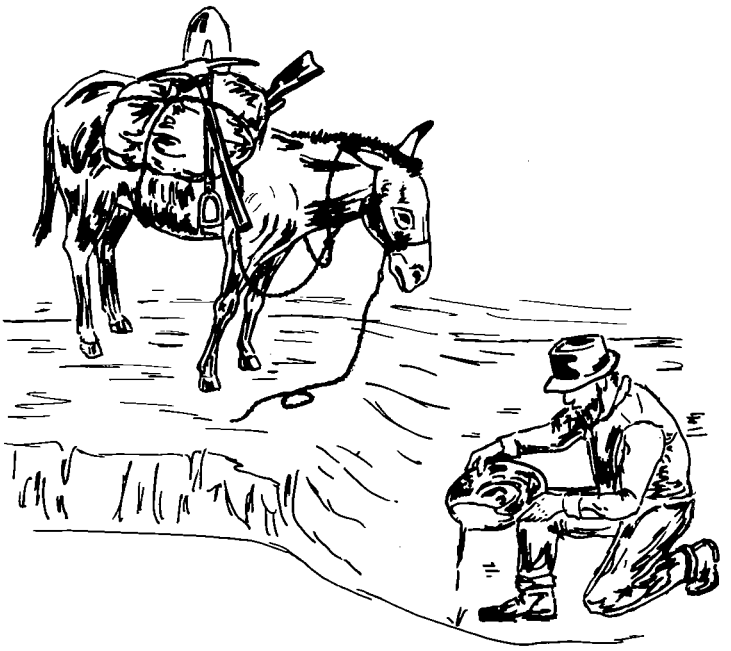
STATE OF SOUTH DAKOTA
Nils Boe, Governor

MINERALS REPORT 12

the MINERAL INDUSTRY *of* SOUTH DAKOTA *in 1964*



by R. B. Stotelmeyer, C. A. Koch,
and Duncan J. McGregor

South Dakota Geological Survey
Vermillion, South Dakota
January 1, 1966

The Mineral Industry of South Dakota

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the South Dakota State Geological Survey for collecting information on all minerals except fuels.

By R. B. Stotelmeyer,[1] C. A. Koch,[2] and Duncan J. McGregor [3]

MINERAL production in South Dakota for 1964 was valued at $53 million. Metals as a group increased 5 percent and fuels 14 percent in value of production; nonmetals declined 8 percent, or more than $2 million. The first production of molybdenum in South Dakota, as a byproduct in processing uranium-bearing lignite ash, was reported in 1963; however, no shipments were made until 1964. For the 16th consecutive year, the State was the leading gold producer in the Nation.

TABLE 1.—Mineral production in South Dakota [1]

Mineral	1963		1964	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement—thousand 376-pound barrels	1,914	$6,107	2,044	$7,073
Clays—thousand short tons	r 240	r 960	245	1,076
Coal (lignite)—do	16	62	13	63
Copper (recoverable content of ores, etc.)—short tons	1	(2)		
Feldspar—long tons	25,590	157	26,980	180
Gem stones	(3)	20	(3)	20
Gold (recoverable content of ores, etc.)—troy ounces	576,726	20,185	616,913	21,592
Gypsum—thousand short tons	24	97	19	76
Lead (recoverable content of ores, etc.)—short tons	4	1		
Mica: Scrap—do	W	W	996	32
Sheet—pounds	10,000	(2)		
Petroleum (crude)—thousand 42-gallon barrels	215	428	247	495
Sand and gravel—thousand short tons	20,806	16,313	13,770	13,641
Silver (recoverable content of ores, etc.) thousand troy ounces	117	150	133	172
Stone—thousand short tons	2,794	7,339	2,118	6,245
Uranium ore—short tons	72,088	1,931	110,147	1,551
Value of items that cannot be disclosed: Beryllium concentrate, lime, lithium minerals, molybdenum (1964), vanadium, and values indicated by symbol W	XX	r 366	XX	608
Total	XX	r 54,116	XX	52,824

r Revised. W Withheld to avoid disclosing individual company confidential data. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Less than $500.

[3] Weight not recorded.

