

Mineralogical Chemistry.

Examination of the Yellow Incrustation found on the Vesuvian Lava of 1631: Vesbium. By A. SCACCHI (*Gazzetta*, 10, 21—37).—The fissures in the immense lava torrent of 1631 are often found coated with an extremely thin green crust, with which one of a yellow colour is occasionally associated. In his attempts to ascertain the composition of this crust, the author has observed reactions differing from those of the known elements, and which he attributes to the presence of a new element, *vesbium*, so called from Vesbio, the ancient name for Vesuvius.

As the crust is too thin to separate mechanically, the pieces of lava are treated with very dilute hydrochloric acid, which dissolves off the crust, forming a blue solution, containing abundance of copper, silica, and other constituents of the lava; the acid solution is evaporated to dryness, heated to 170°, and exhausted with water. The residue consists principally of silica and a vesbium compound, together with a finely divided pulverulent matter which can easily be separated by elutriation; after this has been done, the product is treated with hydrochloric acid, filtered from undissolved silica, and again evaporated to dryness and heated to 170°: the small quantity of copper present is removed by repeated washing with hot water, when the purified vesbium compound remains as a dark-green powder, called *vesbine* by the author. This is hygroscopic, and when ignited becomes brown without fusing. It is soluble in acids, yielding a green solution; the addition of potash or ammonia to this solution precipitates a ferric compound of vesbium, partly soluble in excess of the precipitant, forming a yellow solution. When vesbine is fused with an alkaline carbonate or nitrate, it dissolves with effervescence, forming an alka-

line vesbiate soluble in water; on adding an acid to the colourless solution, it acquires a yellow colour similar to that of a chromate; this becomes bluish-green on heating. Alkaline vesbiates give precipitates of various colours with solutions of metallic salts, that with silver being bright red, whilst the zinc salt is greenish. Attempts to obtain potassium vesbiate in the crystalline state were unsuccessful.

On passing hydrogen sulphide through an acid solution of vesbine, a brown precipitate is produced consisting chiefly of sulphur, but containing small quantities of lead and copper sulphides; the filtrate from this is of a bright blue colour, but becomes colourless on adding excess of ammonia, whilst a brown precipitate is thrown down. When a plate of zinc is immersed in the blue solution, the colour is changed to deep brown, so as to appear almost opaque. Even a very large excess of hydrogen sulphide produces no change in the blue solution. All the vesbium compounds, when fused with microcosmic salts, give a yellow bead tinged with brown in the outer flame, and a green bead in the reducing flame.

C. E. G.

Phosphates and Boro-phosphates of Magnesia and Lime in the Guano Deposit of Mejillones (Lat. 23—24° S.). By DOMEYKO (*Compt rend.*, **90**, 544—547).—Whereas the guanos found in lat. 12—13° S. retain the nitrogen of their organic matter, those in lat. 23—24° S. contain mere traces of this element, but are largely charged with phosphates. The most important deposit of these phosphatic guanos forms a belt round the mountain Moiro de Mejillones, which is composed of granitic and syenitic rocks traversed by dykes of compact or porphyritic felspars. The deposit is about 50 meters in breadth, and varies in depth. It rests on banks of disintegrated rock, of which there are two well-marked varieties, *tosca*, a loose white sandy substance free from guano and phosphates, and *ripio*, a brown earthy substance mixed with a considerable quantity of guano, and often containing fragments of the neighbouring rocks. The *ripio* also contains concretions of gypsum, phosphates, and borophosphates of lime and magnesia. The great mass of the guano proper is brown, earthy, and consists mainly of calcium phosphate and sulphate, common salt, and organic matter, with traces of magnesium phosphates, alumina, oxide of iron, and nitrates. The phosphates and borophosphates found in the interior of this mass are—

1. *Guano en roche*, a hard, compact, somewhat crystalline substance, of a grey colour, and consisting mainly of tri-calcium phosphate.

