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The Mineral Industry of South Dakota



UNITED STATES DEPARTMENT OF THE INTERIOR



UNITED STATES DEPARTMENT OF THE INTERIOR • Donald Paul Hodel, Secretary

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The Mineral Industry of South Dakota

This chapter has been prepared under a Memorandum of Understanding between the Bureau of Mines, U.S. Department of the Interior, and the South Dakota Geological Survey for collecting information on all nonfuel minerals.

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In 1985, South Dakota's nonfuel mineral industry produced \$207.3 million worth of mineral commodities. This value represented an increase of 4% over the 1984 value but was 9% below the record high established in 1980. Value increases in excess of \$1 million were recorded for portland cement, gold, construction sand and gravel, and crushed stone. Nationally, the State ranked 33d in nonfuel mineral production. Gold accounted for 55% of the State's mineral value. Cement was the second leading commodity produced in the State. South Dakota was the Nation's second leading producer of gold and one of two States producing beryllium.

Table 1.—Nonfuel mineral production in South Dakota¹

| Mineral | 1984 | | 1985 | |
|--|--------------------|----------------------|--------------------|---------------------|
| | Quantity | Value (thousands) | Quantity | Value (thousands) |
| Cement: | | | | |
| Masonry | 5 | \$283 | 4 | W |
| Portland | 619 | 30,773 | 655 | W |
| Clays ² | 119 | 343 | 117 | \$309 |
| Feldspar | 7,219 | 124 | 13,721 | W |
| Gem stones | NA | 70 | NA | 70 |
| Gold (recoverable content of ores, etc.) | 310,527 | 111,994 | 356,103 | 113,119 |
| Gypsum | W | W | 34 | 269 |
| Sand and gravel (construction) | 5,786 | 12,168 | ^e 6,400 | ^e 16,000 |
| Silver (recoverable content of ores, etc.) | 50 | 407 | 63 | 388 |
| Stone: | | | | |
| Crushed | ^e 3,800 | ^e 12,800 | 4,071 | 14,412 |
| Dimension | ^e 60 | ^e 18,642 | W | W |
| Combined value of beryllium, clays (bentonite), lime, mica (scrap), and values indicated by symbol W | XX | ^f 11,265 | XX | 62,772 |
| Total | XX | ^f 198,869 | XX | 207,339 |

^eEstimated. ^fRevised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" figure. XX Not applicable.

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

²Excludes bentonite; value included with "Combined value" figure.

Table 2.—Nonfuel minerals produced in South Dakota in 1984, by county¹

| County | Minerals produced in order of value |
|----------------------------|--|
| Beadle | Sand and gravel (construction). |
| Brookings | Do. |
| Brown | Do. |
| Butte | Do. |
| Campbell | Sand and gravel (construction), clays. |
| Charles Mix | Sand and gravel (construction). |
| Clark | Do. |
| Codington | Do. |
| Corson | Do. |
| Custer | Sand and gravel (construction), mica, feldspar, beryllium. |
| Davison | Sand and gravel (construction). |
| Day | Do. |
| Deuel | Do. |
| Douglas | Do. |
| Edmunds | Do. |
| Fall River | Do. |
| Faulk | Do. |
| Grant | Do. |
| Gregory | Do. |
| Hamlin | Do. |
| Hanson | Do. |
| Harding | Do. |
| Hughes | Do. |
| Hutchinson | Do. |
| Hyde | Do. |
| Jerauld | Do. |
| Jones | Do. |
| Kingsbury | Do. |
| Lake | Do. |
| Lawrence | Gold, silver, sand and gravel (construction). |
| Lyman | Sand and gravel (construction). |
| McPherson | Do. |
| Marshall | Do. |
| Meade | Do. |
| Miner | Do. |
| Minnehaha | Do. |
| Moody | Do. |
| Pennington | Cement, lime, sand and gravel (construction), clays, gypsum. |
| Perkins | Sand and gravel (construction). |
| Roberts | Do. |
| Sanborn | Do. |
| Spink | Do. |
| Sully | Do. |
| Tripp | Do. |
| Turner | Do. |
| Union | Do. |
| Walworth | Do. |
| Yankton | Do. |
| Ziebach | Do. |
| Undistributed ² | Stone (crushed and dimension), gem stones. |

¹No production of nonfuel mineral commodities was reported for counties not listed.²Data not available by county for minerals listed.

