

State of South Dakota  
Nils Boe, Governor

*Minerals Report 14*

**THE MINERAL INDUSTRY  
OF SOUTH DAKOTA  
IN 1966**

*by Franklin H. Persse  
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South Dakota Geological Survey  
Vermillion, South Dakota  
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UNITED STATES DEPARTMENT OF THE INTERIOR • Stewart L. Udall, Secretary

BUREAU OF MINES • Walter R. Hibbard, Jr., Director

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## 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 Franklin H. Persse<sup>1</sup> and William C. Henkes<sup>2</sup>

The value of mineral production for 1966 was \$52.7 million, a 5-percent increase over that of 1965, but short of the record high of \$54.1 million reported in 1963.

Increased production of stone and cement, 48 and 24 percent in value, respectively, was the main source of the \$3.2 million gain in nonmetals. The rise in the value of fuels produced (\$37,000) resulted from the increased oil output at the Buffalo oilfield. Metals declined another 3 percent because gold and silver production declined at the Homestake mine at Lead; for the 18th consecutive year, however, this

mine, and South Dakota remained the leading gold producers in the Nation.

During the year, the Federal Bureau of Mines released three publications on mineral deposits within the State: Reports describing nonpegmatitic beryllium occurrences in eight States including South Dakota;<sup>3</sup> and on beryllium-bearing pegma-

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<sup>3</sup> Meeves, Henry C. Nonpegmatitic Beryllium Occurrences in Arizona, Colorado, New Mexico, Utah, and Four Adjacent States. BuMines Rept. of Inv. 6828, 1966, 68 pp.

Table 1.—Mineral production in South Dakota<sup>1</sup>

Mineral	1965		1966	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Beryllium concentrate..... short tons, gross weight..	W	W	124	\$40
Cement:				
Masonry..... thousand 280-pound barrels..	55	\$180	51	170
Portland..... thousand 376-pound barrels..	1,575	5,127	1,974	6,367
Clays..... thousand short tons.....	223	1,220	231	870
do..... do.....	10	49	10	45
Feldspar..... long tons.....	51,560	346	83,950	542
Gem stones..... troy ounces.....	NA	20	NA	20
Gold (recoverable content of ores, etc.).....	628,259	21,989	606,467	21,226
Gypsum..... thousand short tons.....	7	27	17	68
Lithium minerals..... short tons.....	150	5	W	W
Petroleum (crude)..... thousand 42-gallon barrels..	219	438	239	479
Sand and gravel..... thousand short tons.....	13,998	14,155	13,630	13,585
Silver (recoverable content of ores, etc.)..... thousand troy ounces..	129	167	110	142
Stone..... thousand short tons.....	1,554	5,387	2,186	7,995
Uranium ore..... short tons.....	44,738	303	W	W
Value of items that cannot be disclosed: Lime, mica (scrap), molybdenum, tin (1966), vanadium, and values indicated by symbol W.....	XX	762	XX	1,158
Total.....	XX	50,175	XX	52,707

NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed."

XX Not applicable.

<sup>1</sup> Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

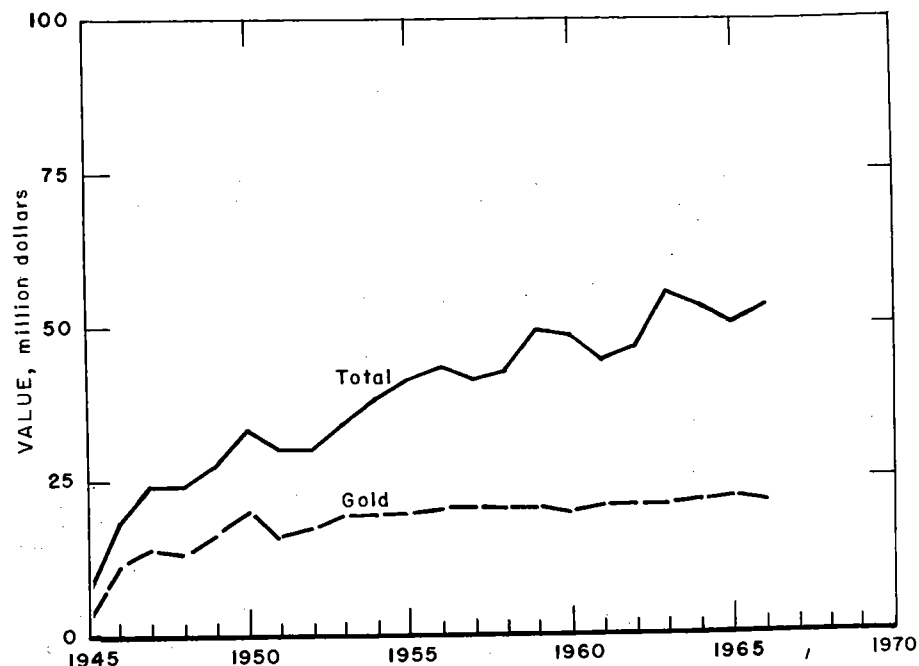


Figure 1.—Value of gold and total value of mineral production in South Dakota.

