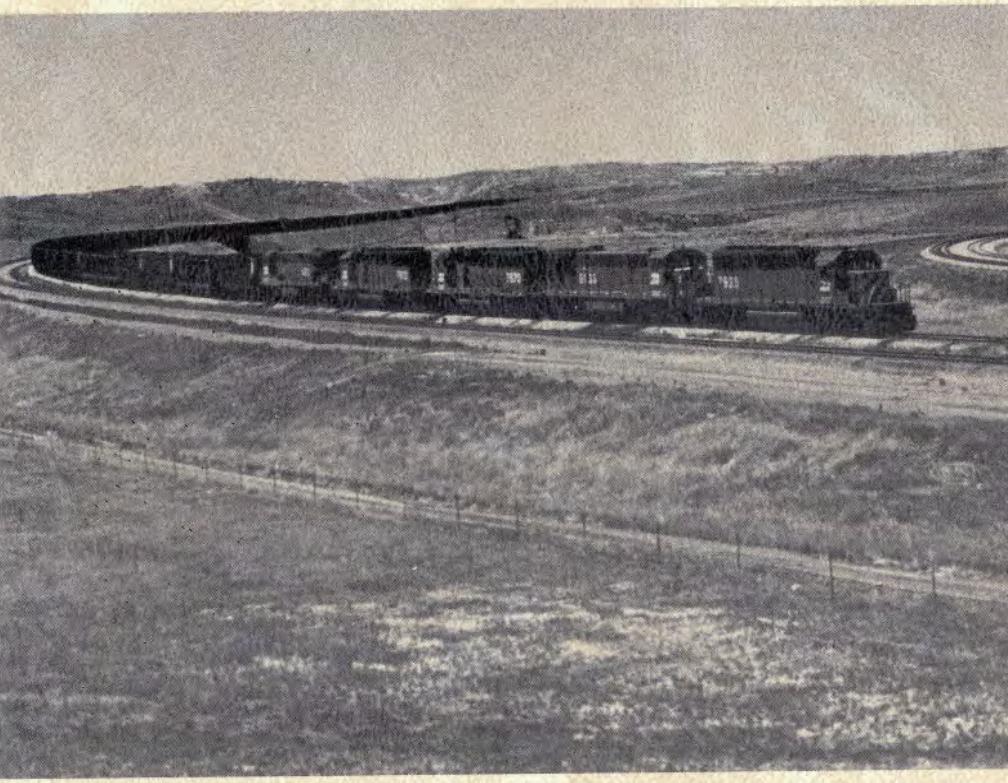
THE GEOLOGICAL SURVEY OF WYOMING
Gary B. Glass, State Geologist

WYOMING GEO-NOTES NO. 15



LARAMIE, WYOMING

June, 1987 edition

THE GEOLOGICAL SURVEY OF WYOMING

Gary B. Glass, *Executive Director and State Geologist*

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WYOMING GEO-NOTES

This quarterly digest on the State's geology and mineral resources and activities of the Geological Survey is available by subscription (four issues for $5.00) or as single copies at $1.50 each.

Front cover: A Burlington Northern Railroad Company (BN) coal unit train leaves Cordero Mining Company's Cordero coal mine south of Gillette enroute to an electric utility customer in Texas. A coal unit train usually has from 100 to 110 coal cars; each coal car carries about 100 tons of coal. Over 1.2 million coal cars were loaded at Wyoming coal mines in 1986. BN was the originating railroad carrier for about 73 percent of the coal transported from Wyoming coal mines in 1986.

See figures on pages 15 and 18 for additional information on utilization and transportation of Wyoming coal and read about coal developments in Wyoming on pages 11 through 21.

This and other publications available from:

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MINERALS UPDATE

OVERVIEW

by Gary B. Glass, State Geologist, Geological Survey of Wyoming.

The impact of lowered mineral values was once again evident late in the second quarter when the Wyoming Revenue Department noted that mineral valuations were down about $2 billion from last year. Statewide mineral valuations for oil, natural gas, coal, uranium, and trona dropped from $5.4 billion in 1986 to $3.4 billion in 1987. Most of the decrease was related to the three largest mineral industries in Wyoming - oil, natural gas, and coal. For 1988, there is some cautious optimism that the valuation of oil will increase since posted prices of Wyoming Sweet crude were approaching $20/barrel, and might reach that price by early August. The prices paid for natural gas and coal, however, were still declining at the end of the second quarter although some observers feel that prices may have bottomed out.

With increasing prices, the oil industry showed some signs of rallying at the end of the second quarter. Growing rig counts were indicating that they might go into the 40's or higher by the third quarter. While a long way from the boom times earlier in the decade, any optimism had been hard to find until recently.

There is also some good news for the uranium industry. Several uranium companies in the State announced that they were hiring. A mill came back on line and two *in situ* operations moved ahead with evaluation studies of their properties.

Seasonal gold activity was definitely up in the South Pass mining district as well as other areas of the State. There were some nuggets up to one inch in length recovered in placer claims.

In regard to other minerals, some beet sugar companies are examining Wyoming limestone deposits and plan test burns later in the year.

Wyoming mineral production forecast to 1991[1].

Calendar Year	Oil Production[2]	Natural Gas Production[3,5]	Carbon Dioxide Production[3]	Coal Production[4]	Trona Production[4]	Uranium Production[4]
*1981	122.1	455.4	--	102.8	11.8	4.6
*1982	118.7	465.1	--	107.9	10.1	2.1
*1983	120.9	539.7	--	112.2	10.5	3.0
*1984	127.8	600.1	--	130.7	11.0	1.6
*1985	131.0	597.9	--	140.4	10.8	0.6
*1986	122.4	573.2	23.8	135.7	13.3	0.3
1987	115.5	605.0	75.0	140.0	13.5	0.3
1988	107.5	629.0	100.0	143.0	13.7	0.4
1989	100.0	664.0	100.0	146.0	13.8	0.5
1990	93.0	699.0	100.0	150.0	14.0	0.5
1991	86.5	730.0	100.0	151.0	14.2	0.6

*Actual values for comparison; [1] Geological Survey of Wyoming, July, 1987; [2] millions of barrels; [3] billions of cubic feet; [4] millions of tons; [5] production estimates for natural gas are the only ones changed since January, 1987.

OIL AND GAS UPDATE

by Rodney H. De Bruin, Oil and Gas Geologist, Geological Survey of Wyoming

During the second quarter of the year, the average posted price of Wyoming Sweet crude increased to $19.00 a barrel. This is an increase of $1.75 over the maximum price of Wyoming Sweet last quarter. Oil futures on the New York Mercantile Exchange closed at a price of $20.06 a barrel on June 15, for July delivery of West Texas Intermediate crude oil. Wyoming Sweet generally sells for about the same price as West Texas Intermediate, so there is some hope that Wyoming crude oil prices may break the $20 barrier in the near future. The last time average postings for Wyoming Sweet were this high was February 1986. The 1987 prices are a marked improvement over April, 1986, when average postings were $12.50 a barrel. Unfortunately, the rise in prices over the past several months is not the result of a sound national energy policy, but is mainly due to OPEC's adherence to a production agreement by member countries and to increased tension in the Persian Gulf region. The increased prices, however, will probably stimulate some additional drilling, and oil production for 1987 will perhaps remain near that of 1986 (see graph on page 5).

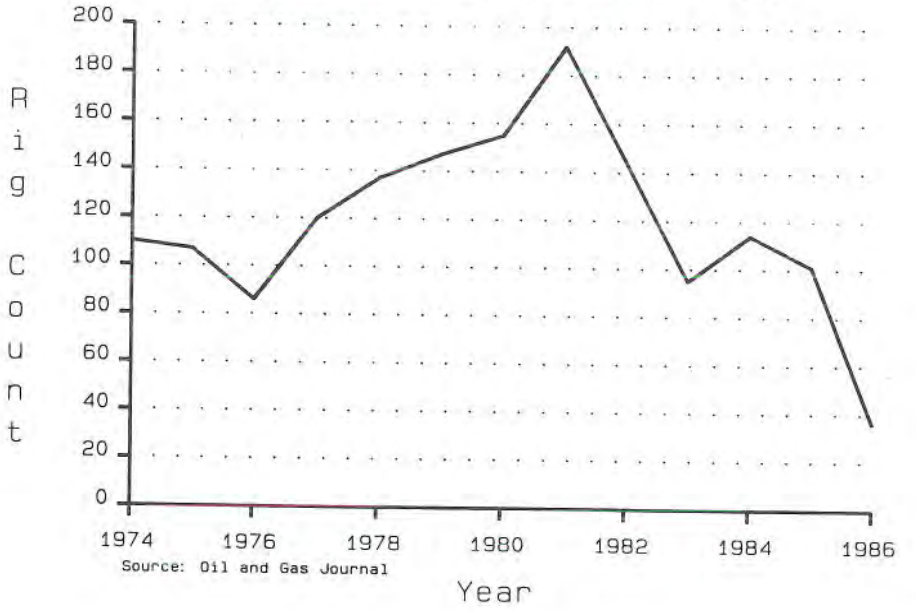
Another positive sign for Wyoming's petroleum industry is the trend in average monthly rig count (see graph on page 4). Although the averages for April, May, and June of 1987 are not that much different than the averages for those months in 1986, the basic trend for 1987 shows a small but steady increase in the average count since the end of February. The basic trend for 1986 was a tremendous drop starting in February and a rebound starting in October. It appears that drilling has started to increase earlier this year than in past years (see graph on page 5). With this trend there may be 40 to 50 rigs working in the State in the not too distant future if prices remain stable or continue to increase. In a related note, Amoco Production Company has announced plans to drill 64 development wells and seven or eight exploratory wells in Wyoming. However, 40 of the development wells will be shallow wells, around 2,000 feet deep, in Salt Creek Field.

There has also been an increase in seismic crews at work in the United States. The count in April was up 14 from March and gained two more in May. April's gain of 14 crews was the largest monthly increase in nearly two years. However, the average count of 158 crews for the first five months of 1987 is still well below the average of 248 for the first five months of 1986.

