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BIG PIPELINE

BIG IMPACT

The Alyeska (Trans-Alaska) Pipeline celebrated its first year of operation on June 20, and the impact of the \$7.7 billion project is being felt around the world.

While the pipeline has caused a glut of crude oil on the U.S. West Coast, tangled political and environmental barriers have so far prevented the oil from reaching the Rocky Mountain region, Middle West and East Coast where it is much needed. At present a transfer from large tankers to small tankers through the Panama Canal bottleneck is the only way Alaskan crude oil can reach Southern and Eastern U.S. ports.

At present levels of Alaskan North Slope production, the U.S. balance of payments deficit resulting from foreign oil imports will be reduced by \$6 billion annually. Alaskan North Slope crude to the lower 48 states plus North Sea oil to Europe has also softened the attitude of OPEC nations and influenced their decision not to raise oil prices this year. The overall effect is to hold down inflation of energy costs and inflation in general, an influence unfortunately not felt in many other commodities.

Production of the Prudhoe Bay field which feeds the huge new pipeline is now 1.17 million barrels per day. Cumulative production is more than 256 million barrels. For comparison total production of all fields in Utah averaged 100,000 barrels per day in 1977, and the State's cumulative production (since the 1950's) is about 625 million barrels.

GREAT SALT LAKE STUDY OF SURFACE CURRENTS

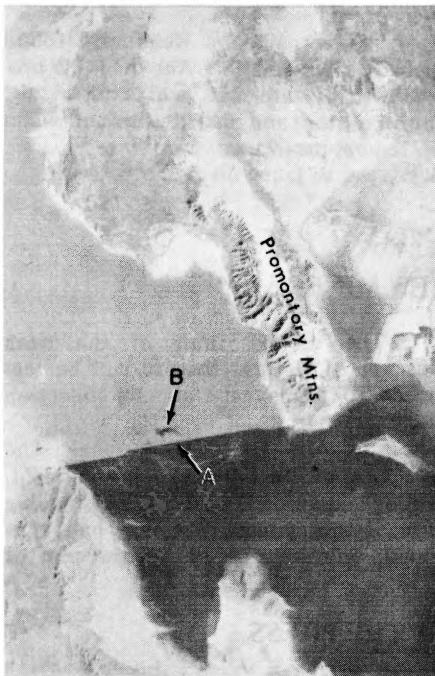


Photo 1.

Landsat photos showing movement of dye in Great Salt Lake.



Photo 2.

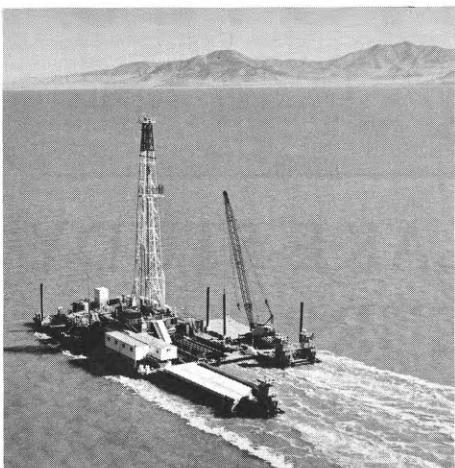
Landsat pass again recorded the position of the dye marker.

The Research Section of the Utah Geological and Mineral Survey conducted a preliminary test on February 22 and 23 to determine if surface currents in the north arm of the Great Salt Lake can be followed by tracking dye markers with the aid of Landsat imagery. Two 30-gallon drums of a blue biodegradeable dye were applied to the surface of water flowing from south to north through the west culvert in the Southern Pacific Railroad causeway. The dye was applied at 8:00 a.m. on the morning of the 22nd at point A on photo 1. Two hours later the position of the dye mark was recorded on Landsat imagery as shown at point B on photo 1. The dye had moved about one mile north and 1.4 miles to the west during the two hour time interval. 26 hours after the dye was applied a second

Landsat pass again recorded the position of the dye marker. The dye had moved about 8 to 9 miles farther to the north as shown at point C on photo 2. Cloud cover obscured the lake during another Landsat overpass nine days later, so the position of the dye marker, if still visible, could not be determined.

During the twenty-six hour time period of the test the winds across the lake were relatively calm, averaging about 4.6 miles per hour in a generally south east direction. The major influence on the dye movement is believed to be the surface currents of Great Salt Lake and not the wind.

AMOCO DRILLS FIRST OIL WELL IN GREAT SALT LAKE



Drilling rig is towed into position in Great Salt Lake

Amoco is drilling the first test well in Great Salt Lake, 45 miles northwest of Salt Lake City. The test well, 1 Indian Cove-State Unit, is in 27 feet of water, about 7 miles off shore.

The rig was towed 12 miles to the site from Little Valley Harbor. It is expected to take 2 months to drill the well to 10,000 feet, at a cost of about 5.5 million dollars.

Amoco has permits to drill six wells in Great Salt Lake. The first two will be north of the causeway; the rig will be dismantled and moved by truck to a new launching site if Amoco decides to drill to the south.

609,000 acres were leased by Amoco in 1973; extensive seismic surveys were made in 1974. Amoco first became interested in the oil possibilities in Great Salt Lake because of an old oil seep at Rozel Point. Parker Drilling Company, Tulsa, Oklahoma is drilling the well with its Rig No. 148. The rig is mounted on a 90 x 180 foot barge especially assembled for the operation.

Should there be a spill, the barge holding the rig is surrounded by a 600-foot boom to contain any spilled oil. Additional boom is available to insure pollution control. *from Oil and Gas Journal, Vol. 76, no. 28, p. 57.*

STATES CONTROL WATER

States have primary control over their water, according to two decisions passed recently by the U.S. Supreme Court. In a 6 to 3 decision passed on July 2, the Court gave California the right to impose conditions on the use of water from the federal government's New Melones Dam, and by 5 to 4 ruled that New Mexico had priority over the federal government in deciding the use of water from the Rio Mimbres, even though the river flows through the Gila National Forest.

Justice William Rehnquist found that the Reclamation Act of 1902 provided that state law will control the appropriation and distribution of water for federal projects.

NEW MINERAL DISPLAY

The second floor of the Utah Museum of Natural History will be renovated to display the superb collection of minerals from all over the world collected by Mr. Alfred M. Buranek. The collection includes fine examples of gold, a rough diamond, and an outstanding suite of tourmalines. The new hall, it is hoped, will be opened by the end of 1979.

AT THE PRESS

"Geology and Uranium - Vanadium deposits of the San Rafael River mining area, Emery County, Utah" by Larry M. Trimble and Hellmut H. Doelling. 122 pages. Includes 4-color map, 38 x 49". Publication date - mid August. Price \$6.00.

NEW BOOK ON ROCK ART

"Petroglyphs and Pictographs of Utah", just published by the Utah Museum of Natural History, is a definitive study of the rock art of the Fremont People who lived in eastern Utah from about 700 A.D. to 1200 A.D. The author, Dr. Kenneth B. Castleton, formerly Dean of the University of Utah College of Medicine, has spent many years locating and photographing the rock art of Utah.

DIGGIN'S

LAND WITHDRAWN IN DEEP CREEK RANGE

27,000 acres were withdrawn in the Deep Creek Range in western Utah by the Secretary of the Interior in May, 1977, under the Federal Land Policy and Management Act. The Bureau of Land Management is studying the range to make further land use recommendations.

The Deep Creeks, an isolated range along Utah's border with Nevada, has been the subject of conflict recently among groups proposing different uses of the land. Cutthroat trout, stranded in the range by the withdrawal of Lake Bonneville, are alleged to be "rare" and "unique" as are several varieties of insects and grasses. Rarity and uniqueness of these have been cited to support wilderness status for parts of the range.

The mineral potential of the range has been described in UGMS Bulletins 77 (1966) and 99 (1973) and most recently in Report of Investigation 117, "Mineral Potential of the Deep Creek Mountains" by H.H. Doelling and L. I. Perry (1977).

UTAHN NOMINATED AS MINES CHIEF

Roger A. Markle has been nominated by President Carter to be director of the Bureau of Mines in the U.S. Department of Interior.

The appointment is subject to confirmation by the Senate.

Markle is a native of Sidney, Montana, and a Navy veteran. From 1965 to 1974 he was mining superintendent of the Standard Oil Company of Indiana. Since 1974 Mr. Markle has been president of the Western Division of the Valley-Camp Coal Company of Salt Lake City.

Markle has a bachelor's degree in mining from the University of Alaska, a master's degree in mine management from Stanford University and MBA degree from the University of Chicago in 1971.

After moving to Salt Lake City he was named by Governor Calvin L. Rampton in 1976 to a joint legislative committee on energy, and in 1977 by Governor Scott M. Matheson to the Utah Energy and Development Council.

U.S. GEOLOGICAL SURVEY OPEN FILE REPORTS

Unpublished reports by the U.S. Geological Survey that describe the geology of Utah are kept on open-file at the Utah Geological and Mineral Survey, 606 Black Hawk Way, Salt Lake City. Because UGMS has only one copy of each report, they must be inspected at its offices and cannot be taken out. Copies of these reports may also be inspected at the USGS Public Inquiries Office, Federal Building, 125 South State Street, Salt Lake City, and may be ordered from: Open-File Services Section, Branch of Distribution, U.S. Geological Survey, Box 25425, Denver Federal Center, Denver, Colorado 80225.

Reports received at UGMS since our last listing in the February SURVEY NOTES are:

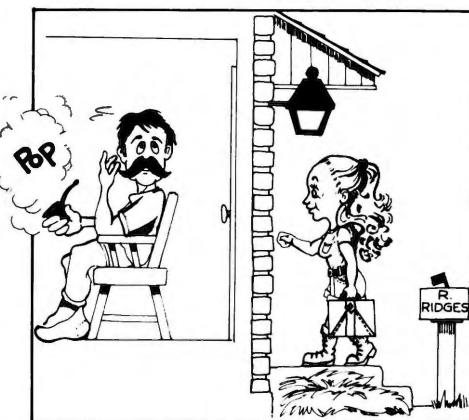
77-872. Geochemical Survey of the Western Energy Regions, Fourth Annual Progress Report, July 1977, by the U.S. Geological Survey, Denver, Colorado 1977.

78-102. Determination of Uranium in Source Rocks by Using Radium in Crystal Springs, Great Salt Lake Area, Utah, by J. Karen Felmlee and Robert A. Cadigan, 1978.

78-147. A Potential Target for Potash Solution Mining in Cycle 18, Paradox Member of the Hermosa Formation, San Juan County, Utah and Dolores and Montezuma Counties, Colorado, by R.J. Hite, 1978.

78-148. The Geology of the Lisbon Valley Potash Deposits, San Juan County, Utah, by R. J. Hite, 1978.

ROCKY RIDGES



78-257. Preliminary Geologic Map of Tooele 2° Quadrangle, Utah, compiled by W. J. Moore and M. L. Sorensen,

78-268. Geophysical Logs of 14 Test Holes Drilled during 1977 in the Kolob Coal Field, Kane County, South-Central Utah, by W. E. Bowers and P.M. Strickland, 1978.

78-314. Preliminary Structure and Mineralogical Analysis of the Deer Trail Mountain-Alunite Ridge Mining Area, Utah, by C. G. Cunningham, T.A. Steven, and C. W. Naeser, 1978.

In addition to the U.S. Geological Survey open-file reports listed here, UGMS receives many open-file reports from the Department of Energy, Grand Junction office. These are too numerous to list here, but they are available for public inspection in our library. The DOE reports are either on paper or microfiche.

NEW RELEASES UGMS OPEN FILE REPORTS

24. Methane Content of Utah Coals: Second Annual Report to the U.S. Bureau of Mines, by F.D. Davis and H.H. Doelling, 1977. Prepared in cooperation with the U.S. Bureau of Mines, Grant No. GO166041.

25. Coal Drilling, Johns Valley, Utah by H. H. Doelling and F.D. Davis 1978.

Map 44, Energy Resources Map of Utah, new edition, in 8 colors, 39" x 54", \$4.00, add 10% for postage on mail orders.

Map 45, Oil and Gas Fields and Pipelines of Utah, 3 colors, 19½" x 24", \$1.00, add 10% for postage on mail orders.

The highest elevation in the Raft River Range (and Box Elder County) is an unnamed prominence 9,931 feet above sea level.

BINGHAM BIBLIOGRAPHY

UGMS has placed on open file a comprehensive bibliography of the West Mountain mining district, more popularly known as Bingham Canyon. This bibliography contains well over five hundred geological, engineering, industrial, historical and sociological references and was prepared by Wilbur H. Smith, long-time geologist of the Kennecott Copper Corporation, Utah Copper Division. The bibliography is available for inspection at the UGMS office and arrangements can be made to purchase copies.

SALT - ONE MILE THICK

A test well for oil drilled in northeastern Millard County was a "duster" but did yield stratigraphic information of interest to oil explorationists in Utah's Basin and Range province.

