

MINERALS REPORT 4

THE MINERAL INDUSTRY OF SOUTH DAKOTA
IN 1957

by

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SOUTH DAKOTA GEOLOGICAL SURVEY
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The Mineral Industry of South Dakota

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By D. H. Mullen¹ and Allen F. Agnew²



MINERAL production in South Dakota in 1957 was valued at \$40 million, a 5-percent decrease compared with 1956. The drop in value was the first in 6 years. Substantial gains in value of beryllium concentrate, columbium-tantalum concentrate, scrap mica, uranium ore, lime, and petroleum failed to offset declines in value of output of all other mineral commodities. The output of gold and silver was only slightly less than in 1956, but substantial decreases were noted in the value of clays, cement, sheet mica, stone, and coal. During the first full year's operation of the uranium-processing mill at Edgemont, production of uranium ore doubled, and the value increased 60 percent. Petroleum production from the one field in Harding County increased substantially.

The value was 5 percent less, but production of sand and gravel increased 18 percent in 1957, largely because of activity by contractors for State highway construction.

EMPLOYMENT

Employment in the mineral industries in 1957 averaged 2,612 engaged in mining and 9,125 in general and contract construction, compared with 2,500 and 10,000, respectively, in 1956. The latter classification included those contractors building highway bridges and similar structures and involved producing substantial quantities of sand and gravel and stone. Employment in mining in the State was 2 percent of the total nonagricultural employment which averaged 125,950 in 1957. Employees in the mineral industries averaged 44.6 hours per week; the weekly wage averaged \$85.70. In contrast, general- and contract-construction workers averaged 42.7 hours per week, and the weekly wage averaged \$95.21. The weekly wage included base pay, overtime, and night differentials and did not represent take-home pay or wage rates.

GOVERNMENT PROGRAMS

General Services Administration (GSA) operated the Government purchase depot at Custer the entire year. The depot purchased sheet and hand-cobbed mica and beryllium and columbium-tantalum concentrates for the strategic mineral stockpile. The hand-cobbed

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TABLE 1.—Mineral production in South Dakota, 1956-57¹

Mineral	1956		1957	
	Thousand short tons (unless otherwise stated)	Value (thousands)	Thousand short tons (unless otherwise stated)	Value (thousands)
Beryllium concentrate.....short tons, gross weight.....	195	\$95	268	\$145
Clays ²	201	201	176	176
Coal (lignite).....	25	90	21	79
Columbium-tantalum concentrate.....pounds.....	237	-----	2,311	6
Feldspar.....thousand long tons.....	45	289	41	267
Gem stones.....	(³)	10	(³)	15
Gold (recoverable content of ores, etc.).....thousand troy ounces.....	569	19,898	568	19,885
Gypsum.....	16	63	13	53
Iron ore (usable).....thousand long tons, gross weight.....	22	100	(⁴)	(⁴)
Mica:				
Scrap.....	1	31	2	43
Sheet.....thousand pounds.....	12	\$ 67	9	46
Sand and gravel.....	12,539	8,423	14,758	8,001
Silver (recoverable content of ores, etc.).....thousand troy ounces.....	136	123	135	122
Stone.....	2,200	5,725	1,718	5,068
Uranium ore.....	35	475	70	760
Value of items that cannot be disclosed: Bentonite, cement, lime, petroleum, and value indicated by footnote 4.....	-----	7,548	-----	6,083
Total ⁶	-----	\$ 42,281	-----	39,990

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; value included with "Items that cannot be disclosed."

⁵ Revised figure.

⁶ Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and lime.

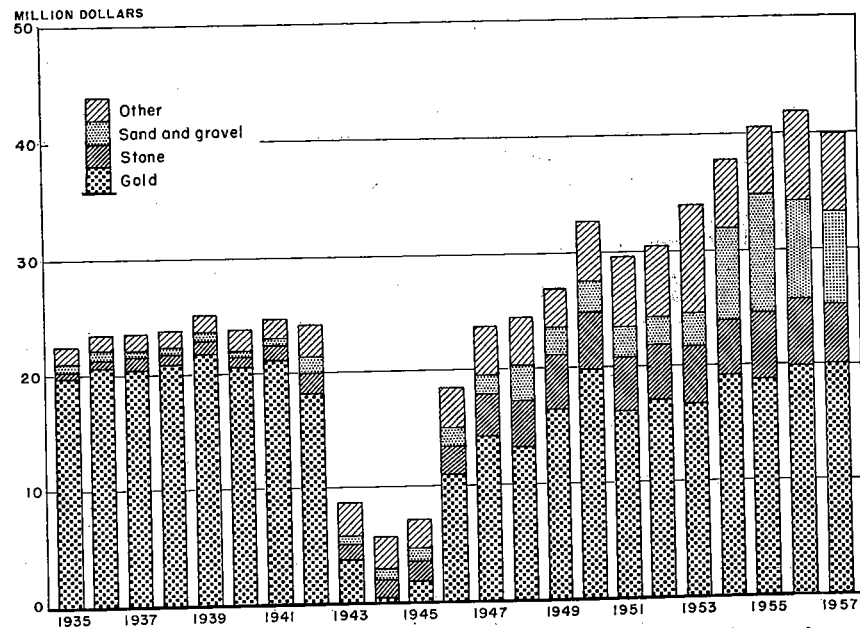


FIGURE 1.—Value of gold, dimension and crushed stone, sand and gravel, and total value of mineral production in South Dakota, 1935-57.

mica was processed under contract between GSA and a private operator. Beryllium and columbium-tantalum concentrates were purchased by GSA. Two contracts (one each in Fall River and Harding Counties) for Government assistance in the exploration of uranium deposits were approved by Defense Minerals Exploration Administration (DMEA). The contracts totaled \$78,836; Government participation was \$59,127.