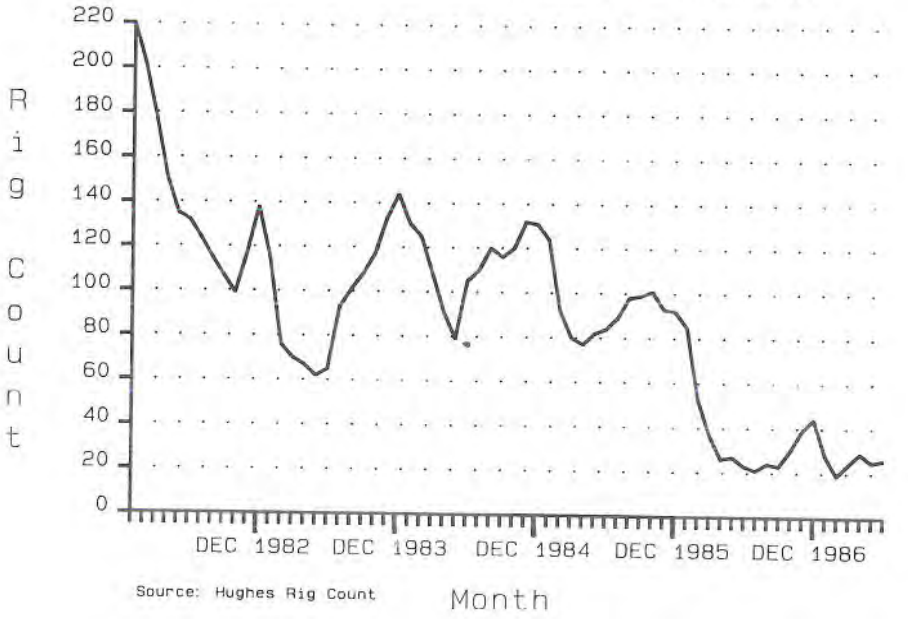
Sun Exploration and Production Company recently estimated proved recoverable reserves of 30 million barrels of oil equivalent in their Luckey Ditch Field, discovered in mid-1985, and one of the best discoveries in the Rocky Mountain region in several years (see *Wyoming Geo-notes No. 13*, pages 16 and 17 and *Wyoming Geo-notes No. 14*, page 10 for more information on the Luckey Ditch Field).

In an item related to the Luckey Ditch Field, the Bureau of Land Management's (BLM's) June lease sale drew high bids totaling $6,436,196 for 25,668 acres. The average bid was $250.75 per acre. Five Luckey Ditch area tracts located just west and north of Sun's current development program drew the five highest bids of the sale and totaled nearly $4.8 million. Anadarko Petroleum made the sale's high bid of $6,550 per acre for a 120-acre tract in section 5, T.12N., R.114W. Texaco, Inc., made the second and third highest bids of the sale. They bid $4,442 per acre for a 620.93-acre lease in section 7, T.12N., R.114W. and $4,290 per acre for an 80-acre lease in section 33, T.13N., R.114W. Texaco's high bids for these two leases totaled over $3.1 million. The fourth and fifth highest per-acre bids were made by Exxon, Incorporated for two leases totaling 274.58 acres in sections 12 and 13, T.12N., R.115W. Exxon offered $3,277 per acre for each of these leases. Donald C. Slawson made the sale's sixth highest bid of $1,061 an acre for an 80-acre Powder River Basin lease in section 11, T.48N., R.70W. The tract is just west of a Minnelusa oil well in Fish Field, which was completed earlier this year. In this sale, 121 of 123 tracts received bids and 29 of the tracts got bids of over $100 per acre. This sale generated more revenue that any sale since August, 1984.

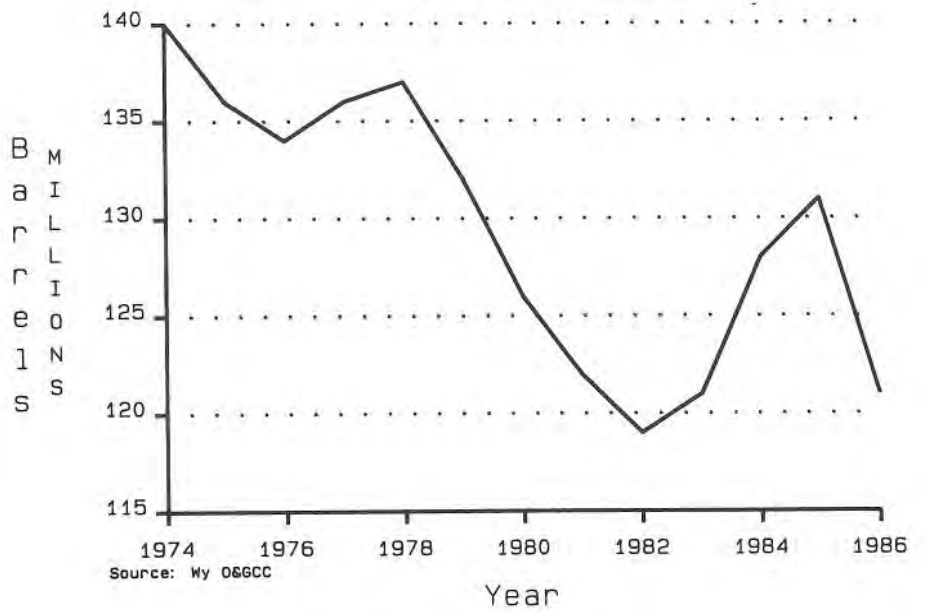
WYOMING RIG COUNT
AVERAGED BY YEAR (1974 TO 1986)



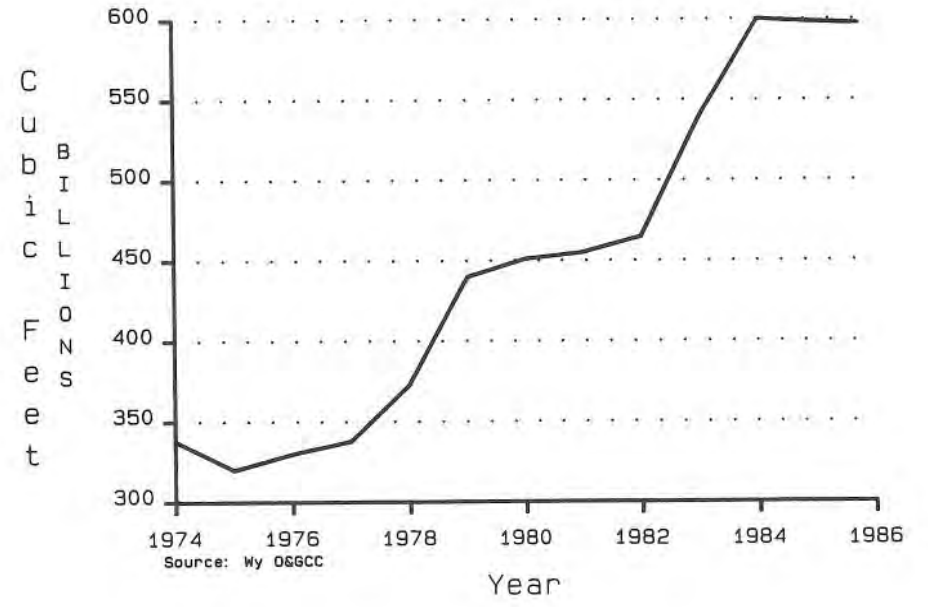
WYOMING RIG COUNT
AVERAGED BY MONTH (1982 TO PRESENT)



WYOMING OIL PRODUCTION BY YEAR (1974 TO 1986)



WYOMING NATURAL GAS PRODUCTION BY YEAR (1974 TO 1986)



The BLM's April sale drew high bids of $779,821 for leases on 16,214 acres, and 68 of the 95 tracts received bids. The top bid of $332 per acre was made by Exxon Incorporated for an 80-acre lease in section 1, T.13N., R.121W. located in the Overthrust Belt about one half mile west of Nugget production in Bessie Bottom Field. A 280-acre tract in section 25, T.39N., R.76W. in the Powder River Basin got the sale's second highest bid. Corbin J. Robertson bid $304.50 per acre for this tract. The total revenue generated by the first three BLM sales has already surpassed the 1986 total for six sales. The BLM sales are summarized in the table on page 7.

The Wyoming Board of Land Commissioners May sale had high bids of $416,108 on 34,111 acres. The average bid was $12.20 per acre. Both the total revenue and the average price per acre are the highest since the July 1986 sale. Almar Petroleum Land Services, Incorporated made the sale's top bid of $260 per acre for a 320-acre tract in the Powder River Basin in section 36, T.36N., R.75W., about three miles from the Blizzard Field discovery. Only three tracts in this sale drew bids of $100 or more. For comparison with past sales, see the table on page 7.

Sun Exploration and Production recently made another significant discovery in Wyoming, this time in the Wind River Basin. The 1 Sun Ranch-Federal was tested on a 25/64-inch choke and has been completed as a discovery in the Muddy Sandstone flowing 1,048 barrels of 33.6 degree oil and 976 MCF of gas per day. The discovery well is just over one mile northwest of two Muddy Sandstone producers in North Grieve Field, but Sun's pressure analyses indicated that the discovery well was in a separate reservoir.

Todd Resources recently completed the third producer in the Wall Creek Sandstone of the Frontier Formation in Rock River Field on the northwestern flank of the Laramie Basin. The field was discovered in 1918 by Marathon, and the main production of over 38 million barrels has come from deeper formations. Todds 2-35 Harrison-Cooper well in section 35, T.20N., R.78W. pumped 128 barrels of 39.5 degree oil and 24 MCF of gas per day with no water. The well is updip from two Marathon Wall Creek wells in sections 34 and 35, T.20N., R.78W. Todd has 1,600 acres under lease in the area, and a spokesman for the company said as many as 25 new locations are possible on their leases.

Hawk Point Field continues to grow as Exxon, Incorporated completed a north offset in section 19, T.47N., R.72W., pumping 820 barrels of 37.3 degree oil and 164 MCF of gas per day from the Minnelusa Formation. Total Petroleum's discovery well for the field in section 30, R.47N., R.72W. was completed last year for an initial flowing potential of 754 barrels of oil and 115 MCF of gas per day. Total has completed four more producing wells in the field since their discovery, and Exxon has completed two others and plans at least four more Minnelusa tests in the area. March production from the field was over 68,000 barrels of oil and nearly 11 million cubic feet of gas. With one or two more good development wells, Hawk Point Field should become one of Wyoming's 25 largest oil fields (see map and table on pages 8 and 9).