The well, Argonaut Energy No. 1 Federal, C NW 23, T. 15 S., R 7 W., 8 miles north of Delta, is reported to have penetrated more than 5,000 feet of salt from 2,600 to 7,700 feet below alluvium and "valley fill". The age of the salt and the thick carbonate sequence drilled below it to 11,266 feet, total depth, has not been identified.

by Greg McLaughlin
Sandy Stewart

NEW LIFE POSSIBLE FOR GREATER ALTAMONT-BLUEBELL

Greater Altamont - Bluebell Field, in Duchesne and Uintah Counties (figure 1) is one of Utah's four giant oil fields, i.e., it contains at least 100 million barrels of producible oil. The first production from the deep pay zones was from the Mountain Fuel Supply Company Cedar Rim No. 1-20 C6, sec. 20, T. 3 S., R. 6 W., which was drilled in 1969. The significance of the discovery was not realized at first, but drilling and production began to increase at a brisk rate (figure 2) after completion of Shell Oil Company's Altamont discovery about 17 miles to the northeast in 1970. This was the No. 1-35A 4 Miles, sec. 35, T. 1 S., R. 4 W. Deep pay zones were discovered at Bluebell in 1971 with the completion of the gas producing Enterprises Powell No. 1-13 A2. Shallow production in the Bluebell area had been established in 1954, with increased shallow drilling about 1967. Bluebell, Altamont and other oil fields have since gradually coalesced into a field containing nearly 400 wells, and covering over 350 square miles. Field extension is presently limited to drilling on the east (Bluebell) and southwest (Cedar Rim) margins. The volume of recoverable oil in the field is difficult to assess because of the complexity of the field. Estimates of recoverable oil range as high as 394 million barrels, but this seems unlikely in view of cumulative production of 104 million barrels through December, 1977, and the rapid decline of oil production since 1975 (figure 2).

The Greater Altamont - Bluebell field is unique in that petroleum in the field is largely contained in fractures, rather than in the minute pore spaces between sand grains. Indeed, the presence of fractures appears to define the geographic limits of the field, and has resulted in production rates sufficient to justify drilling deep wells, some over 18,000 feet. Peak production was reached in 1975 (figure 2), and a relatively short productive life is indicated for the field.

Experiments by Shell with secondary recovery techniques which might slow the production decline and ultimately recover more oil have so far been disappointing. Inasmuch, as one cannot "see" into the earth and know the density of fractures which occur between wells, it is possible that there could be quantities of oil not recoverable with the existing well density. Therefore, Shell

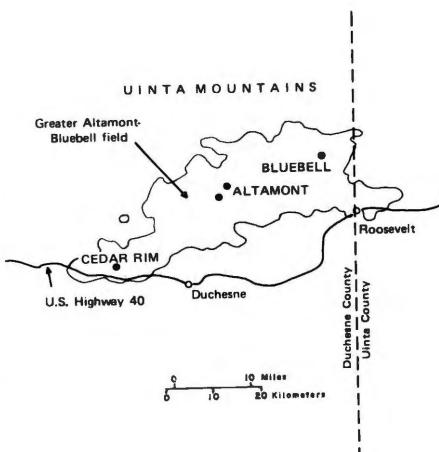


Figure 1. Location of Greater Altamont - Bluebell Production

Oil Company is drilling an experimental well to find if additional wells within the field will increase the production of oil. The Brotherson No. 2-10B4, sec. 10, T. 2 S., R. 4 W., is currently being drilled between existing wells in the central part of the field. The two wells in sec. 10 will not be produced simultaneously, at least for the near future.

Since experience has shown that there is considerable variation in performance of wells in the field more than one experimental well will have to be drilled and many months of pressure measurements and production perfor-

mance will be required before the value of greater density of wells can be assessed. If this additional drilling succeeds for Shell, it will probably be undertaken by other operators. If generally successful, this experiment could result in recovery of significant additional oil from the field and much needed conservation of a valuable resource.

DID YOU KNOW?

That the Gold Hill stock is actually two stocks of different ages, one Oligocene, one Jurassic?

That wind tides may effect the balance of the two-layer brines in Great Salt Lake?

That manganese, molybdenum and selenium do not concentrate in the brine of Great Salt Lake?

That a buried intrusive dike may be the source of heat under Baker Hot Springs?

That North Horn Mountain coals were formed in a shallow-water delta?

The spring 1978 issue of UTAH GEOLOGY discusses these subjects, and more. Available at the UGMS office at 606 Black Hawk Way, Salt Lake City, Utah, 84108, for only \$4.00.

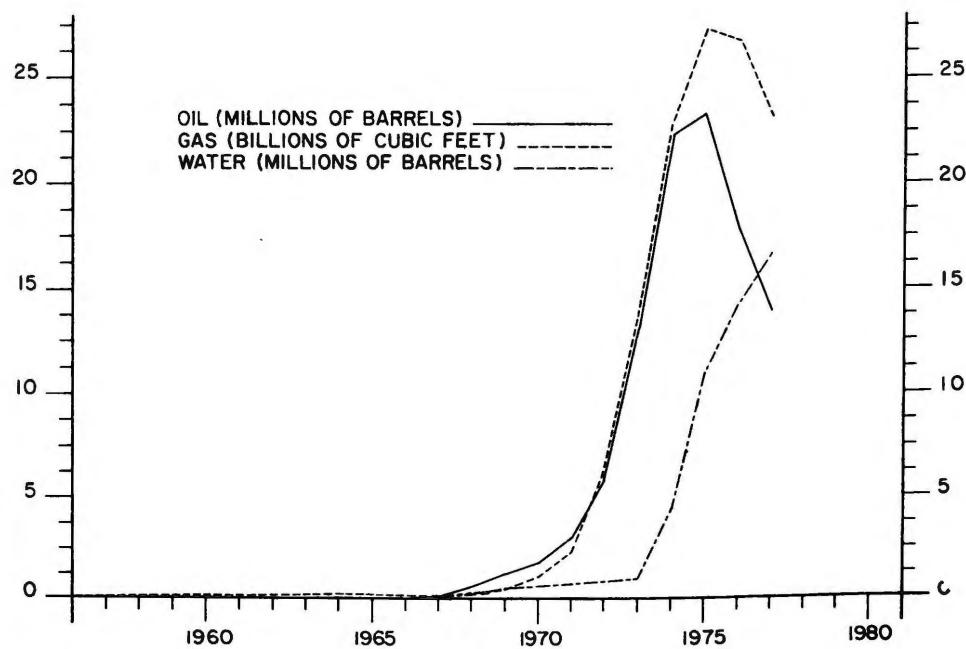


Figure 2. Greater Altamont - Bluebell Production

UTAH MINERAL INDUSTRY ACTIVITY FOR 1977

by Carlton H. Stowe¹

VALUE OF MINERAL PRODUCTION

For the second consecutive year, the value of Utah's mineral production exceeded the billion dollar mark. U.S. Bureau of Mines preliminary data indicate the total reached \$1,140,779,000 during 1977 (table 1)² but complete tabulations may boost the total to about \$1.2 billion. The value of production was \$1.044 billion in 1976.

Table 1 shows the quantity and dollar value of mineral production in Utah in 1976 and 1977. Figure 1 shows the value of Utah's mineral production from 1960 to 1977 in current dollars and constant (1967) dollars. The effects of inflation are very dramatically depicted by the constant dollar graph which shows that without the actual growth in values

in petroleum and coal, Utah's mineral industry would be declining drastically. Reduced to constant dollar values, overall mineral production is "just holding its own".

PRINCIPAL COMMODITIES

Oil and Natural Gas Liquids

The U.S. Bureau of Mines¹ reported Utah oil production to be 33,188,000 barrels in 1977, down from 34,300,000 barrels in 1976. Value in 1977 was \$324,911,000, up from \$318,911,000 in 1976. Average price per barrel was \$9.79, up from \$9.30 in 1976.

Final figures compiled by the Utah Division of Oil, Gas, and Mining² show 36,590,222 barrels produced in 1977 including 33,069,910 barrels of oil and 3,518,659 barrels of natural gas liquids.

Also included for the first time are 1,653 barrels of oil from oil shale. 1976 production was 34,283,691 barrels of oil and 3,032,916 barrels of liquids, totalling 37,316,607 barrels.

Natural Gas

U.S. Bureau of Mines preliminary data show a slight increase in marketed natural gas production and an increase in its value. 57,604 billion cubic foot (57,604,000 mcf) valued at \$30.242 million dollars was marketed, up from 57,416 billion cubic feet valued at \$28.995 in 1976. Average price per 1,000 cubic feet increased from \$1.90 to \$1.98. Highest marketed natural gas production was in 1966 when 69.336 billion cubic feet was recorded.

Gross production of natural gas in Utah during 1977 was 80,790,745 mcf according to the Utah Division of Oil, Gas and Mining, up from 77,090,152 mcf in 1976. DOGM figures include gas used in field operations, reinjected into reservoirs, stored in reservoirs, and vented to the air.

¹ Mineral Information Specialist, Utah Geological and Mineral Survey, Salt Lake City, Utah 84108.

² Source: U.S. Bureau of Land Management, BLM Facts & Figures for Utah-1976.

¹ U.S. Bureau of Mines annual preliminary report, 1977.

² State of Utah, Division of Oil, Gas and Mining, monthly Oil and Gas Production Report, December, 1977.

Table 1. Mineral Production in Utah for 1976 and 1977¹

Mineral	Unit of measurement	1976 ²		1977 ³	
		Quantity	Value (thousands)	Quantity	Value (thousands)
Carbon dioxide, natural	thousand cubic feet	21,875	2	20,000	2
Clays	thousand short tons	206	531	307	819
Coal (bituminous)	thousand short tons	7,967	182,712	9,590	225,000
Copper (recoverable content of ore, etc.)	short tons	185,458	258,157	193,700	258,396
Gem stones	4	4	105	4	105
Gold (recoverable content of ores, etc.)	troy ounces	187,318	23,475	207,300	30,728
Gypsum	thousand short tons	270	1,657	264	1,453
Lead (recoverable content of ores, etc.)	short tons	16,297	7,529	10,500	6,426
Lime	thousand short tons	202	6,855	204	7,153
Natural gas	million cubic feet	57,416	28,995	57,604	30,242
Petroleum (crude)	thousand 42-gallon barrels	34,304	318,911	33,188	324,911
Pumice	thousand short tons	164	264	165	278
Salt	thousand short tons	705	10,090	839	11,449
Sand and gravel	thousand short tons	10,547	13,442	11,000	16,500
Silver (recoverable content of ores, etc.)	thousand troy ounces	3,134	13,633	2,988	13,743
Stone	thousand short tons	2,751	7,009	2,843	8,967
Zinc (recoverable content of ores, etc.)	short tons	22,481	16,636	18,300	12,590
Total			\$1,043,981		\$1,140,779

Value of items that cannot be disclosed: Asphalt, beryllium concentrates (bertrandite), cement, clay (kaolin), fluorspar (1976), iron ore, magnesium compounds, molybdenum, natural gas, liquids, phosphate rock, potassium salts, sand and gravel (industrial), sodium sulfate, tungsten concentrates, uranium and vanadium.

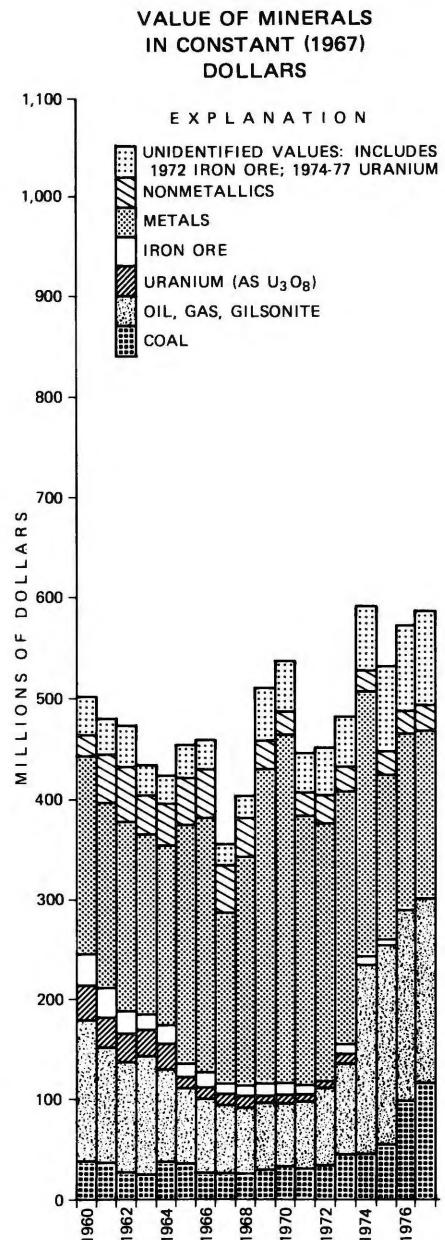
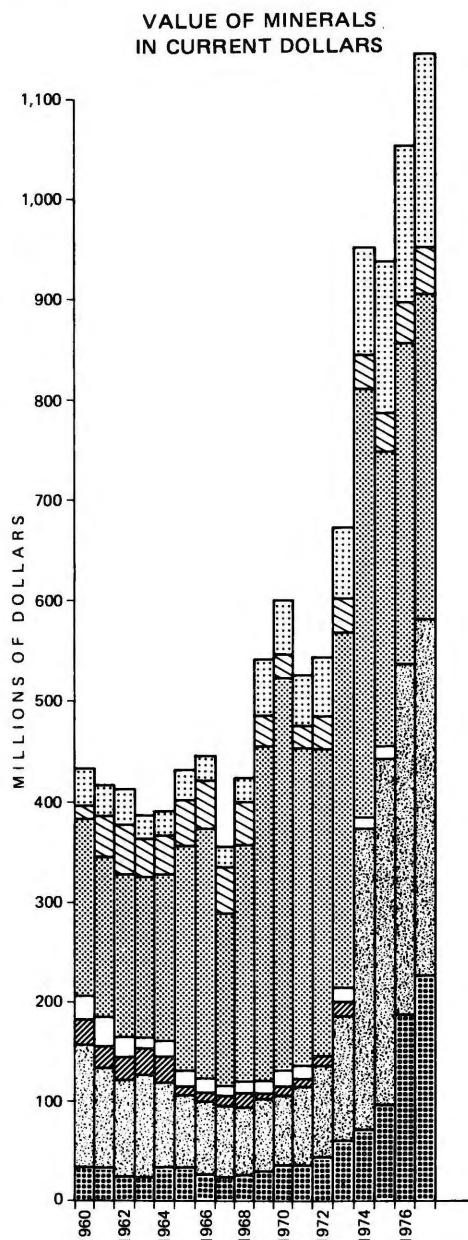
Source: U.S. Bureau of Mines annual preliminary report.

