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IRON AND COPPER IN CAREY'S SALT

by

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Introduction

The spectrographic method used for the estimation of copper and iron in the salt samples is an adaptation of what is commonly called the "total-energy" method, based on the fact that the total radiant energy emitted from an element excited by thermal or electrical means is directly proportional to the mass of the element present in the excited sample. If a sample, say of salt, is volatilized in an electric arc, and the spectrum of the sample is photographed, the more copper or iron present in the salt, the blacker will be the photographed spectral lines of the copper or iron on the film negative. The spectra of several samples may be photographed side by side on one piece of film. We may choose a single line of an element, as the copper line at 3274 Angstrom units, and measure the blackness of this line as it appears in the spectrum of each of the samples. This gives a comparison between the amounts of the element in the different samples. If some of the samples are standards containing different, but known, amounts of the element, a relation may be found between the measured blackness of the photographed line and the concentration in the sample of the element causing the line.

SAMPLE PREPARATION

Copper

Copper was removed from 100 gm of salt (Carey's K. D. Granulated) by precipitation with hydrogen sulfide. The copper-free salt, which a qualitative spectrographic analysis showed to contain no more copper than the spectrographic graphite electrodes, was used to prepare samples containing 0.001, 0.000 1, 0.000 01, 0.000 001, and 0.000 000 1 percent by weight of copper. These prepared samples were used as standards for the copper analyses.

The processed samples to be examined for copper were ground with a mullite mortar and pestle, and required no other treatment.

Iron (Fe_2O_3)

Three analyzed samples of Carey's processed salt were used as standards for iron determinations*:

H-662S	K. D. Granulated (Untreated)	0.0001 % Fe_2O_3
H-663S	A. D. Medium Salt	0.001 % Fe_2O_3
H-656S	Coarse Medium Salt	0.003 % Fe_2O_3

*Carey Salt Co. analyses; C. W. Jobes, Analyst.

The sample to be analyzed for water-soluble iron was H-635, No. 2 crushed rock salt. About 50 grams each of the colorless, red, and black salt crystals were picked out by hand. These samples were dissolved in water, filtered, recrystallized, and pulverized.

ANALYSES

Copper (Cu)

Between 0.000 001 and 0.000 000 1 percent copper:

H-659S Topping Salt

H-661S Flake Flour Salt

H-662S K. D. Granulated (Untreated)

Between 0.000 000 1 and 0.000 000 01 percent copper:

H-656S Coarse Medium Salt

Less than 0.000 000 01 percent copper:

H-660S Fine Flake Salt

H-664S Granulated Flour Salt

H-663S Air Dried Medium Salt

Water-Soluble Iron (Fe_2O_3)

H-635 No. 2 Crushed Rock Salt

Colorless crystals: about 0.000 07 % Fe_2O_3

Black crystals : about 0.000 2 % Fe_2O_3

Red crystals : between 0.007 % and 0.06 %; probably less than 0.02 % Fe_2O_3

DISCUSSION OF RESULTS

1. The very small concentrations of copper in both the standard samples and the samples to be analyzed did not permit achieving homogeneous mixtures of copper in the salt. The reproducibility of the analyses was, therefore, very poor, and did not warrant reporting exact copper concentrations. The analyses indicate the range of copper concentrations within which the samples probably fall. In no case was a sample found to contain any more than 0.000 001 percent copper, and most of the samples contained much less.

2. The colorless and black crystals separated from the No. 2 crushed rock salt were found to contain less than 0.001 percent water-soluble iron oxide. However, the red crystals apparently contained considerably more than this amount, as shown in the analyses. An accurate spectrographic analysis of the red crystals was impossible, due to the continuous spectrum set up by large amounts of calcium, magnesium, and strontium in the red crystals.

3. A qualitative spectrographic analysis of the red crystals, after removing most of the clear halite, leads us to believe that the red crystals contain the mineral, celestite, or at least a mixture of calcium and strontium sulfates. The strontium is apparently present in the same order of magnitude as the calcium. The Geochemistry Laboratory will analyze the No. 2 rock salt and the selected red crystals for strontium, calcium, iron, and potassium; these analyses will be reported at a later date.

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