

bands are carefully represented, and a full description of them is given in the body of the work. The whole is designed to facilitate the application of spectrum analysis to mineral chemistry; and although some of the details may hereafter require correction, the work is well executed, and cannot fail to be of great value to the scientific and practical chemist. The frequent reproduction of the comparatively simple spectra of the metals obtained at the low temperature of the gas flame in elementary works of chemistry, unaccompanied by sufficient explanation, has tended to give rise to partial and even incorrect conceptions of the grandeur and extent of this subject. How many persons believe that the spectrum of sodium consists solely of a pair of fine lines corresponding to the double line *D* of the solar spectrum? How few know that at the high temperature of the electrical spark it exhibits three other pairs of well-defined lines, one in the orange, another in the yellow, and another in the green, together with a nebulous band on the confines of the blue? (Huggins). All these lines may easily be seen by passing the electrical spark in a non-luminous flame between a fused bead of sulphate or chloride of sodium and a platinum wire, together with a few other feeble lines, especially in the violet (Lecoq de Boisbaudran). The vivid line in the red, with its faint companion in the orange, which forms the ordinary spectrum of the compounds of lithium in the gas flame, gives place to a very different spectrum, when sparks are drawn from a solution of the lithium salts. The red ray still continues vivid, but it is surpassed in intensity by the orange, which is now the most characteristic of the lithium rays, while two new rays or lines come into view (λ 4970, 4604). With a solution either of the ferrous or ferric chloride, the electrical spark gives the numerous lines with great sharpness and accuracy of detail, which constitute the spectrum of metallic iron.

M. Lecoq de Boisbaudran gives a delineation of what he considers to be the spectrum of oxide of barium, as it appears after a prolonged heating of the chloride in the gas flame, and also of the spectra proper of the chloride, bromide, and iodide of barium, as obtained by heating those salts in the gas flame charged with hydrochloric acid, bromine, and iodine vapours respectively. These spectra are all different. Thus, in the case of the chloride, only slight traces of the lines and bands due to the oxide are seen, while six new lines appear which are very intense (A. Mitscherlich). On the interesting subject of the bright lines which compose the spectrum of the earth erbia and its phosphate, the following observations are made in the work before us:—"According to Bunsen and Bahr, the addition of a little phosphoric acid to solid erbia gives to that earth a greater emissive power and renders the lines sharper, without modifying their number or position. On repeating this experiment, I find that erbia alone and erbia to which phosphoric acid has been added give very different spectra. On comparing the spectra, the red is more developed in the light of the phosphate, whilst the green and the violet-blue are more vivid in that of the oxide."

The limits of this notice do not permit the discussion of questions of great interest in spectrum analysis, many of which promise soon to be fully resolved. The observation of Roscoe and Upton, that the broad bands characteristic

of certain metallic compounds at the low temperature of the gas flame disappear at the higher temperature of the electrical discharge, and the view they have set forth, that in the former case the spectrum is that of the compound, in the latter case that of the metal, have received confirmation from later researches. Lockyer, in his valuable contributions to spectrum analysis, has shown that what he designates the shortest lines disappear first on reducing the pressure, and that the difference between the spectrum of the chloride and the spectrum of the metal is that under the same spark condition all the short lines are obliterated in the former case. The same investigator has observed that metallic elements of low specific gravity, such as sodium, calcium, magnesium, and aluminium widen their lines by increase of vapour density, while metallic elements of high specific gravity, such as iron, cobalt, and nickel, increase under the same condition the number of their lines.

THOMAS ANDREWS

OUR BOOK SHELF

Comets and the New Comet of 1874. By the Author of "Astronomy Simplified for General Reading." (London: William Tegg and Co., 1874.)