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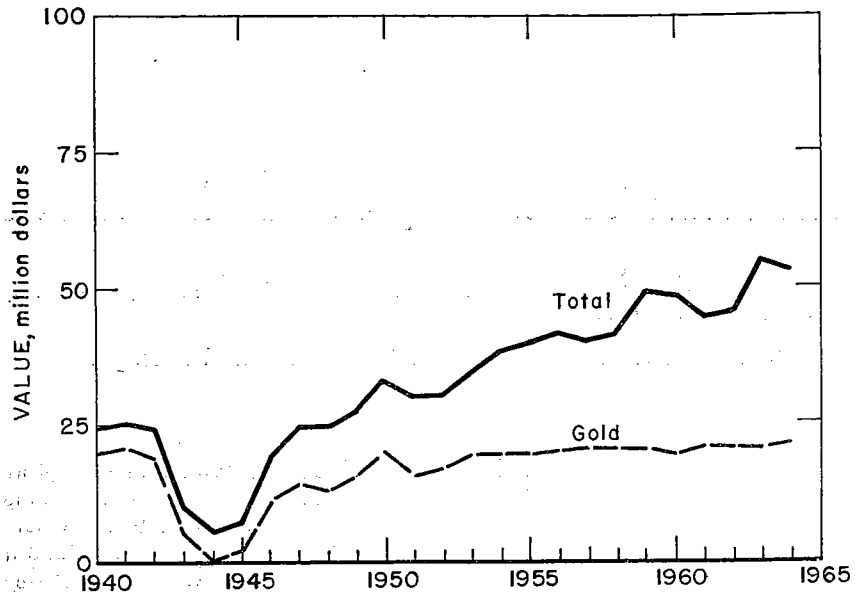

FIGURE 1.—Value of gold and total value of mineral production in South Dakota.

TABLE 2.—Value of mineral production in constant 1957–59 dollars

(Thousands)

Year	Value	Year	Value
1953	$35,157	1959	$48,009
1954	38,970	1960	46,638
1955	41,387	1961	r 43,785
1956	41,836	1962	r 44,387
1957	40,241	1963	r 51,285
1958	41,733	1964	49,482

r Revised.

Employment and Injuries.—Final statistics for 1963 of employment and injuries in the mineral industries, excluding the petroleum industry, and preliminary data for 1964, compiled by the Bureau of Mines, are given in table 3.

Government Programs.—The Federal Bureau of Mines was engaged in studies to determine whether lignite coal from extensive deposits in the State could be used successfully as a soil conditioner and fertilizer. An investigation of iron occurrences was completed. Other projects under way included a study of the petroleum and natural gas resources in the State and a mineral industry survey of the State.

At Sioux Falls, the Pathfinder atomic reactor operated by Northern States Power Co. achieved criticality in the boiler region on March 24. Loading of the boiler core was completed in September, superheater fuel was loaded during November.

The 1964 South Dakota Legislature voted a reduction in the State severance tax from 2.5 to 1 percent.

TABLE 3.—Employment and injury experience in the mineral industries

Year and industry	Men working daily	Man-days worked (thousands)	Man-hours worked (thousands)	Injuries		Injuries per million man-hours
				Fatal	Nonfatal	
1963:						
Coal	8	1	11		1	89
Metal	2,088	612	4,894	3	72	15
Nonmetal	177	39	325		10	31
Sand and gravel	1,615	283	2,321		41	18
Stone	593	134	1,087		30	28
Total	4,481	1,069	8,638	3	154	18
1964: p						
Coal	8	1	11		1	91
Metal	2,085	624	5,000	1	73	15
Nonmetal	235	57	469		8	17
Sand and gravel	1,070	187	1,536		42	27
Stone	725	160	1,317		32	24
Total	4,123	1,029	8,333	1	156	19

p Preliminary.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Shipments of cement from the State-owned plant at Rapid City consisted of approximately 2 million barrels of portland cement and 43,000 barrels of masonry cement. The average price of portland cement in 1964 was $3.43 per barrel, compared with $3.16 in 1963; the price of masonry cement increased from $4.43 to $4.70 per barrel. Out-of-State shipments were made to Iowa, Minnesota, Montana, Nebraska, North Dakota, and Wyoming.

Cement-plant profits of $2.5 million were allocated to the State general fund, $500,000 to the State highway fund, and $500,000 allocated to counties and cities according to a formula established by the State Legislature in 1963. One-third of the $500,000 was distributed in equal shares to all counties. The remaining two-thirds was allocated to counties and cities, on the basis of assessed valuation.

Clays.—Bentonite was mined on State-owned land west of Belle Fourche and processed for use mainly as a refractory in foundries and in preparing well-drilling muds; bentonite also was used in adhesives, animal feed, briquette binding, enameling, filters, insecticides, manufacturing paper, plaster, and reservoir sealants. Processing plants continued to be supplied with crude material from deposits in Wyoming.

Miscellaneous clay was mined near Belle Fourche and was used for manufacturing building brick; shale produced near Rapid City was used as a raw material for cement and in manufacturing lightweight aggregate.