REVIEW BY MINERAL COMMODITIES

METALS

Beryllium.—Beryllium concentrate (beryl) was hand-sorted from pegmatites in Custer and Pennington Counties as a coproduct of mining feldspar and mica. Production was reported from 106 mines. The greatest output came from Pennington County, with 58 percent of the total value. Virtually the entire production was sold to the Government at the GSA purchase depot at Custer, either directly or to buyers who purchased small lots and in turn sold them to GSA. Production increased 37 percent in quantity and 53 percent in value compared with 1956. The grade of the concentrate offered for purchase was higher in 1957 and supplied the substantial increase in value over 1956.

The Federal Bureau of Mines Experiment Station at Rapid City continued to study the recovery of beryllium oxide from low-grade-beryl-flotation concentrate. The Rapid City station was chiefly concerned with a process that involved roasting and leaching the flotation concentrate and recovering the beryllium oxide from the leach liquors by fractional precipitation and solvent extraction. A report³ on the progress of the investigations was published.

Columbium Tantalum.—Production of columbium-tantalum concentrate rose sharply in 1957 as a direct result of extension of the purchase program provided by Public Law 733, which became effective in 1956. There was no immediate effect of the law in 1956, but production in 1957 increased nearly 10-fold compared with 1956, when production was at its lowest point in 5 years. Columbite-tantalite was recovered by hand-sorting as a coproduct of feldspar and mica mining. Production was reported at 8 operations in Custer and Pennington Counties; the largest part (57 percent) came from Pennington County. The entire quantity was sold to the Government (GSA) purchase depot at Custer.

Gold and Silver.—Production of gold and silver from Homestake Mining Co. and Bald Mountain Mining Co., both in Lawrence County, declined only slightly in 1957 compared with 1956. The output of the 2 metals in value in 1957 represented 96 percent of metal production and 50 percent of mineral production in the State. Homestake Mining Co. continued to be the Nation's leading gold producer.

Iron Ore.—Iron ore was produced from an open-pit mine near Nemo in Lawrence County for manufacturing cement. The deposits have been studied at various times to determine if the material could

³ Runke, S. M., and Riley, J. M., Progress report on Pegmatite Investigations in South Dakota for Fiscal Years 1954-56: Bureau of Mines Rept. of Investigations 5339, 1957, 18 pp.

be used in blast furnaces, either with or without beneficiation. Again in 1957 several companies were reported to be continuing such investigations.

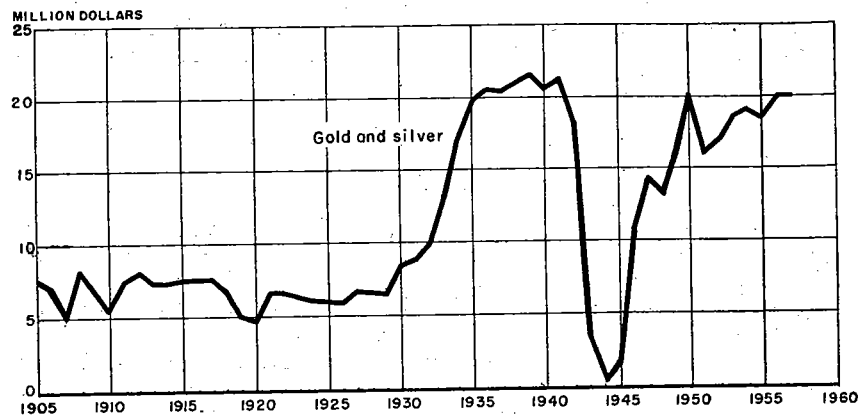


FIGURE 2.—Total value of mine production of gold and silver in South Dakota, 1905-57.

TABLE 2.—Mine production of gold and silver in 1957, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Month	Gold (fine ounces)	Silver (fine ounces)
January.....	50,055	12,607	August.....	46,128	10,451
February.....	44,862	10,404	September.....	44,712	9,952
March.....	50,743	11,562	October.....	48,837	12,580
April.....	45,296	10,297	November.....	47,176	12,292
May.....	49,221	11,098	December.....	47,320	12,245
June.....	45,991	10,460	Total.....	568,130	134,737
July.....	47,739	10,789			

TABLE 3.—Mine production of gold, silver, copper, lead, and zinc, 1948-52 (average), 1953-57, and total 1876-1957, in terms of recoverable metals¹

Year	Mines producing		Material sold or treated ² (short tons)	Gold (lode and placer)		Silver (lode and placer)		Total value
	Lode	Placer		Fine ounces	Value	Fine ounces	Value	
1948-52 (average)	5	1	1,223,574	470,226	\$16,457,917	123,567	\$111,834	\$16,572,960
1953.....	4		1,479,802	534,987	18,724,545	138,642	125,478	18,852,643
1954.....	2		1,600,784	541,445	18,960,575	151,407	137,031	19,087,806
1955.....	2		1,665,341	529,865	18,545,275	154,092	139,461	18,684,736
1956.....	2		1,743,173	568,523	19,898,305	136,118	123,194	20,021,499
1957.....	2		1,778,583	568,130	19,884,550	134,737	121,944	20,006,494
1876-1957.....			(³)	26,547,576	710,762,369	11,132,522	8,207,410	\$719,134,403

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 5 short tons of lead valued at \$1,666 and 6 tons of zinc valued at \$1,543.

⁴ Includes 10 short tons of lead valued at \$2,620 in 1953.

⁵ Figure not available.

⁶ 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.