Table 3.—Indicators of South Dakota business activity

| | 1983 ^F | 1984 | 1985 ^P |
|--|-------------------|----------|-------------------|
| Employment and labor force, annual average: | | | |
| Population | 699 | 705 | 708 |
| Total civilian labor force | 334 | 344 | 347 |
| Unemployment | 5.4 | 4.3 | 5.1 |
| Employment (nonagricultural): | | | |
| Mining total ¹ | 2.6 | 2.7 | 2.4 |
| Oil and gas extraction ² | .1 | .2 | .1 |
| Manufacturing total | 25.9 | 29.2 | 27.4 |
| Stone, clay, and glass products ² | 1.1 | 1.1 | 1.1 |
| Chemicals and allied products ² | .2 | .2 | .3 |
| Construction | 8.4 | 9.3 | 9.4 |
| Transportation and public utilities | 12.3 | 12.3 | 12.7 |
| Wholesale and retail trade | 62.5 | 65.3 | 65.6 |
| Finance, insurance, real estate | 12.4 | 13.1 | 13.9 |
| Services | 54.2 | 57.8 | 58.6 |
| Government and government enterprises | 56.9 | 57.2 | 57.7 |
| Total ³ | 235.3 | 247.0 | 247.7 |
| Personal income: | | | |
| Total | \$6,795 | \$7,606 | \$7,903 |
| Per capita | \$9,726 | \$10,790 | \$11,161 |
| Hours and earnings: | | | |
| Total average weekly hours, production workers | 41.6 | 42.1 | 41.8 |
| Total average hourly earnings, production workers | \$7.3 | \$7.1 | \$7.4 |
| Earnings by industry: | | | |
| Farm income | \$265 | \$666 | \$628 |
| Nonfarm | \$4,151 | \$4,497 | \$4,712 |
| Mining total | \$81 | \$87 | \$86 |
| Metal mining | \$50 | \$53 | \$54 |
| Nonmetallic minerals except fuels | \$21 | \$22 | \$21 |
| Oil and gas extraction | \$10 | \$11 | \$10 |
| Manufacturing total | \$492 | \$539 | \$535 |
| Primary metal industries | \$5 | \$5 | \$7 |
| Stone, clay, and glass products | \$20 | \$23 | \$24 |
| Chemicals and allied products | \$4 | \$4 | \$5 |
| Construction | \$245 | \$288 | \$298 |
| Transportation and public utilities | \$373 | \$426 | \$449 |
| Wholesale and retail trade | \$363 | \$315 | \$339 |
| Finance, insurance, real estate | \$242 | \$266 | \$304 |
| Services | \$386 | \$371 | \$1,046 |
| Government and government enterprises | \$912 | \$959 | \$1,011 |
| Construction activity: | | | |
| Number of private and public residential units authorized ⁴ | 2,501 | 3,221 | 2,544 |
| Value of nonresidential construction ⁴ | \$103.1 | \$101.0 | \$90.4 |
| Value of State road contract awards | \$85.4 | \$101.3 | \$117.0 |
| Shipments of portland and masonry cement to and within the State | 278 | 228 | 296 |
| Nonfuel mineral production value: | | | |
| Total crude mineral value | \$222.1 | \$198.9 | \$207.3 |
| Value per capita | \$318 | \$282 | \$293 |

^PPreliminary. ^FRevised.¹South Dakota Department of Labor mining totals may not add because of inclusion of data from other sources.²Bureau of Economic Analysis, Regional Economic Measurement Division, U.S. Department of Commerce.³Data may not add to totals shown because of independent rounding.⁴1983 data based upon 16,000-place sample; 1984 and 1985 data based upon 17,000-place sample.

Sources: U.S. Department of Commerce, U.S. Department of Labor, Highway and Heavy Construction Magazine, and U.S. Bureau of Mines.

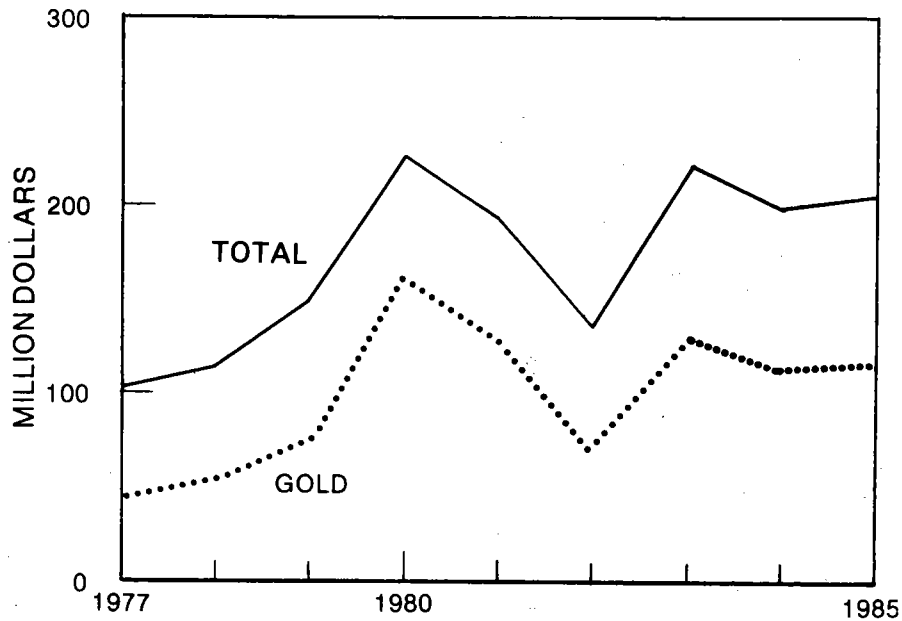


Figure 1.—Value of mine production of gold and total value of nonfuel mineral production in South Dakota.

