STATE OF SOUTH DAKOTA

Joe Foss, Governor

MINERALS REPORT 2

THE MINERAL INDUSTRY OF SOUTH DAKOTA

IN 1955

Prepared by the
U. S. Bureau of Mines
in cooperation with the
South Dakota State Geological Survey

Allen F. Agnew, State Geologist

SOUTH DAKOTA GEOLOGICAL SURVEY

Vermillion, South Dakota

March 1958

PREPRINT FROM
BUREAU OF MINES MINERALS YEARBOOK
1955

The Mineral Industry of South Dakota

BY D. H. MULLEN

For sale by the Superintendent of Documents, U. S. Government Printing Office Washington 25, D. C. Price 10 cents

UNITED STATES DEPARTMENT OF THE INTERIOR • Fred A. Seaton, Secretary
BUREAU OF MINES • Marling J. Ankeny, Director

This publication is a chapter from Volume III, MINERALS YEARBOOK, 1955. The complete volume, covering the Geographic areas, may be purchased from the Superintendent of Documents, Washington 25, D. C., at a date to be announced later. Volume I (Mineral Commodities) and Volume II (Mineral Fuels) also will be available from the Superintendent of Documents.

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, United States Department of the Interior, and the South Dakota State Geological Survey.

By D. H. Mullen [1]

SOUTH DAKOTA mineral production in 1955, exclusive of uranium, was valued at $40.5 million, an increase of 7 percent over 1954. It continued a steady upward trend for the fourth consecutive year. The gain in 1955 can be attributed entirely to the value of the nonmetals—cement, clays, gypsum, lime, sand and gravel, and stone. The value of gold production decreased 2 percent, and silver increased 2 percent. As a group, the value of the metals, of which gold and silver represented 99 percent, was 47 percent of the State total. This was the first year of normal operation since records have been kept (excluding the period from June 8, 1943, to July 1, 1945, when Order L–208 of the War Production Board was in effect in South Dakota) that the value of the metals produced has been less than 50 percent of the State's total mineral production. The steady increase in the pro-

TABLE 1.—Mineral production in South Dakota, 1954–55 [1]

Mineral	1954		1955	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Beryllium concentrate—gross weight	337	$139,663	294	$157,046
Coal (lignite)	(2)	(2)	25,782	90,240
Columbium-tantalum concentrate, pounds, gross weight	25,447	43,260	5,638	9,584
Feldspar—long tons	(2)	(2)	42,164	267,286
Gem stones	(3)	[4] 5,000	(3)	7,400
Gold (recoverable content of ores, etc.)—troy ounces	541,445	18,950,575	529,865	18,545,275
Gypsum (crude)	8,518	11,073	12,592	16,369
Iron ore (usable)—long tons, gross weight	[4] 2,040	(2)	2,048	(2)
Mica:				
Sheet—pounds	16,299	65,222	4,854	21,383
Scrap	1,510	26,943	1,322	26,853
Natural gas—million cubic feet	7	350		
Sand and gravel	[4] 14,819,228	7,840,393	13,537,801	10,096,828
Silver (recoverable content of ores, etc.)—troy ounces	151,407	137,031	154,092	139,461
Stone	1,614,818	4,928,855	2,262,246	5,679,444
Tungsten concentrate—60-percent WO_3 basis	(5)	500		
Value of items that cannot be disclosed: Cement, clays, lime, lithium minerals,[6] petroleum, vanadium (1954), and values indicated by footnote 2		6,121,186		6,114,433
Total South Dakota [7]		37,874,000		40,526,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers). Value of uranium ore is excluded.
[2] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[3] Weight not recorded.
[4] Revised figure.
[5] Less than ½ ton.
[6] Data not available for 1955.
[7] The total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement.

[1] Commodity-industry analyst, Region III, Bureau of Mines, Denver, Colo.

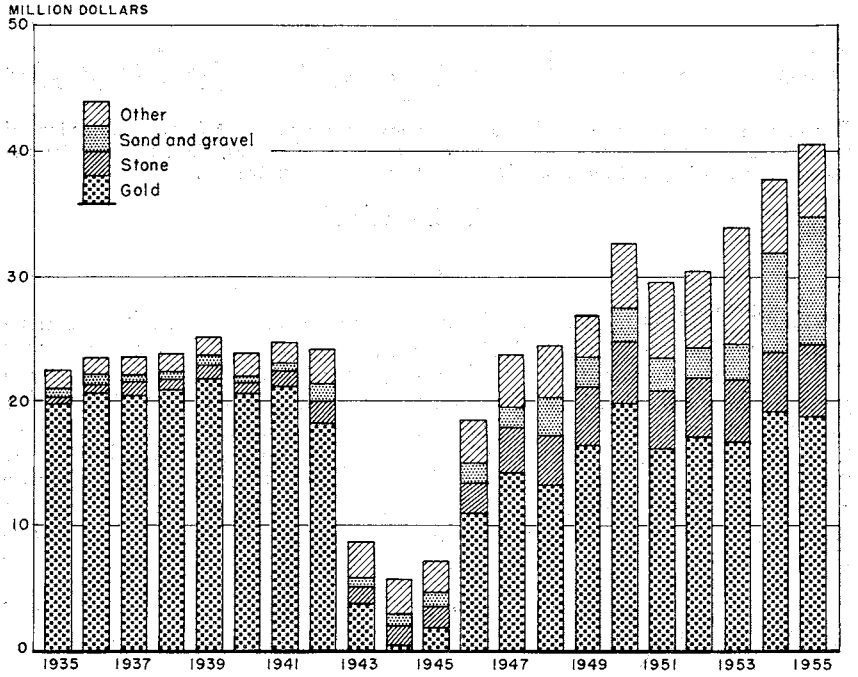

FIGURE 1.—Value of gold, dimension and crushed stone, sand and gravel, and total value of mineral production in South Dakota, 1935–55.

duction of cement, sand and gravel, and stone and advances in unit values of nonmetals resulted in metals being displaced as the leading commodity group in 1955. Production of gold and silver was maintained at near capacity at the two producing mines. A Mineral Atlas [2] of mines and mineral deposits in Custer, Fall River, and a part of Pennington Counties was published. This completed the Mineral Atlas of the Black Hills.

