

# The Mineral Industry of North Dakota

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the State Geological Survey of North Dakota under a cooperative agreement for collecting information on all minerals except fuels.

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The total value of mineral production in North Dakota was \$98.1 million in 1972, a decline of 1.8% from that of 1971. The value of fossil fuel production, excluding natural gas liquids, was \$86.5 million, \$1.5 million less than that of 1971. Changes in value in 1972, in million dollars, were as follows: crude petroleum decreased 3.2, lignite increased 1.8, and natural gas decreased 0.2.

The total value of sand and gravel output, the only major nonmetallic mineral value publishable, was \$5.8 million, \$0.4 million less than that of 1971. Among items the value of which was withheld, the value of natural gas liquids decreased 4%; that of clays, 9%; lime, 3%; stone, 95%; the value of salt increased 97%. No peat was produced in 1972.

**Legislation and Government Programs.**—In 1972, no bills of interest to the North Dakota mineral industry were signed into law. There were however, several bills in various stages of processing. The North Dakota Senate passed and sent to the House a bill on reclamation of strip mined areas.

One of two other bills that imposed a severance tax on coal was rejected by the Senate. The Senate Business, Industry and Labor Committee recommended that a bill imposing a 5% tax on coal be rejected so that the bill imposing a 5¢-per-ton tax could be passed. The Senate rejected the 5% bill and passed the 5¢ bill.

There were several Federal and State government publications issued in 1972 that could be of interest to the mineral industry.<sup>2</sup>

**Employment and Injuries.**—Statistics on employment and injuries in the mineral industries, exclusive of the petroleum industry, are presented in table 4. Information for 1971 data is final data; that for 1972 is preliminary.

<sup>1</sup> Foreign mineral specialist, Division of Fossil Fuels, Assistant Directorate—Mineral Supply.

<sup>2</sup> Arndt, B. M. Environmental Geology and North Dakota. NDGS Misc. Series MS-48, 1972.

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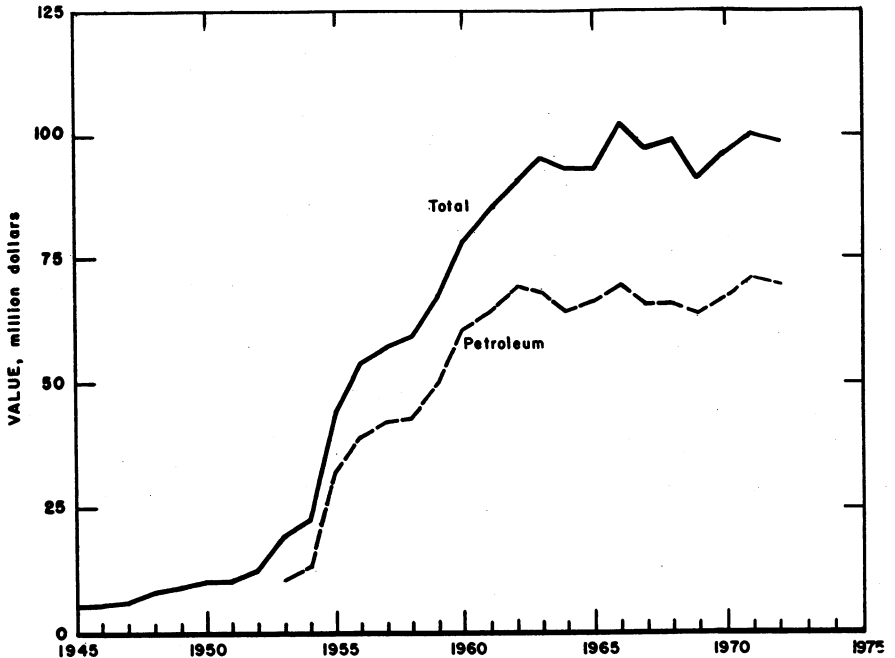


Figure 1.—Value of petroleum and total value of mineral production in North Dakota.

