

NITER, NEAR MELROSE, MONTANA.

BY R. W. RICHARDS.

Discovery.—At the close of his investigations of phosphates near Melrose, Mont., in 1912, the writer had the opportunity to spend a few hours in examining the niter deposit described in the following brief report. The trip was made with Mr. F. C. Moore, of Melrose, who claims to be the original discoverer. The deposit may not prove

of economic importance; it is interesting, however, in that it affords another example of nitrate deposits in a region having a fairly abundant rainfall.

The deposit occurs along the face of cliffs of black limestone, presumably of Devonian age, on Camp Creek, about $3\frac{1}{2}$ miles northeast of Melrose. (See fig. 43.) The nitrate occurs in little veinlets through the limestone, as a crust on the surface of the rock, in the talus accumulations beneath the ledges and also in small caves. The richest salts are found in the loose rock or talus at the base of ledges where protected from the weather by overhanging ledges. The niter salt consists of a snowy white to slightly yellowish mass of needle-like crystals.

The occurrence is essentially of the cave type described by Gale¹ in his discussion of nitrate deposits. Nests of rats or other animals were noted in the higher portion of the ledges.

Quality.—A series of samples were taken by the writer and analyzed by

R. K. Bailey in the laboratory of the United States Geological Survey. Sample R 430 represents the purest material collected. It consists of a snowy white to slightly yellowish mass of acicular

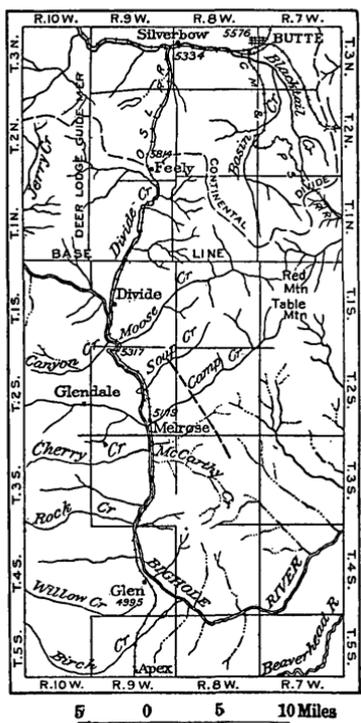


FIGURE 43.—Sketch map showing location of niter deposit near Melrose, Mont. Dashed line indicates approximate position of outcrop of Devonian limestone.

¹ Gale, H. S., Nitrate deposits: Bull. U. S. Geol. Survey No. 523, 1912.

crystals, of which \$6.09 per cent was found soluble in water. This soluble portion of the sample was shown to have the following composition:

Analysis of niter deposit near Molrose, Mont.

CaO.....	4.63
SO ₃	8.19
Cl.....	8.61
N ₂ O ₅	40.05
Na ₂ O.....	16.72
K ₂ O.....	22.05
	99.25

An attempt to express the composition in the form of salts probably present yields:

CaSO ₄	13.94	
Na ₂ SO ₄	3.30	
NaCl.....	20.42	
NaNO ₃	21.77	} 61.25
KNO ₃	39.48	
N ₂ O ₅	1.19	

The excess of nitrogen pentoxide indicated in the second tabulation may be due to inaccuracy caused by applying Gooch and Gruener's iodometric determination to material containing larger quantities of nitrates than this method of analysis is adapted to show.

In the other samples the percentage of water-soluble material and amount of nitrogen pentoxide alone were determined. The latter is equivalent to a little more than half the amount of potassium present if combined in the form of that salt.

Analyses of supposed niter-bearing material.

	R 249.	R 430a.	R 430b.	R 431a.	R 431b.	R 431c.
Inorganic and insoluble.....	96.55	92.74	93.35	98.84	98.62	98.48
Water-soluble (percentage of original sample).....	3.45	7.26	6.55	1.16	1.38	1.52
N ₂ O ₅ (percentage of the water-soluble portion).....	31.22	53.29	38.85	4.99	12.35	18.66

R 249 represents an average sample of a 5-foot face of black limestone.

R 430a represents an average sample of a 1-foot bed of sandy limestone with nitrates visibly included in thin streaks along joints and as crusts on surfaces.

R 430b represents a sample of the same bed, exclusive of all visible joints and surface coatings.

R 431a is a sample of a 10-inch bed of black limestone. The sample was washed in order to remove surficial salts. The remain-

ing water-soluble portion was probably held in small cracks rather than disseminated through the rock.

R 431b is an average sample of the 4-foot face of black limestone, including at its top the 10 inches represented by R 431a.

R 431c is an average of a large sample of the talus at base of the limestone represented by sample R 431b.