WYOMING FEDERAL AND STATE COMPETITIVE OIL AND GAS LEASE SALES

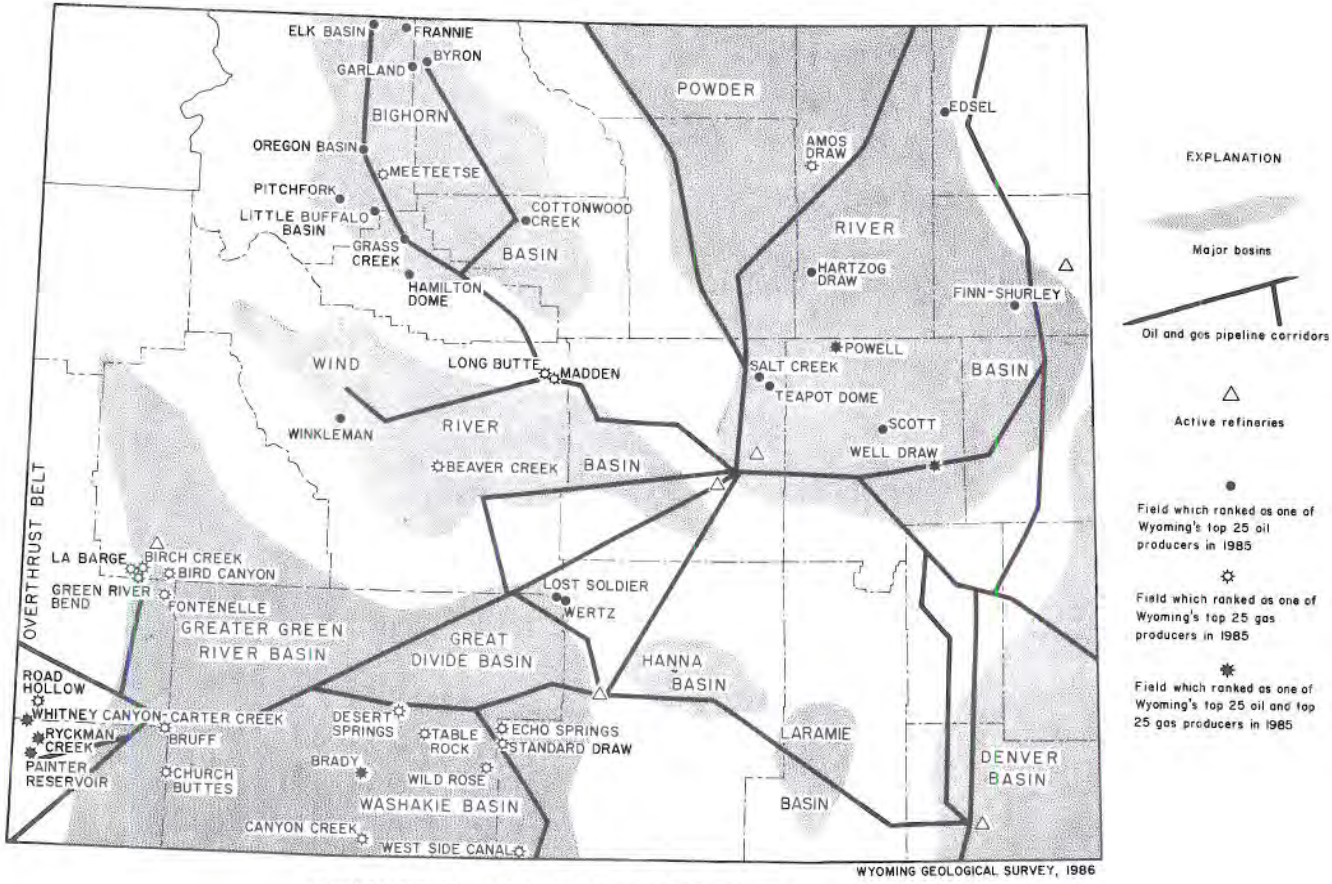
BLM SALES

Month	Total Revenue	Number of parcels offered	Number of parcels sold	Total acres	Acres sold	Average price per acre sold	High price per acre
			1985				
February	$ 3,547,273	117	115	34,948	34,028	$ 104.24	$ 1,700.00
April	2,025,793	133	128	25,497	24,056	84.21	2,609.53
June	1,963,897	140	137	40,304	38,904	50.48	2,577.15
August	2,854,821	190	146	75,094	56,906	50.17	1,732.14
October	1,876,105	208	105	81,611	32,052	58.53	1,108.77
December	1,467,265	211	144	73,723	46,908	31.28	1,167.23
TOTAL	$13,735,154	999	772	331,177	232,854	$ 58.99	$ 2,609.53
			1986				
February	$ 1,992,326	211	154	58,507	38,809	$ 51.34	$ 680.00
April	1,795,890	189	116	54,136	29,938	59.99	1,881.88
June	1,332,216	86	75	27,137	24,512	54.35	437.50
August	529,184	104	88	25,686	22,725	23.29	227.63
October	840,950	76	68	17,827	16,604	50.65	516.86
December	774,824	110	82	28,057	19,840	39.05	3,313.13
TOTAL	$ 7,265,390	776	583	211,350	152,428	$ 47.66	$ 3,313.13
			1987				
February	$ 814,653	78	64	18,866	15,537	$ 52.43	$ 1,226.56
April	779,821	95	68	23,338	16,214	48.10	332.00
June	6,436,196	123	121	26,188	25,668	250.75	6,555.00

STATE SALES

Month	Total Revenue	Number of parcels offered	Number of parcels sold	Total acres	Acres sold	Average price per acre sold	High price per acre
			1985				
January	$ 757,214	200	86	80,019	27,520	$ 26.51	$1,700.00
March	2,077,478	300	172	137,321	69,781	29.77	1,600.00
May	936,374	199	117	73,625	35,273	26.55	350.00
July	636,350	200	113	83,491	43,630	14.59	280.00
September	989,069	200	126	95,052	60,356	16.39	325.00
November	494,739	200	109	70,144	41,399	11.95	320.00
TOTAL	$ 5,891,224	1,299	723	539,652	277,959	$ 21.19	$1,700.00
			1986				
January	$ 630,069	200	123	83,064	49,783	$ 12.66	$ 320.00
March	773,492	199	112	77,237	44,504	17.38	370.00
May	354,941	200	70	74,128	27,543	12.89	140.00
July	418,280	200	63	86,495	25,461	16.43	234.00
September	171,975	200	80	87,017	33,738	5.10	360.00
November	99,403	200	74	75,385	24,728	4.02	120.00
TOTAL	$ 2,448,160	1,199	522	483,326	205,757	$ 11.90	$ 370.00
			1987				
January	$ 300,404	200	74	87,145	32,606	$ 9.21	$2,300.00
March	270,234	200	83	87,034	35,770	7.55	100.00
May	416,108	200	88	81,343	34,111	12.20	260.00

Sources: Wyoming Department of Public Lands, Petroleum Information Corporation – Rocky Mountain Region Report, and U.S. Bureau of Land Management.



WYOMING GEOLOGICAL SURVEY, 1986

GENERALIZED OIL AND GAS INDEX MAP OF WYOMING

TOP 25 GAS FIELDS IN WYOMING BASED ON 1985 PRODUCTION

Name	Year discovered	1985 Production (MCF)	Cumulative production through 1985 (MCF)
Whitney Canyon - Carter Creek	1978	109,834,127	304,509,213
Painter Reservoir	1977	71,903,356	272,395,994
Brady	1973	21,350,632	219,310,370
Table Rock	1946	20,451,870	384,260,489
Echo Springs	1976	18,247,865	99,531,473
Ryckman Creek	1976	16,402,064	67,077,892
Powell	1954	14,525,391	44,957,832
Standard Draw	1979	13,032,332	61,867,786
Madden	1969	11,257,510	220,036,657
Bruff	1974	10,833,216	78,713,861
Long Butte	1982	10,319,659	32,707,991
Amos Draw	1982	10,056,546	17,284,308
Beaver Creek	1938	9,083,218	534,722,318
Wild Rose	1975	8,612,453	53,834,294
Church Buttes	1956	8,217,578	336,599,451
Desert Springs	1958	6,515,804	238,213,340
Road Hollow	1981	6,261,810	10,223,515
La Barge	1925	6,193,973	202,329,406
Meeteetse	1954	6,087,908	9,373,618
Birch Creek	1957	5,801,310	153,740,282
West Side Canal	1964	5,211,606	120,160,813
Canyon Creek	1941	4,759,211	233,266,085
Green River Bend	1958	4,579,841	166,550,082
Bird Canyon	1971	4,556,636	26,207,313
Fontenelle	1974	4,296,180	34,701,440
TOTAL		408,392,096	3,922,575,823

TOP 25 OIL FIELDS IN WYOMING BASED ON 1985 PRODUCTION

Name	Year discovered	1985 Production (Barrels)	Cumulative production through 1985 (Barrels)
Oregon Basin	1912	9,671,706	360,112,778
Painter Reservoir	1977	7,711,152	37,996,305
Salt Creek	1889	6,114,941	610,625,925
Hartzog Draw	1976	5,221,538	46,477,313
Little Buffalo Basin	1914	3,894,253	109,493,484
Powell	1954	3,511,650	11,494,722
Brady	1973	3,487,542	47,037,899
Hamilton Dome	1918	3,266,556	221,237,338
Elk Basin	1915	3,209,906	423,163,041
Lost Soldier	1916	2,891,876	202,639,471
Garland	1906	2,871,820	154,800,791
Grass Creek	1914	2,468,906	177,606,460
Wertz	1921	2,385,066	90,618,339
Byron	1918	2,066,748	116,537,485
Whitney Canyon - Carter Creek	1978	2,005,344	4,053,463
Frannie	1928	1,807,888	108,245,845
Winkleman	1917	1,387,341	82,895,832
Ryckman Creek	1976	1,356,207	13,764,438
Scott	1979	1,277,113	8,801,583
Pitchfork	1930	1,121,636	29,505,530
Teapot Dome Naval Reserve	1922	1,076,595	16,894,643
Edsel	1981	1,046,569	1,850,800
Cottonwood Creek	1953	956,203	50,259,079
Finn-Shurly	1965	912,705	6,121,096
Well Draw	1973	896,280	24,891,927
TOTAL		73,210,302	2,957,125,587

Lario Oil and Gas has completed a Minnelusa discovery northeast of Gillette in section 36, T.52N., R.69W., pumping 104 barrels of 22 degree oil with 3 MCF of gas and one barrel of water per day. The company also swabbed 180 barrels of oil, 416 barrels of water, and nine barrels of sediment and water during a Minnelusa test southeast of Gillette in section 22, T.48N., R.69W. The prospective discovery is west of Raven Creek Field and southeast of Pickrel Field, both Minnelusa producers.

The proposed Kern River pipeline project was once again in the news this quarter. Governor Mike Sullivan said that he is considering low-interest State loans for the project. The pipeline is one of two remaining in the running to deliver 700 million cubic feet of gas per day to southern California. The Kern River pipeline would get at least half of the gas from Wyoming, while the rival Mojave pipeline would get the gas from Texas. The California Public Utilities Commission has further complicated matters by arguing that no gas pipeline is necessary. The Federal Energy Regulatory Commission will make a ruling on the proposals in September. State Oil and Gas Supervisor Don Basko has estimated that it would require 70 additional drilling rigs in Wyoming to maintain gas reserves for the pipeline and that benefits to the State would include an extra $45 million per year in taxes as well as an economic boost, especially for southwest Wyoming.