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

² Final yearbook figures.

³ Preliminary figures.

⁴ Not available.



³ State of Utah, Industrial Commission of Utah, General Summary of Coal Production, 1977, March 1, 1978.

Other commodities (table 1)

Decreasing production and values were recorded for lead, silver and zinc. Increases were recorded for clays, lime, pumice, salt, sand and gravel, and stone.

The U.S. Bureau of Mines withholds production information on 16 commodities, but total value of these rose considerably from \$154 million to \$192 million.

EMPLOYMENT

Total employment averaged 16,200 jobs, up 7.9 percent from the 1976 average¹. Expanding mining operations in coal, uranium, iron ore and additional activities in oil and gas exploration, accounted for most of the 1,100 new jobs in 1977. Rising coal mine activity set the pace for growth.

¹ Source: Utah Department of Employment Security, 1977 study, Employment Newsletter, January, 1978.

Federal lands¹

Percent of Federal lands in Utah dropped to 66.6 percent from 68.1 percent during the year. Including Indian lands the percentage was 70.9 compared to 72.5% in 1976. During 1977, acreage in the land withdrawal category reached 1,305,000 acres - up from 1,300,000 acres in 1976.

The division of federal, state and private land ownership in Utah is shown in figure 2 and table 2. National Forest allocations are shown on table 3.

BLM paid Utah \$8,710,050 during 1977 as its allocation of receipts. 99% of this was \$8,619,239 mineral leasing income from royalties, leases and rentals, mostly from oil and natural gas. Grazing rentals and timber sales accounted for \$87,920 and sale of land and materials was \$2,890.

¹ Source: U.S. Bureau of Land Management, Utah State Office, Information Division.

State Lands¹

The Division of State Lands reported that mineral lease revenue on state land was \$5,492,413 compared with \$4,550,421 in 1976 (figure 3). Royalty revenue was \$2,243,796 compared with \$2,325,418 in 1976. Total collections of \$19,247,886 were a large increase

Copper

increased from \$23.475 million in 1976 to \$30.728 million in 1977.

Coal

Utah's coal production reached another all-time high of 9,590,000 tons in 1977 according to U.S. B.M. preliminary data. In 1976 production was 7,967,000 tons. Value of coal production increased from \$182.712 million to \$225 million; average price per ton also increased from \$22.93 in 1976 to \$23.46 in 1977.

Gold

The Utah Industrial Commission reports 1977 coal production at 8,837,336 tons³. During the year 27 mines were active with 2,991 persons employed.

Surprisingly, despite poor market conditions, labor problems, and other difficulties, copper production increased over the previous year. The U.S. Bureau of Mines estimates 193,700 short tons was produced in 1977, up from 185,456 tons in 1976. Value of copper produced in 1977 was \$258,396,000, virtually equal to the 1976 total of \$258,157,000.

Gold production increased to 207,300 troy ounces from 187,316 troy ounces in 1976. Value of gold production

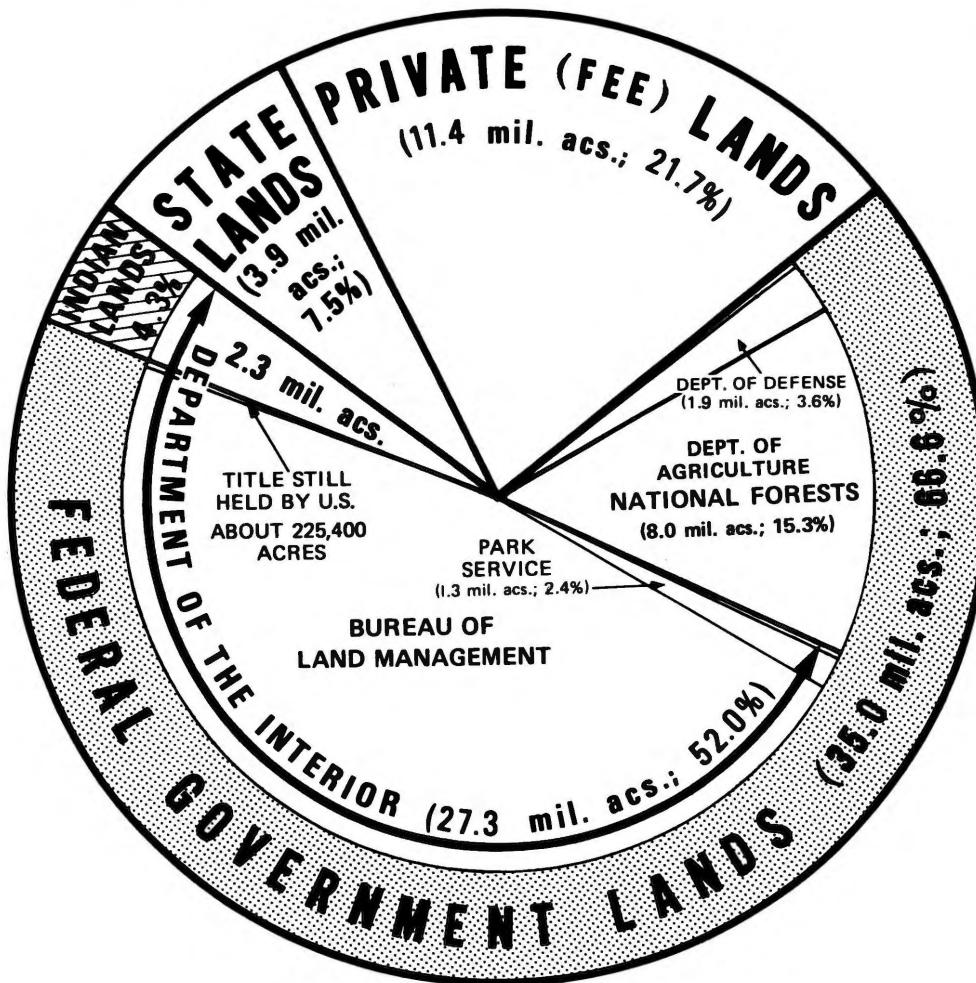


Figure 2. Utah land ownership.

Table 2. Distribution of land ownership in Utah, 1977

Land ownership	Millions of Acres	% of Total
FEDERAL LANDS		
Dept. of Interior - BLM	22.9	43.6
Dept. of Interior - Park Service	0.8	1.7
Dept. of Agriculture - Forest Service	8.0	15.3
Dept. of Defense	1.9	3.6
Other Federal Lands	1.3	2.4
Total	2.3	4.3
INDIAN LANDS		
STATE LANDS	3.9	7.5
PRIVATE OWNERSHIP (FEE LANDS)	11.4	21.7
TOTAL LAND AREA (52,541,440 acres)	52.6	100.0
Water Area (1,804,800 acres)	1.8	
Total Land and Water area	54.3	

Source: U.S. Bureau of Land Management, Utah State Office, Information Division

over the 1976 total of \$12,841,249, yet is still short of the all-time high of \$22.6 million in 1974. Increase in 1977 total collections was primarily from bond redemption, contract sales, interest on bonds and certificates of sales.

The state had 3,553,545 acres under oil and gas leases in 1977 compared

to 3,089,848 acres in 1976 and 2,986,809 acres in 1975. Box Elder County led in oil and gas leases with 458,037 acres. Grand County was second with 365,767 acres, followed by San Juan County with 285,287 acres. Other leases throughout the state were: 1,159,774 acres, metalliferous minerals; 112,561 acres, nonmetallics; 33,466 acres, bitumi-

nous sands; 574,883 acres, coal; 206,497 acres, oil shale; 205,430 acres, salt; and 180,161 acres, geothermal energy.

¹ Source: State of Utah, Division of State Lands, Fiscal Report July 1, 1976 to June 30, 1977.

Mineral Property Valuation¹

Total assessed valuation of Utah mineral properties was \$430,542,437, a decrease of \$70,891,361 from the \$501,433,798 assessed in 1976 and \$62,509,585 less than the 1975 assessment of \$493,052,022. Mining property valuation for 1977 was \$215,297,103; oil and gas was \$215,245,334. The mine occupation tax yielded \$8,413,065 to the state, mostly from oil and gas production.

¹ Source: Utah Geological and Mineral Survey statistical information compiled from records of State Tax Commission, Mineral Property Division. A complete review was published in Survey Notes, Vol. 11 No. 3, August, 1977.

PRINCIPAL COMMODITIES

Oil and Natural Gas Operations¹

Ninety wildcat wells resulted in 14 new field discoveries, more than in any previous year since 1965, when 16 new fields were discovered. Eight were gas discoveries and 6 found oil. The first well drilled in Rich County was the most significant gas discovery in Utah in a decade or more. Additional drilling will be required to confirm the importance of other discoveries, many of which were quite small. In 1976 35 wildcat wells resulted in only one small discovery.

Table 4 summarizes drilling activity in Utah for 1976 and 1977 and table 5 summarizes drilling by county and depth of well for 1977.

At year's end, about 120 locations were waiting to be drilled. Another 50 wells were at total depth and in some stage of being completed. Utah's active drilling rig count varied between 28 and 30 throughout most of the year, an increase of 5 to 7 over 1976. In the Greater Altamont-Bluebell fields, Duchesne and Uintah Counties, where 350 wells are producing, operators scheduled five more 11 to 13,000 foot test wells. South of Vernal, in the Natural Buttes unit and vicinity, new gas wells completed recently bring that field's total producing wells up to 85. Another 10 wells were in various stages of final completion work and 23 locations were being readied for drilling. Chevron's activities at Red Wash field

