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TRACE ELMENTS IN SALT

by

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TRACE ELEMENTS IN SALT

Introduction

A qualitative spectrographic examination of raw and processed salts was performed to determine the trace elements in the salt. Another report will deal with the quantitative estimation of iron and copper present in some of the samples.

Method

Because of the very small amounts of trace elements in the salt samples, the trace elements had to be concentrated somewhat before spectrographic examination. Two methods of concentration were used: (a) filtration of the water solution of the salt removed the insoluble materials; (b) fractional crystallization of the water solution caused a partial separation of the least soluble and the most soluble compounds from the main body of the soluble salt.

A qualitative spectrographic examination of the insoluble residue, the least soluble compounds, and the most soluble compounds permitted the detection of trace elements with some idea of how their concentrations change in the usual purification processes.

Elements Observed in Salt

Samples 662-665

Insoluble Residue: Cu, Pb, Sn, Fe, V, Ti, Al, Mn, Cr*, Si, B, Ca, Sr, Mg, Na, K**.

Least Soluble : Cu, Fe, V, Ti, Al, Si, B, Ca, Sr, Mg, Na, Ag, Cr*.

Most Soluble : Cu, Fe, V, Ti, Al, Si, B, Ca, Sr, Mg, Na, Ag, Cr*.

Samples 635-634, 668

Insoluble Residue: Cu, Pb, Sn, Zn, Fe, V, Ti, Al, Mn, Si, B, Ca, Sr, Mg, Na.

Least Soluble : Cu, Fe, V, Ti, Al, Si, B, Ca, Sr, Mg, Na.

Most Soluble : Cu, Fe, V, Ti, Al, Mn, Si, B, Ca, Sr, Mg, Na, K, Ag.

Samples H-666-S and H-667-S (Hot-pan scale and cold pan scale)

Insoluble Residue: Cu, Fe, V(None from hot-pan), Ti, Al, Si, Mn, B, Ca, Sr, Mg, P, Sn (Extremely small trace), Ag (none in hot pan), Na.

Most Soluble : Cu, Fe, V, Ti, Al (none in hot pan), Mn (none in hot-pan, extremely small trace in cold pan), Si, B, Ca, Sr, Mg, Na, K (small trace), Ag.

*Chromium probably introduced from stainless steel spatula.

**Some potassium in insoluble residue from the shale.

Discussion of Results

1. Some of the elements listed above which are not ordinarily determined in the usual chemical analyses might be determinable if large samples were used (100 gm), and if it became important to know them. These are Sr, K, Al, Ti, Mn, and Cu.

2. There were no observed traces of Li, Cs, Rb, Be, Ba, or any of the rare earth elements. A trace of soluble K was found in the 2 to 4 foot section of the mine face.

3. All samples contained gypsum or anhydrite with strontium salts as impurity, probably less than 0.1 percent of the gypsum (see report on copper and iron).

4. The shale is probably the source of Mn, Si, Fe, and Ti, soluble B, V, and Cu, and insoluble K.

5. Sn and Pb were found only in the insoluble residues, and probably are due to metallic solder from some piece of equipment. Zn found in the insoluble residues of the topping and fine flake salts, samples 659 and 660, may be derived from galvanized steel. These three elements are present in extremely small amounts.

6. Traces of silver were found in the mine-face section and in the grainer brine, and possible traces were found in the fine flake salt and the granulated salts. The silver is estimated to be present in concentrations of the order of 0.000 01 percent or less.

7. Soluble boron and vanadium salts are apparently retained in solution, and would very likely be largely removed from the salt in the waste brine.

8. The most apparent differences between the Louisiana crushed rock salts and the Kansas rock salts, samples 633-636, are a greater amount of vanadium and a lesser amount of strontium in the Louisiana salts as compared with the Kansas salts.

9. The processed salts, samples 658-664 and 668, are very little different from one another in any respect. They differ from the brines, samples 656-657, in that the brines, of course, contain larger amounts of all impurities with the possible exception of Si. The chief differences noted are the presence of Mg and K in the brines, with none detected in the processed salts.

10. In general, the hot-pan and cold pan scales contained the same elements found in all the other samples. Some phosphorus was found in the insoluble residues from the scales, and none was observed any place else.

Conclusions

The raw and processed salts examined are all of great purity, with only a few trace elements detectable by spectrographic means. A few of these elements not ordinarily determined by chemical analyses might be susceptible of analysis if very large samples were used. None of the trace elements are present in the rock salt in sufficient quantities for recovery. With the possible exceptions of iron and copper, no elements were detected in amounts which might be considered deleterious (see report on copper and iron).