POTASH OCCURRENCES IN THE UNITED STATES

By
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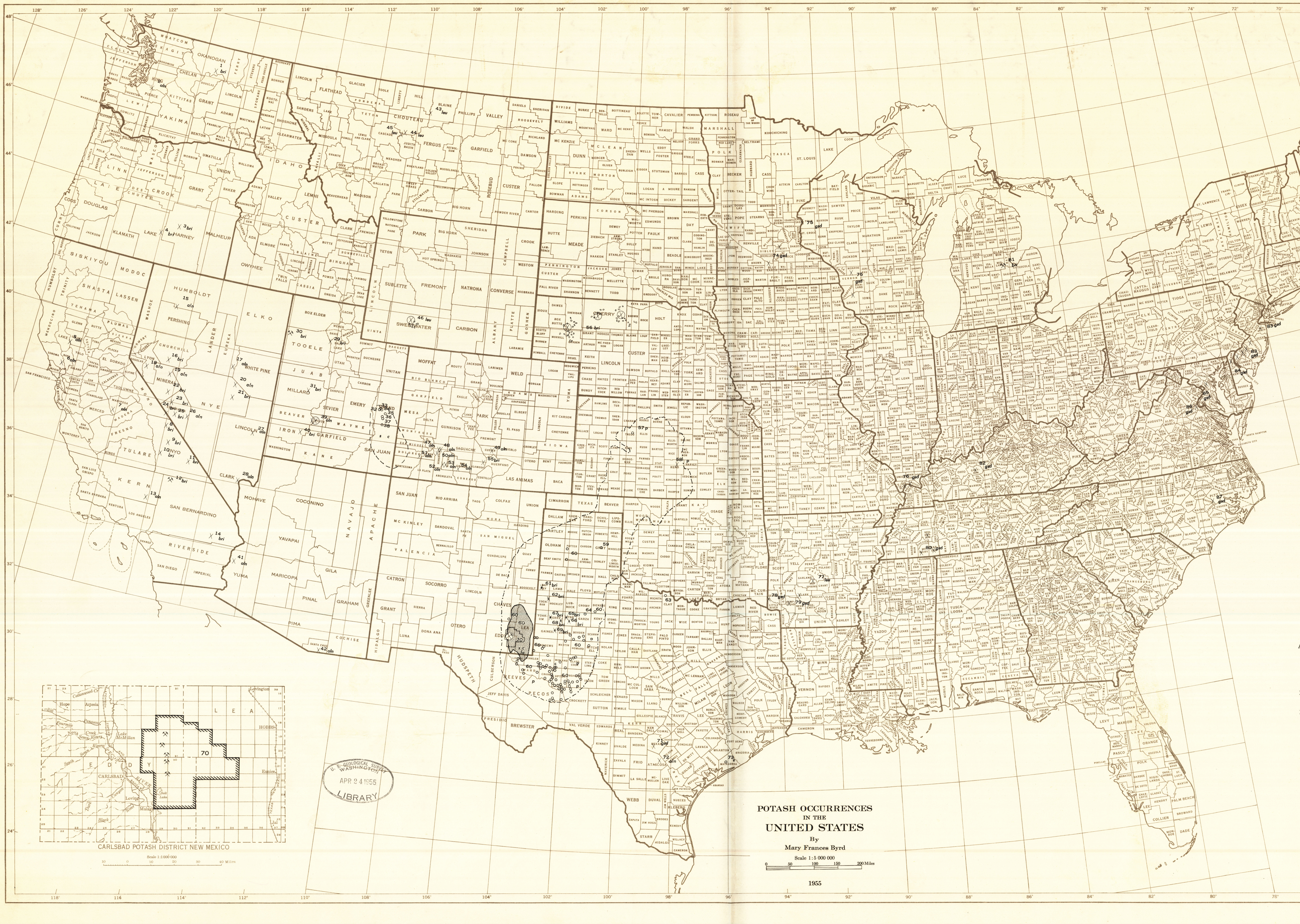

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SUMMARY

Potassium is not found free in nature. It occurs in soluble and insoluble potassium compounds in rocks, brines, and in the waters of lakes, rivers, and the ocean. Because it constitutes one of the major nutrients essential to most plant growth, potassium is an important component of fertilizers. It also has minor uses in chemical and processing industries. The term "potash" originally referred to a crude product obtained by leaching wood ash but now applies to the unit K_2O, which serves as a common denominator for comparing the potassium content of various compounds.

