

Reviews and Notices.

Chapters on the Mineralogy of Scotland by PROF. HEDDLE.

CHAPTER III.—*The Garnets.*

MOST of the members of the Mineralogical Society are familiar with Dr. Heddle's "Chapters on the Mineralogy of Scotland," of which the first, dealing with the rhombohedral carbonates was read at the first meeting of the society after its formation, and the second on the Felspars was reviewed and copiously abstracted in the *Mineralogical Magazine*, No. 8.

We have now a third "Chapter," which deals almost exhaustively with the garnets, and begins as follows :

"Abundant as are the localities in which garnet is found in Scotland, there are but few which yield specimens such as can be analysed.

This is on account of an intermixture of quartz—for the most part in a granular form—the granules being promiscuously scattered throughout the mass of the crystals. In some localities the inter-mixture is not promiscuous but has been governed by some intermittent crystalline action. These localities are Glen Skiag, in Ross, where around a central nucleus of leucitoidal crystals of garnet, translucent quartz is arranged in layer which alternate with those of the garnet, conformably to the figure of its crystal.

The two other localities are the first and third granitic veins to the east of Portsoy ; in both of which garnet of a pale brown colour is laced with quartz, which is arranged in a graphic manner as in the felspars from an adjacent vein."

Dr. Heddle then tells us that he has found the extremely rare *colourless garnets* (water-garnet) in a quarry on Creag Mohr, opposite to Balmoral, associated with the nearly equally rare *grossular*. The water garnet was a simple silicate of lime and alumina with no iron in either state of oxidation.

The grossular on the other hand, though pale in colour, contained as much as 15 per cent. of ferric oxide.

The lens-shaped masses were connected with one another through the continuity of their micaceous coating; forming what may be called a nodose vein,—the mica alone, however, truly constituted the vein;—the quartz, with its included minerals, assuming the nodose arrangement.”

The occurrence of altogether *seven* varieties of garnet in Scotland is shown, and figures of the two singular arrangements of quartz, caught up in the act of crystallization, are given.

The occurrence of zircon in the two new localities in Ross Shire is incidentally mentioned.

The following table embodies the results of the analysis.

Cinnamonstone occurs in quantity both massive and crystallised, at Glen Gairn, in Aberdeenshire, as also of a less fine colour in some other quarries in the neighbourhood; and in a private communication Dr. Heddle informs the writer that he has lately found it in some quantity at the quarry of Ach na Gonolan, about 2 miles east of Grantown.

All the above garnets occur in granular limestone.

We are then presented with an analysis of the “*Elie rubies*,” which at one time were frequently employed for purposes of jewellery in Scotland, and Dr. Heddle regards these as being still, weight for weight, the most valuable gem found in the country; we suppose, however, that he means of a mineral nature, and must except the magnificent pink pearls rarely obtained from the Scotch rivers.

Analyses of *common garnets* and of *almandite* from several localities follow; and lastly there is the description and analysis of the *manganesian variety* already noticed in our own pages.—*Mineralogical Magazine*, No. 9, p. 85.

In connection with this there occurs the following description of a singular granitic vein in a railway cutting near Strathpeffer.

“In carrying the railway through one of the ridges which run north and south in this small glen, a number of huge egg or lens-shaped masses were dislodged from the rock. These masses showed on their exterior a platy covering of glistening greenish mica. Their bulk necessitated their being broken up for removal; their interior was then seen to consist chiefly of quartz, plentifully studded in all directions with large and brilliant plates of mica, and garnets of very unusual beauty of colour.

“In addition, there was found, though in much smaller quantity, black and *green* tourmaline, rarely zircon, and still more rarely apatite.

	S.G.	Si	Al ₂	Fe ₃	Fe	Mn	Ca	Mg	H ₂ O	Total.
<i>Grossular.</i>										
Creag Mohr	3.545	39.83	9.74	15.07	.11	.85	33.57	1.01	.05	99.73
<i>Cinnamonstone.</i>										
Glen Gairn		39.27	21.98	1.49	3.93	.83	31.88	.6	.18	99.66
<i>Pyrope.</i>										
Eile	4.124	40.92	22.45	5.46	8.11	.46	5.04	17.85	.1	100.39
<i>Common Garnet.</i>										
Burra Voe, Yell	3.997	37.3	21.1	7.47	24.02	2.14	4.43	3.53		99.98
Killiecrankie	3.688	37.59	13.66	3.66	32.31	4.47	4.12	3.46	.32	99.59
Meall Luth		37.7	14.8	4.56	32.97	2.87	5.89	1.81		100.05
Knock Hill	4.166	37.11	14.9	10.13	32.41	1.21	2.17	2.93		100.85
<i>Almandite.</i>										
Clach an Evin		39.93	19.81	13.69	13.29	1.	9.13	3.31		100.15
<i>Precious Garnet.</i>										
Glen Sligach, red	4.125	35.99	16.22	8.64	23.27	15.24	.4	.47	.25	100.48
Do. brown		36.08	18.96	7.03	21.56	13.62	1.77	.9	.33	100.29
Loch Garve	4.122	36.15	21.94	15.15	15.09	7.85	2.07	1.62	.31	100.16
Struay Bridge		35.66	15.8	13.12	22.21	11.43	1.12		.06	99.39
Ben Resipol		36.85	21.24	7.38	18.38	14.46	.78	.85		99.92

Professor Heddle concludes a paper of twenty quarto pages as follows :—

“ These analyses show the lime garnets to occur in primitive limestone ; —the magnesian garnet in igneous rock ; and common garnet in micaceous gneiss, and at one locality in diorite.