2. *Guano cristalizado*, which includes double phosphate of calcium and magnesium, $(\text{CaO}, \text{MgO})_2\text{P}_2\text{O}_5 + 6\text{H}_2\text{O}$, found in the crevices of the rock or in the interior of cavities in hard masses of guano. The crystals are colourless, more or less transparent, and have a vitreous lustre. Their faces are indistinct, but the dominant form appears to be a rectangular prism. They have the composition MgO , 18.53; CaO , 5.80; P_2O_5 , 40.13. Water and organic matter 36.00 = 100.46. *Magnesium phosphate*, $\text{Mg}_2\text{P}_2\text{O}_7$, sometimes fibrous, sometimes in the form of long pyramidal crystals, having a greyish colour and vitreous lustre. The fibrous varieties have a silky lustre. The pure mineral contains MgO , 35.11, and P_2O_5 , 64.89 per cent.

3. *Borophosphate of magnesium and calcium*, which occurs in the form of spherical and kidney-shaped concretions, seldom more than 6 cm. in diameter. The exterior of these concretions is soft, but the interior is hard and compact. The mineral is amorphous and of a yellowish-white colour. It is soluble in acids, but after strong ignition is not attacked by nitric acid. On analysis it was found to have the composition:—

MgO	24.38	
CaO.....	0.14	
P ₂ O ₅	27.60	
B ₂ O ₃	6.80	
Water and organic matter ..	38.30	
Al ₂ O ₃ and Fe ₂ O ₃	2.30	
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	99.52	C. H. B.

Artificial Production of Spinel and Corundum. By S. MEUNIER (*Compt. rend.*, **90**, 701—702).—By the action of steam on aluminium chloride at a red heat in the presence of magnesium, minute crystals are obtained which have the composition and properties of spinel. They consist of colourless and transparent cubes and octohedrons, have no action on polarised light, are extremely hard, and are not attacked by boiling nitric acid. Periclase, and possibly corundum, are formed at the same time. Attempts to obtain gahnite by substituting zinc for magnesium were unsuccessful, probably on account of the low temperature, but the white powder left in the tube consisted mainly of very distinct hexagonal plates, having no effect on polarised light. They contained no zinc, but consisted simply of alumina. Similar crystals can be easily obtained by the action of steam on aluminium chloride heated to redness in a porcelain tube.

C. H. B.

Martite from Brazil. By GORCEIX (*Compt. rend.*, **90**, 316—318).—The crystals of martite, which are generally octohedral, are found in the talcose rocks of Boa-Vista in the province of Minas Geraes. They have a brilliant lustre, and are sometimes slightly magnetic. Associated with them are found crystals of limonite, hæmatite, and magnetite, having all the forms common to pyrites, from which they have evidently been derived. The interior of one large cubical crystal composed of a mixture of quartz and limonite, contained octohedral crystals of sulphur. The crystals of martite are composed of a mixture of hæmatite and magnetite, and in all probability have also been derived from pyrites.

C. H. B.

New Silicates of Aluminium and Lithium. By P. HAUTE-FEUILLE (*Compt. rend.*, **90**, 541—544).—I. 5SiO₂.Al₂O₃.Li₂O, may be obtained by heating silica and alumina with lithium vanadate for several hours to a temperature slightly above the fusing point of the latter. If the alumina and the silica be in the proportion of at least 1 mol. of the former to 5 mols. of the latter, the crystals are large and well defined. They have the composition SiO₂, 69.03; Al₂O₃, 23.74;

2 k 2

Li_2O , 6.08; loss, 1.15 = 100.00, corresponding with that of oligoclase. They resist the action of acids, scratch glass easily, and have a sp. gr. of 2.40 at 10° . The crystals are transparent, sometimes milky. The general form is an octohedron with a square base, the ratio of the vertical to the lateral axes being about 0.824. They are bi-refractive, and the faces are frequently striated in a direction parallel to the intersection of the faces of the octohedron with those of the prism. Similar crystals are formed when mica is heated with lithium vanadate.

