

Reviews and Notices.

On the Carboniferous Volcanic rocks of the basin of the Firth of Forth, in the field and under the microscope, by ARCHIBALD GEIKIE, L.L.D., F.R.S.

THIS very valuable communication was read by the author to the Royal Society of Edinburgh, on the 3rd February and the 28th June, 1879. It consists of 80 folio pages with many woodcuts, two plates illustrating the geology of the district, and two (beautifully printed in colours) showing the microscopic structure of the various rocks.

The first part of the memoir is stratigraphical. The author groups the various volcanic rocks into six districts as follows.

1. *Edinburgh district*, including the masses of Arthur Seat, Calton Hill, &c, mostly anamesites, basalts, and porphyrites—erupted about the close of the old red sandstone period.

2. *East Lothian district*, including the Garlton Hills and the coast-hills near Dunbar, mostly porphyrites and claystones—erupted all through the old red sandstone period close up to Carboniferous times.

3. *West Lothian district*, mostly basalts—as at the Binns Hills, Linlithgowshire—erupted chiefly in Carboniferous times.

4. *Stirlingshire district*, including the porphyrites and dolerites, lavas and tuffs of the Campsie Fells and of Kilsyth—erupted in Carboniferous times and probably also in much later times.

5. *West of Fife district*, the Saline and Cleish Hills, Burntisland, &c., with its very distinct lava streams—probably erupted before the Carboniferous period.

6. *East of Fife district*, including the very interesting volcanic vents of the coast near St. Andrews. The author concludes this part of his subject as follows.

“Taking the history of volcanic action as a whole within the basin of the Firth of Forth during the Carboniferous period, we can recognise two distinct types in the occurrence of the rocks,—1st; Successive streams of porphyrite lavas were poured out until their united mass attained a thickness of sometimes more than a thousand feet. Comparatively little tuff was ejected over these areas, except here and there, in the earlier stages of eruption. The lavas now form continuous sheets covering wide spaces of country, and rising into conspicuous ranges of hills. This is undoubtedly the prevalent type of the volcanic accumulations in the Carboniferous system in Scotland. The Campsie Fells in the Stirlingshire district, already described, are only the north-eastera

extremity of the extensive volcanic plateaux of Dumbartonshire, Renfrewshire, and Ayrshire. The Garlton Hills, in the East Lothian, form a small detached area of the same character, and belonging to the same period; while only about 18 miles to the south-east, on the other side of the Lammermuir uplands, the great volcanic zone of Berwickshire begins with the same kind of rocks, and swells out towards the south-west into the ranges of Roxburgh and Dumfries. 2nd; The other type is almost confined to the basin of the Firth of Forth. It consists in the protrusion of numerous detached masses of tuff, and of various augitic lavas never united into wide plateaux or extensive hill-ranges, but all pointing to local and sporadic action. The four districts in the Forth basin where this type is exhibited may, indeed, be viewed broadly as only one area lying between the two districts of the Campsie and Garlton Hills, which so characteristically exemplify the first type.

The local and independent character of the volcanic activity of the second type may be connected here with another feature, which cannot fail to strike the most casual observer. While the great hollow of central Scotland, between the Old Red Sandstone hills on the north, and the Silurian and the Old Red Sandstone heights on the south side, continued for fully a half of the Carboniferous period to be the scene of extraordinary volcanic activity, the eruptions so far as we can judge, were always confined to the valley. It might be contended that possibly many sheets of tuff or of lava may have been stripped off the bounding hills on either side. But the fact remains, that even were it so, these volcanic materials were erupted from orifices in the valley, and not on the hills. In no case have I ever met with true volcanic necks on the hills on either side of the great central valley.* Denudation could not have removed them; their absence makes it certain that the numerous volcanic vents were confined to the low grounds."

Speaking of the structure of the volcanic masses the author remarks:

"The volcanic rocks associated with the Carboniferous formations in the Basin of the Firth of Forth may be conveniently grouped into four sub-divisions according to their mode of occurrence with reference to the surrounding strata. 1st, *Necks*, that is, masses of volcanic material occupying the space of former vents or orifices out of which the volcanic eruptions proceeded. 2nd, *Intrusive Sheets, Dykes and Veins*. These are portions of lava which never succeeded in forcing their way to the surface, but after penetrating some way upward, were arrested in their progress, and consolidated among the rocks. 3rd, *Interbedded or Contemporaneous Lavas*, that is, masses of molten rock which were emitted at the surface, flowed out there in streams, and consolidated into sheets that lie conformably among the strata with which they are geologically contemporaneous. 4th, *Tuffs*, which occur in large stratified masses, or in small beds, either interstratified with ordinary sedimentary deposits, or accompanying sheets of lava."

