Hence by formula (*a*) :—

$$v = \sqrt{\frac{2 \times 32{\cdot}1928 \times 2}{k \times 0{\cdot}048544 \times 0{\cdot}0807288}} = \sqrt{\frac{128{\cdot}77}{k \times 0{\cdot}0039189}}$$

$$= \sqrt{\frac{32859}{k}}.$$

Or $v = \frac{181{\cdot}27}{\sqrt{k}}$ in feet per second.

Assuming $k = 1{\cdot}3$,* we obtain,

$v = 158{\cdot}99$ (= 159) feet per second, as the maximum velocity attained by such a stone in falling to the earth. This velocity does not exceed *one-tenth* of the initial velocity of a rifle bullet. And, as the *penetrating power* of a given projectile is proportional to the *square* of its velocity, its power of penetrating the ice would only be *one-hundredth part as great* as that of a projectile of similar mass and dimensions moving at the rate of a rifle bullet. Hence *we need not be surprised that the ice was not penetrated more than three or four inches.*

If the same mass of stone (two pounds) were *spherical* in form instead of *cubical*, its diameter would be 3·2803 inches = 0·27336 feet, and $A = 0{\cdot}058689$ square feet. In this case, we may assume $k = 0{\cdot}7$ † Hence, by the formula (*a*), we obtain,

$v = 197{\cdot}05$ feet per second : so that in this case likewise its velocity would be quite low, and its penetrating power *very insignificant.*

Of course, in the case of *large* meteoric stones the value of v would be much greater. JOHN LE CONTE

ASTRONOMY

The Solar Eclipse of 1868 ‡

ADEN was chosen as the observing-station because from the general nature of its climate it was thought that a satisfactory view of the phenomena that took place during the eclipse might fairly be expected, and also because, as it was far removed from the stations of the French and English expeditions, any observations taken there would prove of considerable importance. The observers were Prof. Edmund Weiss (the leader) Prof. Oppolzer, and J. Rziha, already known for his observations of the eclipse of 1867.

On the morning of the eclipse (Aug. 17) the state of the atmosphere proved unfortunately anything but favourable for astronomical investigation, owing to the presence of a great amount of cloudiness. According to Oppolzer the beginning of the totality was $18^h\ 29^m\ 30^s{\cdot}0$ (Aden mean time), the end $18^h\ 33^m\ 24^s{\cdot}6$.

A few moments before the total disappearance of the sun, Weiss saw on it a beautiful carmine red border or streak, in the middle of which arose a similarly-coloured complicated prominence (No. 1) which lasted for a few seconds. Half a minute later ($18^h\ 30^m 2^s$) a second prominence (No. 2) appeared, long, thin, and in shape resembling a slighly bent finger ; nearly two minutes later ($18^h\ 31^m\ 58^s$) he noticed a third smaller, hill-shaped, or conical prominence (No. 3). Just at the end of the totality another beautiful red border appeared, on the outer edge of which was a gleam of deep blue, most intense at the point of junction with the red, and rapidly fading away on the outside into the background.

Some English officers stationed a short way off also noticed the first two prominences (which they say were visible to the naked eye) and the red border at the end of the totality, but they failed to see prominence No. 3, perhaps for want of sufficien ly powerful or properly adapted instruments.

Oppolzer's observations coincided with those of Weiss, except that he failed to see prominence No. 3 on account of the interference of passing clouds, though he suspected its presence from a certain red appearance at the spot indicated by Weiss. Satisfactory observations of the corona were rendered impossible by the state of the atmosphere.

Rziha's part was confined to the spectrum, and his account is that simultaneously with the disappearance of the last sunbeam. Fraunhofer's lines entirely vanished, the spectrum became continuous and remained so to the end of the totality. All his efforts to detect any reversal of the lines proved ineffectual. Just before the reappearance of the sun, thin clouds intervened and hid the greater part of the corona, so that the principal sources of light were the red border and the prominences. At this moment the more refrangible rays from the green disappeared gradually, and only the red end of the spectrum remained, consisting of deep red, carmine, orange, feeble yellow, and the faintest possible tinge of green, at the same time this remaining part became discontinuous owing to the appearance of dark lines in it, which did not, however, coincide with any of the principal lines of the ordinary spectrum. The disappearance of the dark lines, Rziha seems to think, would connect the corona with a solar atmosphere ; and he suggests that the lines or streaks which appeared afterwards were due to absorption by the water-vapour of our own atmosphere.