TABLE 4.—Gold and silver bullion produced at mills by amalgamation, 1948-52 (average) and 1953-57

Year	Material sold or treated (short tons)	Gold in bullion (fine ounces)	Silver in bullion (fine ounces)	Year	Material sold or treated (short tons)	Gold in bullion (fine ounces)	Silver in bullion (fine ounces)
1948-52 (average)	1,106,095	319,874	78,797	1955.....	1,550,116	379,249	76,312
1953.....	1,368,059	365,442	74,608	1956.....	1,627,719	404,525	80,044
1954.....	1,485,226	363,831	80,168	1957.....	1,659,705	404,581	85,516

TABLE 5.—Gold and silver bullion produced at mills by cyanidation, 1948-52 (average) and 1953-57

Year	Material treated (short tons)			Gold in bullion (fine ounces)	Silver in bullion (fine ounces)
	Crude ore	Sands and slimes	Total		
1948-52 (average)					
1953.....	117,173	1,105,827	1,223,000	150,332	44,381
1954.....	111,676	1,368,059	1,479,735	169,542	63,434
1955.....	115,558	1,485,226	1,600,784	177,614	71,239
1956.....	115,225	1,550,116	1,665,341	150,616	77,780
1957.....	115,454	1,627,099	1,742,553	163,998	56,074
	118,878	1,659,062	1,777,930	163,549	49,221

¹ Revised figure.

Uranium.—In 1957 accurate data on the production of uranium ore by calendar years became available for release from the Atomic Energy Commission (AEC). Production in 1957 nearly doubled in quantity and increased 60 percent in value compared with 1956. The uranium oxide content, however, declined from 0.18 percent in 1956 to 0.17 percent in 1957. The first full year's operation of the 300-ton-a-day processing plant at Edgemont, Fall River County, completion of exploration and development programs, and the later production were major factors in the increased output. The number of producing properties decreased from 45 to 30 as a result of consolidations that permitted more efficient operations and increased production.

Exploration and development of uranium-ore deposits continued but not as extensively as in 1956. Major exploration was by diamond and rotary drilling. A total of 159,524 linear feet was drilled, most of which was noncoring. Some stripping and bulldozing were done, and 350 feet of underground development was completed. The major part of the exploratory work took place in Fall River County and the remainder in Harding and Meade Counties. Two contracts for exploration assistance by the Government were approved by the Defense Minerals Exploration Administration (DMEA). The total amount of the contracts was \$78,836; the Government participated to the extent of 75 percent. A technically feasible process to extract uranium oxide from the uraniumiferous lignites of North and South Dakota was developed, but at a cost higher than for the carnotite-type ores mined in the southwestern counties. A proposal by Ohio Oil-Arthur Pew Associates to build a processing mill to treat the uraniumiferous lignites was withdrawn after studies indicated that the operation would not be economically feasible. International Resources

TABLE 6.—Mine production of uranium ore, July 1955–December 1957¹

County	July 1–December 31, 1955				1956				1957			
	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	Total mine value ²	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	Total mine value ²	Number of operations	Ore (short tons)	U ₃ O ₈ contained (pounds)	Total mine value ²
Butte.....	3	(³)	(³)	(³)	1	(³)	(³)	(³)	2	(³)	(³)	(³)
Custer.....	24	12,313	44,410	\$158,126	30	33,847	124,073	\$457,021	3	(³)	(³)	(³)
Fall River.....	3	(³)	(³)	(³)	4	(³)	(³)	(³)	29	59,504	197,990	\$647,148
Harding.....	1	(³)	(³)	(³)	1	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Lawrence.....	2	(³)	(³)	(³)	2	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Pennington.....	1	453	1,015	2,191	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Unknown.....	1	1,227	6,047	24,762	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Undistributed.....	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)	(³)
Total.....	34	13,993	51,472	185,079	40	35,302	5,105	18,394	35	69,800	33,928	112,626

¹ Based on data supplied to the Bureau of Mines by the Atomic Energy Commission.

² F. o. b. mine value; base price, grade premiums, and exploration allowances.

³ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

Corp., a South Dakota firm, also proposed building a processing plant in North or South Dakota if a satisfactory contract with AEC for purchasing the concentrates could be negotiated; AEC was considering the suggestion. In October, AEC announced that no additional contracts for purchasing uranium oxide would be considered, as the milling facilities that were in operation and under construction were enough to process ores currently developed. Because of the possible inadequacy of milling facilities to process known reserves by 1962, in some areas, the AEC began to study the exploration, development, and reserves of uranium-bearing material in the Western States known as of November 1, 1957. The capacity of the plant at Edgemont and its relation to the reserves of the carnotite-type ores tributary to the plant also would be studied. Completion of the study was expected early in 1958.

NONMETALS

Cement.—Portland and masonry cements were produced at the State-owned South Dakota Cement Plant at Rapid City, Pennington County. Shipments declined 19 percent compared with 1956. The average price of portland and masonry cements was \$3.00 and \$3.76 per barrel, respectively, compared with \$2.98 and \$3.73 in 1956.

Clays.—Miscellaneous clay was produced in Butte County for manufacturing building brick and other heavy clay products and in Pennington County for manufacturing cement and lightweight aggregate. Production in 1957 declined 13 percent compared with 1956. One operator in Butte County produced bentonite. Two companies processed bentonite at plants in Belle Fourche, and a third announced plans to construct an additional plant. Crude material processed at the plants came largely from deposits in Wyoming.

Feldspar.—Feldspar production in 1957 from pegmatites in Custer and Pennington Counties declined 9 percent in quantity and 8 percent in value compared with 1956. Output was reported from 40 or more operations, and those in Custer County produced 86 percent of the total. Production from one operation in Custer County was shipped to a grinding mill in Illinois. The remainder was ground at a Custer plant. The grinding plant at Keystone, destroyed by fire in January, was not rebuilt. The ground product from the Custer mill was shipped to consumers in Midwestern and Eastern States for use in glass, pottery, and enamel.

Gem Stones.—Various types of agates, petrified and agatized wood, and such minerals as beryl, rose quartz, and jasper were collected in five counties and sold to polishers and as specimens and souvenirs to tourists. The production came mostly from Custer County. The reported value in 1957 was \$15,000—50-percent increase compared with 1956.

Gypsum.—Gypsum was produced from a deposit near Rapid City, Pennington County, by the South Dakota Cement Plant for manufacturing cement.

Lime.—Quicklime was produced at a plant in Custer County. The entire production was consumed within the State for metallurgical uses. Production in 1957 increased 72 percent compared with 1956.

