THE barium salt of a new acid-forming oxide of cobalt, CoO_2, corresponding to the black dioxide of manganese, MnO_2, has been obtained by M. Rousseau, and is described in the current number of the *Comptes rendus*. It forms large black prismatic crystals, and appears to be a very definite compound of the composition $BaO . CoO_2$, and possessing some stability. The most favourable method of preparing it is as follows. A mixture of 15 grams of crystals of barium chloride or bromide with 5 or 6 grams of finely-powdered anhydrous barium oxide is heated gradually to redness in a platinum crucible. The temperature is then raised in a good furnace to 1000°-1100° C., when 1 gram of sesquioxide of cobalt, Co_2O_3, is introduced by degrees into the fused mass, and the temperature maintained for about five hours. At the expiration of this time a ring of large black prisms, exhibiting beautiful iris-coloured reflections, is formed. The crystals are found to contain a little platinate of barium, owing to the platinum crucible being attacked at the high temperature, but after elimination of this impurity the analyses agree very closely with the formula $BaO . CoO_2$. The crystals of this monocobaltite of barium are soluble in cold concentrated hydrochloric acid with evolution of heat, and dissolve likewise in nitric acid with effervescence. At a higher temperature than 1100° they are decomposed with evolution of oxygen gas, the CoO_2 becoming reduced to a lower oxide, probably Co_3O_4, the usual product of the ignition of cobalt oxides. Hence the necessity for keeping the temperature below 1100° during the preparation. If the fusion be simply performed over the Bunsen lamp, another cobaltite is obtained containing two molecules of CoO_2. A crust of crystals of this second compound, $BaO . 2CoO_2$, is formed over the surface of the melt, consisting of brilliant black hexagonal lamellæ. These crystals are likewise soluble in hydrochloric acid with evolution of chlorine gas. In order to avoid the formation of this di-cobaltite it is necessary to maintain the temperature over 1000°, when the neutral monocobaltite is alone produced. Hence the limits of temperature during which the monocobaltite is produced are 1000°-1100°. Thus cobalt resembles manganese in forming a dioxide, capable of liberating chlorine from hydrochloric acid and combining with basic oxides to form cobaltites analogous to the manganites. But this dioxide of cobalt appears from its reactions to be somewhat weaker in its combinations than manganese dioxide, and to form them with greater difficulty, the barium cobaltites above described being as yet the only ones prepared.

THE additions to the Zoological Society's Gardens during the past week include two Crested Porcupines (*Hystrix cristata*), a Desert Buzzard (*Buteo desertorum*), two Natal Francolines (*Francolinus natalensis* ♂ ♀) from South Africa, presented by Captain Henry F. Hoste, R.M.S. *Trojan*; a Common Wolf (*Canis lupus*, juv.) from Provincia de Leon, Spain, presented by Mr. W. S. Lart; four Violaceous Night Herons (*Nycticorax violaceus*), a Green Bittern (*Butorides virescens*), a Dominican Kestrel (*Tinnunculus dominicensis*), a —— Pigeon (*Columba*, sp. inc.) from St. Kitt's, W.I., presented by Dr. A. P. Boon, C.M.Z.S.; two Ocellated Mantis (*Harpax ocellata*) from South Africa, presented by Colonel J. H. Bowker, F.Z.S.; a Wapiti Deer (*Cervus canadensis* ♀), a Peacock Pheasant (*Polyplectron chinquis*), eight Mandarin Ducks (*Æx galericulata*), five Summer Ducks (*Æx sponsa*), two Chiloe Wigeon (*Mareca chiloensis*), six Chilian Pintails (*Dafila spinicauda*), three Australian Wild Ducks (*Anas superciliosa*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE BINARY γ CORONÆ BOREALIS.—Prof. Celoria has recently determined (*Astr. Nach.*, 2904) a new orbit for this difficult binary (Σ 1967), which appears a decided advance upon that of Dr. Doberck's, published twelve years ago. A considerable uncertainty still attaches, however, to the elements, although the star has now been under observation for sixty-three years, and has been watched through nearly three-fourths of a revolution. This is due partly to the circumstance that the orbit is presented to us nearly in profile, and partly to the closeness of the two components. The measures in both elements, therefore, have been difficult to make, and have often been very discordant. Thus some recent position-angles by Engelmann show a systematic difference of 30° or more as compared with measures made at about the same epoch by Schiaparelli and Perrotin. The companion passed its primary on the north side about 1836, reappearing in 1840 on the preceding side. It re-passed the principal star on the south about 1878, and is now again on the following side. Celoria's new elements compare with Doberck's as follows:—