Table 1.—Mineral production in North Dakota <sup>1</sup>

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Coal..... thousand short tons..	6,075	\$11,580	6,632	\$13,416
Gem stones.....	NA	2	NA	2
Natural gas..... million cubic feet..	33,864	5,655	32,472	5,455
Petroleum (crude)..... thousand 42-gallon barrels..	21,653	70,805	20,624	67,647
Sand and gravel..... thousand short tons..	8,196	6,210	6,681	5,757
Value of items that cannot be disclosed:				
Clays, lime, natural gas liquids, peat (1971), pumice (1972), salt, stone.....	XX	5,649	XX	5,809
Total.....	XX	99,901	XX	98,086
Total 1967 constant dollar.....	XX	84,946	XX	<sup>p</sup> 81,598

<sup>p</sup> Preliminary. NA Not available. XX Not applicable.<sup>1</sup> Production as measured by mine shipments, sales, or marketable production (including consumption by producers).Table 2.—Value of mineral production in North Dakota, by county <sup>1</sup>  
(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Adams.....	\$61	W	Coal.
Barnes.....	42	\$161	Sand and gravel.
Benson.....	56	--	--
Billings.....	5,477	6,094	Petroleum.
Bottineau.....	9,337	W	Petroleum, sand and gravel.
Bowman.....	3,494	3,710	Petroleum, coal, sand and gravel.
Burke.....	7,021	7,949	Petroleum, coal, natural gas liquids, sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in North Dakota, by county 1—Continued  
(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Burleigh	W	W	Sand and gravel.
Cass	W	W	Do.
Cavalier	W	W	Do.
Dickey	\$43	W	Sand and gravel, stone.
Divide	879	W	Petroleum, sand and gravel.
Dunn	49	\$39	Petroleum.
Eddy	W	W	Sand and gravel.
Emmons	27	--	
Foster	55	W	Sand and gravel.
Golden Valley	220	308	Petroleum, sand and gravel, stone.
Grand Forks	334	114	Sand and gravel.
Grant	33	W	Coal, sand and gravel.
Griggs	7	10	Sand and gravel.
Hettinger	W	--	
Kidder	W	W	Sand and gravel.
Logan	W	W	Do.
McHenry	W	W	Petroleum, sand and gravel.
McIntosh	W	W	Sand and gravel.
McKenzie	14, 136	13, 140	Petroleum, sand and gravel, pumice.
McLean	W	W	Sand and gravel, coal.
Mercer	5, 515	6, 677	Coal, pumice.
Morton	348	W	Clays, sand and gravel.
Mountrail	W	1, 466	Petroleum.
Nelson	W	--	
Oliver	W	W	Coal, sand and gravel.
Pembina	W	800	Lime, sand and gravel.
Pierce	30	W	Sand and gravel.
Ramsey	W	--	
Ransom	136	W	Sand and gravel.
Renville	5, 581	5, 810	Petroleum, sand and gravel.
Richland	371	81	Sand and gravel.
Rolette	W	W	Do.
Sargent	--	W	Stone.
Sheridan	W	W	Sand and gravel.
Slope	W	397	Petroleum, sand and gravel.
Stark	6, 346	4, 591	Petroleum, coal, sand and gravel, clays.
Steele	W	W	Sand and gravel.
Stutsman	W	W	Sand and gravel, stone.
Towner	W	W	Sand and gravel.
Trall	133	226	Do.
Walsh	183	117	Do.
Ward	3, 537	2, 990	Petroleum, coal, sand and gravel.
Wells	W	--	
Williams	17, 266	20, 469	Petroleum, natural gas liquids, salt, sand and gravel, coal.
Undistributed <sup>2</sup>	19, 184	22, 936	
Total	99, 901	<sup>3</sup> 98, 086	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

<sup>1</sup> La Moure and Sioux Counties are not listed because no production was reported.

<sup>2</sup> Includes gem stones, some sand and gravel, natural gas, and natural gas liquids (1971) that cannot be assigned to specific counties, and values indicated by symbol W.

<sup>3</sup> Data does not add to total shown because of independent rounding.

