

## Mineralogical Chemistry.

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**Mechanical Separation of Minerals.** By C. DOELTER (*Monatsh. Chem.*, **3**, 411—418).—The method in use for the mechanical separation of the constituents of rocks are three in number, depending—1. On difference of density. 2. On the use of an electromagnet. 3. On the use of acids, especially hydrofluoric acid. The first, introduced by Fouqué, which consists in suspending the pulverised rock-constituents in a solution of considerable density, is perhaps the most exact, but it is not always applicable. Of the solutions used for the purpose the author regards that of mercuric iodide, recommended by Goldschmidt, as capable of affording the best results, the denser solution of cadmium-borotungstate being required in comparatively few cases.

The second method, likewise introduced by Fouqué, has been adopted and somewhat modified by the author (p. 656 of this volume), whose mode of proceeding has lately been criticised by Pebal (p. 810), who recommends that the powder to be acted upon by the electromagnet be suspended in water, instead of being used in the dry state. To this Doelter objects, on the ground that when the fine powder is suspended in water, the particles are apt to agglomerate, so that the non-ferruginous minerals are carried forward, together with ferruginous magnetic particles; further, that the loss of material is greater when water is used, and that the fine pulverisation required in this case interferes greatly with the microscopic examination, which is so highly important for the verification of the result. With regard to this electromagnetic method, the author further remarks that it is most easily performed on rocks of granular structure, the grey powder of syenites and diabases, for example, being thereby separated in a few minutes into a white powder containing the non-felspathic minerals,

A third method, frequently employed of late years, is the use of hydrofluoric acid of various degrees of concentration. The author, however, regards it as inferior in accuracy to the two former. The separation of felspar from easily soluble minerals, such as nephelin, leucite, h  yn, by means of cold very dilute hydrofluoric acid, is often difficult, notwithstanding that orthoclase is but slightly attacked by the acid, unless a rise of temperature takes place. Moreover it is difficult to hit upon the right concentration of the acid, which has great influence on the solubility. Better results are obtained in the application of hydrofluoric acid to the separation of the soluble minerals leucite, nephelin, h  yn, and anorthite from pyroxene, hornblende, and biotite, which are insoluble therein. If, however, the last-named minerals are to be separated from felspars, some degree of uncertainty again arises, as the action must be continued for some time and aided by heat, in order to decompose the orthoclase, and in that case the augite is likewise attacked. Treatment of the pulverised rock with other acids does not always yield good results. Experiments made by the author with hydrochloric acid succeeded only for the separation of easily soluble constituents, leucite, nephelin, anorthite, h  yn, from insoluble minerals, orthoclase, biotite, hornblende, and augite; but in the case of olivin, with which the action requires to be continued for some time, the results are doubtful, as the augite is likewise somewhat attacked. The same is the case also with other minerals usually regarded as insoluble. The weak side of the separation of minerals by acids is that it gives exact results only when applied to fresh undecomposed minerals. The use of hydrochloric acid is, however, to be recommended in cases where the soluble part of a rock is to be estimated, which is important with regard to phonolites, diabases, &c. The only objection to the method is that many augites are attacked by prolonged treatment with the strong acid, but it is better to use hydrochloric than hydrofluoric acid. In phonolites, which do not require prolonged treatment with the acid, good results may generally be obtained, and in this manner nephelin may be separated from orthoclase, a result not easily attained by any other method. In separating olivin or plagioclase from other minerals by the action of an acid, it is advisable first to remove augites or other minerals which are attacked by acids if only in traces, by one of the previously described methods. In the treatment with acids for the determination of soluble constituents, it is best to use very fine powder.

H. W.

**Columbite, Orthite, and Monazite, from Amelia Co., Virginia.** By F. P. DUNNINGTON (*Amer. Chem. J.*, **4**, 158—160).—Among the minerals found together with microlite, in this locality (1881, Abstr., 1002), was a variety of *columbite* having a decided red colour in thin splinters. Hardness = 5·5; sp. gr. = 6·48. Lustre subresinous. Colour dark brown. Streak light brown. It gave by analysis—

|   |                    |      |      |      |      |                                 |
|---|--------------------|------|------|------|------|---------------------------------|
| Ta <sub>2</sub> O <sub>5</sub> , Nb <sub>2</sub> O <sub>5</sub> . | SnO <sub>2</sub> . | MnO. | FeO. | CaO. | MgO. | Y <sub>2</sub> O <sub>3</sub> ? |
| 84·81   | trace              | 8·05 | 5·07 | 1·27 | 0·20 | 0·82 = 100·22                   |

The excess of manganese over iron probably accounts for the unusual red colour of the splinters, and the light colour of the streak.

