

SOUTH DAKOTA

By Eileen K. Peterson and Richard H. Hammond

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SOUTH DAKOTA



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COVER PHOTO:

The South Dakota Capitol Building in Pierre symbolizes the cooperative working relationship between the U.S. Bureau of Mines and the mineral agencies of the State. (Photo is courtesy of the South Dakota Department of Tourism.)

For comments or further information, please contact

*Denver Regional Office of State Activities
U.S. Bureau of Mines
Bldg. 20, Denver Federal Center,
Box 25086
Denver, CO 80225-0086
Telephone: (303) 236-0435*

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THE MINERAL INDUSTRY OF SOUTH DAKOTA

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

By Eileen K. Peterson¹ and Richard H. Hammond²

In 1991, the value of nonfuel mineral production in South Dakota was about \$290 million, a 6% decrease from the record-high 1990 level of \$310 million. Decreases in the values of gold, silver, and sand and gravel production accounted for most of the decline in value. The value of gemstone production jumped significantly from the estimated \$110 thousand in 1990 with the opening of a rose quartz mine. Modest increases in value were observed for cement, feldspar, lime, and crushed and dimension stone.

Nonfuel mineral production came from 63 of the State's 67 counties. Lawrence County was again the leading county in terms of value for nonfuel mineral production, contributing almost two-thirds to the State's total.

The State ranked 34th nationwide in the total value of nonfuel mineral

production, accounting for about 1% of the Nation's total. South Dakota ranked fourth in gold production, behind Nevada, California, and Utah, fourth in gemstone production, and in the top five nationally in the production of mica.

Gold, the principal commodity produced in the metallic sector, accounted for approximately \$6 out of every \$10 of the State's total nonfuel mineral value. In terms of value, leading nonmetallic commodities were cement, gemstones, sand and gravel, and stone. Construction commodities contributed about 30% of the State's total nonfuel mineral production value.

TRENDS AND DEVELOPMENTS

Most of South Dakota's industrial minerals production is used in

construction. According to U.S. Department of Commerce figures for South Dakota, 2,507 new residential units valued at \$146 million were permitted for construction in 1991. Permitted nonresidential construction was valued at \$102 million.

State mineral extraction taxes for 1991 generated \$5.2 million for the State treasury. That figure represented a 35% drop in 2 years. Gold and silver severance taxes in South Dakota, the highest in the country, are based on a twofold system: companies are taxed on gross production and on profits. Lower gold prices and production resulted in the decreased severance tax payments.

The South Dakota Supreme Court overturned a South Dakota Board of Minerals and Environment 1989 decision not to transfer a mine permit from Homestake Mining Co. to Minerva

TABLE 1
NONFUEL MINERAL PRODUCTION IN SOUTH DAKOTA¹

Mineral	1989		1990		1991	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
Gemstones	NA	\$150	NA	\$110	NA	W
Gold ² kilograms	16,123	198,318	*17,870	*221,157	16,371	\$191,217
Lead ² metric tons	4	3	—	—	—	—
Sand and gravel (construction) thousand short tons	*6,400	*20,800	9,689	23,689	*8,700	*20,800
Silver ² metric tons	4	705	*10	*1,566	7	944
Stone:						
Crushed thousand short tons	3,833	14,303	*4,800	*16,800	4,824	19,657
Dimension short tons	54,623	17,738	*50,688	*12,871	W	W
Combined value of cement, clays (common), feldspar, gypsum (crude), iron ore (usable), lime, mica (scrap), and values indicated by symbol W	XX	32,341	XX	34,310	XX	57,304
Total	XX	284,358	XX	*310,503	XX	289,922

¹Estimated. ²Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.

³Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

⁴Recoverable content of ores, etc.

Explorations Inc. for the Ragged Top area near Spearfish Canyon. The Department of Environment and Natural Resources (DENR) had recommended that the Board transfer the permit; however, the Board voted against the transfer. Minerva has not announced whether it will mine and treat the ore on-site or ship the ore elsewhere for treatment.

Homestake Mining continued work on expansions of the company's Open Cut Mine and the historic Homestake underground mine, both in Lead. Permitting for the \$30 million expansion of the Open Cut was in process with the State. The expansion will require relocation of about 460 meters (1,500 feet) of highway through Lead, relocation of approximately 175 homes and businesses, and construction of a highway overpass to transport waste rock to a dump. Underground, work on the 4.8-kilometer-long (3-mile) exploration drift to the North Homestake Project neared the halfway point this year. The 5-year, \$23 million project is being driven off the 2,070-meter level (6,800-foot) of the underground mine. In September, Homestake began an unprecedented minewide shutdown of the underground operation. Because of unacceptable safety problems and four fatalities during the year, mine sections were shut down sequentially to correct safety and equipment problems. The inspection was expected to last into 1992.

Brohm Mining Corp. decided to place on hold plans for a large sulfide expansion project at the company's Gilt Edge Mine east of Lead. Continued low gold prices were cited as the major reason for the decision.