Table 3.—Indicators of North Dakota business activity

	1971	1972 <sup>p</sup>	Change, percent
<b>Employment and labor force, annual average:</b>			
Total labor force..... thousands .....	261.5	272.1	+4.0
Employment..... do.....	249.0	259.5	+4.2
Unemployment..... do.....	12.5	12.6	+0.8
Nonagricultural employment..... do.....	167.6	176.7	+5.4
Mining..... do.....	1.6	1.6	--
Construction..... do.....	10.4	11.9	+14.4
Manufacturing..... do.....	10.2	10.7	+4.9
Government..... do.....	49.3	50.0	+1.4
Transportation and public utilities..... do.....	12.3	12.3	--
Wholesale and retail trade..... do.....	45.0	48.6	+8.0
Finance, insurance, and real estate..... do.....	7.2	7.3	+1.4
Services..... do.....	31.8	34.3	+7.9
<b>Personal income:</b>			
Total..... millions .....	\$2,222	\$2,350	+5.8
Per capita..... do.....	\$3,538	\$3,718	+5.1
<b>Construction activity:</b>			
Highway construction contracts awarded..... millions .....	\$34.6	* \$40.0	+15.6
Cement shipments to and within North Dakota..... thousand short tons .....	286	319	+11.5
Value of authorized nonresidential construction..... millions .....	\$18.1	\$31.5	+74.0
Number of authorized residential units..... do.....	3,123	3,984	+26.0
Farm marketing receipts..... millions .....	\$977.0	\$1,107.8	+13.4
Mineral production value..... do.....	\$99.9	\$98.1	-1.8

\* Estimated.    <sup>p</sup> Preliminary.

Source: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
<b>1971:</b>								
Coal.....	278	235	65	518	--	19	36.68	NA
Nonmetal.....	16	84	1	11	--	--	--	--
Sand and gravel.....	535	134	71	648	--	14	21.60	452
Stone.....	4	233	1	7	--	--	--	--
Total.....	833	167	139	1,184	--	33	27.86	NA
<b>1972<sup>2</sup>:</b>								
Coal.....	NA	NA	NA	NA	NA	NA	NA	NA
Nonmetal.....	10	227	2	16	--	3	183.82	368
Sand and gravel.....	200	162	33	292	--	8	27.42	665
Stone.....	--	--	--	--	--	--	--	--
Total.....	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

<sup>1</sup> Data does not add to total shown because of independent rounding.

<sup>2</sup> In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

## REVIEW BY MINERAL COMMODITIES

### MINERAL FUELS

**Coal (Lignite).**—At the 15 operating strip mines, each producing more than 1,000 salable short tons annually, production was 6.6 million tons in 1972, valued at an average of \$2.00 per ton, an increase of 11¢ per ton. In 1972, an estimated 22.9 million cubic yards of overburden was stripped. The overburden ranged from 25 to 70 feet in thickness above the 6- to 16-foot thick coal seams. Three mines, each

producing over 1 million tons per year, delivered a total of 4.01 million tons in 1972. Seven mines producing between 100,000 and 1 million tons annually, collectively produced 2.58 million tons. The other five mines, each with less than 100,000 tons, produced the remainder. All production was sold in the open market. Of the total shipments, 3,223,584 tons were by rail; 203,258 tons were by truck; 3,156,962 tons were used at mine-mouth powerplants; and

66,418 tons were shipped by other methods.

Stripmining equipment included 22 power shovels and 14 draglines, of which 31 were electric or diesel powered. Four shovels and four draglines each had buckets with over a 16-cubic-yard capacity. Carryall scrapers totaled 15, of which six were rated at over 16 cubic yards. Other equipment included one vertical drill, 31 bulldozers, 16 frontend loaders, eight coal drills, two power brooms, and an undetermined number of haulage trucks.

As in the previous year, Mercer County produced about one-half of the State's lignite production.

Basin Electric Power Cooperative of Bismarck announced that in 1973 it will spend more than \$60.5 million for construction. The biggest single item will be for continuation of work on the second unit, which will be 450 megawatts, at the Leland Olds powerplant at Stanton. Related work includes construction of 526 miles of extra high-voltage transmission lines. Two 345 kilovolt lines will leave the plant, one extending 293 miles to Fort Thompson, S. Dak., and the other to Watertown, S. Dak. Construction of the second generating unit, to be commissioned by 1975, will bring total generating capacity to 650,000 megawatts. Total cost of the second unit is \$93 million.<sup>3</sup>

**Natural Gas.**—Marketed natural gas totaled 32,472 million cubic feet, 4.1% less than that of 1971. The average value at 16.8 cents per thousand standard cubic feet was almost unchanged from 1971. No new gas discoveries were made in 1972. Again most of the gas came from three natural gas processing plants, except some dry gas

coming from 21 producing wells, seven less than in 1971. The Signal Companies, Inc. was the principal purchaser of natural gas.