“ The new manganeseous variety is found in granitic veins, which lie in micaceous gneiss.

“ The vein which carries garnet at Glen Skiag is probably the same which is seen at Struay Bridge ; the similarity in appearance and composition of the garnets which occur in these veins may aid in identifying them.

“ At one time I indulged the expectation that the occurrence of garnet in the limestones which are found towards the upper reaches of the Dee would enable us to follow out the bed or beds throughout the numerous and far-reaching windings to which they have been subjected. The two great beds of lime which course up the country from the east and west of Portsoy,—the westerly beneath, the easterly above the quartzite,—may without difficulty be traced until they approach the upper portions of the Don—into the vicinity in fact of the granite. Here, from a direct, they are suddenly thrown into a much winding course ; and here they come into near proximity with an altogether different bed, which, with a general west and east trend, undulates down the valley of the Dee.

“ To follow out their relationships, and even to determine their identity in this highly disturbed district, is a problem of much difficulty.

“ If it could be proved that the garnet was confined to one bed—that in which it first appears to the westward on the slopes of Leach Ghorm, and which can be clearly traced to Creag Mohr,—then it must be held that this bed takes a sudden sweep to the northward, and is that which, with a westerly dip, is seen in Glen Gairn. It must also be held that it is this same bed which, having formed an anticline—now denuded off—reappears with an easterly dip at Crathie, and crossing the river at Boultschoch, is again seen at Corn Tullich,—henceforth holding an almost rectilinear course as far at least as Eslie.

“ The localities at which this *west and east* bed is to be seen are—Leach Ghorm ; near Carn-na-Cuimhne ; on the south of the Dee in the Balmoral Park ; on Creag Mohr ; at Boultschoch ; at Corn Tullich ; in Knappy Park at Aboyne ; at Craigs, Muir, Mid-strath and Wood Cottage, in Birse ; west of Arbeadie, Banchory ; on the Aberdeen road near Banchory ; east of uFegh Bridge ; and in three or four spots on the Hill of Tilquibillie. That only one bed appears at all these spots may however be doubted.

“ But it is probably as correct a view to hold that the limestones become garnetiferous when they are approached by the granite, or become par-

tially at least involved in that process, which in their near neighbourhood resulted in granitic formation. If so, the Glen Gairn, if not also the Craithie lime, must be regarded as the continuation of the great north and south bed last seen in the neighbourhood of Tornahaish.

“It is to be looked for that the occurrence of the garnet may aid in the determination of the true position of the limestones in this troubled district.”

ON SOME POINTS IN LITHOLOGY.—By Jas. D. Dana.—Under this title an important paper has appeared in the *Am. Journ. Sci.* for November and December, 1878. The author concludes his paper as follows:—

1. The necessities of the science of Geology constitute the most prominent motive for distinguishing *kinds* of rocks; and they should determine to a large extent upon what characters distinctions should be based.

2. In determining the rocks to be grouped as one in *kind* under a common name, near identity in the chemical and mineral composition of the chief constituents is the main point to be considered; not near identity in their crystalline forms, for isomorphism presupposes diversity of composition.

3. Distinction of *kind* should be based on difference in chemical and mineral constitution as regards the chief constituents. When such difference exists, rocks are different in *kind*, and need, for the purposes of geology, distinct names. If it does not exist, the distinction is only that of *variety*; unless (as in the case of trachyte and felsyte), the very wide extension of the rock under persistent characters makes a distinction of name important to geology.

4. It follows from the preceding, that differences in texture: as coarse, or fine, or aphanitic; porphyritic, or non-porphyrific; stony throughout, or having unindividualized portions among the stony grains; and differences in microscopic inclusions; are no basis for a distinction of *kind* among rocks, but only of *variety*; and that *porphyritic structure* is of hardly more consequence than coarse or fine granular.

5. No marked change in the constituents of the earth's erupted material occurred after the close of the Cretaceous period, or just before the commencement of the Tertiary era; and, hence, no ground exists for the distinction of “older” and “younger” among eruptive rocks. The “younger” eruptive rocks are essentially like the “older” in chemical composition and their chief mineral constituents; and they

differ when at all only in texture and some other points of as little importance—qualities that distinguish merely varieties, and which have proceeded from greater prevalence in these later times of sub-aerial eruptions.

6. Since “plagioclase” is not the name of a mineral species,—several minerals, of widely different compositions being embraced under it—it is a confounding of differences and resemblances to speak of it as a constituent of a rock. And since it now includes, through the defining of the feldspar microcline, a large part of potash feldspar, which had been supposed to be orthoclase, it has become almost synonymous with the term feldspar. The “simplicity” its adoption has been supposed to give to lithological system would be greater if “feldspar” were substituted, and with its present range of constitution, the evil would be hardly less.

7. Rocks differing mineralogically, and not chemically, like related hornblendic and augitic rocks (the minerals hornblende and augite being *dimorphous*), are rightly made distinct rocks, since the difference has depended, to a large extent, on wide-reaching geological operations or conditions, and is, therefore, of great geological significance.

8. Since quartz is the most widely distributed and therefore the least distinctive of the minerals of rocks, it may rightly be regarded as of subordinate importance in the distinguishing of rocks, and hence not only such names as *dioryte* and *quartz-dioryte*, *trachyte* and *quartz-trachyte*, etc., are acceptable, but *syenite* and *quartz-syenite*.

