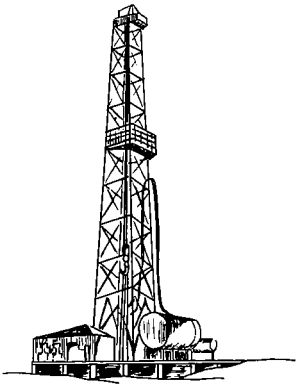
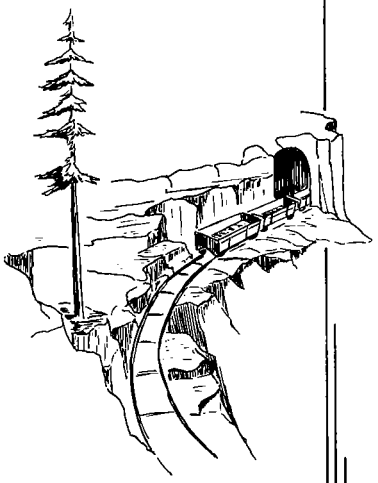




STATE OF SOUTH DAKOTA
Ralph Herseth, Governor

MINERALS REPORT 7

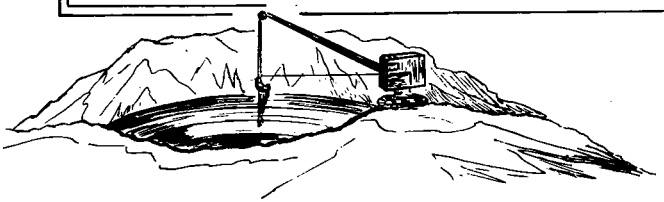
THE MINERAL INDUSTRY OF SOUTH DAKOTA IN 1959

by

D.H. Mullen, U.S. Bureau of Mines

and

Allen F. Agnew, State Geologist



South Dakota State Geological Survey
Vermillion, South Dakota
November 1, 1960

The Mineral Industry of South Dakota

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, U.S. Department of the Interior, and the South Dakota State Geological Survey.

By D. H. Mullen [1] and Allen F. Agnew [2]

THE MINES, quarries, and wells in South Dakota produced mineral products valued at $48.5 million in 1959, a 17-percent increase over 1958 and a new record. The previous high was $42.3 million in 1956. The value of all nonmetals, except scrap mica, lithium minerals and lime, increased substantially over 1958. As a group, the nonmetallic minerals represented 56 percent of the value of the total State mineral production. The quantity and value of sheet mica was more than double that of 1958. Decreases were recorded in the value of beryllium concentrate and silver. Gold production increased a modest 1 percent, whereas the value of produced uranium ore increased 14 percent. Mineral fuels, coal and petroleum, represented only 1 percent of the value of the State mineral production. However, value of coal production was 13 percent greater and that of petroleum more than double that of 1958.

Employment.—Employment in the mineral industries averaged 2,450 persons throughout the year, compared with 2,475 in 1958. Average wages were $92.18 for an average workweek of 45.3 hours, compared with $88.59 and 44.7 hours, respectively, in 1958. The general- and contract-construction industries, producing a substantial part of the crushed stone and sand and gravel used in roadbuilding and heavy construction, employed an average of 8,808 workers, with an average weekly wage of $100.04; and an average workweek of 40.9 hours. The averages were 9,325 workers, $109.61, and 42.3 hours, respectively, in 1958. The weekly wage included base pay, overtime, and night differentials but did not represent take-home pay or wage rates.

Government Programs.—Sheet and hand-cobbed mica and beryllium concentrate (beryl) were purchased by the Federal Government through General Services Administration (GSA) buying station at Custer for the strategic stockpile. Purchases of columbium-tantalum concentrate (columbite-tantalite) ceased late in 1958 when the limit for the stockpile was reached. Hand-cobbed mica was processed at the station by a contractor for GSA. Beryllium concentrate, columbium-tantalum concentrate (acquired until purchases ceased), and strategic mica were shipped from the station to stockpiles.

The Office of Mineral Exploration (OME) did not approve any exploration contracts in 1959.