PHYSICS

On a Quantitative Method of Testing a "Telegraph Earth," by W. E. Ayrton*

THE method used up to the present time for testing a telegraph earth has been *qualitative* only. As, however, the electrical condition of every "earth" is of great practical importance, it is necessary that some accurate *quantitative* method should be devised, in order that every telegraph office may ascertain whether the resistance of their earth is higher or lower than the maximum resistance allowed. The principal difficulty met with is that, if the resistance between two earths be measured successively with positive and negative currents, the same result is not obtained. Consequently the ordinary law for a Wheatstone's Bridge, or Differential Galvanometer, would not hold true. This difficulty, however, has been overcome in this paper, and formulæ are developed suitable for a Wheatstone's Bridge, a Differential Galvanometer, or a Galvanometer of which the law of the deflections is known.

The details of some experiments are also given, and a particular instance is mentioned in which a much better "earth" was obtained by burying the plate in the upper stratum of soil than by burying it much deeper, on account of a bed of sandstone that existed at about fifteen feet below the surface.

SCIENTIFIC SERIALS

THE *American Naturalist* for September commences with an article by Mr. W. J. Hays, entitled "Notes on the range of some of the Animals in America at the time of the arrival of the white men." The moose, now almost entirely driven out of the United States, was, at the time of the first European settlement, found as far south as New York city ; the range of the carriboo was not more extensive then than it is now, although fossil remains have been found as far south as the Ohio ; the musk-ox is not mentioned by the early travellers ; but the common deer (*Cervus virginianus* and *C. campestris*) was everywhere represented as existing in incredible numbers. The Wapiti deer was found all along the coast from Canada to the Gulf of Mexico ; the bison (improperly called the buffalo by the early settlers), also ranged along the coast from the valley of the Connecticut to Florida, and roamed over the entire country now known as the United States, and extending as far north as the sixtieth parallel in British America. Mr. Hays reckons that at the present time not fewer than half-a-million bisons are annually destroyed by the hand of man. The red fox existed in America before the advent of the white man, in addition to the gray species, notwithstanding assertions to the contrary ; wolves were everywhere abundant, as also was the beaver ; the jaguar, not now found east of Texas, occurred in the mountains of North Carolina as recently as 1737 ; the dog was found in all parts of the country ; and, from the descriptions, must have been of the same species as those now found with the Indians of the plain. The only other original article in the number is "On the Food and Habits of some of our Marine Fishes" by Prof. A. E. Verrill.

THE most important paper in the *Journal of Botany* for September is an article by Mr J. G. Baker "On the Dispersion of Montane Plants over the Hills of the North of England." Mr.

* For *cubes* moving in *water* the experiments of Du Buat and Duchemin give $k = 1{\cdot}28$.

† For *spheres* moving in *air* the experiments of Robins and Hutton give for velocities :—

$v = 3{\cdot}28,\ 16{\cdot}4,\ 82,\ 328$ feet per second.
$k = 0{\cdot}59,\ 0{\cdot}63,\ 0{\cdot}67,\ 0{\cdot}71$.

‡ *Astronomische Nachrichten*, No. 1836-1837 : "Account of the observations of the Austrian Expedition sent to Aden to watch the total solar eclipse of 1868."

* From the Proceedings of the Asiatic Society of Bengal.

Baker divides the sub-mountainous regions of the North of England into four distinct ranges:—the Porphyritic Hills, including the Cheviots; the Carboniferous Hills, or that portion of the Pennine chain which falls between the Tyne and the Wharfe; the Slate Hills of the Westmoreland and Cumberland Lake district; and the Oolitic Hills of North-east Yorkshire. The range of each indigenous species of sub-alpine plant is traced, and a comparative table given of the number of species found in each range; those in the Slate and Carboniferous districts more than doubling those in the Porphyry and Oolite. Dr. Trimen contributes a description, with plate, of *Siler trilobum*, an alleged new British plant, the genuinely indigenous character of which is, however, questioned.