9. Biotite being closely like muscovite in composition, and not less common than it in granites, gneisses and mica schists, and being, moreover, unlike the mineral hornblende in chemical constitution and formula, the rocks in which biotite is a chief constituent cannot rightly be put in the same group with hornblende rocks, or those in which hornblende is a chief constituent in a group of mica-bearing rocks. Consequently the name “mica-dioryte,” for a rock containing no hornblende, and the name “hornblende-granite” for a rock containing no mica but hornblende instead, imply alike false relations.

The discussion suggests the following additional remark :

The incapacities of the microscope and polariscope have favored the use of the term “plagioclase,” and have led some investigators to overlook or slight distinctions in chemical constitution. Lithology is to receive hereafter its greatest advances through chemical analyses; for chemistry alone can clear away the doubts the microscope leaves, and so give that completeness to the Science of Rocks which geology requires for right and comprehensive conclusions.

Moreover the researches made in the laboratory to be of real geological value should be, if possible, supplemented by investigations in the field as to transitions among the rocks, and as to other kinds of relations. This field work has often been well done, but not so by all lithological investigators.

The principles presented lead to the following subdivisions in an arrangement of crystalline rocks, exclusive of the Calcareous and Quartzose kinds. Since leucite is a potash-alumina silicate, like orthoclase and microcline (it affording twenty per cent. or more of potash), it is here referred to the same group with the potash feldspars; and nephelite, sodalite and the saussurites being eminently soda-bearing species, they are included with the soda-lime feldspars (anorthite to albite). This reference for lithological purposes of these minerals is sustained by their resemblance to the feldspars in constituents, and also in the quantivalent ratios between the alkalis, alumina and silica; this ratio being in leucite 1 : 3 : 8, as in andesite, and in sodalite and nephelite 1 : 3 : 4, as in anorthite. The term *potash feldspar*, as used in the headings below, is hence to be understood as covering orthoclase, microcline and leucite; and *soda-lime feldspar*, as including the triclinic feldspars from anorthite to albite, and also nephelite, sodalite and the saussurites.

The arrangement is as follows. In the first series, the rocks graduate into kinds which are all feldspar, and into others that are all mica; and yet the amount of potash present is approximately the same.

I. *The Mica and Potash Feldspar Series*: including Granite, Granulyte, Gneiss, Protogine, Mica-schist, etc., Felsyte, Trachyte, etc., and the Leucite rock of Wyoming.

II. *The Mica and Soda-Lime Feldspar Series*: including Kersantite, Kinzigite; and the nephelitic kinds Miascyte, Ditroyte, Phonolyte, etc. (These nephelitic kinds belong almost as well in the preceding series).

III. *The Hornblende and Potash Feldspar Series*: including Syenyte (with Quartz-syenyte), Syenyte-gneiss, Hornblende schist, Amphibolyte, Unakyte (this last containing epidote in place of hornblende); and the nephelitic species Zircon-Syenyte, Foyayte.

IV. *The Hornblende and Soda-Lime Feldspar Series*: including Dioryte (with Propylyte), Andesyte, Labradioryte (or Labrador-dioryte), etc., and the saussurite rock, Euphotide.

V. *The Pyroxene and Potash Feldspar Series*: including Amphigenyte.

VI. *The Pyroxene and Soda-Lime Feldspar Series*: including Augite-Andesyte, Noryte (Hypersthenyte and Gabbro in part), Hypersthenyte

(containing true hypersthene), Doleryte (comprising Basalt and Diabase), Nephelinite, etc.

VII. *Pyroxene, Garnet, Epidote and Chrysolite Rocks containing little or no Feldspar*: including Pyroxenite, Lherzolyte, Garnetyte (Garnet rock), Eclogyte, Epidosyte, Chrysolite or Dunyte (Chrysolite rock), etc.

VIII. *Hydrous Magnesian and Aluminous Rocks, containing little or no Feldspar*: including Chloryte schist, Talcose schist, Serpentine, Ophiolyte, Pyrophyllite schist, etc.

IODOBROMITE: Professor Von Lasaulx's new species.—It is well known that the chloride and bromide of silver occurs associated in the species Embolite. No specimen of embolite, however, has hitherto been found to contain iodide. In fact the iodide, as Iodyrite, crystallizes in the hexagonal system, while Bromyrite and Cerargyrite are isometric. Hence it was hardly to be expected that the three haloids would be found crystallized together in the same mineral. Yet this is what actually occurs in the new species which Prof. Von Lasaulx has lately described under the name of *Iodobromite*. A combination of chloride, bromide and iodide of silver here crystallizes in regular octohedra. It should be noted, however, that Herr O. Lehmann has recently obtained artificially a monometric modification of iodide of silver; and indeed the existence of many cubic iodides, isomorphous with the corresponding chlorides and bromides, has prepared us for the occurrence of native argentic iodide in forms belonging to the regular sytem.

The new mineral, Iodobromite occurs at the mine called "Schöne Aussicht," near Dernbach in Nassau—a mine which has already yielded some notable minerals, such as Beudantite and Scorodite, but which has not heretofore furnished any argentiferous species. In the cavities of the iron-shot quartz in this lode, the iodobromite occurs in the form of minute crystals, which are sharply defined regular octahedra. The faces are perfectly smooth and brilliant in the smaller crystals, but drusy in the larger ones. Occasionally the cube is found in combination with the octahedron; and its faces are characterised by their adamantine lustre. On one crystal an icositetrahedron was observed. Feeble indications of octahedral cleavage have been obtained.