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

Mineral	1958		1959	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate.....short tons, gross weight	240	$129	156	$84
Clays [2]	155	155	227	227
Coal (lignite)	20	78	22	88
Columbium-tantalum concentrate.....pounds	4,294	10		
Feldspar.....long tons	23,229	145	30,825	196
Gem stones	(3)	16	(3)	20
Gold (recoverable content of ores, etc.).....troy ounces	570,830	19,979	577,730	20,221
Gypsum	12	49	19	78
Mica:				
Scrap.....short tons	1,003	24	158	5
Sheet.....pounds	16,772	68	38,775	158
Petroleum.....thousand 42-gallon barrels	58	(4)	119	(4)
Sand and gravel	14,705	9,179	17,775	11,058
Silver (recoverable content of ores, etc.) thousand troy ounces	153	138	124	113
Stone	1,395	4,095	2,721	7,243
Uranium ore.....short tons	35,489	530	45,734	606
Value of items that cannot be disclosed: Cement, clays (bentonite), lime, lithium minerals, and values indicated by footnote 4		7,555		9,333
Total South Dakota [5]		41,534		48,485

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes bentonite; value included with "Items that cannot be disclosed."
[3] Weight not recorded.
[4] Figure withheld to avoid disclosing individual company confidential data.
[5] Total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement and lime.

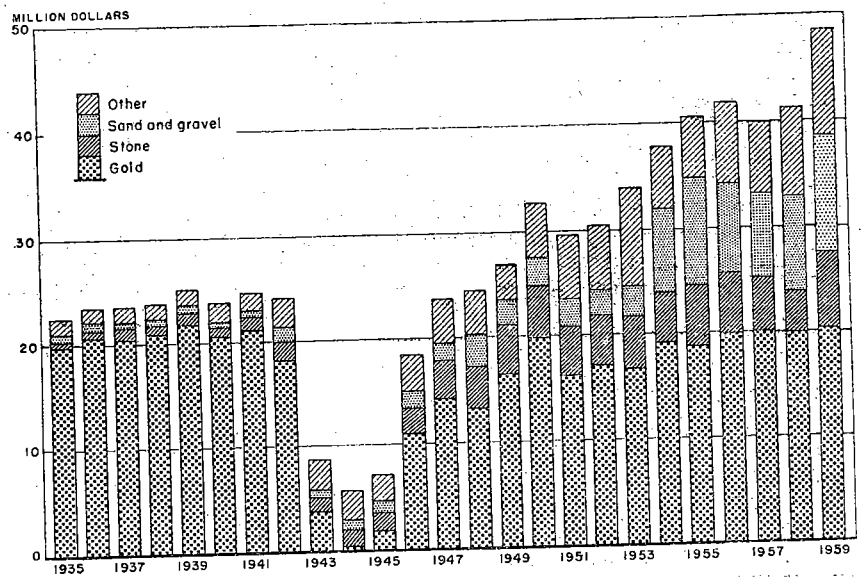

FIGURE 1.—Value of gold, dimension and crushed stone, sand and gravel, and total value of mineral production in South Dakota, 1935–59.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Shipments of masonry and portland cements were 16 percent greater than in 1958. The average price per barrel of portland cement was $3.01, compared with $3.00 in 1958; the price for masonry cement remained unchanged at $3.76 per barrel.

Clays.—Production of miscellaneous clay in Butte County (for manufacturing of building brick, sewer tile, and other heavy clay products) and in Pennington County (for cement and lightweight aggregate) was 46 percent greater than in 1958, reflecting increased cement production. Bentonite production rose 58 percent above 1958. One company at Belle Fourche, Butte County, mined and processed bentonite from deposits in South Dakota and Wyoming. One other firm in Belle Fourche also processed bentonite but only from deposits in Wyoming.

Feldspar.—Production of feldspar from pegmatite deposits in Custer and Pennington Counties increased 33 percent above 1958. The new grinding plant at Custer, replacing the one destroyed by fire in July 1958, operated the entire year and provided an outlet for independent operators. All the output of potash feldspar was ground at the Custer plant. One operator produced soda feldspar for grinding at its plant in Illinois. The ground product from the Custer plant was shipped to consumers in Eastern, Midwestern, and Western States for use in manufacturing glass, pottery, and enamel.

Gem Stones.—Agate, rose quartz, chalcedony, petrified and agatized wood, gem varieties and specimens of beryl, cassoterite, lepidolite, and ore minerals were collected by various individuals, gem and specimen dealers, and gem societies. The greatest quantity was found in Custer County and lesser amounts in most of the other western counties. Reported value of the gems and mineral specimens collected was 25 percent greater than in 1958.