Mica.—Sheet, hand-cobbed, and scrap mica (important products of pegmatite deposits) were produced from mines in Custer and Pennington Counties. Production of full-trimmed sheet mica in 1957 came from 4 operations and declined a sharp 82 percent from 1956. Production of hand-cobbed mica declined 31 percent, but the percentage recovery of block mica from the hand-cobbed mica accepted at the GSA buying station at Custer was better than in 1956. Although the quantity of block mica recovered also declined 26 percent, the percentage recovery increased from 5.64 percent in 1956 to 6.07 in 1957. The quantity of Good Stained and better quality block recovered increased by nearly 1 percent, and the percentage recovery increased from 2.07 percent to 2.82. The quantity of Stained-quality block recovered declined 35 percent, and the percentage recovery declined from 60.63 percent to 53.36. The average value of block mica recovered decreased 7 percent from \$5.31 to \$4.95 per pound. Full-trimmed and hand-cobbed mica was produced from 38 operations—28 in Custer County and 10 in Pennington County.

TABLE 7.—Production of hand-cobbed mica and yield of sheet mica, 1954-57

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
1954	207,221	15,967	7.71	8,381	52.49	477	2.99
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

TABLE 8.—Mica sold or used by producers, 1953-57

	1953	1954	1955	1956	1957
Hand-cobbed mica, total: ¹ Pounds	227,847	207,221	64,673	216,802	149,163
Sheet mica: ¹					
Full trimmed:					
Pounds	921	332	221	256	45
Value	\$8,983	\$3,056	\$1,980	\$2,010	\$756
Average per pound	\$9.75	\$9.20	\$8.96	\$7.85	\$16.80
From hand-cobbed mica:					
Pounds	10,253	15,967	4,633	12,238	9,048
Value	\$68,369	\$62,166	\$19,403	² \$65,043	\$44,751
Average per pound	\$6.67	\$3.89	\$4.19	² \$5.31	\$4.95
Total:					
Pounds	11,174	16,299	4,854	12,494	9,093
Value	\$77,352	\$65,222	\$21,383	² \$67,053	\$45,507
Average per pound	\$6.92	\$4.00	\$4.41	² \$5.37	\$5.00
Scrap mica, total:					
Short tons	1,687	1,510	1,322	1,268	1,626
Value	\$27,388	\$26,943	\$26,853	\$31,224	\$43,142
Average per ton	\$16.23	\$17.84	\$20.31	\$24.62	\$26.53
Total sheet and scrap mica:					
Short tons	1,693	1,518	1,324	1,274	1,631
Value	\$104,740	\$92,165	\$48,236	² \$98,277	\$88,649

¹ Sold to the Government through GSA.

² Revised figure.

A contract for operating the mica-processing section of the GSA purchase depot at Custer was awarded to George R. Campbell, Sr., of Custer in April. He succeeded Monarch Mines, Inc., which had held the contract since the depot was opened in 1952. The number of workers at the depot generally ranged from 50 to 100, depending on the volume of receipts.

Scrap mica came from 68 operations in 2 counties—53 in Custer County and 15 in Pennington County. The output in 1957 was 1,626 tons, a 28-percent increase over 1956. The entire production was shipped to grinders in other States or sold to local purchasers, who in turn shipped to grinders.

Sand and Gravel.—Sand and gravel production increased 18 percent in volume but decreased 5 percent in value compared with 1956. Output by commercial producers declined 16 percent; Government-and-contractor production increased 26 percent and furnished the lower total value because of competitive bidding on contracts. Production was reported in all but 1 of the State's 67 counties. Commercial production was reported in 28 counties, and production

TABLE 9.—Sand and gravel sold or used by producers, 1956-57, by classes of operations and uses

Class of operation and use	1956			1957		
	Thousand short tons	Value		Thousand short tons	Value	
		Total (thousands)	Average per ton		Total (thousands)	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Building	465	\$382	\$0.82	328	\$343	\$1.05
Paving	160	116	.72	133	101	.77
Filter, railroad ballast, and other sand	22	24	1.08	42	24	.57
Total sand	647	522	.81	503	468	.93
Gravel:						
Building	486	387	.80	78	97	1.25
Paving	1,174	818	.70	1,363	836	.61
Railroad ballast	77	65	.84	(¹)	(¹)	(¹)
Other	4	2	.56	74	44	.59
Total gravel	1,741	1,272	.73	1,515	977	.64
Total sand and gravel	2,388	1,794	.75	2,018	1,445	.72
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand: Paving	4	2	.64	375	254	.68
Gravel:						
Building	118	84	.71	10	5	.50
Paving	10,029	6,543	.65	12,355	6,297	.51
Total gravel	10,147	6,627	.65	12,365	6,302	.51
Total sand and gravel	10,151	6,629	.65	12,740	6,556	.51
ALL OPERATIONS						
Sand	651	524	.80	878	722	.82
Gravel	11,888	7,899	.66	13,880	7,279	.52
Grand total	12,539	8,423	.67	14,758	8,001	.54

¹ Figures withheld to avoid disclosing individual company confidential data; included with "Other."

by Government-and-contractor operations was reported in 65 counties. County and city highway departments reported production by their own crews in 31 counties. The State highway commission let contracts for production in 61 counties, and a small quantity was produced by State highway crews in various counties for maintenance work.

Of the total production, 14 million tons (95 percent) was used for paving and road building. Contracts for the State highway commission totaled 9.4 million tons (67 percent of the total used in road building). A greater percentage of the sand and gravel produced was being washed, crushed, sized, or otherwise prepared to meet more rigid specifications of all types of construction. In 1957, 85 percent of the total production was prepared: Commercial producers prepared 53 percent of their output; and Government-and-contractors prepared 90 percent. Sand and gravel in South Dakota was largely transported by truck. If the entire Government-and-contractor production was transported by truck, then 98 percent of the total production was so moved. A report by the Bureau of Public Roads, United States Department of Commerce, on the Progress of the National System of Interstate and Defense Highways in South Dakota showed that between July 1, 1956, and December 31, 1957, 62.5 miles of highway had been programed, 34.8 miles had been authorized, and 27.5 miles were under construction. Since July 1, 1956, 97.3 miles of the National Highway System has been completed in South Dakota. On December 31, 1957, \$16.7 million allotted to the State remained for future programing and construction.