The crystals are of sulphur-yellow colour, showing in some cases a transition to olive-green. Like the other haloid salts of silver, the mineral is very sectile, and may be readily flattened-out under a knife. Fused with bisulphate of potash, the hot bead shews an intense garnet-red colour, which passes into orange and yellow on cooling. On

charcoal before the blowpipe it is reduced to a globule of metallic silver, with evolution of fumes of bromine.

Iodobromite has a specific gravity at 18° C. of 5.713. Only 0.5720 gram. could be used for analysis.

The analysis yielded :—

Silver	59.96
Iodide	15.05
Bromine	17.30
Chlorine	7.09
	99.40

These figures lead to the formula



(Abridged from the author's separate copy from the *Neues Jahrbuch für Mineralogie*.)

F. W. R.

FURTHER RESEARCHES ON THE SUPPOSED SUBSTITUTION OF ZINC FOR MAGNESIUM IN MINERALS.—By Edward T. Hardman, F.C.S., &c., Geological Survey of Ireland. (*Proc. Roy. Irish Acad.* for 1878.)

In all but one or two cases the analysis was twofold. First, an examination with the blowpipe was made, and then if zinc was indicated, a complete analysis in the wet way.

There is one point worth mentioning, however, in this connexion. It appears to be usually the impression that the only reliable blowpipe tests for zinc are the white incrustation, and the green colour imparted by nitrate of cobalt; and that it is too volatile to be reduced to the metallic state on charcoal. Such appears to be the idea on which are based the directions for its detection, in many books on Chemical Analysis, or special works on the blowpipe, but it is an erroneous one, for with care the metal is easily reducible. With less than half a grain of mineral, containing a mere trace of zinc, fused on one of Griffin's reduction pastilles, I have obtained sufficient of the metal to apply the most characteristic wet tests, and such as could leave no doubt as to the nature of it; while with large capsules, and a properly managed reducing flame, the feat is perfectly easy with larger quantities.

The following list gives the principal specimens in which I have found zinc :—

- (1). *Talc schist* from the sea shore, Mullaghglass, county Galway.
- (2). *Hornblende*.—Crystals from the above.

(3). *Dark-green Serpentine* from N. slope of Croagh Patrick Mountain, county Mayo.

(4). *Flesh-coloured Dolomite* from the carboniferous limestone of Ballyfoyle, near Kilkenny.

(5). *Dolomite* from Ballyfoyle, similar to above.

(6). *Dolomite* from Clara, near Kilkenny, similar to the above.

(7). *Very compact Crystalline Magnesian Limestone* from Tawnagh, Toormakeady, county Mayo.

(8). *Hornblende Schist* from Inish-gloria Island, Belmullet, county Mayo.

(9). *Hornblende Rock* from Annagh Head, Belmullet.

(10). *Very pure Talc* from county Galway.

(11). *Black Mica* from a vein in the summit of Liss-oughter, county Galway.

(12). *Orthoclase Felspar* from a felstone porphyry, county Mayo.

(13). *Hornblende Epidotic Rock* containing numerous radiated nests of *Actinolite* or *Tremolite*, from Cannaver Island, Lough Corrib.

(14). *A Serpentine Rock* from N. W. slope of Croagh Patrick, county Mayo.

(15). *Chlorite* from a granite from Limehill, near Pomeroy, county Tyrone.

(16). *A dark graphitoidal steatitic Argillite* from county Mayo.

(17). *Very pure greenish Steatite* from county Mayo.

(18). *Talc Rock* from Crohy Head, county Donegal.

(19). *Iron Pyrites* from county Donegal.

(20). *Actinolite Rock* from Cannaver Island, Lough Corrib. Similar to No. 13.

(21). *Serpentine* from Liss-oughter, county Galway.

What I wish to urge upon your attention, as the result of these investigations, is the almost invariable occurrence of zinc in the minerals examined. I have already shown that the presence of zinc as an accessory component of minerals has been almost entirely neglected—in fact it is only mentioned where it occurs in considerable quantity, as in Franklinite or Automolite; and so uncommon is it looked on as an accessory, that the only augite in which its presence has been recorded before I had commenced this research was dignified with a special name—Jeffersonite.

When a metal not usually occurring in rocks in any large quantity is recorded, it is usually because it exceptionally occurs so abundantly that its presence cannot well be overlooked; and it is only in such

cases that zinc has been hitherto observed. It appears, however, that, like many other substances, it only requires to be sought after; and that its presence is not simply accidental, but the result of the invariable chemical laws of affinity and isomorphism; and I submit that zinc is as much to be regarded as an almost constant associate of the magnesium group as indium and osmium with platinum; niobium with tantalum; rhuthenium and rhodium with palladium, and so on.

In all the instances I have noted in this and my former Paper, the quantity of zinc is small; but this again is really in favour of my view. Had the metal occurred in large quantity in portions of the rock, we should be entitled to consider its presence accidental; but its occurrence in small amount, and its being generally diffused in the rock or mineral, proves it to be truly a constituent.

A lode or thick deposit of zinc ore would be an accidental deposit; but it is from the infinitesimal quantities of this metal disseminated throughout rocks that workable accumulations are derived. As Bischof remarks, the minimum of a mineral in rocks becomes the maximum in lodes; and, although the small traces of zinc in the specimens given above may appear insignificant, it must be remembered that a knowledge of the fact of the diffusion of minute quantities of the metallic compounds through rocks leads to a correct notion of the formation of mineral veins, as otherwise we should be compelled to regard them as exotic productions, derived from unknown sources.

