

ing result has been obtained that these elements in solution follow the law of gaseous diffusion, the chlorine diffusing twice as fast as the iodine.

Prof. J. W. Brühl gave an account of his investigations on tautomerism. By determining the molecular dispersion of compounds, he has been able to obtain values which are independent of temperature, and thus he has arrived at a sure means of distinguishing between bodies containing the group  $\text{HC}=\text{C}=\text{O}$ , or "keto" bodies, and those containing the group  $\text{C}=\text{C}(\text{OH})$ , which he termed "enole" compounds. With simple ketones and di-ketones no tautomerism or change from the keto to the enole form was found to occur. Nor did it occur with the alkyl derivatives of ketonic acids; when, however, the alkyl was replaced by an acid radical in these cases, tautomerism occurred. The author had investigated derivatives of camphor-carboxylic and of malonic and succinic acids, and found the above rule to hold good in these cases, although enolisation was found to depend not only on the number of negative groups present, but also on the position of these in the molecule, and on the simultaneous presence of alkyl groups, which latter sometimes rendered the molecule more stable. An interesting compound had been obtained, namely, mono-brom-formyl camphor, which was a true ketone, and which was the only compound known in which the keto form of the formyl radical was present. In conclusion the assumption of Lahr, that ketonic compounds possess a "labile" constitution, was shown to be untenable, no continuous internal atomic movement being probable. In the case of benzene derivatives, on the other hand, such changes probably occur, and are termed by the author "phasotropic."

Prof. E. Noelting read two papers entitled, respectively, "On Di-nitros Derivatives of the Aromatic Series," and "On the Formation of Indazoles from Diazo-compounds." Both papers dealt with compounds, which showed the dependence of stability on molecular grouping.

Dr. Caro described the method of obtaining a new rhodamine, or pink colouring matter, by the interaction of chloral hydrate and an alkyl derivative of metamidophenol. A salt of a leuco base is formed, which latter on oxidation by ferric chloride gave a blue colouring matter. It was shown by experiment that on heating a solution of this blue compound in water it turned to a fine pink, owing to an intra-molecular change.

A paper followed, by Drs. G. G. Henderson and A. R. Ewing, on "Tetrarsenites." The sodium salt, which was prepared by adding arsenious oxide to acid sodium tartrate, was easily soluble in water, and might be conveniently used for hypodermic injections of arsenic. Other salts had been prepared, and also a solution which probably contained the hypothetical tartrarsenious acid from which they were derived.

Dr. J. B. Cohen read a paper on "The Constitution of the Acid Amides," in which he showed that these might be divided into two classes—those which formed compounds with silver and crystallised in needles or prisms, and those which did not form silver compounds and crystallised in plates. To account for these differences he fell back on Hantzsch's theory of the stereo-isomerism of nitrogen compounds, and concluded that the amides contain a hydroxyl group.

A short discussion followed the paper, in which Prof. Dunstan quoted experiments which he had made on the action of trichloride of phosphorus on acetamide, which did not bear out Dr. Cohen's view of the constitution of the latter body.

Dr. Caro, however, did not consider Prof. Dunstan's experiment conclusive.

The report of the Committee on Isomeric Naphthalene Derivatives was read. Work had been done on chlor-sulphonic and brom-sulphonic derivatives of naphthalene, and the results tended to confirm the previous conclusions of the investigators.

The report of the Committee on the Action of Light upon Dyed Colours was read by the secretary, Prof. Hummel. The colours experimented with this year were chiefly yellows. Of these by far the largest number, ranging from "moderately fast" to "very fast," were to be found among the azo colours. The azoxy colours give good fast tints upon silk and cotton. The fastness of alizarin orange is probably greater than that exhibited by most other colours of the alizarin group. Very few fast yellows are derived from the natural colouring matters. The cultivation of weld, which yields the only fast and, at the same time, bright, natural yellows, is being gradually given up. It is fortunate then that efficient substitutes can be obtained from coal-tar, which, contrary to popular opinion, is the source from

which the greatest number of colours fast to light are derived at the present time.