TABLE 2.—Average unit value of selected mineral commodities in South Dakota, 1954–55 [1]

Commodity	1954	1955	Commodity	1954	1955
Beryl, short ton	$414.430	$534.170	Mica:		
Columbium-tantalum concentrate, pound	1.700	1.700	Sheet, pound	$4.002	$4.405
Gold [2], troy ounce	35.000	35.000	Scrap, short ton	17.843	20.312
			Sand and gravel, do	.529	.746
			Silver [3], troy ounce	.905+	.905+
			Stone, short ton	3.052	2.511

[1] Prices are based on average value f. o. b. mines or mills reported by the producers except as otherwise noted.
[2] Price under authority of Gold Reserve Act of Jan. 31, 1934.
[3] Treasury buying price of newly mined silver July 1, 1946 to date—$0.9050505 ($0.905 used in 1947 for calculating purposes).

[2] Bureau of Mines Staff, Region V, Mining Division, Rapid City, S. Dak., Black Hills Mineral Atlas, Part 2: Bureau of Mines Inf. Circ. 7707, 1955, 208 pp.

REVIEW BY MINERAL COMMODITIES

METALS

Beryllium.—Beryllium-concentrate (beryl) production, about equally divided between Custer and Pennington Counties, was reported by 73 companies, individuals, and combinations of individuals. Custer County had the greatest number (50) of operators. The output was sold to the General Services Administration (GSA) Purchasing Depot at Custer (67 percent); to Gladys W. McKinley, Custer (29 percent); and to Beryl Ores Co., Arvada, Colo. (4 percent). Beryl, produced as a coproduct with feldspar and mica, declined 13 percent in quantity from 1954 and paralleled the decline in the production of those commodities. The average price was higher and the value of production increased 12 percent over 1954.

The Bureau of Mines Experiment Station at Rapid City continued to study methods of separating beryl, columbite-tantalite, and mica from pegmatite rock. A report [3] describing the flotation of beryl was published.

Columbium-Tantalum.—The production of columbite-tantalite concentrate declined sharply in 1955. Government purchase of concentrate under the stockpiling program was terminated subsequent to filling of the quantity limitation established by the Congress. Production in 1955 from Pennington and Custer Counties was 5,638 pounds, a 78-percent decline from 25,447 pounds in 1954. Pennington County, with 3 operators, produced 84 percent of the total, and Custer County, with 10 operators, produced the remainder. All production was sold to the GSA Purchasing Depot at Custer.

Gold and Silver.—Gold and silver produced by Homestake Mining Co. and Bald Mountain Mining Co. in Lawrence County composed 99 percent of the value of metal output in the State. Gold production decreased 2 percent and silver increased 2 percent compared

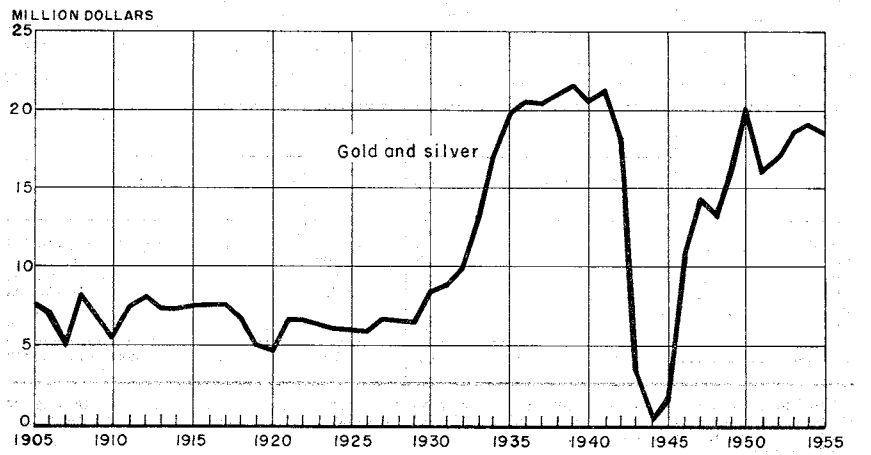

FIGURE 2.—Total value of mine production of gold and silver in South Dakota in 1905–55.

[3] Runke, S. M., Petroleum Sulfonate Flotation of Beryl: Bureau of Mines Rept. of Investigations 5067, 1954, 19 pp.

with 1954. Homestake Mining Co. milled ores of slightly lower gold content, and Bald Mountain Mining Co. milled ores of slightly higher silver content than in preceding years. Homestake Mining Co. retained its position as the leading gold producer in the United States, and Lawrence County continued to be the leading gold-producing area.

Iron Ore.—Iron ore from deposits near Nemo in Lawrence County was produced for use in manufacturing cement. Production of ore (containing approximately 35 to 40 percent iron) in 1955 totaled 2,048 long tons, a slight increase over 1954.

TABLE 3.—Mine production of gold and silver in 1955, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Month	Gold (fine ounces)	Silver (fine ounces)
January	41,880	12,400	August	44,233	13,082
February	39,879	10,930	September	45,196	12,767
March	42,750	10,726	October	43,840	12,374
April	43,371	11,867	November	44,562	13,465
May	45,140	11,670	December	46,277	13,095
June	46,707	16,795			
July	46,030	14,921	Total	529,865	154,092

TABLE 4.—Mine production of gold, silver, copper, lead, and zinc, 1946–50 (average), 1951–55, and total 1876–1955, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1946–50 (average)	4	[3]	1,087,660	425,987	$14,909,559	108,945	$96,913
1951	5	3	1,166,380	458,101	16,033,535	139,590	126,336
1952	6		1,324,817	482,534	16,888,690	132,102	119,559
1953	4		1,479,802	534,987	18,724,545	138,642	125,478
1954	2		1,600,784	541,445	18,950,575	151,407	137,031
1955	2		1,665,341	529,865	18,545,275	154,092	139,461
1876–1955			[4]	25,410,923	670,979,514	10,861,667	7,962,272

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1946–50 (average)			6	$1,859	10	$2,462	$15,010,793
1951			2	692			16,160,563
1952			2	644			17,008,893
1953			10	2,620			18,852,643
1954							19,087,606
1955							18,684,736
1876–1955	106	$36,466	497	71,752	265	56,406	679,106,410

[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] Less than 1.
[4] Figure not available.