The Interior Department's Mineral Management Service (MMS) has proposed to lower Federal gas royalties retroactively and thereby forgive at least $100 million in royalty underpayments. Gas royalties were not officially lowered until July of 1986, but the MMS wants to lower the royalties to January 1, 1983. If the proposal becomes effective, Wyoming could end up owing gas producers several million dollars. In addition, the State would not be able to collect some $12 million that was underpaid between 1983 and July of 1986. The Indian tribes in Wyoming would also be adversely affected if the proposal is adopted.

The U.S. House of Representatives voted in June to bar the purchase of most Federal oil shale claims. Federal oil shale claims totaling 54,400 acres in Lincoln County, Wyoming, are affected by the bill. Present law does not require claim holders to develop their claims for oil shale and allows them to gain title for $2.50 per acre by filing for a patent. The new bill would require claim holders to convert their claims to 20-year leases or to develop the oil shale if they are to retain them.

The University of Wyoming's Enhanced Oil Recovery Institute held its third annual symposium in Casper, May 13-14 with representation from universities, industry, and government. The dominant theme seemed to be that tertiary recovery techniques can be used to recover hundreds of millions of barrels of oil in Wyoming fields, however, they are not going to be implemented to any great degree until economic conditions become more favorable.

In a related item, a University of Wyoming professor has formed a company, Carbon Recovery Technology Inc. (CRT), which plans to remove carbon dioxide (CO_2) from flue gas released from power plants. The

CO_2 would then be dried and compressed for pipeline delivery to oil companies and used for tertiary recovery. CRT would like to build a demonstration project at the Dave Johnston power plant near Glenrock, which is close to a number of oil fields in the Powder River Basin that are prime candidates for enhanced recovery.

COAL UPDATE

by Richard W. Jones, Coal Geologist, Geological Survey of Wyoming

Coal deliveries for the first quarter of 1987 were about 0.4 million tons less than those made for the same period a year ago (see table, page 12 and figure, page 13). If the remaining three quarters of deliveries continue as in 1986, Wyoming's coal production will probably be about the same as it was in 1986 although it is too early to see any real trends developing. The difference in first quarter deliveries is that spot coal sales were 0.5 million tons less in the first quarter of 1987 than in the first quarter of 1986; contract sales in the first quarter of 1987 were actually 0.1 million tons more than those in the first quarter of 1986. With prices for Powder River Basin spot coal reportedly near $3.00 per ton F.O.B. the mine, spot coal sales are expected to increase substantially the next three quarters of 1987.

Statistics on the production of electricity and fuel consumption at electric utility plants in the United States during 1986 recently became available. Overall, electrical demand in the United States increased 0.8 percent in 1986. While the amount of electricity generated by coal decreased from 56.8 percent in 1985 to 55.8 percent in 1986 and the amount of electricity generated from natural gas also decreased (accounting for ten percent of the Nation's total), the amount of electricity generated by oil, nuclear fuel, and hydroelectric plants all increased. Oil accounted for five percent of the Nation's total electricity generation, nuclear fuel accounted for 17 percent, and hydroelectric plants accounted for 12 percent. Although coal still supplied over half the fuel to electric utility companies (with deliveries up almost three percent in 1986 -- the highest level in five years), the use of oil by electric companies increased more than 36 percent (the largest percentage increase since the 1973 Arab oil embargo), and the use of nuclear fuel increased eight percent.

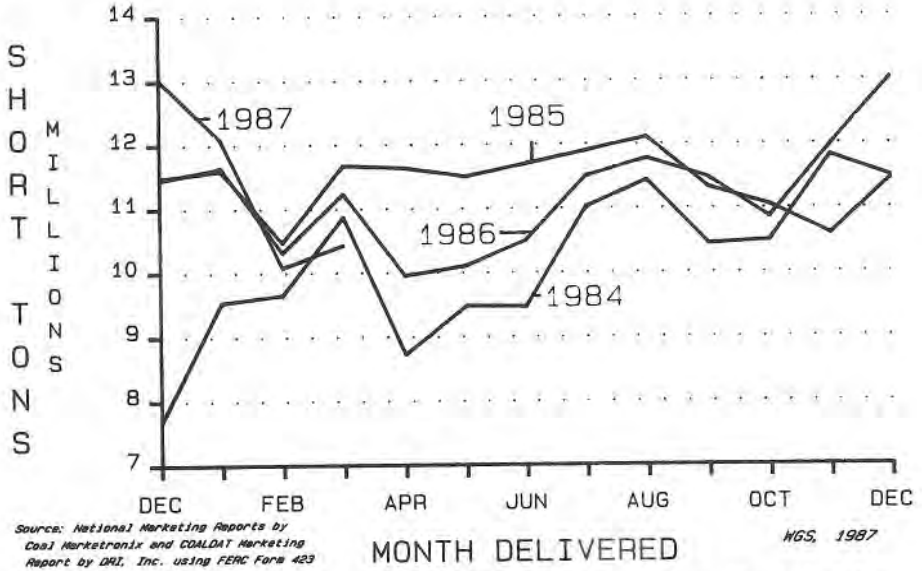
Statistics on the distribution of coal produced in the United States in 1986 also became available (Energy Information Administration, 1987). Of the 889.8 million tons of coal distributed last year, 808.4 million tons, or 90 percent, went to U.S. consumers; the remainder of the coal was exported. About 85 percent of this 808.4 million tons of coal was shipped to electric utility plants. The state that consumed the most coal was Texas (79 million tons), followed by Ohio (61.6 million tons), Pennsylvania (53 million tons), and Indiana (50.4 million tons). Wyoming coal mines accounted for almost 17 percent of the coal used by domestic consumers in 1986 and about 19 percent of the coal supplied to the electric utility market.

COAL DELIVERIES BY MONTH FROM WYOMING MINES

	1983 MONTHLY	1983 CUMULATIVE	1984 MONTHLY	1984 CUMULATIVE	1985 MONTHLY	1985 CUMULATIVE	1986 MONTHLY	1986 CUMULATIVE	1987 MONTHLY	1987 CUMULATIVE
JANUARY	10,313,000	10,313,000	9,540,200	9,540,200	11,601,200	11,601,200	11,646,300	11,646,300	12,085,570	12,085,570
FEBRUARY	8,719,700	19,032,700	9,654,600	19,194,800	10,473,900	22,075,100	10,317,700	21,964,000	10,081,380	22,166,950
MARCH	9,051,200	28,083,900	10,875,000	30,069,800	11,674,900	33,750,000	11,238,520	33,202,520	10,436,610	32,603,560
APRIL	8,195,000	36,278,900	8,721,400	38,791,200	11,632,800	45,382,800	9,954,170	43,156,690		
MAY	8,364,600	44,643,500	9,481,500	48,272,700	11,497,900	56,880,700	10,105,320	53,262,010		
JUNE	8,330,200	52,973,700	9,464,500	57,737,200	11,692,200	68,572,900	10,499,280	63,761,290		
JULY	8,734,700	61,708,400	11,019,600	68,756,800	11,893,500	80,466,400	11,497,190	75,258,480		
AUGUST	9,669,300	71,377,700	11,433,000	80,189,800	12,107,100	92,573,500	11,773,510	87,031,990		
SEPTEMBER	9,189,700	80,567,400	10,440,000	90,629,800	11,325,000	103,898,500	11,474,820	98,506,810		
OCTOBER	9,406,300	89,973,700	10,492,500	101,122,300	11,048,500	114,947,000	10,854,670	109,361,480		
NOVEMBER	9,013,600	98,987,300	11,814,200	112,936,500	10,589,700	125,536,700	11,971,990	121,333,470		
DECEMBER	7,680,600	106,667,900	11,486,800	124,423,300	11,459,300	136,996,000	13,025,490	134,358,960		
TOTAL TONNAGE REPORTED	106,667,900		124,423,300		136,996,000		134,358,960			
TOTAL TONNAGE NOT REPORTED	5,519,300		6,322,479		3,428,446		1,322,109			
TOTAL TONNAGE PRODUCED	112,187,200		130,745,779		140,424,446		135,681,069			

Source: National Marketing Reports by Coal Marketronix, compiled from FERC Form 423 filed monthly by electric utilities.
Wyoming State Mine Inspector's Annual Reports.

REPORTED DELIVERIES FROM WYOMING COAL MINES

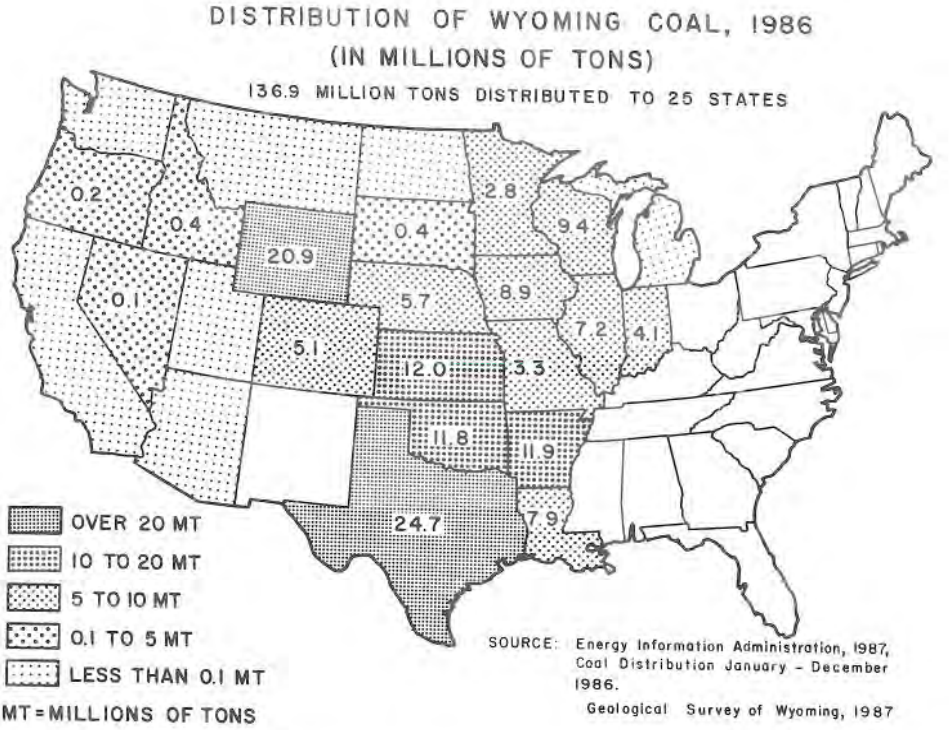


Source: National Marketing Reports by Coal Marketronix and COALDAT Marketing Report by DRI, Inc. using FERC Form 423

WGS, 1987

Coal produced from Wyoming mines in 1986 was used in 25 states (see figure, page 14). Five states each consumed over ten million tons of Wyoming coal. For the fourth consecutive year, Texas consumed the largest amount of Wyoming coal; however, consumption of Wyoming coal at Texas utilities was down almost 18 percent over 1985's record year. Although most of the states consuming Wyoming coal did use less coal in 1986, Minnesota and Wisconsin increased their use of Wyoming coal. Four states consumed over 50 percent of Wyoming's coal, and eight states consumed almost 80 percent of Wyoming's coal.