Feldspar.—Output of feldspar increased 5 percent over that of 1963, although five fewer mines were operated. There were 17 mines in Custer County and 7 in Pennington County. Most of the feldspar, purchased by International Minerals & Chemical Corp. (IMC), was

ground at the company plant near Custer for shipment to out-of-State markets. The feldspar section of the Northwest Beryllium Co. plant, at Keystone, was destroyed by fire on March 30. The section was rebuilt and the entire plant was enlarged.

The ground feldspar was shipped to manufacturers of brick and tile, enamel, glass, porcelain, and pottery in Canada and Mexico in addition to domestic consumers.

Gypsum.—Gypsum, used as a retarder in portland cement, was mined by the South Dakota Cement Commission from deposits in Pennington County.

Lime.—Late in 1964, Pete Lien & Sons began lime production at a new $500,000 plant situated at the company-owned limestone quarry near Rapid City. The quantity produced was four times that originally projected. The company planned to market its product in western North Dakota and Nebraska, eastern Wyoming and Montana, and all of South Dakota. Much of the lime was used for soil stabilization in highway construction.

Production of metallurgical lime was continued by Black Hills Lime Co. at Pringle, in Custer County. Utah-Idaho Sugar Co. produced lime for use in manufacturing beet sugar at its Belle Fourche plant. Late in the year, the company announced that the plant, which was opened in 1927, was to be closed permanently.

Lithium.—Production of lithium (hand-sorted amblygonite) was recorded at the Hugo mine, operated by L. W. Judson, and at the Ingersoll mine, operated by Keystone Chemical Corp. Both mines are near Keystone, in Pennington County. Only two other States, California and North Carolina, reported lithium production.

Mica.—Scrap mica was produced at the Ingersoll mine of Keystone Chemical Co. and at the Peerless mine of Northwest Beryllium Co. Both mines are near Keystone. The mica was sold to manufacturers of paint and roofing materials.

No production of sheet mica was reported, thus ending 12 consecutive years of production.

Sand and Gravel.—Production of sand and gravel was reported in 63 of the 67 counties: Jackson, Jones, Stanley, and Ziebach Counties had no production. Large production was reported for those counties where major road construction was under way.

There were 109 commercial operations in 39 counties and 261 Government-and-contractor operations in 61 counties. Seven of the commercial operators reported production of over 100,000 tons of sand and gravel.

Ten million tons of gravel and 3 million tons of sand—94 percent of the output—was used for paving. The remainder was used mostly in building construction and as fill and railroad ballast. Of the total production, 97 percent was processed by being washed, sized, or otherwise prepared. Except for 164,000 tons moved by rail, all sand and gravel was transported by truck.

The State Highway Commission awarded 177 construction contracts totaling $34 million. There was 925.6 miles of Federal-Aid projects: 65.2 miles in the National System of Interstate and Defense Highways and 860.4 miles in the Federal-Aid Primary and Secondary Highway Systems (ABC programs). As of December 31, 1964, 311.9 miles or 46 percent of the designated 679.2 miles of the interstate

TABLE 4.—Sand and gravel sold or used by producers, by classes of operations and uses

(Thousand short tons and thousand dollars)

Class of operation and use	1963		1964	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Construction:				
Building	598	$597	381	$395
Paving	317	304	301	293
Railroad ballast	W	W		
Fill	44	29	20	16
Industrial:				
Other	3	2	35	35
Total	962	932	737	739
Gravel:				
Construction:				
Building	390	421	276	354
Paving	1,898	1,813	1,468	1,326
Railroad ballast	52	40	24	21
Fill	58	34	54	34
Miscellaneous	139	79		
Total	2,537	2,387	1,822	1,735
Total sand and gravel	3,499	3,319	2,559	2,474
Government-and-contractor operations:				
Sand:				
Building			12	12
Paving	1,352	1,294	2,423	2,423
Total	1,352	1,294	2,435	2,435
Gravel:				
Building	9	9	46	46
Paving	15,944	11,689	8,730	8,686
Fill	2	2		
Total	15,955	11,700	8,776	8,732
Total sand and gravel	17,307	12,994	11,211	11,167
All operations:				
Sand	2,314	2,226	3,172	3,174
Gravel	18,492	14,087	10,598	10,467
Total	20,806	16,313	13,770	13,641

W Withheld to avoid disclosing individual company confidential data; included with "Fill."

system was open to traffic; in addition, engineering planning and right-of-way acquisitions were under way on 302.1 miles and 65.2 miles was under construction. South Dakota was one of nine States where work was either in progress or completed on 100 percent of the designated interstate mileage.[4]

Planned State highway department contracts for 1965 totaled $55.3 million, compared with $34 million in 1964[5] and $60.4 million in 1963.

