to coincide with the Tertiary period, is pushed back farther and farther into the Secondary; a flora in the United States, otherwise Jurassic in facies, containing no less than seventy-five species, or more than 20 per cent. of Phanerogams, according to Lester Ward. In England the mysterious Wealden, which from analogy should preserve rich fossil floras shedding light on the origin of Angiosperms, yields little but tubers and stems of Equisetum, scraps of ferns and conifers, and a unique liliaceous stem; while our Greensands, Gault, and Chalk afford little or nothing from which the existence of flowering plants during their deposition could be inferred. The veil which has proved absolutely impenetrable in our country, and has so long enshrouded the dawn of dicotyledonous vegetation, seems, however, about to be lifted, and we wait with the utmost interest the publication of the infra-Cretaceous floras of the Potomac by Prof. Fontaine, and of the oldest European Dicotyledons, from the beds of Gault age in Portugal, by Saporta. Though, however, the forms will be revealed, a long time must probably elapse before we can hope to rightly interpret them.

J. STARKIE GARDNER.

ON THE INFLUENCE OF HEAT ON COPPER POTASSIUM CHLORIDE AND ITS SATURATED SOLUTION.[1]

THE blue crystals of copper potassium chloride, $CuCl_2.2KCl.2H_2O$, when heated to upwards of 100°, change their colour, and a closer investigation proves such is due to the formation of a new brown salt, $CuCl_2.KCl$, according to the equation—

$$CuCl_2.2KCl.2H_2O = CuCl_2.KCl + KCl + 2H_2O.$$

This same new substance can be obtained at lower temperatures, on heating the blue double salt in presence of copper chloride; it then results according to the following symbols—

$$CuCl_2.2KCl.2H_2O + CuCl_2.2H_2O = 2CuCl_2.KCl + 4H_2O.$$

Both transformations are reversible—*i.e.* the primitive substances are obtained anew on cooling, and both take place at definite temperatures, 93° and 56° respectively, which temperatures can be accurately determined in studying the abrupt change of volume which accompanies that of chemical composition.

The temperatures of 56° and 93° are, moreover, characterized by an intersection of three curves of solubility in each case, viz.—

1. At 56° the following three will meet—

(*a*) That of the system $CuCl_2.2KCl.2H_2O$; $CuCl_2.2H_2O$.
(*b*) That of the system $CuCl_2.2KCl.2H_2O$; $CuCl_2.KCl$.
(*c*) That of the system $CuCl_2$ KCl; $CuCl_2.2H_2O$.

2. At 93°—

(*a*) That of the system $CuCl_2.2KCl.2H_2O$; ClK.
(*b*) That of the system $CuCl_2.2KCl.2H_2O$; $CuCl_2.KCl$.
(*c*) That of the system $CuCl_2KCl$; ClK.

Lastly, those same temperatures are characterized also by an intersection of four vapour pressure lines at each, viz.—

1. At 56° those of the above-mentioned three saturated solutions, and that of the dry blue salt, mixed with copper chloride, meet.

2. At 93° those of the other three mentioned above and that of the dry blue salt, mixed with potassium chloride.

J. H. VAN'T HOFF.

[1] Abstract of a paper read at the Leeds meeting of the British Association.

THOMAS CARNELLEY.

BY the death of Prof. Carnelley the science of chemistry in this country has suffered an irreparable loss. It appears that some little time ago Dr. Carnelley had been suffering from an attack of influenza, and it was whilst returning to Aberdeen after a journey to the south, made with the object of recruiting his health, that he was seized with sudden and severe illness, which was due, as his medical attendants discovered, to the formation of an internal abscess. Surgical aid proved unavailing, the patient's strength gradually gave way, and Dr. Carnelley passed away at mid-day of August 27, at the comparatively early age of thirty-eight.