PETROLEUM OF MARMAROSCH (EXTREME N. E. HUNGARY).—Dr. E. TIETZE (*Imperial Geological Institute Report*, September 30th, 1878. Communicated by Count Marechall.)

Near Dragomir, on the S. side of the river Zea, the *Miocene* Rock-salt Formation appears in its full typical form, as on the N. margin of the Carpathians, where the Galician petroleum-springs exist. Trachytic tuffs and green stone are met with in isolated patches in it. The petroleum is subordinate to the rock-salt formation, not to the trachytes. There is no sufficient reason to consider the "grey clays," to which the naphtha-springs belong, as being the emanations of mud-volcanoes. These light-grey clays are associated to sandy-argillaceous marls with subordinate gypsum and thin layers of a soft, bluish-gray, somewhat micaceous, sandstone. At one place, shales, resembling menilite, appear suddenly. They are thin lamellated, brittle, with the surface of the lamellæ coloured whitish or yellow by decomposition, and evidently intercalated with the rock-salt formation. Similar shales exist in the same formation near Delatyn (Galicia). The rock-salt formation near Dragomir strikes W.N.W. to E.S.E., and dips N. and

N.E. A slight folding occasions a merely local S. dip. In the higher S. horizon of the mountain-range, yellowish, rather fine-grained, somewhat micaceous Carpathian sandstones are met with. They are of *Eocene* age, as ascertained by MM. Fr. de Hauer and Baron Richthofen. The rock-salt formation, keeping its strike, appears again on the S. side of the valley. It is rather abundantly impregnated with hydro-carburets, coming to day-light at a little depth beneath the alluvial gravel in the bed of the river Iza. A shaft, sunk to 162 feet depth, gave a certain quantity of petroleum of middle quality, and in greater depth, water much impregnated with salt, which is considered a rather promising indication. In another place, a certain amount of *Ozokerite* has been found in a depth of 204 feet. *Brown coal* appears only in traces not worth exploitation. Silicified *stems of trees* and a *cold spring*, strongly hydro-sulphuretted are found in the rock-salt formation. This last is quite unconnected with the trachytes in its vicinity.

CRYSTALLOGENESIS, by Chevalier de Hauer (continued).—(*Imperial Geolog. Institute Report*, September 30th, 1878. Communicated by Count Marechall.)

Sulphate of Magnesia.—Crystals having regular terminal surfaces can only be obtained from the solution of this salt, as long as their size remains very moderate. This regularity is only perceivable on the first-formed individualized crystals by refrigeration of a hot solution, or by spontaneous evaporation of an incomplete saturation. Such crystals, especially those obtained by evaporation, are occasionally of correct form at the end in contact with the surface of the solution.

It is absolutely impossible to obtain a complete regular evolution of the crystals by turning them repeatedly, or by suspending them in the solution. As these crystals increase in volume, their terminations become more abnormal, the prismatic surfaces remaining regular. The terminal surfaces of the rhombic prisms disappear and are superseded by cavities and other irregularities, the individual type being thus completely lost, even when the utmost caution is taken to make the process of increase go on slowly and without disturbance. Under these circumstances, sulphate of magnesia must be ranked among the substances possessing a feeble intensity of crystallizing power.

All these circumstances change suddenly by the introduction of a slight proportion of a solution from *Borax* into the solution of sulphate of magnesia. The crystals issuing of such a solution are so different in their physical characters from those of un-mixed sulphate of magnesia, that they can only be identified with them by means of their angles. They offer the form of short and thick prisms, while those

from un-mixed solutions are lengthened or acicular; they are also more pellucid, harder, and probably more compact. They chiefly differ from those of pure sulphate of magnesia by the perfection of their form, the terminal surfaces of these last being invariably disfigured or mutilated. Crystals from a solution of sulphate of magnesia have grown to the diameter of several inches without any alteration of form. Even, crystals purposely mutilated, when plunged into a solution containing borax, are soon completed; obtaining surfaces previously non-existent, or existent ones of greater extension. Crystals of pure sulphate of magnesia frequently are fissured through their mass. When increasing in a solution with borax, these fissures are not continued into the new deposit, which, at the same time, shows more pellucidity and a more homogeneous aggregation of substance. Crystals from a pure solution, being a mere shapeless aggregation of individuals, when immersed into a solution with borax, are surrounded with a crystalline crust, hiding all their irregularity, and thus are transformed into beautifully perfect crystals.

The crystals of sulphate of magnesia, obtained in the manufactures at Stassfurt, surpass in perfection all those obtained in laboratories, and show all the characters of those issuing from a solution mixed with borax. The quantity of solution, out of which these crystals issue, may account for their size, but not for their perfection, as, when plunged into a solution of pure sulphate of magnesia, they lose their regularity, as they increase in volume, while, in a solution mixed with borax, their perfection is not lost nor altered as their volume augments.

A mixture of *Sulphate and Chromate of Magnesia* gives crystals more and more imperfect as they increase in size. An addition of borax is sufficient to obtain perfect crystals. If, to compensate the loss of solvent, saturated solution of pure sulphate of magnesia is repeatedly added, the perfection of the crystals remains unaltered, in whatever quantity they may be obtained.

A chemical combination of borax with sulphate of magnesia may scarcely be admitted, chemical analysis having proved, that only minute particles are included mechanically in the crystallized sulphate of magnesia.

Sulphate of Soda acts as favourably as borax on the crystallization of sulphate of magnesia. Possibly, the perfection of the crystals obtained at Stassfurt may be due to their materials containing a certain proportion of sulphate of soda.