	Doberck.		Celoria.
T =	1843·70	...	1840·508
☊ =	110° 24′	...	113°·47
λ =	233° 30	...	250·68
γ =	85° 12′	...	81·66
e =	0·350	...	0·34827
a =	0″·70	...	0″·63103
P =	95·50 years.	...	85·276 years.

ECLIPSES AND TRANSITS IN FUTURE YEARS.—The Rev. S. J. Johnson, author of "Eclipses Past and Future," and well known as a calculator of eclipses, presented a large manuscript volume to the Royal Astronomical Society a few months ago containing projections and diagrams of eclipses from the year A.D. 538 to the year 2500. He has now published in a little pamphlet the dates of all the eclipses, both of sun and moon, visible in England from 1700 to 2000, with the solar eclipses for the two following centuries, and the larger solar eclipses up to 2500. The transits of Mercury and Venus are also included, of Venus up to 2500, and of Mercury to 2000.

The twentieth century is distinguished by three years in each of which seven eclipses take place. Of these, Mr. Johnson notices two, 1917 and 1935, the latter being particularly noteworthy as showing five solar eclipses, but does not mention the third case, 1985, though calling attention to the rare occurrence of three total eclipses of the moon which fall that year.

The little pamphlet, which is intended as a kind of supplement to the author's larger work, "Eclipses Past and Future," is illustrated by four pages of diagrams showing the greatest phases of the eclipses up to 1949, as seen from London. The diagrams are nowhere explained, and no indication is supplied as to which are solar and which lunar eclipses. It appears that circles on which the eclipsed portion is shown by deep shading, and which are surrounded by a ring of shade, stand for solar eclipses, the plain circles for lunar eclipses.

THE WHITE SPOT ON SATURN'S RING.—M. Terby, who still strongly contends for the reality of the bright white spot next the shadow of the planet on Saturn's ring, quotes, in the *Astronomische Nachrichten*, No. 2910, an observation of Ceraski's made in 1884, as showing that it is not a mere effect of contrast with the shadow. M. Ceraski, on November 1, 1884, noticed a bright white spot on the ring where it touched the planet in a similar position to M. Terby's spot, but the shadow of the planet fell at that time on the other portion of the ring, so that the spot could not be accounted for by contrast.

COMET 1889 *c* (BARNARD, JUNE 23).—The following ephemeris for this object is by Dr. R. Spitaler (*Astr. Nach.* No. 2909):—

For Berlin Midnight.

1889.	R.A. h. m. s.	Decl. ° ′	Log Δ.	Brightness.
July 27	3 51 1	49 27·4 N.	0·1341	0·55
31	4 6 14	49 47·6	0·1416	0·50
Aug. 4	4 20 35	50 0·3	0·1486	0·46
8	4 34 0	50 7·0	0·1549	0·43
12	4 46 29	50 8·5	0·1606	0·40
16	4 58 1	50 6·0	0·1656	0·37
20	5 8 37	50 0·5 N.	0·1699	0·34

ASTRONOMICAL PHENOMENA FOR THE WEEK 1889 JULY 28—AUGUST 3.

(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 July 28

Sun rises, 4h. 20m.; souths, 12h. 6m. 14·0s.; daily decrease of southing, 1·3s.; sets, 19h. 53m.: right asc. on meridian, 8h. 31·6m.; decl. 18° 54′ N. Sidereal Time at Sunset, 16h. 20m.