EMPLOYMENT

Despite some monthly variations in mining employment, South Dakota Department of Labor figures indicated the 1991 employment figure of 2,520 was down slightly from the 1990 average of 2,600 employees. Construction employment increased slightly in 1991 to 11,878, up from 11,676 in 1990. Oil and

gas extraction employment figures remained unchanged from those of 1990.

The mining industry in South Dakota had the highest average annual earnings of any industry group in the State in 1991. Average mining earnings were \$32,810, up 4.3% from \$31,453 in 1990 and a 5-year increase (1987-91) of 17.8%. Metal mining had the highest average at \$35,916, oil and gas earnings averaged \$26,144, and other mining averaged \$25,915. U.S. Department of Labor statistics indicated the 1991 average annual wage in the State was \$16,450, about 50% of the average for the mining sector.

Four fatalities from four separate accidents were reported in 1991 in South Dakota's underground mining operations. No fatalities were reported from associated mills and/or operation plants or surface mines. During the almost 4.6 million employee-hours worked at mines and mining facilities, a reported 125 injuries occurred to workers resulting in lost workdays and an additional 148 injuries occurred with no workdays lost.

REGULATORY ISSUES

Because of a 2-year moratorium on new mining operations, the South Dakota Board of Minerals and Environment (SDBME) issued no life-of-mine permits for large-scale mines in 1991.

SDBME made its first preliminary designation of a "special or unique area" under House bill 1289 (passed by the 1989 State legislature). Spearfish Canyon and its entire 38,850-hectare (96,000-acre) watershed area, about 20% of the land area in Lawrence County, was designated as an "exceptional, special, critical, or unique" land area. The designation does not preempt mining in the area but does add a more stringent set of rules and questions to be answered before permits will be granted.

The Whitewood Creek U.S. Environmental Protection Agency (EPA) Superfund site and about 27 kilometers (17 miles) of Whitewood Creek were nominated for designation but were determined not eligible by the SDBME. Whitewood Development Corp. (a wholly

owned subsidiary of Homestake) and Goldstake Explorations formed a joint venture, Whitewood Creek Joint Venture, to examine the possibility of recovering gold from relict mine tailings along the creek using a sodium cyanide heap-leach pad system. The 27-kilometer-long (17-mile) area has more than 9.4 million metric tons (10.4 million short tons) of tailings containing more than 15,550 kilograms (500,000 troy ounces) of recoverable gold. At yearend, the project was on hold because of low gold prices.

During 1991, two Notices of Violation were issued by DENR for environmental problems. Brohm Mining was issued both notices and was assessed a penalty of \$99,800 for a release of cyanide solution to surface and ground water. The cyanide solution apparently leaked through a heap-leach pad berm when the pad was being used to store excess storm water from spring rains. Brohm reached an agreement with the State and Homestake to transport excess storm water to Homestake's Grizzly Gulch tailings dam. At another mine, elevated levels of nitrate were detected in drainage from waste rock depositories. The nitrate levels did not exceed permitted levels, however, and no fines were assessed. Research was undertaken to identify possible sources of the elevated nitrate levels. All other large-scale gold mining in the Black Hills proceeded within required environmental controls.

Cleanup at the abandoned Spokane Mine site southeast of Keystone was undertaken when the mine was found to contain chemical and physical hazards. Abandoned shafts, adits, mill tailings, and a waste pit were covered or sealed at a cost of \$420,000. The Spokane Mine produced lead, silver, and zinc from about 1898 until 1940.

Waste disposal and landfills continued to make news in South Dakota in 1991. RSW Inc., a Torrington, CT, company, proposed a 2,050-hectare (5,067-acre) solid waste landfill on the Rosebud Sioux Indian Reservation, Todd County. The landfill would be used to dispose of ash from waste incineration. Concerns about lead and cadmium in the ash have been voiced by reservation residents and

environmental groups. The decision whether to approve the landfill will be made by the tribe and the U.S. Bureau of Indian Affairs.

Late in 1991, two former investors in the bankrupt CMC (Consolidated Waste Management Corp.) filed a preliminary application with the South Dakota DENR to reopen the defunct sewage-ash landfill near Edgemont in Fall River County. A new company, Fall River Properties, was formed to manage the project that would dispose of about 136,000 metric tons (150,000 short tons) of ash per year at the old Igloo munitions depot 8 kilometers (5 miles) south of Edgemont. CMC had planned to extract gold and other precious metals from the ash. DENR will review the application and make a recommendation to the SDBME, which has the authority to approve or deny the permit.

The South Dakota Supreme Court was reviewing several lawsuits related to the proposed Lonetree Landfill, also near Edgemont. SDBME authorized the South Dakota Disposal Systems Inc. landfill in 1989; however, because of ongoing opposition, the landfill has not been constructed. In the November 1990 election, voters approved a law requiring legislative approval of large-scale landfills. The 1991 legislature approved the landfill but opponents gathered enough signatures to put the issue on the November 1992 ballot. Late in 1991, the operating company filed two lawsuits against the State seeking financial damages resulting from delayed opening of the landfill and to stop the Statewide vote on the landfill scheduled for November 1992. The company wants a judge to rule on whether the landfill can begin operation. At yearend, no decision had been reached.