The density of the mixed acid oxides is 6·51. Now pure Ta<sub>2</sub>O<sub>5</sub> and Nb<sub>2</sub>O<sub>5</sub>, similarly ignited, gave respectively the densities 7·87 and 4·20, whence approximately Ta<sub>2</sub>O<sub>5</sub> = 53·4, and Nb<sub>2</sub>O<sub>5</sub> 31·4 per cent., giving for the oxygen-ratio of the acid and basic oxides,

$$\text{Ta} : \text{Nb} : \text{R} = 77 : 26 : 10,$$

and leading to a formula in which the molecular ratio of

$$\text{Nb}_2\text{O}_5 : \text{Ta}_2\text{O}_5 = 1 : 1.$$

In Dana's Mineralogy the ratios given are Nb<sub>2</sub>O<sub>5</sub> : Ta<sub>2</sub>O<sub>5</sub> = 2 : 1, 3 : 1, and 4 : 1. In accordance with the above analysis, the density of the mineral is greater than that of any of the specimens whose analyses are quoted by Dana.

*Orthite* occurs in the same locality in blade-like crystals several inches long, and with partly decomposed faces. Hardness, 5·5. Sp. gr. 3·323. Lustre pitchy. Colour greyish-black. Streak, greenish-grey. Fuses with much intumescence, and is gelatinised by hydrochloric acid at ordinary temperatures. Its analysis gave—

|                                      |       |                           |        |
|--------------------------------------|-------|---------------------------|--------|
| SiO <sub>2</sub> .....               | 32·35 | FeO .....                 | 10·48  |
| Al <sub>2</sub> O <sub>3</sub> ..... | 16·42 | MnO .....                 | 1·12   |
| Fe <sub>2</sub> O <sub>3</sub> ..... | 4·49  | CaO .....                 | 11·47  |
| Ce <sub>2</sub> O <sub>3</sub> ..... | 11·14 | K <sub>2</sub> O } .....  | 0·46   |
| La <sub>2</sub> O <sub>3</sub> ..... | 3·47  | Na <sub>2</sub> O } ..... |        |
| Di <sub>2</sub> O <sub>3</sub> ..... | 6·91  | H <sub>2</sub> O .....    | 2·31   |
|                                      |       |                           | 100·62 |

*Monazite* from the same locality was found to contain thorium, a constituent not hitherto found in this mineral. Its analysis gave—

|                                  |                                  |                                  |                                 |                                  |
|----------------------------------|----------------------------------|----------------------------------|---------------------------------|----------------------------------|
| Ce <sub>2</sub> O <sub>3</sub> . | Di <sub>2</sub> O <sub>3</sub> . | La <sub>2</sub> O <sub>3</sub> . | Y <sub>2</sub> O <sub>3</sub> . | Fe <sub>2</sub> O <sub>3</sub> . |
| 16·30                            | 24·4                             | 10·3                             | 1·1                             | 0·9                              |
| Al <sub>2</sub> O <sub>3</sub> . | ThO <sub>2</sub> .               | P <sub>2</sub> O <sub>5</sub> .  | SiO <sub>2</sub> .              |                                  |
| 0·04                             | 18·6                             | 24·04                            | 2·7 = 98·38                     |                                  |

Excluding the thorium and silica, the remaining constituents give approximately the formula (R<sub>2</sub>)<sup>vi</sup>P<sub>2</sub>O<sub>8</sub>, the thorium being perhaps in the form of orangite.

H. W.

**Chemical Composition of the Minerals of the Cryolite Group.** By J. BRANDL (*Annalen*, **213**, 1—15).—This paper contains an account of the results obtained on analysing several of these minerals, which were obtained from Professor Groth, who had previously determined their crystalline form. The bases were determined in the solutions obtained by heating the finely powdered mineral with concentrated sulphuric acid, and for the determination of fluorine, Fresenius' modification (*Zeits. Anal. Chem.*, **5**, 190) of Wöhler's method was adopted with some slight alterations. The water in the majority of cases was determined directly by heating the mineral with lead oxide, and collecting the water in a calcium chloride tube.

*Cryolite.* A crystalline variety of this mineral was used; it belongs to the monosymmetric system, and has the same composition as the ordinary variety, viz.,  $\text{AlF}_3 \cdot 3\text{NaF}$ .

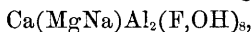
*Pachnolite* crystallises in thin monosymmetric needles, united in twin forms of an apparently rhombic habit; it occurs in cavities of thomsenolite; the analysis shows it to have the composition  $\text{AlF}_3 \cdot \text{CaF}_2 \cdot \text{NaF}$ .

*Thomsenolite* occurs in a variety of forms, and has frequently been confounded with pachnolite: the specimen analysed consisted of colourless, transparent, right-angled parallelopipeds. In composition it differs from pachnolite by containing 1 mol. of water.