TABLE 5.—Gold and silver bullion produced at mills by amalgamation, 1946–50 (average) and 1951–55

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)
1946–50 (average)	983,280	282,523	70,855	1953	1,368,059	365,442	74,608
1951	1,046,305	317,593	62,685	1954	1,485,226	363,831	80,168
1952	1,209,926	328,844	64,584	1955	1,550,116	379,249	76,312

TABLE 6.—Gold and silver bullion produced at mills by cyanidation, 1946–50 (average) and 1951–55

Year	Material treated (short tons)			Gold in bullion (fine ounces)	Silver in bullion (fine ounces)
	Crude ore	Sands and slimes	Total		
1946–50 (average)	103,334	981,169	1,084,503	143,436	37,756
1951	120,051	1,045,384	1,165,435	140,493	76,436
1952	114,863	1,209,884	1,324,747	153,690	67,183
1953	111,676	1,368,059	1,479,735	169,542	63,434
1954	115,558	1,485,226	1,600,784	177,614	71,239
1955	115,225	1,550,116	1,665,341	150,616	77,780

Uranium.—Exploration and development of uranium deposits in Fall River County continued. American Smelting and Refining Co. operated the buying station at Edgemont as agents for the Atomic Energy Commission (AEC) for the entire year. Ore for stockpiling was received from approximately 35 producers. AEC approved a concentrate purchase contract with Mines Development, Inc., and plans were completed for constructing a 300-ton-per-day processing plant at Edgemont.

The AEC Suboffice, Raw Materials Division, at Hot Springs was moved to the campus of the South Dakota School of Mines and Technology at Rapid City. The office continued its detailed study of uranium-bearing areas in North and South Dakota, Wyoming, and Montana. The airborne radioactivity survey of the White River Badlands in Pennington County was followed by a more detailed study of a selected area near Scenic and a report published.[4]

Exploratory drilling in Fall River and Harding Counties consisted of diamond drilling, 5 percent (72 percent cored); rotary, 22 (13 cored); wagon, 2; churn, 64; and auger, 7. Total footage was 88,512 feet. Development and exploration work consisted of 1,870 feet of adits, drifts, and crosscuts, 3 miles of road construction, and removal of about 180,000 cubic yards of material in trenching and in stripping opencut operations. Nearly all operations have been opencut; however, as overburden became excessive, some operators began, and others are preparing to begin, underground openings. All production in 1955 was from the Edgemont area in Fall River County. Production figures are not available.

[4] Moore, George W., and Murray, Levish, Uranium-Bearing Sandstone in the White River Badlands, Pennington County, S. Dak.: Geol. Survey Circ. 359, 1955, 7 pp.

NONMETALS

Cement.—South Dakota Cement Plant at Rapid City, Pennington County, operated the entire year producing general-use and moderate-heat (types I and II), high-early-strength (type III), high-sulfate-resistance (type V), and masonry cements. A portion of the general-use and moderate-heat cements was air-entrained. Masonry cement was manufactured from a base of portland-cement clinker. Shipments of portland and masonry cements in 1955 increased 15 percent over 1954. A major portion of the cement (72 percent) was shipped to South Dakota points. Substantial quantities were shipped to North Dakota, Nebraska, and Wyoming, and smaller shipments were made to Iowa, Illinois, Colorado, Minnesota, Montana, and Canada. The average price of portland cement in both 1954 and 1955 was $2.84 per barrel.

Clays.—Clay from the Fuson formation was mined near Belle Fourche in Butte County for manufacturing building brick, drain tile, and other heavy clay products. Bentonite from deposits in Wyoming and South Dakota was processed at two plants in Belle Fourche. A major portion of the raw material was from Wyoming. Principal uses were for foundries, drilling mud, filtering, insecticides, and concrete admixture. Shale from the Pierre formation was mined in Pennington County near Rapid City for portland-cement manufacture and for lightweight aggregate. Production in 1955 was 15 percent greater than in 1954; value increased 4 percent.

Feldspar.—Feldspar from numerous pegmatite deposits was produced by 43 operators in Custer County and 16 in Pennington County. Six operators, producing over 1,000 long tons each, supplied 64 percent of the total. Abingdon Potteries, Inc., operated several mines near Pringle and shipped its entire production to its grinding plant at Abingdon, Ill. Consolidated Feldspar Department of International Minerals & Chemical Corp. operated mines in Custer and Pennington Counties and also purchased the material produced by independent operators; all was ground at company-owned grinding plants at Custer and Keystone. The ground product, shipped either bagged or in bulk, was used in manufacturing glass, pottery, enamel, brick and tile, and soaps and abrasives. Production of crude feldspar in 1955 was slightly below that in 1954.

Gem Stones.—Various types of agate, agatized and petrified wood, and garnets occurring in Custer, Pennington, and Meade Counties were collected for sale as specimens or to processors for polishing. The Fairburn agates, found near Fairburn in Custer County on the southeastern edge of the Black Hills, are quite spectacular and have been sold for $5 to $200 each, depending on the size and quality. Production of gem stones was reported from Custer and Pennington Counties and consisted of rose quartz, various types of agates, and garnets. The total value was $7,400.

Gypsum.—The South Dakota Cement Commission mined gypsum from deposits in the Spearfish formation near Rapid City for use as an additive in manufacturing portland and masonry cements. Production in 1955 increased 48 percent over 1954.

Lime.—Quicklime was produced at a plant at Pringle, Custer County. The entire output was used within the State for metal-

lurgical purposes. Production in 1955 increased 11 percent over 1954.

Lithium.—Lithium minerals (spodumene, amblygonite, and lepidolite) were produced in Pennington and Custer Counties. Spodumene was shipped to plants in Minnesota and New Jersey for manufacturing lithium compounds; the amblygonite was shipped to Germany and the lepidolite stockpiled.

Mica.—Sheet, hand-cobbed, and scrap micas were produced from pegmatite deposits in Custer and Pennington Counties. Sheet and hand-cobbed micas were sold to the GSA Purchasing Depot at Custer. Scrap mica was sold to grinders in Illinois, North Carolina, and Colorado. The quantity of hand-cobbed mica offered to GSA declined sharply from 1954, decreasing 69 percent. The quantity of sheet mica of all grades recovered from the hand-cobbed mica was 7.16 percent, a slight decrease from the 7.7 percent recovered in 1954. The quantity of scrap mica produced was 12 percent below that of 1954.

Regulations [5] governing the method of payment for hand-cobbed mica were amended. The amendment retained the method of calculating the value of acceptable sheet mica provided in Revision 3 of May 1954 but removed the limitation of $600 per ton, as previously established, and increased the charge for rifting and trimming. The purpose was to induce producers to prepare their mica so that a greater proportion of high-quality product could be recovered. In the accompanying table percentage yields of Good-Stained, Stained, and total sheet mica have been calculated and compared with minimum GSA specifications.