Gypsum.—Gypsum for use in manufacturing cement was mined by the South Dakota State Cement Commission from deposits in the Spearfish formation near Rapid City, Pennington County; production was 58 percent greater than in 1958.

Lime.—High-calcium limestone was mined from deposits in Custer County for manufacturing quicklime at a plant near Pringle. The entire output was used in the State for metallurgical purposes; production was 38 percent below that of 1958.

Mica.—Mica (full-trimmed, hand-cobbed, and scrap) came from 16 mines in Custer and Pennington Counties. Scrap-mica production decreased 84 percent compared with 1958, whereas the quantity of sheet mica recovered more than doubled. Scrap mica came from two mines in Pennington County, and the major portion (82 percent) of the full-trimmed and hand-cobbed mica was from mines in Custer County. Yield of block mica increased to 10.59 percent of the hand-cobbed mica processed, compared with 6.49 in 1958; however, recovery of Stained quality and Good-Stained and better decreased to 1.55 and 51.84 percent, respectively, of the hand-cobbed mica processed, compared with 2.82 and 57.26 percent in 1958. The output of hand-cobbed

TABLE 2.—Production of hand-cobbed mica and yield of sheet mica

Year	Hand-cobbed mica	Total block mica recovered		Stained quality recovered		Good-Stained and better quality recovered	
	Pounds	Pounds	Percent of hand-cobbed	Pounds	Percent of total block	Pounds	Percent of total block
1955	64,673	4,633	7.16	1,856	40.06	259	5.59
1956	216,802	12,238	5.64	7,420	60.63	253	2.07
1957	149,163	9,048	6.07	4,828	53.36	255	2.82
1958	257,198	16,681	6.49	9,552	57.26	471	2.82
1959	365,712	38,734	10.59	20,079	51.84	601	1.55

and full-trimmed mica was sold to GSA at Custer, where it was processed by a private contractor for the Government.

Sand and Gravel.—Sand and gravel production was reported from 62 of 67 counties, and increased 21 percent, compared with 1958. Commercial production was reported at 97 operations in 33 counties; production by Government-and-contractor operators was reported in 60 counties. Contractors for the State department of highways operated in 52 counties. Of the total sand and gravel produced, 92 percent was used for paving and roadbuilding; 97 percent of production by Government-and-contractor operations was used for roadbuilding.

Counties producing in excess of 500,000 tons of sand and gravel were Pennington (1,696,300), Brown (1,205,900), Minnehaha (718,300), Lake (718,300), Hughes (656,800), Brookings (631,500), Stanley (571,400), and Clark (567,500).

Stone.—Stone production—dimension granite, crushed limestone, sandstone, and miscellaneous stone—increased 95 percent in quantity

TABLE 3.—Mica sold or used by producers

	1955	1956	1957	1958	1959
Hand-cobbed mica, total:[1] Pounds	64,673	216,802	149,163	257,198	365,712
Sheet mica:[1]					
Full trimmed:					
Pounds	221	256	45	94	41
Value	$1,980	$2,010	$756	$1,393	$593
Average per pound	$8.96	$7.85	$16.80	$14.82	$14.46
From hand-cobbed mica:					
Pounds	4,633	12,238	9,048	16,678	38,734
Value	$19,403	$65,043	$44,751	$66,489	$157,234
Average per pound	$4.19	$5.31	$4.95	$3.99	$4.06
Total:					
Pounds	4,854	12,494	9,093	16,772	38,775
Value	$21,383	$67,053	$45,507	$67,882	$157,827
Average per pound	$4.41	$5.37	$5.00	$4.05	$4.07
Scrap mica, total:					
Short tons	1,322	1,268	1,626	1,003	158
Value	$26,853	$31,224	$43,142	$24,241	$4,916
Average per ton	$20.31	$24.62	$26.53	$24.17	$31.11
Total sheet and scrap mica:					
Short tons	1,324	1,274	1,631	1,011	177
Value	$48,236	$98,277	$88,649	$92,123	$162,743

[1] Sold to the Government through GSA.