These different modes of occurrence are then described in great detail.

The second portion of the memoir deals with the macroscopic and microscopic petrography of the district in considerable detail. To this part of the subject the author has devoted much of his attention for twelve years, and we have here the results of this long extended study.

The rocks are classed as Diabase, Dolerite, Basalt, Pikrite (a remarkable

* In the valley of the Nith and its tributary the Carron Water, among the high grounds of Dumfriesshire, necks belonging to the Permian series of volcanoes occur. At the head of Lauderdale, Mr. B. N. PEARCE has observed a small neck coming through the Upper Old Red conglomerate, and possibly connected with the volcanic action in which the Berwickshire and Roxburghshire porphyrites were erupted. But in these cases the orifices have been opened in deep valleys among the hills. [Since this was written, Mr. PEARCE has met with a number of volcanic necks of Lower Carboniferous age in valleys of the Silurian uplands of Roxburghshire, extending to a distance of at least 10 miles from the edge of the lava-sheets.]

serpentine-olivine rock), Porphyrite, Felsites and fragmental rocks or tuffs all of which occur within the area in question. This second part of Professor Geikie's memoir should be carefully studied by all petrographers.

J.H.C.

Crystallized Danberite, (G. J. BRUSH & Ed. S. DANA, *Am. Journ. Sci.* Aug. 1880). This is a memoir in which the mode of occurrence, crystallographic and chemical characters, optical properties and chemical composition of the danberite of Russell, St. Laurence Co., New York, are described in considerable detail. The form is orthorhombic and very similar to topaz, the axial ratios being as under:—

	<i>c</i> (vert)	<i>b</i>	<i>a</i>
Danberite ..	0.8830	1.8367	1.0000
Topuz ..	0.9024	1.8920	1.0000

Seven figures of crystals are given. Some of the crystals are of considerable size, the largest is 4 inches long and $2\frac{1}{4}$ inches wide.

H=7 to 7.25; G 2.986 to 3.021, lustre of crystalline surfaces brilliant, on fractured surfaces vitreous to greasy; colour pale wine-yellow to yellowish-brown; cleavage basal but not very distinct; fracture uneven to sub-conchoidal. B.B. fuses at 3.5 to a colourless glass, tinging the flame green, the bead is milk-white on cooling; in matrass phosphorises on heating with a reddish-yellow light; slightly acted on by HCl, gelatinizes readily with HCl after heating. The following is the mean of four analyses.

Silica	48.23
Boron trioxide	26.93
Lime	23.24
Alumina47
Ignition63

99.50

Agreeing very well with the formula $\text{Ca B}_2 \text{Si}_2 \text{O}_8$.

J.H.C.

On the theory of Twin Crystals.—G. TSOHERMAX, (*Min. u. Pet. Mitt.* II. 6. p. 499.) This paper consists of a hypothetical examination of the mode in which twin crystals may be produced, starting from the molecules of the crystals. The author deduces the following theoretical results from his inquiry.

The origin of a true twin crystal is occasioned by two molecules which cohere before they have been able to take up positions of perfect symmetry, the arrangement being such that they have one plane of symmetrical position, and one axis of symmetry lying in that plane-parallel. Two

molecules possessing parallel lines of symmetry, but which do not correspond in their lines of growth, form interpenetration twins (like the interpenetrating tetrahedra of Fahlerz, &c.)

In true twin crystals the two molecules stand to each other in hemitrope positions, i.e. one is turned through 180° , but in interpenetration twins they are parallel.

All true twins have their molecules symmetrical to a crystallographically determinate plane, whilst interpenetration twins behave like parallel aggregates. The mechanical production of twins of calcite may be explained by the semi-revolution on the twin axis of the molecules that have been acted on by pressure.