II. $6\text{SiO}_2 \cdot \text{Al}_2\text{O}_3 \cdot \text{Li}_2\text{O}$, may be prepared by heating lithium tungstate or vanadate with alumina and silica in the proportion of 1 mol. of the former to 6 mols. of the latter. The crystals have the composition SiO_2 , 72.60; Al_2O_3 , 22.00; Li_2O (by diff.), 5.40, and stand in the same relation to orthoclase and albite that the preceding compound stands to oligoclase. They have the hardness of orthoclase, and offer the same resistance to the action of reagents; their sp. gr. is 2.41 at 11° . When prepared by means of the vanadate, this compound crystallises in octohedra, the angles of which are identical with those of the preceding compound. When obtained from the tungstate, the usual form is a very obtuse prism, the edges of which are truncated by the faces of the octohedron observed on the crystals obtained from the vanadate.

These two silicates, which have not yet been found in nature, furnish another example of geometric isomorphism similar to that observed in the case of the triclinic feldspars.

The crystals of the first compound differ from those of the second, in that they are bi-refractive, and depolarise polarised light.

The author proposes to class these compounds with amphigene.

C. H. B.

Artificial Production of a Leucitophyr identical with the Crystalline Lavas of Vesuvius and Somma. Incipient Crystalline Forms of Leucite and Nepheline. By F. FOUQUÉ and A. M. LEVY (*Compt. rend.*, **90**, 698—701).—By fusing for twenty-four hours at a bright red heat, and then for twenty-four hours at a cherry-red heat, a mixture of silica, alumina, potash, soda, magnesia, lime, and oxide of iron, in proportions representing one part of augite, four of labradorite, and eight of leucite, a crystalline mass is obtained, the optical properties of which correspond exactly with those of the natural lavas. The augite is in small green microliths, the labradorite is in large microliths, twinned according to the same law as albite, and the leucite is in large and small trapezohedrons. Octohedral crystals of magnetite and picotite are also present. If the fused mass be allowed to cool slowly after the first twenty-four hours' fusion, the formation of the crystals of leucite can be distinctly observed.

When thin slices of leucite thus obtained are examined under the microscope, arborescent forms, generally at right angles, are observed. With polarised light, the two series of elements of the right angle are differently tinted, and extinction takes place in the direction of the branches of the cross. Less complicated forms are obtained with artificial nepheline.

C. H. B.

Artificial Production of Felspars containing Barium, Strontium, and Lead. By F. FOUQUÉ and A. M. LEVY (*Compt. rend.*, 90, 620—622).—By heating mixtures of silica, alumina, sodium carbonate, and strontia, baryta, or lead oxide, in the requisite proportions to a temperature just below their fusing points for forty-eight hours, crystalline masses are obtained which correspond in composition to oligoclase, labradorite, and anorthite, but contain baryta, strontia, and lead oxide in the place of lime. These crystals resemble feldspathic microliths in their behaviour with polarised light, and one of the axes of elasticity coincides with the direction of elongation. The anorthite of baryta is probably orthorhombic, the labradorite of lead is decidedly triclinic, but the determination of the crystalline forms of the other compounds could not be made with certainty. The macle of albite, characteristic of triclinic felspars, was not observed on the artificial products. They all scratch glass, and, with the exception of the oligoclases of baryta, strontia, and lead, and the labradorite of strontia, are attacked by acids. Their specific gravities are given in the following table :—

	Strontia.	Baryta.	Lead.
Oligoclase.....	2·619	2·906	3·196
Labradorite	2·862	3·333	3·609
Anorthite	3·043	3·573	4·093

None of these artificial products corresponds with the natural triclinic barytic felspar recently described by Descloizeaux (*Bull. Soc. Min.*, 1878). C. H. B.