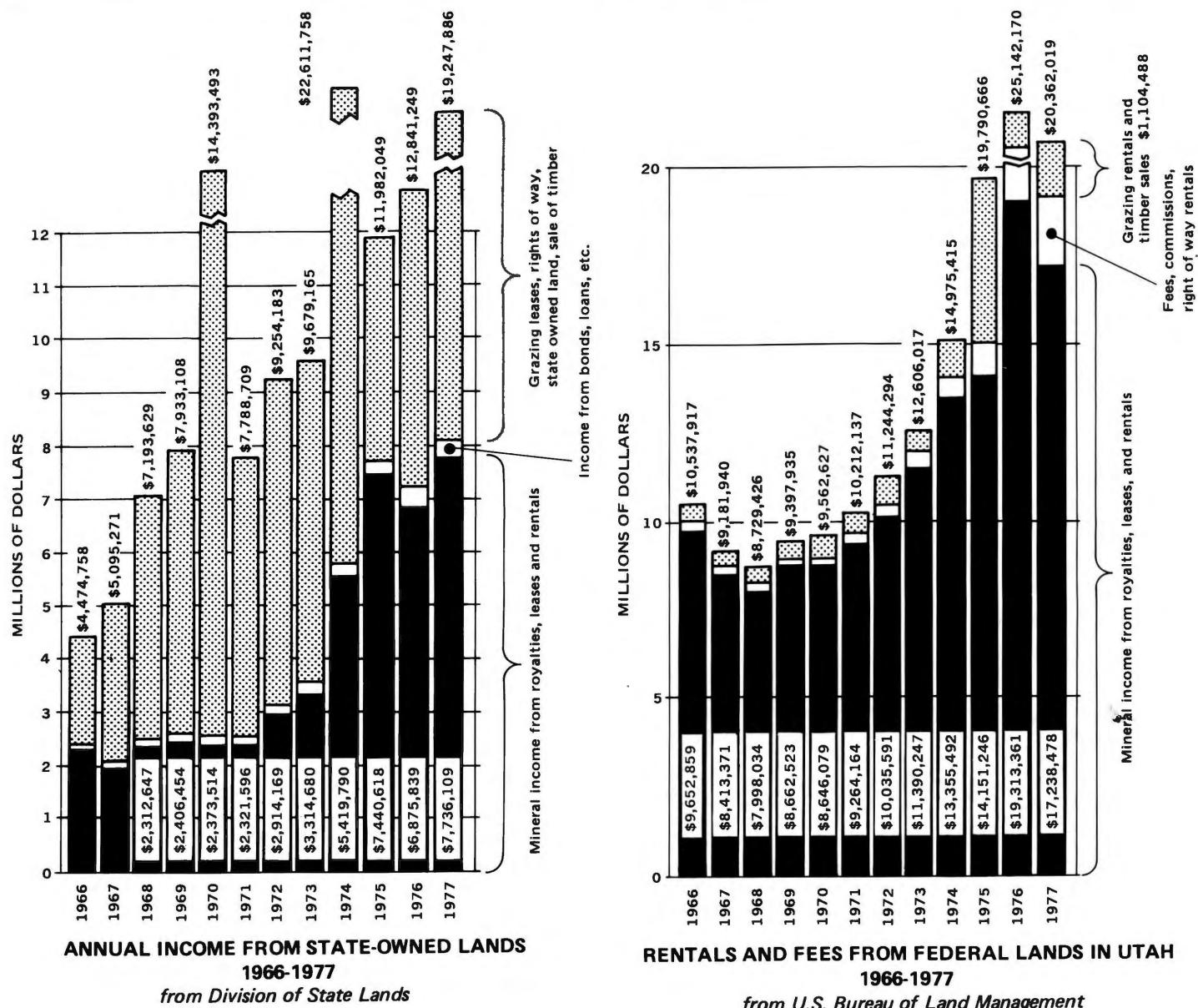


Figure 3. Source of income from Utah lands 1966-1977

Table 3. National Forest allocations in Utah

National Forest	Net Acreage	Amount Paid
Caribou	6,955	\$ 608.91
Sawtooth	71,183	4,544.14
Ashley	1,288,422	96,557.44
Cache	416,176	51,140.60
Dixie	1,883,902	138,010.54
Fishlake	1,424,021	91,681.04
Manti-LaSal	1,238,150	62,125.43
Uinta	812,790	64,640.42
Wasatch	848,672	120,673.00
Total-	7,990,271	\$629,981.52

Table 4. Drilling statistics

Year	Total Wells	Oil	Gas	Dry	Total Footage Drilled (Ft.)	Average Depth Per Well	Total Wildcat	Oil	Gas	Dry
1976	120	59	9	52	838,238	6,985	35	1	0	34
1977	281	131	46	104	1,672,210	6,103	90	6	8	76

Source: Petroleum Information Corporation Annual Resumes and Annual review, January, 1978

were also steady with new wells scheduled.

New producers completed in Summit County's Pineview oil field brought total wells there up to 16 at the end of the year. Other Summit County drilling was very active throughout 1977 with many shallow wells drilled to meet lease commitments and to obtain stratigraphic information.

Drilling of shallow wells in Grand County near the close of the year was also very active. December 1977 reports showed 28 exploratory wells scheduled, 23 field development wells being readied for drilling, and six wells in final stages of completion. In addition, 10 wildcat wells

were drilled in the county. Anschutz Corporation was the most active company in the area.

During the year "in-fill" drilling within the Greater Aneth field in San Juan County was active. In addition several exploratory tests were under way throughout southern Utah.

Overthrust Belt Region

Most significant oil discovery in Utah's Overthrust Belt region during the year was a 1,530 barrel per day completion by American Quasar Petroleum in Summit County. The discovery well, No. 19-1 UPRR, SW 1/4 NE 1/4 section 19, T. 2 N. R. 7 E., found production from the Twin Creek Formation from 11,000 to 11,030 feet. It is three miles southwest of the Pineview field and the same distance northeast of the operator's No. 35-1 UPRR, SE 1/4 NW 1/4 section 35, T. 2 N., R. 6 E., a completed discovery pumping 128 barrels of oil and 2 barrels of water daily. The No. 35-1 UPRR produces from Twin Creek from 11,190 to 11,385 feet. American Quasar, late in the year, also completed an extension of Pineview field flowing 368 barrels of oil, 143,000 cubic feet of gas and 63 barrels of water per day at the No. 5-1 UPRR. It was a deepening and a work-over with production from Twin Creek perforated 9,814 to 9,815 feet. American Quasar drilled the well from an old total depth of 10,527 feet to 10,534 feet. The well was originally abandoned in 1972 by Occidental Petroleum.

During December, American Quasar completed the No. 3-6 UPRR flowing at a combined rate of 3,712 barrels of oil and 3,351,000 cubic feet of gas per day. The well was completed from both the Twin Creek Formation (a 90 foot interval between 8,954 and 9,004 feet), and the Nugget Formation (a total of 115 feet between 9,339 and 9,553 feet). It is on the southeastern edge of the Pineview field, was drilled to 10,432 feet total depth. It is the 17th consecutive successful well in the field and is second in production only to the No. 3-3 UPRR (a half mile to the northwest) which was completed for 4,752 barrels of oil and 5,800,000 cubic feet of gas daily. American Quasar's No. 3-6 UPRR well is the seventh to have been dually completed from the Twin Creek limestone and the Nugget sandstone.

Several other exploratory wells were drilled in Summit County.

One of the more interesting drilling ventures of the year was a well drilled on

Table 5. 1977 Oil and Gas Discoveries

Duchesne County

Indian Canyon field
10 miles south of Duchesne

W.A. Moncrief

No. 14-1 Marsing NW SW 14-5s-
6w Green River Formation
(Eocene) 3,152-74
Flowed 930,000 Cubic feet
of gas per day

Sowers Canyon area
8 miles south of Duchesne

Burton-Hawks Inc.

No. 5-1 Nutters Ridge-
Federal NW SW 5-6s-4w
Green River Formation
(Eocene) 4,676-94
Flowed 488,000 cubic feet
of gas per day

Sowers Canyon area
12 miles south of Duchesne

Burton-Hawks Inc.

Odessa Natural Corp.
No. 15-1 Wire Fence Canyon
Federal NE NW 15-6s-5w
Green River Formation
(Eocene) 3,959-4,002
Flowed 4 barrels of oil, 6
barrels of water, and 232,000
cubic feet of gas per day

Sowers Canyon area

Burton-Hawks, Inc.

No. 25-1 Right Fork Antelope
Canyon-Federal NE NE 25-6s-
5w Green River Formation
(Eocene) 2,054-4,044
Flowed 1,154,000 cubic feet
of gas per day and 170
barrels of water

Emery County

Unnamed area
near Fenton

Fossil Petroleum Co.

No. 2 Ferron Creek SE NE 17-
20s-7e Kaibab Formation
(Perm.) 7,644-7,712
Pumped 60 barrels of oil,
50 barrels of water per day

Grand County

Unnamed area
Northeast of Crescent Junction
and north of Thompson

Anschutz Corporation

No. 1 Federal - 258
NW SE 5-18s-24e
Dakota Formation (Cret.)
3,928-45
Pumped 80 barrels of oil and
1 barrel of water per day.

Rich County

Hogback Ridge field
12 miles north of the town
of Randolph

American Quasar Petroleum

No. 20-1 Hogback Ridge NE SE
20-13n-7e Dinwoody and
Phosphoria Formations (Tr.-
Perm.) 22.4 million cubic
feet (Dinwoody) 10.0 million
cubic feet (Phosphoria)

San Juan County

Unnamed area
4 miles northwest of Lisbon
field; south of Moab

Husky Oil Co.

No. 15-25 Husky-Federal,
SW SE 25-29s-23e
Redwall Limestone (Miss.)
9,010-80
Flowed 5 million cubic
feet of gas daily

Summit County

Elkhorn field
Southeast of Coalville

American Quasar Petroleum

No. 19-1 UPRR
SW NE 19-2n-7e
Twin Creek Formation (Jur.)
11,000-11,030
Flowed 1,530 Barrels of
oil per day
No. 35-1 UPRR
SE NW 35-2n-6e
Twin Creek Formation
(Jur.) Pumped 128 barrels of
oil and 2 barrels of water per
day.

Lodgepole field
6 miles southwest of
Pineview field

American Quasar Petroleum
Energetics Inc., and
North Central Oil Co.

Uintah County

Sand Ridge Unit
19 miles south of town

Pacific Transmission
Supply Company

No. 23-25 PTS-Federal
NE SW 25-8s-23e
(continued)

Table 5. (*continued from previous page*)Uintah County (*continued*)
of Jensen

Unnamed area	Pacific Transmission Supply Co.	Wasatch Formation (Eocene) 5,124-42 Flowed 720,000 cubic feet of gas per day.	wildcat wells in Morgan County in an attempt to establish the first recorded production in the county.
Unnamed area 15 miles south of Ouray	Texas American Oil	No. 44-5 PTS-Federal SE SE 5-10s-24e Wasatch Formation ((Eocene) 4,864-70 Flowed 2,210,000 cubic feet of gas per day	Duchesne County
Roosevelt field Deeper formation test New pool discovery	Flying Diamond Oil	No. 1 Home-Federal NE NE 34-10s-19e Mesaverde Formation (Cret.) 7,768-9,433 Flowed 1,440,000 cubic feet of gas per day.	Three of the 14 new discoveries in Utah are gas wells completed in Duchesne County by Burton Hawks Company, Casper. The company and its partner, Odessa Natural Corporation, completed the No. 15-1 Wire Fence Canyon-Federal, NE 1/4 NW 1/4 section 15, T. 6 S., R. 5 W., for just under 5 barrels of oil and 232,000 cubic feet of gas per day from a depth of 3,969 feet. It produces from the Green River Formation. Duchesne field, which also produces from the Green River, is some 12 miles to the northeast. About 8 miles south of Duchesne field, the No. 5-1 Nutters Ridge-Federal, NW 1/4 SW 1/4 section 5, T. 6 S., R. 4 W., was completed flowing 488,000 cubic feet of gas per day from Green River. Production was established from 4,676 to 4,694 feet. The operator's No. 25-1 Right Fork Antelope Canyon-Federal, NE 1/4 NE 1/4 section 25, T. 6 S., R. 5 W., flowed 1,154,000 cubic feet of gas and 170 barrels of water daily from the Green River Formation, 2,054 to 4,044 feet. W. A. Moncrief completed the No. 14-1 Marsing, NW 1/4 SW 1/4 section 14, T. 5 S., R. 6 W., flowing 930,000 cubic feet of gas per day from Green River, 3,152 to 3,174 feet. The well, 10 miles south of Duchesne, was drilled to a total depth of 19,405 feet, in Cretaceous, but the deeper formations were nonproductive and the well was plugged back to 3,320 feet for completion.

Source: Petroleum Information Corporation, Annual Review, January 26, 1978.

the outskirts of Coalville by Colorado Energetics and Impel Corporation, both of Denver. The No. 13-3 Weber Coal Co. was drilled to 17,300 feet and was temporarily abandoned. No details were released other than that intermediate casing was set at 10,663 feet. By the close of 1977, no further operations had been conducted at the well site.

A remote deep test, 15 miles south of Wyoming's shallow shut-in Sulphur Creek field southeast of Evanston and nearly 16 miles east of Pineview field, was abandoned by Quintana Petroleum. The No. 20-1 Burt was drilled to 11,020 feet where 14 drillstem tests were run, but no shows of oil or gas were reported. It bottomed in the Weber Formation.

In Cache County, Amoco Production drilled the No. 1 Reese to 8,159 feet without shows. The remote test, a mile west of North Logan, was drilled without release of information.

The most significant gas discovery in Utah in many years was completed in Rich County by the American Quasar Petroleum Company. The No. 20-1 Hogback Ridge, NE 1/4 SE 1/4 section 20, T. 13 N., R. 7 E., 12 miles north of the town of Randolph, flowed 22,400,000 cubic feet of gas daily from Dinwoody (Triassic) Formation from 9,468-9, 630 feet. Flow was gauged through a three-quarter inch choke. It also flowed 9,967,000 cubic feet of gas per day from Phosphoria (Permian) Formation from 10,070 to 10,234 feet. The Phosphoria flow was gauged through

a one-half inch choke. Total depth is 10,910 feet. American Quasar reported a combined calculated absolute open flow rate of 242 million cubic feet of gas per day. The Hogback Ridge discovery well is located some 40 miles northwest of Wyoming's Ryckman Creek field and about 70 miles north of Utah's Pineview field. The well site is within seven miles of Northwest Pipeline's 22-inch main gas line which connects gas fields in the Rockies with the Pacific Northwest. The operator was drilling the No. 28-1 Hogback Ridge well a little more than a mile to the southeast at the end of the year.

Other work in Rich County during the year included two wildcat wells drilled by American Quasar Petroleum which failed to find production. The No. 1 Hoffman, a mile southwest of Randolph, reached a total depth of 15,400 feet. Tests below 9,000 feet recovered water. Approximately 10 miles to the southeast, American Quasar drilled the No. 23-1 Putnam to 14,183 feet. Mud and water without shows were recovered on tests. It is three and three-quarters miles west-southwest of the town of Woodruff. Amoco Production drilled the No. 1 Champlin -471, 30 miles north of Pineview field, to 6,100 feet without shows.