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

Class of operation and use	1958		1959	
	Thousand short tons	Value (thousands)	Thousand short tons	Value (thousands)
COMMERCIAL OPERATIONS				
Construction sand:				
Building	346	$366	478	$529
Paving	266	237	377	351
Railroad ballast			45	24
Fill	4	2	22	11
Other	11	6	20	8
Industrial sand:				
Filtration	88	88		
Molding	(1)	2	1	5
Total sand	715	701	943	928
Construction gravel:				
Building	234	291	294	282
Paving	1,517	921	4,010	2,678
Railroad ballast	181	151	52	34
Fill	20	11	46	16
Other	9	5	(1)	(1)
Miscellaneous gravel			36	11
Total gravel	1,961	1,379	4,438	3,021
Total sand and gravel	2,676	2,080	5,381	3,949
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Building	49	49		
Paving	475	310	445	300
Total sand	524	359	445	300
Gravel:				
Building			399	349
Paving	11,505	6,740	11,550	6,460
Total gravel	11,505	6,740	11,949	6,809
Total sand and gravel	12,029	7,099	12,394	7,109
ALL OPERATIONS				
Sand	1,239	1,060	1,388	1,228
Gravel	13,466	8,119	16,387	9,830
Grand total	14,705	9,179	17,775	11,058

[1] Less than 1,000 tons.

and 77 percent in value, compared with 1958. Quantity of dimension granite produced in Grant County for monuments and architectural use declined slightly, compared with 1958. Production of crushed limestone, sandstone, and miscellaneous stone (used almost entirely for concrete aggregate and road construction) more than doubled that of 1958. A substantial quantity of limestone was mined from deposits in Pennington and Custer Counties for manufacturing cement and lime. Sandstone produced in Hanson and Minnehaha Counties was used as refractory stone, and in foundries and filters, manufacturing ferrosilicon, and road construction. Miscellaneous stone of undefined type was produced in 35 counties by contractors for use on State highways.

METALS

Beryllium.—Beryllium concentrate (beryl) was produced at 49 properties by 66 operators in Pennington and Custer Counties as a coproduct of feldspar and mica mining. Output, which declined 35 percent below that of 1958, was sold to GSA at Custer and to Gladys Wells of Custer who purchased small lots for resale to consumers.

The Federal Bureau of Mines continued its investigation of beryllium recovery from low-grade products by solvent extraction at its research laboratory in Rapid City.

Columbium-Tantalum.—The Government completed its purchase program of columbium-tantalum concentrate (columbite-tantalite) in 1958, and there was no reported production or sale of the mineral in 1959.

Gold and Silver.—Production of gold increased only 1 percent over that of 1958, and silver production decreased 19 percent. Homestake Mining Co., the Nation's leading gold producer, was the only gold and silver mine operating in the State at the close of the year.

Iron Ore.—The Colorado Fuel and Iron Corp. continued to drill iron deposits near Nemo, Lawrence County. The corporation announced plans to construct a $15 million beneficiation plant to upgrade the iron-bearing material when an adequate reserve of raw material was developed. It was anticipated that development of the ore bodies and construction of the plant would be completed within 7 to 8 years. No production was reported in 1959.

Uranium.—Production of uranium ore from mines in Fall River and Custer Counties advanced 29 percent in quantity and 14 percent in value, compared with 1958. The grade of ore produced declined from 0.20 percent (4.0 pounds per ton) uranium oxide to 0.19 percent (3.8 pounds per ton). The number of shippers increased from 28 in 1958 to 36 in 1959. A description [3] of the uranium-bearing formation in the Black Hills was published.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (thousand short tons)	Gold (lode and placer)		Silver (lode and placer)		Total value (thousands)
	Lode	Placer		Troy ounces	Value (thousands)	Troy ounces (thousands)	Value (thousands)	
1950–54 (average)	4	1	1,393	517,013	$18,095	141	$127	[3] $18,224
1955	2	--	1,665	529,865	18,545	154	140	18,685
1956	2	--	1,743	568,523	19,898	136	123	20,021
1957	2	--	1,779	568,130	19,885	135	122	20,007
1958	3	--	1,824	570,830	19,979	153	138	20,117
1959	2	--	1,778	577,730	20,221	124	113	20,334
1876–1959	--	--	(4)	27,696,136	750,962	11,410	8,459	[5] 759,585

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore or old tailings shipped directly to smelters during the calendar year indicated.
[2] Does not include gravel washed.
[3] Includes 14 short tons of lead valued at $3,956.
[4] Data not available.
[5] Includes 106 short tons of copper valued at $36,466, 497 tons of lead valued at $71,752, and 265 tons of zinc valued at $56,406 produced before 1954.