SOCIETIES AND ACADEMIES

PARIS

Academie des Sciences, September 4.—M. Faye in the chair.—M. Bertrand read a long note on the theory of the moon. The learned member supported the same theory as the one advocated by M. Biot, and contended that the third of the three great lunar inequalities had been discovered by Ptolemy. M. Sedillot, a learned Arabic scholar, is of the contrary opinion, and his views were successively supported by M. Leverrier and M. Chasles.—Father Secchi sent from Rome the result of observations made with the same instruments as those he had previously made, and which, having been executed up to the 26th of August, during a period of magnificent weather, are of special interest. An engraving, which is necessary for their comprehension, is sent for publication in the *Comptes Rendus*. It shows the sun as it was observed on the 23d of July from 8.30 to 9.40 at Rome; protuberances are seen, as exhibited by spectroscopic observations. They are very great in number as well as in dimension. Father Secchi says that he is now engaged in making special observation, to ascertain if variations observed in the number and form of protuberances are not connected with variations in the photosphere, and, consequently, with the diameter of the sun itself. Father Secchi states, moreover, that it is very difficult to account for the differences between several accurate observers, which amount to two seconds, without some elements of the kind. He said that he will very soon send a special paper on this important matter. M. Faye, in review of the paper, said that great discoveries might be expected very shortly relatively to the constitution of the sun, and that the labours of various contributors to this subject might be very shortly rewarded.—M. Chasles presented to the Academy a book sent by M. Quetelet, Director of the Royal Brussels Observatory, entitled "Anthropometry; or Measurement of the different Human Faculties." The author tried to find curves, exhibiting not only muscular force and vitality, but also the vices and virtues, representing the period of life at which the proclivities are the strongest for murder, robbery, love, &c. &c.—M. de Tastes sent a paper "On the Atmospheric Currents of the Northern Hemisphere," which, if grounded on facts, may help to prognosticate the weather. He supposes that the polar regions are not disturbed by storms, but are regions of calm. In order to support his theory he quotes a letter sent to the Academy in July 1870, in which he wrote these words, "the next winter, 1870-71, will be one of the coldest in the whole century."—M. Dumas read a note from MM. Troost and Hautefeuille founded on the memoir published by M. Morren on the spectrum of carbon in the Ann. Phys. et Chemie (4th ser., vol. iv., p. 365), and several other accurate spectroscopic determinations. The authors endeavoured to show that the spectra of carbon, boron, silicon, titanium, and zirconium may be derived from each other by special and gradual modifications indicative of certain secret affinities or rather analogies in the form of the molecules. An analogous series was established by M. Ditte for the spectra of sulphur, selenium, and tellurium. M. Dumas suggested whether each natural chemical family cannot be expected to show some spectroscopic affinities for its different members.

MELBOURNE

Royal Society of Victoria, April 17.—Mr. Foord read some notes on the enhydros or water stones, and described the result of experiments upon a sample weighing over 900 grains, which he had obtained through Mr. Ulrich from Mr. Dunn, the mineralogist, who was the discoverer of these stones in Victoria. The sample had for its largest section a form closely approaching an equilateral triangle. It clearly included two separate chambers; in fact, during the experiment it was cloven into two separate water stones, one of which appeared to be quite filled up with quartz crystal; the other containing, besides an inner lining of quartz, a mobile fluid and a bubble of air. To extract the fluid, a fragment was broken from one of the corners of the stone. This disclosed a fine opening or pore in the quartz lining connected with the inner gravity. The fluid was perfectly pellucid, but contained a few minute angular transparent fragments. The fluid was water, slightly mineralised. A single drop evaporated on glass left a slight residue, forming a gummy annular outline, but affording distinct evidence of crystallisation when examined under the microscope. When fifteen drops of the fluid were evaporated on a watch-glass over oil of vitriol, in vacuo, the fluid froze, giving out air bubbles, which vesiculated the icy crust; the ice gradually disappearing left a small residue, nearly white in colour, now crystalline and wrinkled on the surface. A few small crystals and some large ones were observed in the mass. A small crop of beautiful microscopical crystals were obtained on resolution and spontaneous evaporation. Among them were recognised cubic crystals and crystals pertaining to the cubic system. On dissolving the crystals a delicate impress of their form was left, white on a delicately pale yellow ground, as though a deposit of colloidal ferruginous silica remained, with colourless cavities where the crystals had occupied position. On testing the re-dissolved saline matter, it gave a distinct white flocculent precipitate with nitrate of silver, immediately soluble in ammonia. It also gave a granular precipitate with chloride of barium. With ammonia and oxalate of ammonia a very slight granular precipitate was obtained after some time, and with ammonia, chloride of ammonia, and phosphate of soda, relatively abundant crystalline precipitate tufts, or stellate groups of acicular crystals, were obtained. A drop of the fluid examined in the microscope showed vividly the sodium double line, but no indication of potassium, lithium, calcium, nor indeed of any other metal, was apparent. Having thus described the result of his experiment, Mr. Foord endeavoured to show that the wall of the enhydros owed its plane form to crystalline silica deposited along with the amorphous silica, the two together forming the chalcedony. It was also attempted to be shown that there was every gradation from agate, in which the deposit was on the wall of the cavity like a varnish, up to enhydros, in which the cavity was interlaced by planes dividing it into angular chambers. Specimens of thin laminæ were shown, in which the crystalline character of quartz was distinctly observable, resembling the geometric carpet pattern. The President again brought under the notice of the Society the proposed expedition to Cape York in December next, to view the Total Eclipse of the sun, to the preparations for observing which we have already alluded.

BOOKS RECEIVED

ENGLISH.—Phrenology; and How to Use it in Analysing Characters: N. Morgan (Longmans).—Hints on Shore Shooting: J. E. Harting (Van Voorst).—Modern Scepticism: C. J. Ellicott (Hodder and Stoughton).—The Phœnix; vol. i., and vol. ii., No. 13.

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