Stone.—Granite, all mined at seven quarries in Grant County, accounted for 45 percent of the value of stone produced. Most of the granite was finished at plants in Minnesota for use in building construction and as monumental stone. Crushed and broken limestone was mined in Custer, Fall River, Lawrence, and Pennington Counties

[4] Bureau of Public Roads. Quarterly Report on the Federal-Aid Highway Program, Dec. 31, 1964. Press Release BPR 65–10, Feb. 11, 1965.
[5] Engineering News-Record. State Highway Contract Awards Jump to a Record High. V. 174, No. 12, Mar. 25, 1965, pp. 30–32.

for asphalt filler, in manufacturing cement and lime, as railroad ballast and riprap, and in road construction. Noncommercial uses were by the U.S. Army Corps of Engineers, the Federal Bureau of Reclamation, the Federal Forest Service, and the South Dakota and Wyoming State Highway Departments. Crushed and broken sandstone was produced in Hanson, Minnehaha, Pennington, and Tripp Counties for concrete and road aggregates, filters, railroad ballast, refractory stone, riprap, and roofing granules.

TABLE 5.—Sand and gravel production in 1964, by counties

(Thousand short tons and thousand dollars)

County	Quantity	Value	County	Quantity	Value
Aurora	205	$205	Hyde	198	$198
Beadle	404	404	Jerauld	89	89
Bennett	187	187	Kingsbury	174	174
Bon Homme	191	191	Lake	171	172
Brookings	233	247	Lawrence	307	307
Brown	579	580	Lincoln	161	160
Brule	1,036	1,036	Lyman	151	151
Buffalo	117	116	Marshall	232	228
Butte	59	83	McCook	138	138
Campbell	3	2	McPherson	114	114
Charles Mix	533	533	Meade	315	310
Clark	229	220	Mellette	15	15
Clay	76	75	Miner	105	105
Codington	135	124	Minnehaha	1,206	1,181
Corson	450	450	Moody	609	615
Custer	82	82	Pennington	434	459
Davison	93	93	Perkins	189	200
Day	329	328	Potter	116	116
Deuel	69	70	Roberts	399	391
Dewey	99	99	Sanborn	45	50
Douglas	231	237	Shannon	37	37
Edmunds	412	414	Spink	269	269
Fall River	97	103	Sully	47	47
Faulk	89	89	Todd	78	78
Grant	56	56	Tripp	84	52
Gregory	84	75	Turner	422	418
Haakon	50	50	Union	95	95
Hamlin	12	13	Walworth	270	150
Hand	25	25	Washabaugh	74	74
Hanson	48	48	Yankton	181	181
Harding	390	390			
Hughes	89	89	Total	13,770	13,641
Hutchinson	353	353			

TABLE 6.—Stone sold or used by producers, by kinds

Year	Granite		Limestone		Sandstone [1]	
	Short tons	Value	Short tons	Value	Short tons	Value
1960	17,915	$3,002,488	1,578,618	$2,501,216	1,031,524	$1,855,179
1961	26,476	2,823,441	1,378,062	1,939,293	984,512	1,493,464
1962	25,923	2,442,181	1,572,300	2,184,374	1,119,655	1,779,639
1963	24,630	2,761,546	1,652,571	2,427,016	1,033,749	2,070,837
1964	17,803	2,807,851	1,179,551	1,734,812	920,361	1,702,349

Year	Other stone		Total	
	Short tons	Value	Short tons	Value
1960	520,945	$550,469	3,149,002	$7,909,352
1961	417,391	385,953	2,806,441	6,642,151
1962	[2] 134,056	[2] 126,373	2,851,934	6,532,567
1963	82,618	79,310	2,793,568	7,338,709
1964			2,117,715	6,245,012

[1] Includes quartz and quartzite.
[2] Includes slate.

TABLE 7.—Stone sold or used by producers, by uses

Use	1963		1964	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and rubble, short tons	W	W		
Rough architectural, cubic feet	W	W	4,000	$15,810
Dressed architectural, do.	22,518	$167,714	16,410	110,136
Rough monumental, do.	W	W	23,000	77,190
Dressed monumental, do.	170,511	2,482,407	176,382	2,604,715
Flagging, do.	W	W		
Other, do.	71,900	134,652		
Total (approximate, in short tons)	25,430	2,784,773	17,803	2,807,851
Crushed and broken stone:				
Riprap, short tons	184,140	238,984	258,242	529,044
Railroad ballast, do.	W	W	220,958	330,974
Concrete and roadstone, do.	1,929,070	3,325,693	1,108,020	1,778,340
Cement, do.	416,642	624,963	W	W
Other, do.	[1] 238,286	[1] 364,296	[2] 512,692	[2] 798,803
Total, do.	2,768,138	4,553,936	2,099,912	3,437,161
Total stone (approximate, in short tons)	2,793,568	7,338,709	2,117,715	6,245,012

W Withheld to avoid disclosing individual company confidential data; included with "Other."
[1] Includes stone used in asphalt, filler, lightweight aggregate, lime, and refractory.
[2] Includes stone used in asphalt filler, filter, lime, refractory, and roofing granules.