EXPLORATION ACTIVITIES

The South Dakota DENR issued 11 exploration permits in 1991, down from the 15 issued in 1990. Eight of the 11 permits were for gold exploration in Lawrence and Pennington Counties. A 16% increase from 1990 permits was noted in the number of exploration drill

holes permitted. Some companies have slowed exploration activities in South Dakota because of uncertainties about the future of mining in the State pending State action on the recommendations of the Cumulative Environmental Evaluation (CEE), completed in December 1990.

Kalahari Resources of Vancouver, Canada, conducted a geophysical program in the Keystone area of Pennington County. Based on estimates in a 1940 U.S. Bureau of Mines Bulletin,³ the company estimated that two long inactive mines in the Keystone area contain estimated reserves of 1.3 million metric tons with 10.6 grams of gold per metric ton (1.4 million short tons of 0.31 ounce of gold per short ton). Gold mineralization is hosted in a Precambrian iron-formation similar to that at the Homestake Mine at Lead. Kalahari holds a land position 8.8 kilometers long (5.5 miles) and up to 0.8 kilometer wide (0.5 mile). Upon completion of the geophysical work, 12 anomalies were identified with lengths from 305 to 914 meters (1,000 to 3,000 feet).

LEGISLATION AND GOVERNMENT PROGRAMS

During the 1991 session, the South Dakota Legislature defeated a proposal to extend the moratorium on large-scale gold and silver mining in the Black Hills. The current 2-year moratorium is scheduled to expire January 1, 1992.

The CEE of mining in the Black Hills was completed in December 1990, and six recommendations were presented to SDBME in 1991. The major impacts on mining would be a proposed 2,430-hectare (6,000-acre) limit on large-scale gold and silver surface mines in the Black Hills and a requirement that 202 hectares (500 acres) of land affected by the mines be reclaimed by September 1997. All six of the recommendations will be part of the Second Century Environmental Protection Act to be considered by the 1992 South Dakota Legislature.

DENR completed a study funded by the Western Governors' Association

regarding cyanide testing of treated spent ore.

The U.S. Forest Service began studying reclamation plans for an abandoned uranium strip mine at Riley Pass near Ludlow, Harding County. Uranium was produced from the area in the 1960's by strip mining uranium-bearing lignite coal beds up to 24 meters (80 feet) below the ground surface. Full-scale restoration of the 81-hectare (200-acre) site could cost as much as \$8 million.

The South Dakota Geological Survey continued to assess the potential for economic deposits of manganese in eastern South Dakota and completed reports on sand and gravel resources in Lincoln and Codington Counties.

An allotment grant of \$148,000 from the U.S. Bureau of Mines was received by the Mining and Mineral Resources Research Institute at the South Dakota School of Mines and Technology in Rapid City. The grant was given under provisions of Public Laws 98-409 and 100-483. The purpose of the institute is to coordinate and administer training and research in mining, mineral resources, minerals development, and mineral processing. In State fiscal year 1991, Bureau-sponsored research included the use of insulation in critical areas of hot mines, leaching behavior of metal alloys, fine particle separation by centrifugation, and efficient removal of toxic ionics using liquid fluidized beds. Additional research was done on characterization of metal zoning in sediment-hosted parts of tertiary epithermal-mesothermal systems in the northern Black Hills. Twelve graduate fellowships benefited by the allotment grant.

South Dakota received \$592,000 in Federal royalties for minerals produced on Federal lands within the State borders. The money represents the State's share of bonuses, rents, and royalties collected by the U.S. Department of the Interior's Minerals Management Service. The State also received about \$1.3 million in Payments in Lieu of Taxes through the U.S. Bureau of Land Management to offset the loss of revenues caused by tax-

exempt Federal land located within the jurisdiction of local governments.

REVIEW BY NONFUEL MINERAL COMMODITIES

Metals

Gold and Silver.—The quantity and value of gold produced in the State decreased slightly from the 20-year high reported in 1990 of 17,870 kilograms (574,537 troy ounces). Production of silver, obtained as a coproduct with gold at four of the five major gold mines, also fell from the revised 1990 production figure of 10 metric tons (324,815 troy ounces).

Collectively, in 1991 the major gold mining operations processed in excess of 8.7 million metric tons (9.6 million short tons) of ore from which 16,371 kilograms (526,261 troy ounces) of gold and 7 metric tons (233,590 troy ounces) of silver were recovered. The average unit prices in 1991 were \$363.29 per troy ounce for gold and \$4.04 per troy ounce for silver, down from 1990 when gold was \$384.93 per troy ounce and silver was \$4.82 per troy ounce.