Sulphate of magnesia, mixed in any proportion with *sulphate of nickel*, which is isomorphous with it, is crystallizable. The same is

the case with *sulphate of cobalt*, although this last is not isomorphous with it. The isomorphous combinations of sulphate of magnesia with those of nickel, cobalt and chromium give rise by superposition to uncommonly beautiful crystals. Their form becomes perfect by plunging them, at last, in a solution of sulphate of magnesia with admixture of borax. Care must be taken to avoid the immediate contact of the crystals, containing nickel or cobalt, with the solution of sulpho-chromate of magnesia, before a stratum of sulphate of magnesia has been deposited on their surface, else the purity of the crystals might be altered by formation of a small proportion of chromate of nickel or of cobalt. All these crystals, when increasing within a solution of sulphate or of sulpho-chromate of magnesia, containing borax, gradually adopt the above-mentioned typical form of thickened prisms. Immediately after the first formation of crystals in a solution of sulphate of magnesia, this type prevails so much, that the surfaces of the prisms are almost completely wanting. The most perfect crystals of *sulpho-chromate of magnesia* are obtained by letting them increase in the pure solution, and then immersing them in a solution of borax. The crystals, issuing from the pure solution are affected, as they increase in volume, with the same imperfections as those of sulphate of magnesia.

Derivations of the Sulphate of Magnesia and Iron.—These sulphates crystallize in various proportions of quantitative mixture, and show the form of sulphate of iron, with a less number of surfaces. This double combination crystallizes, without alteration of form, when mixed in very variable proportion with sulphates of zinc, nickel, cobalt, copper, manganese and more complicated mixtures of these all. The crystals, thus obtained, offer an admirable variety of colours and forms. However, among hundreds of them, not one of them has been found offering an equal number of surfaces to sulphate of iron. Whenever a crystal of sulphate of iron is left to increase in a solution of one of the above-mentioned mixtures, some of its surfaces soon disappear. Sulphates of magnesia or zinc being added to the saturated solutions of these mixtures, in such quantities as they may still be dissolved, these solutions become saturated with respect to the crystals of each of these combined mixtures.

The whole of the mixtures of sulphate of magnesia and of iron with other sulphates may be obtained in superposition to each other in any desired order of succession. When carefully managed, these crystals keep their pellucidity, thus offering an uncommon variety of coloration, chiefly due to the little difference of solubility between these mixtures. The mixture of *sulphate of copper* with those of iron,

zinc, cobalt or nickel, in nearly equal proportion, at first constantly give rise to triclinical crystals of sulphate of copper (as proved by Professor *Rammelsberg*) with a very slight admixture of the second substance. The subsequent crystals have the same form as those of sulphate of iron.

The crystals issuing from these mixtures are generally of still simpler form than those from a mixture of sulphate of iron and of magnesia, so that the crystallographical system into which they are to be ranked, cannot be certainly ascertained. According to *Dr. Brezina's* measurements, they may be admitted to be triclinical. The same crystals, immersed into a solution of the sulphates of magnesia and iron, continue to increase; consequently they are isomorphous with those of sulphate of iron. Solutions of *sulphate of manganese*, mixed with those of the sulphates of magnesia, cobalt, nickel and zinc, so that the first of these solutions prevails, give crystals of the same form as those of sulphate of iron, differing only in "habit," especially those of a mixture of sulphates of magnesia and manganese. The crystals, different in chemical composition, issuing from the various mixtures of sulphates, may be divided into three groups, whose terms are isomorphous to each other, although the terms of each group offer a common peculiar "habit" which is not to be met with in the two other groups. If a crystal is left to increase in a solution of a crystal of a different group, it gradually assumes the type of the dissolved one. The same takes place in other isomorphous groups; a proof that the "habit" of the form, and certain aberrations from the strictly geometrical form are in no way merely fortuitous. Mixed crystals from two terms of these three groups, offer, in some cases, intermediate forms; occasionally the type of one of the two groups becomes prevalent, whatever may be the quantitative proportions of the mixture.

All the combinations, issuing from mixtures of sulphates, possess an intense power of crystallization. Even, when increased to a very notable volume, their crystals are perfect in form, and pellucid; they resist better the action of air (and those containing iron) are less oxidizable than sulphate of iron.

Meteoric Fall at Dhulia (Hindustan)—*Dr. A. BREZINA.* (*Vienna Imperial Academy Meeting, November 7th, 1878.* Communicated by Count Marechall.)—This fall took place in November, 1877, at 6 p.m. A fiery globe, of the size of a hen's egg, was seen in S. about 50° above the horizon, slowly advancing westward and gradually notably increasing in size. The light, at first similar to a light-

blue signal-light, became light-red and as intense as day-light. The globe, having disappeared, left a luminous trace, first distinctly limited, then gradually dissolving into an indistinct nebulosity. Six or seven minutes (an interval very probably much over-rated) after the meteor had come to its maximum of luminous intensity, a noise like slow thunder was perceived. The altitude of the meteor above the soil is estimated, although without certitude, at between 80 and 100 miles. The meteorite has been analysed at Bombay; its constituents are: nickeliferous iron and magnetic pyrites, 32·62 p.c.; mechanically aggregated silicates, 69·38 p.c. These silicates are composed of silica, 34·73; magnesia, 24·17; oxide of iron and alumina, 6·66; lime, 3·82. The quotient of oxygen being equal to 38, and the proportion of lime being rather considerable, this meteorite is to be considered as an aggregation of peridot with pyroxene, slightly calciferous, in which the first constituent prevails. No trace of carbonous substance has been found.