Prof. Carnelley was a native of Manchester, the son of Mr. William Carnelley, Chairman of the directors of Messrs. Rylands, Limited, of that city. His early education was received at King's College School, London, and it was during this period, whilst attending the evening classes at King's College, that Carnelley began the study of that science with which he in after life identified himself. In 1868 he entered the Owens College, Manchester, gaining one of the Dalton Entrance Mathematical Exhibitions. During his career as a student, an exceptionally brilliant one, he busied himself not only with the study of the many subjects required of graduates in science of the London University, but found time to devote special attention to his favourite science, and carried out an original investigation on the vanadates of thallium, for which he received in 1872 the Dalton Chemical Scholarship. In this year also he obtained the degree of Bachelor of Science of the University of London, gaining at the final examination for this degree marks qualifying for the scholarship in chemistry, in consequence of which he held the Dalton Chemical Scholarship for an additional year. During the next two years he acted as private assistant to Prof. Roscoe, and commenced his career as a teacher by giving lectures in connection with the evening classes of the Owens College. During the year 1874–75 he continued his studies at the University of Bonn under Profs. Kekulé, Zincke, and Wallach; and on his return to England in 1875 was appointed Demonstrator and Assistant-Lecturer in Chemistry in the Owens College under Prof. Roscoe. During the time that he held this appointment he also acted as Principal of the North Staffordshire School of Science at Hanley, where his teaching proved eminently successful. In 1879 Carnelley, who had taken the London degree of D.Sc., was appointed to the newly-founded chair of chemistry in the Firth College, Sheffield, and, after three years' successful work in this institution in fitting up the chemical laboratory and inaugurating the teaching of chemistry in this College, he passed on to the then recently endowed University College of Dundee. Here ample means were placed at his disposal, and he had the satisfaction of superintending the erection of a block of buildings in which are located the chemical laboratories, lecture-rooms, &c., which he had designed and carefully planned. Under his guidance the Chemical Department of the Dundee College rapidly developed; his enthusiasm, his forgetfulness of self, his unstinted energy, and his ability and zeal as a teacher, all combined to make his department the most important one in the new College and to endear him to his students. Signally successful as was Carnelley's career in Dundee as a professor of chemistry, he also in many other ways conferred lasting benefits on the town and its inhabitants, amongst whom he spent six years, perhaps the most active of his life, and his acceptance of the appointment to the chair of chemistry at the University of Aberdeen in 1888 caused universal regret in Dundee.

Amidst his many duties, first at Owens College, then at Firth College, and afterwards at University College, Dundee, where he conducted both day and evening classes and superintended the teaching in the laboratories, Dr. Carnelley did not forget that the first duty of a man of science is to advance his subject. That he did so with good effect is seen from the numerous communications of importance contributed to the various learned societies both in this country and in Germany, either alone or in conjunction with other investigators. Prominent amongst the researches with the results of which he has enriched science are those by which he sought to extend the application of Mendeléeff's discovery of the "periodic law," in accordance with which the chemical and physical properties of the elements and of their compounds are periodic functions of the atomic weights of the elements. Carnelley, when a student at the Owens College, appears to have been greatly impressed with Mendeléeff's conceptions, and it was to the study of the physical properties of the elements and their compounds, and to the devising of new methods of obtaining trustworthy determinations of the melting-points of metallic salts and the elements, that he early devoted his energies. The results of these experiments were subsequently utilized to show that the fusibility of the elements and of certain of their compounds is a periodic function of their atomic weights. From the relationships discovered by him to exist between the melting-points of the chlorides of the elements and the atomic weights of those elements Carnelley was led to draw conclusions respecting the atomic weight of the element beryllium and to fix its position in the classification of the elements.

Other physical properties have been shown by Carnelley to be related to the atomic weights of the elements, and in a paper read at the Aberdeen meeting of the British Association he developed a series of analogies between the elements and various series of hydrocarbons, from which he concluded that the chemical elements may be represented by a formula $A_nB_{2n+(2-x)}$, in which n is the series and x the group to which the element belongs; $A = 12$ and $B = -2$. In a paper published in the *Philosophical Magazine* in January last, he tells us that since 1872 he had attempted to give the periodic law a simple numerical expression, and states that early in the summer of 1889 he had obtained such an expression, in which the atomic weight is represented as equivalent to the product of a constant, c, into a factor made up of m, a member of an arithmetical progression, dependent on the series to which the element belongs, and v, the maximum valency, or the number of the group of which the element is a member. Thus—

$$A = c\left(m + v^{\frac{1}{x}}\right).$$

The best results are obtained when $x = 2$, and m is 0 for series II., $2\frac{1}{2}$ for III., 5 for IV., $8\frac{1}{2}$ for V., 12 for VI., $15\frac{1}{2}$ for VII., 19 for IX., $22\frac{1}{2}$ for X., 26 for XI., and $29\frac{1}{2}$ for XII.