Stone.—Dimension granite produced in Grant County in 1957 increased 7 percent in quantity and 14 percent in value compared with 1956. Eight companies operated 10 quarries; the production of 5 quarries was finished at plants in Minnesota. Crushed and broken stone produced in 10 counties consisted of granite, limestone, sandstone, and miscellaneous stone. Production in 1957 declined 22 percent in quantity and 11 percent in value compared with 1956. The entire production of crushed and broken stone was used for concrete aggregate, roadbuilding, and riprap, except the limestone used in manufacturing cement and lime, as railroad ballast, and in sugar refining, and the sandstone used as refractory stone and in foundries.

MINERAL FUELS

Coal (Lignite).—Production of coal from 1 strip mine in Dewey County decreased 14 percent in quantity and 12 percent in value compared with 1956. The output was sold in Dewey and adjoining counties. Other mines producing less than 1,000 tons a year were operated in Dewey, Corson, and Perkins Counties; the coal was consumed locally.

Petroleum.—Petroleum output from the Buffalo field, Harding County, increased 59 percent compared with 1956. Exploration activity rose sharply to nearly double the 23 in 1954—the previous most active year, with 49 completions compared to 37 in 1956. The major part of the exploratory drilling was done in the southwestern counties. Fall River County led the State with 10 completions, followed by Meade and Pennington Counties with 7 each, Harding

County with 6, and Custer County with 5. Drilling in other counties included Tripp and Ziebach Counties with 3 completions each, Corson and Union Counties with 2 each, and Butte, Codington, Hughes, and Perkins Counties with 1 each. Drilling totaled 173,439 feet. One discovery was recorded when the No. 32-17 Graves well, 1 mile west of the Buffalo field in Harding County, was completed in the Red River formation at a depth of 8,824 feet. Initial production was 144 barrels on pump. No development drilling was done during the year.

REVIEW BY COUNTIES

Sand and gravel was produced throughout the State, chiefly for construction of Federal, State, and county highways; in many counties the quantity was substantial. The bulk of the sand and gravel (86 percent) was produced by contractors for the State and county highway departments. Other than sand and gravel throughout the State, dimension granite produced in Grant County and sandstone produced in Hanson and Minnehaha Counties, the bulk of the mineral production of the State was from six western counties. The total value of all minerals produced in these counties was \$30.9 million—77 percent of the total for South Dakota. Only those counties in which there were major mining activities or where the production of a single mineral commodity had outstanding significance are described in detail in the following section.

Butte.—In 1957 Butte County ranked fourth in the State in the value of mineral production. Miscellaneous clay produced by the Black Hills Clay Products Co. was used for building bricks, draitile, and other heavy clay products. American Colloid Co. produced bentonite and operated its processing plant at Belle Fourche. Eastern Clay Products Department, International Minerals & Chemical Corp., also operated mill at Belle Fourche and processed crude bentonite from deposits in Wyoming. Archer-Daniels-Midland Co., Minneapolis, Minn., announced plans to build a third bentonite-processing plant northwest of Belle Fourche. The output of the plant was to be used by the Erie Mining Co. at its Taconite plant at Aurora, Minn.

TABLE 10.—Value of mineral production in South Dakota, 1956-57, by counties ¹

County	1956 ²	1957	Minerals produced in 1957 in order of value
Aurora.....	\$29,000	(³)	Stone, sand and gravel.
Beadle.....	58,509	\$37,800	Sand and gravel.
Bennett.....		4,800	Do.
Bon Homme.....	18,000	175,600	Do.
Brookings.....		396,000	Do.
Brown.....		347,250	Do.
Brule.....	(³)	41,100	Do.
Buffalo.....	4,000	16,400	Do.
Butte.....	(³)	(³)	Clays, sand and gravel, uranium ore.
Campbell.....		70,000	Sand and gravel.
Charles Mix.....	61,500	172,600	Do.
Clark.....	61,250	123,700	Do.
Clay.....		44,000	Do.
Codington.....		316,500	Do.
Corson.....		101,800	Do.
Custer.....	4 5 366,079	610,874	Feldspar, uranium ore, sand and gravel, lime, beryllium concentrate, mica, stone, gem stones, columbium-tantalum concentrate.
Davison.....	34,750	243,000	Sand and gravel.
Day.....	36,500	171,100	Do.
Deuel.....	12,750	12,000	Do.

See footnotes at end of table.

TABLE 10.—Value of mineral production in South Dakota, 1956-57, by counties¹—Continued