METALS

Beryllium.—Production of beryl increased substantially. Beryllium concentrate (beryl) production was purchased by Beryl Ores Co., Golden, Colo., from independent producers including Keystone Chemical Co., operator of the Ingersoll mine, in Pennington County.

Copper.—No production of copper was reported in 1964; a small amount had been produced in Pennington County in 1963.

Gold and Silver.—Gold production increased 7 percent and silver 14 percent. Except for a small amount of gold recovered from a placer operation in Pennington County, all of the gold and silver was produced by Homestake Mining Co. at its Homestake mine at Lead, Lawrence County. The quantity of ore mined and milled and the value of gold and silver recovered in 1964 were the largest in the history of the company.

TABLE 8.—Mine production of gold and silver in terms of recoverable metals

Year	Mines producing		Material sold or treated [1] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1955–59 (average)	2	----------	1,758	563,016	$19,706	140	$127
1960	2	----------	1,767	554,771	19,417	108	98
1961	2	----------	1,781	557,855	19,525	127	118
1962	2	----------	1,869	577,232	20,203	113	123
1963	3	1	1,909	576,726	20,185	117	150
1964	1	1	2,033	616,913	21,592	133	172
1876–1964	NA	NA	NA	30,579,633	851,884	12,008	9,120

NA Not available.
[1] Excludes placer gravel.

Iron Ore.—Magnetic highs, often indicative of iron occurrences, were discovered near Bristol and near Crandall, in Day County, and Langford, in Marshall County. The discoveries were the result of surveys made in 1963 by the South Dakota Geological Survey and the University of South Dakota. American Metal Climax, Inc., leased approximately 4,500 acres in the area.

Iron ore mined in prior years from deposits near Nemo and stockpiled was used in manufacturing cement at Rapid City. None was produced in 1964.

Lead.—No production of lead was reported in 1964; a small amount had been produced in Lawrence and Pennington Counties in 1963.

Molybdenum.—Molybdenum was recovered as a byproduct in the treatment of uranium-bearing lignite ash at the mines Development mill at Edgemont and at the Kermac Nuclear mill in New Mexico. This was the first known shipment of molybdenum from the State.

Uranium.—The quantity of uranium ore mined increased 53 percent over that of 1963; however, the value of the contained uranium declined 20 percent because of a drop in the average grade of ore mined. The greatest increase was in the sandstone ores mined in Custer and Fall River Counties. Output of uranium ores from Harding County declined.

Kermac Nuclear Fuels Corp. began burning uranium-bearing lignite ore, mined in South Dakota, at the company burning plant at Bowman, N. Dak. The lignite was burned under controlled conditions to yield an ash amenable to treatment. The ash was processed at the company uranium mill near Grants, N. Mex.

At the Edgemont, Fall River County, uranium mill of Mines Development, Inc., a subsidiary of Susquehanna-Western, Inc., lignite ash and sandstone ores were treated for recovery of uranium, vanadium, and molybdenum. The sandstone ores were from South Dakota and Wyoming and included both company-mined and custom ores. The ash was produced at the company burner near Buffalo, in Harding County. The plant also processed lignite ash from deposits in Billings County, N. Dak. Operation of the mill was to continue until the 1966 Atomic Energy Commission (AEC) contract expires.

Vanadium.—Production of vanadium oxide (V_2O_5) was continued at the Mines Development, Inc., uranium mill at Edgemont. The vanadium was contained in sandstone ores from Custer and Fall River Counties, S. Dak., and from Wyoming.

MINERAL FUELS

Coal (Lignite).—Output of coal (lignite), other than uraniferous lignite, was from the Dewey County Coal Co. strip mine near Firesteel. The coal, under 27 feet of overburden, was mined with a power shovel and dragline for stripping and loading.

Petroleum.—Production of crude petroleum in 1964 was 247,422 barrels. Of this 195,551 barrels was from 20 wells in the Buffalo field in Harding County, and the remainder from 4 wells in the Barker Dome field in Custer County. Some oil was recovered from a remote well in Dewey County. The showing was with a large amount of water, produced in a well drilled to the Red River formation.