Production of Amphigene. By P. HAUTEFEUILLE (*Compt. rend.*, 90, 313—316).—Very distinct crystals of amphigene were obtained by fusing potassium vanadate and aluminate with fragments of strongly ignited silica at a red heat in a platinum crucible for several days. Some of the faces of these crystals showed striæ similar to those observed on twinned crystals of triclinic felspars. Goniometric measurements proved that the faces and angles are strictly comparable with those of the crystals from Mount Somma described by von Rath. The action of the artificial crystals on polarised light showed that, like the natural crystals from Frascati, they are composed of several systems of repeated twins. The oxygen ratios determined by analysis were 1 : 3 : 8. The crystals have a sp. gr. 2·47, that of the natural crystals being 2·48. Like the latter, they are dissolved by sulphuric acid. C. H. B.

Formation of Soils by Weathering. By J. HAZARD (*Landw. Versuchs.-Stat.*, 24, 225—251).—The author has analysed three rocks, weathered portions from them, and the soils to which they have given rise. First a greywacke consisting of an aggregate of quartz-grains and felspar with mica fragments, a little carbon and crystallised silica. Second, a tolerably coarse-grained granite, consisting of quartz felspar plagioclase mainly, and biotite, with fissures charged with iron oxide; a little apatite and iron pyrites also occur. Third, phyllite, a fine-grained schistose rock, consisting mainly of a lamellar mineral of

the mica group; minute quartz needles permeate the mass, and other minerals occur sparingly. The following results were obtained:—

	1.	2.	3.	4.	5.
Moisture	0·13	2·40	1·53	{ —	2·49
H ₂ O combined	1·30	1·23		{ 2·27	2·13
C	0·29	2·42	—	—	4·87
SiO ₂	73·95	72·32	77·42	63·39	64·06
Al ₂ O ₃	14·30	14·37	15·39	{ 18·25	16·74
Fe ₂ O ₃	3·72			{ 5·94	
Mn ₂ O ₃	0·22	0·12	0·12	0·14	—
CaO	0·97	1·15	1·23	4·27	1·52
MgO	1·07	0·75	0·80	1·88	1·54
K ₂ O	1·37	1·65	1·77	1·38	1·23
Na ₂ O	2·86	1·57	1·68	3·25	1·19
	100·18	99·58	99·94	100·77	95·77
Loss on ignition, less water and carbon ..	—	—	—	—	4·87
					100·64

	6.	7.	8.	9.
Moisture	—	0·30	1·65	—
H ₂ O combined	2·58	29·5	3·23	3·53
C	—	—	3·00	—
SiO ₂	72·87	33·54	19·14	63·58
Al ₂ O ₃	19·04	{ 23·64	25·05	27·23
Fe ₂ O ₃		{ 7·40		
Mn ₂ O ₃	—	0·18	0·13	0·14
CaO	1·73	0·86	1·30	1·41
MgO	1·75	1·89	1·29	1·40
K ₂ O	1·40	2·99	1·68	1·83
Na ₂ O	1·35	1·16	0·75	0·82
Quartz	—	25·42	39·35	—
P ₂ O ₅	—	0·28	—	—
	100·72	100·33	96·57	99·94
Loss on ignition, less water and carbon ..	—	—	3·00	—
			99·57	

1. Fresh greywacke from a quarry, the mean of two analyses. 2. Soil above, taken in a fir-wood. Humus calculated from the C found given as 4·03 per cent.: loss on ignition 7·66 per cent. 3. The inorganic constituents of 2, with the water of 1. calculated to 100 approximately. 4. Mean of two analyses of fresh granite. 5. Soil above the granite, estimated to contain 9·74 per cent. of cellulose and humus, with a loss on ignition of 14·36 per cent. 6. The inorganic constituents of 5 with the water of 4 calculated to 100 approxi-

mately. 7, 8, 9, the corresponding results for the phyllite and its soil.

From the analysis we have the following proportions:—

Greywacke.

	Silica.	Sesquioxides.	Monoxides.
Stone	11·79	2·92	1
Soil	14·13	2·84	1

Granite.