Near the end of the year, Amoco Production was drilling the No. 1 Amoco-Marathon WI a scheduled 11,200 foot test in Morgan County about 21 miles northeast of the town of Morgan, some 20 miles northwest of the Pineview field. During the year, Amoco drilled other

wildcat wells in Morgan County in an attempt to establish the first recorded production in the county.

Duchesne County

Three of the 14 new discoveries in Utah are gas wells completed in Duchesne County by Burton Hawks Company, Casper. The company and its partner, Odessa Natural Corporation, completed the No. 15-1 Wire Fence Canyon-Federal, NE 1/4 NW 1/4 section 15, T. 6 S., R. 5 W., for just under 5 barrels of oil and 232,000 cubic feet of gas per day from a depth of 3,969 feet. It produces from the Green River Formation. Duchesne field, which also produces from the Green River, is some 12 miles to the northeast. About 8 miles south of Duchesne field, the No. 5-1 Nutters Ridge-Federal, NW 1/4 SW 1/4 section 5, T. 6 S., R. 4 W., was completed flowing 488,000 cubic feet of gas per day from Green River. Production was established from 4,676 to 4,694 feet. The operator's No. 25-1 Right Fork Antelope Canyon-Federal, NE 1/4 NE 1/4 section 25, T. 6 S., R. 5 W., flowed 1,154,000 cubic feet of gas and 170 barrels of water daily from the Green River Formation, 2,054 to 4,044 feet. W. A. Moncrief completed the No. 14-1 Marsing, NW 1/4 SW 1/4 section 14, T. 5 S., R. 6 W., flowing 930,000 cubic feet of gas per day from Green River, 3,152 to 3,174 feet. The well, 10 miles south of Duchesne, was drilled to a total depth of 19,405 feet, in Cretaceous, but the deeper formations were nonproductive and the well was plugged back to 3,320 feet for completion.

Unsuccessful drilling was done in the county some 18 miles south of Cedar Rim field.

Uintah County

Four discovery wells resulted from drilling efforts in Uintah County. One of the new wells was a deeper pool formation discovery in the Roosevelt field. The three others were gas wells. Flying Diamond Oil Company completed the deeper pool discovery in Roosevelt field flowing 524 barrels of oil and 175,000 cubic feet of gas per day from the Wasatch Formation. The No. 1-16 Ute Tribal, SE 1/4 SE 1/4 section 16, T. 1 S., R. 1 E., USM, produced from a net 100 feet of perforations between 12,314 and 12,910 feet. The well bottomed at 13,170 feet. It extended the field three-quarters of a mile to the north. The company completed a second well in the field flowing 856 barrels of oil and

475,000 cubic feet of gas, confirming Wasatch Formation production. It was the No. 1-23 Hackford and was drilled to 13,007 feet.

Pacific Transmission Supply Company completed two Wasatch Formation gas discoveries in the county. The No. 44-5 PTS-Federal, SE 1/4 SE 1/4 section 5, T. 10 S., R. 24 E., flowed 2,210,000 cubic feet of gas per day. It produces from a treated interval perforated 4,864 to 4,870 feet, and is three miles southwest of Bonanza, about six miles southeast of the Chapita Wells field. The company's second discovery is approximately eight miles to the north-northwest. It is the No. 23-25 PTS-Federal, NE 1/4 SW 1/4 section 25, T. 8 S., R. 23 E. It flowed 720,000 cubic feet of gas daily from Wasatch Formation 5,124 to 5,142 feet. This discovery is within the Sand Ridge II Unit, operated by Pacific Transmission. The unit area covers 24,284 acres.

Some 15 miles south of Ouray, Texas American Oil, Midland, Texas completed the No. 1 Home-Federal, NE 1/4 NE 1/4 section 34, T. 10 S., R. 19 E., flowing 1,440,000 cubic feet of gas, three barrels of condensate, and 20 barrels of load water per day. Production zone is Mesaverde Formation between 7,768 and 9,433 feet. The operator drilled the test well to 10,780 feet.

Several oil and gas operators were active in Uintah County during the year including Exxon, USA, Taiga Energy, Gilman Hill, Great Basins Petroleum Company, Belco Petroleum, General Crude Oil and Gulf Oil. Chevron Oil added several development wells in its Red Wash field and Belco Petroleum conducted extensive drilling in the Natural Buttes vicinity.

Grand County

Grand County's lone discovery was by Anschutz Oil Corporation. The No. 1 Federal-258, NW 1/4 SE 1/4 section 5, T. 18 S., R. 24 E., 19 miles north of Cisco, was completed pumping 80 barrels of oil and 1 barrel of water per day from the Dakota Formation 3,928 to 3,945 feet. The oil is 41 gravity. The well was drilled to a total depth of 4,768 feet and plugged back to 4,392 feet. Closest production is four miles to the west at the Pear Park field and about the same distance to the north at Westwater field. Anschutz scheduled five new wells within a half mile of the discovery and announced a 15,000 foot test nine miles south-southwest of Segundo

Canyon gas field, about 26 miles northwest of Cisco.

Mobil Oil was drilling a 20,000 foot Mississippian test some six miles west-northwest of Cisco at the end of the year. The No. C-1 McCormick-Federal is on the Pinto Wash unit operated by Mobil. The unit area, approved by the U.S. Geological Survey in June, includes 25,580 acres.

San Juan County

Utah's southeastern San Juan County had a new gas discovery completed by Husky Oil Company at the No. 15-25 Husky-Federal, SW 1/4 NE 1/4 section 25, T. 29 S., R. 23 E. It flowed 5,000,000 cubic feet of gas and 25 barrels of condensate per day from Mississippian 9,010 to 9,020 and 9,032 to 9,080 feet. It was drilled to 9,578 feet, total depth. Husky set production casing after gas flowed at a rate of 7,400,000 cubic feet per day on a test of the formation. It is four miles northwest of Lisbon field, a Mississippian oil and gas pool, and a mile and a half south of Wilson Canyon field, where production is from Cane Creek (Pennsylvanian). Husky scheduled an east offset to the discovery well to be drilled to about 9,900 feet.

Drilling in the county included a 5,853 foot failure five miles northeast of Hatch field by Oil Development of Utah. A drillstem test in upper Ismay Formation recovered 303 feet of gas cut mud. Coquina Oil abandoned the No. 1 Frizell, a scheduled test of Pennsylvanian eight miles southeast of Monticello. It went to 2,690 feet without shows. Superior Oil completed several in-field development wells in the Aneth area, and Texaco Inc. continued its development program in the Aneth vicinity.

The Basin & Range Province

The western 40% of Utah lies in the Basin and Range Province in western Utah. Although there were no discovery wells during the year, several significant developments took place.

Amoco Production announced in November that it would begin its exploration program in the Great Salt Lake. Approval was requested for six locations - two in the north arm and four in the south arm of the lake. The company estimated costs of at least \$5 million would be incurred for the first test well with somewhat declining costs for the

remainder. Projected depths range from 3,500 to 11,000 feet.

Drilling is scheduled to begin in mid-May 1978 from a rig mounted on an anchored barge. Amoco acquired some 606,000 acres of oil and gas leases on the Great Salt Lake in 1973.

Willard Pease abandoned the No. 3 Gillmore-Fee, four and a half miles west of Salt Lake City, early in 1977. The well went to 2,180 feet. No shows were reported.

In Washington County, Dwayne Lovell's No. 1 Lovell-State, 7 miles south of the town of Washington was abandoned at 2,548 feet. Oil shows were reported at depths below 2,210 feet.

Gulf Oil drilled the No. 1 Banks near Spanish Fork, Utah County, to 12,995 feet without release of information. Gulf temporarily abandoned the well late in the year. During November, Union Oil of California announced it would drill the No. 1 Federal J-9 an 8,000 foot test in Utah County about 17 miles north of the town of Fairview.

Two remote wildcat wells were scheduled late in the year in Millard County. Tiger Oil Company announced location for a 17,500 foot test at the No. 1 USA Bishop Spring, 14 miles east of the Nevada state line. Argonaut Energy and Cominco American announced they will drill a 10,000 foot wildcat on a geophysical prospect in the northeast part of the country, 10 miles north of Delta.

Basin and Range - Plateau Transition

Throughout the year industry attention was focused on two deep test wells in the central Utah "Hingeline" area. In Juab County, about 15 miles south of Nephi on the western edge of the San Pitch Mountains, Dixie Resources was drilling below 14,000 feet at a scheduled 18,000 foot test of the Mississippian at the No. 1 Gunnison-State. The operator had set intermediate casing to about 13,000 feet in the well. To the northeast, near the town of Moroni, Hanson Oil was drilling below 17,000 feet at the No. 1-AX Moroni, a remote well in Sanpete County. Plans call for a 20,000 foot test, with the Nugget Formation expected at about 18,000 feet. In late April, gas shows were reported in Cretaceous at a depth of 11,744 feet and below 11,784 feet. No attempt to drillstem test the zones was made.

Emery County

Fossil Petroleum completed a Kaibab Formation discovery in western Emery County pumping 60 barrels of oil and 50 barrels of water per day. The No. 2 Ferron Creek, SE 1/4 NE 1/4 section 17, T. 20 S., R. 7 E., produces from 7,644 to 7,708 feet. The discovery is a mile and a half northwest of a Kaibab Formation oil well in the Ferron field, a half mile west of the town of Ferron. Ferron field produces gas from the Ferron Sandstone. About 19 miles northeast of the Ferron field, William G. Bush abandoned the No. 1 Bush-USA at 1,578 feet. There were no reported shows of oil or gas. Five miles north of the town of Orangeville, T.L. Britt and Associates abandoned the No. 1 Brock Bank at 1,957 feet, total depth. The wildcat had gas shows at 1,717 feet but completion was unsuccessful.

Five wells were drilled to depths of 205 to 400 feet by St. Croix Exploration, St. Paul, Minnesota, 37 miles southeast of the town of Emery. Oil shows were recovered but tests failed to establish commercial production. Last Chance, a shut in Moenkopi Formation gas field, is about 33 miles southwest of the St. Croix tests.

Information for this section is compiled from:

State of Utah, Division of Oil, Gas & Mining, Weekly Notices of Intention to Drill, Abandon, and Convert, and Oil & Gas Well Completions.

Petroleum Information Corporation, Rocky Mountain Region Drilling Reports.

Petroleum company personal communications to the author and "Press Releases".

OIL AND GAS LEASING AND LEASE SALES¹

Heavy oil and gas leasing activity was recorded at the U. S. Bureau of Land Management land office in Salt Lake City during late 1976 and into January 1977. About 288,000 acres in Beaver, Iron, Kane, Washington and Garfield Counties in the southwestern part of the state were filed on in early January. The BLM then announced an increase in annual rental rates for oil and gas leases from 50 cents to \$1 an acre effective February 1, and lease applications dropped drastically.

Oil and gas leases on 3,065 acres

in San Juan County were offered by the BLM in June. A. Kimball, Nebraska independent was high bidder at the sale with \$267.12 an acre for 120 acres in the Lisbon area. An offering of 42 parcels totaling 14,552 acres in September received a total bonus of \$891,088.35. High bids totaling \$507,433.86 were received by BLM for leases on 25 parcels of land in five Utah counties at another sale also held in September.

The Uintah and Ouray Agency, Fort Duchesne, held an oil and gas lease sale in August where bids totaling \$800,989.84 were received, an average of \$16.52 per acre. Continental Oil paid \$64.90 an acre for two tracts covering 481.10 acres in the Natural Buttes field area. A total of 48,476.15 acres were sold at the sale.

The Utah Department of Natural Resources, Division of State Lands held sales during the year in February, March, April, July and November. Per acre bids tended to be modest with the highest recorded for lands near the Greater Altamont-Bluebell Field in the Uinta Basin. Also included were geothermal and coal leases.

In other activity, the State Land Board rejected an application by Ed Pendleton, Denver, for oil and gas leases on some 35,095 acres in the Bear Lake area, and an application by Oliver Gushee covering 9,826 acres of land on the west shore of Great Salt Lake.

¹ Data for this section compiled from:

BLM, Weekly Lease Applications, Salt Lake City, Utah.

Uintah and Ouray Agency, Fort Duchesne, Utah

State of Utah, Department of Natural Resources, Division of State Lands.

Petroleum company personal communication as well as "Press Releases".

OIL AND GAS PRODUCTION¹

Oil production decreased during 1977. Preliminary USBM figures (table 1) indicate a total of 33,188,000 barrels of oil produced in 1977 in Utah. Utah fields produced 100,247 barrels daily which indicates a continuing decreasing trend since 1975's peak of 109,659 barrels daily (see table 6). The Greater Altamont-Bluebell field at the end of 1975 was producing 56,646 barrels daily, accounting for 56.2 per cent of Utah's

total production. In late 1977 the field had slipped to 35,791 bopd to 38.5 per cent of the state's total production. Gas and oil production records for 1976 and 1977 are shown on table 7 and table 8.