Leasing was a highlight of petroleum activity marked by the largest lease sale in South Dakota history in December when 369,355 acres was leased.

Drilling activity increased with the drilling of 26 wells, 8 more than in 1963. The well in Dewey County was not considered completed in 1964.

TABLE 9.—Wildcat and development well completions in 1964, by counties

County	Oil	Dry	Total	Footage
Wildcat:				
Fall River		11	11	30,300
Gregory		1	1	2,200
Harding		2	2	18,000
Jones		1	1	2,500
Mellette		1	1	2,600
Spink		2	2	2,000
Stanley		1	1	3,300
Tripp		1	1	3,200
Total		20	20	64,100
Development:				
Custer	2	3	5	7,700
Harding	1		1	8,800
Total	3	3	6	16,500
Total all drilling	3	23	26	80,600

Source: Oil and Gas Journal.

Exploration and development drilling in the Minnelusa formation in eastern Wyoming prompted the drilling of wildcat wells in southwestern South Dakota. A series of Minnelusa tests were started in Meade and Butte Counties.

Kaneb Pipe Line Co. expanded its system by laying 120 miles of 6-inch products pipeline from Yankton to Wolsey.

REVIEW BY COUNTIES

Mineral production was reported from all but 4 of the 67 counties in the State. Jackson, Jones, Stanley, and Ziebach Counties reported no mineral production.

Butte.—American Colloid Co. produced bentonite and operated its processing plant at Belle Fourche. IMC processed bentonite at its Belle Fourche plant from the raw material mined in Wyoming. Bentonite was used as refractories in foundries and steel plants, in rotary-drilling mud, and in many other uses.

Black Hills Clay Products Co. produced clay for manufacturing building brick.

Sand and gravel was produced by three commercial and two Government-and-contractor operators. Sand was used in paving; gravel was used in building construction and in paving.

Utah-Idaho Sugar Co., a producer of lime used in manufacturing beet sugar, announced that the Belle Fourche plant was to be closed early in 1965.

TABLE 10.—Value of mineral production in South Dakota, by counties[1]

County	1963	1964	Minerals produced in 1964 in order of value
Aurora	$145,000	$205,000	Sand and gravel.
Beadle	265,973	404,000	Do.
Bennett	13,000	187,000	Do.
Bon Homme	180,537	191,000	Do.
Brookings	W	247,000	Do.
Brown	304,836	580,000	Do.
Brule	356,000	1,036,000	Do.
Buffalo	166,000	116,000	Do.
Butte	W	W	Clays, sand and gravel, lime.
Campbell	17,000	2,000	Sand and gravel.
Charles Mix	95,773	533,000	Do.
Clark	118,000	220,000	Do.
Clay	70,000	75,000	Do.
Codington	410,000	124,000	Do.
Corson	321,081	450,000	Do.
Custer	r 1,039,798	614,380	Feldspar, stone, petroleum, sand and gravel, uranium ore, vanadium, lime.
Davison	97,000	93,000	Sand and gravel.
Day	253,000	328,000	Do.
Deuel	111,331	70,000	Do.
Dewey	107,872	162,050	Sand and gravel, coal.
Douglas	338,309	237,000	Sand and gravel.
Edmunds	70,000	414,000	Do.
Fall River	312,816	474,893	Uranium ore, vanadium, sand and gravel, stone.
Faulk	157,000	89,000	Sand and gravel.
Grant	3,692,773	2,863,851	Stone, sand and gravel.
Gregory	124,000	75,000	Sand and gravel.
Haakon	284,000	524,575	Stone, sand and gravel.
Hamlin	134,000	13,000	Sand and gravel.
Hand	285,000	25,000	Do.
Hanson	617,204	48,000	Do.
Harding	r 2,266,875	2,117,697	Uranium ore, petroleum, sand and gravel, molybdenum.
Hughes	251,000	89,000	Sand and gravel.
Hutchinson	403,203	353,000	Do.
Hyde	54,000	198,000	Do.
Jackson	69,005		
Jerauld	414,000	89,000	Sand and gravel.
Kingsbury	189,000	174,000	Do.
Lake	242,000	172,000	Do.
Lawrence	20,767,795	22,122,992	Gold, sand and gravel, silver, stone.
Lincoln	257,000	160,000	Sand and gravel.
Lyman	417,000	151,000	Do.
Marshall	162,000	228,000	Do.
McCook	182,194	138,000	Do.
McPherson	122,542	114,000	Do.
Meade	504,649	310,000	Do.
Mellette	70,000	15,000	Do.
Miner	225,000	105,000	Do.
Minnehaha	2,734,878	2,192,098	Sand and gravel, stone.
Moody	234,000	615,000	Sand and gravel.
Pennington	9,351,442	9,622,948	Cement, stone, sand and gravel, lime, clays, gypsum, mica (scrap), feldspar, lithium, beryllium concentrates, gold.
Perkins	180,000	200,000	Sand and gravel.
Potter	191,000	116,000	Do.
Roberts	255,240	391,000	Do.
Sanborn	39,000	50,000	Do.
Shannon	5,000	37,000	Do.
Spink	205,000	269,000	Do.
Stanley	37,452		
Sully	63,000	47,000	Sand and gravel.
Todd	14,000	78,000	Do.
Tripp	1,000	W	Stone, sand and gravel.
Turner	940,218	418,000	Sand and gravel.
Union	95,000	95,000	Do.
Walworth	303,000	150,000	Do.
Washabaugh		74,000	Do.
Yankton	134,000	181,000	Do.
Ziebach	37,000		
Undistributed[2]	r 2,611,158	1,349,866	
Total	r 54,116,000	52,824,000	