Trends and Developments.—During 1985, the State of South Dakota issued 11 mining permits for nonfuel minerals, 1 less than in 1984. The life-of-mine permits, which went into effect in 1982, allow mining companies to continue operations as long as

permit requirements are met. Prior to 1982, permits had to be renewed periodically. Permits were issued to nine companies with operations in four counties. Table 4 summarizes permitting activity in 1985.

Table 4.—South Dakota: Life-of-mine permits issued in 1985

| Company | County | Commodities |
|--------------------------------|------------|---------------------|
| A & H Minerals | Custer | Pegmatite minerals. |
| G. L. Bland | do | Do. |
| W. M. Boggs | do | Feldspar. |
| I. Brazell | do | Do. |
| H. Bruch & S. Beutgen | Meade | Shale. |
| Hills Materials Co | Custer | Limestone. |
| Pacer Corp | do | Pegmatite minerals. |
| South Dakota Cement Commission | do | Gypsum. |
| Do | Pennington | Do. |
| Do | do | Sand. |
| Strawberry Hill Mining Co | Lawrence | Gold and silver. |

Several developments occurred in the State's mineral industry. In the metallic sector, Homestake Mining Co. announced in February that it was being forced to undertake a cost-cutting program because of falling gold prices. Salaried workers at the mine received a 5% pay cut beginning March 1. By early April, 55 salaried workers and 38 hourly employees had accepted a

company offer of early retirement in the cost-cutting program that was expected to save \$4 million by yearend. Major nonproduction expenditures at the mine and plant were also canceled to conserve cash flow. At the time, there were about 1,200 hourly and 300 salaried workers at the mine. Hourly workers were not affected by the cutbacks because the mine needed to operate at full

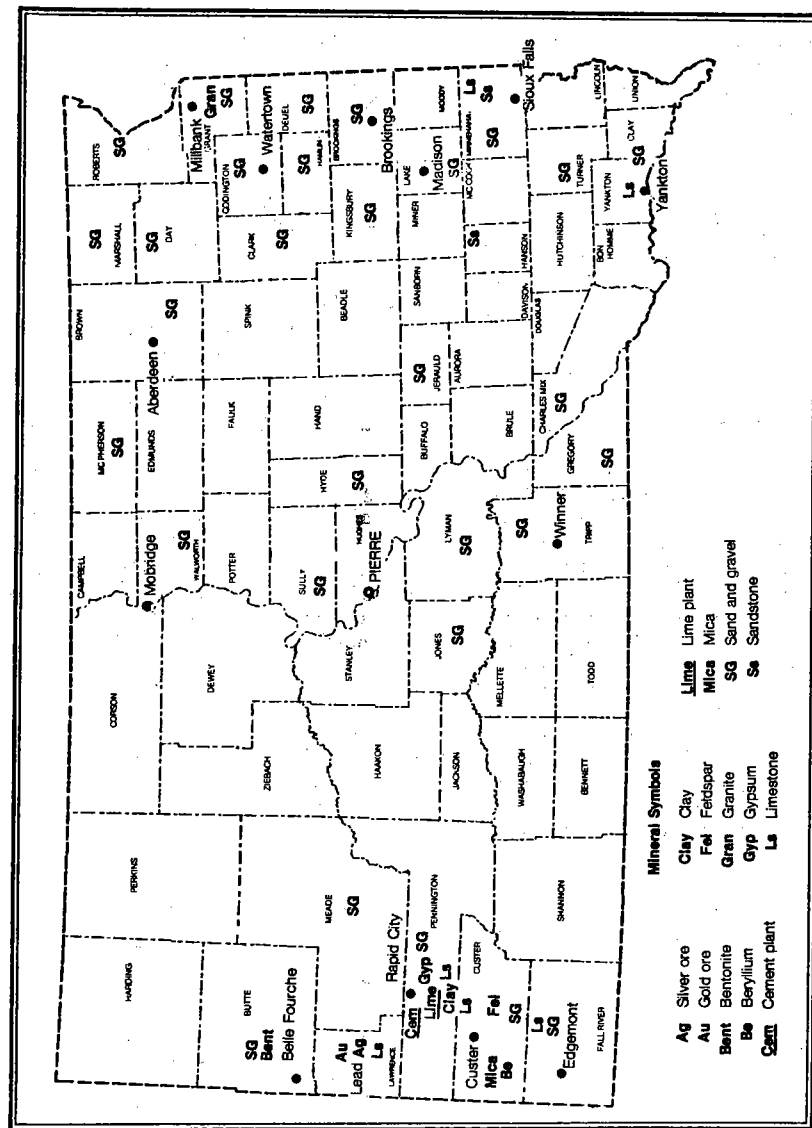


Figure 2.—Principal mineral producing localities in South Dakota.

capacity to keep production costs down.