Electric utility companies located in 18 different states used nearly 98 percent of Wyoming's total coal production in 1986 to fuel steam-electric generating plants (see figure, page 15). The other seven states that consumed Wyoming coal used it primarily to fuel industrial boilers and secondarily to provide residential/commercial heating. About 1.9 million tons of the 3.1 million tons in the "other industrial" and "residential/commercial" categories went to Wyoming users. Most of this coal was used by other mineral-related industries in the State, including the trona and bentonite industries. Additional coal was used at FMC Corporation's formcoke plant in Lincoln County (which converts noncoking subbituminous coal to formcoke through the company's patented process), and by sugar beet processing plants. Although 85 percent of Wyoming's coal was shipped to out-of-state consumers, a small amount of coal (38,500 tons) was imported into the State from producers in Colorado, Utah, Montana, and Pennsylvania.

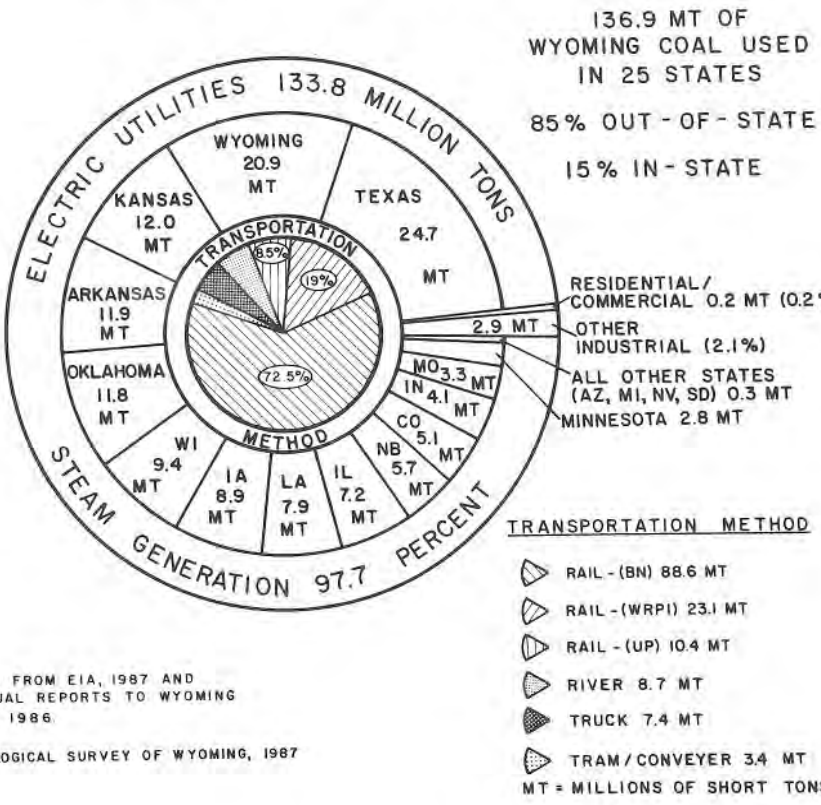


Transportation of Wyoming coal in 1986 (figure page 18) was primarily by rail (92 percent); coal transported by river refers to coal that was delivered to its final destination by river barge (after originating on a railroad). Coal shipments on the Burlington Northern Railroad (BN) were 6.1 million tons less than in 1985; accordingly, the percentage of the State's coal shipped by BN dropped from 76 percent in 1985 to 72.5 percent in 1986. Western Railroad Properties, Incorporated (WRPI), which reports tonnages carried by the Chicago and North Western (C&NW)/Union Pacific (UP) joint-venture railroad, increased their coal shipments by almost five million tons in 1986. The Union Pacific Railroad Company, serving mines in southern and western Wyoming, recorded a slight decrease in coal shipments in 1986.

In 1986, 1.2 million coal cars were loaded with 122.1 million tons of Wyoming coal. Of this total, about 7.3 million tons of coal were unloaded at in-state power plants; the remainder of the coal was transported out-of-state via coal unit trains (see figure, page _). In 1986, coal accounted for 92 percent of the total tonnage of the railroad freight that originated in Wyoming. Incidentally, over 99 percent of the railroad freight carried in 1986 was related to the State's mineral industry, including (along with coal) nonmetallic minerals; chemicals and allied products; petroleum and coal products; and stone, clay, and glass products.

In other transportation news, C&NW announced in May that the eight contracts they signed in 1986 would increase the amount of coal they

UTILIZATION AND TRANSPORTATION OF WYOMING COAL, 1986



DATA FROM EIA, 1987 AND ANNUAL REPORTS TO WYOMING PSC, 1986.

GEOLOGICAL SURVEY OF WYOMING, 1987

would haul out of the Powder River Basin to 33 million tons in 1987. C&NW currently operates an average of 16 coal unit trains per day into and out of the basin. Commonwealth Edison (CE), an Illinois electric utility company, recently announced that they had signed four ten-year transportation contracts with BN for coal haulage from Powder River Basin mines in Wyoming and Montana. Although Big Horn Coal Company's contract with CE is due to expire in 1988, CE announced that they would continue to take a small amount of coal from the Big Horn mine after the contract ended.

In the second quarter of 1986, several developments concerning Wyoming coal are notable. First, Amax Coal Company announced construction of a $20 million coal drying facility at their Belle Ayr mine south of Gillette. Although many companies in the Powder River Basin have experimented with coal drying techniques to increase the

MINERAL RESOURCE AND RESERVE BASE ESTIMATES FOR WYOMING

PETROLEUM

Remaining Resources (January 1, 1987)

Discovered (Includes 10 billion barrels recoverable by enhanced recovery techniques).....13.3 billion barrels[1]
Undiscovered.....7.6 billion barrels[1]
Total.....20.9 billion barrels

Remaining Reserve Base (January 1, 1987)

Measured reserves (Proved reserves).....0.72 billion barrels[2]
Indicated and inferred reserves.....2.8 billion barrels[3]
Total.....3.52 billion barrels

NATURAL GAS

Remaining Resources (January 1, 1987)

Discovered.....18.6 trillion cubic feet[1]
Undiscovered (there is at least another 115 trillion cubic feet of noncombustible CO_2 gas)[9].....58.0 trillion cubic feet[1]
Total.....76.6 trillion cubic feet[1]

Remaining Reserve Base (January 1, 1987)

Measured reserves (Proved reserves).....9.28 trillion cubic feet[2]

COAL

Remaining Resources (January 1, 1987)

Identified (Discovered).....136.0 billion tons[4]
Undiscovered.....800.0 billion tons[5]
Total.....936.0 billion tons

Remaining Reserve Base (January 1, 1987)

Demonstrated strippable (Measured and indicated reserve base).....27.1 billion tons[4]
Demonstrated underground-minable (Measured and indicated reserve base).....38.4 billion tons[4]
Total.....65.6 billion tons

TRONA

Original Resources (1983 estimate)

Trona	81.7 billion tons[6]
Mixed trona and halite	52.7 billion tons[6]
Total	134.4 billion tons

URANIUM

Remaining Resource (December 31, 1985) ..... 1,990,000,000 pounds U_3O_8

Remaining Reserve Base (December 31, 1985)

	U_3O_8
Uranium oxide recoverable at $30.00 per pound	83 million pounds
Uranium oxide recoverable at $50.00 per pound	365 million pounds
Uranium oxide recoverable at $100.00 per pound	632 million pounds

OIL SHALE

Original Resources (January 1, 1983)

Identified (Discovered) ..... 320 billion barrels of shale oil[8]

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1 Modified from Barlow, J.A., Jr. and Doelger, M.J., 1983, *Wyoming mineral resources:* Barlow and Haun, Inc., Casper, 14 p.

2 Energy Information Administration, 1985, *U.S. crude oil, natural gas, and natural gas liquids reserves: 1984 Annual Report, October.* (1984, 1985, and 1986 production has been subtracted).

3 Modified from Barlow and Doelger (1983), footnote 1.

4 Wyoming Geological Survey, July, 1987. (Modified from Berryhill, H.L., Jr. and others, 1950, *Coal resources of Wyoming:* U.S. Geological Survey Circular 81, 78 p.

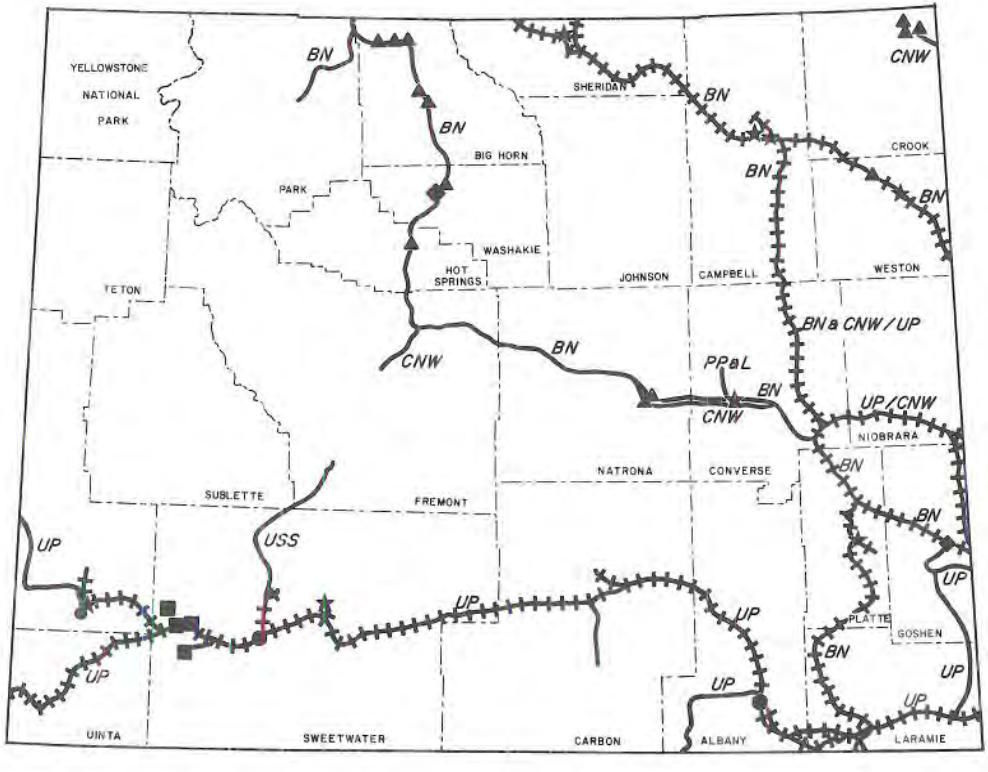
5 Averitt, Paul, 1975, *Coal resources of the United States:* U.S. Geological Survey Bulletin 1412, p. 15.