Estimated total proved reserves of natural gas, totaling 503.7 billion cubic feet at the start of the year, decreased to 441.6 billion cubic feet at yearend, partly because of revisions.<sup>4</sup>

**Natural Gas Liquids.**—The production of natural gas liquids, comprising liquid petroleum and natural gasoline cycle products declined 10%; its value declined 3.5%. Three natural gas processing plants—Lignite Gas Plant, at Lignite; North Tioga Gas Plant, at Gregor; and Signal Companies, Inc. at Tioga—continued processing casing-head gas. Sulfur was recovered at two of these operations, namely the Signal Companies, Inc. plant and the Lignite Gasoline plant. Estimated total proved reserves of natural gas liquids at the start of 1972 was 47.1 million barrels, compared with 45.4 million barrels at yearend.<sup>5</sup>

**Petroleum.**—Crude oil production declined for the sixth consecutive year, because development failed to offset the normal depletion of reservoirs. Output was down 4.8% below the 1971 level, while its value decreased by 4.5%.

During 1972, 50 drilling permits were issued, 79 fewer than in 1971; 124 producing wells were abandoned; and only 23 new producing wells were completed. Production continued to drop during the year as the older fields continued their natural

<sup>3</sup> Bismarck Tribune, Feb. 20, 1973.

<sup>4</sup> American Gas Association, American Petroleum Institute, and The Canadian Petroleum Association. Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas in the U.S. and Canada, v. 27, May 1973, p. 114, table 1.

<sup>5</sup> Table 4 of work cited in footnote 4.

Table 5.—North Dakota: Lignite strip production, by county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines	Production (thousand short tons)	Value (thousands)
Adams.....	2	19	W
Bowman.....	1	166	W
Burke.....	2	487	W
Grant.....	1	3	W
McLean.....	1	16	W
Mercer.....	3	3,148	W
Oliver.....	2	2,278	W
Stark.....	1	117	W
Ward.....	1	393	W
Williams.....	1	5	W
Total.....	15	6,632	\$13,416

W Withheld to avoid disclosing individual company confidential data.

decline. The new fields discovered in 1972 were not sufficiently developed to offset the decline. Lack of energy-supplementation projects to add additional reserves resulted in a reduction of total remaining reserves.

The American Petroleum Institute reported,<sup>6</sup> that 99 wells, with a total depth of 654,230 feet were drilled in 1972. Of these, 23 were oil wells and 76 were dry wells. There were no gas wells drilled. Exploratory well drilling, 86,305 feet less than in 1971, totaled 486,006 feet for 65 wells. The drilling was distributed between seven oil wells and 58 dry wells, a 12.1% success ratio. Development well drilling totaled 34 wells, distributed among 16 oil wells and 18 dry wells. The total number of exploratory and development wells was 63 less than the 162 drilled in 1971; the total footage drilled was 318,247 feet less than the 972,477 feet drilled in 1971.

According to the Petroleum Information Corp.,<sup>7</sup> successful deep drilling in western North Dakota was the highlight of exploratory activity in the Williston Basin in 1972. Seven of the State's new field discoveries were in the "central fairway" of the basin, west and southwest of the Nesson anticline. Among them are some of the Rocky Mountain Region's top discoveries of the year. This successful work may reverse the general downward trend in activity that has been in evidence during the past decade. Drilling in North Dakota during 1972 dropped to its lowest level in 20 years.

Wildcat drilling in North Dakota during 1972 departed from the previous decade's pattern in which the areas between Mississippian pools in the north central part of the State and the Nesson anticline captured the bulk of the exploratory effort. In recent years, however, the relatively untested areas in the southwest part of the State have been getting a larger share of the attention. The Mississippian provided the reservoir at five of the successful wildcats. Red River produced at the others and one of these Ordovician discoveries was dually completed from Winnipegosis (Devonian) as well.

True Oil's 22-27 Burlington Northern Inc., SE NW 27-148N-101W, McKenzie County, tapped a reservoir of great potential, with 2,700 feet of effective pay indicated in Mississippian. Oil shows were found almost continuously in samples from

6,800 to 9,200 feet, and from 9,400 to 9,800 feet. A drillstem test at 6,803 to 6,398 feet flowed 43.5 gravity oil in 35 minutes. The well bottomed in the Ordovician level at 13,720 feet and was cased to 10,588 feet. Although three porosity zones were perforated between 8,874 and 9,498 feet, and are capable of production, only one zone (8,874 to 8,890 feet) was open when the well was completed for 500 barrels of oil per day through a 20/64-inch choke. None of the pay between 6,800 and 9,000 feet has been tested since the pipe was set. The discovery found a unique structural anomaly associated with a complex fault system, not normally found in an area characterized by gentle dipping structures and subtle stratigraphic changes. Many normal faults were found in the Mississippian section. The pre-Mississippian section had several reverse faults.

