

NOTES ON "SALT LIME."

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"Ye are the salt of the earth; but if the salt have lost his savour, wherewith shall it be salted? it is thenceforth good for nothing but to be cast out and trodden under foot of men."—Matthew, v, 13.

This passage from "the Sermon on the Mount" has doubtless puzzled many a chemist, for salt without savour is as much an anomaly as a smile without a face.

Last summer, while spending my vacation at the seashore, I came across an old-fashioned "salt works," where common salt is prepared by evaporation of sea water, partly by means of trickling it over masses of brush and further by solar evaporation in shallow vats.

It was while investigating the process that I came upon what seems to me to be a plausible explanation of the scriptural passage, and at the same time I secured a quantity of the material called by the salt makers "salt lime," which is the subject of this paper.

It seems that the first solid product to separate from the sea water upon concentration by evaporation is a very slightly soluble, white, crystalline substance, which gathers in the first four or five shallow vats. These are provided, so that the tasteless, gritty substance may not come down along with the salt and constitute an undesirable impurity in it. This tasteless substance is "salt lime."

As to the connection between this substance and the salt which had lost its savour, I think it very probable that the ancient salt makers omitted to provide separate vats for the first, very slightly soluble product, and that as a result it got mixed up with their salt. Then, possibly, owing to exposure to moisture, the real salt may have become dissolved away from this less soluble part in certain instances, and the residue, being tasteless, would naturally be supposed to have "lost its savour," by the unscientific mind of that time.

Having secured eight or ten pounds of salt lime, I made an examination of the substance to determine its nature.

In physical appearance it is grayish white in color, crystalline in struc-

ture and it forms a layer about one-quarter inch thick as scraped from the evaporators. I was told by the owner of the salt works that not over thirty or forty bushels were obtained from the evaporation of an amount of sea water that would yield 5,000 bushels of salt; so it will be seen that the substance represents a high degree of concentration as the average per cent. of common salt in sea water is only 2.61 per cent.* and the amount of "salt lime" obtained is only about 1 per cent. of that of the common salt.

This high degree of concentration has led me to investigate the substance to see if it possesses any radio-activity, as, owing to the wide distribution of radio-active material more or less of it must find its way into the ocean, and, judging from the position of radium in the periodic system, the salts of radium ought to be found as sulphates among the less soluble constituents of the ocean water.

Experiments are now under way with a view to still further concentrate the material and to find whether it contains any trace of radio-active material.

Upon consulting the literature to which I have had access, I find that mention is made in nearly all cases of the separation of gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) prior to the separation of common salt in the evaporation of both sea water and natural brines from wells.

I have conducted a qualitative analysis of the salt lime in the regular way and find that it does consist mainly of gypsum. It has the water of crystallization and gives the reactions of Ca and SO_4 . It gives, moreover, evidence of the presence of a small amount of carbonate of calcium. I have seen no mention of this last fact in the literature to which I have had access. In order to determine the proportion of carbonate in the mixture I pulverized about 20g. in an agate mortar until it had all passed through a 100-mesh sieve; then taking a "fair sample," as in assaying, I weighed out 5.6623 grams into a Schrötter apparatus and determined the weight of CO_2 lost, in the usual manner.

The weight of CO_2 lost was .0156g, indicating a weight of .4354g of CaCO_3 (calculated) or .62 per cent. CaCO_3 . A second determination gave .71 per cent.

I have tested carefully for Ba and Sr, using the ordinary form of chemical spectroscopy as well as the regular analytical tests, and have

* New International Encyclopoedia, p. 723. 3.5 parts solid in 100. 77.76 per cent of solid is salt.

found no trace of either. I have also tested for PO_4 and fluorine with negative results.

On heating a sample of the salt lime in a dry test tube, there was a slight charring, possibly due to a slight amount of material from the wooden vats or perhaps from sea algae. There was also a slight smell of NH_3 on boiling a large mass of the finely-powdered substance with excess of NaOH in an attempt to remove CaSO_4 to secure concentration of the less soluble constituents. This was probably also due to small amounts of remains of sea algae..

From my study of the substance I would conclude that it consists mainly of gypsum, but that it contains an appreciable amount of CaCO_3 (.65 per cent.) and that it is remarkably free from other constituents, due probably to the sharp distinctions in solubility between the less soluble and the more soluble constituents of sea water. I hope to concentrate further a considerable amount of the substance and examine it for traces of radioactive material or other constituents.