	Silica.	Sesquioxides.	Monoxides.
Stone	5·78	2·21	1
Soil	11·69	2·06	1

Phyllite.

	Silica.	Sesquioxides.	Monoxides.
Stone	8·54	4·53	1
Soil	11·64	5·02	1

In all three soils, the silica has increased, whilst the oxides have diminished; possibly the increase of lime in the phyllite soil may be due to additions made to the soil. The separation of silica into free and combined was only successfully made in the case of phyllite, from which it appears that there is less combined silica in the soil than in the stone.

By neglecting quartz in the analyses of phyllite and its soil, and calculating up to 100, we get:—

	SiO ₂ .	Sesqui-oxides.	Mon-oxides.	Humus.	H ₂ O.
Unweathered silicate in fresh stone	44·78	41·68	9·20	—	4·34
Unweathered silicate plus weathered products in soil	31·78	41·83	8·33	9·96	8·10
Unweathered silicate in soil*	31·78	29·68	6·53	—	3·08
Weathering products in soil	—	12·15	1·80	9·96	5·02

The bottom line shows base in excess of that required for the silica. This may be combined with humic acid, so that the phyllite soil may have the following composition:—

Quartz	39·35	
Silicate undecomposed	42·74	(19·14 SiO ₂ + 17·81 sesquioxide + 3·93 monoxide + 1·86 H ₂ O.)
Humic salts	14·46	(6·00 humic acid + 7·37 sesquioxide + 1·09 monoxide.)
Water	3·02	(1·35 of which is moisture.)
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	99·57	

* Obtained by taking the same proportions with the silica of the second line as are found in the first line.

Determination of absorption, soluble bases, moisture, combined water, carbon, humus (calculated), and loss on ignition.—The material used was well air-dried and freed from root fibres as far as possible. For the absorption of nitrogen, 50 grams were treated with ammonium chloride solution of known strength; after two days the nitrogen left in the solution was determined, and the c.c. absorbed by the material gives the number in the table. The soluble bases were determined by treating with dilute hydrochloric acid, evaporating to dryness, taking up with concentrated hydrochloric acid and water, &c. The water and carbon determinations were made by elementary analysis.

	Granite.						
	1.	2.	3.	4.	5.	6.	7.
Absorption	—	13	30	29	37	40	41
Soluble bases	11·32	14·00	12·64	9·65	11·35	12·10	9·60
Moisture	—	0·68	0·88	1·62	1·73	1·87	2·49
H ₂ O combined	2·27	2·06	2·48	2·33	2·48	2·48	2·13
C	—	—	—	0·86	1·15	2·70	4·87
Humus (calculated) ..	—	—	—	1·72	2·30	5·40	9·74
Loss on ignition	2·27	2·74	3·36	5·67	6·51	9·75	14·36

	Phyllite.				Greywacke.				
	8.	9.	10.	11.	12.	13.	14.	15.	16.
Absorption	2	9	25	36	8	40	47	28	24
Soluble bases	8·87	12·40	14·36	13·38	6·62	12·29	19·11	6·80	8·73
Moisture	0·30	0·80	1·22	1·65	0·13	1·23	2·18	2·42	2·40
H ₂ O combined	2·95	4·44	3·67	3·23	1·30	3·55	3·94	2·03	1·23
C	—	—	0·73	3·00	0·29	0·25	0·58	4·77	2·42
Humus (calculated) ..	—	—	1·46	6·00	—	—	1·16	9·55	4·03
Loss on ignition	3·25	5·24	6·35	10·88	1·72	5·03	7·28	14·00	7·66

Nos. 1, 8 and 12 are the fresh rocks; 2 to 6 are rubble, gradually diminishing in size; 9 and 13 are also rubble; 7 is the granite soil before given; 10 subsoil, and 11 upper soil, both above phyllite; 14, subsoil about 0·80 meter deep, 15, the soil above it, both in a fir-wood, and 16, soil from a meadow, all three being over greywacke.