THIS book purposes to be "a complete popular account of all that is known of these wonderful bodies which are so great a perplexity to science;" but the work consists of only 56 pages, and it is needless to say that even a popular account of these bodies to be complete must extend over a much larger space. We think that a work on any subject in science, to be popular, that is written to be read by the public at large and not by persons who are conversant with the subject only, should not refer to explanations or theories that are not generally known, without a very intelligible explanation; theories of the action of observed phenomena should not be given without a very strong probability of their truth, or without a caution against their acceptance; and in dealing with a subject like the present one, when our knowledge is limited, and when there are so many different modes of explaining appearances, it behoves an author to use more than ordinary caution against the mention of anything that is not strictly in accordance with ascertained physical laws. On both these points the present book is at fault. As an instance, the author mentions M. Faye's theory of the repulsive power of the sun in virtue of its heat, and then urges objections to the theory without a word of explanation of it. Now to a person not conversant with the experiments on the repulsion of gases and solids by heat rays, the theory would seem absurd and contrary to experience; and so the author carries the day with the theory that the effect of solar heat upon the cometary matter is electrical in its action. Again, he says: "For example, the matter of comets is not possessed of concentric attraction even with reference to itself, neither is it possessed of chemical affinity for itself. This is fully established by the eccentric forms of comets and through conspicuous variations of shape and size." This is quite new to us. Again, after mentioning that Lexell's comet was entangled for about a month among the satellites of Jupiter, he says: "Is there another instance—a single analogy on record outside of cometary phenomena—of a body of dead matter under great velocity being actually barred and stopped in its path for four months, and then suddenly starting off again after being divested of its force for so long a period? What can the composition and resolution of forces do for us here? for here is the most wonderful problem ever submitted to their laws. What must be the amazing force of a body which, like an

unspent cannon-ball impeded by a bank of earth, keeps spinning and grinding in its bed for four months, and then suddenly goes off with unabated velocity as if it were merely ricocheting from its point of interruption?"

Did the writer never hear that the motion of this comet was in strict accordance with the laws of gravitation, and Laplace used it for correcting the value of Jupiter's mass? In these cases, and in many others, the author has gone sadly astray. The accounts of the appearance of the different comets are good and clear and are well worth reading, but one or two drawings of comets would have improved matters considerably. There is a plate at the beginning of the book, of the earth in a comet's tail, which draws somewhat on the imagination. A want of soundness with reference to mechanical laws appears throughout the book, for we read of the two parts of Biela's Comet having less mass to be acted upon by solar attraction than they had before separation, so that the original orbit must have been altered; and we hear of a comet altering capriciously its centre of gravity with reference to solar attraction. The words *orbital* and *phosphorous* occur frequently, we hope for the last time. The book is spoilt by the endeavour to explain the appearances of comets without regard to the most fundamental physical laws which have so far been found to be rigorously exact.

G. M. S.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.]

Pollen-grains in the Air

MR. HUBERT AIRY's letter printed in your issue of Sept. 3 appears, to a great extent, to reconcile that gentleman's observations with my own. My set of drawings have been made entirely from pollen-grains in the *dry* state, and in this condition (in which of course it is wafted through the air) I find the pollen of plants fertilised by the wind, though belonging to the most widely dissociated natural orders, to be uniformly, as far as I have been able to observe, nearly or perfectly spherical, with no prominences or furrows visible on magnifying about 250. A very short immersion in glycerine would cause the protrusion of the intine through the weak spots of the extine, and would give to the grains of birch and hazel the spherically triangular appearance described by Mr. Airy, and represented in some of the plates by an old German writer.

ALFRED W. BENNETT

Penmaenmawr, Sept. 9

Fossils in Trap

WHEN examining the great exposure of trap and associated Upper Silurian rocks at Cape Bon Ami, New Brunswick, I unexpectedly found fossils in the trap. I was at the time collecting agates and amygdals of calcite. One amygdal attracted my attention as singularly regular in shape. On detaching it from the rock and examining it with the magnifying glass, I found it to be a coral, *Favosites gothlandica*. The fossil is nearly circular. Its greatest diameter is $1\frac{7}{16}$ in., its smallest diameter $1\frac{1}{16}$ in., its greatest thickness is $\frac{1}{2}$ in. Notwithstanding the rubbing by exposure on the shore, many of the cells are quite distinct: the side attached to the trap is without cells. I found a second specimen of a similar coral in another part of the trap-rock. Of this the length is 1 in., the width $\frac{3}{16}$ in. The exposed part is a section having the structure perfect; it is slightly weathered. The fossil is indissolubly united with the trap, its sharp septa penetrating it: the trap of the specimen is very compact.