Table 2.—Value of mineral production in constant 1957-59 dollars  
(Thousands)

Year	Value <sup>1</sup>
1957	\$40,129
1958	41,648
1959	48,222
1960	46,117
1961	43,459
1962	43,809
1963	50,889
1964	49,152
1965	46,851
1966	49,154

<sup>1</sup> Data for 1957-65 revised.

tite deposits in six western States including South Dakota,<sup>4</sup> and on the iron resources in South Dakota.<sup>5</sup>

**Employment and Injuries.**—Exclusive of the petroleum industry, final statistics for 1965 and preliminary statistics for 1966 of employment and injuries in the mineral industry are given in table 3.

**Government Programs.**—The South Dakota School of Mines and Technology at Rapid City received two grants from the

Federal Bureau of Mines. One grant for \$18,046 was to finance research on recovery of beryllium and other valuable metals from mine dumps and mill tailings in the Black Hills. The other, for \$11,528, was to be used to develop methods for recovering silver, copper, and other valuable metals from ash generated at power stations in the northern Great Plains that burn lignite. The School also received a grant of \$15,965 from the U.S. Geological Survey to gather information on ore deposits in the Black Hills.

Contracts awarded for highway construction in South Dakota amounted to \$46.3 million, a 12-percent increase over that of 1965. Contracts awarded for Interstate highway construction had the greatest in-

<sup>4</sup> Meeves, Henry C., Clarence M. Harrer, Melford H. Salsbury, Albert S. Kosselman, and Spencer S. Shannon, Jr., *Reconnaissance of Beryllium-Bearing Pegmatite Deposits in Six Western States: Arizona, Colorado, New Mexico, South Dakota, Utah, and Wyoming*. BuMines Inf. Circ. 8298, 1966, 34 pp.

<sup>5</sup> Harrer, C. M., *Iron Resources of South Dakota*. BuMines Inf. Circ. 8278, 1966, 160 pp.

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

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
<b>1965:</b>								
Coal	4	125	1	4	3	33	19.17	6,612
Metal	1,877	299	561	4,487	10	20.48	479	424
Nonmetal	265	227	60	488	26	18.98	424	8,592
Sand and gravel	1,056	158	166	1,370	1	18	24.40	8,592
Stone	413	235	97	779	1	18	24.40	8,592
Total	3,615	245	885	7,128	4	137	19.78	5,215
<b>1966: P</b>								
Coal	5	121	( <sup>1</sup> )	4	1	85	19.78	2,234
Metal	1,830	299	547	4,359	8	16.63	81	81
Nonmetal	270	219	59	481	25	18.41	4,933	4,933
Sand and gravel	1,085	157	171	1,412	19	23.14	1,291	1,291
Stone	405	244	98	821	2	137	19.64	2,516
Total	3,595	243	875	7,077	2	137	19.64	2,516

P Preliminary.

<sup>1</sup> Less than 500.

crease, \$4.1 million or 21 percent.<sup>6</sup> As of December 31, 376.7 miles of Interstate highway was open for traffic—42.4 miles more than as of this date 1 year ago. Highway-maintenance expenditures were \$7.3 million, a 25.8-percent increase.<sup>7</sup>

The Secretary of the Interior, Stewart L. Udall, approved the recommendation made by the Office of Coal Research (OCR) that a pilot plant for the gasification of lignite be located at Rapid City. A contract with Consolidation Coal Co. for constructing and operating the plant was to be awarded early in 1967. The operation of the plant would require lignites and limestone, both found in the area. The product would be a

synthetic gas competitive with natural gas.

Two applications were submitted to the Office of Minerals Exploration (OME) for loans to explore silver properties; however, none were approved in 1966.

Under the Mining Claim Occupancy Act of 1962, 27 patents were issued to residents of the Lead area at a ceremony held at Lead on December 18.

<sup>6</sup> Engineering News-Record, State Highway Department's Construction Plans for 1967 . . . and Budgets for Maintenance: Highway Construction Spending Will Reach For a Record This Year. V. 78, No. 12, Mar. 23, 1967, pp. 24-25.

<sup>7</sup> Bureau of Public Roads, Quarterly Report on The Federal-Aid Highway Program, Dec. 31, 1966. Press Release BPR 67-5, Feb. 1, 1967.