In May, Homestake announced plans to develop a large, modern open pit in the historic "Open Cut" after conducting a successful 2-year test mining project on the site near the former townsite of Terraville. Gold ore from the surface mine was to be crushed and transported to Homestake's processing facilities via a 6,700-foot conveyor system that was expected to be completed by 1987.

The public focus on mining was heightened during 1985 by the proposed expansion of an open pit heap-leach gold mine at Annie Creek, 1 mile northwest of Terry Peak, a ski area in Lawrence County. The Lawrence County Board of Commissioners approved a zoning change and granted a permit to Wharf Resources (USA) Inc. to expand its heap-leach gold mining operation on a 183-acre tract at Foley Ridge where richer ore reserves were identified. Local property owners opposed the expansion saying it was only the beginning of extensive open pit mining in the northern Black Hills and questioned whether tourism and winter recreation would be of greater economic benefit to the local economy.

Wharf Resources was expected to apply for a State mining permit in early 1986. The company applied to the Denver regional office of the U.S. Environmental Protection Agency (EPA) for a Federal water discharge permit for the operation. When the EPA received the application, it published notices requesting public comment; after receiving extensive comments, EPA officials said that a hearing on the water discharge permit would be held in conjunction with the State's hearing on Wharf Resources' application for a mining permit for its planned expansion into the Foley Ridge area. EPA officials stated that the hearing might lead to a major study of cyanide heap-

leach mining methods in the Black Hills.

Cleanup of uranium mill tailings at a former Tennessee Valley Authority uranium mill near Edgemont was under way in 1985. Scheduled for completion in 1986, the \$2.7 million program was being conducted under the Federal Uranium Mill Tailings Remedial Action Program to remove mill tailings used as building material on 110 properties within Edgemont.

Site preparation was also under way on a 70-acre disposal area, 2 miles south of Edgemont, where 5 million tons of tailings was to be deposited in a separate \$39 million project. Completion of this project was expected to take about 5 years.⁴

Employment.—Total nonagricultural employment in the State rose to about 247,700 persons, the highest level ever recorded in South Dakota. Employment in the State's mining industry totaled 2,400 persons in 1985, 300 less than were employed in mining during 1984. Employment levels were fairly strong in the beginning of the year but weakened in the second half. Lower prices for precious metals and oil and gas, and a limited demand for road construction materials were the primary reasons for the decline.

Average weekly wages in mining were \$522.41, an 8% increase over 1984 wages. Compared with all other industry groups, mining employees received the highest average weekly wages during the past 5 years.

Exploration Activities.—Exploration for gold and other precious metals was conducted at an almost feverish pace during the year, mainly in the northern Black Hills. Eight companies were issued exploration permits in 1985 and planned to drill several hundred holes. Permitting activities are summarized in table 5.

Table 5.—South Dakota: Exploration permits issued in 1985

| Company | County | Commodities |
|--|---------------------|---------------------------|
| Freeport Exploration Co | Custer and Lawrence | Precious and base metals. |
| Homestake Mining Co | Lawrence | Gold and silver. |
| Moruya Gold Mines of North America Inc | do | Do. |
| Pete Lien & Sons Inc | do | Iron ore. |
| St. Joe American Corp | do | Gold and silver. |
| Strawberry Hill Mining Co | Custer | Pegmatite minerals. |
| Utah International Inc | Lawrence | Precious metals. |
| Wharf Resources (USA) Inc | do | Gold and silver. |

Moruya Gold Mines of North America Inc., a public Australian company, acquired the Golden Reward properties for Anaconda Minerals Co. during the year. The properties consisted of patented claims on 2,823 acres in the Ruby Basin District.⁵

The U.S. Bureau of Land Management had records of approximately 10,000 active mining claims in South Dakota as of year-end. All the claims were in seven counties in the western part of the State. Lawrence County had the greatest number of active

claims, followed by Pennington and Custer Counties.

Legislation and Government Programs.—Several mineral industry-related pieces of legislation were enacted into law during 1985:

House bill 1112 provided for the exemption of certain severed mineral interests from taxation.

House bill 1159 repealed a statute that was thought to be unconstitutional and provided a procedure for joining severed mineral interests with the surface estate.

Senate bill 12 repealed certain statutes relating to mine safety.

Senate bill 13 revised certain service requirements for the Board of Minerals and Environment.

Senate bill 162 provided for limited oil and gas exploration with vibrator-equipped trucks without filing a notice of intent.

Senate bill 166 required the registration for extensions of oil, gas, or mineral leases.