All the major gold operations were within an 11.3-kilometer (7-mile) radius of Lead, in Lawrence County. Four of the five major gold producers recovered gold by heap leaching with cyanide; the other producer used vat leaching with cyanide.

Homestake, despite having an almost 18% drop in gold production, continued to be the State's largest gold producer, accounting for nearly two-thirds of the total output. The decrease in gold production resulted from lower ore grades and an interruption in underground production. The underground mine underwent a 5-month cleanup and safety evaluation following four unrelated deaths in the mine in 7 months.

Homestake's 1991 annual report reported gold production levels of 7,014 kilograms (225,515 troy ounces) from the underground mine and 2,910 kilograms (93,565 troy ounces) from the Open Cut. To maintain full milling rates, production

of lower grade Open Cut ore was increased to offset loss of production from the underground mine. As a result, the average grade of processed ore dropped 15% while tonnage milled increased 5%. A total of 2.3 million metric tons (2.5 million short tons) of ore was milled with an average gold grade of 4.8 grams per metric ton (0.140 troy ounce per short ton) and a recovery of 92.7%. Average cash costs were \$377 per troy ounce of gold recovered. Cumulative production from the Homestake mines surpassed 1.13 million kilograms (36.5 million troy ounces) during 1991. Company annual reports listed yearend proven and probable reserves at 26.6 million metric tons with 6.9 grams of gold per metric ton (29.3 million short tons with 0.202 troy ounce of gold per ton). During 1991, Homestake spent \$10.6 million on a mill optimization project.

Bond Gold Richmond Hill Inc. (wholly owned subsidiary of LAC Minerals Ltd.) conducted exploration drilling near the Richmond Hill Mine, 8 kilometers (5 miles) northwest of Lead, to define more ore reserves. Current mine reserves will be mined out in 1992 if no additional mining areas are defined and permitted. According to the LAC Minerals annual report for 1991, Richmond Hill Mine produced 1,300 kilograms (41,815 troy ounces) of gold and 1,552 kilograms (49,884 troy ounces) of silver from 1.34 million metric tons of ore (1.48 million short tons). Average gold grade was 0.96 gram per metric ton (0.028 troy ounce per short ton). Cash costs associated with production were \$277 per troy ounce of gold produced. Proven and probable gold reserves at yearend were 772,900 metric tons with 1.7 grams gold per metric ton (852,000 short tons with 0.05 troy ounce of gold per short ton).

Operators of the Golden Reward Mine (MinVen Gold Corp. and United Coin Mines), 4.8 kilometers (3 miles) southwest of Lead, encountered problems with pond leakage, slow detoxification of spent ore, and equipment. The mine was basically shut down for most of February and March. Ice buildup on the leach cells precluded use of the reclaimer, and

off-loading was done using front-end loaders. Stress fractures in the leach pad were repaired as the cells were off-loaded.

MinVen Gold's annual report for 1991 showed production at the Golden Reward Mine included 1,262 kilograms (40,590 troy ounces) of gold and 2,677 kilograms (86,080 troy ounces) of silver from 1.18 million metric tons (1.3 million short tons) of ore. Cash cost was \$269 per troy ounce of gold recovered. At yearend, proven and probable gold reserves within the permitted mine area were identified as more than 9 million metric tons (10 million short tons) with an average gold grade of 1.44 grams per metric ton (0.042 troy ounce per ton). Outside the permitted mine area, the company has more than 3.6 million metric tons of reserves with 1.3 grams of gold per metric ton (4 million short tons with 0.038 troy ounce of gold per short ton).

Late in 1991, MinVen Gold announced plans to acquire the Golden Reward stock held by United Coin Mines (66.7%). MinVen currently holds 33.3% of the Golden Reward stock in addition to 100% of the Gilt Edge Mine, southeast of Lead. The acquisition is subject to regulatory and stockholder approvals.

Operations at the Brohm Mining (subsidiary of MinVen Gold) Gilt Edge Mine encountered problems during the first half of 1991 with heavy rainfall that subsequently led to a cyanide leak and temporarily halted cyanide additions to a heap-leach pad. MinVen Gold's annual reports for 1991 showed production in 1991 included 992 kilograms of gold (29,872 troy ounces) and 1,179 kilograms of silver (37,898 troy ounces) from 1.18 million metric tons (1.3 million short tons) of ore processed. The average gold grade was 1.4 grams per metric ton (0.041 troy ounce per short ton) and recovery was about 61%. Average cash costs were \$389 per troy ounce of gold recovered. Both ore processed and gold recovered were down slightly from those of 1990.

The company's annual report for 1991 showed that at yearend, the Gilt Edge Mine had proven and probable reserves

of 745,000 metric tons with 1.2 grams of gold per metric ton (821,000 short tons with 0.035 troy ounce of gold per short ton). Outside the currently permitted mine area, the company reported more than 4.5 million metric tons of ore with 0.89 gram of gold per metric ton (5 million short tons with 0.026 troy ounce of gold per short ton).