## REVIEW BY MINERAL COMMODITIES

### NONMETALS

**Cement.**—The only State-owned cement plant in the United States was the South Dakota Cement Commission plant at Rapid City. This plant, the only cement producer in the State, was the only consumer of gypsum and iron ore, and the largest consumer of limestone and shale in the State; in addition about 11,000 tons of sand, was consumed. These minerals yielded 2,004,330 barrels of portland cement and 64,714 barrels of masonry cement, 30 percent more than in 1965. The gain was attributed to the increased use of concrete in highway construction: Highway contractors received 41.5 percent and ready-mix con-

crete companies received 33.2 percent of the cement produced. Of the remainder, 15.6 percent went to building material dealers, 6.5 percent to concrete-products manufacturers, 2 percent to other contractors, and 1.2 percent to miscellaneous users. Sixty-five percent of the cement shipments were by railroad.

**Clays.**—Bentonite, shale, and common clays were produced and processed in the State. American Colloid Co. and International Minerals & Chemical Corp. (IMC) each operated a bentonite processing plant near Belle Fourche where ores mined in Wyoming and South Dakota were processed. IMC resumed mining bentonite in South Dakota after many years. Shale

mined at two locations in Pennington County was the source of more than one-half of the State's total clay production. South Dakota Cement Commission mined the shale used in manufacturing cement. Light Aggregates, Inc. of Rapid City, mined shale and expanded it to light-weight aggregate. Black Hills Clay Products Co. mined common clays in Butte County for brick manufacture at its Belle Fourche plant.

**Feldspar.**—Twenty-two mines in Custer County and five in Pennington County were the sources of feldspar, all potash type. Although these 27 operations were 8 fewer than in 1965, production increased 63 percent.

Small amounts of hand-sorted ore were shipped to manufacturers of glass, porcelain, and pottery. The remainder was

treated at either the grinding plant near Custer or the Northwest Beryllium Corp. flotation mill at Keystone.

Northwest Beryllium Corp. obtained most of its ore from its own Peerless mine. Both the ground feldspar and the floated feldspar were shipped to users in other States, Canada, and Mexico.

**Gypsum.**—The only producer and consumer of gypsum within the State was the South Dakota Cement Commission. Production from its open pit mine in Pennington County was 17,103 tons, 2.4 times as much as was mined in 1965. Of this amount, 16,714 tons was used at the Rapid City plant for manufacturing cement. The remainder was stockpiled.

**Lime.**—Lime was produced by Black Hills Lime Co. at Pringle and Pete Lien & Sons near Rapid City. The former com-

pany manufactured quicklime for metallurgical use, and the latter manufactured quicklime and hydrated lime for use in plaster and water treatment. Substantial quantities of hydrated lime also were used for soil stabilization.

Table 5.—Sand and gravel production in 1966, by counties

(Thousand short tons and thousand dollars)		
County	Quantity	Value
Aurora	360	\$866
Beadle	105	107
Bennett	3	3
Bon Homme	205	198
Brookings	269	303
Brown	560	602
Brule	78	86
Butte	78	79
Butte	1,021	1,076
Campbell	123	124
Charles Mix	443	374
Clark	246	187
Clay	70	69
Codington	299	367
Corson	271	238
Custer	102	64
Davison	845	817
Day	344	298
Deuel	110	127
Dewey	49	49
Douglas	99	110
Edmunds	18	18
Fall River	95	95
Faulk	153	153
Grant	469	482
Gregory	114	122
Haakon	56	56
Hamlin	28	30
Hand	318	272
Hanson	289	292
Harding	100	26
Hughes	161	98
Hutchinson	57	167
Hyde	76	46
Jackson	76	76
Jerauld	229	229
Jones	99	89
Kingsbury	95	95
Lake	104	95
Lawrence	121	189
Lincoln	93	95
Lyman	206	199
McCook	166	131
McPearson	244	244
Marshall	138	131
Meade	155	155
Mellette	28	28
Miner	71	71
Minnehaha	585	532
Moody	319	338
Pennington	822	879
Perkins	499	555
Potter	140	140
Roberts	129	143
Sanborn	54	57
Shannon	73	73
Spink	98	94
Sully	87	87
Todd	80	80
Tripp	387	325
Turner	300	303
Union	149	149
Walworth	282	295
Washabaugh	55	55
Yankton	177	184
Ziebach	75	75
Total	13,630	13,585

**Lithium.**—South Dakota, one of the three States that produced lithium minerals, shipped a small amount of hand-sorted amblygonite ore.

**Mica.**—Scrap mica was produced from the Hugo mine operated by L. W. Judson, the Ingersoll operated by Keystone Chemical Co., and the Peerless operated by Northwest Beryllium Corp., all in Pennington County near Keystone. The product was shipped to consumers outside of the State, mainly in the Chicago area for paint and roofing material.

Black Hills Rose Quartz Co. trimmed some sheet mica; however, no shipments were made.

**Sand and Gravel.**—Sand and gravel was produced in 66 of the 67 counties; Stanley County reported no production. The State total production declined 368,000 tons because of a slowdown in building and highway construction during the last half of the year. Butte County led the State with a production of 1 million tons, approximately three times the amount produced in the county in 1965. The South Dakota Department of Highways construction program in Butte County stimulated this increase.