The South Dakota Supreme Court overturned a circuit court ruling that one section of the State's 1981 severance tax law was unconstitutional. Homestake contended that a provision exempting any company that mined less than 1,000 ounces of precious metal per year from the State's tax of 6% on gold sales was discriminative and unequal taxation. The circuit court ruled in 1983 that Homestake should be exempted from paying the taxes on the first 1,000 ounces, just like smaller companies, and ordered the State to repay \$69,433 in principal and \$16,792 in interest for taxes already collected. The U.S. Supreme Court ruling found that the tax was constitutional and stated "that the appropriate level or rate of taxation is essentially a matter for legislative, and not judicial resolution." The 1984 legislature replaced the 1981 severance tax by combining a 2% severance tax with an 8% tax on the mines' net income.⁶

Several State and Federal agencies had programs that related, directly or indirectly, to the South Dakota mineral industry. The South Dakota Geological Survey (SDGS), with offices at Vermillion, maintained a full-time staff of 31 persons; 21 of whom were geologists, hydrologists, and chemists. During 1985, the SDGS continued work on its 25-year-old cooperative program with the U.S. Geological Survey to prepare

a geologic-hydrologic study for each county in eastern South Dakota. Thirty-eight studies had been completed or were ongoing. The program was reorganized in 1983 to develop a complete geologic-hydrologic investigation of the Big Sioux River Basin, leading to a computerized ground water model that would allow for optimum development of the basin's water resources through proper management.

The SDGS also had an urban-rural program that provided for water resource studies at the request of local government agencies. Approximately 110 such studies had been completed since 1959.

Other ground water studies involved the construction of digital models to determine the optimum number of irrigation permits for an area; a series of statewide water supply studies for the U.S. Army Corps of Engineers; the hydrogeology of till; and the ground water protection aspects of landfill and nuclear waste repository siting and hazardous waste spills.

In December, a U.S. Department of the Interior task group released a preliminary evaluation of irrigation drainage water quality. The study, while confirming that a number of sites had high selenium levels, found no evidence of widespread harm to wildlife or human health. Areas with high selenium levels, which included the Angostura and Belle Fourche Reservoirs in South Dakota, were to be investigated further.⁷

The U.S. Bureau of Mines distributed \$252,000 to the South Dakota School of Mines and Technology at Rapid City, the designated Mining and Mineral Resources and Research Institute for the State under title III of Public Law 95-87. The funds were provided as part of a program to assist the institute's efforts in training engineers and scientists in mineral-related disciplines.

The Federal Government distributed \$797,407 to South Dakota for its share of funds generated by activities (mineral leasing, recreation, timbering, user fees, etc.) on national forest lands in fiscal year 1985. This compared with \$1,091,350 in funds the State received in fiscal year 1984. South Dakota's local governments received \$1,542,405 in fiscal year 1985 funds as "payments in lieu of taxes" for Federal tax-exempt lands within their boundaries.

REVIEW BY NONFUEL MINERAL COMMODITIES

METALS

In 1985, metal production accounted for 55% of the State's mineral value. South

Dakota ranked 2d of 14 States in gold production, 2d of 2 States in beryllium production, and 11th of 17 States in silver production.

Beryllium.—Pacer Corp. recovered a small tonnage of hand-cobbed beryl, along with feldspar and mica, at its pegmatite operations during the year. The firm operated several leased mines in the Custer County area with contract miners, and it also purchased beryl from independent miners. When sufficient quantities of beryl were accumulated, the firm trucked the material to Salt Lake City where it was sold

to Brush Wellman Inc. Beryl production reported by Pacer fell 67% below the 1984 level, and value decreased 66%.

Gold.—South Dakota ranked second behind Nevada in the production of gold and produced 14% of the Nation's total in 1985. Although production increased 15% above the 1984 level, value increased only 1% because of the depressed gold price.

Table 6.—South Dakota: Mine production of gold and silver in terms of recoverable metal

| Year | Mines producing | | Material sold or treated ¹ (thousand metric tons) | Gold (lode and placer) | | Silver (lode and placer) | |
|-----------|-----------------|--------|---|------------------------|-------------------|--------------------------|-------------------|
| | Lode | Placer | | Troy ounces | Value (thousands) | Thousand troy ounces | Value (thousands) |
| 1981 | 1 | 1 | 1,677 | 278,162 | \$127,854 | 56 | \$587 |
| 1982 | 1 | — | 1,059 | 185,035 | 69,558 | 26 | 209 |
| 1983 | 2 | — | 1,771 | 309,784 | 131,348 | 62 | 713 |
| 1984 | 2 | — | 2,252 | 310,527 | 111,994 | 50 | 407 |
| 1985 | 2 | — | 2,309 | 356,103 | 113,119 | 63 | 388 |
| 1876-1985 | NA | NA | NA | 38,970,185 | 2,103,130 | 13,706 | 16,318 |

NA Not available.

¹Excludes placer gravel.

The State's gold industry consisted of two companies; namely, Homestake with a new surface mine, an underground mine, and a mill near Lead, and Wharf Resources with a surface mine and ore treatment/heap-leach pads near Trojan.