Dr. W. Meyerhoffer read a paper on "Certain Phenomena of Equilibrium during the Evaporation of Salt Solutions." For a given mixture of salts in a saturated solution it was found that there existed a certain transition temperature above which double decomposition took place. Thus with a saturated solution containing ammonium chloride and sodium nitrate, sodium chloride was formed above  $6^{\circ}\text{C}$ ., while below that temperature no change took place.

#### GEOLOGY AT THE BRITISH ASSOCIATION.

OF the forty-three papers presented to Section C this year, comparatively few are of lasting importance, geologists having apparently saved up their best work for presentation at Zurich, or else having exhausted themselves at the excellent and successful session of the previous year. The President's address, containing an excellent epitome of the recent progress of mineralogy, was rather fitted for quiet and thoughtful perusal than for reading to a mixed audience, but it will be looked back upon as one of the most valuable of the contributions to the forthcoming volume of *Proceedings*. It was followed up by only one paper dealing with pure mineralogy, that of Mr. H. A. Miers, on a new method of measuring crystals. The two fundamental laws of crystallography—namely, (1) the constancy of the angle in crystals of the same substance, and (2) the law of simple rational indices—seem to be violated by those crystals which are liable to irregular variations in their angles, or those which have the simple faces replaced by complicated "vicinal" planes. Both these anomalies are exhibited by potash- and ammonia-alum. Brilliant and apparently perfect octahedra of these salts show large variations in the octahedron angle; other crystals show low vicinal planes in place of the octahedron faces. If it be true, as is supposed, that the octahedron angle varies in different crystals, it would be interesting to ascertain whether progressive variations can be traced during the growth of a single crystal, and whether some or all of the octahedron faces change their direction in space if the crystal be held fixed during growth.

In order to solve this problem a new goniometer has been constructed, in which the crystal is fixed at the lower end of a vertical axis, so that it can be immersed in a liquid during measurement. This device is in reality an inversion of the ordinary goniometer with horizontal disc; the liquid is contained in a rectangular glass trough with parallel-plate sides; one side is placed rigidly perpendicular to the fixed collimator, and the other is perpendicular to the telescope, which is set at  $90^{\circ}$  to the collimator. The trough is supported on a table which can be raised and lowered, so that the crystal can be placed at any required depth in the liquid. If the liquid used be its own concentrated solution the crystal can be measured during growth, and the changes of angle, if any, can be observed at different stages. In order that it may be held rigidly, the crystal is mounted, when small, in a platinum clip, which it envelops as it grows larger.

The results derived from the measurement of a large number of alum crystals are as follows:—

(1) The faces of the regular octahedron are never developed upon alum growing from aqueous solution.

(2) The reflecting planes (which are often very perfect) are those of a very flat triangular pyramid (triakis octahedron) which overlies each octahedron face.

(3) The three faces of this triangular pyramid may be very unequal in size.

(4) The triakis octahedron which replaces one octahedron may be different from that which replaces another octahedron face upon the same crystal.

(5) During the growth of the crystal the reflecting planes change their mutual inclinations; the triakis octahedron becomes in general more acute, *i.e.* deviates further from the octahedron which it replaces, as the crystal grows.

(6) This change takes place not continuously, but *per saltum*, each reflecting plane becoming replaced by another which is inclined at a small angle (generally about three minutes) to it.

(7) During growth the faces are always those of triakis octahedra; if, owing to rise of temperature, re-solution begins to take place, faces of icositrahedra are developed.

