

THE additions to the Zoological Society's Gardens during the past week include two Stock-Doves (*Columba œnas*), British, presented by Lieut.-Colonel W. G. Dawkins; a Gayal (*Bibos frontalis*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

DISTRIBUTION OF THE SUNSPOTS OF 1886 AND 1887.—Prof. Spoerer points out in a short note in the *Astronomische Nachrichten*, No. 2828, that the predominance of the southern hemisphere over the northern as to the numbers and areas of sunspots which they have displayed has continued throughout the two years just past. It would seem, indeed, as if the maximum for the southern hemisphere had fallen later than for the northern, for after the last return of the great group of November 12–25, 1882, the latter hemisphere became comparatively quiescent for a considerable time, and from that date the predominance of the southern hemisphere has been almost uninterrupted, the displays it exhibited during the latter part of 1883 and the earlier months of 1884 being so considerable and so numerous as to make the date of maximum the same for the sun as a whole as for the southern zone. So in the decline since the maximum, not only has the mean spotted area of the northern hemisphere been scarcely more than half that of the southern, but the running down in latitude has been more marked in the former than the latter. Thus in 1884, the northern zones above lat. 25° were already free from spots, whilst in the south the zone 25° to 30° was still occupied. In 1886 spots had ceased to be seen in the zones north of N. lat. 20°, but were still seen in the corresponding southern belt; whilst in 1887 they had almost vanished from the zone N. lat. 15° to 20°, though still fairly numerous at a like distance from the equator on the other side. The actual distribution of the spots is shown by Prof. Spoerer in the following table:—

Year.	+20°	+15°	+10°	+5°	0°	−5°	−10°	−15°	−20°	−25°	Totals. N.	Totals. S.
1886	17	30	40	14	50	45	68	47	5		101	215
1887	2	22	15	14	19	56	27	14			53	116

THE TOTAL ECLIPSE OF THE MOON, JANUARY 28.—By the kindness of Dr. E. Lindemann we are enabled to give the following further list of occultations observed during the total eclipse of the moon on January 28:—Amherst, U.S., 7; Clinton, U.S., 3; Copenhagen, 25; Harvard College, U.S., 23; Madrid, 20; Montreal, 6; Moscow, 15; Nice, 24; Princeton, U.S., 8; Toulouse, 13; Utrecht, 15; Washington, 11; West Point, U.S., 2. The weather was also favourable at the Birkdale Observatory, Southport, and at Berlin and Dun Echt; but at the last two Observatories, and also at Lord Rosse's, the occultations were not observed. The sky was cloudy at Herény, O'Gyalla, Quebec, Rió Janeiro, Stockholm, and Vienna.

SPECTROSCOPIC DETERMINATION OF THE ROTATION PERIOD OF THE SUN.—Mr. Henry Crew, Assistant in Physics at the Johns Hopkins University, has recently published (*American Journal of Science*, February 1888) a series of observations made with a fine Rowland grating of 14,436 lines to the inch, of the relative displacement of certain lines in the solar spectrum, as given by the opposite limbs, with a view to determine the rotation period of the sun. The result which he obtained from 455 settings in the course of observations ranging over four months and a half, gives, for the mean equatorial velocity, $v' - v'' = 2{\cdot}437 \pm {\cdot}024$ miles per second, corresponding to a true period of 25·88 days. But an unexpected and remarkable circumstance was brought out by the investigation, in that the observations seemed to show a gradual *increase* of daily angular motion with higher heliographical latitude, whilst, as is well known, Carrington found a *decrease* of such motion for the spots. Mr. Crew gives for the equation of this change—

$$v = 1{\cdot}158 \cos \chi^\circ (1 + 0{\cdot}00335 \chi^\circ),$$

whence we have for the daily angular motion of any point in the reversing layer—

$$\theta = 794' (1 + 0{\cdot}00335 \chi^\circ),$$

whilst Carrington obtained for the sunspots—

$$\theta = 865' (1 - 0{\cdot}191 \sin^2 \chi^\circ).$$

The greatest irregularities in the value of $v' - v''$ occurred between the latitudes 15° and 25°, *i.e.* in the chief spot zone.

It should be added that different lines gave different values of $v' - v''$, with nearly as large a range as the different latitudes did, but there appeared to be no connection between the order of the velocities and the order in which the elements causing the lines observed are generally supposed to be distributed in the solar atmosphere. The double line, 1474 K, of which one component is due to iron, and the other is the line of the corona, gave no evidence of variation in width on one limb, as compared with the other, so if the two lines be produced by absorption from different layers, those layers cannot be drifting with respect to each other at a higher rate than one-third of a mile per second.

The spectrum of the fourth order was used throughout. Attempts were made to measure the relative displacement of the D_3 line, as given by opposite limbs, but with this dispersion the definition was not sufficiently good to permit satisfactory measures of the line to be made.