True's northwest offset, 11-27 Burlington Northern, NW NW 27-148N-101W, confirmed the discovery and was completed flowing 430 barrels of oil per day on a one-quarter-inch choke through the Mission Canyon at 9,060 to 9,082, 9,124 to 9,142, 9,168 to 9,169, and 9,368 to 9,379 feet. It bottomed in the Lodgepole formation at 10,218 feet. This well, an 80-acre northwest offset to the discovery, ran 2,400 feet low, structurally, at the top of Mission Canyon compared with the field opener. It also found oil in the Kibbey zone of the Mississippian formations. There is no production from Kibbey in North Dakota. True was drilling a northeast offset at year's end. Working interest owners in the wells are True, with 81.25%; Amoco Production Co., with 6.25%; Tiger Oil, with 6.25%; Newmont Oil, with 4.68%; and Franklin, Aston & Fair, with 1.56%. This well was drilled on lands farmed out by Rainbow Resources, but Rainbow sold its interest in the immediate area for more than \$10 million.

Seventeen miles south of Red Wing Creek field, Belco Petroleum Corp.'s 1-28 Roughrider, SW SW 28-145N-101W, McKenzie County, found oil in the Madison formation. This discovery is 3 miles southwest of the Rough Rider, Inc., Madison pool established 13 years ago. Its delineation was expanded to include the

<sup>6</sup> Source: American Petroleum Institute.

<sup>7</sup> 1972 Resume, Petroleum Information Corp., Dallas, Tex., 1973, pp. RM-17-RM-18.

Belco discovery. The well flowed 560 barrels of oil per day through a 12/64-inch choke. Only 4 feet of the Madison, between 9,253 and 9,257 feet, was opened.

Three Red River discoveries were posted in the southwest corner of the State. Depco Inc. and Hanover Planning completed a Bowman County prospect, 33-20 Dronen, NW SE 20-30N-103W, flowing 258 barrels of oil per day on a 16/64-inch choke. Red River A, B, and C zones are perforated selectively between 9,381 and 9,536 feet. This producer is 2 miles southeast of Medicine Pole Hills field.

Depco and Hanover scored again in Bowman County, finding another Red River field nine miles southeast of Medicine Pole Hills. Their 33-26 Greni, NW per day through a 24/64-inch choke from three Red River porosity zones between SE 26-129N-103W, flowed 624 barrels of oil 8,926 and 9,146 feet. Both discoveries evaluated seismic prospects. Two and one-half miles west of Bowman County's Horse Creek field, Eason Oil Co. completed a Red River producer at 1-13 Olson, SW SW 13-129N-105W. It pumped 156 barrels of oil and 193 barrels of water per day.

Farmers Union Central Exchange, W. R. Grace & Co. and Inexco Oil Company completed a confirmation well in Coyote Creek field flowing 313 barrels of oil and 31 barrels of water per day. It produces

from Red River B and D zones. Lamar Hunt finaled the Rider field Nesson (Madison) discovery well in early 1972 pumping 343 barrels of oil and 75 barrels of water per day. This Golden Valley County well, 1 Osterhout, N SW 24-140N-103W, produces from 9,025 to 9,028 feet, and is the first Nesson zone success in this part of the State.

Lone Star Producing Co. recorded a Madison discovery 2 miles north of the Heath area in the Rocky Ridge field. Its 1 Schwartz, NE NW 2-137N-100W, Billings County, pumped 218 barrels of oil and 66 barrels of water per day from the Fryburg zone of the Madison. Except for the Mississippian pools along the south-east edge of the Cedar Creek anticline, the Lone Star well established the southernmost Madison production in the Williston Basin. The Madison producer was combined with Rocky Ridge field and designated a new pay discovery by the State geological survey. In the same area, Petroleum Inc. and others completed a 1¼ mile southeast stepout from Rocky Ridge, in 12-136N-100W, Slope County. It pumped 70 barrels of oil per day from the Heath formation at 7,889 to 7,895 feet.