At Homestake, mining and exploratory work continued below the 6,800-foot level, and major development work occurred on the 6,950-, 7,100-, and 8,000-foot levels. Preparation work for sinking the No. 4 Winze continued on a reduced schedule.

According to its annual report to stockholders, Homestake produced 343,103 troy ounces of gold in 1985, the company's highest output since 1974. Over 2.3 million short tons of ore was mined, and the average ore grade was 0.174 ounce per ton. The ore tonnage milled was the highest in the mine's history, and the unit production costs were the lowest since 1979. The overall ore grade fell 5% and mill recovery 1% because of the increased tonnage of lower grade ore from the test mining in the old open pit.

Homestake's South Dakota mining costs in 1984 averaged \$324 per ounce. In 1985, gold prices on the world market fell to an average of \$317.66 per ounce. By implementing a cost containment program, which included work force and pay reductions and early retirements, production costs were reduced to \$294 per ounce.

In August, Homestake dedicated a new \$10 million waste water treatment plant that used the bacterium *pseudomonas paucimobilis mudlock* to digest cyanide, lead, zinc, and other toxins into carbon and ammonia. Other bacteria attacked the ammonia, which was broken into harmless byproducts.⁸

The mining of Homestake's north test pit in the historic "Open Cut" at Lead, which began in 1984, was completed in August 1985. Almost 316,000 tons of ore was mined and over 22,000 ounces of gold was recovered. Both tonnage and grade were close to the original reserve estimates, and the company decided to put the opencut into full-scale production. In October, Homestake announced that it had awarded a 5-year, \$50 million contract to two firms to expand the original open pit. Approximately 50 million tons of waste will be removed from the opencut to expose the first 2.5 million tons of ore.

At Wharf Resources, ore was mined by conventional surface methods, crushed, spread on leach pads, and treated with a cyanide solution that dissolved the gold, which was then recovered and the solution reused. During much of 1985, Wharf Resources personnel concentrated on acquiring the necessary permits from the Lawrence County Commission to expand mining to a 183-acre site on nearby Foley Ridge. In

December, Wharf Resources received a conditional use permit covering 90% of the proposed mine area, and a zoning change was made that would allow the expansion. The company still required a State mining permit and a second conditional use permit for the remaining 10% of the site. The expansion plans were the center of a major controversy involving property owners in the area. At yearend, a group of concerned owners were considering a petition for a referendum on the mine expansion or a civil suit to challenge the commission's actions that permitted the Foley Ridge expansion.⁹

Silver.—South Dakota's silver production was obtained as a coproduct of gold recovery at the Homestake mill. Output increased 26% in quantity, but because of a decrease of \$2.00 per troy ounce in the average price, the total value fell by 5% compared with that of 1984.

INDUSTRIAL MINERALS

In 1985, industrial minerals accounted for 45% of the State's mineral value.

Cement.—The State-owned cement plant at Rapid City was the only producer in South Dakota. The plant, with an annual clinker capacity of 880,000 short tons, was equipped with two wet-process and one dry-process kilns. Clay, gypsum, limestone, and sand mined instate and iron materials brought in from out of State were used for cement manufacture. Both portland and masonry cement were produced; portland shipments increased 6%, whereas masonry sales declined 20%. Approximately 94% of the cement produced at the Rapid City facility is sold in Colorado, North Dakota, South Dakota, and Wyoming. Minor markets exist in Iowa, Minnesota, Montana, and Nebraska.¹⁰

In December, the Cement Commission, at the request of the Governor, agreed to pay the State treasury a "largest ever" dividend of \$33 million. Since 1979, the cement plant has added \$94 million to the South Dakota treasury.¹¹

Clays.—South Dakota's clay industry—two companies operating two mines in the western part of the State—produced both bentonite and common clay.

American Colloid Co. mined bentonite in Butte County by open pit methods and trucked it to its Belle Fourche plant where it was crushed, dried, ground, sized, and shipped in bulk and bagged form, mostly by rail, to consumers. The Belle Fourche plant was one of four operated by the company in

Montana, South Dakota, and Wyoming. American Colloid's principal markets were the foundry and drilling industries. Production in 1985 decreased 16% from that reported for 1984 as the demand for oil well drilling mud, a major market for South Dakota bentonite, declined sharply as world oil prices plummeted.

The South Dakota Cement Commission mined common clay for use in manufacturing cement at its Rapid City plant. Production was about 2% less than in 1984.

Feldspar.—South Dakota was one of six States producing feldspar—an anhydrous aluminum silicate used as a flux in glass and ceramics manufacture. Pacer owns several surface mines and a grinding plant in Custer County. The plant in Custer grinds ore mined by approximately 25 independent operations, all in the pegmatite district of the Southern Black Hills. Sales, in both bulk and bag form, were primarily to the electrical, porcelain, and pottery industries.

