On the analysis of German silver, and the separation of zinc from nickel, &c.

Mr. Joseph D. Smith

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cumstances usually observed would be accounted for by supposing the rain-drops of the diameter of $1\frac{7}{12}$ of an inch. The considerations account for the supernumerary bows being seen near the summit of the bow only, since the drops, as they fall lower, coalesce, and become larger; and the white fog-bows, which are often seen, would result from very minute drops, of the diameter perhaps of one thousandth of an inch.

Afterwards a communication was also read from C. Darwin, Esq., containing a notice that animals (lizards, &c.) which are oviparous in certain districts of South America, as they are in this country, are viviparous in the province of Mendoza, which he visited. Mr. Darwin also gave an account of red snow observed by him in the road from St. Jago de Chili to Mendoza, by the Portello pass, and of a microscopical examination of the substance.

XV. Intelligence and Miscellaneous Articles.

ON THE ANALYSIS OF GERMAN SILVER, AND THE SEPARATION OF ZINC FROM NICKEL, &c. BY MR. JOSEPH D. SMITH.

WISHING to ascertain in what proportions the copper, zinc, and nickel were combined in a specimen of German silver, or pak-fong, an alloy which has within a few years been extensively employed as a substitute for silver plate, I referred to Rose's Analytical Chemistry, in which I find it stated, that when a solution of potash or soda is added to one containing the oxides of nickel and zinc, their separation is by no means completely effected, a great excess of alkali not redissolving the whole of the oxide of zinc, even when boiled; he therefore directs the oxides to be converted into chlorides, and then to volatilize the chloride of zinc; but the manipulation in this process is of so complicated a nature and requires such numerous precautions to ensure accuracy, that it is quite unsuited to any but the most experienced and skilful analysts.

Among many of the experiments performed I tried to discover a simpler method than that recommended by Rose: there was one which I made to ascertain to what extent the oxide of zinc was soluble in soda or potash after precipitation in mixture with oxide of nickel; for if the method would give results correct within 3 or 4 per cent., it would have answered my purpose sufficiently well: therefore I took 20 grains of zinc and 30 grains of oxide of nickel, dissolved them in muriatic acid, and having largely diluted the solution, boiled it for half an hour with four times as much soda as it took to precipitate the oxides. The precipitate when dried and ignited weighed 46.4 grains, showing that 16.4 grains of oxide of zinc were precipitated with the 30 grains of oxide of nickel. Thus the results obtained by the use of caustic alkali are as incorrect in this instance, or even more so, than when this process is employed to separate copper from zinc, the unfitness of which method was pointed out by Mr. Keates in a paper on the Analysis of Brass (Ann. of Philosophy, vol. xix.), and he at the same time gave directions for the performance of its analysis. Although the results obtained by the employment of his process are sufficiently

correct, yet it may be advantageously superseded by passing a current of sulphuretted hydrogen gas through the solution of the mixed metals made strongly acid, separating the bisulphuret of copper, and after heating the solution to expel the excess of sulphuretted hydrogen, the zinc may be precipitated by carbonate of soda. Another experiment, in which the process recommended by Mr. Phillips for separating oxide of cobalt from oxide of nickel by adding a solution of potash to an ammoniacal one of the mixed metals, was tried with equally unsatisfactory results, for from 20 grains of zinc and 30 grains of oxide of nickel a precipitate was thrown down from an ammoniacal solution by potash, weighing after ignition 48 grains, giving 18 grains of oxide of zinc mixed with 30 grains of oxide of nickel.