County	1956 ²	1957	Minerals produced in 1957 in order of value
Dewey	\$89,761	\$109,318	Coal, stone, sand and gravel.
Douglas	35,000	58,800	Sand and gravel.
Edmunds		22,800	Do.
Fall River	(³)	872,048	Uranium ore, sand and gravel, stone.
Faulk		52,900	Sand and gravel.
Grant	2,381,950	2,779,095	Stone, sand and gravel.
Gregory	50,500	69,100	Sand and gravel.
Hamlin	59,250	98,900	Do.
Hand	9,250	53,400	Do.
Hanson	499,804	349,200	Stone, sand and gravel.
Harding	(³)	(³)	Petroleum, sand and gravel.
Hughes	(³)	56,600	Sand and gravel.
Hutchinson	40,500	154,300	Do.
Hyde	7,500	38,300	Do.
Jackson		205,100	Do.
Jerauld	19,750	28,700	Do.
Jones		180,900	Do.
Kingsbury	(³)	78,600	Do.
Lake	189,250	138,100	Do.
Lawrence	⁴ 20,250,192	20,129,244	Gold, silver, stone, sand and gravel, iron ore, gem stones.
Lincoln	52,750	116,500	Sand and gravel.
Lyman		341,100	Do.
Marshall	20,000	158,300	Do.
McCook		83,400	Do.
McPherson	(³)	73,700	Do.
Meade	446,942	623,700	Do.
Melette		131,500	Do.
Miner	(³)	12,600	Do.
Minnehaha	1,013,400	778,200	Stone, sand and gravel.
Moody	63,150	132,300	Sand and gravel.
Pennington	⁴ 7,910,675	6,823,401	Cement, stone, sand and gravel, clays, beryllium concentrate, gypsum, mica, feldspar, columbium-tantalum, gem stones, uranium ore.
Perkins	12,900	6,923	Sand and gravel, gem stones.
Potter		61,600	Sand and gravel, stone.
Roberts	65,000	108,900	Sand and gravel.
Sandborn		29,400	Do.
Shannon		75,900	Do.
Spink	47,000	180,400	Do.
Stanley	(³)	98,400	Do.
Sully	72,750	87,700	Do.
Todd		10,400	Do.
Tripp		55,800	Sand and gravel, stone.
Turner	73,750	46,100	Sand and gravel.
Union	24,000	102,300	Do.
Walworth	23,750	46,400	Do.
Washabaugh		9,500	Do.
Yankton		1,450	Sand and gravel, gem stones.
Ziebach		200	Sand and gravel.
Undistributed ⁵	7,894,128	2,182,700	
Total ⁷	⁵ 42,281,000	39,990,000	

¹ Haakon County not listed because no production was reported.

² Revised to include final value of uranium production.

³ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁴ Uranium value withheld to avoid disclosing individual company confidential data; included with "Undistributed."

⁵ Revised figure.

⁶ Includes gem stone and sand and gravel values that cannot be assigned to specific counties, confidential uranium values (1956), and values indicated by footnote 3.

⁷ Total has been adjusted to eliminate duplicating the value of raw materials used in manufacturing cement and lime.

H. W. McDonald and Union Gulf Oil and Mining Corp. produced uranium ore from the Kling No. 1 and No. 2 mines in the Aladdin district. The ore was processed at the mill in Edgemont. Government-and-contractor operators produced 679,600 tons of paving sand and gravel. One unsuccessful exploratory oil well was drilled to a depth of 1,142 feet.

Custer.—The mines and quarries of Custer County produced beryllium and columbium-tantalum concentrates, gem stones, feldspar, mica, lime, uranium ore, sand and gravel, and stone. The county ranked eighth in the State in the value of mineral production.

Beryllium and columbium-tantalum concentrates were obtained as coproducts in the mining of feldspar and mica. Beryllium concentrate was produced at 90 operations and columbium-tantalum concentrate at 5. Beryllium concentrate was sold directly by some producers to the GSA purchase depot at Custer; others sold their output to Gladys Wells and George Bland of Custer, who in turn sold to GSA. The value of production of beryllium concentrate increased 33 percent, and columbium-tantalum concentrate increased over ninefold compared with 1956.

Feldspar was produced at 27 operations compared with 94 in 1956; output increased 22 percent. Abingdon Potteries, Inc., operated the White Elephant mine and shipped the crude ore to its grinding plant at Abingdon, Ill. Consolidated Feldspar Department, International Minerals & Chemical Corp., operated the Ballard, Rachel and Shamrock mines and purchased the output of independent operators in Custer and Pennington Counties; the entire output was ground at its plant at Custer. The ground product was shipped to consumers in the Rocky Mountains, Mississippi Valley, and Eastern States for glass, pottery, and ceramics. The 9 largest operations, producing over 1,000 tons each, supplied 83 percent of the county total. Mica, 1 of the 2 principal commodities from pegmatite deposits, was produced at 78 operations compared with 46 in 1956. Scrap mica was produced at 53 locations, 2 of which also yielded hand-cobbed mica. The Old Mike mine, the leading producer of scrap mica in the county, was acquired by Samica Corp., Rutland, Vt., in March and operated under contract by Mineral Mills, Inc. The output was shipped to Samica Corp. for processing. Scrap mica produced at other operations was shipped to grinding plants in Colorado and Illinois. Hand-cobbed mica was produced by 19 operators; all of it was sold to GSA at Custer. Glen Ventling (at the New York), Walter S. Clifford (at the Red Deer, New York, and Rachel D. mines), George R. Campbell, Sr. (at the Sky Rocket, Red Deer, New York, Rachel D., and White Spar mines), L. R. York (York Minerals; at the Red Deer), and Loren Potter (at the Sky Rocket)—the five leading producers—delivered to GSA 84 percent of all hand-cobbed mica produced in the county. Three operators produced and sold a small quantity of full-trimmed mica to GSA.

Quicklime produced by the Black Hills Lime Co. at its plant at Pringle was consumed within the State for metallurgical uses. The company produced the limestone used at the plant from a nearby quarry. Gem stones, consisting of agates, gem beryl, rose quartz, satin spar, and pudding stone, were collected by Scott's Rose Quartz Co., Black Hills Mineral Society, and individuals for polishing and sale to processors and tourists. The estimated value of gem stones collected in 1957 exceeded \$10,000. Gravel for paving and road-building was produced by contractors for the Forest Service, United States Department of Agriculture, and the State highway commission, and by crews of the county highway department.

Uranium ore produced at the Bud No. 1 by Triangle Enterprises, at the Freezeout No. 2 by Edgemont Mining & Uranium Corp. and Giant Cycle Corp., and at the Caylor lease by Western Giant Oil Co. was shipped to the processing mill at Edgemont.

Five exploratory oil wells ranging in depth from 1,600 to 2,800 feet were completed during the year. None were successful.

Dewey.—Dewey County Coal Co., the only coal operator in the State reporting production over 1,000 tons, mined coal (lignite) at its strip pit at Firesteel. Production declined 12 percent compared with 1956. Paving sand and gravel and broken granite for riprap was produced by contractors for the State highway commission.