[3] Waagé, K. M., Stratigraphy of the Inyan Kara Group in the Black Hills: Geol. Survey Bull. 1081(b), 1959, pp. 11–90.

MINERAL FUELS

Coal (Lignite).—Output from a strip mine in Dewey County increased 10 percent, compared with 1958, and was consumed locally. Part of the production was crushed and oil-treated for use in stokers. Other mines producing less than 1,000 tons a year—all for local consumption—were operated in Dewey, Corson, and Perkins Counties.

Petroleum.—Petroleum production from fields in Harding and Custer Counties was more than double that of 1958. Drilling was more extensive than in the previous year, and according to data collected by the State geologist, 28 wells were completed (17 exploratory and 11 development). Some of the six exploratory wells listed as discoveries were later included in the Buffalo field in Harding County; others failed to produce oil in commercial quantities. Drilling totaled 218,758 feet. The 12–11 Tilus, located 5 miles south and slightly east of the Buffalo field, was the most significant discovery and pumped 111 barrels of oil a day. All production in Harding County has been from the Red River (Ordovician) formation at depths of approximately 8,500 feet.

REVIEW BY COUNTIES

Butte.—Bentonite, produced by American Colloid Co., was processed at the company mill at Belle Fourche. Eastern Clay Products Department, International Minerals & Chemical Corp., operated its bentonite mill at Belle Fourche and processed material from deposits in Wyoming. Miscellaneous clay was produced by Black Hills Clay Products Co. for manufacturing building brick, draintile, and other heavy clay products. Crushed stone and sand and gravel were produced by contractors for the State department of highways and the city of Belle Fourche for road construction. Butte County Highway Department produced sand and gravel for road repairs.

Custer.—Beryllium concentrate (beryl) was produced as a coproduct of feldspar and mica mining from pegmatite deposits at 36 mines by 45 operators. The major producers were Bland Mining & Milling Co. operating at the Autumn Charm, Bull Moose, Beecher No. 3, Ballard Dyke, Lucky Tin, Someday, and Tin Mountain mines; Dakota Beryllium & Oil Co. at the Red Bird lode; and Leonard E. Wood at the Lucky Strike. Most of the production was sold to the GSA purchase depot at Custer. Gladys Wells of Custer purchased small lots for resale to GSA and consumers. Feldspar production was from 64 operations at 61 mines. Abingdon Potteries, Inc., produced soda feldspar at the Townsite mine for shipment to its grinding plant in Illinois. Consolidated Feldspar Department, International Minerals & Chemical Corp., operated the Dorothy, Shamrock, and White Elephant mines. Other producers included George Bland and Russell Wineteer at the Ballard Dyke mine, Royce McRobbie at the Rainbow, John Phepps at the Tip Top, and Ray Wineteer at the Warren Draw. The Consolidated Feldspar Department, International Minerals & Chemical Corp., operated its new mill at Custer the entire year and processed the total output of potash feldspar. The ground product was shipped to consumers in more than 20 States, Canada, and Mexico for use in manufacturing glass, pottery, and enamel.