After many other methods, of which it will suffice to say that they were all unsuccessful, I was led to try the effect of sulphuretted hydrogen gas upon the salts of nickel and zinc, when solutions of them, previously neutral, are acidified by one of the weaker acids, and which acid should likewise form soluble salts with both metals. Pursuing this idea, I mixed a little acetic acid with a neutral solution of zinc, and also with a neutral solution of nickel, and passed a current of sulphuretted hydrogen through both the solutions: in the solution of nickel no precipitation took place, but in that of zinc an abundant white precipitate fell; and by passing excess of the gas through the solution, the whole of the zinc was precipitated as a sulphuret. I then made an experiment to determine whether it was possible to analyse German silver by passing sulphuretted hydrogen through its solution, differing in its acidity, both as regards the acid and degree of acidity at different times, according to the nature of the precipitate desired, whether copper or zinc; the results obtained were very satisfactory.

24½ grains of copper, 12 grains of zinc, and 20 grains of oxide of nickel were dissolved in nitromuriatic acid; the solution, strongly acidified with muriatic acid, was diluted with about a pint of water; a current of sulphuretted hydrogen gas was then passed through the solution until all the copper was precipitated; the bisulphuret of copper formed having been well washed, was acted on by nitric acid, which dissolved the copper and left some sulphur; after the separation of the latter, the solution of copper was boiled with caustic soda to precipitate the peroxide, which after ignition weighed 30·4 = 24·3 grains of copper. The solution containing the zinc and nickel was carefully evaporated to dryness, to expel the excess of acid, and the residue dissolved in water acidulated with one fluid ounce of strong acetic acid sp. gr. 1·0691, and warmed to assist the action: when this was effected, the solution was diluted to about a pint, and a stream of sulphuretted hydrogen gas was passed through it until the gas was in excess; a dingy white precipitate of sulphuret of zinc fell, which weighed 18 grains = 12 grains of metallic zinc.

The remaining solution containing the nickel, after being heated to expel the sulphuretted hydrogen, was decomposed by caustic soda; this gave hydrate of nickel, which when reduced to protoxide by strong ignition, weighed 20·1 grains. In this experiment there was a loss

of 0·2 grain of copper and a surplus of 0·1 grain of oxide of nickel ; errors so small that they are evidently those of manipulation and not owing to any defect in the process followed.

70 grains of German silver gave by the above process :

Copper.....	42·1
Zinc.....	12·5
Nickel.....	13·2
Cobalt.....	2·4
	<hr/>
	70·2

There appears to be a larger proportion of copper in this than is generally met with in German silver, for only one out of four alloys, the composition of which, on the authority of Gersdorff, is given by Bourchardat (*Cours de Chimie*, 1^{er} partie, page 289), contains as large a proportion of copper as the specimen I analysed, and to it may be attributed the very yellow shade which this alloy possessed ; its chief advantage over many others being what is technically called ' dipping well.'

The same method may doubtless also be employed to separate manganese and cobalt from zinc, for solutions of the former metals, when acidified by acetic acid, are not precipitated by sulphuretted hydrogen gas.

St. Thomas's Hospital,
December 1835.

ACTION OF MUSHROOMS ON ATMOSPHERIC AIR.

M. Marcet subjected known quantities of mushrooms to the action of oxygen, azote, and atmospheric air under graduated receivers ; and having left them for a certain time, and ascertained the alteration both in the volume and nature of the gases ; the conclusions at which he arrived, after performing numerous experiments, are the following :

1st. That mushrooms produce very different effects upon atmospheric air from those which result from the action of green plants under similar circumstances. They vitiate the air very readily, either by absorbing its oxygen to form carbonic acid gas at the expense of the carbon of the vegetable, or by disengaging carbonic acid ready formed.

2nd. That the modifications which atmospheric air suffers by the contact of mushrooms in a vegetating state are the same day and night.

3rd. That if fresh mushrooms are suffered to remain in pure oxygen gas, a large portion of the gas disappears in a few hours. One part of it combines with the carbon of the vegetable to form carbonic acid gas, while another portion is fixed in the vegetable, and is replaced by azotic gas liberated from the mushrooms.

4th. That fresh mushrooms, by remaining for some hours in azotic gas, produce but little change in it ; a small quantity of carbonic acid