Fall River.—The sharp increase in uranium-ore production and the first full year of operating the processing plant at Edgemont were of major importance in 1957. The county ranked fifth in the State in the value of mineral production. The output of uranium ore increased 76 percent compared with 1956, but the average grade declined from 0.18 to 0.17 percent contained uranium oxide. Production came from 35 operations; output was reported from 45 operations in 1956. The Giant Cycle Corp. was formed after Giant Resources, Inc., had acquired all of the assets of Edgemont Mining & Uranium Corp., one of the first large operators in South Dakota and Golden Cycle Corp. had purchased half the assets of Giant Resources, Inc. The leading producers include: Giant Cycle Corp. at the Gould lease, Gould No. 2, and Taylor No. 2; Pictograph Mining & Uranium Co., Inc., at the Buda No. 5 and Dexter No. 4 and 5; Roy Cram at the Roy Marty lease; and Roy E. Chord and Diamond Mining Co. at the Gertrude JoAnn King, Ophelia, and Pennywitt No. 1. These producers furnished 92 percent of the county value of uranium output. Exploration by 7 operators consisted of diamond and rotary drilling, stripping, and underground openings. Drilling totaled 157,430 feet, of which 46 percent was diamond-core drilling. A contract for assistance in exploring the Star claims by McAlester Fuel Co. was approved by DMEA. Of the \$72,136 contract total, 75 percent was Government participation. Mines Development, Inc., subsidiary of Susquehanna Corp., a Chicago transit company, operated its 300-ton-a-day plant at Edgemont the entire year. The daily throughput of the mill has averaged about 400 tons.

Sand and gravel for building, paving, roadbuilding, railroad ballast, and fills was produced by four operators. Paving sand and gravel was produced by contractors for the State highway commission. Flyte Rock Co. produced crushed limestone for road construction.

Ten exploratory oil wells were completed during the year at depths ranging from 723 to 3,105 feet. None were successful.

Grant.—Grant County ranked third in the State in the value of mineral production. The combined value of dimension granite and sand and gravel produced in 1957 increased 17 percent compared with 1956, and a gain in output was recorded for each commodity. Rough and dressed architectural and monumental granite was produced at 10 quarries near Milbank and Big Stone City. Rough stone from five quarries was finished at Minnesota plants. The granites in Grant County are particularly desirable and were used for monuments because of the deep red and brown mahogany colors. Sand and gravel for paving and road construction was produced by Walter

Lindberg, the county highway department, and contractors for the State highway commission.

Harding.—Petroleum output in the State's only producing field (Buffalo) increased 59 percent compared with 1956. The crude oil was transported by truck to North Dakota and shipped by rail to refineries. Six exploratory wells were completed during the year, and one new field was discovered about 1 mile west of the Buffalo field at a depth of 8,824 feet. Initial daily production was 144 barrels on pump from the Red River formation. All other wells completed were unsuccessful. No development wells were drilled during the year.

Peter Kiewit Sons' Co. did some exploratory drilling for uranium on the Kelley-DeSart and Patterson, Ward, and LeMar leases. A contract for 75-percent participation by the Government through DMEA for exploration of the Jill group of claims by Wesley Anderson was approved. The total amount of the contract was \$6,700.

Paving gravel for road construction was produced by contractors for the State highway commission.

TABLE 11.—Ore milled, receipts, and dividends, Homestake mine, 1953-57¹

Year	Ore milled (short tons)	Receipts for bullion product		Dividends
		Total	Per ton	
1953	1,368,059	\$18,251,984	\$13.34	\$4,018,560
1954	1,485,226	18,409,610	12.40	4,018,560
1955	1,550,116	18,055,258	11.65	4,018,560
1956	1,627,719	19,354,312	11.89	4,018,560
1957	1,659,705	19,479,489	11.74	4,018,560

¹ From 1876 to 1957, inclusive, this mine yielded bullion and concentrates that brought a net return of \$638,794,520 and paid \$198,832,234 in dividends.

Lawrence.—Lawrence County led the State in the value of mineral production and continued to be the Nation's leading gold-producing area. The value of minerals produced in 1957 was slightly (less than 1 percent) below that of 1956, chiefly because of a drop in the total value of gold and silver. The value of the output of sand and gravel increased, but that of iron ore and crushed stone decreased. Homestake Mining Co. operated its mine and mill at Lead at capacity. According to the annual company report, the tons milled increased 31,986 tons (2 percent) compared with 1956. The percentage recovery increased from 97.06 to 97.18 percent, and the value per ton on the basis of recovered metal declined from \$11.89 to \$11.74. Operating costs again increased in 1957. Preliminary development on the 5300 and 5600 levels from the interior shaft sunk from the 5000 level was completed, and the diamond-drilling program was expected to be completed about mid-1958. The ventilation program continued as planned. Results of the exploration program (diamond-drilling) below the 5000 level were not as good as expected. The extent and quantity of the Homestake formation and the grade and mineralogy of ore found were comparable to those above the 5000 level, but the quantity of ore intersected in the drill holes was less. The reserve of proved ore

declined as development of the lower levels had not progressed enough to warrant including any ore below the 5000 level in the reserve.

Bald Mountain Mining Co. operated the Clinton, Portland, Decorah, and Gold Bug group of mines (counted as 1 mine) and the 350-ton all-slime cyanide plant at Trojan. Tons of ore milled increased 3 percent compared with 1956, but the value of the ore declined 23 percent.

Iron ore was mined near Nemo for use in manufacturing cement at the South Dakota Cement Plant at Rapid City. A small quantity of jasper was collected near Moon and Spearfish for specimens. Sand and gravel for road construction was produced by contractors for the State highway commission. The county highway department produced broken porphyry for use as riprap, and Colorado Construction Co. produced crushed limestone for road construction and for sugar refining.

Meade.—Meade County was the leading producer of sand and gravel in the State and ranked seventh in total value of mineral production. The bulk of the sand and gravel was produced by contractors for the State highway commission for use in road construction. Paving gravel was produced by Robert Strong for the county highway department. Henry, Hanson, and Conlon Exploration Co. completed a limited amount of diamond and rotary drilling on the Lamberton property for uranium. Seven exploratory oil wells were drilled, ranging from 2,343 to 6,250 feet in depth; total footage was 29,486. None were successful.