Meanwhile, the Nesson anticline, site of the first commercial wells in the Williston Basin, continued to offer opportunities. Work in 1972 demonstrated that there are

Table 6.—North Dakota: Oil and gas well drilling completions, by county

County	Proved field wells <sup>1</sup>			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Benson	--	--	--	--	--	--	1	2,775
Billings	--	--	--	1	--	--	3	4 38,451
Bottineau	5	--	6	--	--	--	3	14 59,546
Bowman	1	--	1	3	--	--	1	6 57,613
Burke	2	--	1	1	--	--	--	4 31,660
Divide	--	--	--	--	--	--	3	3 14,811
Dunn	--	--	--	--	--	--	6	6 47,959
Golden Valley	--	--	--	1	--	--	1	2 18,225
Grand Forks	--	--	--	--	--	--	1	1 1,745
McHenry	--	--	--	--	--	--	2	2 9,756
McKenzie	1	--	--	--	--	--	1	2 18,475
Morton	--	--	--	--	--	--	2	2 10,086
Mountrail	--	--	--	--	--	--	1	1 11,785
Pierce	--	--	--	--	--	--	3	3 9,758
Ramsey	--	--	--	--	--	--	1	1 2,016
Renville	6	--	4	--	--	--	5	15 77,014
Slope	--	--	--	1	--	--	2	3 24,501
Stark	--	--	3	--	--	--	7	10 88,562
Ward	1	--	3	--	--	--	13	17 108,663
Williams	--	--	--	--	--	--	2	2 20,823
<b>Total</b>	<b>16</b>	<b>--</b>	<b>18</b>	<b>7</b>	<b>--</b>	<b>--</b>	<b>58</b>	<b>99 654,230</b>

<sup>1</sup> Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

still areas along this structure to be evaluated. A deeper pay test in the Stoneview field, on the north side of the anticline, found oil shows in seven zones in the lower Mississippian and pre-Mississippian rocks. The North American Royalties, Inc., H. L. Hunt and L. W. Hill, 1 Holte-Bank of North Dakota, NE NW 31-161 N-94W, H. L. Hunt and L. W. Hill, 1 Holte-Bank of North Dakota, NE NW 31-161N-94W, Burke County, was completed from Winnipegosis (Devonian) 10,714 to 10,722 feet, flowing 160 barrels of oil per day. It also flowed 3,000,000 cubic feet of gas and 72 barrels of condensate per day from Red River 12,090 to 12,104 feet but, owing to the lack of an outlet for the gas, the lower zone was shut in. The well also recovered oil from Bakken and Nisku, two separate zones in Duperow and Silurian. The deep test is the first well at Stoneview to penetrate horizons below Nesson. A Midale discovery in Bottineau County was completed by Gemini Corp. and others in NW SE 15-162N-79W, 2½-miles southeast of the Landa field. It was the only wildcat success among the 25 north central North Dakota wildcats drilled this year.

At yearend, there were 1,946 wells capable of producing oil, of which 749 were stripper wells. It is estimated that about 51.8% of the reserves could be recovered from 25 of the 134 producing pools by energy supplementation. On January 1, 1973, primary plus secondary reserves considered to be recoverable with present equipment and techniques totaled 667.8

million stock tank barrels. At yearend, reserves were 664.6 barrels, of which 305.1 million barrels were classed as primary and 315.2 million barrels were classed as secondary.<sup>8</sup>

#### NONMETALS

**Clays.**—Compared with 1971, the total production of clays was 11% less, and its total value decreased by 9.3%.

**Gem Stones.**—Total value of gem stones gathered in the State was about the same as that of 1971, according to estimates. Stones usually produced in the State included agate, chalcedony, jasper, and petrified wood.

**Lime.**—American Crystal Sugar Co. produced lime in Pembina County for sugar refining. Output decreased 10% and was 22% below the 1969 record high. Total consumption of lime in North Dakota was 36,810 tons.

**Salt.**—North Dakota's only salt producer, Dakota Salt & Chemical Co., which produces evaporated salt, produced 68% more by weight and 97% more in value than in 1971.

**Sand and Gravel.**—There were 161 active sand and gravel operations in 1972, one more than in 1971. These operations included 117 commercial, two Federal, 36 county, and six municipal plants. The volume of sand and gravel production decreased by 18.5%, although its value decreased by only 7.3%.

