XVI. Analysis of the emerald of Peru

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the existence and direction of this great river; but its termination still continues unknown.

[To be concluded in the next Number.]

XVI. *Analysis of the Emerald of Peru.* By M. VAUQUELIN. From the *Annales de Chimie*, Vol. XXVI.

SEVERAL celebrated chemists have already analysed the emerald; but, as I am convinced that science is promoted and individuals instructed by repeating the labours of those who have preceded us, I have again subjected this fossil to a chemical analysis. Klaproth, one of the most accurate analysts of modern times, found in the emerald of Peru siliceous earth 66.25, alumine 31.25, oxyde of iron 0.50. It will be seen in the course of this short memoir, that the result of my labour differs from that of the Prussian chemist, not only in the proportion of the constituent principles, but in their number, and the nature of some of them*.

Exp. I. This stone, broken into small fragments, and exposed to a strong heat, lost a part of its beautiful green colour, and retained only a light shade of it. In many places of it there were cracks; and it lost of its weight 0.02 grains.

Exp. II. Two hundred parts of this fossil, which answered to 200 grains, *poind de marc* (eight ounces to the pound), or 10.615 grammes, were melted for an hour in a silver crucible with 600 parts of caustic potash. The matter had then a greenish yellow colour. This solution, when evaporated to a quarter of its bulk, was converted into a green jelly, the shade of which was much weakened by desiccation.

The residue was diluted in a large quantity of water; and it was observed, that the first portions of this liquid, poured

* According to the first analysis of the emerald, the results of which I presented to the National Institute, I found in it siliceous earth, alumine, lime, and the oxyde of *chrome*; but since that epoch, having discovered a new earth in the beryl, or *aigue marine*, I repeated my analysis, under this new point of view, and I found also that particular earth, as will be seen in the course of this memoir.

upon the substance, made it assume a bright and very agreeable green colour. The solution of the salt had also the same shade, but weaker. There remained a white insipid substance, full of grains, which was insoluble in water, and had all the properties of filiceous earth. It weighed 129 parts, after having been exposed to a red heat.

Exp. III. To the liquor of the second experiment, from which the filiceous earth had been separated, I added caustic potash, more than necessary for saturation, and then boiled it for some time. The greater part of the matter precipitated was at first re-dissolved; but there remained a certain quantity which obstinately resisted solution. The solution having been filtered, the insoluble matter, which, when washed and dried, weighed seven parts, was collected on the filter.

This matter had a light lilac colour, which became green by the heat of the blow-pipe. When melted with borax and the fusible salt of urine, it gave them a superb green colour, perfectly like that of the emerald. This property of thus giving a green colour to borax and microcosmic salt, made me abandon the idea I had first conceived, that this matter might be the oxyde of nickel; since the oxyde of that metal, though green, communicates to borax a hyacinth colour. As this colour had a perfect resemblance to that which I obtained from the oxyde of the metal * contained in the red lead of Siberia, I directed my experiments with a view to establish that resemblance. I therefore took this colouring matter, drawn from the emerald, and boiled it to dryness with concentrated nitric acid. I then poured upon the residue caustic potash, and obtained a solution of an orange-yellow colour; which when mixed with a solution of the nitrate of lead immediately produced the red lead of Siberia, and gave, with the nitrate of mercury, a precipitate of a vermilion red colour, absolutely in the same manner as does the acid of the red lead.

* Vauquelin's account of this new metal, called *Chrome*, will be given in our next number. EDIT.

These experiments, though not numerous, are sufficient to prove, that the colouring matter of the emerald of Peru is not iron, as announced by Klaproth, but that it is, on the other hand, the oxyde of the new metal which I discovered in the red lead of Siberia. One thing, however, which ought to surprize those acquainted with the sagacity and accuracy which the chemist of Berlin shews in his labours, and which have gained him so high reputation, is, that he did not observe this substance, so easily to be distinguished by a great number of characterising marks, entirely different from those exhibited by other minerals. I shall now proceed to other principles of the emerald.