Output was reported by 148 respondents from 410 operations. One hundred and thirty-four commercial operations utilized 27 stationary and 60 portable plants. Government-and-contractor operations numbered 276; using 20 stationary and 49 portable plants. The Government-and-contractor sand and gravel was produced for the Federal Bureau of Indian Affairs, Federal Bureau of Reclamation, U.S. Army Corps of Engineers, South Dakota Aeronautic Commission, South Dakota Cement Commission, South Dakota Department of Highways, and county and municipal highway departments.

**Stone.**—Seven classifications of stone were produced; crushed and dimension granite, crushed and dimension limestone, crushed and dimension sandstone, and crushed miscellaneous stone. The quantity of total stone produced increased 41 percent and value increased 48 percent; dimension limestone, an exception, decreased slightly. Output came from 41 operations in 11 counties. The leading counties were Grant, with a production value of \$4.1 million from six dimension granite quarries and one crushed miscellaneous stone quarry;

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	1965		1966	
	Quantity	Value	Quantity	Value
<b>Commercial operations:</b>				
<b>Sand:</b>				
<b>Construction:</b>				
Building	420	\$503	404	\$493
Paving	200	249	165	206
Fill	39	30	73	65
Other			13	12
Industrial: Glass			( <sup>1</sup> )	( <sup>1</sup> )
Total	659	782	645	776
<b>Gravel:</b>				
<b>Construction:</b>				
Building	305	364	214	317
Paving	1,547	1,796	1,459	1,700
Railroad ballast	32	38	12	9
Fill	57	38	44	35
Other	8	8	30	20
Miscellaneous	2	1	18	18
Total	1,951	2,245	1,777	2,099
Total sand and gravel	2,610	3,027	2,422	2,875
<b>Government-and-contractor operations:</b>				
<b>Sand:</b>				
Building	( <sup>2</sup> )	1		
Paving	2,772	2,773	2,246	2,258
Other	7	6	9	9
Total	2,779	2,780	2,255	2,267
<b>Gravel:</b>				
Building	66	55	135	100
Paving	8,543	8,293	8,818	8,343
Total	8,609	8,348	8,953	8,443
Total sand and gravel	11,388	11,128	11,208	10,710
<b>All operations:</b>				
Sand	3,438	3,562	2,900	3,043
Gravel	10,560	10,593	10,730	10,542
Total	13,998	14,155	13,630	13,585

<sup>1</sup> Includes glass sand.

<sup>2</sup> Less than 1/2 unit.

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

Year	Granite		Limestone		Sandstone <sup>1</sup>	
	Short tons	Value	Short tons	Value	Short tons	Value
1962-----	25,923	\$2,442,181	1,572,300	\$2,184,374	1,119,655	\$1,779,689
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	920,861	1,702,849
1965-----	20,129	2,944,586	868,726	1,411,917	650,847	1,006,609
1966-----	23,806	4,066,853	1,100,575	1,793,263	983,897	1,997,291
	Other stone		Total			
	Short tons	Value	Short tons	Value	Short tons	Value
1962-----	2 134,056	2 126,373	2,851,984	\$6,532,567		
1963-----	82,618	79,310	2,793,563	7,333,709		
1964-----			2,117,715	6,245,012		
1965-----	14,068	24,117	1,553,770	5,387,229		
1966-----	77,800	137,349	2,186,078	7,994,756		

<sup>1</sup> Includes quartz and quartzite.<sup>2</sup> Includes slate.

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

Use	1965		1966	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and rubble.....short tons	4,000	\$6,000	W	W
Rough architectural.....cubic feet				
Dressed architectural.....do	116,635	1,869,679	136,764	1,741,591
Rough monumental.....do				
Dressed monumental.....do	131,903	2,074,907	157,177	2,330,462
Flagging.....do	25,000	3,000	W	W
Total (approximate, in short tons).....	26,129	2,953,586	28,796	4,079,553
Crushed and broken stone:				
Riprap.....short tons	33,858	45,915	75,335	127,753
Railroad ballast.....do	235,167	392,220	279,494	373,945
Concrete and roadstone.....do	321,577	1,294,181	1,235,485	2,294,570
Cement.....do	312,564	562,615	451,115	812,007
Other.....do	2 74,475	2 138,712	2 115,853	2 301,928
Total.....do	1,527,641	2,433,643	2,157,282	3,915,203
Total stone (approximate, in short tons).....	1,553,800	5,387,229	2,186,100	7,994,756

W Withheld to avoid disclosing individual company confidential data; included in "Totals."

<sup>1</sup> Rough architectural, dressed architectural, and rough monumental combined to avoid disclosing individual company confidential data.<sup>2</sup> Includes stone used in other filler, lime, and refractory.<sup>3</sup> Includes stone used for decorative use, other filler, landscaping, lime, precasting, refractory, and roofing granules.

and Pennington with an output value of \$1.8 million from eight limestone and three sandstone operations.