<sup>8</sup> Folsom, Clarence B. Jr. North Dakota Crude Oil Inventory as of January 1, 1973. N. Dak. Geol. Survey, Misc. Series No. 51, 1972, 11 pp.

Table 7.—North Dakota: Crude oil production, by county  
(Thousand 42-gallon barrels and thousand dollars)

County	Quantity		Principal fields in 1972 in order of production
	1971	1972	
Billings	1,675	1,858	Fryburg, Medora, Rocky Ridge.
Bottineau	2,844	2,938	Newburgh, South Westhope, Wiley.
Bowman	933	981	Cedar Creek, Medicine Pole Hills.
Burke	1,800	1,750	Rival, North Tioga, Northeast Foothills, Black Slough.
Divide	255	209	North Tioga, Stoneview.
Dunn	15	12	Lost Bridge.
Golden Valley	64	90	Square Butte.
McHenry	17	20	Pratt.
McKenzie	4,287	3,978	Antelope, Charlson, Blue Buttes, Hawkeye, Clear Creek.
Mountrail	503	447	Tioga.
Renville	1,665	1,765	Sherwood, Glenburn.
Slope	129	120	Eleven Bar.
Stark	1,721	1,242	Dickinson, West Dickinson, Zenith.
Ward	662	459	South Lone Tree, Lone Tree.
Williams	5,083	4,755	Beavers Lodge, Tioga, Grenora, Capa.
Total	21,653	20,624	
Value	70,805	67,647	

Source: Quantity, North Dakota Geological Survey; Value, U.S. Bureau of Mines.



**Stone.**—Shipments of stone in 1972 decreased 94.1% in quantity and 95.3% in value. All stone was crushed and broken stone, and included limestone and other stone. The unit value was \$2.00 per ton for limestone, \$1.50 per ton for other stone, and averaged \$1.73 per ton for all stone. Almost all of the stone shipped was by truck.

**Sulfur.**—Natural gas processing plants at Lignite and Tioga recovered elemental sulfur as a byproduct. The output of sulfur increased from 1971 by 12% and the value increased by 6.5%.

**Vermiculite.**—In 1972, vermiculite continued to be shipped into the State and was exfoliated and sold by the Robinson Insulation Co. at Minot. Some of its uses, in decreasing order, were pipe covering insulation, loose fill insulation, concrete and plaster aggregates, poultry litter, and soil conditioning.

**Volcanic Ash (Pumice).**—Production of volcanic ash was started in 1972. Average value was 90¢ per ton. The crude volcanic ash was used for road construction.

**Table 8.—North Dakota: Sand and gravel sold or used by producers, by class of operation and use**

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
<b>Commercial operations:</b>				
<b>Sand:</b>				
Building .....	555	769	470	757
Fill .....	194	160	W	W
Paving .....	457	382	82	85
Other uses .....	13	16	305	200
Total <sup>1</sup> .....	1,218	1,327	856	1,043
<b>Gravel:</b>				
Building .....	1,159	1,363	665	1,204
Fill .....	154	149	226	182
Paving .....	3,266	2,244	2,864	2,107
Railroad ballast .....	—	—	W	W
Miscellaneous .....	47	39	31	55
Other uses .....	209	130	66	87
Total <sup>1</sup> .....	4,835	3,924	3,851	3,635
<b>Government-and-contractor operations:</b>				
<b>Sand:</b>				
Fill .....	45	8	79	31
Paving .....	126	145	84	8
Total <sup>1</sup> .....	171	152	163	39
<b>Gravel:</b>				
Building .....	286	39	135	110
Fill .....	99	20	90	11
Paving .....	1,579	748	1,521	909
Other uses .....	8	1	65	9
Total <sup>1</sup> .....	1,972	806	1,811	1,039
<b>Total sand and gravel <sup>1</sup> .....</b>	<b>8,196</b>	<b>6,210</b>	<b>6,681</b>	<b>5,757</b>

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

<sup>1</sup> Data may not add to totals shown because of independent rounding.