These fossils are derived from the associated strata of Niagara limestone: Wenlock limestone age.

The strata have been coral reefs: they are filled with corals, *Favosites* and *Cyathophylla*. I collected magnificent specimens of the former, also *Crinoid* joint, *Orthis* sp., *Strophomena depressa*, *Atrypa reticularis*, *Rhynchonella* sp., *Athyris nitida*, *Orthoceras* sp.?

The fossils are easily detached from the strata.

I have no doubt that the notice of the occurrence of the fossils in trap will be new to many of your readers. In all my investigations I have not met with a similar occurrence. The first example proves that the trap was, at least, in a *plastic* state when the fossil dropped into it. The second proves that it was in a *fluid* state.

This is all very satisfactory to us, as proving that trap is a true *lava*, although the Wernerian might thereby infer that the trap was a sedimentary rock. The section of the coral in the trap is as perfect as sections of *Lithostrotrion* in the Lower Carboniferous limestone of East River Pluton in our museum collection.

By what process were these fossils preserved from destruction in the molten trap?

D. HONEYMAN

Halifax, Nova Scotia, Aug. 27

[Our correspondent does not define in what sense he uses the vague word "trap." Fossils, both animal and vegetable, are of common occurrence in some kinds of "trap," e.g. in the different forms of tuff. We presume that the specimens he refers to were of true basalt, or some other form of crystalline, and once molten igneous rock. If so the fact is interesting, though possibly some of our readers may be able to adduce similar cases.—Ed.]

Curious Rainbow

THREE or four days ago I observed a phenomenon which may possibly be interesting to some of your readers. I was standing on a hillside, about 200 ft. above the sea, and saw a rainbow of the ordinary description, very vivid and extending to the horizon at both ends of the arch; outside this was a secondary bow, also very distinct, and inside the primary bow was a series of coloured bands, to all appearance identical with the series in the primary bow from the green to the violet, so placed that the green of this third bow was next to the violet of the primary bow, and the violet of the third bow the innermost of all. There was no appearance of any superposition of colours, and the third bow was nearly as bright as the primary, and the interval between them was hardly appreciable. The whole series was concentric. I have not observed any notice, in works on the subject, of a phenomenon similar to this, or any hint that it might be expected according to the geometrical or physical theories of the rainbow, and therefore think the appearance may possibly be of rare occurrence.

R. P. A. SWETTENHAM

Glen Caladh, Kyles of Bute, Sept. 5

Polarisation of the Aurora

IN answer to Mr. Procter's first question (vol. x. p. 355), I would refer him to *NATURE*, vol. vii., p. 201, where he will find an account of observations of the polarisation of the zodiacal light, and of the aurora, by Mr. Ranyard, who appears to have used a double image prism and Savart, during the great aurora of Feb. 4, 1872, and to have detected no polarisation. He refers also to some observations made upon the small aurora of Nov. 11, 1871, in which he could detect no polarisation. The only other account of observations that I have met with are contained in the report of Prof. Stephen Alexander on his expedition to Labrador, given in Appendix 21 of the United States Coast Survey Report for 1860, p. 30. He found strong polarisation with a Savart's polariscope, and, what is most remarkable, thought that the dark parts of the aurora gave the strongest polarisation. This was at the beginning of July. He was in latitude about 60°, and the observations appear to have been made near midnight. But he does not state whether there was twilight or traces of air polarisation at the time, nor does he give the plane of polarisation.

Cheltenham

J. A. FLEMING

FRANCIS EDMUND ANSTIE, M.D., F.R.C.P.

ON Saturday, 12th inst., in his forty-first year, after an illness of only four days' duration, died Dr. F. E. Anstie, from the consequences of a dissection-wound inflicted while he was investigating the causes of a serious and somewhat mysterious disease which had for some time prevailed in a large school at Wandsworth, and had rapidly carried off several of the pupils. Thus he must