¹ Source: Department of Natural Resources, Division of Oil, Gas and Mining,

Table 6. Crude Oil Annual Production (Barrels)

	Total Production	Daily Average
1976	37,316,607	102,237
1977	36,590,222	100,247

Source: Department of Natural Resources, Monthly Production Report, Division of Oil, Gas and Mining, Utah

Table 7. Natural gas Annual Production (Million Cubic Feet)

	Gross Production ¹	Marketed Production ²
1976	77,090	57,416
1977	80,791	*57,604

Source: 1. Department of Natural Resources, Monthly Production Report, Division of Oil Gas and Mining,

2. U. S. Bureau of Mines Statistics - Annual *USBM Preliminary

Oil Shale¹

A cost-sharing contract to Geokinetics Oil Shale Group, Concord, California, was awarded in July, with a total estimated project cost of more than \$9 million for an in-situ oil shale project in the Uinta Basin. The contract, awarded by the Energy Research and Development Administration, was announced by Senators Jake Garn and Orrin Hatch. The Geokinetics Group, composed of Geokinetics, and Aminoil USA Inc. produced Utah's first oil from oil shale during the year - a total of 1,653 barrels. The "fluff and puff" method was used in which thin but rich oil shale beds at shallow depth are fluffed up by charges of conventional explosives set off in shallow drill holes. The shale is then ignited and the oil retorted by the heat produced. Crude shale oil flows by gravity to the lower end of the pattern of explosive holes, and a small pump lifts the oil a few tens of feet to the surface.

TOSCO Corporation holds leases on 19,917 acres south and east of Ouray and south of the White River in the Sand Wash area. Of this 14,688 acres have been incorporated in a unit agreement and a cooperative plan of development approved by the State and TOSCO. Drilling crews were working during the year at a site designated for a pilot shaft. Environmental studies were also being conducted.

Table 8. Production of Utah's Largest Oil Fields for 1977

	Total Production	Average Barrels Per day	Percent of State Total	December 1977	
				Barrels Per day	Percent of Total
Greater Altamont - Bluebell Duchesne and Uintah Counties	13,824,875	37,876	37.8	33,798	33.7
Greater Aneth, San Juan County	8,258,120	22,625	22.6	21,487	21.4
Greater Red Wash, Uintah County (Includes Walker Hollow and Wonsits Valley)	3,406,435	9,333	09.3	9,643	09.6
Upper Valley Garfield County	932,438	2,555	02.5	2,610	02.6
Lisbon San Juan County	954,982	2,616	02.6	2,692	02.8
Brider Lake Summit County	315,115	863	00.9	921	00.9
Pineview	4,236,159	11,006	11.6	14,765	14.7
Remaining Oil Fields	4,662,098	12,773	12.7	14,331	14.3
Total	33,069,910	100,247	100.0	100,247	100.0
Liquids	3,518,659				
Oil Shale	1,653				
Total	36,590,222				

Source: Compiled from Division of Oil, Gas and Mining Monthly Production Reports.

UTAH MINERAL OPERATIONS

Alunite

The Department of Interior released the final environmental impact statement for the proposed alunite processing plant and mine in Beaver County in September¹. The Alumet Company of Golden, Colorado is project sponsor. Alumet is a partnership of the National Steel Corporation, Pittsburgh; the Southwire Company, Carrollton, Georgia; and Earth Sciences, Inc., of Golden. Alunite ore would be mined from the Wah Wah Mountains and then processed into alumina at the rate of 500,000 tons a year. The development is scheduled to produce 370,000 tons of potassium sulfate fertilizer, up to 1.7 million tons of phosphate fertilizer, and up to 20,000 tons of aluminum fluoride. Alumet says proposed costs are at \$500 million (in 1976 dollars) and by 1980 costs could reach \$700 million. The Environmental Protection Agency released a report saying that the plant would violate the clean

air act standards prohibiting significant degradation of existing air quality. It said the project could either change its emission control system or move the plant to flatter terrain where pollutants would disperse farther. The proposed operation would employ about 1,000 people.

¹ Source: BLM news release, September, 1977.

Barite

Both ground and crushed barite are processed in the Salt Lake City area from mines in Nevada. More than 120,000 short tons were handled by five companies in the Salt Lake vicinity during the year. The All Minerals Corporation, Murray plant facilities; Custom Milling and Supply; Eisenmann Chemical; Rocky Mountain Refractories, and Westemco, all of Salt Lake City, processed ore valued at more than \$3 million during the year.

Beryllium

No report.

Clay and Shale

Eight counties in Utah produce clay and shale for commercial purposes.¹

Summit County is the leading producer with more than half of total production. Ten companies with 17 properties are active. Types of clay produced include kaolin, fire clay, bentonite, fullers earth and commercial clay and shale. During 1976, 206,000 short tons were sold for \$531,000. In 1977, estimates of production are in excess of 307,000 tons, valued at more than \$819,000. Most clays are used as expanded materials in making lightweight aggregate, in manufacturing building brick, and as catalysts in oil refining.

¹ U.S. Bureau of Mines

Coal¹

The Mining Enforcement and Safety Administration, U.S. Department of Interior reported more than 6.4 million tons of coal were produced in Utah to the end of September, 1977². The U.S. Bureau of Mines preliminary report estimated 9,590,000 tons valued at \$225,000,000 for the year, another all-time high. The Utah Industrial Commission reported production of 8,837,336 tons in 1977³. Coal production records are found in table 9 and table 10.

Expansion programs at several Utah mines were under way during 1977; new mines started in 1976 came into full production. New mining operations were announced and several new agreements were signed to increase coal production from existing properties. And, several companies announced acquisition of coal leases with plans for immediate development.

A strike idled nearly 2,375 union coal miners in early December when contract talks broke down between the United Mine Workers and coal operators. Work stopped at the state's 14 union mines and pickets were placed at several non-union mines. The last coal strike in Utah, which lasted about a month, was in 1974.

Kennecott Copper Corporation filed proposals with the Federal Trade Commission to sell Utah Power & Light Company the Peabody Coal properties in Emery County. Involved in the sale of more than \$25.5 million are Peabody's Deer Creek and Wilberg mines as well as other properties in T. 17 S., R. 7 E., west of Huntington in Emery County. Peabody has operated the mines under a contract with Utah Power & Light. The Deer Creek mine is in the 900,000 tons per year class and currently supplies the Huntington Power Plant. The Wilberg

¹ Source: Data for this section compiled from press releases from companies and federal agencies.

mine produces about 220,000 tons of coal yearly and is scheduled to supply the UP&L's Emery Plant.

Emery Coal Inc., Salt Lake City, sold 13,080 acres of coal leases in which it has a 50 per cent interest, along with pending preference right lease applications, to Atlantic Richfield Company in June. The lands, within the Emery Coal field, T. 22 and 23 S., R. 6 E., are south of Emery. The field, operated by Kemmerer Coal Company and Consolidation Coal Company, produces some 150 to 200,000 tons yearly. Emery Coal Inc. indicated the area contains at least a 25 million ton reserve.

Table 9. Utah Coal Production by County (short tons)

Year	Carbon	Emery	Kane	Sevier	Summit	Total
1970	4,234,991	395,700	670	89,128	12,511	4,733,000
1971	3,954,362	501,876		157,808	12,432	4,626,478
1972	3,636,338	942,822		184,023	38,817	4,802,000
1973	3,613,779	1,697,110		338,979		5,649,868
1974	3,425,686	2,229,789		391,361		6,046,836
1975	3,464,972	2,645,103		827,462		6,937,537
1976	4,124,011	2,800,632		1,043,248		7,967,891
1977	4,989,275	2,508,261		1,336,500		8,837,336

Cumulative production of coal 1870 - 1977

359,372,000

Source: U.G.M.S. statistical compilations based on U.S. Bureau of Mines, Utah Mining Association, and Utah Industrial Commission records.

Table 10. Utah Active Coal Mines 1977

	Coal Companies	Coal Mines	Area
1.	American Coal Company	Beehive, Deseret and Little Dove mines	Wasatch Plateau West of Huntington, Emery County
2.	Braztah Corporation	Braztah No. 3 and No. 5 mines	Book Cliffs Spring Canyon, Castle Gate and Kenilworth area, Carbon County
3.	Coal Search Corporation	Knight mine	Wasatch Plateau Southwest of Emery, Sevier County
4.	Consolidated and Kemmerer Coal Companies	Emery mine	Emery South of Emery, Emery County
5.	Co-op Mining Company	Co-op mine	Wasatch Plateau Northwest of Huntington, Emery County
6.	Kaiser Steel Corporation	Sunnyside No's. 1, 2, & 3	Book Cliffs Sunnyside area, Carbon County
7.	Peabody Coal Company (American Coal Company)	Deer Creek mine Wilberg mine	Wasatch Plateau West of Huntington, Emery County
8.	Plateau Mining Company	Star Point No. 1 and Star Point No. 2 mines	Wasatch Plateau. Wattis Canyon area, Carbon County
9.	Soldier Creek Coal Company	Soldier Creek mine	Book Cliffs. Area northeast of Price Carbon County
10.	Southern Utah Fuel Company	Convulsion Canyon mine	Wasatch Plateau East of Salina, Sevier County
11.	Swisher Coal Company	Gordon Creek No. 2 and No. 3 Huntington No. 4 mines	Wasatch Plateau Swittes area, Carbon County
12.	Trail Mountain Coal Company	Trail Mountain mine	Wasatch Plateau Huntington area, Carbon County
13.	United States Fuel Company	King mine No. 4	Wasatch Plateau Hiawatha area, Carbon and Emery County's
14.	U. S. Steel Corporation	Geneva mine	Book Cliffs Horse Canyon area south of Sunnyside, Carbon County
15.	Wes-Pac Energy Corporation	Thompson Coal mine	Southern Book Cliffs region Thompson Canyon area, Grand County
16.	Western States Coal Corporation	Dog Valley mine	Emery South of Emery, Emery County
17.	Valley Camp of Utah, Inc.	Utah No. 2 and Belina No. 1 mines	Wasatch Plateau North of Clear Creek, Whiskey Canyon area, Carbon County

Source: U.G.M.S. records based on U.S. Bureau of Mines, Utah Mining Association and Utah Industrial Commission reports.

Intercoast Coal Company, a Sacramento, California firm, acquired 40,000 acres of coal leases in northern Grand County from several individual lease holders. The company conducted a development feasibility study of the acreage and is further evaluating its program.

A \$260 million agreement was signed early in the year by Swisher Coal Company of Price and the Mississippi Power Company, Patagonia, Mississippi. Swisher is to provide the utility with 13 million tons of coal over a 15-year period to fire its 600-megawatt power plant in Mississippi. Swisher expects to increase employment rolls at its Wasatch Plateau mines from the present 110 to 300 persons by mid-1979 and will expand its coal washing facilities and construct a unit train loading facility. The Swisher operated mines, Gordon Creek No. 2 and 3 in Carbon County, have averaged some 400,000 tons of coal yearly.

Utah Coal & Energy, Kearns, Utah, announced in October that it would commence mining operations at its Black Hawk mine, section 36 T. 3 N., R. 6 E., in Summit County near Upton east of Coalville. Construction facilities were started last year where a 10-foot coal seam in the Frontier Formation is expected to yield 30 million short tons. It is estimated that production will increase to 2,000 tons per day by April, 1978.

Two contract agreements, totaling some \$55 million, were made by Coastal States Energy Corporation of Houston which will further aid economic conditions in Sevier County. The company through its subsidiary, Southern Utah Fuel Company, signed an agreement with the Salt River Project of Arizona to supply up to 530,000 tons of coal per year to its new Coronado Generating Station currently under construction near St. Johns, Arizona. The transaction, valued at some \$35 million, calls for deliveries to start in January, 1980. The company also completed a four-year, \$20 million agreement with Kennecott Copper to supply them with 1.5 million tons of coal. The coal is to be shipped to Kennecott's electric generating facility at the smelting and refining complex at Magna, Utah. Coal will come from Southern Utah Fuel Company's Convulsion Canyon properties near Salina, Utah. The mine, located in T. 21 and 22 S., R. 3 to 6 S., produces more than one million tons per year.

A drilling program and coal lands held in the Salina area by Mountain

States Resources Corporation was started in August. Ute Energy Company, Oklahoma City, is doing the drilling to obtain reserve and geological data for mine planning and market evaluation. Mountain States, which several years ago had applied for federal preference right leases in the area, was awarded the leases in April.

In late November, Atlas Resources, Inc., Houston, announced plans for a coal-loading facility four miles west of Green River and an open-pit coal mine in the Factory Butte area north of Hanksville. The coal is to be shipped to Nevada Power Company, Moapa, Nevada. The mine will be operated under a partnership of Atlas Resources and Dirty Devil Mining Company. Operations are to begin by April, 1978. 22 to 25 trucks will be used on a two-shift basis between the mine and the loading facility. Amount of coal to be furnished the Nevada Power Company or reserve estimates of the mine have not been revealed.

