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327

THE SCIENTIFIC WRITINGS

OF

JAMES SMITHSON.

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substance, in appearance similar to ulmin, but on adding water to this dry mass, a large quantity of brown glutinous matter remained insoluble. The mixture being thrown on a filter, a clear yellow liquor passed, which may have contained ulmin, but the quantity was too small to admit of satisfactory conclusions.

Perhaps older wood, the juice of which was more perfected, would afford other results, since ulmin appears to be the product of old trees; but the inquiry, being merely collateral to the object I had originally in view, was not persevered in.

ON A SALINE SUBSTANCE FROM MOUNT VESUVIUS.

From the Philosophical Transactions of the Royal Society of London, Vol. CIII, Part I, 1813, p. 256.—Read July 8, 1813.

It has very long appeared to me, that when the earth is considered with attention, innumerable circumstances are perceived, which cannot but lead to the belief, that it has once been in a state of general conflagration. The existence in the skies of planetary bodies, which seem to be actually burning, and the appearances of original fire discernible on our globe, I have conceived to be mutually corroborative of each other; and at the time when no answers could be given to the most essential objections to the hypothesis, the mass of facts in favour of it fully justified, I thought, the inference that our habitation is an extinct comet or sun.

The mighty difficulties which formerly assailed this opinion, great modern discoveries have dissipated. Acquainted now, that the bases of alkalies and earths are metals, eminently oxydable, we are no longer embarrassed

either for the pabulum of the inflammation, or to account for the products of it.

In the primitive strata, we behold the result of the combustion. In them we see the oxyd collected on the surface of the calcining mass, first melted by the heat, then by its increase arresting farther combination, and extinguishing the fires which had generated it, and in fine become solid and crystallized over the metallic ball.

Every thing tells that a large body of combustible matter still remains enclosed within this stony envelope, and of which volcanic eruptions are partial and small accensions.

Under this point of view, an high interest attaches itself to volcanoes, and their ejections. They cease to be local phenomena; they become principal elements in the history of our globe; they connect its present with its former condition; and we have good grounds for supposing, that in their flames are to be read its future destinies.

In support of the igneous origin, here attributed to the primitive strata, I will observe, that not only no crystal imbedded in them, such as quartz, garnet, tourmaline, &c. has ever been seen enclosing drops of water; but that none of the materials of these strata contain water in any state.

a. The present saline substance was sent to me from Naples to Florence, where I was, in May 1794, with a request to ascertain its nature. The general examination which I then made of it, shewed it to be principally what was at that time called *vitriolated tartar*, and it was in consequence mentioned as such in an Italian publication soon after. But as this denomination, surprising at that period, was not supported by the relation of any experiments, or the citation of any authority, no attention was paid to it; and the existence of this species of salt, native in the earth, has not been admitted by mineralogists, no mention being made of it, I believe, in any mineralogical work published since.

b. I was informed by letter, that it had "flowed out liquid

from a small aperture in the cone of Vesuvius," and which I apprehend to have happened in 1792 or 1793.

c. The masses of this salt are perfectly irregular, their texture compact, their colour a clouded mixture of white, of the green of copper, and of a rusty yellow, and in some places are specks and streaks of black.

d. A fragment melted on the charcoal at the blow-pipe formed hepar sulphuris.

e. A piece weighing 9.5 grains was so strongly heated in a platina crucible, that it melted and flowed level over the bottom of it, but did not lose the least weight.

f. Not the slightest fume could be perceived on holding a glass tube wetted with marine acid over some of this salt, while triturating in a mortar with liquid potash; but a similar mixture being made in a bottle, and which was immediately closed with a cork, to which was fixed a bit of reddened litmus paper, the blue colour of the paper was restored.

g. Being dissolved in water, there was a small sandy residue, which consisted of green particles of a cupreous nature, of a yellow ochraceous powder, and of minute crystals of a metallic aspect of red oxyd of iron, by which the black spots in the mass had been occasioned.* Mr. KLAPROTH found a similar admixture in muriate of soda from Vesuvius.†

h. The solution had a feeble green tint. It did not alter blue or reddened turnsol paper.

i. Prussiate of soda-and-iron threw down a small quantity of red prussiate of copper from it. Liver of sulphur and tincture of galls likewise caused very small precipitations.

j. Carbonate of soda, and oxalate of potash, and solutions

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* What mineralogists denominate speculary iron ore, *Fer oligiste* of Mr. HAÜY, appears to be merely red oxyd of iron in crystals; red hematite the same substance in the state of stalactite; and red ochres the same in a pulverulent form. The hematites which afford a yellow powder are hydrates of iron.

† Essays, Vol. II. p. 67, Eng. Trans.

of magnesia, clay, copper, iron, and zinc, either had no effects, or extremely slight ones.

k. Solution of sulphate of silver produced a white curd-like precipitate. 9.35 grains of this salt (the weight of the insoluble matter being deducted) afforded 1.05 grains of slightly melted muriate, or chloride, of silver. This precipitate was equally produced after the salt had been made strongly red hot, so that it was not owing to a portion of sal ammoniac.

l. Tartaric acid, and muriate of platinum, occasioned the precipitates in its solution which indicate potash.

m. Nitrate of lime did not form any immediate precipitate in a dilute solution of it; but in a short time, numerous minute prismatic crystals of hydrate of sulphate of lime were generated.

n. Nitrate of barytes poured into a solution containing 9.8 grains of this salt afforded a precipitate, which after being ignited weighed 12.3 grains. The filtered solution crystallized entirely into nitrate of potash mixed with a few rhomboides of nitrate of soda.