NEW MINOR PLANET.—A new minor planet, No. 273, was discovered on March 8, by Herr Palisa at Vienna. This is Herr Palisa's sixty-first discovery.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 MARCH 25–31.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on March 25

Sun rises, 5h. 51m.; souths, 12h. 5m. 54·3s.; sets, 18h. 20m.: right asc. on meridian, 0h. 19·4m.; decl. 2° 6′ N. Sidereal Time at Sunset, 6h. 34m.

Moon (Full, March 27, 22h.) rises, 15h. 12m.; souths, 22h. 28m.; sets, 5h. 29m.*: right asc. on meridian, 10h. 43·4m.; decl. 10° 51′ N.

Planet.	Rises. h. m.	Souths. h. m.	Sets. h. m.	Right asc. and declination on meridian. h. m.	° ′
Mercury..	5 10 ...	10 27 ..	15 44 ...	22 40·8 ...	9 9 S.
Venus ...	5 10 ...	10 23 ..	15 36 ...	22 36·7 ...	9 59 S.
Mars ...	20 12*...	1 34 ...	6 56 ...	13 46·0 ...	8 10 S.
Jupiter ...	23 54*...	4 6 ...	8 18 ...	16 18·6 ...	20 25 S.
Saturn ...	11 54 ...	19 53 ...	3 52*...	8 7·6 ...	20 48 N.
Uranus...	19 12*...	0 47 ...	6 22 ...	12 58·8 ...	5 32 S.
Neptune..	7 49 ...	15 30 ...	23 11 ...	3 44·1 ...	18 6 N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

Occultations of Stars by the Moon (visible at Greenwich).

March.	Star.	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image. ° °
28 ...	80 Virginis ...	6 ...	19 49 ...	20 43 ...	10 230
31 ...	η Libræ ...	6 ...	1 20 ...	2 30 ...	61 234

March.	h.	
28 ...	2 ...	Mercury in conjunction with and 0° 2′ north of Mars.
29 ...	2 ...	Mars in conjunction with and 2° 35′ south of the Moon.
31 ...	1 ...	Mercury at greatest elongation from the Sun 28° west.
31 ...	2 ...	Saturn stationary.
31 ...	19 ...	Jupiter in conjunction with and 3° 32′ south of the Moon.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei	0 52·4	81 16 N.	Mar. 28,	5 3	*m*
S Piscium	1 11·7	8 20 N.	,, 31,		*M*
Algol	3 0·9	40 31 N.	,, 26,	22 33	*m*
			,, 29,	19 21	*m*
R Canis Majoris...	7 14·5	16 12 S.	,, 25,	19 8	*m*
			,, 26,	22 24	*m*
S Cancri	8 37·5	19 26 N.	,, 25,	20 14	*m*
δ Libræ	14 55·0	8 4 S.	,, 27,	23 48	*m*
U Coronæ	15 13·6	32 3 N.	,, 30,	21 15	*m*
U Ophiuchi... ...	17 10·9	1 20 N.	,, 26,	4 32	*m*
			,, 27,	0 40	*m*
W Sagittarii ...	17 57·9	29 35 S.	,, 28,	3 0	*M*
R Scuti...	18 41·5	5 50 S.	,, 25,		*m*
R Delphini	20 9·5	8 45 N.	,, 28,		*M*
T Vulpeculæ ...	20 46·7	27 50 N.	,, 30,	20 0	*M*
			,, 31,	22 0	*m*
δ Cephei	22 25·0	57 51 N.	,, 27,	1 0	*m*

M signifies maximum; *m* minimum.

Meteor-Showers.

	R.A.	Decl.	
Near β Draconis	263° ...	49° N.	
,, ζ Draconis	260 ...	63 N.	... March 28. Rather slow.

GEOGRAPHICAL NOTES.

In a previous number we referred to the return of M. Edouard Dupont, Director of the Brussels Natural History Museum, from his visit to the Congo for the purpose of scientific exploration. Some of the results of his visit he described the other day to the Belgian Society of Engineers. M. Dupont pointed out that the African interior is drained mainly by four great rivers—the Nile, the Niger, the Zambezi, and the Congo—each of which has to break through the low range that bounds the interior somewhat saucer-shaped table land. The Congo, before making its great final effort, is to some extent dammed back into the reservoir known as Stanley Pool. M. Dupont's journey extended from the mouth of the river to the *embouchure* of the Kassai. The subsoil of the Lower Congo he found to be a soft and impure limestone covered with sand and clay. The mountainous region begins before arriving at Boma, and may be divided into three sections, according to the composition and aspect of the rocks. There is in the first place granite, gneiss, mica-schist, quartzite, and amphibolic rocks, in strongly inclined beds, and extending from Fetish Rock, below Boma, to the neighbourhood of Isanghila. The river from Vivi rushes in a series of cataracts through a gorge 55 miles long. Then follow schists and sandstones; and a little beyond Isanghila, at the great bend of the Congo, appear masses of limestone, very similar to those of the Meuse, and which alternate with the schists for about 35 miles. Then follow schists and red sandstones to beyond Manyanga. At Isanghila the banks rise into walls, some 700 feet high, of rough-grained, almost horizontal sandstone. This ends at Stanley Pool, where begins the Upper Congo. There is an immediate change in the strata. Some coherent sandstones show themselves at the base of the new deposits, and are topped by a great mass of soft sandstone, of the whiteness of chalk. M. Dupont traced these new rocks to the mouth of the Kassai, where there was nothing to indicate that they soon came to an end. He believes, on the contrary, that they constitute the subsoil of the greater part of the Upper Congo. M. Dupont is convinced, from his observations on the Congo, that the waters in the interior of Central Africa were at one time accumulated in a great lake, of which Stanley Pool is the last remnant. Gradually rising to the height of the mountains that bordered the plateau, they at last overtopped them, and, rushing down towards the Atlantic, gradually scooped out the channel now occupied by the Lower Congo. Stanley Pool, he considers, is the final stage of this supposed great internal lake.