r Revised. W Withheld to avoid disclosing individual company confidential data.
[1] Jones County is not listed because no production was reported.
[2] Includes production of some sand and gravel (1963), gem stones, and beryllium concentrates (1964) that cannot be assigned to specific counties, and values indicated by symbol W.

Custer.—A decline in the value of mineral production of 41 percent compared with that of 1963 resulted chiefly because stone production dropped sharply. Increases in value of production were noted for feldspar and petroleum; decreases were registered for sand and gravel, stone, uranium, and vanadium. Beryllium and sheet mica had been produced in 1963, but were not reported in 1964.

Feldspar was produced at 17 mines, of which 5 yielded in excess of 1,000 long tons. IMC purchased feldspar in addition to operating its own mines. The feldspar was ground at the company plant near Custer before shipment to out-of-State markets.

Sand and gravel was produced for use in paving. Limestone was mined for manufacturing lime at Black Hills Lime Co. near Pringle. Although uranium ore production increased, the lower average grade of the ore resulted in a decreased value of production. Byproduct vanadium was recovered from the treatment of the uranium ores.

At the Barker Dome field, four producing oil wells, two more than in 1963, increased output from 4,000 barrels in 1963 to 52,000 in 1964. Oil well exploration was continued: five wells were drilled to completion, and two became producers.

Fall River.—Sandstone uranium ore from 20 mines in the county was processed at Mines Development, Inc., mill at Edgemont. The mill-feed also included sandstone ores from three mines in Custer County; lignite ash from mines in Harding County and from Billings County, N. Dak.; and approximately 122,000 tons of ore from mines in Campbell, Converse, and Crook Counties, Wyo. Vanadium oxide from sandstone ores and molybdenum from lignite ash were recovered as byproducts.

Value of sand and gravel production was $103,000, a 102-percent increase. All production by commercial operators, Flyte Sand & Gravel Co. and Oral Sand Co., was used for building construction. There were also two Government-and-contractor operators.

Oil well exploration activity was greater than any other county as 11 wildcat wells were drilled to completion; all were dry.

Grant.—Grant County was ranked third in the value of minerals produced due to output of granite at seven quarries near Milbank and Big Stone City. Although the value of stone production increased, a sharp decline in sand and gravel output resulted in an $829,000 drop in overall value of minerals produced.

Harding.—Petroleum production from 20 producing wells at the Buffalo field declined slightly. Three wells were completed.

Kermac Nuclear Fuels Corp. mined uranium-bearing lignite ore. Susquehanna-Western, Inc., burned lignite at the company burner near Buffalo.

Lawrence.—All of the gold and silver produced in Lawrence County was mined by Homestake Mining Co. According to the company annual report to stockholders, both tonnage and revenue, increasing by 7 percent, established new annual alltime highs for the mine. Metallurgical recovery was 96.24 percent, compared with 96.92 percent in 1963.

According to the annual report to stockholders the measured ore reserve as of December 31, 1964, was 16.8 million tons, with an esti-

TABLE 11.—Homestake mine ore milled, receipts, and dividends[1]

Year	Ore milled (thousand short tons)	Receipts for bullion product		Dividends (thousands)
		Total (thousands)	Per ton	
1960	1,767	$19,465	$11.02	$4,021
1961	1,781	19,590	11.00	4,030
1962	1,869	20,271	10.85	3,242
1963	1,909	20,278	10.62	3,265
1964	2,033	21,703	10.68	3,288

[1] From 1876 to 1964, inclusive, this mine yielded bullion and concentrates that brought a net return of $779.9 million and paid $224.7 million in dividends.

