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 sub-soil of the Lower Congo he found to be a soft and impure lime-stone 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 sand-stones; 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 which the Ordnance map gives no hint. On the "Palæozoic schist" range, south of Suanetia, there are glaciers not very inferior to those of the Grand Paradis group, near Aosta. Dismiss for ever, Mr. Freshfield says, that preposterous fiction about the 120 square kilometres of ice in the Caucasus. It is too soon to say how many square kilometres there really are. One estimate, Von Thielmann's, would make the extent covered by ice close upon 2000 square kilometres, or equal to that in Switzerland—political Switzerland, not the Alps. Mr. Freshfield dwelt on many other points in connection with this interesting range, his notes on the inhabitants of the Caucasus being specially valuable, correcting as they do many prevalent errors.

OUR ELECTRICAL COLUMN.

CONSIDERABLE attention has been drawn to the peculiarities of manganese steel by a paper read before the Institution of Civil Engineers, by Mr. Hadfield. Not only is such steel entirely non-magnetic, but its electric resistance is extremely high. Prof. Fleming (*Electrician*, March 9) gives the following figures:—

German silver	20·9	·044
Platinoid	32·8	·021
Manganese steel	68	·122

The first column gives the resistance in microhms per cubic centimetre at 0° C., and the second column the average percentage variation of resistance per 1° C. between 0° and 100° C. These figures agree very well with those given by Prof. Barrett at the British Association meeting at Manchester.

HEIM has been investigating the electro-positive character of magnesium, with the view of replacing zinc in primary batteries. He finds that in a Daniell cell its E.M.F. is 2 volts, in a Grove cell it gives 2·9 volts, and in a Leclanche cell 2·2 volts. In a bichromate cell it gives as much as 3 volts.

MAGNESIUM can now be produced for about 8*s*. per lb., but local action is considerable, and its constancy uncertain. Hence, except for exceptional circumstances, its practical use is still questionable.

PROF. OLIVER LODGE has been giving some admirable lectures on lightning-protectors at the Society of Arts, and has pronounced the use of copper for such purposes as doomed. He argued that the supposed area of protection was mythical, and that the true way to protect a building was Maxwell's cage. He advocated iron, and showed copper to possess "inertia" to such an extent as to render its use dangerous. He also found that under certain circumstances, such as sudden violent discharges, untempered by time, points were of no use, but he suggested the use of barbed wire along the ridges and eaves of roofs.

THAT careful and accurate worker, Prof. Roberts-Austen submitted a paper to the Royal Society on the 15th inst., in which he narrated his recent inquiries into the mechanical properties of certain alloys that will have an important bearing on the metallic conductors employed in electrical enterprises. He has found that the tenacity of pure gold is very much diminished by the smallest admixture of impurities, and that this follows the order of the atomic volumes of the elements. Those elements the atomic volumes of which are higher than gold greatly diminish its tenacity. Doubtless the same principle is applicable to copper and other metals. The abnormal price of copper has raised a great demand for some better conductor than iron, or some improvement of iron in this respect.

DERHAM'S HYDROMETER.

THE Revenue system of estimating the duty on spirits consists of hydrometer, and tables of strengths for each degree of temperature from 30° to 80° F. When constructing the present Revenue tables of strengths, Sikes ignored the expansion and contraction of spirits due to variations of temperature from the standard temperature of 51° F., and assumed that the strength of any given sample of spirits remained the same at all degrees of temperature. From this false assumption it follows in practice, for example, that 100 gallons 40 overproof at 51° are estimated at 98·9 gallons at 30°, and 101·6 gallons at 80°, of the same strength as at 51°; reducing these quantities to the standard of proof strength, we have—

At 30°	...	98·9 × 1·40 = 138·5 gallons of proof,
51°	...	100·0 × 1·40 = 140·0 ,, ,,
80°	...	101·6 × 1·40 = 142·2 ,, ,,

showing a discrepancy of over 3½ gallons, although the same actual quantity of spirit is present in each case.

In its original construction, Sikes's hydrometer was not intended to furnish specific gravities, but simply so many indications, respectively corresponding to the strengths in his tables. But it has since been found necessary to supply a table of specific gravities corresponding to the indications of the instrument. It is well known that scientific precision cannot be attained in experiments with the hydrometer, consequently the specific gravities in this table are far from accurate: for example, the specific gravity at the proof point, to the accurate definition of which the Inland Revenue attaches so much importance, is given as ·9233, instead of ·9236. The whole specific gravity table is in fact incorrect, the error sometimes amounting to two subdivisions of the stem. The errors, however, arising from this source are trifling compared with those inherent in the tables of strengths. For the purpose of constructing correct tables of strengths, the best data and those susceptible of the most accurate determination are the specific gravities of the spirits and the percentage by weight of alcohol they contain. The specific gravity of proof spirit, as defined by the Spirit Act is ·9236; therefore the weight of one gallon is 9·236 pounds. Proof spirit contains 49·3 per cent. by weight of alcohol, of specific gravity ·79385 at 60°; therefore one gallon of proof spirit contains—

$$\frac{9·236 \times 49·3}{100} = 4·553 \text{ pounds of alcohol.}$$

To determine the true ratio of any spirit to proof spirit nothing more is required than to ascertain the weight of alcohol in one gallon of the spirit, and to divide that weight by the pounds of alcohol in a gallon of proof spirit; for example, spirit having a specific gravity of ·825 at 60° weighs 8·25 pounds per gallon; its percentage by weight of alcohol is 89·13; therefore one gallon contains—

$$\frac{8·25 \times 89·13}{100} = 7·353 \text{ pounds of alcohol,}$$

equivalent to

$$\frac{7·353}{4·553} = 1·615 \text{ gallons of proof spirit.}$$

Or 100 gallons are equivalent to 161·5 gallons of proof spirit, and the spirit is said to be 61·5 overproof. It is obvious that although the bulk and specific gravity of a spirit vary with the temperature, the percentage by weight of alcohol it contains does not vary from that cause. The specific gravity of the spirit in the preceding example is ·839 at 30°; the weight of one gallon therefore is 8·39 pounds; its percentage by weight of alcohol is 89·13 as before; therefore one gallon contains—

$$\frac{8·39 \times 89·13}{100} = 7·478 \text{ pounds of alcohol,}$$

equivalent to

$$\frac{7·478}{4·553} = 1·642 \text{ gallons of proof spirit.}$$

The strength of the spirit, therefore, at 30° is 64·2 overproof.

It should be here pointed out that the diminished bulk of the spirit at 30°, as compared with its bulk at 60°, is exactly compensated, in estimating the equivalent value in proof gallons, by the increased strength at the former temperature; for 100 gallons of spirit 61·5 overproof at 60° contract to 98·33 gallons at 30°; and, reducing to proof strength—

$$100 \times 1·615 = 161·5 \text{ gallons of proof spirit,}$$
$$98·33 \times 1·642 = 161·5 \text{ do. do.}$$

whence it is evident that, by the employment of correct tables of strengths, the estimate of the equivalent value of a given quantity of spirit in gallons of proof spirit would be identical at all degrees of temperature. The spirit tables published by Dr. Derham, to which Sir Henry Roscoe lately called the attention of the Chancellor of the Exchequer, are calculated on this principle.