A Brussels telegram announces that Lieut. Van Gele has at last succeeded in tracing the connection between the Mobangi and the Welle, proving that the latter flows into the Congo, and is not the upper course of the Shari, thus solving one of the few remaining hydrographical problems in Africa.

In Ergänzungsheft No. 89 of *Petermann's Mitteilungen*, Prof. R. Credner concludes his very valuable monograph on "Reliktenseen,"—lakes which have remained behind after the departure of the sea from a particular area, as contrasted with continental lakes, which have from their origin been altogether independent of the sea. In the present instalment Prof. Credner deals in detail with the geological evidence, and with the various classes of "Reliktenseen" and the mode of their formation. He divides such lakes into three great classes: (1) such as have been formed through the damming up and isolation of parts of the sea through the elevation of the land above sea-level, as in the case of Lake Pontchartrain and the Kurische Haff; (2) such as are due to the isolation of basin-formed depths of the ocean-bed as a result of "negative changes in level"—emersion lakes, as Loch Lomond and Lakes Wetter and Wenner; (3) those caused by the retirement or shrinking of mediterranean seas, as the Caspian and Lake Aral.

At the last meeting of the Royal Geographical Society, Mr. Douglas W. Freshfield read a paper giving the results of his visit to the Caucasus last summer in company with M. de Dechy. Mr. Freshfield dealt at great length with the orography, the glaciation, geology, and ethnology of the Caucasus, and it is impossible to give an adequate idea of his important paper in a note. We can only refer to one or two important corrections which he made in the prevalent statements about the Caucasus. Some existing misconceptions are due to the fact that the Russian staff map embraces only the lower features, the higher ranges being unmapped. Mr. Freshfield dealt mainly with the part of the chain between Elbruz and Kazbek—the Central Caucasus. The geological structure of the chain has been represented with general accuracy by M. Ernest Favre, a son of the well-known Genevese geologist, who visited it in 1868. The backbone, composed of two or more ridges closely parallel, with many short spurs, is in great part gneiss or granite mixed up with crystalline slates. By what seems a strange freak of Nature, it is, east of Adai Choch, rent over and over again to its base by gorges, the watershed being transferred to a parallel chain of clay slates ("Palæozoic schists"), which has followed it from the Black Sea. There are clay-slate formations north as well as south of the granite backbone; but on the north they take the form of rolling downs—of any peaks they ever had they have long been denuded. What the mountain climber looking out from any northern outlier of the granite chain sees is a limestone crest, turning its precipitous face towards the snows, sinking gradually to the low foot-hills which fringe the steppe. It is pierced by deep romantic defiles through which the glacier torrents make their escape. South of the Caucasus, parallel to, but much further from the main chain, runs a line of limestone heights, the most conspicuous summits of which are the Quamli, close to the Rion, and the Nakerale range, the limit of the Radsha. At the foot of the latter lie the coal-mines of Khebouli, recently connected with Kutais by a railway. Over the summit plateau spreads one of the noblest beech forests in the world, varied by an undergrowth of azaleas, laurels, and box, such as we try vainly to imitate in our English parks. Parallel chains and longitudinal valleys characterize this portion of the chain. In the most reputable treatises it is stated that there are not 50 square miles of glaciers in the Caucasus altogether. Mr. Freshfield shows that such a statement is ludicrously absurd. The glaciers of the main chain are many, and some of them are enormous. Among those that have the largest basins Mr. Freshfield mentions, between the Djiper Pass and the Mamisson on the south side, the Betsho, the Ushba, the Gvalda, the Thuber, the Zanner, Tetnuld, and Adish, the Sopchetura at the western and at the eastern source of the Rion. On the north side there is a great glacier in every glen; the Karagam and the Bezingi are the largest; next come the Dychsu, the Zea, the Adyrsu, and Adylsu, and a host of others lying not only on the main chain, but on its spurs, which are glaciated to an extent of