Brohm completed feasibility studies for milling operations to recover gold from 40.8 million metric tons (45 million short tons) of sulfide reserves at the Gilt Edge Mine. Because of high cash and capital costs and the low market price for gold, plans for milling the sulfide reserves are on hold. Metallurgical tests indicated some of the sulfide reserves are amenable to heap leaching, and the company is studying this alternate processing plan.

At the Annie Creek/Foley Ridge Mine 6.4 kilometers (4 miles) west of Lead, Wharf Resources Inc. produced a record 2,910 kilograms of gold (93,569 troy ounces) from 3 million metric tons (3.3 million short tons) of ore at a cash cost of \$209 per troy ounce of gold recovered. The Annie Creek pit is nearly mined out, except for some small extensions, and backfilling of the pit is expected to begin in 1992. Drilling on mine properties resulted in expanding the proven and probable reserve figure to 22.3 million metric tons with 1.3 grams of gold per metric ton (24.6 million short tons with 0.039 troy ounce of gold per short ton) and drilling outside the permit area defined additional gold ore. At yearend, Wharf had not applied for permits to expand the mine outside the currently permitted area.

Dakota Placers Inc. requested permission from the State to increase processing capacity at the Red-Ex Mine from 382,280 cubic meters (500,000 cubic yards) to 611,650 cubic meters (800,000 cubic yards) per year. The placer operation processes alluvial deposits along Whitewood Creek near Deadwood.

Iron Ore.—Pete Lien & Sons Inc. produced iron ore from a pit near Nemo in Pennington County. The ore was used by the South Dakota Cement Plant in

Rapid City as an ingredient in cement manufacturing. Production was estimated by the U.S. Bureau of Mines to have increased significantly from that of 1990.

Industrial Minerals

The State's industrial minerals sector manufactured or produced 10 different industrial minerals. The top three, which accounted for more than 20% of the total nonfuel mineral value, were sand and gravel, stone, and lime.

Cement.—All cement manufactured in South Dakota came from the State-owned plant in Rapid City. Production at the plant increased for the third straight year. The output consisted of portland and masonry cement. Mineral resources used in the manufacturing of cement at this plant included clay, gypsum, iron ore, and limestone. The South Dakota Cement Plant Commission had been looking into burning hazardous wastes in its cement kilns but did not apply to EPA for interim status that would have allowed burning of the wastes.

Clays.—The South Dakota Cement Commission mined common clay in Pennington County for use in cement manufacturing. Production increased slightly in both quantity and value. The State Geological Survey reported that minor amounts of shale were mined for use in production of cement blocks and a small amount was manufactured for expanded shale (lightweight aggregate).

Feldspar.—Feldspar production continued to decrease, both in quantity and value. Production decreased almost 50% from the 1989 level. Pacer Corp. of Custer was the sole processor of the hand-cobbed feldspar from pegmatite deposits in Custer County.

Gemstones.—During 1991, International Rose Quartz began mining rose quartz from pegmatites near Custer, Custer County. The company's production moved South Dakota from the

25th to the 4th largest gem material producer in the country.

Gypsum.—Crude gypsum was produced in Meade County by the South Dakota Cement Commission for use in cement manufacturing. Both quantity and value of production decreased by more than 50% from 1990 figures.

Lime.—Pete Lien & Sons in Rapid City was the sole producer of lime in the State. Although concealed, both production and value of quicklime and hydrated lime increased slightly over 1990 figures.

Mica.—Mica production and value both decreased slightly in 1991. Pacer Corp. of Custer accounted for the entire State output. Scrap mica was produced from pegmatites in Custer County.

Sand and Gravel (Construction).—Construction sand and gravel production is surveyed by the U.S. Bureau of Mines for even-numbered years only; data for odd-numbered years are based on annual company estimates. This chapter contains actual data for 1990 and estimates for 1989 and 1991.

Based on company estimates, construction sand and gravel output decreased about 10% from that of the previous year. Leading counties in terms of production were Pennington and Minnehaha.

Stone.—Stone production is surveyed by the U.S. Bureau of Mines for odd-numbered years only; data for even-numbered years are based on annual company estimates. This report contains estimates for 1990 and actual data for 1989 and 1991.

Crushed.—Crushed stone was produced from 11 quarries in 5 counties by 10 operators. Granite, limestone, sandstone, and quartzite were produced in 1991. Production and value in 1991 increased slightly, compared with estimates for 1990. Counties leading in crushed stone production were

TABLE 2
SOUTH DAKOTA: CRUSHED STONE¹ SOLD OR USED BY PRODUCERS
IN 1991, BY USE

(Thousand short tons and thousand dollars)

Use	Quantity	Value	Unit value
Coarse aggregate (+1 inch):			
Riprap and jetty stone	20	103	\$5.15
Filter stone	87	396	4.55
Coarse aggregate, graded:			
Concrete aggregate, coarse	269	1,240	4.61
Bituminous aggregate, coarse	W	W	4.38
Bituminous surface-treatment aggregate	109	561	5.15
Railroad ballast	63	303	4.81
Fine aggregate (-3/8 inch): Stone sand, bituminous mix or seal ²			
	154	455	2.95
Coarse and fine aggregate: Graded road base or subbase			
Other construction materials ³	W	W	3.57
	254	998	3.93
Chemical and metallurgical:			
Cement manufacture	W	W	1.30
Lime manufacture	W	W	5.52
Other miscellaneous uses ⁴	1,109	2,035	1.83
Unspecified: ⁵			
Actual	1,931	10,666	5.52
Estimated	827	2,900	3.51
Total	⁶ 4,824	19,657	4.07

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials" and "Other miscellaneous uses."