Moon (New on July 28, 0h.) rises, 4h. 27m.; souths, 12h. 33m.; sets, 20h. 28m.: right asc. on meridian, 8h. 58·4m.; decl. 19° 51′ N.

Planet.	Rises. h. m.	Souths. h. m.	Sets. h. m.	Right asc. on meridian h. m.	Declination on meridian ° ′
Mercury..	3 13	11 19	19 25	7 44·6	22 4 N.
Venus ...	1 1	8 56	16 51	5 20·5	20 20 N.
Mars ...	3 10	11 18	19 26	7 43·1	22 20 N.
Jupiter ...	17 38	21 31	1 24*	17 58·1	23 22 S.
Saturn ...	5 46	13 11	20 36	9 36·7	15 27 N.
Uranus ...	11 12	16 42	22 12	13 8·6	6 38 S.
Neptune..	23 56*	7 45	15 34	4 9·8	19 23 N.

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

July.	h.	
28 ...	5 ...	Mercury in conjunction with and 0° 14′ south of Mars.
28 ...	20 ...	Mercury at least distance from the Sun.
29 ...	7 ...	Saturn in conjunction with and 2° 16′ south of the Moon.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
Algol	3 1·0	40 32 N.	Aug. 2,	1 50	*m*
R Ursæ Majoris ...	10 36·8	69 22 N.	,, 3,		*M*
W Virginis ...	13 20·3	2 48 S.	July 31,	22 0	*m*
X Boötis	14 19·0	16 50 N.	Aug. 2,		*M*
R Camelopardalis.	14 26·0	84 20 N.	July 31,		*M*
δ Libræ	14 55·1	8 5 S.	Aug. 1,	2 32	*m*
U Coronæ	15 13·7	32 3 N.	,, 3,	0 20	*m*
U Ophiuchi... ...	17 10·9	1 20 N.	July 28,	23 17	*m*
			Aug. 3,	0 2	*m*
X Sagittarii... ...	17 40·6	27 47 S.	July 28,	23 0	*M*
			Aug. 2,	3 0	*m*
U Sagittarii... ...	18 25·6	19 12 S.	July 29,	0 0	*M*
U Aquilæ	19 23·4	7 16 S.	,, 31,	22 0	*m*
η Aquilæ	19 46·8	0 43 N.	Aug. 3,	3 0	*M*
T Vulpeculæ ...	20 46·8	27 50 N.	July 31,	22 0	*M*
δ Cephei	22 25·1	57 51 N.	,, 30,	0 0	*M*

M signifies maximum; *m* minimum.

Meteor-Showers.

	R.A.	Decl.	
Near δ Andromedæ ...	8°	32° N.	Swift; streaks.
,, δ Cassiopeiæ	20	58 N.	,, ,,
The *Perseids*	33	55 N.	,, ,,
The *Aquarids*	340	13 S.	Max. July 28.

GEOGRAPHICAL NOTES.

AN expedition is about to start for the exploration of Central Australia. Baron von Müller is interesting himself in the expedition, which will be under the command of the experienced explorer, Mr. Tietkens, who will also look specially after the botany and mineralogy. The point of departure will be Alice Springs, on the central telegraph line, and the country round Lake Amadeus will be carefully examined.

IT is reported from Brisbane, according to the *Colonies and India*, that the Queensland Government has concluded an agreement with Mr. A. Weston to lead an exploring party into the almost untrodden recesses of the northern portion of the colony, with a view to bringing to light scientific treasures supposed to be hidden there. Mr. Weston has accepted the undivided responsibility of leadership. Messrs. Broadbent and Bailey will be associated with him, and will respectively discharge the duties of collecting fauna and flora. The party will explore the region lying to the north-west of Cairns, including the Bellenden Ker Range and the shores of the volcanic lakes. It is also thought that something may be heard of Leichardt's expedition, traces of which are popularly supposed to be yet found in the back country. Mr. Weston has refused to accept any pecuniary assistance from the Government for his services.