Probable origin.—The occurrence of potash and soda-rich nitrates in limestone, where the calcium nitrate would naturally be expected, can not be readily explained from the data in hand. The nitrates contained in these salts may result from the decomposition of the rat or other guano, and the alkalis, potash and soda, may have been derived (1) from ordinary surface or ground water, (2) from solutions which have taken up these elements from igneous rocks, possibly the monzonite mass which is generally thought to underlie the region at depth, or (3) from minute proportions of these elements included in the limestone.

Value and extent.—The value of the deposits can not be safely estimated from the data which have been collected. Further exploration is needed to determine whether or not the potash and soda nitrates are included in the limestone back from the outcrop. General considerations suggest that the successful development of the deposits can be expected only under exceptionally favorable conditions. As the average soluble portion of the samples is only about 1 to 5 per cent, it appears that about 35 tons of rock would have to be treated to obtain 1 ton of the crude salts. This quantity if refined would yield theoretically about 440 pounds of soda niter and about 790 pounds of potash niter, the former being at present worth about \$24 and the latter about \$41, making a gross yield of about \$1.80 per ton of rock treated. It is not, however, practical to estimate a theoretical total extraction, either of all the salts present in the rock or of the nitrate portion to be refined from the crude salts. Better returns might be obtained by treating the loose rock fragments which lie at the base of the cliffs, but such material is very meager in amount.

The location of the limestone belt east of Melrose, in which the niter occurs, is shown on the sketch map (fig. 43). Other areas of the same limestone are known in western Montana, but so far as known niter has not been reported from them.

The Devonian limestone that is known to be locally associated with nitrate deposits may be distinguished from the other limestones of the region that are not yet known to be so associated by its darker color. The other limestones are mainly light bluish gray and brown.

Suggestions for prospecting.—Interest in the better understanding of the actual nature of these deposits, as well as the hope of developing something of value, may lead to a more thorough prospecting of

similar rocks in the surrounding area. In this work special attention may be given to the outcrops of limestones and particularly to such mine workings as have recently penetrated the limestones at a distance from the outcrop, so that samples may be obtained which represent the average content of the rock at depth and not the surface enrichment.

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.

- ARNOLD, RALPH, and JOHNSON, H. R., Sodium sulphate in Soda Lake, Carriso Plain, San Luis Obispo County, Cal.: Bull. 380, 1909, pp. 369-371. 40c.
- BREGER, C. L., The salt resources of the Idaho-Wyoming border, with notes on the geology: Bull. 430, 1910, pp. 555-569.
- CAMPBELL, M. R., Reconnaissance of the borax deposits of Death Valley and Mohave Desert: Bull. 200, 1902, 23 pp. 5c.
- Borax deposits of eastern California: Bull. 213, 1903, pp. 401-405. 25c.
- CHATARD, T. M., Salt-making processes in the United States: Seventh Ann. Rept., 1888, pp. 491-535. \$2.
- DARTON, N. H., Zuni salt deposits, New Mexico: Bull. 260, 1905, pp. 565-566. Exhausted.
- DOLE, R. B., Exploration of salines in Silver Peak Marsh, Nevada: Bull. 530, 1913, pp. 330-345.
- ECKEL, E. C., Salt and gypsum deposits of southwestern Virginia: Bull. 213, 1903, pp. 406-416. 25c.
- Salt industry of Utah and California: Bull. 225, 1904, pp. 488-495. 35c.
- GALE, H. S., Nitrate deposits: Bull. 523, 1912, 36 pp.
- Borax in 1912: Mineral Resources U. S. for 1912, 1913.
- The search for potash salts in the desert basin region: Bull. 530, 1913, pp. 295-312.
- HAYES, C. W., The Gila River alum deposits: Bull. 315, 1907, pp. 215-223. 50c.
- KINDLE, E. M., Salt resources of the Watkins Glen district, New York: Bull. 260, 1905, pp. 567-572. Exhausted.
- PACKARD, R. L., Natural sodium salts: Mineral Resources U. S. for 1893, 1894, pp. 728-738. 50c.
- PHALEN, W. C., Salt and bromine in 1912: Mineral Resources U. S. for 1912, 1913.
- Potash salts, their uses and occurrence in the United States: Mineral Resources U. S. for 1910, pt. 2, 1911, pp. 747-767.
- Potash salts, summary for 1912: Mineral Resources U. S. for 1912, 1913.
- The occurrence of potash salts in the bitters of the eastern United States: Bull. 530, 1913, pp. 313-329.

RICHARDSON, G. B., Salt, gypsum, and petroleum in trans-Pecos Texas: Bull. 260, 1905, pp. 573-585. Exhausted.

SCHULTZ, A. R., Deposits of sodium salts in Wyoming: Bull. 430, 1910, pp. 570-588.

SCHULTZ, A. R., and CROSS, WHITMAN, Potash-bearing rocks of the Leucite Hills, Sweetwater County, Wyo.: Bull. 512, 1912, 39 pp.

YALE, C. G., and GALE, H. S., Borax in 1912: Mineral Resources U. S. for 1912, 1913.