¹Includes granite, limestone, miscellaneous stone, quartzite, and sandstone.

²Includes stone sand, concrete, and screening, undesignated.

³Includes withheld amounts for coarse aggregate, graded, and coarse and fine aggregate.

⁴Includes withheld amounts for chemical and metallurgical.

⁵Includes production reported without a breakdown by use and estimates for nonrespondents.

⁶Data do not add to total shown because of independent rounding.

Minnehaha, Pennington, and Hanson. Major uses of the crushed stone were concrete aggregate, cement manufacturing, lime manufacturing, and graded road base. Unit values for all crushed stone ranged from \$5.15 per short ton for exposed aggregate to \$1.30 per short ton for cement manufacturing. Average unit value for all crushed stone uses was \$4.08 per short ton.

Dimension.—South Dakota ranked sixth of 34 States in dimension stone production. Milbank Granite, a dark to medium red granite found in the northeastern part of the State, has been quarried continuously since 1907 and is the major source of dimension stone in the State. Three companies, Cold Springs Granite Co., Dakota Granite Co., and Georgia Stone Industries Inc.,

produced dimension stone from eight quarries in Grant County. Most of the production was used as monument stone, building stone veneer, steps, and floor tile. The average unit value for all uses was about \$285 per short ton. A small amount of slate was produced in the Black Hills for use as dimension stone.

¹Mining engineer, U.S. Bureau of Mines, Denver, CO. She has 16 years of mineral-related work with the Government. Assistance in the preparation of the chapter was given by Pat LaTour, editorial assistant.

²Geologist, South Dakota Geological Survey, Vermillion, SD.

³Allsman, P. T. Reconnaissance of Gold-Mining Districts in the Black Hills, SD. U.S. Bureau of Mines Bulletin 727, 1940, 146 pp.

TABLE 3
SOUTH DAKOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1991, BY DISTRICT AND USE

(Thousand short tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity
Construction aggregates:								
Coarse aggregates (+ 1 1/2 inch) ¹	W	W	—	—	W	W	8	31
Coarse aggregates, graded ²	W	W	—	—	W	W	134	658
Fine aggregates (-3/8 inch) ³	W	W	—	—	W	W	41	76
Coarse and fine aggregates ⁴	W	W	—	—	—	—	—	—
Other construction materials	1,670	4,308	—	—	212	1,018	—	—
Agricultural	—	—	—	—	—	—	—	—
Chemical and metallurgical ⁵	W	W	—	—	—	—	—	—
Special	—	—	—	—	—	—	—	—
Other miscellaneous uses	—	—	—	—	—	—	—	—
Unspecified: ⁶								
Actual	30	136	—	—	101	364	1,800	10,166
Estimated	820	2,868	—	—	—	—	7	32
Total	2,520	7,312	—	—	313	1,382	1,990	10,963

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."

¹Includes riprap and jetty stone, and filler stone.

²Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.

³Includes stone sand (concrete), stone sand (bituminous mix or seal), and screening (undesignated).

⁴Includes graded road base or subbase.

⁵Includes cement manufacture and lime manufacture.

⁶Includes production reported without a breakdown by end use and estimates for nonrespondents.

TABLE 4
SOUTH DAKOTA: CRUSHED STONE SOLD OR USED, BY KIND

Kind	1989				1991			
	Number of quarries	Quantity (thousand short tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand short tons)	Value (thousands)	Unit value
Limestone	8	2,332	\$6,697	\$2.87	5	2,619	\$7,667	\$2.93
Granite	—	—	—	—	1	W	W	4.57
Sandstone and quartzite	4	W	W	5.09	4	2,195	11,949	5.44
Miscellaneous stone	1	W	W	4.09	1	W	W	4.50
Total¹	XX	3,833	14,303	3.73	XX	4,824	19,657	4.07

W Withheld to avoid disclosing company proprietary data, included in "Total." XX Not applicable.

¹Data may not add to totals shown because of independent rounding.