TABLE 6.—Value of mineral production in South Dakota, by counties

County	1958	1959	Minerals produced in 1959 in order of value
Aurora	$84,300	$52,400	Sand and gravel.
Beadle	339,200	260,919	Sand and gravel, stone.
Bennett	29,900	42,600	Sand and gravel.
Bon Homme	142,800	145,200	Do.
Brookings	217,000	486,400	Do.
Brown	345,800	783,348	Sand and gravel, stone.
Brule	42,800	37,472	Do.
Buffalo	65,900	49,900	Sand and gravel.
Butte	1,572,189	2,359,203	Clays, sand and gravel, stone.
Campbell	11,500	39,319	Sand and gravel, stone.
Charles Mix	230,800	184,236	Do.
Clark	135,600	299,806	Do.
Clay	53,900	50,027	Do.
Codington	531,800	404,795	Do.
Corson	65,800	179,200	Sand and gravel.
Custer	488,653	702,902	Uranium ore, feldspar, mica (sheet), lime, beryllium concentrate, stone, gem stones, petroleum.
Davison	118,000	129,584	Sand and gravel, stone.
Day	157,100	280,946	Do.
Deuel	64,500	45,685	Do.
Dewey	130,484	87,712	Coal.
Douglas	118,700	124,700	Sand and gravel.
Edmunds	119,600	38,600	Do.
Fall River	617,021	572,042	Uranium ore, sand and gravel, stone, gem stones.
Faulk	115,900	175,844	Sand and gravel, stone.
Grant	2,303,762	3,077,096	Stone, sand and gravel.
Gregory	284,000	121,905	Sand and gravel, stone.
Haakon	184,500	70,536	Do.
Hamlin	98,700	45,400	Sand and gravel.
Hand	93,200	28,197	Sand and gravel, stone.
Hanson	392,300	377,534	Stone, sand and gravel.
Harding	(1)	(1)	Petroleum, sand and gravel.
Hughes	173,100	481,400	Sand and gravel.
Hutchinson	143,000	55,950	Sand and gravel, stone.
Hyde	90,400	209,800	Sand and gravel.
Jackson	195,600	61,818	Sand and gravel, stone.
Jerauld	114,400	107,200	Sand and gravel.
Jones	2,300	----	
Kingsbury	111,300	131,714	Sand and gravel, stone.
Lake	170,300	584,075	Do.
Lawrence	20,238,118	20,477,494	Gold, silver, sand and gravel, stone.
Lincoln	525,400	179,118	Sand and gravel, stone.
Lyman	86,300	153,800	Sand and gravel.
Marshall	158,800	146,000	Do.
McCook	32,100	10,800	Do.
McPherson	157,000	146,000	Do.
Meade	225,200	76,500	Do.
Mellette	15,300	20,000	Do.
Miner	32,100	76,400	Do.
Minnehaha	854,900	1,816,926	Stone, sand and gravel.
Moody	130,300	113,500	Sand and gravel.
Pennington	7,933,023	10,531,492	Cement, stone, sand and gravel, clays, gypsum, beryllium concentrate, mica (sheet), feldspar, mica (scrap), gem stones.
Perkins	137,000	92,500	Sand and gravel.
Potter	96,000	119,844	Sand and gravel, stone.
Roberts	197,500	256,520	Do.
Sanborn	11,500	6,884	Do.
Shannon	----	49,500	Sand and gravel.
Spink	266,400	135,806	Sand and gravel, stone.
Stanley	95,300	334,800	Sand and gravel.
Sully	55,300	35,800	Do.
Todd	18,600	27,203	Sand and gravel, stone.
Tripp	94,900	4,324	Stone.
Turner	57,300	28,700	Sand and gravel.
Union	41,300	262,083	Sand and gravel, stone.
Walworth	118,300	159,621	Do.
Washabaugh	25,000	150	Gem stones.
Yankton	45,300	128,800	Sand and gravel.
Ziebach	22,400	6,900	Do.
Undistributed [2]	323,000	1,147,280	
Total [3]	41,534,000	48,485,000	

[1] Figure witheld to avoid disclosing individual company confidential data; included with "Undistributed."
[2] Includes production of some sand and gravel, lithium minerals, and gem stones that cannot be assigned to specific counties and values indicated by footnote 1.
[3] Total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement and lime.

Full-trimmed and hand-cobbed mica, an important coproduct from pegmatite deposits, was produced from 16 operations at 12 mines. Only two operators produced full-trimmed mica. The entire output was sold to GSA purchase depot. The hand-cobbed mica was processed at the depot by a contractor for the Government, and the strategic mica recovered was reserved for the national stockpile. Scrap generated in processing was sold to grinders as it accumulated. Principal producers were York Minerals at the Red Deer mine and Kennedy and Cram at the Red Fawn. No scrap mica was reported produced or sold in 1959. High-calcium limestone was produced near Pringle for manufacturing quicklime. The entire output of quicklime was used in the State for metallurgical purposes.