FELSPARS.—Professor Joseph Szabo of Budapest, in a letter to Prof. Heddle, in which he discusses the conclusions arrived at in the monogram on the Felspars, lately reviewed in this Journal, remarks,—

“Your conclusion is for me very interesting, because I came, some five years ago, to the same result, as regards the tertiary and some of the older eruptive rocks; the felspars are in their association very constant.

“The term plagioclase must be abandoned, and the special name of the plagioclase is to be used.

“For the determination of a felspathic rock the species of the felspar must be known. Of all the constituting minerals it is the felspar which is the most essential, and in many cases through the felspar the rock itself is determined.

“As regards the eruptive rocks belonging to the same cycles of eruption,—for instance as regards the tertiary trachytes of Hungary and the adjacent countries to the south of Europe, where the beginning and the end of the eruption is well-known, I came even to the conclusion, that the felspars indicate also the relative age of the respective rocks.

The products of the last trachytic eruptions contain anorthite; the first eruption was a trachyte with most acid-potash-felspar, and so came successively the oligoclase, labradorite, and at last the anorthitic lavas.

“I have established a method of determining the felspars even in the rocks. The *American Journal of Science* gives a description of it (1877).

There exist now three methods of determining the felspars,—

a. The optical methods of Descloizeaux.

b. The method of the flame-reactions (Szabo's).

c. The method of Boricky (Prague) by converting the felspars into fluo-silicate combinations and observing their different forms of crystallization.

“I use them all, but in most cases it is my method which gives the surest and the quickest results. In some cases the other methods are preferable.”

Professor Szabo is to carry out a new set of observations upon the series of specimens which were analysed by Professor Heddle.

J. H. C.

SPECIFIC GRAVITY OF ROCKS FROM FINLAND.—By Dr. F. J. Wiik.—
(*Proceed. Imper. Geol. Instit. Vienna*, January, 1878.)

Gneissic, porphyritic, and syenitic granite..	2·580..2·736
Compact diabase, with long acicular crystals of apatite, forming a vein near Sordawola	2·742..2·746
Peridot of diabase, breaking through the granite of West Finland, and found in loose fragments on the island of Aland ..	3·100
Peridotie gabbro, from Tisrois	2·862
Peridotie diorite, from Kurn.....	3·161
Diabase of Kristmestadt	3·014
Gabbro from Heinola.....	2·949
Dioritic porphyry, from Berthula.....	2·925
Uralitic porphyry, from Hattula	3·015
Diorite, from Idensalmi.....	3·129

Elæolithie syenite, Iiwaare, in Kuusamo, holds an intermediate place between the acid and the basic rocks; and is allied to the orthoclase-elæolithie rocks from Portugal (foynite), and from the Urals (miascite), &c.

T. R. J.

TELLURIUM ORES OF TRANSYLVANIA.—By A. Schrauf.—(*Imper. Geol. Insti., Vienna, Report, August 31, 1878.*)

These ores are Sylvanite (ascertained to belong to the monoclinic system), white tellurium ore (krennerite), nagyagite, and the tellurets of silver, distinguishable into species—hessite, (silver-tellurium-glance) of the tesseral crystalline form, isomorphous argentite, and a new species, stutzite (tellurium-silver-blende) isomorphous with discrazite and copper-glance. The new species is only known by a unique specimen, probably from Nagyàg, and preserved in the museum of the Vienna University.

The analysis of a very minute quantity exhibits a chemical composition expressed by the formula, $Ag_4 Te$.

T. R. J.

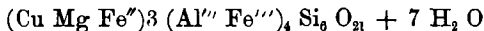
HULLITE.—A short notice of this mineral appeared in the *Min. Mag.*, No. 10. It has since been fully described by Mr. E. T. Hardman, F.C.S., and Prof. Hull in the *Proceedings of the Royal Irish Academy*, Nov., 1878.

Analysis by Mr. E. T. Hardman,

Silica	39·437
Alumina.....	10·350
Peroxide of iron	20·720
Protoxide of iron	3·699
Protoxide of manganese.....	trace
Lime	4·484
Magnesia	7·474
Water.....	13·618
Carbonic acid	trace
	<hr/>
	99·782
	<hr/>
Sp. Gr.	1·76

The author calls attention to its very low specific gravity, and regards it as a ferruginous chlorite near *delessite*.

Probable formula—



Microscopic appearance (by Prof. Hull).—With 25 diameters the rock in which it occurs is seen to consist of light-brown amorphous augite with short prisms of plagioclase, imperfect crystals of olivine, and a very few grains of magnetite enclosed in the new mineral. This is

dark umber-brown, almost opaque except at edges—does not polarize. With a high power shews stalagmitic or chalcedonic structure, with wavy bands. Is apparently a secondary mineral.

SZABOITE.—*Am. Journ. Sci.*, Nov., 1878).—Occurs in minute exceedingly thin triclinic crystals—much like pyroxene; $H=6$ and above, $G=3.505$; hair-brown to hyacinth red—opaque to translucent.

Si O ₂	52.35
Fe ₂ O ₃	44.70
Al ₂ O ₃	trace
Cu O.....	3.12
Mg O.....	trace
Na ₂ O.....	trace
Ignition.....	.40

Is more or less closely related to babingtonite.

J. H. C.

PSEUDOBROOKITE.—(*Am. Journ. Sci.*, Nov., 1878.)—Minute tabular rhombic crystals; distinct brachy-diagonal cleavage, $H=6$, $G=4.98$; dark-brown to iron-black, thinnest crystals brown to red; translucent; lustre adamantine.

