SALINES.

SODIUM SULPHATE IN SODA LAKE, CARRISO PLAIN, SAN LUIS OBISPO COUNTY, CALIFORNIA.

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INTRODUCTION.

The deposits of sodium sulphate described in this paper are found in the lowest portion of the Carriso Plain, which extends along and within the northeast boundary of San Luis Obispo County, Cal. The lake known locally as Soda Lake, or Salt Lake, in the bed of which this salt occurs, lies wholly within T. 31 S., R. 19 E., and T. 31 S., R. 20 E., and is about 12 to 15 miles west-southwest of McKittrick, Kern County, the nearest railroad station. Soda Lake receives the drainage from the Carriso Plain and the adjoining flanks of the bounding ranges, the total catchment basin being somewhat over 525 square miles in extent. The lake has a length of about 5 miles and a maximum width of a little over a mile, and includes an area of nearly 3,000 acres. It remains practically dry except in extraordinarily wet seasons. The region in which the deposits occur is of the arid type characteristic of the intermontane valleys of California away from the coast. The Carriso Plain has a length of about 40 miles and an average width of 12 or 15 miles and extends parallel to the inclosing mountains—the Caliente Range on the southwest and the Temblor Range on the northeast. The lowest point in the plain lies at an elevation of about 1,925 feet above sea level.

Rainfall records for this region are not available, but the precipitation is probably about the same as that of the west side of the San Joaquin Valley—between 5 and 10 inches annually. No axial stream flows through the Carriso Plain, although numerous small gulches and canyons, whose mouths debouch upon the gravelly slopes of its margin, enter from both sides. The nearest running stream in the region is San Juan River, which flows northwestward in a deep gorge parallel to the Carriso Plain but lying outside of its drainage area, in the Caliente Range to the southwest.

OCCURRENCE.

Geologic statement.—The Carriso Plain is a structural depression which has been faulted down between the Caliente and Temblor ranges and has been sufficiently covered by Pleistocene and possibly earlier débris to mask its real character. Faults, some of them very recent geologically, bound the plain along its northeast and southwest margins. The amount of folding and faulting which has taken place in this region is very great. This intense deformation has, in conjunction with denudation, exposed large areas of soft conglomerate, sandstone, and shale, particularly in the adjacent ranges, to the solvent action of rain, and thus through the agency of running water the soluble salts of these rocks have been transferred, in part, to the lowest portion of the plain. There they have been deposited, through evaporation of the solvent, in a series of saline beds, the chief constituent of which is sodium sulphate.

Chemical nature.—A sample of this salt collected at the surface of the lake, just west of the present evaporation plant, which is in sec. 19, T. 31 S., R. 20 E., varies from dull to lustrous pure white in color and, though more or less grainy, may be easily crushed between the fingers. An analysis of the salt, made by George Steiger in the laboratory of the United States Geological Survey, is as follows:

Analysis of salt crust from Soda Lake.

Insoluble	0.40
Al_2O_3	.04
MgO	1.66
CaO	.45
Na_2O	40.50
K_2O	.28
H_2O-, H_2O+	3.65
CO_2	None.
SO_3	46.12
Cl	9.27
	102.37
Less oxygen	2.09
	100.28

The two analyses below were made by Thomas Price & Son, of San Francisco, the first in October, 1904, and the second in November, 1905.

Analysis of sodium sulphate crystals from Soda Lake.

Anhydrous sodium sulphate	42.78
Sodium chloride	.32
Water	56.90
	100.00

Analysis of dried sample crust from top of Soda Lake.

Insoluble matter	0.16
Sodium sulphate	98.65
Sodium chloride	.47
Magnesium sulphate	.43
Loss and undetermined	.29
	100.00

It is stated that tests indicate that the surficial deposit of this salt is from 1 to 6 feet in depth and is underlain by a supersaturated solution of the sulphate and water.

COMMERCIAL DEVELOPMENT.

The deposit offers an almost unlimited supply of the mixed salts and its profitable exploitation is dependent almost entirely on transportation facilities, which at present are inadequate. The developing company owns traction engines with which it expects to haul the product to the most available railroad point, presumably Hazelton, near the terminus of the Sunset branch of the Southern Pacific Railroad, 32 miles to the southeast and 1,200 feet lower than the lake. The McKittrick branch of the same railroad lies only about 15 miles distant, but the Temblor Range, which must be crossed in making the trip, presents a considerable obstacle. With the construction of a contemplated railroad to San Luis Obispo by way of the Carriso Plain the commercial development of this deposit will be greatly assisted.

The exploitation of this deposit has been undertaken by the Carisa Chemical Company, which is incorporated under the laws of California with a capital of $1,000,000. It is stated that about $60,000 has been expended for machinery and other equipment for the extraction of the sodium sulphate, but at the time the plant was visited in September, 1908, operations had been temporarily suspended.

SURVEY PUBLICATIONS ON SALINES, INCLUDING SALT, BORAX, AND SODA.

The more important publications of the United States Geological Survey on the natural lime, sodium, and potassium salts included in this group are those listed below.

These publications, except those to which a price is affixed, may be obtained free by applying to the Director, United States Geological Survey, Washington, D. C. The priced publications may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C.

CAMPBELL, M. R. Reconnaissance of the borax deposits of Death Valley and Mohave Desert. Bulletin No. 200. 23 pp. 1902. 5c.

——— Borax deposits of eastern California. In Bulletin No. 213, pp. 401–405. 1903. 25c.

CHATARD, T. M. Salt-making processes in the United States. In Seventh Ann. Rept., pp. 491–535. 1888.

DARTON, N. H. Zuñi salt deposits, New Mexico. In Bulletin No. 260, pp. 565–566. 1905. 40c.

DAY, W. C. Potassium salts. In Mineral Resources U. S. for 1887, pp. 628–650. 1888.

——— Sodium salts. In Mineral Resources U. S. for 1887, pp. 651–658. 1888.

ECKEL, E. C. Salt and gypsum deposits of southwestern Virginia. In Bulletin No. 213, pp. 406–416. 1903. 25c.

——— Salt industry of Utah and California. In Bulletin No. 225, pp. 488–495. 1904. 35c.

HILGARD, E. W. The salines of Louisiana. In Mineral Resources U. S. for 1882, pp. 554–565. 1883.

KINDLE, E. M. Salt resources of the Watkins Glen district, New York. In Bulletin No. 260, pp. 567–572. 1905. 40c.

PACKARD, R. L. Natural sodium salts. In Mineral Resources U. S. for 1893, pp. 728–738. 1894.

PHALEN, W. C. Salt and bromine. In Mineral Resources U. S. for 1907, pt. 2, pp. 659–672. 1908.

RICHARDSON, G. B. Salt, gypsum, and petroleum in trans-Pecos Texas. In Bulletin No. 260, pp. 573–585. 1905. 40c.

YALE, C. G. Borax. In Mineral Resources U. S. for 1889–1890, pp. 494–506. 1902.

——— Borax. In Mineral Resources U. S. for 1906, pp. 1059–1062. 1907.

——— Borax. In Mineral Resources U. S. for 1907, pt. 2, pp. 631–635. 1908.