Source: Homestake Mining Co. annual report to stockholders.

mated grade of $11.01 (0.315 ounces) of gold per ton, a decline of 31 cents per ton. For the first time, the measured reserve included ore in Eleven Ledge, from the 3,950-foot level to the 4,400-foot level, and from the 5,000-foot level to the 6,050-foot level.

Progress was made in preparation for mining below the 4,850-foot level. The planned rate of 800 tons per day from the lower levels was achieved late in the year. In the lower levels, ore shoots, though numerous, were small and irregular; and rock pressures were higher.

As depth of mining increased, ventilation and air conditioning continued to be major factors.[6] Rock temperature at the surface of the Homestake mine was 44° Fahrenheit. The temperature and latent humidity increased about 1.5° Fahrenheit with each 100 feet of depth. At the lowest point in the mine, 6,800 feet below the surface, air temperature reaches 120° Fahrenheit. In addition to an extensive ventilation system, Homestake used portable refrigeration units. The units were specially designed and custom built, patterned on similar units in use in South Africa, by Yale Inc., Minneapolis, Minn. The air conditioners are operated from 100 to 1,000 feet from the working face.

Pennington.—Eleven minerals were produced, more than in any other county, and all of the State production of cement, gypsum, lithium, and mica came from the county.

Shipments of portland and masonry cements from the State-owned cement plant at Rapid City were valued at more than $7 million, a 16-percent increase. Limestone, shale, gypsum, and sand used at the plant were mined near Rapid City. Iron ore, used in manufacturing specialty cements, was obtained from stockpiles. Cement shipments were made to all of the States bordering South Dakota.

Crushed and broken limestone also was produced by Hills Materials Co., L. G. Everist, Inc., and Pete Lien & Sons, for use in manufacturing lime, as railroad ballast and riprap, and in road construction. Crushed sandstone, produced by Newlon & Cordes, was used as roofing granules.

Sand and gravel for use in building and paving was produced by commercial and Government-and-contractor operators. The commercial operators were Birdsall Sand & Gravel Co., and L. G. Everist, Inc. Government operators were the South Dakota Cement Commission, the Federal Forest Service, and the South Dakota Department of Highways.

[6] Engineering and Mining Journal. Homestake Spot Cools Hot Work Levels. V. 166, No. 4, April 1965, p. 91.

Feldspar production was reported from seven mines and five producers: Hough & Judson, IMC, Keystone Chemical Co., Northwest Beryllium Co., and Robert Stilen. Mica also was produced by Keystone Chemical Co. and Northwest Beryllium Co.

Northwest Beryllium Co. continued to operate its flotation mill at Keystone. In March, fire destroyed the building housing the feldspar section. A new building was constructed containing feldspar-concentrating equipment, filter, magnetic separators, and a shop. Reportedly, a modification of a flotation process developed by the Federal Bureau of Mines was used to recover pegmatite minerals. The process was adopted after considerable research and laboratory work by the company. The mill was equipped to recover scrap mica, soda feldspar, high-purity silica sand, beryl, columbite-tantalite, and cassiterite. The company also planned to recover potash feldspar, which was to be selectively mined, dry crushed, and hand sorted. Metallurgical steps were to include crushing and screening to produce a scrap mica product and to provide rodmill feed; grinding followed by gravity concentration to produce a concentrate of columbite-tantalite and cassiterite; flotation to recover fine mica, feldspar, and beryl; magnetic concentration to remove impurities; and acid digestion and magnetic separation to produce silica sand. Planning was designed to increase daily mill capacity to 200 tons of ore.[7]

Production was begun at the lime plant operated by Pete Lien & Sons of Rapid City. The 175-ton-per-day calcining and hydrating plant used a rotary kiln with continuous hydrator and automatic mill to treat the raw material obtained from the 40-foot-thick Minnekahta limestone formation near the plant. Most of the product was to be used as a soil stabilizer in road construction. The firm had been awarded a contract by Northwestern Engineering Co. of Denver (Colo.) and Rapid City, to provide 8,035 tons of hydrated lime for highway construction. About 50 men were to be employed at the plant.[8]

Miscellaneous clay, in addition to that used for cement, was produced from deposits near Rapid City for manufacturing lightweight aggregate. Lithium was produced at the Hugo and Ingersoll mines near Keystone. Virgil Williams, of Keystone, produced a small amount of gold from a stream-gravel placer deposit.

[7] Thom, Clarence. Mineral Recovery at Northwest Beryllium Corp. Deco Trefoil, v. 29, No. 1, January–February 1965, pp. 9–16.

[8] Simpson, Jack R., New Rotary-Kiln Lime Plant in South Dakota. Pit and Quarry, v. 56, No. 11, May 1964, pp. 92–97.

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