6 Culbertson, W.C., 1983, *Genesis and distribution of trona deposits in Wyoming* (abstract) in *Genesis and exploration of metallic and nonmetallic mineral and ore deposits of Wyoming and adjacent areas:* Geological Survey of Wyoming Public Information Circular 19, p. 34.

7 U.S. Energy Information Agency, 1985, Uranium Industry Annual, U.S. Department of Energy Report DOE/EIA-0478(85), 142 p.

8 Knutson, C.F., and Dana, G.F., 1982, *Developments in oil shale in 1981:* American Association of Petroleum Geologists Bulletin, Volume 66, no. 11, p. 2513.

9 Derived from Exxon information.



EXPLANATION

- Coal-Fired Electrical Generating Plant
- Trona Plant
- Bentonite Plant
- Synthetic Coke Plant
- Sugar Beet Plant
- Cement Plant

- *UP* Union Pacific R.R.
- *CNW* Chicago and North Western Transportation Co.
- *BN* Burlington Northern, Inc.
- *USS* United States Steel Co.
- *PPaL* Pacific Power and Light
- Unit Coal Train Route

RAILROAD ROUTES AND MAJOR COAL USERS IN WYOMING

Btu content of the coals by removing part of the moisture in the coal, this is the first commercial sized plant in the basin. Amax expects to upgrade 8,300 Btu/pound coal to 10,790 Btu/pound coal by removing about two-thirds of the moisture present in the coal. Production of one million tons of upgraded coal annually is expected by 1989. If this plant is successful, many other mines in the State with low Btu coal (see figure, page 20) could be forced to install coal drying facilities to compete for the higher Btu coal markets.

The second development occurred in southern Wyoming when Wyoming Coalbrik, Incorporated, announced their intent to start construction of a $2 million plant (subject to availability of funding) to manufacture coal bricks at Rawlins (see *Wyoming Geo-notes No. 13*, page 24 through 41). The plant would use low-sulfur coal from the Hanna Basin to make 7½-pound coal bricks that have a heat content equal to 25 pounds of firewood.

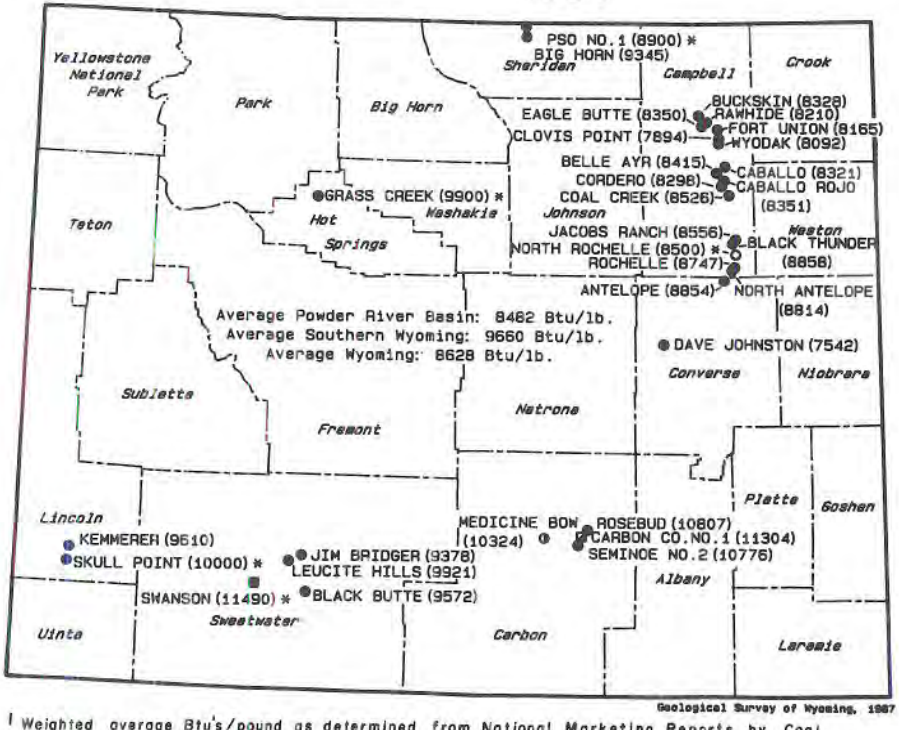
A third development occurred in May when Pacific Power and Light Company (PP&L) announced that they would conduct a year-long test burn of eastern Powder River Basin coal at their Dave Johnston power plant at Glenrock. The test burn, which was scheduled to begin on June first of this year, will use 20,000 tons of coal per month from Mobil Coal Producing, Incorporated's Caballo Rojo mine south of Gillette. The coal would be trucked 130 miles from the mine to the plant by Savage Coal Services Coal Corporation of Salt Lake City, Utah. Although coal production will continue at Glenrock Coal Company's Dave Johnston mine north of the power plant, PP&L hopes to double the life of the Dave Johnston mine by purchasing supplemental coal elsewhere. If the test burn is successful and the supplemental coal is determined to be competitive in price with coal produced at the Dave Johnston mine, PP&L will purchase supplemental coal for their Wyodak; Jim Bridger; Centralia, Washington; and Colstrip, Montana, power plants.

Several new contracts and coal sales were announced in the second quarter of 1987. The purchase of 0.6 million tons of spot coal from Mobil Coal Producing, Incorporated's Caballo Rojo mine was recently announced by Omaha Public Power District (OPPD). Although Carter Mining Company renegotiated a long-term contract with OPPD in March, 1987, the utility needs the additional spot coal at their Nebraska City, Nebraska, power station and expects this additional coal to meet their spot coal requirements for the remainder of 1987.

A seven-year, 140,000-ton per year coal contract was announced between Rochelle Coal Company, which operates the newly-opened Rochelle coal mine in southern Campbell County, and the City of Ames, Iowa. This contract will replace the utility's current contract with Fort Union Coal Company in July of this year. A transportation contract was also signed with C&NW for hauling this coal from the Rochelle mine to the Ames Municipal Power Plant. Burlington Northern's transportation contract to haul coal from the Fort Union mine to Ames will also end in July.

Rochelle Coal Company also signed a ten-year contract with Applied Energy Services of Arlington, Virginia, to supply up to 1.5 million

DELIVERED HEATING VALUES[1] OF WYOMING COAL
1986



EXPLANATION

- Active surface coal mine
- Active underground coal mine
- Inactive or recently closed surface coal mine
- Inactive or recently closed underground coal mine
- Surface coal mine under construction

[1] Weighted average Btu's/pound as determined from National Marketing Reports by Coal Marketronix and COALDAT Marketing Reports by DRI, Inc. (based on FERC Form 423 filed monthly by electric utilities).

* Indicates average as-received heating value for mine property only.

tons of coal per year to a 320-megawatt cogeneration plant located in Shady Point, Oklahoma. The coal will supplement Oklahoma coal as fuel for the plant, and new circulating fluidized-bed technology will be used in the plant's boiler design. Oklahoma Gas and Electric will purchase power from this plant, and Burlington Northern will transport the coal from Wyoming.

In southern Wyoming, Arch Mineral Corporation may be selling spot coal to Kansas Power and Light Company after their current contract expires at the end of the year. Evidently, the price of spot coal offered by Arch was significantly lower than the current contract price. It is believed that the tax break enacted by the Wyoming Legislature in early 1987, which places a cap on the amount of severance tax paid on a ton of coal (see *Wyoming Geo-notes No. 14*, pages 13 through 25), was a factor in the lowered price of coal from Arch's Seminoe No. 2 mine near Hanna.

Finally, Pacific Power and Light Company (PP&L) and Wyodak Resources Development Corporation recently concluded contract negotiations for coal supplies to PP&L's Wyodak generating plant east of Gillette. The contract talks followed PP&L's recent decision to postpone indefinitely the construction of a second unit at the Wyodak plant. Wyodak released PP&L from a 35-year, 40-million ton contract for this proposed second unit and extended their existing coal supply contract for Unit 1 from 25 to 35 years. Prices on the existing 1.2-million-ton per year contract were increased by $1.25 per ton to offset the loss of the contract for Unit 2.

REFERENCE CITED

Energy Information Administration, 1987, Coal distribution, January-December, 1986: Energy Information Administration DOE/EIA-0125 (86/4Q), 187 p.

METALS AND PRECIOUS STONES UPDATE

by W. Dan Hausel, Deputy Director, Geological Survey of Wyoming.

Gold exploration activity in Wyoming has picked up substantially with the recent rises in the price of gold. In the South Pass greenstone belt at the southern tip of the Wind River Range, placers are being worked in many drainages including Meadow Gulch, Rock Creek, and Wilson Bar (see Hausel, 1980, for locations and descriptions of these placers). Some successes are being reported, and nuggets up to one inch in length have been recovered.

A group of samples recently collected in the South Pass region and assayed for gold by the Geological Survey of Wyoming produced the following results:

Sample No.	Sample description	Gold (ppm)[1]
MD-1-87	Quartz-rich iron formation collected northeast of Atlantic City mine.	ND[2]
MD-2-87	Iron formation collected northeast of Atlantic City mine.	ND
MD-4-87	Limonite-stained iron formation from prospect pit northeast of Atlantic City mine.	ND
MD-5-87	Silicified breccia in chlorite schist (E1/2 sec. 36, T.30N., R.99W.).	ND
MD-6-87	Milky quartz vein stained with hematite collected from prospect pit in greenstones (sec. 31, T.30N., R.99W.).	2.39
MD-8-87	Quartz boudin stained with copper and limonite in greenstones (sec. 31, T.30N., R.99W.).	4.53
MD-10-87	Grab sample of quartz and hematite from dump (sec. 31, T.30N., R.99W.).	ND
MD-11-87	Milky quartz collected from dump in sec. 31, T.30N., R.99W. The quartz is hosted by metagreywacke.	0.05
LOUL-1-87	Talc-chlorite schist collected adjacent to Atlantic City iron mill.	ND
LOUL-3-87	Cumulus-textured(?) peridotite collected adjacent to Atlantic City mill.	ND
LOUL-4-87	Iron formation sample collected adjacent to Atlantic City iron mill.	ND

[1] Parts per million [2] ND = not detected

At the Carissa mine near the western edge of the South Pass-Atlantic City district, the McKinney Resources and Carissa Gold Mines joint venture is presently dewatering the mine workings and doing some construction work on the surface. The present exploration is designed to determine the potential for large-tonnage, low-grade gold deposits.