The American colonists obtained their potash from wood ash. Production from this source reached its peak in 1825 (Smith, 1949, p. 684) and continued to supply domestic needs until shortly after the Civil War. After the Civil War, production declined rapidly because of the depletion of forests and because of the effect of German potash on the world market.

Before World War I, the United States was largely dependent upon Germany for potash. When this source was cut off at the outbreak of the war, governmental agencies and private industry investigated many potential sources for the recovery of potash. During the war years it was recovered from brines, alunite, greensands, leucite-bearing rocks, kelp, molasses distillery wastes, cement and blast-furnace dust, beet-sugar water, and wool washings. At the close of the war the United States again began importing potash. The brine operation at Searles Lake, Calif., is one of the wartime potash industries that did not close after World War I. Nevertheless, exploration and investigation of potash deposits in this country were continued, much attention being given the enormous deposits of salt and anhydrite in the Permian basin. This salt basin underlies parts of Colorado, Kansas, Oklahoma, Texas, and New Mexico. Geologists recognized the possibility of the presence of buried soluble potash deposits in the Permian basin as early as 1910 (Phalen, 1911, p. 765). In 1912 potassium was found in brine taken from a well in Dickens County, Tex. The first potassium mineral was identified in 1921, when polyhalite was found in drill cuttings from an oil well drilled near Midland, Tex.; and in 1925, sylvite was identified in drill cuttings from an oil test well drilled about 20 miles east of Carlsbad, N. Mex. Exploration and drilling during the period 1925-1935 revealed important quantities of sylvite, langbeinite, and carnallite (potassium minerals) in the salt deposits on the western flank of the basin, beneath an area of approximately 3000 square miles in southeastern New Mexico and the adjoining part of Texas (Smith, 1949, p. 688). Polyhalite, a less soluble potash mineral, was found at depth in the southern part of the Permian basin in an area of about 40,000 square miles (Mansfield and Lang, 1929, p. 241). The rich potash beds east of Carlsbad, N. Mex., constitute the most important potash resource in the United States, and current operations in this area account for almost 90 percent of our total domestic production of potash salts (Ruhlman and Tucker, 1954, p. 3). Sylvite (KCl) is the only potassium mineral that is mined in the New Mexico area other than langbeinite ($K_2SO_4 \cdot 2MgSO_4$), which is produced at one mine. Potash also is extracted from the brines of Searles Lake in San Bernardino County, Calif.; Salduro Marsh, near Wendover, in Tooele County, Utah; and at Midland, in Midland County, Mich. Searles Lake is in reality a dry lake in a desert basin and consists for the most part of a porous crystalline salt body saturated with brine. This dry lake, or salt flat, covers an area of approximately 12 square miles. Searles Lake is the second largest potash-producing area in the United States. Salduro Marsh, about 110 miles west of Salt Lake City, covers an area of about 125 square miles. During the winter, brine covers the area and in the following summer a surface layer of salt, about 3 feet thick, is formed (Gale, 1917, p. 98-100). The mud stratum below this layer also is impregnated with brine, consisting primarily of sodium, potassium, and magnesium chlorides (Nolan, 1927, p. 35-39). At Midland, Mich., potassium chloride is produced from natural brine wells. A minor amount of potash is obtained as a byproduct from cement-kiln flue dust at Security, Md., and at Davenport, Calif. (Ruhlman and Tucker, 1954, p. 3). Greensand deposits on the eastern coast have been used locally as a fertilizer material for many years. Greensand is also produced by open-pit operations in Burlington and Gloucester Counties, N. J., for use in water softening and purification (Arundale and North, 1954, p. 1).

The United States is now self-sufficient in potash. Economic reserves in this country are contained in the following types of deposits: (1) highly soluble potash salts of not less than 14 percent K_2O in buried saline deposits with a minimum thickness of 4 feet; and (2) natural brines containing an average of 2.5 percent K_2O. Economic reserves in these two types total more than a quarter of a billion tons of K_2O (Jones and Waggaman, 1952, p. 157). Marginal reserves include thinner strata of soluble potash salts and some beds of highly soluble potash salts containing less than 14 percent K_2O. These reserves total more than a billion tons of K_2O and could be exploited after further developments in mining and technologic processes, or under better economic conditions. Deposits of polyhalite belong to the lower level of marginal sources (Jones and Waggaman, 1952, p. 157). Additional enormous supplies of other present noneconomic sources of potash also are available at higher costs of production. Both known and potential sources of potash in the United States are extensive, and early depletion of resources is unlikely. At present, the United States imports and exports potash, but the imports are essentially the result of local market adjustment for specific types of potassium compounds.