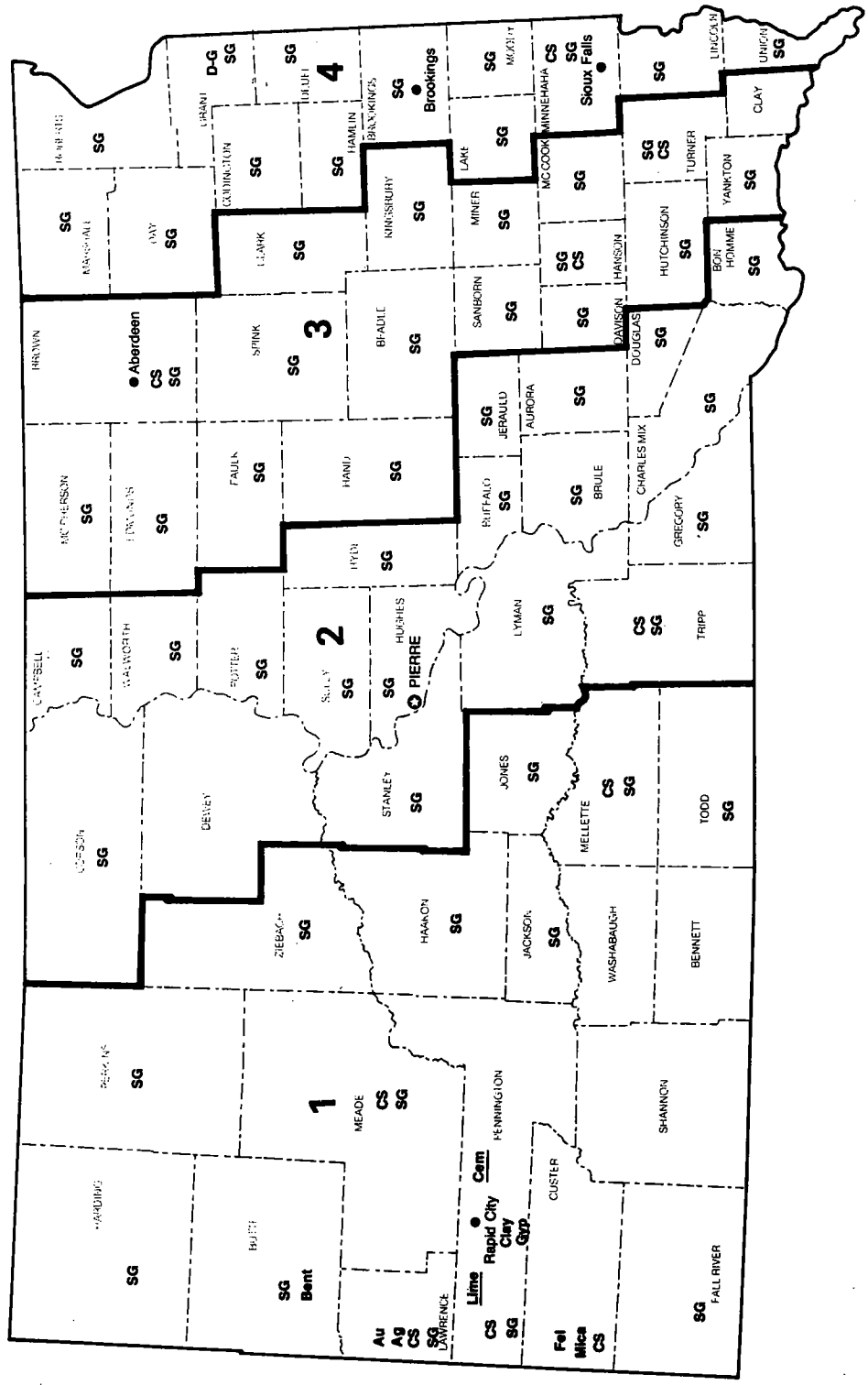
SOUTH DAKOTA

LEGEND

- State boundary
- - - County boundary
- Capital
- City
- Crushed stone/sand & gravel districts

MINERAL SYMBOLS

- Ag Silver
- Au Gold
- Bent Bentonite
- Cem Cement plant
- Clay Clay
- CS Crushed Stone
- D-G Dimension Granite
- Fel Feldspar
- Gyp Gypsum
- Lime Lime plant
- Mica Mica
- SG Sand and Gravel