The formula thus becomes $A = c(m + \sqrt{v})$, and m is a member of an arithmetical series in which the difference is $3\frac{1}{2}$, save in the first two series, when it is $2\frac{1}{2}$. By using this equation, the value for c in the case of 55 elements is found to lie between 6·0 and 7·2, with a mean value of 6·64. Accepting 6·6 as the value of c, the calculated atomic weight of sodium, for example, would be found as follows:—Sodium is the first member of series III., m is therefore 2·5 and $v = 1$, so that $A = 6{\cdot}6(2{\cdot}5 + \sqrt{1}) = 23{\cdot}1$. In the paper referred to the atomic weights of all the elements are given as calculated by this formula, and compared with those generally accepted. The results obtained exhibit very near approximation, the calculated values being, in fact, nearer the experimental numbers than those obtained by the aid of Dulong and Petit's law. The remarkable coincidence that the value 6·6 for the constant c in the above formula very nearly approximates to the value 6·4, accepted as the atomic heat of the elements, in acccordance with Dulong and Petit's law, is noted, and that the specific heats of the elements may consequently be represented as equivalent to $\frac{1}{m + \sqrt{v}}$. The specific heats calculated by the aid of this formula are compared with the experimental values, and in the case of the 55 elements, in which a comparison can be instituted in 45 instances the agreement is very satisfactory, while the other 10 are elements the specific heats of which, according to Dulong and Petit's law, are more or less abnormal.

Accepting Bettone's conclusion that the hardness of an element is inversely proportional to its specific volume, it is shown that hardness may be represented in terms of the specific gravity, and the expression $6{\cdot}6(m + \sqrt{v})$, thus—

$$\text{Hardness} = \frac{1}{\text{spec. vol.}} = \frac{\text{sp. gr.}}{\text{at. wt.}} = \frac{\text{sp. gr.}}{6{\cdot}6(m + \sqrt{v})}.$$

But Carnelley's energies were not alone given to the investigation of questions of a purely scientific interest, for, naturally, one situated as he was all his life in the midst of active industrial communities found many opportunities of applying his knowledge and training for the benefit of those around him. Notably was this the case in the valuable examinations, chemical and bacteriological, of the air of dwellings, schools, &c., in Dundee and district, in a report to the School Board, of which he was an active member. Much valuable information was brought to light by these investigations, and it would appear that one result attained was the realization by the authorities in Dundee, Aberdeen, and some other towns, of the necessity of making provision in schools for the supply of a pure aërial food for the scholars. This subject—the ventilation and heating of schools, &c.—was, we believe, one with which he was busily engaged at the time of his last illness, and it is to be hoped that the labour which he expended upon it will be continued by one of his competent collaborateurs.

Prof. Carnelley was also the author of an elaborate and most valuable compilation of certain physical constants of chemical compounds, published in two large volumes, a monument of industry and devotion to science; he was, moreover, an extensive contributor to the German-English dictionary of scientific and technical terms published by Messrs. Vieweg and Son, of Brunswick.

Of a retiring, modest, unselfish, and deeply religious nature, his earnest enthusiasm served not only to create in all a sincere regard for him, but to make him beloved by those who were privileged, whether as teachers or students, to become intimately acquainted with him. At all times an ardent student, an untiring investigator, a successful teacher, and a contributor in so great a variety of ways to the advancement of science, by his early death an already brilliant career has been deplorably cut short and a vacancy created in the ranks of scientific men in this country which must long remain unfilled.

H. E. R.
P. P. B.

NOTES.

THE well-known writer on vegetable palæontology, Prof. E. Weiss, of Berlin, died on July 5 last.

THE Swedish residents of Chicago have subscribed for a statue of Linnæus, which will shortly be erected in the Lincoln Park in that city.

DR. A. MÖLLER, of Berlin, has established, at Blumenau in the State of S. Catharina in South Brazil, with the assistance of the Prussian Academy of Sciences, a botanical laboratory, where, during the next two years, he will pursue Brefeld's method of the artificial culture of the higher and lower filamentous Fungi. He will be glad to receive suggestions from botanists interested in the subject