These observations prove that the growth of an alum crystal

expresses an ever-changing condition of equilibrium between the crystal and the mother liquor. It does not take place by the deposition of parallel plane layers; new faces are constantly developed: since these succeed one another *per saltum* they doubtless obey the law of rational indices, though not that of simple rational indices. From the mutual inclinations of these vicinal faces it is possible to calculate with absolute accuracy the angle of the faces to which they symmetrically approximate. This angle is found to be that of the regular octahedron  $70^{\circ} 31\frac{1}{2}'$ . The octahedron angle of alum is not, therefore, as appeared from the observations of Pfaff and Brauns, subject to any variation.

Mr. Howard Fox described a remarkable rock which occurs at Dinas Head in Cornwall, between a greenstone and a slate, and apparently intruded upon by the former. It has the composition of albite felspar, with as much as 10 per cent. of soda, and is like the keratophyres in composition as well as in the possession of concretionary and spherulitic structures. The nodules and spherulites stand out as the rock weathers, and the latter are shown by the microscope to consist of blades of albite radiating round centres of cryptocrystalline material. On the other hand, the rock might belong to the altered sediments called adinolos, of which some, in the Harz, yield 7.5 per cent. of soda, and with this the field evidence and the presence of idiomorphic crystals of ferrous carbonate appear to agree. Mr. W. W. Watts exhibited photographs of a stack of Keuper sandstone at the Peakstones, near Alton, Staffordshire, which, he claimed to have proved, owed its resisting power to the existence of almost vertical planes in the rock cemented by the deposit of barium sulphate. These planes strike along a prominent ridge between two valleys, and at the end of it is the projection of the Peakstones rock. Other cases in which basement beds of the Keuper sandstone are similarly cemented were quoted by the author.

Amongst the papers dealing with Oxfordshire geology, that by Prof. Green demands attention first. In it he described the sections displayed at Fawler and Stonesfield, Shotover, Faringdon, Culham, and Swindon. The thinness of the Upper Lias at Fawler was remarked upon, and a curious case of contemporaneous erosion in the Forest Marble described; the peculiar character of the iron-sands was explained by their having been deposited in a long strait, in which Faringdon was a sheltered bay, suited for the growth of the organisms which here make up almost the whole deposit. In the section at Culham, which shows Gault resting directly on Kimmeridge or Portland limestone, the denudation of the iron-sand was described as a local phenomenon, it being found in full force at another section hard by. The excavations at Stonesfield, carried out by Mr. Walford, were the subject of a report by him, in which he showed that about 30 feet of limestone with clay seams, presenting on the whole the aspect of the great oolite, occurred beneath the "slate" bed. He intends to continue his excavations in order to determine the relationship of these deposits to the Chipping Norton limestone and the Clypeus grit of the Oxfordshire Inferior Oolite. In another paper the same author points out that the terraced hill slopes occur in one geological line in Oxfordshire, the outcrop of a band of micaceous marl in the Middle Lias just below the "red rock bed." The water penetrates from above where the Upper Lias has been stripped off by denudation and filters through to the top of the clay of the *margaritatus* zone, where it makes its escape. The saturated marls are continually creeping down hill, and, in doing so, give rise to the terraces.

Prof. W. Boyd Dawkins endeavoured to trace the submerged folds of palaeozoic rocks under the mantle of newer formations in Oxfordshire, by means of the principle originally laid down by Godwin-Austen and elaborated by Bertrand in recent papers, that the great pre-carboniferous folds form lines of weakness, along which the upper skin of later rock wrinkles and cracks. The northern rim of the South Wales syncline, which contains the coal-basin, was traced eastwards through the Forest of Dean, the partially covered fields north of the Mendips, through Gloucester, Blenheim, Kirtlington, Quainton, Bishop's Stortford, Braintree, and Colchester. From this it is reasonable to infer that coalfields will be found in the area between this line and that from the Mendips to Hythe. One such the author claims to have been discovered at Burford, and he advises that further investigation should be carried on, there and in the neighbourhood, to set at rest the question whether workable coals occur in this syncline. Three other papers by the same author dealt with evidence from borings.