All three soils are fertile ores. The *absorption* of the rocks increases with rate at which they weather; the greywacke soils show a diminishing absorption probably due to the effect of rain, as they were taken from a hill side.

The absorption increases generally with the increase of the soluble bases, but not invariably. By degrees, the silicates of the sesquioxides pass into clay, which absorbs, whilst the monoxides are partly washed out, and the soluble bases are diminished. From this it happens, as in the granite, that the last weathering product with 9·6 per cent. of soluble bases has an absorption of 41.

J. T.

Examination of Volcanic Dust which fell January 4th, 1880, at Dominica, and of the Water which accompanied it. By DAUBRÉE (*Compt. rend.*, 90, 624—626).—The powder collected after the rain was fine-grained, and resembled puzzuolana. Microscopic examination revealed the presence of colourless grains of labradorite and sanidine, greenish grains of pyroxene, crystals of gypsum, and very distinct cubic crystals of pyrites from 0.2 to 0.33 mm. diameter. Grains of galena were also present. The sand was impregnated with highly deliquescent salts. Analysis of the powder collected in the dry state gave the following results:—

	KCl.	NaCl.	CaSO ₄ .	Organic.	
Soluble in H ₂ O	1.96	0.63	0.28	0.70 =	3.57
	FeSO ₄ .	CaCO ₃ .	MgCO ₃ .		
Soluble in dilute HCl	6.20	3.60	0.80	— =	9.60
	FeS ₂ .	PbS.			
Soluble in HNO ₃	5.30	0.65	—	— =	5.95
Insoluble in acids.					80.30
Total					99.42

No copper was detected.

The rain received in a rain gauge was charged with about 20 per cent. by weight of a somewhat coarser powder. It held in solution 20 parts per 1000 of the salts found in the dry powder.

The presence of pyrites and galena in the powder is a fact worthy of special notice. The former has probably been recently produced in the volcano by the action of the sulphurous vapours, and resembles in appearance the pyrites found in the fumerolles of Iceland.

C. H. B.

Sketch of the Origin of the Mineral Waters of Savoy. By L. LÉVY (*Compt. rend.*, 90, 628—630).—The mineral waters of the Savoy Alps may be arranged in three classes: (1) sulphuretted; (2) saline (chlorides and sulphates); (3) carbonated (alkaline, calcareous, or ferruginous). To the first class belong the springs of Aix, Marlioz, and Challes, in Savoie, and of Bromines, la Caille, and Menthon, in Haute-Savoie. Analyses of the three first give the following results in parts per liter:—

	Aix-les-Bains.	
	Sulphur spring.	Alum spring.
Temperature	43.5°	44.6°
Hydrogen sulphide, free ..	3.37—4.13 mgrm.	3.74 mgrm.
Sulphur as thiosulphate ..	3.84 mgrm.	3.60 mgrm.
Total solid matter.	0.4925 gr.	0.4443 gr.
	Marlioz.	Challes great spring.
Temperature	11°	10.5°
Sodium sulphhydrate	0.0285 gr.	0.3594 gr.
Total solid matter	0.6383	1.3453

In the second class are the waters of Bride, Salins, l'Echaillon, and

Bonneval (Tarentaise) in Savoie, and of Saint Gervais in Haute-Savoie. These contain from 16 (Salins) to 5 (Saint Gervais) grams of solid matter per liter, consisting principally of sodium and magnesium chlorides, and calcium and sodium sulphates. Their temperature varies from 30° to 40°, except in the case of Saint Gervais, where the temperature is 20°.

To the third class belong the springs of Saint Simon, Coise, Farette and la Bauche in Savoie, and of Evian and Amphion in Haute-Savoie. These always contain less than one gram of solid matter per liter, and their temperature is from 10° to 12°. The waters of Evian are alkaline and calcareous, those of la Bauche are highly ferruginous.

The sulphuretted springs are found to the east of the axis of elevation of the Western Alps, which stretches from Grenoble to Sallanches, in a district occupied by jurassic and cretaceous limestones traversed by faults. The waters acquire their sulphuretted character whilst percolating through the limestones, which contain concretions of gypsum and pyrites, and also bituminous organic matter.

