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# ALKALI DEPOSITS OF WESTERN CANADA.

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## OCCURRENCE. -

Natural occurrences of soluble mineral salts are known in the provinces of Manitoba, Saskatchewan, Alberta, and British Columbia, either in the form of bedded deposits, or as brines. Some are of considerable extent, and are probably of sufficient size to warrant commercial development.

The occurrences of these salts may be broadly classed under two types:-

(1) Solid salts and brines in undrained or partially drained basins;
(2) Brines of flowing streams or springs.

### Type 1.

Those of the first class are very numerous in the prairie provinces.

It is probable that the accumulation of salts is due to leaching out of the soluble salts in the prairie soils by surface waters, and their concentration and deposition in the undrained basins which are found in the glacial morainic covering of the western prairies.

These deposits are generally of a similar character, although the percentage of the different salts will vary in different localities. In many cases the name 'alkali lake' has been appropriately applied to deposits of this nature, since in the early spring and often into late summer the deposits are covered with water. The water accumulating through the melting snow and rain is often a foot or two in depth, and carries a considerable quantity of the alkali salts in solution. Beneath this water one generally finds a solid bed of crystallized salts. In the late summer, especially when the season is a dry one, these so-called lakes become deposits of snow white alkali, which when seen from a distance resemble snow covered basins.

The deposits will vary in size from a few acres to many acres in extent, and in thickness, from a few inches to possibly 15 feet. The salts are generally found interbedded or mixed with mud or peaty material, and in very few instances are the deposits in a pure enough form to be commercially marketable in their raw state. The mud beds also contain numerous crystals of the alkali salts.

Type 2.

Brine streams or springs occur in many places, and may carry sufficient salts in solution to warrant their commercial exploitation for medicinal and other purposes. In some of the occurrences of this nature the principal salt present is sodium chloride, the other salts being present only in small quantities. The brine springs of northern Manitoba are good examples of this class of deposit.

COMPOSITION. -

The composition of the salts occurring in these basins consists chiefly of mixtures of sodium and magnesium sulphates in varying proportions, with, generally, small quantities of sodium chloride and possibly other salts such as sodium carbonate, etc.

Sodium Sulphate

Sodium sulphate in the hydrous form (known as MIRABILITE or GLAUBER'S SALT) has the following composition:-

$$Na_2SO_4.10H_2O = \begin{cases} SO_3 & 24.8\% \text{ (sulphur trioxide)} \\ Na_2O & 19.3\% \text{ (soda)} \\ H_2O & 55.9\% \text{ (water)} \end{cases}$$

In its pure state it is white, transparent to opaque; and has a hardness, 1.5-2 with a specific gravity, 1.48. It is readily soluble in water, and at first is cool to the taste, and afterwards saline and bitter.

Sodium sulphate in the anhydrous form (known as THENARDITE) has the following composition:-

$$Na_2SO_4 = \begin{cases} SO_3 & 43.7\% \text{ (sulphur trioxide)} \\ Na_2O & 56.3\% \text{ (soda)} \end{cases}$$

Its colour, when pure, is white, translucent to transparent, and the mineral has a hardness of 2-3, with a specific gravity of 2.68.

Magnesium Sulphate

Hydrous magnesium sulphate, (known as EPSOMITE or EPSOM SALTS) has the following composition:-

$$MgSO_4.7H_2O = \begin{cases} SO_3 & 32.5\% \text{ (sulphur trioxide)} \\ MgO & 16.3\% \text{ (magnesia)} \\ H_2O & 51.2\% \text{ (water)} \end{cases}$$

This is a soft, white or colorless mineral, readily soluble in water, and with a bitter saline taste. Its hardness is from 2 - 2.5, and a specific gravity, 1.75.

## Sodium Chloride

Sodium Chloride (known as HALITE or COMMON SALT) has the following composition:-

$$NaCl = \begin{cases} Na & 60.6\% \text{ (sodium)} \\ Cl & 39.4\% \text{ (chlorine)} \end{cases}$$

The natural salt is nearly always impure. It has a hardness of 2.5 and a specific gravity 2.1 - 2.6. It is colourless or white when pure, but often yellowish, or red or purplish, from the presence of metallic oxides or organic matter. It is readily soluble in cold water, and has a saline taste.

With these salts may be associated other soluble salts such as sodium carbonate, and in small quantities, the salts of the calcium, potassium and alum groups.

On account of the nature of the natural alkali deposits and brines of western Canada, it will be necessary in nearly all cases to purify the raw product from such deposits, in order to produce marketable commodities. A pure Glauber's salt can be obtained by evaporating the brines or by dissolving the soluble salts already deposited and separating the sulphate of soda by differential crystallization. To produce salt cake from the hydrous salt it will be necessary to develop processes for eliminating the water of crystallization. Theoretically, this appears easy, but there are a number of practical difficulties in the way of development which have not yet been overcome.