Ti O ₂	= 52.74
Fe ₂ O ₃	42.29
Al ₂ O ₃	trace
Cu O)	
Mg O).....	4.28
Ignition.....	.70

Like manaccanite, but differs in crystalline form.

J. H. C.

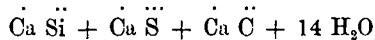
STUTZITE.—(*Schrauf. Zeitschrift für Kryst.*, II, 245.)—Lead-gray highly-modified oblique crystals with hexagonal habit, on gold, from Transylvania. Composition nearly Ag₄ Te=tellurium 22.5, silver, 77.5. Form “closely related to that of dyscrasite and chalcosite.”

J. H. C.

GRAPHIC GRANITE.—Mr. F. Johnson has recently found this on waste heaps at South Crofty Mine, near Redruth.

J. H. C.

THAUMASITE. (*Comptes Rendus des Séances de l'Académie des Sciences, Paris, tom. 87, 1878, p. 313.*) Prof. Nordenskiöld communicates a note through Prof. Daubrée to the French Academy of Sciences, upon a mineral having a remarkable composition which has been found in Gustav and Carlberg, or Bjelke mines, Areskustan, Sweden. Specimens obtained in 1859 by Prof. Nordenskiöld, others procured in 1878, and some existing in an old collection which were taken from these mines a century ago, have all been studied with extreme care by his assistant, Dr. M. G. Lindström. All the analyses yield with atomic precision the formula,



Notwithstanding the extraordinary composition of this mineral, microscopical examination shews that it is a true species, and not a mixture. It appears to Nordenskiöld that the knowledge of the existence of a mineral with such a composition will be very important in studying the changes which take place in the paste of rocks, and he feels convinced that this mineral—to which he gives the name of Thaumassite from the Greek word signifying to astonish—will be found in other mines now that the attention of mineralogists is directed to it.

T. D.

THE KEITH MEDAL.—On the 3rd inst., at a meeting of the Royal Society of Edinburgh, the President, Professor Kelland, in presenting the Keith Medal which had been awarded by the Council to Professor Heddle, of St. Andrews, delivered the following address:—"Professor Heddle—I am here to-night to exemplify a remark which is often made, that to insure success in an address, such as I am about to deliver, the best way is to commit the charge of it to one absolutely ignorant of the subject. No false pride will then stand in the way of the best sources of information, nor will any undue admixture of half knowledge clog and darken the truth. For every particular contained in these remarks, then, I at once unhesitatingly acknowledge myself indebted to Professor Geikie. When I first became acquainted with this Society, forty years ago, there used to frequent our meetings men who had the reputation of being mineralogists rather than geologists—Lord Greenock, Allan, and perhaps Jameson himself. That race has now died out, and with them mineralogy, as a distinct science, has all but lain dormant amongst us. During the preceding quarter of a century that science had flourished nowhere more vigorously than in Edinburgh. Professor Jameson introduced the definiteness of system of the Freyberg School, and infused into his pupils such a love of minerals that numerous private cabinets were formed; while under his fostering care the University Museum grew into a large and admirable series. One of my first acts as Professor in the University was

to vote out of the Reid Fund, which had just come into our hands, a large sum (some thousands) to pay back moneys expended on minerals throughout a series of years preceding. During these years, Geology, as the science is now understood, hardly existed. For, as the nature and importance of the organic remains embedded in rocks became recognised, their enormous value in the elucidation of geological problems gradually drew observers away from the study of minerals. Consequently, as Palæontology increased, Mineralogy waned among us. To such an extent was the study of minerals neglected, that geologists, even of high reputation, could not distinguish many ordinary varieties. But, as a knowledge of rocks presupposes an acquaintance more or less extensive with minerals, the neglect of mineralogy reacted most disadvantageously on that domain of geology which deals with the composition and structure of rocks. The nomenclature of the rocks of Britain sank into a state of confusion, from which it is now only beginning to recover. To you, Professor Heddle, belongs the merit of having almost alone upheld the mineralogical reputation of your native country during these long years of depression. You have devoted your life to the study, and have made more analyses of minerals than any other observer in Britain. You have not contented yourself with determining their composition and their names; you have gone into almost every parish in the more mountainous regions, have searched them out in their native localities, and, by this means, have studied their geological relations, treasuring up evidences from which to reason regarding their origin and history. After thirty years of continuous work, you have communicated the results of your labours to this Society. For the first two of these papers on the Rhombohedral Carbonates and on the Feldspars, in which you have greatly extended our knowledge of pseudomorphic change among minerals, enunciating a law of the shrinkage so frequently resulting therefrom, the Society proposes now to express its gratitude to you. The value of your papers is undoubted. Through the kindness of Mr. Milne Home, I have been favoured with the sight of letters addressed to you by four eminent mineralogists, Dana of America, Rammelsberg of Berlin, Szabo of Buda-Pesth, and King of Queen's College, Galway. Szabo states that the notice of your paper on the Feldspars, which appeared in Groth's *Zeitschrift für Mineralogie*, greatly interests him, and makes him desirous of placing himself in direct communication with the author. Dana says, 'I have read your paper on the Feldspars, in the transactions of the Royal Society of Edinburgh, with great satisfaction. Your thorough method of work leads towards important results of great geological, as well as mineralogical value.'

"I have the satisfaction, in the name of the Council of this Society, of presenting you with the Keith Medal. It is hoped that this recognition of your labours will not be without encouragement to you in the arduous researches in which you are engaged."—*Nature*, Feb. 13, 1879.