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The first drew attention to a seam of oolitic iron ore (grains of hydrated oxide embedded in calcium and iron carbonates) of Kimmeridgian age, met with at the Dover boring. The second dealt with the Permian strata of the north of the Isle of Man, consisting of 913 feet of red Roth-liegende sandstone, followed by 455 feet of calcareous conglomerates and breccias, which were correlated with the magnesian limestone; these rocks form a connecting link between those of Cumberland and North Ireland. The third communication described three borings in the north of the same island, one of which had penetrated 33 feet of salt-bearing marls apparently at a greater depth than 450 feet from the surfaces: the Triassic sandstones and saliferous marls again present another link between Carrickfergus and the English coast. A paper by Prof. Bonney instituted a comparison between the pebbles in the trias at Cannock and Budleigh Salterton, as a result of which he concluded that those of Budleigh must have come from the south-west, but that similar fragmental rocks fringed the ancient western land in localities far apart.

Sir Archibald Geikie corroborated Heddle's identification of the Pitchstone of Hysgeir, an island about eighteen miles west of Eigg, with that of the latter island. This lava, which flowed into a river channel sloping from east to west, is exactly like that of the Scur of Eigg, but unfortunately its base cannot be seen. The old river channel would be at least 20 miles long, with a fall of perhaps as much as 35 feet in a mile. Gravels containing masses of volcanic rocks (some of them possibly thrown direct from volcanoes), with water-worn blocks of Torridon sandstone, grit, quartzite, and other rocks, rapidly thinning out or passing into fine tuff or volcanic mudstone, are to be found in the islands to the north of Hysgeir, intercalated at various horizons in the bedded basalts, and have doubtless been formed by the flooding and torrential action of contemporaneous rivers.

A joint discussion on the plateau implements of Kent, held by Sections C and H, was opened by Prof. Rupert Jones, who agreed with Prof. Prestwich that the implements were of human origin and dated back to an ancient time when the physical geography of the Weald was very different from its character to-day. Mr. Whitaker followed with a paper, in which he stated that he did not consider the plateau gravels so ancient as had been supposed by other authors, but that part of the deposit, at any rate, was a residuum which had grown where it stood, and is still growing, so that implements in it might be of almost any age. He further stated that he could find no evidence to connect men with preglacial or even glacial times. Amongst the other speakers were Mr. Montgomerie Bell, Sir John Evans, Dr. H. Hicks, Prof. Boyd Dawkins, General Pitt-Rivers, Sir Henry Howorth, Mr. Clement Reed, and Lieut.-Colonel Godwin-Austen.

The more important palaeontological communications included Prof. Rupert Jones's eleventh report on Palaeozoic Phyllopora, Mr. Laurie's second report on the Eurypterids of the Pentlands; recording the obtaining of a large amount of material from which important results are to be expected; Dr. Traquair's preliminary notice of a new fossil fish from the upper Old Red Sandstone of Elginshire; Mr. Jeffs' descriptions of forms of Saurian footprints from the Cheshire Trias, some of which were new, while apparently none of them could be referred to any known species of Labyrinthodont; and Dr. Hicks's conclusion that the original home of the earliest forms of animal life was at some point in the Atlantic. Mr. Montagu Browne's third paper on Rhætic Vertebrata, in which teeth of "Saurichthyan" type were described in the same jaws as Labyrinthodont teeth, proving that the remains attributed to Saurichthys must be assigned to Labyrinthodonts, Plesiosaurus, Hybodus, and Gyrolepis, also called attention to remains of Rysosteus, Metoposaurus or Trematosaurus (?), and Dinosauria.

The consecration of Monday to pleistocene geology has almost become an institution, probably because, although new facts of consequence may not have been discovered within the year, at least one new interpretation of them, or a new theory founded on some of them, can always be relied upon. The day was opened by Mr. Bell's report on the well and borings at Chapelhall, near Airdrie, which completely proved that there was now no shelly clay to be found in the well or in borings in its immediate neighbourhood. Mr. Kendall followed with a report on the boulders examined and collected during the year.