TABLE 7.—Mica sold or used by producers, 1951–55

	1951	1952	1953	1954	1955
Hand-cobbed mica, total: Pounds		84,846	227,847	207,221	64,673
Sheet mica:					
Uncut larger than punch and circle:					
Pounds		[1] 490	[1] 921	[2] 332	[2] 221
Value		$6,580	$8,983	$3,056	$1,980
Average per pound		$13.43	$9.75	$9.20	$8.96
From hand-cobbed mica:					
Pounds		[3] 3,818	[3] 10,253	15,967	[4] 4,633
Value		$25,454	$68,369	$62,166	$19,403
Average per pound		$6.67	$6.67	$3.89	$4.19
Total:					
Pounds		4,308	11,174	16,299	4,854
Value		$32,034	$77,352	$65,222	$21,383
Average per pound		$7.44	$6.92	$4.00	$4.41
Scrap mica, total:					
Short tons	2,292	915	1,687	1,510	1,322
Value	$42,714	$24,148	$27,388	$26,943	$26,853
Average per ton	$18.64	$26.39	$16.23	$17.84	$20.31
Total sheet and scrap mica:					
Short tons	2,292	917	1,693	1,518	1,324
Value	$42,714	$56,182	$104,740	$92,165	$48,236

[1] Major part of this production sold to GSA as full-trimmed sheet.
[2] Sold to GSA.
[3] Sold to GSA. Sheet mica from hand-cobbed mica was estimated to be 4½ percent of the total hand-cobbed mica purchased by GSA. This is the minimum GSA specification.
[4] Sold to GSA. Heavy-Stained and Better recovered from total hand-cobbed mica purchased by GSA.

[5] General Services Administration, Mica Regulation: Purchase Programs for Domestic Mica: Title 32–A–National Defense Appendix, Chap. 14, Revision 3, May 26, 1954; amendment 2, Feb. 10, 1955.

The data as presented below show that, although the production decreased sharply in 1955, the percentage recovery of Good-Stained-and Better-quality mica more than doubled that in 1954.

Production of hand-cobbed mica and yield of sheet mica, 1954–55

Year	Production of hand-cobbed mica	Total block		Stained and Better qualities		Good-Stained and Better qualities	Percent of Stained and Better qualities
	Pounds	Pounds	Percent recovery	Pounds	Percent total block	Pounds	
1954	207,221	15,967	7.71	8,858	55.48	477	5.38
1955	64,673	4,633	7.16	2,115	45.65	259	12.25

Sand and Gravel.—Production of sand and gravel in 1955 deceased 9 percent compared with 1954. Commercial sand and gravel, reported by operators in 34 counties, increased considerably over 1954. Government-and-contractor production, reported in 42 counties, deceased 19 percent from 1954. Paving and road construction consumed 91 percent of the States sand and gravel production; of this, 85 percent was produced by Government agencies or contractors. Production figures are not strictly comparable on a year-to-year basis, since some Government agencies, particularly State highway departments and to a small extent county highway departments, report production by contractors in the year in which the contract is completed, which may be other than the year of production. Also, purchases of sand and gravel by Government agencies from commercial producers varies considerably from year to year, depending on the type of contract and the availability of sand-and-gravel deposits to contractors in a particular area.

The leading commercial producers in 1955 were W. E. Bartholow & Son Construction Co., Ed Birdsall Sand Co., Concrete Materials Co., Eagle Sand & Gravel Co., Geo. Garvin, Mannerud Bros., Geo. Michael, Steve R. Oberg Construction Co., A. W. Schnuerle Construction Co., and Floyd Stapp Construction Co. Leading producers for Government-and-contractor operations were Ed Cox & Son, G. H. Lindekugel & Sons, Dean R. Rounds, and Weelborg Bros.

Stone.—Seven companies operated 8 quarries in Grant County and produced dimension granite for building and monuments; 3 of these companies finished the rough stone at plants in Minnesota. A small quantity of dressed granite was produced in Hughes County. Production of dimension granite was 3 percent greater than in 1954.

Crushed limestone produced in Lawrence and Pennington Counties was used for riprap, concrete aggregate, roadstone, sugar refining, and the manufacture of cement.

Crushed miscellaneous stone was produced by county highway departments and other Government agencies for riprap and road construction in Butte, Davison, Kingsbury, Meade, and Pennington Counties. The South Dakota State Highway Commission produced

crushed stone in various counties for road construction. Total stone production increased 40 percent in quantity and 15 percent in value over 1954.

TABLE 8.—Sand and gravel sold or used by producers, 1954–55, by classes of operation and uses

Class of operation and use	1954			1955		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Building	425,250	$370,569	$0.87	487,503	$432,592	$0.89
Paving	124,074	107,105	.86	490,734	131,859	.27
Filter	(1)	(1)	(1)			
Gravel:						
Building	86,529	97,382	1.13	336,276	213,458	.63
Paving	839,139	304,509	.36	1,349,441	570,083	.42
Railroad ballast	(1)	(1)	(1)	(1)	(1)	(1)
Other				(1)	(1)	(1)
Undistributed [1]	51,833	27,323	.53	86,279	33,262	.39
Total commercial sand and gravel	1,526,825	906,888	.59	2,750,233	1,381,254	.50
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building	(1)	(1)	(1)	270	600	2.22
Paving	[2] 1,730,631	1,728,926	1.00	535,124	633,598	1.18
Gravel:						
Building	(1)	(1)	(1)	364,435	60,408	.17
Paving	[2] 11,522,810	5,200,809	.45	9,887,739	8,020,968	.81
Undistributed [1]	38,962	3,770	.10			
Total Government-and-contractor sand and gravel	[2] 13,292,403	6,933,505	.52	10,787,568	8,715,574	.81
Grand total	[2] 14,819,228	7,840,393	.53	13,537,801	10,096,828	.75

[1] Figures that may not be shown separately are combined as "Undistributed."
[2] Revised figure.

MINERAL FUELS

Coal (Lignite).—Lignite was produced by two operators from strip mines in Dewey County. Small mines in Dewey, Clay, Corson, and other northwestern counties produced lignite for local consumption. Production in 1955, from mines producing over 1,000 tons, was 25,782 tons valued at $90,240.

Natural Gas.—Natural gas was produced from shallow wells in the glacial drift near Pierre in Hughes County. The gas was used locally for domestic heating and cooking. Production has ranged from 5 to 7 million cubic feet a year. No report for 1955 was available.

Petroleum.—Petroleum was produced from two wells in the Buffalo field in Harding County; a second field was discovered in August when L. A. Helms completed the No. 1 Coffing well in Custer County. Sixteen wildcat wells, one of which was the discovery well in Custer County, were completed during the year compared with 22 in 1954.