Sources: Data for this section compiled from:

¹ BLM news releases.
Company reports and press releases
U.S.B.M. reports and personal communication

² MESA Safety Reviews, U.S. Department of the Interior, Mining Enforcement and Safety Administration, Washington, D.C. "Coal-Mine Injuries and Worktime", Table No. 7, p. 9, September 1977.

³ State of Utah, Industrial Commission of Utah, General Summary of Coal Production, 1977. March 1, 1978.

Non Ferrous Metals Copper, Gold, Lead, Silver and Zinc¹

Copper production at the Bingham Mine peaked in 1969 when some 589.4 million pounds were produced. During 1970 production was 586.3 million pounds; in 1971, 510.5 million pounds; and in 1976 only 377.6 million pounds. Although 1977 production is preliminary, it is thought that total production of the mine will be somewhat higher than the 1976 total. Copper production was halted in Utah, Arizona, New Mexico and Nevada by a 19 day strike in July. Gold production since 1972 has averaged 180 to 250 thousand troy ounces. However, a jump from 187, 000 troy ounces in 1976 to around 207,000 troy ounces was recorded. The Bingham mine also produces silver, molybdenum, selenium and

palladium. Sulfuric acid is produced as a by-product of smelting. A recovery plant now under construction is designed to produce upwards of 144,000 pounds of uranium oxide annually.

The United Park City Mines Company reported in early 1977 that mining development and exploration would continue for at least the next three to five years at its Park City Ventures. Ores from the Bingham district were purchased during 1977 for processing at the Park City Ventures mill.

Park City Consolidated Mining Company announced a letter of intent to purchase the Agathos Consolidated Mining Company which owns 21 claims, approximating 1,000 acres of mineral rights, in the Smoke Creek mining district of Wasatch County. The lead-zinc-silver claims, which underlie state park lands, have been inactive for several years. Mill site and access rights are included in the sale agreement.

United Minerals International reopened the old South Hecla mine on the south side of Little Cottonwood Canyon beneath the Alta "Wildcat" run ski lift. The firm budgeted \$1.2 million to renovate the old mine leased from Alta United Mines and to construct a mill in Orem to process the minerals. The 1,000 ton capacity of the mill, on a per-day basis, will handle other projects of United Minerals in addition to the Alta mine. The Alta mine is expected to produce 150 tons of ore rich in bismuth, silver, gold, tungsten, lead and zinc daily. United plans to drill and blast 2,200 additional lateral feet from the existing 150 foot shaft. The ore will be transported to the Orem mill by trucks. Active Metal Mines in Utah 1976 1977 are shown in Table 11.

Fluorspar

Fluorspar, used as flux in the steel industries, is produced from mines in Juab County. Production the past several years has been erratic and has declined from 1975 through 1977. Operations in Juab County include the Emerald properties in the Drum Mountain area northwest of Delta, owned by Spor Brothers of Delta; the Fluorine Queen mine in the Topaz area, by the U.S. Energy Corporation; and Willden Brothers Company's Lost Sheep Incline mine in the Thomas Range near Topaz Mountain.

Geothermal

Geothermal activities during the

Table 11. Active Metal Mines in Utah 1976 - 1977.

Mine	Metals	Sold to
Amax Arizona Inc., Ball Park Mine, East Tintic District, Utah County	Lead, Silver, Zinc	Bunker Hill Co., Kellogg & Bradley, Idaho
Chief Consolidated Mining Company, Kennecott Burgin Mine, East Tintic District Utah County	Gold, Lead, Silver, Zinc	Bunker Hill Co.,
State Line Mining & Milling Company, Gold Dome Mine, Iron County	Gold, Silver, Lead, Zinc	
Glenn Moughan, Susan Dee Mine, Millard County	Silver, Copper	
Deer Trial Development Corporation, Deer Trail Mine, Piute County	Copper, Gold, Lead,	Idarado Mining Co.,
Eureka Standard Consolidated Mining Company, Utah County	Copper, Gold, Silver	Kennecott Copper Corp
Kennecott Copper Corp. Utah Copper Mine, Salt Lake County	Copper, Gold, Silver, Lead, Zinc, Molybdenum and others	
Park City Ventures, Ontario Mine, Summit County	Gold, Silver, Copper Lead, Zinc	
South Standard Mining Company, Trixie Mine, East Tintic area	Copper, Gold, Silver	Kennecott Copper
United Park City Mines Company, Uintah, Blue Ledge and Snake Creek, Summit and Wasatch Counties	Lead, Silver, Zinc	
U.V. Industries, Inc., U. S. & Lark Mine (discontinued 1976) Salt Lake County	Lead, Silver, Zinc	

year were primarily in the Milford region, and consisted largely of programs and operational projects filed with the U. S. Geological Survey.

Plans for drilling 14 wells for Phillips Petroleum, 23 wells for Union Oil Company, and one for Geo-Thermal Republic were filed with USGS, Menlo Park, California. The wells are within the three Known Geothermal Resources Areas (KGRA's) of Beaver County in Roosevelt Hot Springs, Cove Fort-Sulphurdale and Thermo Hot Springs. Plans were approved in August; Phillips and Union Oil announced drilling operation would commence shortly.

Nine leasing units, approximately 16,308 acres, in Beaver, Iron, Millard and Sevier counties were offered in

competitive bids by the Bureau of Land Management in September. Acreage lies within the Cove Fort area, the Monroe-Joseph vicinity of Sevier County, the Thermo Hot Springs area of Beaver County and the Newcastle area of Iron County.

Final approval for transfer of BLM and A.L. McDonald properties to Bountiful City for the development of geothermal property in Roosevelt Hot Springs was made in November. The Bountiful City Council is studying procedures for development, with the possibility a well will be drilled in the early future.

Phillips conducted tests at a number of wells at Roosevelt during the year. Thermal Power Company was drilling a well in the vicinity at the close

of the year and a deep test well was being drilled by Republic Geothermal at the Thermo area. Chevron Oil plans drilling between Roosevelt and Cove Fort, and Getty Oil indicates it is planning a test well at Roosevelt.

During October, the U.S. Department of Energy (D.O.E.) announced it had awarded six contracts totaling more than \$4 million to provide geothermal reservoir information on two known geothermal resource areas in southwestern Utah. Seismic Exploration Inc., Salt Lake City, received \$11,740 to obtain and analyze seismic data at Roosevelt Hot Springs. Union Oil received some \$2,559,258 to drill, test and provide information from three 10,000 foot wells in the Cove Fort area. Thermal Power Company is to receive \$282,000 to provide data from two test wells at Roosevelt. The Geothermal Power Company will receive up to \$710,468 to drill 15 heat gradient holes 300 to 500 feet deep; 2 observation wells and 3 projected 10,000 foot test wells will be drilled in the Roosevelt area. Also included is a \$67,330 contract to the University of Denver to provide data from an existing productive geothermal well in Roosevelt and to Getty Oil Company to drill a 6,000 foot well in the area. Getty's contract is for \$11,740.

In late December, Utah Power & Light Company announced it had signed an agreement to negotiate a contract with Phillips Petroleum and Rogers International for completion of a 52-megawatt plant at Roosevelt Hot Springs. Under the proposed terms of the agreement, UP&L will purchase power and Phillips will supply geothermal steam to Rogers International, which will be responsible for financing, design and construction of the power plant. Plans are to have the plant in operation by June, 1982.

Gypsum

Gypsum is produced in four counties in Utah. The two largest operations are in Sevier County by U.S. Gypsum and Georgia Pacific Corporation. Over 100,000 tons ore mined annually. Gypsum is also mined in Juab, Millard and Sanpete County.

Halloysite clay

Filtrol Corporation suspended operations at its Dragon Consolidated halloysite clay mine in Juab County in June. The mine, southwest of Eureka in section 31, T. 10 S., R. 2 W., Tintic mining district, has been operated by

Filtrol Corporation since 1953. Production of the halloysite clay, used as a catalyst in oil refining, was 500 tons monthly. About 35 employees were affected.

Filtrol is also operator of the Emerald properties in the Drum Mountains northwest of Delta and maintains a halloysite processing plant in Salt Lake City.

Iron

The Iron Springs District, on the east edge of the Basin and Range Province in southwestern Utah, is the largest iron-producing district in the western states. Principal ore bodies are located 12 to 20 miles west of Cedar City where several open-pit mines are in operation. Colorado Fuel & Iron Corporation's Comstock mine and the Utah International Inc.'s Thompson mine are the area's principal producers.

Magnesium compounds, chlorine, potash

N. L. Industries, Inc., announced resumption of magnesium chloride production at its Rowley area plant and facilities southwest of Great Salt Lake in Tooele County's Lakeside mining district during February. The company expected to be producing at a 25,000 ton annual rate by the end of the year. Chlorine, a byproduct of the magnesium extraction process, also was being produced and shipped to the Thatcher Chemical Company for manufacturers of bleaches and water purification products. About 45 to 50 per cent of the plant's magnesium output goes into aluminum alloys used to make beverage cans and other aluminum products. Kaiser Aluminum and Alcoa Co. plants in the northwestern United States are purchasers of the Utah product. The Doehler-Jarvis Castings Company, a division of N. L. Industries in Toledo, Ohio is the principal products producer for aluminum, zinc and magnesium die castings for automotive and power tool industries. The Rowley plant had shut down in 1975 because of technical difficulties.

Magnesium salts are also produced by Kaiser Chemicals at its Bonneville Ltd., plant in the Silver Islet mining district of western Tooele County. The plant, located in section 15, T. 1 S., R. 19 W., is also one of Utah's largest producers of potassium salts. Texas Gulf, Inc., Cane Creek plant in Grand County and the Great Salt Lake Minerals and Chemical Corporation's Weber County plant are also Utah's principal potassium salts

producers. Potassium sulfate, manure salts, and muriate production in Utah is valued at more than \$30 million annually.

Potash exploration in the Moab area was increased during 1977. Texas Gulf, Inc., drilled an exploratory well at a site some 20 miles northwest of its Cane Creek facility and outlined several other ore bodies for future drilling.

Buttes Resources Company plans to drill 4 exploratory test wells in the Ten Mile area about 18 miles northwest of Moab. Environmental studies by the U.S. Bureau of Land Management found that only minimal adverse impacts would result from the drilling program. Buttes made intensive geologic studies of the structures above the potash ore bodies, which lie some 5,000 feet below the surface. The planned development in the area is indicated to employ some 250 people. Buttes controls 51,000 acres in the vicinity.

Phosphate

Production and value of Utah's phosphate ore are withheld by the U.S. Bureau of Mines at the request of the producer. About 82 per cent of the United States phosphate production is produced by Florida and North Carolina. Tennessee and Arkansas produce 5 per cent; the remainder, 13 per cent, is produced by the states of Idaho, Missouri, Montana, Wyoming and Utah. Production for the western states for 10 months of 1977 was 4,302,000 short tons. In 1976, production amounted to 5.8 million short tons.

Stauffer Chemical Company is the principal phosphate producer in Utah. It is thought that 1976 production of phosphate rock amounted to approximately 450,000 short tons with about 135,000 short tons of phosphate (P_2O_5) actually produced. However, estimates are not confirmed. Stauffer operates the Rex Peak-Brazier Canyon area properties in the Crawford Mountains in Rich County, east of Randolph. The company's beneficiating plant is at Leefe, Wyoming. The concentrate is shipped by railroad to the Garfield plant in Salt Lake County. Stauffer also operates phosphate properties north of Vernal, in Uintah County.

Environmental assessment work by the U. S. Bureau of Land Management was completed on U. S. Steel's application to lease 7,650 acres about 12 miles northeast of Vernal for phosphate operations. The company is now being given

time for evaluation of economic feasibility studies.

Sand and Gravel

Salt Lake County is the largest producer of sand and gravel in the state, with more than 14 operations, followed by Utah, Davis, and Washington counties. There are 84 operations in 25 Utah counties with an output exceeding \$20 million annually. The largest percentage of properties, 25.3 per cent, produce between 100 to 200,000 short tons each year. There are, however, 30 operations in the state where annual production is less than 25,000 short tons each.

Stone

Dimension stone: Six producers quarried dimension stone in Utah during the year. The stone was used primarily for house stone, veneer, rough building stone, sawed stone and cut stone. Approximately 7,000 tons, valued at \$328,000 was produced. Leading producers of dimension stone were the Star Stone Inc., Oakley, Idaho, where output is from their quarries in Box Elder County, and the Stone Quarries Inc., Wilford H. Hansen Wasatch quarry in Brown Canyon between Snyderville and Park City, Summit County.

Crushed stone: Crushed stone is produced at 33 quarries in the state by 13 companies. Several expansion projects underway during the year further increased production of crushed stone. Total production was just under 3,000,000 tons valued at nearly \$7 million. Production includes ferrosilicon, lime (including dead-burned dolomite), surface treatment aggregate, flux stone, refractory stone, and railroad ballast. Leading producers in the state include U. S. Steel Corporation, Ideal Basic Industries, and the Southern Pacific Railroad Company.