Dimension granite was used for architectural and monumental stone and the crushed granite was used for riprap by the city of Lead. Dimension limestone uses were crushed rubble, curbing, and flagging and the limestone was used for riprap, concrete aggregate, road metal, railroad ballast, filler, and manufacturing lime and cement.

All of the dimension sandstone produced was used as building stone. Crushed sandstone was produced in five counties by eight firms and included uses as ganister,

riprap, concrete aggregate, road metal, railroad ballast, filler, and decoration. The leading producers of crushed sandstone were Spencer Quarries, Inc., Hanson County; Concrete Materials Co., Minnehaha County; and John A. Carlson, Inc., Tripp County.

Crushed miscellaneous stone was produced in six counties for riprap, concrete aggregate, and road metal. The product was used on construction projects of the U.S. Army Corps of Engineers, Federal Bureau of Public Roads, South Dakota Department of Highways, and Grant County Highway Department.

## METALS

**Beryllium.**—Production of beryl concentrate increased substantially. Output was reported from the Tin Mountain mine operated by Walter S. Clifford in Custer County, and from various mines in Pennington County. The major Pennington County producers were the Hugo mine operated by L. W. Judson and the Peerless mine operated by Northwest Beryllium Corp. Purchasers included Beryl Ores Co. of Arvada, Colo.

**Gold and Silver.**—All gold and silver mined within the State came from the Homestake mine at Lead. According to the Homestake Mining Co. annual report, 2,002,239 tons of ore was produced, yielding 606,467 ounces of gold and 109,885 ounces of silver with a combined value of \$21,309,115. This amount was \$784,757 less than the value of the gold and silver recovered in 1965. Part of this decrease was attributed to the lower grade of ore recovered during the year; in addition, the labor shortage was also a factor, with mine production falling below mill capacity. The metallurgical recovery was 95.7 percent, the same as in 1965.

Ending more than 50 years of operation without union representation, the hourly employees of Homestake Mining Co., in June, voted to be represented by the United Steelworkers of America. A 3-year labor contract was negotiated and signed on December 5. Since 1947, six previous attempts to organize a union at the mine had failed.

**Iron Ore.**—Iron ore had been mined near Nemo and stockpiled in sufficient quantity to last the only consumer, the State-owned cement plant, many years. Production was to resume when the stockpile was depleted.

**Molybdenum.**—Molybdenum output was from uraniferous lignite ore mined in Harding County. Most of the ore was shipped for processing to the Kerr-McGee Corp. burning plant at Bowman, N. Dak. The ash was then shipped to its New Mexico mill for recovery of uranium and molybdenum. A small quantity of molybdenum also was recovered as a byproduct by Mines Development, Inc., a subsidiary of The Susquehanna Corp. at its Edgemont plant.

**Tin.**—Northwest Beryllium Corp. recovered a small amount of tin concentrate (cassiterite) from the pegmatite ore processed at its Keystone mill, the first production reported in the State after a lapse of 17 years.

**Uranium.**—Output of uranium ore increased slightly over that of 1965. Uraniferous lignite ore was produced at 5 mines in Harding County and sandstone ore was produced at 27 mines in Fall River County; a total of 5 more operations than in 1965. The uraniferous lignite ore was shipped to the Mines Development, Inc., mill at Edgemont and to the Kerr-McGee Corp. plant at Bowman, N. Dak. After burning the ore, Kerr-McGee sent the ash to its mill at Grants, N. Mex., for recovery of uranium and molybdenum. The sandstone ore was shipped to the Mines Development, Inc., mill at Edgemont for recovery of uranium.

In addition to processing indigenous uranium ore, Mines Development, Inc., processed uraniferous lignite ore from North Dakota and sandstone ore from Washington and Wyoming.

The authority for Mines Development, Inc., to sell uranium ore to the U.S. Atomic Energy Commission (AEC), due to expire December 31, 1966, was extended to

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

Year	Mines producing		Material sold or treated <sup>1</sup> (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)
1957-61 (average)-----	2	-----	1,786	565,863	\$19,805	129	\$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
1965-----	1	-----	2,032	628,259	21,989	129	167
1966-----	1	-----	2,002	606,467	21,226	110	142
1876-1966-----	NA	NA	NA	31,814,359	895,099	12,247	9,429

NA Not available.

<sup>1</sup> Excludes placer gravel.

permit limited production for sale to the AEC through December 31, 1968.

**Vanadium.**—Susquehanna-Western, Inc., a subsidiary of The Susquehanna Corp., recovered vanadium pentoxide at its Edgemont plant. The product was recovered from uranium-sandstone ore tailings from the adjoining uranium mill of Mines Development, Inc., and from California slag. The uranium-vanadium sandstone ores were mined in Fall River County and Washington and Wyoming.