Drilling statistics, 1955, wildcat completions by county (Oil and Gas Journal):

County	Oil	Dry	Total [1]	Footage
Custer	1	3	4	9,767
Fall River		3	3	7,780
Haakon		1	1	5,555
Harding		4	4	28,827
Pennington		2	2	5,803
Stanley		2	2	6,752
Total	1	15	16	64,484

[1] No gas completions in 1955.

In addition, Continental Oil Co., Pure Oil Co., and Herndon Drilling Co. completed 24 slim test holes, drilled to evaluate large areas in the Williston-Basin portion of the State.

Results of this drilling were not released; however, slight indications of oil were reported in holes drilled in Dewey and Meade Counties. Seven holes were completed in Custer County, 4 in Dewey County, 2 in Fall River County, 7 in Meade County, 3 in Pennington County, and 1 in Ziebach County.

Geophysical (seismograph) work also declined during the year. Nine companies completed 128 crew weeks of work compared to 236 crew weeks in 1954. Principal activities were in Harding, Butte, Ziebach, Fall River, Jackson, Stanley, Perkins, and Washabaugh Counties by Shell Oil Co., Amerada Petroleum Co., and Atlantic Oil Co.

Leasing activity in the northwestern counties declined following the failure of exploratory drilling in 1955 and previous years. Some activity was evident in the southwestern part of the State in Fall River and Custer Counties along the Black Hills uplift. The activity followed a trend established during the past 2 years for exploration along the Chadron arch through central Nebraska.

REVIEW BY COUNTIES

Brookings.—The county was the second largest source of sand and gravel in the State. Mannerud Bros. produced paving gravel and Grant VandenBerg produced building sand and gravel. The county highway department produced paving gravel.

Butte.—Shale was mined from the Fuson formation near Belle Fourche by the Black Hills Clay Products Co. for the manufacture of building brick, drain tile, and other heavy clay products. Eastern Clay Products Department of International Minerals & Chemical Corp. and American Colloid Co. operated mills at Belle Fourche for processing bentonite. A major portion of the crude bentonite was from deposits in Wyoming; the remainder being from pits near Belle Fourche. J. B. O'Connor produced building sand and gravel and paving gravel. The county highway department produced crushed stone and gravel for road construction. Shell Oil Co. and Superior Oil Co. completed 21 crew weeks of geophysical (seismograph) work during the year.

Codington.—Codington County ranked fifth in the production of sand and gravel. Hallett Construction Co., Zeller Concrete Materials Co., American Sand & Gravel, Inc., and Elmer C. Zwieg produced building and paving sand and gravel. The county highway department produced paving gravel.

TABLE 9.—Value of mineral production in South Dakota, 1954–55, by counties [1] [2]

County	1954	1955	Minerals produced in 1955 in order of value
Aurora	$30,347	[3]	Sand and gravel.
Beadle	106,246	$46,629	Do.
Bonne Homme	477,164	18,100	Do.
Brookings	121,887	122,783	Do.
Brown	264,130	30,084	Do.
Butte	1,216,347	1,340,389	Clays, stone, sand and gravel.
Campbell	6,329		
Charles Mix	7,802	6,499	Sand and gravel.
Clark	16,138	14,997	Do.
Clay	5,370	12,629	Do.
Codington	166,450	199,632	Do.
Corson	4,800	1,800	Do.
Custer	429,294	337,888	Feldspar, beryl, lime, mica, gem stones, columbium-tantalum.
Davison	8,603	32,961	Sand and gravel, stone.
Day	90,481	22,538	Sand and gravel.
Deuel	11,658	11,326	Do.
Dewey	[3]	90,240	Coal.
Douglas	14,458	15,505	Sand and gravel.
Edmunds	8,594	7,938	Do.
Fall River	29,612	[3]	Do.
Grant	2,311,091	2,405,455	Stone, sand and gravel.
Gregory	33,493	20,165	Sand and gravel.
Haakon	4,729	8,000	Do.
Hamlin	20,315	83,539	Do.
Hand	1,130	350	Do.
Hanson	319,100	359,566	Stone.
Harding	[3]	[3]	Petroleum.
Hughes		[3]	Stone.
Hutchinson	[3]	26,499	Sand and gravel.
Hyde	3,922	894	Do.
Jackson	23,000	1,719	Do.
Jerauld	9,692	[3]	Do.
Kingsbury	[3]	45,093	Sand and gravel, stone.
Lake	44,772	76,985	Sand and gravel.
Lawrence	19,206,286	18,741,872	Gold, silver, stone, iron ore, sand and gravel.
Lincoln	41,010	82,588	Sand and gravel.
Lyman	29,464	27,187	Do.
Marshall	5,228	6,565	Do.
McCook	280,665	21,880	Do.
McPherson	2,825	1,189	Do.
Meade	3,820	44,055	Stone, sand and gravel.
Mellette	1,770		
Miner	550	3,666	Sand and gravel.
Minnehaha	[3]	[3]	Stone, sand and gravel.
Moody	88,844	17,422	Sand and gravel.
Pennington	6,537,872	6,838,936	Cement, stone, sand and gravel, clays, beryl, feldspar, mica, gypsum, columbium-tantalum, gem stones.
Perkins	18,660	21,188	Sand and gravel.
Roberts	[3]	41,830	Do.
Spink	20,496	14,007	Do.
Stanley		39,500	Do.
Sully	10,777	20,600	Do.
Turner	50,637	39,938	Do.
Union	24,414	24,595	Do.
Walworth	33,700	24,250	Do.
Yankton	7,000		
Undistributed	6,119,079	9,820,131	
Total [4]	37,874,000	40,526,000	

[1] The following counties are not listed because no production was reported: Bennett, Brule, Buffalo, Faulk, Jones, Potter, Sandborn, Shannon, Todd, Tripp, Washabaugh, Ziebach.

[2] Values of some beryl (1955), gem stones (1954), natural gas (1954), some sand and gravel, some stone (1955), and vanadium (1954) that cannot be assigned to specific counties are excluded from county totals and included with "Undistributed." Excludes value of uranium ore.

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

[4] The total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement.

Custer.—Minerals produced in 1955 were derived almost entirely from the numerous pegmatite deposits in the county. Beryl, columbite-tantalite, feldspar, mica, lithium minerals, quartz, and some gem stones occur as major and minor constituents of the pegmatites and were coproducts or byproducts, depending on the concentration of the various minerals in individual deposits. Some operators produced only 1 mineral; others produced 2 to 4 minerals from the same deposit. Feldspar was the major pegmatite mineral produced and led all other minerals in the county in value of production; 43 companies, individuals, and combinations of individuals reported production. Abingdon Potteries, Inc., operated its mines near Pringle and purchased a small quantity from an independent producer. Consolidated Feldspar Department of International Minerals & Chemical Corp., the largest producer, operated several mines and purchased the production of independent operators. All production and purchases were ground at its plant at Custer. Beryl, second in value of mineral production in the county, was produced by 50 operators. George C. Bland, the largest producer, operated the Beecher, Beecher No. 3, Someday, Bull Moose lode, and Lincoln Fracture mines.