## USES

Sodium sulphate in the anhydrous form is more commonly known by its trade name SALT CAKE. As salt cake, it finds its chief use in the manufacture of sulphate pulp; in metallurgical work in the in the refining of nickel; in the manufacture of window, plate and bottle glass; and in making water glass. In the hydrous form, it is marketed as Glauber's salts, and as such, is used in dyeing; in tanning; in the textile industry as a mordant; and in medicine.

Magnesium Sulphate or Epsom salts is largely used in the cotton trade for warp-sizing; it is also employed for medicinal and agricultural purposes, and in dyeingwith analine colours, since goods thus dyed are found to stand the action of soap better.

Sodium Chloride is the ordinary common salt of commerce, and as such, does not need further mention.

MARKET SITUATION

Sodium Sulphate

So far there has been no steady production of sodium sulphate from the alkali lakes of western Canada. The Salts and Potash Company, Ltd., of Kitchener, Ont., operating Muskiki lake, (Tp. 39, R. 16, W.2nd), Sask., have erected refining plants at their lake and also at Kitchener, Ont., in which they have carried out considerable experimental work and hope shortly to be in a position to place the refined products regularly on the market. The salt cake so far used in the country has been obtained as a by-product from the manufacture of hydrochloric acid. The amount produced by this process in future will necessarily be governed by the market for hydrochloric acid. Glauber's salts are made from the anhydrous form by dissolving the salt cake and recrystallizing below 32.4°C.

Salt cake is manufactured in Canada by the following firms:-

Grasselli Chemical Co., Hamilton, Ont.

Nicholas Chemical Co., Montreal, P. Q.
Plants:- Sulphide, Ont.
Capelton, Ont.

Victoria Chemical Co., Victoria, B. C.

The Canadian production of salt cake and Glauber's salts as furnished by the Dominion Bureau of Statistics for 1918 and 1919 was as follows:-

| | 1918 | | 1919 | |
|---|---|---|---|---|
| | Tons | Value | Tons | Value |
| Salt Cake | 6001 | $133,544 | 3197 | $57,045 |
| Glauber's Salts | 2358 | 60,281 | 1423 | 45,731 |

Canadian Imports of salt cake and Glauber's salts are as follows:-

| Calendar Year | Salt Cake Amt. lbs. | Salt Cake Value $ | Glauber's Salts Amt. lbs. | Glauber's Salts Value $ |
|---|---|---|---|---|
| 1910 | 17,728,543 | 95,054 | 1,080,309 | 5,217 |
| 1911 | 13,782,241 | 88,761 | 1,531,555 | 7,826 |
| 1912 | 19,243,823 | 97,768 | 1,951,619 | 9,129 |
| 1913 | 25,902,190 | 133,030 | 811,053 | 3,815 |
| 1914 | 38,175,604 | 170,333 | 810,062 | 3,407 |
| 1915 | 39,970,231 | 147,047 | 840,994 | 8,058 |
| 1916 | 42,194,077 | 178,370 | 522,703 | 8,133 |
| 1917 | 71,583,645 | 560,711 | 722,913 | 16,248 |
| 1918 | 68,773,441 | 676,571 | 686,712 | 9,748 |
| 1919 | 47,905,004 | 343,007 | 738,423 | 9,763 |

Magnesium Sulphate.

During the year ending March 31st, 1920, there was imported into Canada $67,074 worth of Epsom salts, and in the same period, 1523 cwt., valued at $893 was exported. This export was from the natural deposits of Epsom salts in British Columbia.

MARKET PRICES

The market prices of these commodities are constantly varying. The following figures as reported in the Oil, Paint and Drug Reporter, New York, give the New York market prices for the years 1914 to date.

| | Aug.14 1914 $ | Jan.1 1915 $ | Jan.1 1917 $ | Jan.1 1918 $ | * 1919 $ | * 1920 $ |
|---|---|---|---|---|---|---|
| Salt Cake ground - bbls. per ton. | 11.00 to 13.00 | 11.00 to 13.00 | --- | 30.00 to 35.00 | 12.00 to 30.00 | 17.60 to 60.00 |
| Glauber's Salts. cwt. | 0.65 to 0.75 | 0.60 to 0.75 | 0.60 to 0.65 | 0.90 to 1.00 | 1.00 to 2.25 | 1.15 to 3.00 |
| Epsom Salt U.S.P. cwt. | not quoted prior to 1918. | | | 3.62½ to 3.90 | 2.75 to 3.62½ | 2.50 to 6.00 |
| Epsom Salt tech. cwt. | 1.00 1.10 | 1.75 2.00 | 1.75 1.85 | 3.37½ 3.50 | 1.80 3.37½ | 1.75 3.75 |

* High and low figures for year.