Table 9.—Principal producers

Commodity and company	Address	Type of activity	County
<b>Clays:</b>			
Baukol-Noonan, Inc.-----	Noonan, N. Dak. 58765-----	Open pit mine and plant...	Morton.
Hebron Brick Co.-----	Hebron, N. Dak. 58638-----	Open pit mine-----	Do.
<b>Coal:</b>			
Baukol-Noonan, Inc.-----	Noonan, N. Dak. 58765-----	Strip mine; crushing plant, thermal drying.	Burke.
Consolidation Coal Co., Western Division.	Box 200 Stanton, N. Dak. 58571	Strip mine----- Crushing plant----- Strip mine and crushing plant.	Oliver. Mercer. Ward.
Knife River Coal Mining Co.	Bismarck, N. Dak. 58501-----	.....do-----	Bowman, Mercer.
North American Coal Corp., Lignite Division.	12800 Shaker Blvd. Cleveland, Ohio 44120	.....do-----	Mercer.
Lime: American Crystal Sugar Co.	Box 419 Denver, Colo. 80201	Shaft kiln at beet sugar re- finery.	Pembina.
<b>Natural gas and petroleum:</b>			
Amerada Hess Corp.-----	Box 2040 Tulsa, Okla. 74102	Crude oil wells: Fryburg field. Crude oil wells: Lost Bridge field. Crude oil wells: Antelope, Blue Buttes, and Charl- son fields. Crude oil wells: Beaver Lodge field.	Billings. Dunn. McKenzie. Williams. Morton.
American Oil Co.-----	910 South Michigan Ave. Chicago, Ill. 60680	Refinery-----	Morton.
Chevron Oil Co., Western Division	1700 Broadway Denver, Colo. 80202	Crude oil wells: Glenburn field.	Renville.
Chandler & Associates, Inc.	1401 Denver Club Bldg. Denver, Colo. 80202	Crude oil wells: Sherwood field.	Bottineau.
Hunt Oil Co. (Hunt Industries).	1401 Elm Dallas, Tex. 75202	Crude oil wells: North Tioga field and gas pro- cessing plant.	Burke.
Marathon Oil Co.-----	539 South Main St. Findley, Ohio 45840	Crude oil wells: Glenburn field.	Renville.
Amoco Production Co.-----	Box 591 Tulsa, Okla. 74102	Crude oil wells: Black Slough and Rival fields.	Burke.
Petroleum, Inc.-----	300 West Douglas Wichita, Kans. 67202	Crude oil wells: Sherwood field.	Bottineau.
Shell Oil Co.-----	50 West 50th St. New York, N.Y. 10020	Crude oil wells: Cedar Creek field.	Bowman.
The Signal Companies, Inc.	1010 Wilshire Blvd. Los Angeles, Calif. 90017	Crude oil wells: Tioga field.	Mountrail.
		Crude oil wells: Beaver Lodge field and gas pro- cessing plant.	Williams.
Tenneco Oil Co.-----	Box 2511 Houston, Tex. 77051	Crude oil wells: Glenburn field.	Renville.
Texaco Inc.-----	Box 52332 Houston, Tex. 77052	Crude oil wells: Blue Buttes and Charlson fields.	McKenzie.
		Gas processing plant-----	Burke.
Union Oil Co. of California.	Box 7600 Los Angeles, Calif. 90017	Crude oil wells: Sherwood field.	Renville.
Westland Oil Co.-----	Box 1549 Minot, N. Dak. 58701	Refinery-----	Williams.
Salt: Dakota Salt & Chemical Co.	P.O. Box 7063 St. Louis, Mo. 63177	Well and plant-----	Do.
<b>Sand and gravel:</b>			
A. Campbell, Inc.-----	New Rockford, N. Dak. 58356	2 plants-----	Various.
Minot Sand and Gravel Co.	Box 116 Minot, N. Dak. 58702	Pit and plant-----	Ward.
Schriock Constr. Inc.-----	Rural Route 3, Radio City Minot, N. Dak. 58701	1 plant-----	Various.
Tennefos Constr. Co., Inc.	2504 Fifth Ave., South Fargo, N. Dak. 58101	2 plants-----	Do.
<b>Stone:</b>			
A. Campbell, Inc.-----	New Rockford, N. Dak. 58356	Quarry-----	Golden Valley.
Hansted Sand & Gravel Co.	Rt. 1 Jamestown, N. Dak. 58401	.....do-----	Stutsman.
Industrial Builders Inc.---	Box 406 Fargo, N. Dak. 58102	2 quarries-----	Dickey, Sargent.