Consolidated Feldspar Department of International Minerals & Chemical Corp. produced beryl at the Mountain lode, Tin Mountain lode, and Triangle A pegmatites. Kenneth Spring operated the Springs Homestead. John Roseberry produced from the Elk Mountain lode and Elk Ridge lode, and Jim Koch operated the Hi Climb. Seventy-two percent of the production was sold to GSA at Custer. Gladys W. McKinley, Custer, purchased the remainder. Hand-cobbed and scrap mica produced from pegmatite deposits declined sharply from 1954. George C. Bland produced hand-cobbed and scrap mica at the Ann and Beecher No. 3 mines. Other major producers were Otis Palmer, Robert Davis, Russell Wineteer, Leonard Wood, Dale Brown, and Carl Roseberry. Hand-cobbed mica was sold to GSA at Custer for processing. Scrap mica was purchased by Gladys W. McKinley for sale to grinding plants and by Consolidated Feldspar Department of International Minerals & Chemical Corp. for shipment to its grinding plant at Pueblo, Colo.

Columbite-tantalite was produced by 10 operators at 13 deposits. The quantity declined 96 percent from that in 1954. The principal producer was Mineral Mills, Inc., operating the Old Mike. The entire production was sold to GSA at Custer. Lithium minerals—amblygonite and spodumene—were produced by three operators: The amblygonite was sold to the Black Hills Keystone Corp. at Keystone and the spodumene to Maywood Chemical Works at Maywood, N. J.

Rose quartz and several varieties of agate were collected by Robert B. Berry Co., The Black Hills Mineral Society, A. L. Krueger, and Scott's Rose Quartz Co. "The Wilkins" collected a number of Fairburn agates. Black Hills Lime Co. produced quicklime at its plant at Pringle. The entire production was used for metallurgical purposes.

L. A. Helms completed the No. 1 Coffing well in August at 1,393 feet in the First Leo sandstone. Initial flow was 80 barrels a day of 30° gravity oil. The discovery, on the Barker dome 18 miles north of Edgemont, was the second producing oilfield in the State. Shell Oil Co. drilled three wells during the year. The wells ranged in depth

from 2,602 to 2,890 feet and were bottomed in the Dakota and Morrison sandstones; all were dry and were abandoned. The company also completed some geophysical (seismograph) work. Pure Oil Co. drilled 7 slim test holes ranging from 800 to 1,800 feet in depth; they were stopped in the Muddy sandstone. Total footage drilled was 8,000 feet.

Dewey.—Dewey County Coal Co., Firesteel, and Baker Coal Co., Isabel, produced coal (lignite) from strip mines. Output in 1955 increased slightly over 1954. Other operators producing less than 1,000 tons a year produced lignite for local consumption. Herndon Drilling Co. completed four slim test holes to the Mission Canyon and Red River formations. Total footage drilled was 18,588 feet.

Fall River.—Development of uranium deposits continued. The buying station at Edgemont, operated by American Smelting and Refining Co. for the AEC, purchased ore the entire year. Receipts included some ores produced in Wyoming. Mines Development, Inc., was awarded a contract for purchasing uranium concentrate by AEC and began constructing a 300-ton-per-day concentrator at Edgemont in August. The mill, the eleventh in the United States and the first outside the Colorado Plateau area, was designed to use a sulfuric-acid leach and the resin-in-pulp ion-exchange process to recover the uranium. Operation of the plant was expected to begin in 1956. Edgemont Mining & Uranium Co., the largest producer, operated the Gould, Freezeout, Taylor, Lundberg, Virginia C, and Crandell properties and continued exploring the deposits by churn drilling and trenching. Sodak Uranium & Mining Co. operated the Matias Peak and Trade Dollar groups and other claims in the district. Black Hills Uranium Co. operated its claims in Red and Craven Canyons. Pictograph Mining & Uranium Co., Inc., operated the Marty lease, Maryjac group, Pat lease, Pictograph claim, and Runge leases, and conducted an extensive exploration program of rotary drilling. Uranium Research & Development Co. explored the Tepee claims by rotary drilling. Diamond Oils, Inc., drilled the Radon & U. P. groups, and Lorenz Bros. explored the Damsite group by wagon drilling.

Pure Oil Co. drilled two slim test holes. They were completed at 1,700 and 1,800 feet in the Muddy sandstone. Results were not reported. Shell Oil Co. completed 12 crew weeks of geophysical (seismograph) work.

Building and paving sand and gravel were produced by Batie Gravel Co., Fall River Sand & Gravel Co., Reitz & Critz Sand Co., and the Bureau of Reclamation.

Grant.—Dimension granite for architectural and monumental use was produced from quarries at Milbank and Big Stone City. The stone, reddish-brown and mahogany in color, was used extensively for interior and exterior building facings and for monuments. Consolidated Quarries, Inc., produced rough stone at its Dakota Mahogany quarry at Milbank. The stone was finished at Sauk Rapids, Minn. Melrose Granite Co. produced Melrose Russet at its quarry near Big Stone City. The rough stone was finished at St. Cloud, Minn., for use in monuments. Steiner-Rausch operated the American Beauty Mahogany quarry at Milbank. Robert Hunter operated a

quarry at Milbank. The rough stone was finished for use in monuments. Dakota Granite Co. operated its Dakota No. 1 and American Rose No. 2 quarries at Milbank. Rough and finished monumental stone was sold. Delano Granite Works, Inc., operated the Imperial Mahogany quarry at Milbank; rough stone was finished at Delano, Minn., for monuments. North Star Granite Corp. operated its quarry at Milbank and finished the rough stone at St. Cloud, Minn. Walter Lindberg produced paving sand and the county highway department produced paving gravel.

Haakon.—E. E. Pohle Enterprises, Inc., drilled a wildcat well to the Winnipeg sandstone at a depth of 5,556 feet, where it was abandoned. Shell Oil Co. completed six crew weeks of geophysical (seismograph) work. George Michael produced paving sand.