SCOPE OF MAP

The purpose of this map is to summarize the potash occurrences in the United States that have been most commonly referred to in the literature, regardless of their economic importance. The map includes not only potash deposits of commercial importance, but also occurrences that are not now economic and may or may not be in the future. As much of the potash occurs in materials of no present economic value, these deposits probably will not be explored unless present commercial sources of potash are depleted. Numerous surface brine localities have been discussed in the literature in relation to their possible potash value; most of the brines are low in potash content. In this general survey, it has been necessary to include only those localities where the brine comprises approximately 1 percent or more of K_2O (dissolved salts in brine). Moreover, the small amount of all dissolved salts in many of the brines causes the potash content in the total brine to be much lower. The present economic reserves of potash are contained in natural brines having an average of 2.5 percent K_2O (Jones and Waggaman, 1952, p. 157). Potash also is present in small amounts in natural brines found at depth in some of the eastern States, principally Michigan, New York, West Virginia, and Ohio. To date, the only commercial recovery of potash from this source is the brine operation at Midland, Mich., where potassium chloride is recovered as a coproduct along with calcium, magnesium, and sodium chlorides, and bromine (Harley, 1953, p. 316). Any future use of these natural brines as a source of potash will be governed by the establishment of a basic salt operation, where the potash would be one of several products recovered from the brine. This also appears to be true for the brines occurring in the western United States. Some of the wells in Texas and New Mexico have given only showings of potash in the cuttings; however, they do indicate possible potash areas.

Other sources of potash covered in the literature have been considered and noted on the map, with the exception of the potash feldspars, potassium-bearing micas, and the potassium nitrate deposits. Only those greensands mentioned in the literature as being possible commercial sources of K_2O have been shown. Rocks containing potash feldspars and micas are very widely distributed and therefore have not been shown. These include, in part, pegmatite, granite, various shales, slate, and schist mentioned in the literature for their possible potash value.

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LOCALITY—REFERENCE KEY

Each locality number on the map has one or more corresponding bibliographic reference numbers, as listed in the key below. The references so listed contain information on that particular potash locality.