#### MINERAL FUELS

**Coal.**—Lignite was strip mined from the 54-inch thick Hellcreek seam near Firesteel. Although the mine, operated by Dewey County Coal Co., was idle from mid-February until late fall, output was approximately the same as that of 1965.

**Petroleum.**—Crude oil production from the Buffalo field in Harding County increased 16 percent to 219,888 barrels. This increase resulted from three new wells (two in late 1965) and from more efficient operation of the field.

The increase at the Buffalo field more than offset the drop in production at the small Barker Dome field. The net increase for the State was 9 percent. Natural gas produced at Buffalo field, 14 million cubic feet, was used for field fuel or flared.

Drilling declined sharply from the 1965 peak; total drilling amounted to 14 wells, compared with 33 wells in 1965. Two development oil wells were drilled: One each in the Buffalo and Barker Dome fields. Exploratory drilling was scattered through the southcentral part of the State. In its continuing exploration program—with five wells during the year—Gulf Oil Corp. found shows of oil in the Winnipeg formation (Ordovician) in a well drilled in 1965 in sec 14, T43N, R29E, Mellette County. Additional tests in 1966 failed to establish commercial production.

At yearend, 475,453 acres of Federal and 50,422 acres of Indian lands were under lease for oil and gas. Sales of Indian leases were held on June 21 and July 13. The first sale covered lands on the Rosebud Reservation and totaled 39,202 acres for which the average bid was 52 cents an acre. The second, in the Cheyenne River Reservation, covered 7,542 acres which received an average bid of \$3.34 an acre.

The State Department of School and Public Lands held two oil- and gas-lease sales. Total acreage leased was 244,556 which brought a bonus of \$15,224. Largest offerings were in the southcentral counties: Bennett, Jones, Mellette, Stanley, Sully, and Tripp. Most active leases were Gulf Oil Corp. and Tenneco Oil Co.

#### REVIEW BY COUNTIES

Mineral output was reported by 66 of the 67 counties; Stanley County was the exception. However, only those counties with significant production or activity in the mineral industry are discussed.

**Butte.**—Value of mineral production increased 20 percent, as a result of substantial increases in the output and value of sand and gravel and in the output of common clay. Sand and gravel output was stimulated principally by increased highway construction.

Black Hills Clay Products Co. manufactured brick at its Belle Fourche plant from the miscellaneous clay mined within the county.

The plants at Belle Fourche, owned by American Colloid Co. and IMC, processed bentonite ore mined in the county and in Wyoming; however, total production was below that of 1965. Nearly one-half of the South Dakota bentonite was used by foundries. Other principal uses were in rotary drilling, insulation, animal feed, and reservoir lining. A substantial tonnage was exported.

**Custer.**—Increased production of sand and gravel and feldspar more than offset the decline in lime, stone, beryl concentrate, and petroleum.

Twenty-two mines, five fewer than in 1965, yielded the increased amount of feldspar ore—mostly processed at the IMC plant at Custer. The one major producer was IMC at the Shamrock and Tip Top mines. Sand and gravel production increased many fold because of use for road construction and maintenance by the Custer County Highway Department and the State Department of Highways.

Although a new development well was drilled in the Barker Dome Oilfield, production declined 34 percent; the decline reflected the steady depletion of the reservoir.

Walter Clifford, operating the Tin Mountain mine, reported a small amount of tantalum produced and stockpiled.

**Fall River.**—The value of the three minerals produced—sand and gravel, uranium, and vanadium—increased.

Sand and gravel, all used for State and county highway construction, more than doubled. The number of uranium ore mines and the value of the uranium ore

both increased. The ore, a sandstone containing uranium and vanadium, was processed at the Edgemont mills. Mines Development, Inc., recovered uranium from sandstone ore mined in Fall River County and from ore mined in Washington and Wyoming. The company also recovered uranium from uraniumiferous lignite mined in Harding County, S. Dak., and Billings and Slope Counties, N. Dak. Tailings from the sandstone ores were processed in the adjoining Susquehanna-Western, Inc., mill where vanadium pentoxide was recovered. The Susquehanna-Western, Inc., mill also processed vanadium bearing slags from California. Vanadium pentoxide recovery from ores mined in Fall River County declined. Additional equipment installed in the vanadium mill at yearend was expected to increase the vanadium pentoxide output.<sup>8</sup>

At its Edgemont mill, Mines Development, Inc., recovered a small amount of molybdenum from uraniumiferous lignite ores mined in Harding County.

Only 1 exploratory oil well was completed, compared with 11 for each of the 2 previous years.

**Grant.**—The value of mineral production increased 48 percent. Sand and gravel and stone were the only two mineral commodities produced. The sand and gravel producers were the South Dakota Department of Highways and the Grant County Highway Department, which also produced crushed stone. The value of dimension stone from six granite quarries near Milbank and Big Stone City was over \$4 million. Quarry operators were Cold Spring Granite Co., Dakota Granite Co. (operating two quarries); Delano Granite Works, Inc., Robert Hunter Granite Co., Inc.; and Steiner-Rausch Granite Co.

