ON CLEOPATRA'S NEEDLE.

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Read before the Society of Public Analysts on the 20th November, 1878.

I NEED hardly remind the members present that the granite of which Cleopatra's Needle is composed, was obtained from quarries situate at Syene, on the Nile. The general appearance of the granite is probably pretty well known, so that I need not do more than draw attention to the specimens, which, by the courtesy of Mr. Dixon, I am enabled to exhibit to-night. There will, however, I think, be some interest taken in the results of some analyses which I have recently made of different parts of it.

The specific gravity of the stone is 2.682. It has a very uniform density throughout, fragments broken from the top and bottom differing in gravity only in the fourth place of decimals. The surface of some portions, especially of that face which has laid upwards in Egypt is very considerably weathered, and it was consequently desirable to ascertain the relative absorbent powers of the unchanged stone and of the weathered surface when exposed to water. For this determination two pieces were selected, one of which was taken from the centre of the base, which had to be dressed flat in order to make the obelisk stand erect on its pedestal, and the other piece, which had a considerable portion of weathered surface on one side.

The lump of sound granite weighed about 2,000 grains, and after two days submersion in distilled water it had absorbed .6 of a grain of water, but no further increase in weight took place although it was left some days longer under water and was repeatedly weighed. On being exposed to the air of a warm room for 24 hours it lost all the moisture it had absorbed, and weighed .10 of a grain less than it did at first. Calculating as closely as I can, from the area of the rough stone, the absorption would be at the rate of 7.8 grains of water per square foot of surface.

The lump having a portion of the surface weathered, weighed about 3,300 grs.; after being submerged in distilled water for two days the weight had increased 1.3 grs., after two days more it had increased another 2 grs., after which time the weight remained

very nearly constant. A considerable portion of the surface of this piece of stone was of course a recent fracture, and calculating the absorption of this newly fractured part at the same rate as above would only account for an increase of weight of .70 grain. We have, therefore, 1.6 grs. absorbed by the weathered surface; this surface measured 5 square inches and the absorption was therefore at the rate of 46.1 grs. per square foot, or nearly six times as much as on the sound part. This absorption does not of course include surface moisture, as the surface water was in each case carefully removed by blotting, and the stone exposed for an hour on a table to a temperature of 65 Fahr. before being weighed.

The 46 grs. of absorption per square foot gives us a comparatively fair estimate of the amount of water which can be retained in the weathered surface and which is ready by its expansion on freezing to split or disintegrate that surface still further.

Another portion of the stone was roughly powdered and by means of Sonstadt's solution separated as far as possible into Mica, Quartz and Feldspar. After dividing it in this way into 12 or 14 portions of different gravities, the proportions of each of the proximate constituents were estimated so that the following results are probably within about 1 or at most 1.5 per cent. of the truth.—They showed,—

Mica	...	...	...	...	...	...	9 per cent.
Quartz	...	...	...	...	...	...	22 "
Feldspar	...	...	...	...	...	...	69 "
							100

Taking pure fragments of each of the three constituents the specific gravities were found to be as follows :—

Mica	...	...	...	...	...	...	2.986
Quartz	...	...	...	...	...	...	2.747
Feldspar	...	...	...	...	...	...	2.595

I should note that the proportion of Mica varied considerably in different parts of the stone.

The portion of granite taken from the centre of the base and not weathered was analysed, and gave the following results :—

Silica	...	...	...	...	...	...	68.18 per cent.
Sesqui Oxide of Iron	...	...	...	...	...	...	4.10 "
Alumina	...	...	...	...	...	...	16.20 "
Lime	...	...	...	...	...	...	1.75 "
Magnesia	...	...	...	...	...	...	.48 "
Soda	...	...	...	...	...	...	2.88 "
Potash	...	...	...	...	...	...	6.48 "
Manganese	...	...	...	...	...	traces	
							100.07

The portion taken from the exterior surface which was probably weathered as much as any portion of the Needle, gave the following results :—

Silica	...	...	...	...	...	...	70.36 per cent.
Sesqui Oxide of Iron	...	...	...	...	...	...	4.13 "
Alumina	...	...	...	...	...	...	15.37 "
Lime	...	...	...	...	...	...	2.05 "
Magnesia	...	...	...	...	...	...	.45 "
Soda	...	...	...	...	...	...	2.40 "
Potash	...	...	...	...	...	...	5.34 "
Manganese	...	...	...	...	...	slight traces	
							100.10

It will be seen that the weathering has scarcely affected the iron. The alumina has decreased from 16·20 to 15·37, and the lime has increased from 1·75 to 2·05, while the alkalis show a decrease in the case of soda from 2·88 per cent. to 2·40 per cent. and in the case of potash from 6·48 per cent. to 5·34 per cent.

A few of the most perfect crystals of Feldspar were picked out and analysed separately, and gave the following results:—

Silica	...	...	...	...	...	...	63·88	per cent.
Oxide of Iron	}	...	...	...	...	...	22·25	"
and Alumina		...	...	...	...	...		
Lime	...	...	...	...	...	...	1·09	"
Magnesia	...	...	...	...	...	...	·45	"
Soda	...	...	...	...	...	...	1·84	"
Potash	...	...	...	...	...	...	10·66	"
							100·17	

Some of the Mica separated and analysed in the same way gave the following results:—

Silica	...	...	...	...	...	...	41·16	per cent.
Oxide of Iron	...	...	...	...	...	...	7·30	"
Alumina	...	...	...	...	...	...	41·18	"
Magnesia	...	...	...	...	...	...	6·77	"
Soda	...	...	...	...	...	...	·92	"
Potash	...	...	...	...	...	...	5·24	"
							102·57	

The quantity of Mica separated was so small that it was impossible to repeat this analysis.

In conclusion, I must point out what an act of vandalism it would be to cover such a stone as this with silicate solution, as has been proposed. Such a solution would not even fill up the pores of the weathered portion, and it could not sensibly increase the coherence of the porous surface. The only proper course is to fill the pores with a non-porous and neutral substance—such as paraffin wax for instance.