Harding.—Petroleum was produced at the Buffalo field. Because of transportation difficulties production was less than 1954. Wildcat wells were drilled by Amerada Petroleum Co., Richfield Oil Co., Shell Oil Co. and Carter Oil Co., and Hunt Oil Co. The wells, ranging from 3,640 feet to 9,050 feet in depth, were dry and were abandoned. Geophysical (seismograph) work was continued by Amerada Petroleum Co., Hunt Oil Co., Mobil Producing Co., Sun Oil Co., and Skelly Oil Co. A total of 27 crew weeks were completed.

Limited exploratory drilling was completed on uraniferous lignite deposits. Bryco Mining Co. did auger drilling on the Mary Jane and Buckham groups. Fred Loflin auger drilled the Hinds and Moonshine groups. Peter Kiewit Construction Co. explored the Kelly-DeSort lease, Patterson and Ward groups and the Le Mar lease by rotary and auger drilling. Results were not announced.

Hughes.—S. T. Jacobs produced a small quantity of dressed granite for monuments. Atlantic Oil Co. completed nine crew weeks of geophysical (seismograph) work.

Jackson.—Shell Oil Co. completed 11 crew weeks of geophysical (seismograph) work. The Chicago, Milwaukee, St. Paul & Pacific Railroad Co. produced gravel for road ballast.

Lawrence.—Mineral production in Lawrence County, valued at $18.7 million (a decline of 2 percent from 1954), represented 46 percent of the total production in South Dakota. Gold production decreased 2 percent and silver production rose 2 percent. The quantity of iron ore mined increased slightly. The production of crushed limestone and sand and gravel was lower.

Homestake Mining Co. operated its mine and mill at Lead the entire year. The quantity of ore milled gained 4 percent but because of a lower grade material milled, the quantity of gold and silver recovered declined 2 and 10 percent, respectively. The following information and data are from the 78th Annual Report of Homestake Mining Co. for the year ending December 31, 1955.

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In spite of an increase of around 4 percent in quantity of ore milled at the Homestake Mine and continued improvement in metallurgical recovery of gold, the value of bullion produced in 1955 was some $354,000 less than in 1954, which is to be attributed entirely to the lower grade of ore mined in accordance with a systematic program of stoping. Mining and milling costs per ton were reduced during the year which is something of an achievement in view of the continued increase in prices of nearly all supplies consumed in the operations.

Ore reserves reported as of January 1, 1956 are 898,000 tons less than the comparable figure for the previous year, indicating that the quantity of ore mined during the year (1,550,000 tons) was offset by the addition of 652,000 tons largely through extensions of ore revealed as the mining operations advanced. The tonnage reported in the reserves (16,689,000) includes only the ore that can be measured with reasonable accuracy between exposures in mine openings or revealed by diamond drilling at sufficiently close intervals for reasonable projections. The orebodies outlined on the 5,000 level give assurance that ore persists, but no tonnage for ore below this depth is included in the formally estimated reserves.

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Tons milled in 1955 were 1,550,116, an increase of 64,890 tons over 1954. Bullion production was $18,055,257.58, a decrease of $354,352.77 from 1954. Recovered value per ton was $11.65. Extraction was 97.08 percent. Recovered value in 1954 was $12.40; extraction was 96.66 percent.

Although mining was programmed for the year to yield ore of average grade of reserves, the head value that was realized was slightly lower than this figure. This resulted largely from obtaining larger tonnage than expected in certain lower grade stopes, which delayed the mining of some scheduled sections of higher grade.

Mining costs in 1955 were 16.3 cents per ton lower than in 1954. Milling costs were 4.4 cents less than in 1954. Administrative and general costs, however, rose 22.1 cents per ton, due to a new employee group insurance plan and to a larger contribution to the pension fund. All costs before depreciation and Federal income tax were 1.4 cents per ton greater than in 1954. Tons per manshift for the entire payroll rose from 2.90 in 1954 to 3.04 in 1955.

The developed ore reserve (including broken ore) as of January 1, 1956 was 16,689,400 tons, a decrease of 897,800 tons from January 1, 1955. Average grade of the reserves declined slightly.

Excellent progress on the deep level program was made in 1955. The Yates shaft was completed to the 5050 level and pocket installation was about two-thirds complete. Number Four Winze was at the 5150 level at the close of the year. Crosscutting on the 5300 and 5600 levels to potential ore areas is expected to start near the end of the year.

The decrease in ore reserves was 652,000 tons less than tonnage milled. It will be well into 1957 before enough development footage can be driven to give any significant information on lower level results.

In the Mill, classification changes started in 1954 were completed. A fourth ball mill unit was partially installed in December and will be in operation in February. This new unit will permit treatment of larger tonnage when labor supply is adequate and will compensate for down time for lining and repairs on the other three units.

After thorough study, a long range lower level ventilation program was approved. Proper solution of this problem necessitated a new air shaft from the surface to the 5000 level and the enlarging of present exhaust capacity. The surface site and access roads were completed in the summer and fall of 1955. Access drifts on the 2000, 2900 and 3800 levels were also started. Actual sinking will begin near the end of 1956. This whole program is well ahead of the schedule established at the time of approval.

In the Mine, replacement of old locomotives and mine cars with heavier and more efficient equipment continues. During 1956 the car replacement program will be completed. Locomotive replacement will require several years more.

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The Bald Mountain Mining Co. operated the Portland-Dakota-Clinton-Decorah group of mines and the 370-ton all-slime cyanide mill at Trojan. Production of crude ore decreased less than 1 percent. The recovery of gold decreased 10 percent, and the recovery of silver increased 41 percent.

TABLE 10.—Ore milled, receipts, and dividends, Homestake mine, 1951–55 [1]

Year	Ore milled (short tons)	Receipts for bullion product		Dividends
		Total	Per ton	
1951	1,046,203	$15,486,682.10	$14.8028	$4,319,952
1952	1,209,884	16,379,986.02	13.5385	3,717,168
1953	1,368,059	18,251,984.24	13.3415	4,018,560
1954	1,485,226	18,409,610.35	12.3951	4,018,560
1955	1,550,116	18,055,257.58	11.6477	4,018,560

[1] From 1876 to 1955, inclusive, this mine yielded bullion and concentrates that brought a net return of $599,960,719 and paid $190,795,114 in dividends.

Nemo Ore Co. produced iron ore from an opencut mine near Nemo. The entire production was used in the manufacture of portland cement by South Dakota Cement Plant at Rapid City. The ore was hematitic and contained from 35 to 40 percent iron. Cole Construction Co. produced crushed limestone for riprap, road construction, and sugar refining. The county highway department produced paving gravel.