*Ralstonite* is a rare mineral, discovered by Brush (*Sill. Amer. J.*, **1871**, **7**, 30), it crystallises in regular octohedrons, and occurs in spathic iron ore associated with thomsenolite. From the analysis, the formula  $4\text{AlF}_3 + 3\text{Na}(\text{Mg}, \text{Ca})\text{F} + 3\text{H}_2\text{O}$  may be deduced, in which it is supposed that a portion of the sodium is replaced by magnesium and calcium.

*Chiolite* is found in a massive form, associated with cryolite, at Mask, in the Ural Mountains. Analyses of this mineral have led to different formulæ being assigned to it by different observers. It has also been found in well-defined transparent crystals by Koksharov, and from the analyses of specimens of this variety, the formula  $3\text{AlF}_3 + 5\text{NaF}$  is assigned to it by the author.

*Prosopile* was discovered by Scheerer (*Pogg. Ann.*, **90**, 315, and **101**, 361), who thought that it contained silicon. The author has been unable to discover this element in it, and assigns to it the formula



in which the hydroxyl is supposed to replace fluorine, a supposition which is supported not only by the percentage of hydrogen and oxygen, but also by the fact that the mineral does not lose weight, even at  $260^\circ$ .

*Fluellite*, discovered by Levy, and shown by Wollaston to contain aluminium and fluorine: its formula is probably  $\text{AlF}_3 + \text{H}_2\text{O}$ .

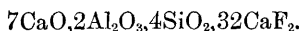
P. P. B.

**Gunnisonite: a New Mineral from Colorado.** By F. W. CLARKE and N. W. PERRY (*Amer. Chem. J.*, **4**, 140—142).—This mineral, found in considerable quantity about twenty miles south of Gunnison in Colorado, is massive, easily scratched by the knife, and of deep purple colour both in mass and in powder. It is intimately

mixed with a semimassive calcite partly tinged with ferric oxide. Analysis of the mixture gave 31.96 F, 45.91 Ca, 6.02 SiO<sub>2</sub>, 5.21 Al<sub>2</sub>O<sub>3</sub> with trace of Fe<sub>2</sub>O<sub>3</sub>, 5.61 CO<sub>2</sub> and 0.74 Na<sub>2</sub>O = 93.45. The loss is oxygen, which must be reckoned as united with part of the calcium. Assuming that the fluorine and carbonic anhydride are wholly united with calcium, and recalculating the remainder of the calcium as oxide, the preceding results may be thus stated: 65.60 CaF<sub>2</sub>, 12.75 CaCO<sub>3</sub>, 10.02 CaO, 6.02 SiO<sub>2</sub>, 5.21 Al<sub>2</sub>O<sub>3</sub>, and 0.74 Na<sub>2</sub>O = 100.34, and lastly if the calcium carbonate be regarded as merely admixed calcite, the remaining numbers will give for pure gunnisonite—

|                    |       |                    |                                  |                    |
|--------------------|-------|--------------------|----------------------------------|--------------------|
| CaF <sub>2</sub> . | CaO.  | SiO <sub>2</sub> . | Al <sub>2</sub> O <sub>3</sub> . | Na <sub>2</sub> O. |
| 74.89              | 11.44 | 6.87               | 5.95                             | 0.85 = 100         |

these numbers agreeing closely with the formula



The mineral is probably an alteration-product of fluor spar, although it may possibly be only a mixture of that species with a silicate.

H. W.

**Crystalline Rocks in the Neighbourhood of Messina.** By L. RICCIARDI (*Gazzetta*, 12, 203—206). This paper contains analyses of granite, gneiss, and mica-schist from the neighbourhood of Messina.

I, granite; II, gneiss; III, mica-schist. The powder of all of them when moistened was sensibly alkaline to litmus.

|                                      | I.    | II.    | III.  |
|--------------------------------------|-------|--------|-------|
| SiO <sub>2</sub> .....               | 74.09 | 70.57  | 57.67 |
| Al <sub>2</sub> O <sub>3</sub> ..... | 15.13 | 17.96  | 17.92 |
| FeO .....                            | 2.33  | 1.25   | 9.10  |
| CaO .....                            | 2.92  | 5.17   | 3.19  |
| MgO .....                            | 0.97  | 1.51   | 3.29  |
| Cl .....                             | trace | trace  | trace |
| K <sub>2</sub> O .....               | 2.34  | 2.03   | 3.86  |
| Na <sub>2</sub> O .....              | 0.85  | 0.77   | 1.09  |
| P <sub>2</sub> O <sub>5</sub> .....  | 0.41  | 0.32   | 0.38  |
| Loss on ignition ....                | 0.70  | 0.83   | 3.19  |
|                                      | 99.74 | 100.41 | 99.69 |
| Sp. gr. at 18° .....                 | 2.63  | 2.66   | 2.88  |