Dr. Hicks next endeavoured to prove that the stratified gravels, sands, and clay of the plateaux of Hendon, Finchley, and Whetstone, which are covered by chalky boulder clay, had

been formed in a lake dammed to the east and west by ice in a moraine, a view which elicited considerable comment and disagreement from a number of glacialists present. Prof. Blake described areas in the Harlech Mountains, some of which were flooded by bare, ice-scratched rocks, side by side with others covered by thick drift deposits. Prof. Bonney, judging by the temperature at which glaciers now form in the Alps, came to the conclusion that a fall of  $15^{\circ}$  to  $20^{\circ}$  F. would be quite sufficient to cause all the known glaciation in the northern hemisphere. Mr. E. P. Culverwell read a paper entitled "An Examination of Croll's and Ball's Theory of Ice Ages and Genial Ages," in which he stated that an appeal to figures conclusively proved the inadequacy of the astronomical theory as at present formulated. By calculating the comparative solar heat of the high eccentricity winter of 199 days, and that of 199 coldest days of the present winter, he showed that the isochimicals would be about  $4^{\circ}$  of latitude further south, and the isothermals more than  $4^{\circ}$  further north, than now. In the "genial age" the shifting would not be more than  $2\frac{1}{2}^{\circ}$ . This cause he considers totally inadequate to account for glacial and genial ages, and therefore falls back on changes in physical geography for the former, and shift of the pole, or greater solar and terrestrial activity, for the latter. In the discussion Sir Robert Ball defended his position, but was further attacked by Prof. Fitzgerald and other speakers.

Prof. Blake endeavoured to show that by the lowering of its centre of gravity as a whole the further end of an ice-sheet might be raised and carry boulders and detritus up a slope. The Rev. E. Jones presented the final report on the Elbolton Cave, stating that no palæolithic remains had been found, and that the investigation was consequently abandoned. The preliminary work, however, in the Calf Hole Cave, near Skipton, was more hopeful, and already a hafted implement, made of a chisel-like tooth bedded in antler and mounted in wood, had been found. In a short paper on the palæolithic section at Wolvercote, near Oxford, Mr. Montgomerie Bell described the section as follows: (1) a "northern drift" and subangular gravel resting in eroded hollows of the Oxford clay. (2) A river gravel containing shell seams, and in whose lowest bed palæolithic implements associated with mammoth, *Cervus elaphus*, *Bison priscus*, &c., have been found. (3) A bed of peat containing the remains of local plants. (4) Sand, mud, and hail close the section. Two palæolithic implements were recorded by Mr. Bruce Foote from an old alluvium, through which the Sabarmati river in Guzerat had cut a channel, varying from 100 to 200 feet in depth.

Dealing with questions of physical geology, Mr. Lobley tried to show that the contraction theory would not explain volcanoes and earthquakes. Dr. Tempest Anderson described three types of subsidences occurring in connection with volcanic rocks in Iceland; the most common type was due to a falling crust where the inner lava stream escaped, others were due to earthquakes, and still others to faulting, probably caused by subsidence of a volcanic centre as a whole. Dr. Johnston-Lavis recorded his observations on the activity of Vesuvius during the year. Mr. De Rance reported in underground waters. Prof. Herdman drew attention to the geological results flowing from his investigation of the bed of the Irish Sea. Prof. Sollas announced that arrangements were in progress for commencing the boring of a coral island. Prof. Hennessy described the channels of streamlets in estuaries as possessing a section constructed of two catenary curves, the only shape which gives a constant velocity whatever the depth of the stream; and Sir H. Howarth passed a series of strictures on current geological nomenclature, with suggestions for its revision, which will doubtless receive the attention due to so high an authority in these matters.