The historic mining at the Carissa followed narrow (5 to 15 feet) high-grade shear zones in metagreywacke. However, the mine may also

have low-grade resources tied up in the fractured wall rock. Last year, the Geological Survey of Wyoming collected a 30-foot composite chip sample in the fractured wall rock north of the Carissa shear. One split of this sample assayed 2.4 ppm (0.07 ounce/ton) gold.

Follow-up samples were taken over a 97-foot width with the following assay results:

Sample description	Gold (ppm)
0 to 10 feet north of the Carissa shear	0.4
10 to 20 feet north of the Carissa shear	1.05
20 to 37 feet north of the Carissa shear	2.5
0 to 10 feet south of the Carissa shear	0.65
10 to 20 feet south of the Carissa shear	0.25
20 to 30 feet south of the Carissa shear	0.30
30 to 60 feet south of the Carissa shear	0.35
Composite sample (97 feet)	0.50

In an other development, a group from Riverton has scheduled some work on the historic Tabor Grand mine near Atlantic City.

The Geological Survey of Wyoming is continuing with a long-term mapping project of the greenstone belt with the mapping of the Miners Delight Quadrangle. The Survey is also scheduling a detailed sampling project of several of the mines in the belt.

Some preliminary exploration for gold was reported in the Bear Lodge alkalic complex in the Bear Lodge Mountains of northeastern Wyoming and in the Hartville uplift of eastern Wyoming. In the Medicine Bow Mountains and Sierra Madre of southeastern Wyoming, some placer gold prospecting was reported as well as exploration for platinum by major mining companies.

Reference cited

Hausel, W.D., 1980, Gold districts of Wyoming: Geological Survey of Wyoming Report of Investigations 23, 71 p.

INDUSTRIAL MINERALS AND URANIUM UPDATE

by Ray E. Harris, Industrial Minerals and Uranium Geologist, Geological Survey of Wyoming

Uranium

For the first time in six years, employment in Wyoming's uranium industry is increasing. Twenty rehirings for the startup of the Lucky Mc mill (COGEMA) in the Gas Hills, and new hirings for Malapai Resources' Irigary Ranch and Everest Minerals' Highland *in situ* projects will increase employment in the industry.

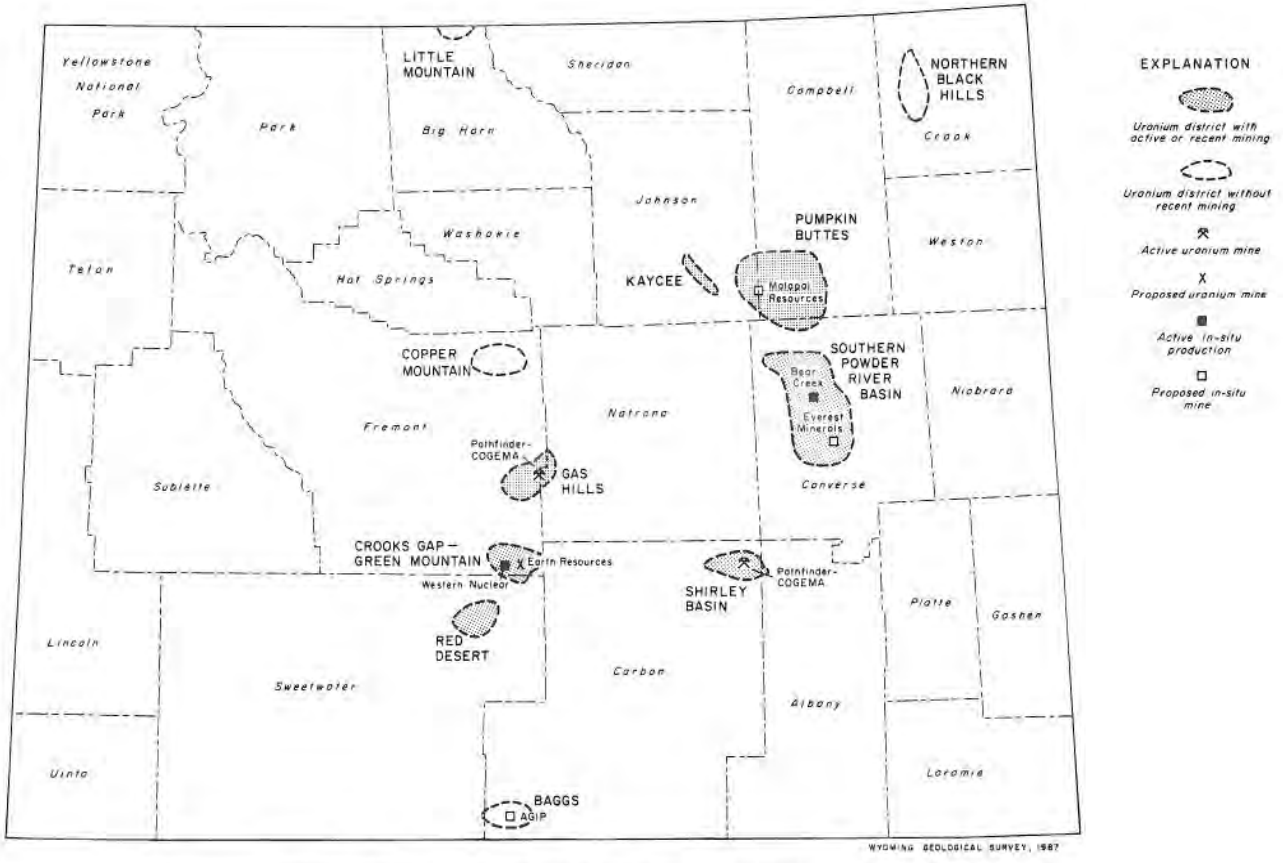
The Lucky Mc mill was restarted June 3, 1987, following a two-year shutdown for major renovation. The mill now has a capacity of 2,800 tons of ore per day. Pathfinder Mines, now 100-percent owned by the French company COGEMA (see *Wyoming Geo-notes No. 14* page 31), is milling ore from the Shirley Basin mine. The mill is, however, operating at greatly reduced capacity.

Both *in situ* operations, Malapai Resources (Arizona Public Service) and Everest Minerals, continue to test their *in situ* recovery rates. Both have announced supply contracts beginning in 1988.

U.S. Energy Corporation of Riverton is trying to interest other mining and mineral companies in a partnership or joint venture to develop a mine on the south side of Green Mountain, in Fremont County near the Crooks Gap district south of Jeffrey City. U.S. Energy has developed plans for an underground mine on their property.

The renewed activity is due to several factors. Domestic uranium production has fallen to around 13 million pounds per year, while domestic uranium consumption is steady at under 40 million pounds per year (as fuel for nuclear power plants). Domestic uranium that can be produced at $25.00 per pound or less may be able to compete with foreign uranium, given certain transportation cost differences. The spot market price of uranium is $17.00 per pound. There is some hope that it will rise as uncertainties about nuclear power that have arisen as a result of the Chernobyl power plant meltdown and a failure to establish import restrictions (quotas or tariffs) on foreign uranium are resolved.

In Wyoming, the question of how to dispose of uranium mill tailings located at the abandoned former Susquehanna-Western mill near Riverton has been resolved. The U.S. Department of Energy agreed to move the tailings to a disposal site in an abandoned open pit uranium mine in the Gas Hills. This was the method favored by the Wyoming Department of Environmental Quality. Removal of the tailings is scheduled to begin July 15. Bids have been let, but the contractor for the removal has not been announced. The entire project will cost about $24 million.



MAJOR ACTIVE AND INACTIVE URANIUM DISTRICTS

Trona

Trona production continues at the same pace as last year. A record 13,264,747 tons of trona were processed in Wyoming in 1986. Trona companies continue to search for export markets while the domestic glass and sodium chemical industries, the major consumers of Wyoming soda ash (refined trona), cut back production. Wyoming produces over 90 percent of the United States' soda ash, the rest coming from Recent saline lake deposits in California. Wyoming's deposits are 45-million-year-old buried saline lake deposits in the Green River Basin west of Green River. The current export market accounts for 25 percent of all domestically produced soda ash.

Japan represents the greatest potential for export sales of soda ash. They have a demand for over one million tons of soda ash per year. They manufacture soda ash synthetically, which costs more than Wyoming mined and refined soda ash, including transportation costs. Recently, the Federal government has been putting pressure on Japan to allow more domestic soda ash imports as one means of easing the trade imbalance. Wyoming's Congressional Delegation has also been trying to work on the trade restrictions.

Meanwhile, 21 jobs were cut by General Chemical Company's Green River soda ash plant in April. General has been cutting back since January. They now have 153 employees, down from 174 in January.

Wyoming Trona Production

Year	FMC	General Chemical[1]	Stauffer Chemical	IG Inc[2]	Tenneco	Total
1980	4,418,258	3,109,019	2,658,377	1,973,587	-0-	12,159,241
1981	4,684,744	2,909,953	2,645,599	1,547,435	-0-	11,787,731
1982	3,575,678	2,499,689	2,180,962	1,171,071	646,290	10,073,690
1983	3,102,074	2,818,826	2,570,190	807,475	943,852	10,242,417
1984	3,400,458	2,600,611	2,333,364	1,386,933	1,249,843	10,971,209
1985	3,164,611	2,466,095	2,191,952	1,603,339	1,350,307	10,776,304
1986	4,046,958[3]	3,061,054	2,607,878	2,043,819	1,505,038	13,264,747

[1] Formerly Allied Chemical.

[2] Formerly Texasgulf.

[3] Includes 293,718 tons produced by *in situ* recovery methods.

Unless exports rise dramatically, there is still little chance for any accelerated growth for the trona industry, according to A.F. Zeller of Chemical Mineral Marketing Services. Zeller sees production remaining steady since the lowering demand of flat glass is being balanced by slightly increasing exports.

A British company, Imperial Chemical Industries (ICI) is in the process of buying Stauffer Chemical Company. They plan to divest themselves of the soda ash production in Wyoming. ICI does plan to keep the agricultural chemicals division of Stauffer, including the Leefe, Wyoming, phosphate plant (see **Phosphate**).