Triangle Enterprises, Inc., the leading producer of uranium ore in the State, operated the Lucky Bud No. 2 mine. Ore was shipped to the plant at Edgemont for processing. Crushed rock was produced by contractors for the State department of highways for road construction. Petroleum was produced from a single well in the Barker field. Gem stones and mineral specimens, including several varieties of quartz, garnet, feldspar, chalcedony, and agate, were collected by individuals, mineral shops, and gem societies. The better grades were polished or otherwise prepared for sale as individual specimens. Lower grades were used as decorative material on art objects for sale as curios and in collections of mineral specimens characteristic of the Black Hills Region.

Fall River.—Uranium ore produced from 35 operations was shipped to the processing plant at Edgemont for recovery of uranium. Principal operators were Bear Lodge Mineral Corp. and Giant Cycle Corp., Soto and Verde mines; Chord Uranium Co., Coal Canyon No. 1, Darrow Lease, Gertrude, Get Me Rich No. 1, King, and Trail Fraction mines; Shelton Warren Oil Co., K–9 mine; Montana Chemical & Milling Corp., Gull Lease and Gull No. 3 mines; Emmet Isaacs, Hey & Fay Nos. 5 and 6 mines; and Pictograph Mining Co. and Matthew J. Brown, Dexter No. 4 mine. Mines Development, Inc., operated its 400-ton-a-day processing plant at Edgemont all year. Improvements were made in the mill to control radioactivity. Test work was begun to design a vanadium recovery unit for the plant. The uranium ore treated contained approximately 3 pounds of vanadium per ton, and recovery was expected to be 90 percent or better. Sand and gravel for building and paving was produced by four operators. Major producers were Flyte Rock Products Co. and Oral Sand Co. Contractors produced sand and gravel for road construction for the State department of highways. Specimens of agate, jasper, and petrified moss were collected by individuals and gem societies.

Grant.—Dimension granite produced at 11 quarries near Milbank and Big Stone City declined 1 percent, compared with 1958. The mahogany-brown and deep-red granites of the area were used extensively for monuments, building facings, and interior decoration. A substantial portion of the production was finished at plants in Minnesota. Major producers included Cold Spring Granite Co. (Carnelian and Melrose quarries), Dakota Granite Co. (American Rose, Bellingham, and Dakota No. 1 quarries), Delano Granite Works, Inc. (Mahogany quarry), North Star Granite Corp., and Robert Hunter

Granite Co., Inc. Walter Lindberg produced paving gravel. Paving gravel also was produced by contractors for the State department of highways.

Harding.—Petroleum production in South Dakota was almost entirely from fields in Harding County; 14 producing wells were operating at the close of the year. Most of the exploratory drilling and all development drilling were in Harding County. Exploratory drilling was significant in that the production area adjacent to the Buffalo field was extended 5 miles south. The South Dakota Oil and Gas Board defined the limits of the Buffalo field and established a spacing pattern of 160 acres. Spacing was subject to reexamination at a later date. Sand and gravel was produced by contractors for the State department of highways.

Lawrence.—Gold production increased 1 percent over 1958, and that of silver decreased 19 percent. Production of crushed limestone by Cole Construction Co. for use in sugar refining and road construction and of crushed miscellaneous stone by contractors for the State department of highways increased 51 percent; sand and gravel used for building and road construction decreased 9 percent.

Homestake Mining Co. operated its Homestake mine and amalgamation-cyanidation plant at Lead the entire year, maintaining its position as the leading gold producer in the Nation. Milled ore totaled nearly 1.75 million tons, the highest achieved in 82 years of operation. Recovery of gold and silver was 97.21 percent, or $11.52 a ton, compared with 97.13 percent and $11.37, respectively, in 1958. Direct operating costs increased only 2 cents a ton and reflected an increased productivity rate of 3.41 tons per man-shift, compared with 3.25 tons in 1958.

Ore reserve, for the first time in several years, increased by more than 0.5 million tons to a total of 13.9 million tons. Results of diamond drilling on the 4,250 level permitted the inclusion of ore between the 4,100 and 4,400 levels without the severe discount factor previously applied. The average value of the ore reserve increased by 14 cents a ton.