o. Some of this salt finely pulverized was treated with alcohol. This alcohol on exhaling left a number of minute cubic crystals, which proved, by the test of nitric acid, to be muriate of soda. Prussiate of soda-and-iron caused a red precipitate of prussiate of copper in this alcoholic solution.

p. The solution of this salt afforded, by crystallization, sulphate of potash in its usual forms, and some prismatic crystals of hydrate of sulphate of soda.

q. To discover what had occasioned the precipitate with galls, (*i*) since copper has not this quality, a portion of this salt, which had been recovered by evaporation from a filtered solution of it, was made red hot in a platina crucible. On extraction of the saline part by water, a very small quantity of a black powder was obtained. Ammonia dissolved only part of it, which was copper. The rest being

digested with muriatic acid, and prussiate of soda-and-iron added, a fine Prussian blue was formed.

r. From several of the foregoing experiments, it appeared that no sensible quantity of any of the mineral acids, besides the sulphuric and muriatic, existed in combination with alkali in this volcanic salt. But Mr. TENNANT, whose many and highly important discoveries have so greatly contributed to the progress of chemical science, having detected disengaged boracic acid amongst the volcanic productions of the Lipari islands, and suggested that it might be a more general product of volcanoes than had been suspected,* it became important to ascertain whether the presence of any in this salt proved Vesuvius likewise to be a source of this acid. Alcohol heated on a portion of it in fine powder, and then burned on it, did not however shew the least green hue in its flame.

s. To ascertain the proportions of the ingredients of this saline substance, the following experiments were made:

10 grains of sulphate of potash of the shops were dissolved in 200 grains of water, and an excess of muriate of platina added. The precipitate edulcorated with 100 grains of water, and dried on a water bath, weighed 24.1 grains.

10 grains of the saline part of the native salt, treated precisely in every respect in the same way, afforded 17.2 grains of precipitated muriate of platina-and-potash.

If 24.1 grains of this precipitate correspond to 10 grains of sulphate of potash, 17.2 grains of it correspond to 7.14 grains of this salt.

It has been seen (*n*) that 10 grains of the saline part of this volcanic salt would have afforded 12.55 grains of sulphate of barytes.

But 7.14 grains of sulphate of potash form only 9.42 grains of sulphate of barytes,† and therefore the remaining 3.13 grains of sulphate of barytes would be produced by the

* Trans. of the Geolog. Soc.

† Dr. MARCET on Dropsical Fluids.

sulphate of soda, and correspond to 1.86 grains of it in an arid state, or uncombined with ice.*

10 grains of the saline part of this native salt would have produced 1.12 grains of ignited muriate of silver (*k*). By accurate experiments 241 grains of ignited muriate of silver have been found to correspond to 100 grains of ignited muriate of soda.†

Consequently the soluble portion of the present Vesuvian salt consists of

Sulphate of potash - -	7.14
Sulphate of soda - -	1.86
Muriate of soda - -	0.46
Muriate of ammonia, Muriate of copper, Muriate of iron - - -	0.54
	10.00

t. The insoluble sandy residue (*g*) having been thoroughly edulcorated, dilute nitric acid was put to it. A green solution formed without any effervescence. Acetate of barytes scarcely rendered this solution turbid; but nitrate of silver produced a copious curd-like precipitate, and iron abundantly threw down copper from it. The green grains enclosed in this native sulphate of potash, appear, therefore, to be a submuriate of copper, of the same species as that of the green sands of Peru and Chili.

Muriatic acid dissolved the yellow ochraceous powder, and prussiate of soda-and-iron produced Prussian blue. I am inclined to believe this yellow powder to be a submuriate of iron, but its small quantity, and the admixture of the submuriate of copper, were impediments to entirely satisfactory results. Such a submuriate of iron, though, if I mistake not, overlooked by chemists, exists, for the precipitate which oxygen occasions in solution of green muriate of iron, contains marine acid.

* Prof. KLAPROTH's Essays, Vol. 1, p. 282.
† Dr. HENRY, Phil. Trans. 1810.

Possibly this yellow powder, and the crystals of speculary iron which exist in this Vesuvian salt, have been produced by a natural sublimation of muriate of iron, similar to that of the experiment of the Duke d'AYEN, recorded by MACQUER,* and which was known long before to Mr. BOYLE and Dr. LEWIS.†

This Vesuvian salt, considered in its totality, has presented no less than nine distinct species of matters, and a more rigorous investigation, than I was willing to bestow on it, would probably add to their number.

July 3, 1813.

A FEW FACTS RELATIVE TO THE COLOURING MATTERS OF SOME VEGETABLES.

From the Philosophical Transactions of the Royal Society of London, Vol. CVIII, p. 110.—Read December 18, 1817.

I BEGAN, a great many years ago, some researches on the colouring matters of vegetables. From the enquiry being to be prosecuted only at a particular season of the year, the great delicacy of the experiments, and the great care required in them, and consequently the trouble with which they were attended, very little was done. I have now no idea of pursuing the subject.

In destroying lately the memorandums of the experiments which had been made, a few scattered facts were met with which seemed deserving of being preserved. They are here offered, in hopes that they will induce some other person to give extension to an investigation interesting to chemistry and to the art of dying.

* *Dict. de Chemie, Art. Fer.*

† A course of practical chemistry by WILLIAM LEWIS, 1746, p. 63, note *f*.