Map no.	Locality	Reference no.
1	Okanogan County, Wash.	54.
2	Enumclaw, King County, Wash.	52, p. 35.
3	Stinking Lake, Harney County, Oreg.	21, p. 426.
4	Little Alkali Lake, Lake County, Oreg.	20, p. 83.
5	Sulphur Creek, Colusa County, Calif.	6, p. 237.
6	Near Glen Ellen, Sonoma County, Calif.	6, p. 237.
7	Tres Carritos, Mariposa County, Calif.	52, p. 12.
8	Deep Springs Valley, Inyo County, Calif.	21, p. 417.
9	Saline Valley, Inyo County, Calif.	18, p. 416-421.
10	Owens Lake, Inyo County, Calif.	13, p. 8; 19, p. 251-323.
11	Death Valley, Inyo County, Calif.	18, p. 407-415.
12	Searles Lake, San Bernardino County, Calif.	19, p. 251-323; 23, p. 287-322.
13	Middle Buttes, Kern County, Calif.	6, p. 237.
14	Cadiz Lake, San Bernardino County, Calif.	21, p. 418.
15	Sulphur, Humboldt County, Nev.	8, p. 159-163; 52, p. 17-18.
16	Fourmile Flat, Churchill County, Nev.	22, p. 462-463.
17	Eureka County, Nev.	17, p. 2.
18	Lyon County, Nev.	17, p. 2.
19	Bovard, Mineral County, Nev.	46, p. 351-356.
20	Nye County, Nev.	17, p. 2.
21	Butterfield Marsh, Nye County, Nev.	22, p. 457-462.
22	Mineral County, Nev.	54.
23	Columbus Marsh, Esmeralda County, Nev.	18, p. 422-427.
24	Fish Lake Valley, Esmeralda County, Nev.	21, p. 422.
25	Silver Peak Marsh, Esmeralda County, Nev.	12, p. 330-345.
26	Goldfield district, Esmeralda County, Nev.	42, p. 129-133.
27	Near Boyd, Lincoln County, Nev.	25, p. 145-146; 52, p. 18-19.
28	Railroad Pass district, Clark County, Nev.	25, p. 144-145; 52, p. 15.
29	Great Salt Lake, Utah.	20, p. 95.
30	Great Salt Lake Desert, Tooele County, Utah.	23, p. 287-322; 38, p. 25-44; 44, p. 3.
31	Hawley Salt Marsh, Millard County, Utah.	20, p. 107.
32	Defense Plant well, Crescent Eagle area, Grand County, Utah; and Thompson Magnesium well, Grand County, Utah.	15, p. 2-4; 49, p. 17-21.
33	Crescent Eagle well, Crescent Eagle area, Grand County, Utah.	15, p. 2-4.
34	Brendel well, Crescent Eagle area, Grand County, Utah.	15, p. 2-4.
35	King No. 1 well, Salt Valley area, Grand County, Utah.	15, p. 2-4.
36	Grand County, Utah.	54.
37	Columbia Crude Corp. well, Seven Mile area, Grand County, Utah.	15, p. 5-6.
38	Cane Creek area, Grand County, Utah.	15, p. 6.
39	Marysvale region, Beaver and Piute Counties, Utah.	7, p. 91-134; 33, p. 237-270.
40	Little Salt Lake, Iron County, Utah.	20, p. 106.
41	Sugarloaf Butte, Yuma County, Ariz.	24, p. 138-139.
42	Near Patagonia, Santa Cruz County, Ariz.	46.
43	Bearpaw Mountains, Mont.	57, p. 143-148.
44	East Peak stock, Highwood Mountains, Chouteau County, Mont.	32, p. 837-849; 41, p. 168.
45	Saddle between Highwood and Pinewood peaks, Cascade County, Mont.	41, p. 168.
46	Leucite Hills, Sweetwater County, Wyo.	48.
47	Red Mountain, Hinsdale County, Colo.	31, p. 181-182.
48	Slumgullion Gulch, Hinsdale County, Colo.	31, p. 181.
49	Rosita Hills, Custer County, Colo.	9, p. 38-41.
50	Carson, Hinsdale County, Colo.	31, p. 181.
51	Rico Mountains, Dolores County, Colo.	10, p. 92-94.
52	Head of west branch of Middle Fork of Piedra River, Mineral County, Colo.	31, p. 180.
53	Head of South River, Mineral County, Colo.	31, p. 180-181.
54	Rio Grande County, Colo.	54.
55	Soda Lake, San Luis Valley, Alamosa and Saguache Counties, Colo.	20, p. 105.
56	Northwestern Nebraska.	26, p. 125-139; 43.
57	Central Commercial Oil Co. well, 4 miles south of Riga, Trago County, Kans.	56.
58	Reno County, Kans.	45, p. 193-218; 51, p. 364-370.
59	Gray County, Tex.	54.
60	New Mexico and Texas potash field.	30, p. 32-38; 36, p. 655, 657, 694-832.
61	Coyote Lake, Bailey County, Tex.	37, p. 29-31.
62	Silver Lake, Cochran and Hockley Counties, Tex.	37, p. 26-28.
63	Clay County, Tex.	54.
64	Garza County, Tex.	54.
65	Double Lake No. 1 and No. 2, Lynn County, Tex.	37, p. 18-26.
66	Guthrie Lake, Lynn County, Tex.	55.
67	Rich Lake, Terry County, Tex.	55.
68	Mound Lake, border of Lynn and Terry Counties, Tex.	55.
69	Cedar Lake, Gaines County, Tex.	55.
70	Carlsbad potash district, N. Mex.	14, p. 909-923; 27.
71	Bexar County, Tex.	29, p. 1.
72	Atascosa County, Tex.	5, p. 225.
73	Markham, Matagorda County, Tex.	11, p. 348; 30, p. 29-43; 36, p. 655, 657, 694-832.
74	Southern Minnesota.	16, p. 132.
75	Wisconsin greensands.	53.
76	Pulaski and Massac Counties, Ill.	47, p. 435.
77	Magnet Cove district, Hot Spring County, Ark.	1, p. 90.
78	Near Morris Ferry, Little River County, Ark.	4, p. 61.
79	Sec. 15, T. 8 S., R. 22 W., Clark County, Ark.; and near Washington, Hempstead County, Ark.	3, p. 46-47; 4, p. 61.
80	Henderson, McNairy, and Hardin Counties, Tenn.	3, p. 46; 40, p. 903.
81	Midland County, Mich.	23, p. 287-322; 44, p. 3.
82	Near Leitchfield, Grayson County, Ky.	40, p. 902.
83	Greensand beds in New Jersey	3, p. 37-40; 34.
84	New Castle County, Del.	3, p. 40-43.
85	Anne Arundel and Prince Georges Counties, Md.	3, p. 43.
86	Stafford County, Va.	3, p. 44-45.
87	Near Grifton, Pitt County, N. C.	3, p. 45-46.

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