

XV. *On the Composition of Emery.* By Smithson Tennant,  
Esq. F. R. S.

Read July 1, 1802.

THE substance called emery, which, from its great hardness, has been long used in various manufactures, for grinding and polishing other bodies, has not, it appears, been hitherto correctly analyzed. In books of mineralogy, it is considered as an ore of iron; an opinion probably derived from its great specific gravity, as well as from the iron which it frequently contains. But, where this metal is most abundant, it could not be extracted from it with advantage, and ought rather to be regarded as an impurity, as it does not contribute to produce the peculiar hardness for which this substance is distinguished. In Mr. KIRWAN's mineralogy, he mentions an examination of emery made by Mr. WIEGLEB, from which he inferred that 100 parts consisted of 95,6 of silex, and 4,4 of iron. Mr. KIRWAN, however, justly suspects the correctness of this account, and observes that he had no doubt but some other stone was imposed upon Mr. WIEGLEB for emery.

When powder of emery is boiled in acids, it becomes of a lighter colour, from the loss of part of the iron; after which, it does not seem to undergo any further alteration. As acids produce so little effect on it, I exposed it to a pretty strong red heat, with carbonate of soda, in a crucible of platina. On adding water to the mass contained in the crucible, the greater part of

the emery was found in powder ; having only become of a light colour, from the extraction of part of the iron. Though this process was twice repeated with the remaining powder, and in a stronger heat, a great proportion of it remained undissolved.

The alkaline solution, after a red calx of iron had subsided from it, was saturated with acid ; and gave a precipitate of a white earth, which I found to be almost purely argillaceous.

The result of these experiments, was so similar to those of Mr. KLAPROTH on diamond spar, as to render it very probable that emery was in reality the same substance, though usually mixed with a larger proportion of iron ; and the subsequent experiments appear to confirm this opinion.

In order to obtain a quantity of emery as free from iron as I could, I reduced to a coarse powder, a piece which consisted of different strata, some of which were of much lighter colour than others ; and afterwards separated, by a magnet, the particles which were attracted by it. The part which was not attracted by the magnet, I observed to have the usual degree of hardness, (by the scratches which might be made with it on flint.) I then reduced it to a finer powder, in an agate mortar ; and, as this was principally done by pressure, and not by grinding, hardly any sensible addition was made to its weight. In the same manner, I found that diamond spar might be powdered to the same degree of fineness, without any material increase of weight from the mortar.

Of the emery powder thus prepared, 20 grains were taken, and heated in the manner before described, with 120 grains of soda, which had been previously deprived of carbonic acid, and boiled to dryness in a silver pan. By nearly the same process

as that used by Mr. KLAPROTH, I obtained about 16,0 grains of argillaceous earth, ,6 of siliceous earth, ,8 or ,9 of iron, and ,6 of a grain remained undissolved. These numbers, reduced to parts of a hundred, are therefore,

Argillaceous earth	-	-	-	80
Silex	-	-	-	3
Iron	-	-	-	4
Undissolved	-	-	-	<u>3</u>
				90.

Mr. KLAPROTH obtained from the Chinese corundum, after separating from it the particles which were attracted by the magnet,

Argillaceous earth	-	-	-	84
Silex	-	-	-	6,5
Iron	-	-	-	<u>7,5</u>
				98.

As this analysis was no doubt conducted with greater care than mine, the loss of weight was less; but the proportion of the ingredients is sufficiently near to show that the substances are essentially the same.

From 25 grains of emery which appeared the most impregnated with iron, and yet retained its usual hardness, I obtained, argillaceous earth 12,5, silex 2, iron 8, and one grain was not dissolved; or, per cent.

Argillaceous earth	-	-	-	50
Silex	-	-	-	8
Iron	-	-	-	32
Undissolved	-	-	-	<u>4</u>
				94.

As such emery can easily be had of uniform quality in large pieces, I procured the powder employed in this experiment, by rubbing two pieces against each other.

From 25 grains of emery, similar in appearance to the preceding, but which had been digested with marine acid previous to the action of the alkali, I had,

		per cent.
Of argillaceous earth	- - 16,4	65,6
Siliceous earth	- - - ,8	3,2
Iron	- - - 2,	8,
Not dissolved	- - - 4,5	18,0
	<hr style="width: 50%; margin: 0 auto;"/> 23,7	<hr style="width: 50%; margin: 0 auto;"/> 94,8.

The hardness of emery, as far as I could judge by its cutting rock crystal and flint, appeared to be equal to that of diamond spar. The latter could not be scratched by the former; but, as emery has not a surface sufficiently polished to render a mark visible, the converse of this could not be tried.

All the emery which is used in England, is said to be brought from the Islands of the Archipelago, and principally from Naxos. In those places, it is probably very abundant; as the price of it in London, which I was told was 8 or 10 shillings the hundred weight, appears little more than sufficient for the charges of carriage. Though I saw a very large quantity in one place, (more than a thousand hundred weight,) I could not find any pieces of a crystallized form; possibly the great proportion of iron usually mixed with it, may prevent its crystallization. The whole consisted of angular blocks incrustated with iron ore, sometimes of an octaedral form, with pyrites, and very often with mica. The latter frequently penetrates the whole substance of the mass, giving it, when broken, a silvery appearance,

if seen in the direction in which the flat surfaces present themselves to the eye. As these substances have no chemical relation to the emery itself, it is remarkable that they should also accompany the diamond spar from China; for Mr. KLAPROTH observes, "that its lateral facets are mostly coated with a "firmly-adhering crust of micaceous scales, of a silvery lustre:" he also mentions, besides felspar, pyrites, and grains of magnetic iron ore.