The chief laws regulating the forms of twin crystals are:—

Twin crystals are aggregates of two individuals, which are not completely parallel, but are so placed as to have at least one possible similar plane and one edge lying in that plane parallel in each.

There are three forms of twins according as the two individuals have all the edges in the above plane parallel, or have the entire zone of which the edge and plane form part, parallel, or merely satisfy the above general condition.

A hemitrope position is a necessary condition of true twin crystals.

The axis of revolution is either perpendicular or parallel to a possible plane of the crystal; in the latter case it is either parallel or perpendicular to a possible edge.

Twins of parallel sided individuals are either directly or after suitable parallel displacement symmetrical to a plane which is either parallel or perpendicular to a possible plane of the crystal, being in the latter case also parallel or perpendicular to a zone.

Twins of individuals with inclined sides are usually asymmetrical. If however the two individual crystals are imagined as being holohedral, the corresponding twin crystal would be symmetrical.

Regular aggregates of crystals obey laws similar to those of twin crystals.

H. L.

Mineralogical Notes by CARL VEBER, (*Czernowitz*) (*Zeitsch. f. Kryst. u. Min., P. Groth* IV. 4).—*Vanadinite from the Obir, Carinthia*.—The author has re-determined the angular elements of this mineral, there being a considerable discrepancy between the previously obtained results of Rammelsberg and Schabus. The author finds the angle $1011:0001$ ($P:OP$)= $39^\circ 25'56''$, whence $c=0.712177$, thus agreeing closely with the results of Schabus; he moreover records in specimens from the above locality the forms $(10\bar{1}2)$ $(30\bar{3}1)$ $(21\bar{3}0)$, which have not hitherto been noticed in Vanadinite.

H.L.

Miscellaneous contributions to Microscopic Mineralogy.—By H. FISCHER, (*Freiberg i. B.*) (*Zeitsch. f. Kryst. u. Min., P. Groth.* IV. 4.)—This paper contains the record of a series of microscopic examinations of various minerals, in many of which the author finds more or less impurities, producing variations in the formula of the mineral, e.g. minute cubes of iron pyrites in berthierite. The following is a list of the minerals examined: berthierite, chrome iron ore, incrustations of blende (which proved to be wurtzite), klipsteinite, karpfolite, krokydolite, augite from Sicily, beauxite, isopyre, aphrodite, stilpnomelane, lazurite, jadeite, fayalite, monazite, svanbergite, cryptolite, kakoxene, arseniosiderite, and aluminite.

H. L.

Hannayite and Newberyite, by McIVOR, (*Melbourne*,) *Sitzungsber. der. Nieder-rhein. Ges. f. Natur. u. Heilk., January 1879.* (previously noticed in *this Mag.* Vol. III p. 108.)—Hannayite occurs in the guano of the caves at Skipton, near Ballarat. The crystals are 10-12 m.m. long and 1-2 m.m. in thickness. Triclinic:

$$a : b : c = 0.6990 : 1 : 0.9743.$$

$$a = 122^\circ 31' \quad \beta = 126^\circ 46' \quad \gamma = 54^\circ 10\frac{1}{2}'.$$

The forms that have been observed are: (100) (110) ($\bar{1}\bar{1}0$) (001) and ($\bar{1}\bar{3}\bar{3}$). Cleavages occur parallel to 001, 110, $\bar{1}\bar{1}0$, and 130. Color pale yellow. Specific gravity 1.893.

Analyses:—

P ₂ O ₅	45.63		45.77
MgO (with trace FeO)	18.72		19.08
(NH ₄) ₂ O	8.19		7.99
H ₂ O	28.12		28.29
	100.66		101.13

This composition corresponds to the formula:



Newberyite, from the same locality as the last mineral, discovered by C. Newbery; it occurs in large tabular crystals. Rhombic system:

$$a : b : c = 0.9435 : 1 : 0.9299.$$

Observed forms: (100) (010) (001) (111) (102) (021), the plane of cleavage being 010.

The following is an analysis of the mineral:

P ₂ O ₅	41.25
MgO (with trace of MnO)	(23.02)
H ₂ O	35.73
	100.00

The formula is therefore Mg₃H₂P₂O₈ + 6H₂O.