**Harding.**—The 6-percent increase in the value of minerals produced could be attributed to only two minerals, petroleum and uranium. Full production from three new wells and more efficient operations increased output at the Buffalo oilfield by 30,350 barrels. Uranium content of the uraniumiferous lignite ash—shipped by Kerr-McGee Corp. to its plant in Grants, N. Mex., and by Susquehanna-Western, Inc, to

Table 9.—Drilling for petroleum in 1966, by counties

County	Oil	Dry	Total	Footage
<b>Exploratory completions:</b>				
Bennett.....		1	1	4,556
Custer.....		1	1	1,333
Fall River.....		1	1	1,526
Haakon.....		2	2	8,947
Harding.....		1	1	7,800
Jones.....		1	1	2,653
Lyman.....		1	1	2,458
Mellette.....		1	1	3,276
Stanley.....		2	2	5,537
Sully.....		1	1	2,251
<b>Total.....</b>		<b>12</b>	<b>12</b>	<b>40,337</b>
<b>Development completions:</b>				
Custer.....	1		1	1,426
Harding.....	1		1	8,420
<b>Total.....</b>	<b>2</b>		<b>2</b>	<b>9,846</b>
<b>Total all drilling.....</b>	<b>2</b>	<b>12</b>	<b>14</b>	<b>50,183</b>

Source: Committee on Statistics of Drilling, American Association of Petroleum Geologists.

<sup>8</sup> The Susquehanna Corp. annual report 1966 to stockholders.

Table 10.—Value of mineral production in South Dakota, by counties

County	1965	1966	Minerals produced in 1966 in order of value
Aurora	\$382,000	\$366,000	Sand and gravel.
Beadle	99,000	107,000	Do.
Bennett	77,000	3,000	Do.
Bon Homme	289,000	198,000	Do.
Brookings	543,000	303,000	Do.
Brown	W	602,000	Do.
Brule	752,970	86,000	Do.
Buffalo	4,000	82,300	Sand and gravel, stone.
Butte	W	12,000	Sand and gravel, clays.
Campbell	83,000	124,000	Sand and gravel.
Charles Mix	474,480	374,000	Do.
Clark	197,000	187,000	Do.
Clay	82,000	69,000	Do.
Codington	631,000	367,000	Do.
Corson	644,000	233,000	Do.
Custer	464,628	471,538	Feldspar, sand and gravel, petroleum, lime, stone, beryllium concentrate.
Davison	176,000	817,000	Sand and gravel.
Day	371,000	298,000	Do.
Deuel	141,000	127,000	Do.
Dewey	67,700	94,125	Sand and gravel, coal.
Douglas	266,000	110,000	Sand and gravel.
Edmunds	70,000	18,000	Do.
Fall River	250,187	W	Uranium ore, sand and gravel, vanadium.
Faulk	166,000	153,000	Sand and gravel.
Grant	3,079,586	4,549,927	Stone, sand and gravel.
Gregory	256,000	122,000	Sand and gravel.
Haakon	30,000	56,000	Do.
Hamlin	17,000	30,000	Do.
Hand	50,000	272,000	Do.
Hanson	969,781	1,089,239	Stone, sand and gravel.
Harding	838,639	392,773	Petroleum, uranium ore, molybdenum, sand and gravel.
Hughes	70,603	110,350	Sand and gravel, stone.
Hutchinson	295,000	167,000	Sand and gravel.
Hyde	25,000	46,000	Do.
Jackson	15,000	76,000	Do.
Jerauld	42,000	229,000	Do.
Jones	W	39,000	Do.
Kingsbury	268,000	95,000	Do.
Lake	99,000	95,000	Do.
Lawrence	22,831,179	21,696,095	Gold, stone, silver, sand and gravel.
Lincoln	561,000	95,000	Sand and gravel.
Lyman	200,000	199,000	Do.
Marshall	127,000	131,000	Do.
McCook	659,000	131,000	Do.
McPherson	161,000	244,000	Do.
Meade	186,000	155,015	Sand and gravel, stone.
Mellette	65,000	28,000	Sand and gravel.
Miner	30,000	71,000	Do.
Minnehaha	1,239,430	1,191,069	Stone, sand and gravel.
Moody	229,000	338,000	Sand and gravel.
Pennington	7,557,035	10,178,931	Cement, stone, sand and gravel, lime, feldspar, clays, gypsum, beryllium concentrate, mica (scrap), tin.
Perkins	335,000	555,000	Sand and gravel.
Potter	W	140,000	Do.
Roberts	438,000	143,000	Do.
Sandborn	87,000	57,000	Do.
Shannon	37,000	73,000	Do.
Spink	284,000	94,000	Do.
Stanley	27,000	W	Do.
Sully	108,000	87,000	Sand and gravel.
Todd	26,000	80,000	Do.
Tripp	W	W	Stone, sand and gravel.
Turner	259,000	303,000	Sand and gravel.
Union	209,000	149,000	Do.
Walworth	496,000	295,000	Do.
Washabaugh	47,000	55,000	Do.
Yankton	W	W	Sand and gravel, stone.
Ziebach	W	75,000	Sand and gravel.
Undistributed <sup>1</sup>	2,160,044	3,083,617	
Total	50,175,000	52,707,000	

W Withheld to avoid disclosing individual company confidential data, included with "Undistributed."