Meade.—Pure Oil Co., Herndon Drilling Co., and Continental Oil Co. drilled 7 slim test holes to depths ranging from 1,300 to 6,250 feet. They were completed in the Muddy sandstone and the Red River formation. Results of the drilling were not announced. Paving gravel was produced for the county highway department; Daane Bros. Construction Co. produced road gravel. Henry Hanson and Conlon Exploration Co. completed a limited amount of diamond drilling for uranium on the Lamberton property.

Minnehaha.—Concrete Materials Co. produced crushed sandstone for refractory use, for road construction, and for filters. L. G. Everist, Inc., produced crushed sandstone for riprap, road construction, railroad ballast, filters, the manufacture of ferrosilicon, and for foundries. The county ranked first in the production of sand and gravel. Building and paving sand and gravel were produced by Concrete Materials Co., Eagle Sand & Gravel Co., Steve Oberg, Weelborg Bros., and Frank E. Lacy. Paving gravel was produced for the State highway commission.

Pennington.—The value of mineral production in 1954 was $6.8 million, a 5-percent increase over 1955. Gains were recorded in the value of beryl, cement, clays, columbite-tantalite, gypsum, mica, and crushed stone. A sharp decrease was recorded in the production of sand and gravel used principally for road construction. This was compensated for largely by crushed stone, the quantity and value of which more than doubled those in 1954.

Beryl production was reported by 23 operators. Consolidated Feldspar Department of International Minerals & Chemical Corp., the largest producer, operated the Hugo, Barker, and White Cap mines. Other major producers were Black Hills Keystone Corp., operating the Bob Ingersoll; Keystone Feldspar and Chemical Corp., operating the Peerless; Harold Hall, operating the Hardesty and other deposits; and Dale McDermond, at the White Cap. GSA at Custer purchased 62 percent of the production; Gladys W. McKinley, Custer, 30 percent; and Beryl Ores, Arvada, Colo., 8 percent.

The South Dakota Cement Plant at Rapid City, owned by the State of South Dakota and operated by the South Dakota State Cement Commission, produced general-use and moderate-heat (types I and II), high-early-strength (type III), high-sulfate-resistance (type V) portland cements and masonry cement. A portion of the general-use and moderate-heat cement was air-entrained. Portland-cement clinker was used as a base for the masonry cement. Finished-cement storage capacity was increased 150,000 barrels. Shipments of portland and masonry cement increased 15 percent over 1954. The cement commission produces the limestone, shale, and sand used from deposits near Rapid City. Gypsum was produced under contract from State-owned land, and the iron ore was purchased from Nemo Ore Co., which operated a mine in Lawrence County.

Light Aggregates, Inc., Rapid City, produced shale from the Pierre formation and operated its bloating plant at Rapid City to produce lightweight aggregate. The aggregate was used principally in manufacturing concrete building blocks.

Feldspar, produced by 16 operators from the pegmatite deposits near Keystone, decreased slightly from 1954. Consolidated Feldspar Department of International Minerals & Chemical Corp. produced crude feldspar from several properties and operated its grinding plant at Keystone. The ground product was used for pottery, enamel, brick and tile, other ceramic products, and soaps and abrasives. The entire production by independent producers was sold to Consolidated Feldspar Department.

Maywood Chemical Works operated the Etta mine, producing spodumene, which was shipped to its processing plant at Maywood, N. J. Lithium Corp. of America, Inc., resumed activity in March at the Mateen mine and flotation mill at Hill City that had been shut down since July 1954 because of a water shortage. Operation continued for a short time; then the mine and mill were again shut down. At the end of the year the corporation announced that South Dakota operations would be maintained on a standby basis as spodumene, adequate to meet demands, could be obtained from other sources. Black Hills Keystone Corp. produced amblygonite and lepidolite at the Bob Ingersoll mine near Keystone and purchased amblygonite from producers in Custer County. The amblygonite was shipped to Germany and the lepidolite stockpiled. Uranium & Allied Minerals, Inc., produced lithium ores at the Edison mine and at the Dyke Lode and operated the Holy Terror mill at Keystone. Concentrates were sold to processors. National Processing Products Co., Rapid City, acquired the idle plant of United States Gypsum Co. at Piedmont in Meade County and installed equipment to concentrate lithium ore and produce lithium compounds. Crude ore was from the Hunter-Louise mine south of Hill City and from independent producers. Operations were not too successful, although a small quantity of lithium hydroxide was produced. Midwest Lithium Corp., organized in the latter part of 1955, acquired the properties of National Processing Co., and began a program for remodeling the plant at Piedmont and expanding operations.

Columbite-tantalite concentrates were produced by George C. Bland from various mines, by Uranium & Allied Minerals, Inc., at the Dyke Lode, and by J. D. Long at the Big Chief and Townsite mines.

Production in 1955 was 91 percent greater than in 1954. The entire production was purchased by GSA at Custer.

Scrap mica was produced by 12 operators; 2 operators also produced hand-cobbed mica; 1 operator produced only hand-cobbed mica. Principal producers of scrap mica were Consolidated Feldspar Department of International Minerals & Chemical Corp. and Keystone Feldspar & Chemical Co. Production was sold to grinders in Illinois, North Carolina, and Colorado. Uranium & Allied Minerals, Inc., was the principal producer of hand-cobbed mica, all of which was sold to GSA at Custer for processing.

Ed Birdsall Sand Co. produced sand and gravel for building, paving, and railroad ballast. Building and paving gravels were produced for the Bureau of Reclamation.

Crushed granite was produced by Northwestern Engineering Co. for road construction. L. G. Everist, Hills Materials Co., and Pete Lien & Sons produced crushed limestone for riprap and road construction. Pennington County Highway Department produced crushed stone for road construction. Crushed stone was produced for the following agencies: State Highway Commission, used for road construction; Federal Bureau of Reclamation, used at Pactola Dam; and United States Corps of Engineers, used as riprap in Wyoming. Crushed quartz was produced by Black Hills Keystone Corp. for use as roofing material. A. L. Krueger produced garnets and agatized wood. Pure Oil Co. drilled 3 slim test holes; all (about 2,000 feet in depth) were completed in the Muddy sandstone. Six crew weeks of geophysical (seismograph) work were completed by Amerada Petroleum Co., Atlantic Oil Co., and Shell Oil Co.

Ziebach.—Herndon Drilling Co. completed a slim test hole in the Red River formation at a depth of 5,970 feet. Amerada Petroleum Co., Atlantic Oil Co., and Pure Oil Co. completed 20 crew weeks of geophysical (seismograph) work.

U. S. GOVERNMENT PRINTING OFFICE: 1958