C. E. G.

**Origin of Volcanic Ashes, and Chemical Composition of the Lavas and Ashes ejected in the latest Eruptions of Vesuvius (1868—1882).** By L. RICCIARDI (*Gazzetta*, 1882, 305—328).—This paper gives a summary of the views of various authors on the formation of volcanic ashes, and analyses of the lavas, sands and ashes ejected from Vesuvius in the interval 1868 to 1882. The following table shows the maximum and minimum values of the several constituents of these sands and lavas:—

|                                      | Sands. |          |  | Lavas. |          |
|--------------------------------------|--------|----------|--|--------|----------|
| SiO <sub>2</sub> .....               | 45·91  | to 48·27 |  | 47·43  | to 48·83 |
| SO <sub>3</sub> .....                | 0·04   | 0·08     |  | 0·00   | 0·15     |
| P <sub>2</sub> O <sub>5</sub> .....  | 1·65   | 2·65     |  | 1·83   | 2·12     |
| Cl .....                             | 0·02   | 0·06     |  | traces |          |
| Al <sub>2</sub> O <sub>3</sub> ..... | 15·11  | 18·65    |  | 15·58  | to 19·58 |
| Fe <sub>2</sub> O <sub>3</sub> ..... | 6·06   | 8·41     |  | 3·93   | 7·39     |
| FeO .....                            | 3·01   | 6·31     |  | 3·34   | 4·56     |
| CaO .....                            | 9·61   | 15·78    |  | 9·12   | 13·63    |
| MgO .....                            | 4·03   | 5·58     |  | 3·12   | 4·65     |
| K <sub>2</sub> O .....               | 2·73   | 6·27     |  | 3·68   | 6·27     |
| Na <sub>2</sub> O .....              | 1·02   | 1·77     |  | 1·41   | 2·47     |
| Loss by ignition ..                  | 1·30   | 3·67     |  | 0·12   | 1·41     |

The conclusions drawn from these analyses and from the study of the minerals of which the lava, sand, and ashes are composed, are as follows:—

1. The ashes are produced by disintegration of the lavas resulting from the action of aqueous vapour disengaged from the semifluid mass.

2. The lava consists of crystals formed in the interior of the mountain, and of an amorphous, often vitrified mass, either interposed between the several minerals, or including them within itself.

3. The salammoniac in volcanic products is formed partly by direct combination of nitrogen with hydrogen, partly by the combustion of organic substances overflowed by the lava.

4. The metallic sulphides in the ashes and lavas are formed by the action of hydrogen sulphide on metallic oxides.

5. The phosphoric acid in these volcanic products is in combination with lime. Only a small proportion of it is, however, in the form of apatite, the remainder of the calcium phosphate entering into the composition of the amorphous substances.

H. W.

**Waters of the Isthmus of Panama.** By AILLAUD (*Compt. rend.*, 95, 104—106).—This paper contains analyses of the water of two deep wells at Emperador, 50 kilometers from the northern extremity of the canal, and of the Rio Grande, which flows into the Pacific to the south of the town of Panama. The water of one of the wells is of good quality, the other is somewhat rich in organic matter. The river water furnishes a good potable water. It contains, however, 0·057 gram silica per litre, and also traces of ruthenium.

C. H. B.

**Analysis of the Oberbrunnen Springs at Salzbrunn in Silesia.** By R. FRESENIUS (*J. pr. Chem.* [2], 25, 310—320).—The waters of these springs have been analysed with great completeness of detail, at the request of the proprietor. Compared with an analysis made in 1866 by Dr. Valentiner the composition appears to be uniform. The water is in great demand for drinking at the wells and for export in bottles. The following is contained in 1000 grams of the water:—

|                                | Valentiner,<br>1866. | Fresenius,<br>1881. |
|--------------------------------|----------------------|---------------------|
| Sodium carbonate.....          | 1·5294               | 1·521213            |
| Lithium carbonate .....        | 0·0075               | 0·008180            |
| Sodium sulphate .....          | 0·4773               | 0·459389            |
| Potassium sulphate .....       | 0·0268               | 0·052829            |
| Sodium chloride .....          | 0·1719               | 0·176658            |
| Calcium carbonate .....        | 0·2951               | 0·304345            |
| Strontium carbonate .....      | 0·0033               | 0·003405            |
| Magnesium carbonate .....      | 0·2902               | 0·311065            |
| Ferric carbonate .....         | 0·00022              | 0·004137            |
| Alumina and phosphoric acid..  | 0·0005               | —                   |
| Silicic acid.....              | 0·0255               | 0·030750            |
|                                | <hr/>                | <hr/>               |
|                                | 2·82772              | 2·871971            |
| Carbonic acid, semi-combined.. | 0·0220               | 0·935715            |
| Carbonic acid, free .....      | 1·2430               | 1·876571            |

J. F.

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