<sup>1</sup> Includes production of gem stones that cannot be assigned to specific counties and values indicated by symbol W.

Mines Development, Inc., plant at Edgemont—was slightly higher. Molybdenum production decreased. Sand and gravel production declined 46 percent; the only consumer was the South Dakota Department of Highways.

**Lawrence.**—With mineral production valued at \$21.7 million, 3 percent below that of 1965, the county led the State in output value. Decreased production of gold and silver at the Homestake mine at Lead accounted for part of the decline.

Homestake Mining Co. annual report stated:

Development of Nineteen ledge continued from the 5,000 level to the 6,800 level. Numerous good ore intersections were found. Between the 4,700 and 5,900 levels, there were 1,332,000 tons of measured and indicated ore with an average grade of about \$12.65 per ton in gold. \* \* \* Bottomdump skips having a 10-percent increase in capacity were installed at the Ross and Yates shafts \* \* \*

Sand and gravel and stone were the other minerals produced. Sand and gravel, used mainly by the State and county highway departments, decreased 58,000 tons. Production of stone from five quarries increased more than threefold as crushed stone was used for road surfacing and riprap by the Federal Bureau of Public Roads, Federal Forest Service, State Department of Highways, and the city of Lead.

**Mellette.**—The only mineral production was 28,000 tons of sand and gravel for use by the State Department of Highways. Petroleum activity, however, was increasing. A total of 36,800 acres of oil and gas leases in the county was sold at a State sale in April; most of the acreage was acquired by

Gulf Oil Corp. The northcentral part of the county was the site of a significant show of oil in one of Gulf's exploratory wells.

**Pennington.**—The value of mineral production was \$10.2 million, a 35-percent increase. Of the 12 minerals produced, only lithium and mica declined in quantity and value.

Cement shipped by the State-owned cement plant at Rapid City had the largest increase (\$1.2 million), 25 percent more than in 1965. This gain, in turn, contributed to the increased production of clay (shale), gypsum, limestone, and sand.

Clay (shale), in addition to that used for manufacturing cement, was mined and expanded to a lightweight aggregate by Light Aggregates, Inc., of Rapid City.

The only consumer of gypsum and the largest consumer of crushed limestone was the State-owned cement plant at Rapid City. Other uses of crushed limestone were concrete aggregate, road metal, railroad ballast, lime manufacture, filler, and riprap. Crushed limestone was produced by L. G. Everist, Inc.; Hills Materials Co., a subsidiary of Northwestern Engineering Co.; Pete Lien & Sons; Northwestern Engineering Co.; and Summit, Inc. Pete Lien & Sons also produced dimension limestone for curbing and flagging. Small quantities of crushed quartz for decorative use were produced at the Hugo mine by L. W. Judson and at the Peerless mine by Northwest Beryllium Corp. Dimension sandstone produced by Black Hills Rose Quartz Co. was used for architectural purposes.

Sand and gravel production increased almost twofold because of increased use in highway construction.

Various operators, in the vicinity of Key-

Table 11.—Homestake mine ore milled, receipts, and dividends<sup>1</sup>

Year	Ore milled (thousand short tons)	Receipts for bullion product		Dividends (thousands)
		Total (thousands)	Per ton	
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
1965	2,032	22,094	10.88	3,445
1966	2,002	21,309	10.64	3,937

<sup>1</sup> From 1876 to 1966, inclusive, this mine yielded bullion and concentrates that brought a net return of \$823.3 million and paid \$232.0 million in dividends.

Source: Homestake Mining Co. annual report.

stone, mined pegmatites from which seven mineral products were recovered; beryllium concentrate, feldspar, glass sand, lithium, mica, columbium-tantalum concentrate, and tin concentrate (cassiterite). Northwest Beryllium Corp., operating the Peerless mine, recovered beryllium concentrate, feldspar, glass sand, scrap mica, tin concentrate

(cassiterite), and columbium-tantalum concentrate by processing the ore in its flotation mill at Keystone. Beryllium concentrate, feldspar, lithium (amblygonite), and scrap mica were recovered from the Ingersoll mine operated by Keystone Chemical Co. Beryllium concentrate, feldspar, and scrap mica were recovered from ore from the Hugo mine operated by L. W. Judson.