Exp. IV. The reader will recollect that the liquor of the second experiment, deprived of its siliceous earth, was precipitated by caustic potash, and that the precipitate was, in great part, re-dissolved by an excess of this alkali. This solution was then supersaturated with the muriatic acid, and carbonate of potash used in commerce was poured over it. This produced a very abundant precipitate, which, being washed, and exposed to a red heat in a silver crucible, weighed fifty-four parts.

These fifty-four parts were dissolved in the sulphuric acid; and the solution, by the addition of a little potash at intervals, gave, by several successive crystallisations, 149 parts of alum crystallised in octaedra, among which there were eight or nine parts of the sulphate of lime; but as these 140 parts of alum contained only about twenty-six parts of pure alumine, and as the mother-water, the taste of which was exceedingly saccharine, gave no more alum by the addition of a new quantity of potash, I diluted it in water, and mixed with it a solution of the carbonate of ammoniac, until there was an excess. I shook this mixture from time to time, for several hours; at the end of which the greater part of the precipitate, which had been at first formed, was dissolved.

I then filtered the liquor, and collected on the paper the undissolved matter, which, when washed and dried, weighed

two parts, and exhibited all the properties of alumine. The liquor, being exposed to the action of fire, deposited, some moments after, a white insipid dust, full of grains, which dissolved with an effervescence in acids. Being collected with care, washed, and made red-hot, it weighed twenty-six parts. This substance, subjected to different tests, exhibited all the characterising marks of that earth which I found in the beryl; the properties of which I explained at large in a memoir inserted in the preceding number of the *Annales*, and which has obtained the name of *Glucine*.

It appears from the experiments announced in the course of this analysis, that 100 parts of the emerald of Peru consist of

1st, Siliceous earth	-	-	-	64.60
2d, Alumine	-	-	-	14.00
3d, The particular earth, or <i>glucine</i>	-			13.00
4th, Lime	-	-	-	2.56
5th, The oxyde of <i>chrome</i>		-	-	3.50
6th, Moisture, or other volatile matter	-			2.00
				<hr/>
				99.66
				<hr/>

It appears then by the result of this analysis, that there is a very great difference between the proportion, the number, and the nature of the principles which constitute the emerald, and those found by Klaproth; since, according to him, it is composed of only 66.25 of siliceous earth, 31.25 alumine, and 0.50 of the oxyde of iron. There are in this stone then three substances not observed by the above chemist, viz. *glucine*, the oxyde of *chrome*, and lime; while the oxyde of iron, which he announces, does not exist in it.

It follows therefore from this result, that the emerald and the beryl are two stones perfectly similar, and composed of the same principles, the colouring matter excepted; and mineralogy had already got the start of chemistry by bring-

ing together these two fossils, and making them only one species*.

XVII. Curfory View of some of the late Discoveries in Science.

[Continued from the last Number, p. 65.]

METEOROLOGY.

METEOROLOGY, which depends only on an immense number of observations, has, however, been exalted into a science. It affords general results of great importance; a collection of which has been made by Cotte. By these it appears that the barometer varies very little under the equator. Its variation becomes greater in proportion as it approaches the poles. It seems to experience a diurnal and an annual variation.

Diurnal variation.—Between the hours of ten and two, both of the day and the night, the risings and fallings of the mercury are the least. The contrary takes place between the hours of six and ten of the morning and evening. This seems to depend on the sun and the moon passing the zenith.

Annual variation.—The oscillations are less in summer, greater in winter, and very great at the equinoxes. This seems to depend, like the tides and the winds, on the same action of the sun and the moon.

Thermometers.—The mean degrees of heat are almost the same in all latitudes. Kirwan has given a table for calculating the mean degrees of heat in different latitudes.

Rains are more frequent in winter than in summer; more abundant in summer than in winter. Mean quantity of rain at Paris twenty-two inches. The evaporation generally exceeds the rain at Paris. The mean evaporation is thirty-three inches.

Aurora borealis is more frequent about the time of the equinoxes than at any other season. This phenomenon is

* See Abbé Haüy on Crystallisation.