Principal Mineral-Producing Localities

TABLE 4
PRINCIPAL PRODUCERS

Commodity and company	Address	Type of activity	County
Cement:			
South Dakota Cement Commission	Box 360 Rapid City, SD 57709	Plant	Pennington.
Clays:			
South Dakota Cement Commission	do.	Open pit mine	Do.
Feldspar:			
Pacer Corp.	Box 912 Custer, SD 57730	Open pit mines and dry-grinding plant	Custer.
Gold:			
Bond Gold-Richmond Hill Inc., a subsidiary of LAC Minerals Ltd. ¹	Box 892 Lead, SD 57754	Open pit and leach pads	Lawrence.
Brohm Mining Corp., a division of MinVen Gold Corp. ¹	Box 485 Deadwood, SD 57732	do.	Do.
Golden Reward Mining Co., a joint venture of United Coin Mines Ltd. and MinVen Gold Corp. ¹	Box 888 Lead, SD 57754	do.	Do.
Homestake Mining Co. ¹	Box 875 Lead, SD 57754	Underground mine and open pit, cyanidation mill, gravity separation, refinery	Do.
Wharf Resources (U.S.A.) Inc. ¹	Box 897 Lead, SD 57754	Open pit and leach pads	Do.
Gypsum:			
South Dakota Cement Commission	Box 360 Rapid City, SD 57709	Open pit mine	Meade.
Iron ore:			
Pete Lien & Sons Inc.	Box 440 Rapid City, SD 57709	do.	Lawrence.
Lime:			
Pete Lien & Sons Inc.	do.	Plant	Pennington.
Mica:			
Pacer Corp.	Box 912 Custer, SD 57730	Mine and dry-grinding plant	Custer.
Sand and gravel (construction):			
Birdsall Sand & Gravel Co., a division of Pete Lien & Sons Inc.	Box 767 Rapid City, SD 57709-0767	Pits and plants	Fall River, Pennington, Sully.
Brownlee Construction Co.	717 South Broadway Watertown, SD 57201	do.	Codington.
Fisher Sand & Gravel Co.	Box 1034 Dickinson, ND 58602	do.	Beadle, Clark, Davison, Hanson, Pennington, Sanborn, Union, Walworth.
Myrl & Roy's Paving Inc.	1300 North Bahnson Sioux Falls, SD 57103	do.	Lincoln and Minnehaha.
Sweetman Construction Inc.	Box 84140 Sioux Falls, SD 57118	do.	Minnehaha and Roberts.
Stone:			
Crushed:			
Limestone:			
Pete Lien & Sons Inc.	Box 440 Rapid City, SD 57709	Quarry and plant	Pennington.

See footnote at the end of table.

TABLE 4—Continued
PRINCIPAL PRODUCERS

Commodity and company	Address	Type of activity	County
Stone—Continued:			
Crushed—Continued:			
Limestone—Continued:			
Northwestern Engineering Co. (Hills Materials Co.)	Box 2320 Rapid City, SD 57709	Quarries and plants	Pennington.
South Dakota Cement Commission	Box 360 Rapid City, SD 57709	Quarry and plant	Do.
Sandstone-quartzite:			
L. G. Everist Inc.	Box 829 Sioux Falls, SD 57117	do.	Minnehaha.
Spencer Quarries Inc.	Box 198 Spencer, SD 57374	do.	Hanson.
Sweetman Construction Co.	Box 84140 Sioux Falls, SD 57118	do.	Minnehaha.
Dimension, granite:			
Cold Spring Granite Co.	202 South 3d Ave. Cold Spring, MN 56320	Quarries and plant	Grant.
Dakota Granite Co.	Box 1351 Milbank, SD 57252	do.	Do.

¹Also silver.

MINERAL-RELATED GOVERNMENT AGENCIES

FEDERAL

U.S. Department of the Interior
Bureau of Mines
Denver Regional Office of State
Activities
Bldg. 20, Denver Federal Center
Denver, CO 80225-0086
Telephone: (303) 236-0435

U.S. Department of the Interior
Bureau of Land Management
Thomas Lonnie, Deputy State Director
for Mineral Resources
Box 36800
Billings, MT 59107
Telephone: (406) 255-2805

U.S. Department of Labor
Mine Safety and Health Administration
Rodric M. Breland, District Manager
Rocky Mountain District Office
Metal and Nonmetal Mine Safety and
Health
Box 25367, Denver Federal Center
Denver, CO 80225-0367
Telephone: (303) 231-5465

U.S. Forest Service
Region I (Custer National Forest)
Lands and Minerals
Charles E. Wassinger, Director
Box 7669
Missoula, MT 59807
Telephone: (406) 329-3595

U.S. Forest Service
Region II (Black Hills National Forest)
Watershed, Soils, and Minerals
Charles Hendricks, Director
Box 25127
Lakewood, CO 80225
Telephone: (303) 236-9467

STATE

South Dakota Cement Commission
David O'Brien, Chairman
Box 360
Rapid City, SD 57709
Telephone: (605) 394-5200

South Dakota Department of Environment
and Natural Resources
Robert E. Roberts, Secretary
523 East Capitol
Joe Foss Bldg.
Pierre, SD 57501
Telephone: (605) 773-3151

South Dakota Geological Survey
Cleo Christensen, Acting State Geologist
Science Center
University of South Dakota
Vermillion, SD 57069
Telephone: (605) 677-5227

South Dakota School of Mines and
Technology
Richard J. Gowen, President
501 East St. Joseph St.
Rapid City, SD 57701-3995
Telephone: (605) 394-2413

South Dakota School of Mines and
Technology
Zbigniew Hladysz, Director
Mining and Mineral Resources Research
Institute
501 East St. Joseph St.
Rapid City, SD 57701-3995
Telephone: (605) 394-1971