The saline springs are found to the west of the same axis in a district occupied by triassic beds which consist of white grits, magnesian limestones, glossy schists, gypsum with common salt, and ferruginous-clayey schists.

The waters of the third class are, comparatively speaking, of surface origin, and are found in the old alluvium or in marshes. They derive their carbonic anhydride mainly from the air, and their iron from oxidised pyrites.

C. H. B.

Composition of the Waters of Cransac (Aveyron). By E. WILLM (*Compt. rend.*, 90, 547—548).

	April 15th, 1879.	July 14th, 1879.
	Grams.	Grams.
Free carbonic anhydride	0·0175	—
Magnesium sulphate	1·7920	1·9985
Calcium „	1·5640	1·5623
Aluminium „	0·2800	0·1760
Manganese „	0·0158	0·0704
Nickel „	0·0007	0·0008
Potassium „	0·2230	{ 0·1446 0·0908
Sodium „		
Lithium „		
Rubidium „	traces	traces
Zinc „		
Sodium chloride	0·0151	0·0161
Silica	0·0790	0·0870
Phosphoric and boric acids. . .	traces	traces
Total per liter . .	3·9696	4·1465
Amount directly determined . .	3·9820	4·1820

The mineral matter of the water of Cransac consists mainly of sulphates, and contains sulphates of manganese and aluminium,

together with small quantities of the sulphates of nickel and zinc. Copper, iron, and arsenic are absent, although the mineral matter is probably derived from iron pyrites undergoing decomposition. The amount of potassium present is considerably greater than that of sodium. The analyses (p. 454) of the principal spring (source Basse Richard) made at different dates seem to indicate that the composition of the water is subject to variation.

The temperature of the water is 12·4° C.

C. H. B.

Mineral Waters of Bussang (Vosges). By E. WILLM (*Compt. rend.*, 90, 630—633).

	Source Salmade.	Source d'en haut.	Source Marie.
Temperature	12°	12·5°	11°
Total CO ₂	2·8719	2·1890	2·4934

(a.) Portion of residue insoluble in water :—

SiO ₂	0·0641	0·0634	0·0536
Fe ₂ O ₃	0·0059	0·0024	0·0024
Mn ₂ O ₄	0·0019	0·0019	0·0020
Al	0·0012	0·0010	0·0011
Ca	0·1519	0·1495	0·1880
Mg	0·0506	0·0506	0·0540
CO ₃	0·3589	0·3546	0·4196
As	0·00047	0·00026	0·00043

(b.) Portion of residue soluble in water :—

CO ₃	0·3801	0·3912	0·3081
SO ₄	0·0904	0·0896	0·0806
Cl	0·0507	0·0572	0·0497
Na	0·3495	0·3580	0·2890
K	0·0346	0·0360	0·0264
Li	0·00116	0·0013	0·0010
P ₂ O ₅ , B ₂ O ₃ , and F ..	traces	traces	traces
Total	1·54143	1·55696	1·47593

The “source Marie” rises in the bed of the Moselle.

C. H. B.

Waters of Bourboule. By A. RICHE (*J. Pharm. Chim.* [5], 1, 302—306). — The springs of Bourboule, viz., Choussy, Perrière, Sédaiges, La Plage, and Fenestre owe their healing properties to the large quantities of arsenic they contain, viz., 0·0068 gram per liter in Perrière and 0·0064 in Choussy. In the case of Perrière and Sédaiges, the quantity of arsenic does not appear to alter; but in the springs of Choussy and La Plage it is slowly decreasing. Periodic analyses made during the year show that the total mineral matter decreases as it has done since 1867 from 5·886 gram per liter in that year to 4·970 gram per liter in 1879. The quantity of mineral matter in the Choussy and Perrière springs is about the same, as is also the proportion of lithium.

L. T. O'S.