Mr. C. Davison's report on earth tremors contained an account of the trial and modifications of Mr. H. Darwin's bifilar pendulum, and of the horizontal pendulum used at Nicolaiew; then followed an elaborate analysis of the pulsations of the Greek earthquake of this year, showing how they spread to one observatory after another, and were felt at Rome, Siena, Nicolaiew, Potsdam, Kew, and Birmingham. In his report on geological photographs, Mr. Jeffs stated that the collection now amounted to 1055, and that the time seemed to have arrived when it should be housed in some convenient and central position, although it was still necessary to add to the collection, so as to make it thoroughly representative of the whole country. A number of photographs were exhibited and slides from some of them displayed at the second conversazione.

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## NOTES.

M. GUSTAVE COTTEAU, a Correspondent of the Paris Academy, in the Section d'Anatomie et Zoologie, died at Paris on the 10th inst.

MR. M. A. RYERSON has presented to the University of Chicago the Ryerson Physical Laboratory, built at a cost of 250,000 dollars.

THE International Congress of Applied Chemistry, which has just finished a session at Brussels, will hold its next meeting at Paris in 1896.

DR. D. F. OLTMANN has been appointed Extraordinary Professor of Botany at the University of Freiburg-i. B.

THE Imperial Acclimatisation Society of Moscow has founded a botanical section for the purpose of collecting materials for a Flora of Russia. The co-operation is invited of all who are able to assist in this work. Communications should be addressed to the Director of the Polytechnic Museum, Moscow.

MR. H. W. UNTHANK informs us that while shore-hunting at Brightlingsea on August 4, he came upon a stranded Aurelia which exhibited a pentamerous instead of the usual tetramerous symmetry. The specimen is at present in the Brightlingsea Marine Laboratory of the Essex County Council.

MR. FRED N. SCOTT, Assistant Professor of Rhetoric in the University of Michigan, has issued, in the form of a leaflet, a series of questions on the psychology of usage. He wishes to ascertain the origin of dislikes, especially of arbitrary, unreasoning dislikes, for certain words and phrases. He will be glad to send a copy to anyone who is interested in the subject and who will take the trouble to answer the questions.

THE annual general meeting of the Federated Institution of Mining Engineers will be held in Newcastle-upon-Tyne, on Wednesday, September 5, in the Wood Memorial Hall of the North of England Institute of Mining and Mechanical Engineers. The papers down for reading are:—"The Stetefeldt Furnace," by Mr. C. A. Stetefeldt; "Walling and Sinking simultaneously with the Galloway Scaffold," by Mr. John Morison; "Timber Bridges and Viaducts," by Mr. Morgan W. Davies; "Explosions in Nova Scotian Coal-mines," by Mr. Edwin Gilpin, jun.; and "The Shaw Gas-tester for detecting the Presence and Percentages of Fire-damp and Choke-damp in Coal-mines, &c.," by Mr. Joseph R. Wilson. There will also be discussions on other papers, and various excursions.

THE cholera epidemic is slowly spreading, especially in European Russia. Since the end of June, fifteen new districts in Russia have been declared to be infected, making a total of about forty. In Austria-Hungary, in many towns situate on the Vistula, and in Belgium, the disease has extended, and a number of fatal cases have occurred in places in Northern Holland. The Local Government Board is keeping a close watch on the progress of the epidemic, and every precaution is being taken to prevent it from obtaining a foothold in this country. Some anxiety will be felt for a month or so, for during this period the risk of infection is greatest. The dismal weather we have been experiencing this summer, though hardly conducive to pleasant holidays, has one redeeming feature, for it is decidedly unfavourable to the development of a cholera epidemic.

BY the death of Dr. C. R. Alder Wright, at the end of last month, science lost a tireless and enthusiastic worker. He was educated at the Owens College, Manchester, and early showed an aptitude for scientific research. His work extended over a large part of the domain of chemistry. It comprises, says the *Chemical News*, "investigations of simple substances, like hydriodic acid, and some of the most complex substances, like