H. L.

On an artificial silicate resembling Orthose, by C. FRIEDEL and E. SARASIN, (*Bull. d. l. Soc. Min. d. France* III, 1.)—The authors heated strongly a mixture of silicate of alumina, silicate of potash and water in an imperfectly closed tube, so that the water escaped at an elevated temperature. On treating the dry residue with hydrochloric acid, there remained a coarse powder, consisting of nacreous crystalline plates, which, on measurement, appeared to be Orthose; small crystals of quartz were also produced in this experiment.

H. L.

On the separation of heavy microscopic minerals, by RENÉ BRÉON. (*Bull. d. l. Soc. Min. d. France*, III, 3.)—In order to separate minute particles of heavy minerals, of different specific gravities, from each other, the author proposes to employ a mixture of the fused chlorides of lead and zinc, the respective specific gravities of these two liquids being 5 and 2.4, so that by properly proportioning the mixture, any two minerals, of different specific gravities, but lying within the above limits, can be separated. The fine powder, to be experimented on, is thrown into the fused chlorides, contained in a conical glass tube, when the particles speedily come to rest, some floating, and the others sunk at the bottom of the tube; the mass is then allowed to cool, and when set, the tube is plunged into cold water, thus cracking the glass. The upper and lower portions of the mass of chlorides containing the minerals can then be removed, and the chlorides dissolved out with water acidulated with hydrochloric acid.

H. L.

On Pseudomorphs. F. E. GEINITZ (*Min. u. Pet. Mitt., G. Tschermak*. II. 6. p. 489.) The author maintains his views on the systematic classification of pseudomorphs against those of R. Blum, and proposes the following subdivisions:—

I. Classification of pseudomorphs according to the chemical processes of their formation:

- (1.) Pseudomorphs produced without loss or gain of components.
- (2.) Pseudomorphs produced by loss of components.
- (3.) Pseudomorphs produced by gain of components.
- (4.) Pseudomorphs produced by exchange of components, in which the connection between the constituents of the original and the pseudomorphous minerals is still capable of demonstration.
- (5.) Pseudomorphs produced by exchange of components, but wanting the above mentioned connection.

II. The following stages were passed through by each of these pseudomorphs in the process of its formation :—

- (1.) Envelopment in some medium that preserved the external form ; such envelope either being furnished by
 - a. Some foreign substance or incrustation,
 - b. Some process of change producing a crust of decomposed mineral, or else it was already present in the
 - c. Original envelope or matrix.
 - d. In certain pseudomorphs, namely paramorphs, an envelope may have been rendered unnecessary by the strong tendency to crystallise (“ Krystallisations-Tendenz ”) of the original mineral.
- (2.) Solution and extraction of the original mineral, and an almost contemporaneous, or an afterwards occurring
- (3.) Replacement by new substance ; either by
 - a. Continuation of the already commenced decomposition, or by
 - b. Infiltration, more or less independent of the decomposition.

These three stages of formation may either follow each other closely or they may suffer interruptions.

The author holds that there is no true displacement of mineral substance, and objects to the term “ displacement pseudomorphs ” (“ Verdraengungs-Pseudomorphosen) of Blum, preferring “ exchange pseudomorphs ” (“ Austausch-Pseudomorphosen.”)

He finally suggests the following names for the five classes, defined in the beginning of his paper.

1. Paramorphs.
2. Apomorphs.
3. Epimorphs.
4. (4. a.) Partial allomorphs (= a contraction for allassomorphs.)
5. (4. b.) Complete allomorphs.

H. L.

ПРЪСНАМИТЪ (J. L. SMITH, *Am. Jour. Sci.*, Aug., 1880).—This occurs in the Emmet County Meteorite. It has a fused surface of a dingy-yellow colour ; when broken, it has a greasy aspect with traces of cleavage, and the yellow colour has a greenish hue ; G.=3·23. Analysis as follows :—

Silica	49·50	49·59	
Ferrous Oxide	15·88	17·01	
Magnesia	33·01	32·51	
	98·39	99·11	

This agrees with the formula $2 \ddot{\text{Si}} \ddot{\text{R}} + \ddot{\text{Si}} \ddot{\text{R}}_2$, “ being two atoms of enstatite or bronzite plus one atom of olivine.”