Bonneville Transloaders, Inc.

Wyoming's largest ton-mile trucking firm is Bonneville Transloaders, Inc. (BTI), which hauls one product -- soda ash - from the trona mines west of Green River to Bonneville, north of Shoshoni. At Bonneville, the trucks are unloaded, and the soda ash is transferred to railroad cars. In this way, the Burlington Northern Railroad competes with the Union Pacific Railroad in the trona hauling business. BTI employs about 100 drivers, maintenance workers, and others, and depends on the Burlington Northern Railroad for income. BTI has been in operation since 1985, and will continue to operate as long as the Burlington Northern ships trona at a rate competitive to Union Pacific's.

Bentonite

Wyoming's bentonite industry continues to struggle along at greatly reduced production rates. 1986 production was 31.4 percent below 1985. Bentonite is used primarily as drilling mud, by an industry that is suffering due to drastically decreased domestic exploration rates for oil and gas. Bentonite production today is less than half of the high rates of 1981-1982. In contrast to other Wyoming operations, the bentonite industry has not closed down. Only one plant, N.L. Baroid's Lovell plant has closed since 1982. Employment is down, but not proportionately to production.

Limestone

Divide Construction, which operates the Lost Day quarry north of Fort Laramie, won the bid to supply Basin Electric's Laramie River power plant near Wheatland with high-quality limestone for burn control. The source of this limestone is immediately north of the Lost Day quarry.

Limestone for sugar-beet refining at Western Sugar's Scottsbluff and Mitchell, Nebraska, sugar-beet refining plants will be supplied from a Western Sugar quarry at Warren, Montana, north of Frannie, Wyoming. Although transportation costs have been cited as the greatest expense for sugar rock, this long rail haul is apparently

cost-effective. This source is more distant than Pringle, South Dakota, the former source. Wyoming limestone deposits are located closer than either the Montana or South Dakota sources. Due to efforts by the Geological Survey of Wyoming, Western Sugar and Holly Sugar in Torrington will conduct burn tests on Wyoming limestone this fall.

Mountain States Cement applied for a permit to quarry limestone from a new area south of Laramie near the old limestone source and close to their cement plant.

Phosphate

Phosphate produced at the two Wyoming phosphate plants, Stauffer at Leefe, west of Kemmerer, and Chevron, southeast of Rock Springs, is becoming more in demand. Phosphate rock mined in Idaho and Utah supplies these plants. Phosphate consumption was greater than production in 1986. Most Wyoming phosphate is used in fertilizer.

The fate of the Leefe plant is unclear as Stauffer Chemical Company was purchased by Imperial Chemical Industries (ICI) of Great Britain. ICI wishes to keep the agricultural-related parts of Stauffer, which would include phosphate production. So far, no changes have been made at the Leefe plant.

Sulfur

Despite optimistic predictions, the price of sulfur fell in 1986 as consumption declined. Apparently Canadian stockpiles were not being depleted as fast as predicted, and the predicted sulfur shortage did not occur. Prices will probably rise in the future, however, with the inevitable depletion of the Canadian sulfur deposits.

Wyoming produces sulfur as a by-product from the desulfurization of natural gas and petroleum at several locations. A natural deposit near Thermopolis is also being tested for mining.

Other Industrial Minerals

Mountain States Cement is testing a gypsum deposit fifteen miles south of Laramie. Their existing gypsum source is 40 haul-miles from the plant. Mountain States uses gypsum to mix with lime and marl to produce cement.

Mountain States Cement is also testing a new marl (impure limestone) deposit south of their plant. Their old quarry west of Laramie has been mined out.

A permit to quarry ornamental stone from an area east of Superior was denied by the Environmental Quality Council last year, and recently this decision was upheld by the Wyoming Supreme Court. The U.S. Bureau of Land Management is now seeking to ban all mining in that area, known as the "natural corrals", an eroded area with cliffs and walls of weathered wyomingite and orendite (potassium-rich volcanic rocks). Other locations of these rocks have been mined for pumice in the past and may be suitable for ornamental stone.

GEOLOGIC HAZARDS UPDATE

by James C. Case, Geologic Hazards Geologist, Geological Survey of Wyoming.

Earthquakes

The National Earthquake Information Service in Golden, Colorado, reported no recorded earthquake activity in Wyoming for the period March, 1987, through May, 1987. On June 6, 1987, two events were reported in Yellowstone National Park. At 6:40 A.M., an earthquake of magnitude 4.0 occurred with an epicenter approximately 20 miles south of Old Faithful. That quake was felt at West Thumb, Grants Village, and Old Faithful. At 10:56 A.M., another event of magnitude 3.7 occurred in the same vicinity, and was reported felt at Old Faithful. No damage was reported.

Active faults

The Geologic Hazards Division of the Wyoming Geological Survey is compiling information and remapping select areas of the State for active faults. A report titled *Aerial and field investigations of the Wheatland-Whalen fault system, southeastern Wyoming*, prepared by Earth Technology Corporation for the U.S. Air Force, was recently released to the Division. The report states that, based upon aerial photography, aerial reconnaissance, and field investigations, the Wheatland-Whalen fault system shows no sign of late Quaternary movement (last 700,000 years). The faults are thought to have been active during Late Miocene to Early Pliocene. The fault system is located in Platte and Goshen Counties, and trends from southwest to northeast.

Another report titled *Seismotectonic study for the Palisades Dam, Palisades Project, Idaho*, prepared by the U.S. Bureau of Reclamation, was also recently released. The report is the best study to date of the Star Valley fault, which bounds the eastern side of Star Valley. At three locations along the fault, there is evidence for movement in the last 10,000 to 15,000 years. A maximum credible earthquake of magnitude 7.5 has been inferred for the fault area.

An unpublished manuscript titled *Quaternary faulting in southwestern Wyoming and the adjacent part of Utah,* by D. Dickey and A. Gibbons, was recently obtained. The report generally describes many of the faults in U.S. Geological Survey Open File Report 83-288 (*Quaternary faults in Lincoln and Uinta Counties, Wyoming, and Rich County, Utah.*) In particular, the report discussed the Rock Creek fault which is a north-south trending normal fault located west of Fossil Butte National Monument in Lincoln County. Aerial photographs examined by the Division reveal a 40-mile-long fault with possible Quaternary displacement. The Geologic Hazards Division will initiate studies on the fault this year.

STRATIGRAPHY UPDATE

by Alan J. Ver Ploeg, Stratigrapher, Geological Survey of Wyoming

With the advent of the field season, work is continuing on the COGEOMAP Project on the southeastern flanks of the Bighorn Mountains west of Kaycee, Wyoming. Preliminary geologic maps for the Mayoworth and Red Fork Powder River Quadrangles have been released. This field season, the Barnum, Fraker Mountain, and Tabletop Quadrangles will be completed and work will begin on the Turk Springs Quadrangle. The Barnum Quadrangle is nearly complete, having been reconciled with the adjacent Red Fork Powder River Quadrangle and needs only a final field check. Early field examination of the Tabletop Quadrangle, immediately west of the Fraker Mountain Quadrangle, indicates the probable presence of a major fault system trending along the west side of Fraker Mountain and extending diagonally across the Tabletop Quadrangle. The faulting appears to be related to the asymmetrical-to-the-west folding of the Fraker Mountain anticline. In addition, it appears the thickness of the Ordovician Bighorn Dolomite may change significantly in the Tabletop Quadrangle.

Work has been completed on the *First draft of the proposed stratigraphic nomenclature chart for the State of Wyoming.* The chart was prepared as a joint effort with J.D. Love, A.C. Christiansen, and the Stratigraphy Division of the Survey. The chart will be available for comment at the Wyoming Geological Association's Annual Field Conference in Jackson in September. See also page 32 of this report.

Some interesting new geologic maps that cover portions of the State of Wyoming have been recently released by the U.S. Geological Survey. These include: *Geologic maps of greenstone-granite areas, northern Laramie Mountains, Converse and Natrona Counties, Wyoming,* by Delores Gable (Map I-1724, scale 1:24,000); *Sedimentologic and stratigraphic framework of the upper part of the Fort Union Formation, western Powder River Basin, Wyoming,* by J.N. Weaver and R.M. Flores (Map MF-1929, scale 1:24,000); *Geologic map of the Crowheart NE Quadrangle, Fremont County, Wyoming,* by R.C. Warlow, N.L. Hickling, and J.F. Windolph, Jr. (Map GQ-1631, scale 1:24,000); *Surface-subsurface correlations of the Mesaverde Group and associated Upper Cretaceous formations, Rock Springs, Wyoming, to Mountain Harris, Colorado,* by H. Roehler (Map MF-1937); *Surficial geologic map of the Gillette 30' x*

60' Quadrangle, Campbell and Crook Counties, Wyoming, by M.C. Rehels (Map C-105, scale 1:100:000); and *Surficial geologic map of the Reno Junction 30' x 60' Quadrangle, Campbell and Weston Counties, Wyoming*, by M.C. Rehels and D.A. Coates (Map C-106, scale 1:100,000). These maps are available through the Distribution Branch of the U.S. Geological Survey. Their address is:

Distribution Branch
U.S. Geological Survey
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RECENT AND NEW PUBLICATIONS BY THE GEOLOGICAL SURVEY OF WYOMING

*Tectonic map of the Overthrust Belt, western Wyoming, northwestern Utah, and southeastern Idaho, showing oil and gas fields and exploratory wells in the Overthrust Belt and adjacent Green River Basin, D.L. Blackstone, Jr. and R.H. DeBruin, Map Series 23, 1987, ($5.00).

*Late Pleistocene periglacial wedge sites in Wyoming: an illustrated compendium, Brainerd Mears, Jr., Memoir 3, 1987, ($8.00).

*Geothermal resources of the Wind River Basin, Wyoming, B.S. Hinckley and H.P. Heasler, Report of Investigations 38, 1987, ($7.00).

*The Wyoming State Fossil, *Knightia*, Postcard, 1987, (20¢ each or 6 for $1.00).

*First draft of proposed stratigraphic nomenclature chart for the State of Wyoming, J.D. Love, A.C. Christiansen, and A.J. VerPloeg, 1987, ($1.50).

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* New releases since the last issue of *Wyoming Geo-notes*.

Order these and other publications from: Geological Survey of Wyoming, Box 3008, University Station, Laramie, Wyoming 82071. Phone: (307) 766-2286. Many of these publications are also available over-the-counter at the Wyoming Oil and Gas Conservation Commission (Basko Building) in Casper, Wyoming.

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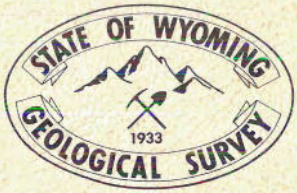
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