Gem Stones.—The collection of gem stones and mineral specimens was a small but active segment of South Dakota's mineral industry. Several varieties of agate are found in the State, including the Fairburn agate, the State gem stone. The Fairburn agate is found in a belt extending from Farmingdale, SD, to Orella, NE. Also, many types of fossils, both vertebrate and invertebrate, are found in many areas of the State.

A mine 17 miles west of Custer produced Teepee Canyon agates,¹² and several of the independent feldspar miners stockpiled rose quartz and other mineral specimens for sale. The Tip Top Mine near Custer was the site of a previously undescribed mineral discovery. Tiptopite, as the new mineral was named, is a "secondary phosphate mineral derived from triphylite and beryl."¹³

Gypsum.—The South Dakota Cement Commission produced crude gypsum at a surface mine in Pennington County where it was crushed and shipped by rail to the Commission's cement plant in Rapid City. Ground clinker was mixed with gypsum for use as a setting retardant in portland cement. Gypsum production paralleled cement demand, and output increased over that of 1984.

Lime.—One company, Pete Lien & Sons Inc., produced both hydrated lime and quicklime at a plant in Rapid City that had both a rotary and a vertical kiln. Limestone was mined by surface methods from a property in Pennington County. Principal sales were for road and soil stabilization, sulfur removal from stack gases, and basic oxygen

furnace steel. Output and value decreased 4% for hydrated lime and 14% for quicklime from 1984 levels.

Mica.—Pacer produced mica-bearing pegmatite material from a surface mine in Custer County. After drilling and shooting, the ore was crushed before it was trucked to one of two plants in the Custer area. One plant used gravity separation to obtain a crude mica product and the second utilized crushing and screening.

Sand and Gravel (Construction).—Construction sand and gravel production is surveyed by the U.S. Bureau of Mines for even-numbered years only; therefore, this chapter contains only estimates for 1985. Data for odd-numbered years are based on annual company estimates made before yearend.

South Dakota's sand and gravel industry in 1985 was similar to that of 1984 when 106 firms and government agencies operated 183 pits in 50 counties. The five leading

counties in terms of tonnage were in the eastern part of the State. The estimated 1985 production exceeded the 1984 reported output by 614,000 tons. Historically, almost 50% of the sand and gravel output in South Dakota has been for road construction and stabilization.

Stone.—Stone production is surveyed by the U.S. Bureau of Mines for odd-numbered years only; therefore, this chapter contains only estimates for 1984. Data for even-numbered years are based on annual company estimates made before yearend.

Crushed.—Crushed stone output, reported by 11 companies operating 13 quarries in 4 southwestern and 3 eastern counties, increased 7% in quantity and 13% in value over that of 1984. Limestone production, totaling over 3 million tons, was reported from 10 quarries and represented nearly three-quarters of the total. Sandstone and quartzite from three quarries constituted the remainder.

Table 7.—South Dakota: Crushed stone¹ sold or used by producers in 1985, by use

(Thousand short tons and thousand dollars)

| Use | Quantity | Value |
|--|--------------|---------------|
| Coarse aggregate (+1-1/2 inch): | | |
| Riprap and jetty stone | 14 | 53 |
| Filter stone | 13 | 52 |
| Coarse aggregate, graded: | | |
| Concrete aggregate, coarse | 97 | 618 |
| Bituminous surface-treatment aggregate | 41 | 321 |
| Combined coarse and fine aggregates: Other construction ² | 181 | 839 |
| Chemical and metallurgical: Cement manufacture | 950 | 1,994 |
| Other unspecified ³ | 2,777 | 10,534 |
| Total⁴ | 4,071 | 14,412 |

¹Includes limestone, quartzite, and sandstone.

²Includes bituminous aggregate (coarse), graded road base or subbase, unpaved road surfacing, stone sand (concrete), terrazzo and exposed aggregate, stone sand (bituminous mix or seal), and fine aggregate (screening).

³Includes production reported without a breakdown by end use and estimates for nonrespondents.

⁴Data may not add to totals shown because of independent rounding.

Controversy developed during the year when two construction companies—one South Dakota-based and the other based in Iowa—applied for quarry permits in Minnehaha County in the southeastern part of the State. The companies were attracted to the areas because the Iowa Department of Transportation changed its specifications for highway construction materials to a standard that could only be met by a rock type such as that found in the area. County residents protested the applications because of concerns about declining property values, blasting damage, and increased dust, noise, and traffic. Action on the permit applications was expected in early 1986.¹⁴

Dimension.—South Dakota ranked fifth among 20 States in the quarrying and

cutting of dimension granite. Production was centered in Grant County in the northeastern part of the State where four companies operated eight quarries. Quantity and value of sales, all for construction and monumental uses, decreased moderately compared with 1984 figures.

¹State Mineral Officer, Bureau of Mines, Tuscaloosa, AL.

²State Mineral Officer, Bureau of Mines, Minneapolis, MN.

³Editorial assistant, Bureau of Mines, Minneapolis, MN.

⁴The Rapid City Journal. Tailings To Be Moved to Safer Spot Next Spring. Sept. 21, 1985.