J. H. C.

ONTARIOLITE (C. U. SHEPHARD, *Am. Jour. Sci.*, July, 1880).—This is a mineral hitherto taken to be Scapolite, but Prof. Shephard finds it differs chemically from Scapolite. $H=7$ to 7.5 ; $G=2.608$; resinous to vitreous; contains several per cents of organic matter. Powder very feebly acted on by strong acids. It occurs in small crystals embedded in bluish-grey saccharine limestone and looks like chialtolite. Chemical analysis gives the following results:—

Silica	48.65 to 51.30
Alumina	13.45 to 19.62
Lime	17.43 to 21.60
Titanic Oxide	4.35 to 5.21
Soda	4.35
Potash	1.109
Magnesia468

J. H. C.

CASSITERITE (*ibid.*).—This occurs at Corsa, Alabama, in crystals smaller than a pea with fragments and grains of tantalite; one crystal of Yttrantalite was also observed.

J. H. C.

PARACOLUMBITE (*ibid.*).—Prof. Shephard proposes to name the Paracolumbite from Taunton, Mass., Para-ilmenite, since it has “no chemical relation to Columbite.

J. H. C.

STAUROLITE (*ibid.*).—Hemihedral forms of this mineral have been found at Morganton, Georgia, U.S.A.

J. H. C.

FERGUSONITE (*ibid.*).—This occurs with Samarskite at Mitchell Co., North Carolina, and is “identical with Rutherfordite.”

J. H. C.

PAGODITE (*ibid.*).—This occurs of a fine-green colour in Georgia, U.S.A. “It probably forms a stratum of considerable dimensions in a mica-slate formation.” It often encloses copper-red rutile. $H=3$, $G=2.86$. B.B. turns white and suffers slight fusion; with borax an apple-green bead. Analysis gave:—

Silica	48 to 52
Alumina	22.6 to 34
Ferrous Oxide.. .. .	2.10
Soda	5.12
Potash	4.43
Water	3.50

Chromium and titanium not determined.

J. H. C.

PANDERMITE (C. G. WARNFORD LOCK, *Jour. Soc. Arts*, Aug. 6, 1880).—This is a hydrous borate of lime occurring in considerable quantity over a large area near the port of Panderna on the Asiatic shore of the Sea of Marmora. "It occurs in a stratum at the bottom of an enormous bed of gypsum—has been proved for a vertical distance of 45 feet. The mineral exists in closely packed nodules, of very irregular size and shape, and of all weights up to a ton. . . . In outward appearance it closely resembles a snow-white fine-grained marble." J. H. C.

Obituary.

HENRY LUDLAM.—Again we have to record the loss of an original member of the Mineralogical Society, in the person of Mr. Henry Ludlam, F.G.S., who died on the 23rd of June, at the age of 58.

Early a student of the natural sciences, that of Mineralogy became his favourite subject, in which he was greatly assisted by the study of chemistry, which occupied many of the leisure evening hours which the care of an important business allowed him. Aided by an unusually critical judgment he gathered together a large and valuable collection of minerals in which some of the species were conspicuous for their perfection of crystalline form. To these he subsequently added the well-known and important collection which belonged to the late Mr. Charles Hampden Turner, of Rooksnest, Surrey; and also that made by the late Mr. William Nevill, F.G.S., of Godalming. The whole forms certainly the most complete and probably the finest collection of minerals ever made by a private collector. It is now the property of the nation, having been left to the Museum of Practical Geology, Jermyn Street, London.

But Mr. Ludlam was not the mere collector. He had long had in view the desirability of preparing a complete descriptive and crystallographic catalogue of that which it had been his good fortune to accumulate. This great work, to which he looked forward as to a labour of love, was actually commenced by him shortly before the illness which ended in his premature death. The science of mineralogy has thus lost an earnest worker, while his personal friends have to lament the loss of a warm-hearted and true English gentleman. T. D.

W. W. STODDART, F.G.S., F.C.S., F.I.C., &c., Public Analyst for the city and county of Bristol and the county of Gloucester, died of heart disease at his residence, Sneyd Park, Bristol, on the 30th of May last, aged 57. Mr. Stoddart was one of the original members of this society, and he contributed a paper, "on the occurrence of Celestine in the Keuper marls, and its influence on the composition of plants"—to the first number of the *Mineralogical Magazine*. J. H. C.