M. A. DELCOMMUNE, who has been exploring several of the affluents of the Upper Congo, has arrived in Brussels. He has brought with him a valuable collection of African products, and some 200 views on the Upper Congo.

THE news that Dr. Macgregor, the Administrator of British New Guinea, has reached the summit of the Owen Stanley Range is of much interest. Since Captain Owen Stanley discovered the range, about forty-five years ago, various explorers have attempted to scale it, but all have failed. The summit reached by Dr. Macgregor is over 13,000 feet, and he reports several peaks almost equal in height. As Dr. Macgregor is a good botanist, his journey is likely to yield valuable scientific results.

DR. ALFRED HETTNER, in a communication to the *Verhandlungen* of the Berlin Geographical Society (No. 6, 1889), on his travels in Peru and Bolivia, gives the results of his observations on Lake Titicaca, which are of some interest. The surface of the lake, he states, has in the course of time been subject to great changes of level. The proof of these changes is to be found in the terraces around the lake. In a comparatively recent geological period, Dr. Hettner believes, the level of the lake must have been 20 metres higher than it is to-day, and the lake must have spread over the great part of the plain which now incloses it, perhaps as far as Lake Poopo. At a still earlier period the level of the lake must have been 200 metres above its present level, but between these stages, as many appearances indicate, the lake must have sunk below that level. The highest position of the lake-level is older than the glaciation of the district, and contemporaneous with a period of strong volcanic activity. The 20-metre high terraces may belong to the ice-period. For the idea of a former submersion below the sea Dr. Hettner can find no support; at the same time, he cannot altogether deny the possibility that at the time of the 200-metre terrace the lake may have had some connection with the ocean.

NITRATE OF SODA, AND THE NITRATE COUNTRY.[1]

II.

WE will now consider the structure of the actual nitrate beds. As before mentioned, there is no nitrate under the flat Pampa; but exactly where the first slopes of the coast range spring out of the plain, there nitrate is found at a small but variable distance below the surface. The width of the belt varies with the slope of the hill, being greatest where the slope is least, and the vertical height of the highest part of the bed appears to vary from 100 to 120 feet above the plain. It is, however, most important to notice that *the beds of nitrate follow the slope of the Pampa, and not a level line.* For instance, the northern extremity of the Pampa is some hundreds of feet higher than the southern portion, but the nitrate beds follow the spring of the hill from the plain, throughout their whole extent.

A very different sequence of beds lies under the slope of the hills from those alternating layers of mud, sand, and gravel which are found under the level Pampa. The surface covering of loose dust and small stones, extending to a depth of only a few inches, is locally known as *chuca* (see Fig. 3). This seems to be a native word, but I have been unable to ascertain its meaning. Below the *chuca* comes a very hard layer of earth and stones, almost compacted into rock, from 1 to 2 feet thick, which is called *costra* (Span. crust). Under this lies the *caliche*, or true nitrate deposit. This is a bed of from 1 to 3 feet thick, usually of a whitish crystalline structure, containing from 20 to 50 per cent. of nitrate of soda, with a residuum made up chiefly of common salt and earthy matter. *Caliche* is an Indian word, and may possibly come from the Aymara word *callachi*, a shell, or skull.

Passing through the *caliche*, a hard layer of stones and earth, compacted with salt crystals, is usually encountered. The Spanish workmen call this "*congelo*," because it is congealed or concreted by the salt.

After a foot or so of this, there comes finally a bed of soft, loose, *sweet* earth, containing a few very small loose stones, known as *covà*. I could not discover the signification of this word; but the whole method of working a nitrate bed turns round the properties of the *cova*.

A workman, with three or four chisel-pointed bars of iron, hence called a *barretero*, stands on the surface of the ground, and chips out a round hole, about a foot in diameter, down to the level of the *cova*. This hole is called a *tiro*, or charge for

[1] Continued from p. 188.