⁵Lead Daily Call. Anaconda Lands Sold. July 5, 1985.

⁶Gold Tax Refund Rejected by Court. Sept. 6, 1985.

⁷U.S. Department of the Interior News Release. Interior Expands Water Quality Review; Preliminary Study Finds No Widespread Toxic Effects From Selenium. Dec. 11, 1985.

⁸The Rapid City Journal. Bacteria Doing Their Bit To Improve Environment. Aug. 15, 1985.

⁹Wharf Needs Expansion To Keep Its Golden Eggs in Hills Basket. Dec. 22, 1985.

¹⁰Cement Plant OK's Transfer of \$8 Million to State Fund. June 14, 1985.

¹¹Cement Plant To Pay State \$33 Million. Dec. 4,

1985.

¹²The Rapid City Journal. Custer Family Upholds Independent Mining Tradition. Jan. 5, 1985.

¹³_____. Tech Curator, Student Discover a New Mineral. May 7, 1985.

¹⁴Argus Leader (Sioux Falls, SD). Four-Corner Tussle Has Participants on Rocky Ground. Dec. 6, 1985.

Table 8.—Principal producers

| Commodity and company | Address | Type of activity | County |
|--|---|---|---|
| Beryllium concentrate: | | | |
| Pacer Corp | Box 912 Custer, SD 57730 | Mine and plant | Custer. |
| Cement: | | | |
| South Dakota Cement Commission. | Box 360 Rapid City, SD 57709 | 3 rotary kilns | Pennington. |
| Clays: | | | |
| American Colloid Co | 5100 Suffield Ct. Skokie, IL 60076 | Open pit mine and plant | Butte. |
| South Dakota Cement Commission. | Box 360 Rapid City, SD 57709 | Open pit mine | Pennington. |
| Feldspar: | | | |
| Pacer Corp | Box 912 Custer, SD 57730 | Open pit mines and dry-grinding plant. | Custer. |
| Gold: | | | |
| Homestake Mining Co | Box 875 Lead, SD 57754 | Underground and open pit mines, cyanidation mill, refinery. | Lawrence. |
| Wharf Resources (USA) Inc | Box 897 Lead, SD 57754 | Open pit mine and heap leaching. | Do. |
| Gypsum: | | | |
| South Dakota Cement Commission. | Box 360 Rapid City, SD 57709 | Open pit mine | Pennington. |
| Lime: | | | |
| Pete Lien & Sons Inc | Box 440 Rapid City, SD 57709 | 1 rotary kiln, 1 vertical kiln, continuous-hydrator plant. | Do. |
| Mica: | | | |
| Pacer Corp | Box 912 Custer, SD 57730 | Mine and dry-grinding plant | Custer. |
| Sand and gravel (construction, 1984): | | | |
| W. E. Bartholow & Son Construction Co. | Route 3 Huron, SD 57350 | Pits and plants | Jerauld. |
| Birdsall Sand & Gravel Co. Inc | Box 767 Rapid City, SD 57709 | do | Fall River, Pennington, Sully, Brookings. |
| Bowes Construction Inc | Box 451 Brookings, SD 57006 | do | Brookings. |
| Fisher Sand & Gravel Co | Box 1034 Dickinson, ND 58601 | do | Pennington, Roberts, Tripp, Ziebach, Minnehaha. |
| Myrl & Roy's Paving Inc | 1500 East 39th St. North Sioux Falls, SD 57101 | Pit and plant | Minnehaha. |
| Rechnagel Construction Co | Hurley, SD 57036 | Pits and plants | Turner. |
| Sweetman Construction Inc | 100 South Dakota Ave. Summit, SD 57266 | do | Minnehaha and Roberts. |
| Silver: | | | |
| Homestake Mining Co | Box 875 Lead, SD 57754 | See "Gold" | Lawrence. |
| Stone: | | | |
| Crushed: | | | |
| Limestone: | | | |
| Pete Lien & Sons Inc | Box 440 Rapid City, SD 57709 | Quarries and plants | Custer and Pennington. |
| Northwestern Engineering Co. (Hills Materials Co.) | Box 2320 Rapid City, SD 57709 | do | Fall River and Pennington. |
| South Dakota Cement Commission. | Box 360 Rapid City, SD 57709 | Quarry and plant | Pennington. |
| Sandstone-quartzite: | | | |
| Concrete Materials Co | Box 809 Sioux Falls, SD 57101 | do | Minnehaha. |
| L. G. Everist Inc | 313 South Phillips Sioux Falls, SD 57101 | do | Do. |
| Spencer Quarries Inc | Box 25 Spencer, SD 57374 | do | Hanson. |
| Dimension: | | | |
| Granite: | | | |
| Cold Spring Granite Co. | 202 South 3d Ave. Cold Spring, MN 56320 | Quarries | Grant. |
| Dakota Granite Co | Box 1351 Milbank, SD 57252 | do | Do. |