In February the No. 4 shaft was completed at a depth of 6,253 feet. Development continued on the 5,900 and 6,200 levels but was confined to the main ledge on the 5,900 level and the No. 9 ledge on the 6,200 level because of the high rock temperatures (113° F.) on the lowest levels. The No. 5 shaft of the long-range ventilation program was completed to the 5,000-foot level. Stripping of the Oro Hondo shaft

TABLE 7.—Ore milled, receipts, and dividends, Homestake mine[1]

Year	Ore milled (thousand short tons)	Receipts for bullion product		Dividends (thousands)
		Total (thousands)	Per ton	
1955	1,550	$18,055	$11.65	$4,019
1956	1,628	19,354	11.89	4,019
1957	1,660	19,479	11.74	4,019
1958	1,725	19,611	11.37	4,019
1959	1,746	20,120	11.52	4,019

[1] From 1876 to 1959, inclusive, this mine yielded bullion and concentrates that brought a net return of $678.5 million and paid $206.9 million in dividends.

was to begin in 1960 and the entire ventilation program was scheduled to be completed in 1961, permitting extensive development of the 5,900- and 6,200-foot levels. Total development in 1959 consisted of 80 feet of shaft sinking, 7,516 feet of raising, 29,138 feet of drifts and crosscuts, and 67,332 feet of diamond drilling.

The Bald Mountain Mining Co. operated the Dakota, Portland, Clinton, Decorah, and Folger mines and its 350-ton-a-day all-slime cyanide plant at Trojan until July, when operations were suspended for an indefinite period. The average value of the ore mined and milled was only slightly more than $5 a ton, and constantly increasing operating costs made the suspension necessary.

Pennington.—The county ranked second in the State in the value of various minerals and mineral products. Beryllium concentrate (beryl) was produced at 13 properties from 21 operations as a coproduct in the mining of feldspar and mica. The quantity recovered was 38 percent below that of 1958. Major producers were Keystone Feldspar & Chemical Co., Peerless lode; Thomas M. Edson, also at the Peerless lode; Elmer C. Harris, Peerless dump; McCarty-Pullen Mines, White Cap mine; Mylett Mining Account, Sackett Fraction lode; and Walter Hough, High Climb mine. These operators produced 85 percent of the beryl in the county, nearly all of which was sold to GSA at Custer. Gladys Wells purchased small lots for resale to GSA and to consumers. Feldspar was produced at seven mines and sold to Consolidated Feldspar Department, International Minerals & Chemical Corp., at Custer for grinding. Principal producers were Walter Hough at the High Climb mine and McCarty-Pullen Mines at the White Cap. Mica was produced at four mines, and hand-cobbed mica output was 48 percent greater than in 1958. Major producers were McCarty-Pullen Mines at the White Cap mine and Thomas M. Edson at the Peerless lode. Glen Ventling produced a small quantity of full-trimmed mica at the Dike lode. All hand-cobbed and full-trimmed mica was sold to GSA. Scrap mica produced at the Peerless lode by Thomas M. Edson and at the White Cap mine by McCarty-Pullen Mines was 83 percent below that of 1958; all was sold to grinders.

Shipments of portland and masonry cements by South Dakota State Cement Commission at Rapid City increased 16 percent, compared with 1958. The Commission produced the limestone, shale, sand, and gypsum used at the plant from deposits near Rapid City. Cement clinker was used as a base in manufacturing masonry cement. Shipments were made to consumers throughout South Dakota and to the adjoining States of North Dakota, Wyoming, Montana, Nebraska, and Minnesota. Small shipments also were made to Colorado and Illinois.

Miscellaneous clay was mined from the Pierre formation near Rapid City for manufacturing lightweight aggregate. Light Aggregates, Inc., operated its bloating plant at Rapid City, and the entire output was used as a concrete aggregate and in manufacturing building blocks. The county led the State in the production of sand and gravel. Production in 1959 was 1.7 million tons, more than double that of the previous year. Approximately half of the 1959 production was by contractors for the State department of highways, Fed-

eral agencies, and the county highway department. Principal producers were Rounds Construction Co., Floyd Stapp Construction Co., and Birdsall Sand & Gravel Co.

Crushed limestone for riprap, road construction, concrete aggregate, and railroad ballast was produced by three operators, Hills Materials Co., L. G. Everist, Inc., and Pete Lien & Sons. The latter company began constructing a modern aggregate plant at Rapid City, designed to produce all sizes of sand, gravel, and crushed rock for use in building, heavy construction, and highways.

Gem stones and mineral specimens were collected by individuals and gem societies from the various mineral deposits in the county. Most of the material collected was sold to tourists as specimens and curios; the better grades were polished.