Minnehaha.—Minnehaha, 1 of the 2 counties in the State producing crushed sandstone, ranked sixth in the State in the value of mineral production. The production of crushed sandstone declined more than 50 percent compared with 1956. Output by Concrete Materials Co. was used as refractory stone and in foundries and for riprap and road construction. L. G. Everist, Inc., produced crushed sandstone for road construction and paving sand and gravel for the Federal Bureau of Reclamation. Sand and gravel for building, paving, and fill was produced by Concrete Materials Co., Eagle Sand & Gravel Co., Healy Construction Co., and Wheelborg Bros.

Pennington.—The mines and quarries of Pennington County produced a variety of minerals and mineral products, and the county ranked second in the State in the value of mineral production. Beryllium concentrate, produced at 28 mines and totaling 36 operations, furnished 58 percent of the total value of South Dakota's beryl production. Hough & Judson (at the High Climb), Consolidated Feldspar Department, International Minerals & Chemical Corp. (at the Hugo), Black Hills Keystone Corp. (at the Bob Ingersoll), G. R. Jurisch (from the Bob Ingersoll dump), John Nickels, Jr. (at the Nickels lode), Keystone Feldspar & Chemical Co. (at the Peerless), Alex Zwetzig (at the Putt), and Dale McDermond (at the White Cap) produced 88 percent of the total for the county. The GSA depot at Custer purchased the entire output, either directly from producers or from Gladys Wells and George Bland (who purchased small lots from individual producers). Columbium-tantalum concentrate was obtained as a coproduct in processing other pegmatite minerals by Black Hills Keystone Corp. at the Bob Ingersoll, Keystone Feldspar & Chemical Co. at the Peerless, and Dale McDermond

at the Whitecap. Production in 1957 increased more than twenty-fold compared with 1956 and represented 76 percent of the total production. The entire output was sold by producers to the GSA purchase depot at Custer. Mica (an important pegmatite mineral) was produced by 20 operators. Fifteen produced scrap mica; two also produced hand-cobbed and one full-trimmed sheet mica. Five operators produced only hand-cobbed mica, and the major producers included: Consolidated Feldspar Department, International Minerals & Chemical Corp., hand-cobbed and scrap mica at the Hugo; Dale McDermond, full-trimmed sheet, hand-cobbed, and scrap mica at the Whitecap and Dyke lodes; Ray Darling, hand-cobbed mica at the Hazeltine, Cobb, and Peerless; Keystone Feldspar & Chemical Co., scrap mica at the Peerless. Full-trimmed sheet and hand-cobbed mica was purchased by the GSA purchase depot at Custer, and scrap mica was shipped to grinders in Colorado and Illinois. Production of feldspar as the major mineral recovered from pegmatite deposits was reported from 8 mines; output from 12 others was small. The principal producers were the Consolidated Feldspar Department, International Minerals & Chemical Corp., at the Hugo, Vickers Feldspar Corp. at the Big Chief, and Hough & Judson at the High Climb. The entire output was purchased by Consolidated Feldspar Department, International Minerals & Chemical Corp., for grinding at the corporation Custer mill. The mill at Keystone was completely destroyed by fire in January and not rebuilt; the Custer mill became the only outlet for ore from independent producers. Production in the county declined 63 percent compared with 1956.

Miscellaneous clay and shale were produced at pits near Rapid City for manufacturing cement and lightweight aggregate. Output declined in 1957 because of reduced requirements for cement. Light Aggregates, Inc., operated its bloating plant at Rapid City and produced a lightweight aggregate used largely in manufacturing building blocks. The South Dakota Cement Plant, operated by the State Cement Commission, produced types I, II, III, and V portland cements and masonry cement. Portland-cement clinker was used as a base for the masonry cement. Shipments in 1957 declined 19 percent compared with 1956. The bulk of the cement was shipped to points in South Dakota, North Dakota, Wyoming, Montana, Minnesota, and Nebraska; small quantities went to Illinois, Kansas, Missouri, and Colorado. The Cement Commission announced plans for a substantial expansion of the plant late in 1956. The program consisted of installing a fifth kiln (11 by 375 feet) and the necessary grinding and accessory equipment. The expansion would increase the annual capacity of the plant to 2.5 million barrels. In May 1957 a contract for constructing the new kiln facilities was awarded to the M. A. Garland Construction Co. Completion was expected early in 1958.

Gem stones and mineral specimens were collected by individuals at pegmatite mines and near the Cheyenne River and Iron Creek. The specimens, consisting of agate, petrified wood, jasper, lollingite, iron ore, and columbite, were sold to polishers and to tourists as souvenirs. Gypsum produced by the South Dakota Cement Plant from pits near Rapid City was used in manufacturing cement. L. G. Everist, Inc., Hills Materials Co., Pete Lien & Sons, Summers Co.,

and South Dakota Cement Plant produced crushed and broken limestone for concrete aggregate, roadbuilding, railroad ballast, manufacturing cement, and riprap. Production in 1957 decreased only slightly from that of 1956. Sand for building, paving, and railroad ballast and gravel for building, paving, and fill was produced by Birdsall Sand & Gravel, Ray Hillery, Hills Material Co., Pete Lien & Sons, and Peter Kiewit & Sons' Co. The South Dakota Cement Commission produced sand used in manufacturing cement. Contractors produced paving sand and gravel for the Federal Bureau of Public Roads, the State highway commission, and the county highway department. Production in 1957 increased 26 percent compared with 1956.

Tom Timmons produced a small quantity of uranium ore from the Rube Nos. 1 and 4 claims. The ore was shipped to the processing plant at Edgemont. Seven exploratory oil wells were drilled ranging in depth from 1,000 to 4,882 feet. Total footage drilled was 18,210. None were successful.