Lime: Four lime producers in Utah produced slightly more than 204,000 short tons valued at more than \$7 million (includes quicklime and hydrates). In Box Elder County, Utah-Idaho Sugar Company operated its Garland plant north of Tremonton. In Salt Lake City, Kennecott Copper Corporation produced lime at its facilities. Largest of the lime producers in Utah are located in Tooele County. The Flintkote Company's McBride & Hyder quarry (2 shaft-kiln plant) in the Free Coinage mining district produced slightly more than 61,000 tons. The Utah Marblehead Lime Company's facilities in the

Lakeside mining district produced nearly 100,000 tons.

Pumiceous Material: Pumice (volcanic ash) was produced primarily in Millard County by Fillmore Products Inc., and by the Utah State Department of Highways for road material. Fillmore Products Inc. produced about 150,000 tons valued at more than \$215,000 from its Red Dome mine. Products from this mine are used in concrete aggregates, landscaping and a number of unspecified areas.

Uranium

Increased exploration and development in Utah's uranium industry was felt during 1977 and should continue to build momentum during the coming year. An average of 19 exploratory rigs were working in 1977 and an average of 23 to 25 at work are expected throughout 1978.

Increased demand for uranium and the need for expanded facilities to mine and process ore is predicted. Price of uranium, since February, has averaged near \$41.40 a pound. Utah's uranium production is not reported by the U.S. Bureau of Mines or the U.S. Department of Energy since individual producers have asked them to withhold that information. Best estimates indicate 1977 production was somewhat more than 1.1 thousand short tons valued at approximately \$46 million. At the start of the year, a little more than 5.5 million acres were held by uranium companies for exploration and mining in Utah. In 1976 4,185,000 acres in Utah were held. No actual reserve figures for the state have been compiled but UGMS estimates about 17 million tons of ore which would produce about 89 million pounds of uranium oxide. Utah ranks third of six uranium producing states.

Atlas Minerals shut its Moab mill down for a week while modifying the mill tailings containment system. Plant capacity was under expansion and will be increased to at least 1,200 tons daily. Atlas has several mines in southeastern Utah where more than 10,000 tons annually are produced. These include the Columbia mine, Big Indian district; the Pandora mine in the LaSal area; Rim Shaft-Humbug in Dry Valley of the Monticello district; Standard No. 2, White Canyon district and the Wood mine in southwest Lisbon Valley.

Uranium deliveries were started in July by the Whitelock Corporation,

operator of the Thornburg Memorial Mine in R. 24 S., R. 20 E., north of Moab. Ore in excess of 1,000 tons a week was delivered to the Cotter Corporation, a division of Consolidated Edison Company, Golden, Colorado. Work was also underway on a 1,100 foot incline to a second ore body in the area previously delineated by Cotter. Further development will be undertaken early in 1978.

Recovery of 143,000 pounds of uranium oxide per year was expected to be achieved at a plant constructed near Copperton, southwest of Salt Lake City. The plant recovers uranium from leach solutions used by Kennecott Copper in removing copper from overburden through precipitation. Wyoming Mineral Corporation, Littleton, Colorado, a subsidiary of Western Westinghouse Electric, constructed the plant at a cost of about \$6 million.

Rimrock Inc., Reno, Nevada, announced in March that they had drilled into a 40-foot zone of .22 per cent uranium in the Shinarump Formation in T. 28 S., R. 12 E., about 18 miles south of Hanksville, Wayne County. The company owns 5,700 acres of uranium claims in the vicinity and planned more extensive drilling during the coming year.

Lucky Mc Uranium Co., Riverton, Wyoming started drilling in November on 42 uranium claims in Wayne County to determine if content of the ores would warrant further development. The claims are on property owned by Boyd and Katherine Black near Bicknell.

New Products Corporation, Salt Lake City, acquired options to purchase approximately 3,000 acres of uranium properties — 2,000 acres in the Blawn Mountain area near Milford in Beaver County, and 920 acres in Grand County near Green River. Plans to develop the claims through drilling funds were offered in the Pacific Northwest. The company acquired nearly 22,700 acres in the Montezuma Canyon area of the Monticello mining district, San Juan County, earlier in the year.

Polaris Resources Company and Geosurveys Inc., Denver, reported significant amounts of uranium mineralization from an initial drilling program in the Topaz Mountain area of Juab County. The two companies entered into an agreement with Energy Fuels Limited for exploration of the 20,000 acres held in the vicinity. Further exploration and development was done and underway at the end of the year.

Energy Resources Corporation, Denver, acquired 18,000 acres of uranium claims in the Black Mesa area in San Juan County, increasing its total holdings to 42,000 acres in the area. A total of 372 drill holes, approximately 121,000 feet of hole, were drilled during the year.

Mineral Energy Inc., Orem, signed an agreement for exploration of some 100,000 acres with Emery Uranium Inc., Moab. Exploration of the mineral properties in southeastern Utah is expected to be conducted over a two year period. Mineral Energy is required to spend one million dollars in exploration over the period with the right to purchase all recoverable uranium located on the properties.

Plateau Resources, Ltd., opened its new uranium ore buying station 12 miles south of Blanding in September. The plant processes 50 tons of ore an hour. Additional mining and ore processing facilities in the Henry Mountains vicinity of Garfield County is planned. A proposed town near Lake Powell's Bullfrog Basin Marina was approved with an environmental assessment conducted by Utah State University. The proposed site would supply facilities and services for approximately 170 to 200 Plateau Resources Ltd., uranium mine and mill employees and families.

Rio Algom Corporation's Lisbon mine in the Big Indian district continued production of more than an estimated 1 million pounds of uranium during the year. Ore from the mine is processed at the firm's mining and milling complex in the Lisbon Valley area south of La Sal. Ranchers Exploration & Development Corporation produced more than an estimated half-a-million tons of ore from its Small Fry mine in San Juan County and expects to increase development efforts during 1978.

Vanadium

Vanadium from Utah mines was delivered to Union Carbide Corporation facilities at Rifle and Uravan, Colorado. The Atlas Corporation mill at Moab also processed vanadium during the year. No production figures were released but estimates place vanadium production in the state at approximately 2 million pounds of vanadium oxide valued at somewhat more than \$10 million. Vanadium is produced at mines in Emery and San Juan counties.

POLLUTION CONTROL

A \$9 million air pollution control facility being constructed at U.S. Steel's

Geneva works in Provo was a little more than half finished by the close of the year. The facility, called a "baghouse", is located at the south end of the plant's powerhouse. It will be approximately six-stories high when finished. The building is to include 11,500 square feet. It will have more than 6,600 cloth filters, each 20 feet long, and will provide a total collection surface equal to about seven acres, cleaning nearly one million cubic feet per minute of waste gases from three steam boilers at the powerhouse.

At its smelter near Magna, Kennecott Copper continued construction and installation of various components of its multi-million dollar emission control system. The fiberglass sleeve which rises to a total height of 1215 feet above the outer concrete stack was placed in late 1976. The entire system is scheduled to be in operation by spring 1978.

LEGAL ACTIONS

Two suits were filed November 28 in the U.S. District Court for Utah, challenging Union Pacific Railroad's mineral ownership under approximately 38,000 acres of the land grant properties on the Overthrust Belt in northeastern Utah. The complaints were filed by Anschutz Land & Livestock Company and Antelope Island Cattle Company, both subsidiaries of the Anschutz Corporation of Denver. In question are quiet title actions concerning validity of the defendant's mineral reservations when the land was conveyed to the plaintiffs' predecessors by the Union Pacific Railroad 60 or more years ago.

POWER PLANTS

Utah Power & Light Company plans to construct two new 400-megawatt coal-fired generating units at its Emery, Utah plant site with completion planned for 1983 and 1985 at a cost of about \$620 million. Each unit was originally planned for a year earlier at a site at Naughton, Wyoming. UP&L reported that delays in government approval and a comparison of construction and fuel costs forced the changes. Two other units are currently under construction in Emery and are scheduled to be completed in 1978 and 1980.

Officials of the proposed Allen-Warner Valley coal-fired power plant in southern Utah announced withdrawal of the 80% share of the City of Los Angeles from the project. However, several other utilities expressed interest in taking over the relinquished share.

The Utah Interagency Task Force on Power Plant Siting studied six alternate sites for the proposed 3,000 megawatt IPP (Intermountain Power Project) coal fired plant in November and made two recommendations. One is north of Delta, about 10 miles west of Lynndyl, in Millard County. The other is 3 miles northeast of Hanksville, Wayne County. The Hanksville site is about 35 miles from Capitol Reef National Park and about 25 miles east of the original site at Salt Wash. Late in December, however, the Department of Interior advised officials that it disapproves of both plant sites in the Hanksville and Salt Wash areas because of the threat to air quality in Capitol Reef National Park.

The Task Force also studied 12 potential sites for the Moon Lake Electric Association's planned 1,000 megawatt coal-fired power plant south of Vernal.

WITHDRAWALS - WILDERNESS AREA STUDIES

The U. S. Forest Service's 1977 Roadless Area Review and Evaluation Program includes 326 areas totaling nearly 13 million acres being studied as potential wilderness areas in six Rocky Mountain states. In Utah, 131 areas included in the review encompass 2.97 million acres. An appeal was filed with the Forest Service by the Sierra Club calling for the suspension of mineral leasing and operations in 11 national forests on the Overthrust Belt province in early December. It was returned to the Sierra Club without action after Forest Service officials determined that the appeal failed to meet criteria on which it could act. The appeal may be resubmitted after amendment or may be dropped, or other action by the Sierra Club may include various options under federal regulations.

The Bureau of Land Management selected 11 sites in Utah, containing more than one million acres, for study as possible areas for wilderness designation. They include: Escalante Canyon, 129,000 acres; Dark Canyon, 57,248 acres; Phipps-Death Hollow, 84,300 acres; Grand Gulch, 24,080 acres; North Escalante, 5,800 acres; The Gulch, 3,480 acres; Joshua Tree, 1,040 acres; Link Flats, 792 acres; Devils Garden, 640 acres; Book Cliffs, 400 acres; and Paria Canyon, 27,515 acres. In May, BLM started an inventory for the Escalante Resource area which is bounded on the west by the Kaiparowits Plateau, on the north by Dixie National Forest, on the northeast by Capitol Reef National Park,

and on the south and east by Glen Canyon National Recreation Area.

More than 26,900 acres of federal land in the Deep Creek Mountains of Juab and Tooele Counties were withdrawn by the Department of Interior from mining exploration in April. The federal action halts all mining exploration in the vicinity.

The Lone Peak area on the east side of the Wasatch Front was approved by the U.S. House of Representatives as a wilderness area in September. It includes 29,567 acres.

¹ Source: Data for this section compiled from records of the U.S. Bureau of Land Management; Mineral Property Division of the Utah Tax Commission; Company Annual Reports; U.S. Bureau of Mines reports; news releases; U.S. Department of Energy monthly Energy Data Reports; U.S. Forest Service reports and personal communication.



GEOOTHERMAL PROJECTS STUDIED BY UGMS

At Crystal Hot Springs, near the State Prison, six geothermal gradient holes were completed in April. Temperature gradients approached 31°C/km (a normal Basin and Range gradient). Our present knowledge indicates that the system is fracture controlled, and that water warmed by the normal geothermal gradient is moving upward through highly fractured quartzite. A small quantity of this water issues from the springs at the surface but most of the water flows to the north northwest in the subsurface through sands and gravels overlying the quartzite.

Encouraged by the Survey's findings the State Division of Forestry drilled a six inch diameter well 85 meters deep into the sands and gravels to the north of Crystal Hot Springs. After completion, the well flowed at 13 gpm at a temperature of 75°C. The Forestry Division intends to use the warm water to heat a green house to be located in the vicinity of the Utah State Prison farm complex.

In the Midway areas, four thermal gradient wells were completed by UGMS in May. They range in depth from 50 to 84 meters. The maximum temperature encountered was 43.7°C. Eleven water samples have been taken and analyzed as part of a thesis research study by James Kohler and financed by UGMS.

MUSK OXEN IN UTAH

Modern musk oxen, with their long shaggy coats and massive drooping horns, are found only in the arctic regions of the world, but Dr. Michael A. Nelson, Chairman of the Department of Earth Sciences at Fort Hayes State University, Kansas, has studied the fossils of nearly two dozen musk oxen found in Utah. These fossils, found along the Wasatch Front from Logan to Santaquin, indicate that musk oxen lived here from 10,000 to 70,000 years ago when Lake Bonneville occupied much of western Utah. At that time, large alpine glaciers filled many of the major valleys in the mountains and provided the chilly climate preferred by the musk oxen, which even then had coats of long hair underlain by a thick layer of wool to protect them from intense cold.

The largest musk ox skull, on display at the Utah Museum of Natural History, possibly belonged to a very large bull who guarded a herd of perhaps twenty cows and calves, in the foothills of the snow-covered Wasatch Mountains some 25,000 years ago. When he died, his bones were buried in the beach sands and gravels of Lake Bonneville, to be uncovered many thousands of years later in the Hardman Sand and Gravel Quarries north of the Salt Lake City Cemetery. (*from Utah Natural History*, Vol. 10, no. 2, 1978).

IN MEMORIAM

Edmund M. Spieker

Edmund M. Spieker, a student of the structure and stratigraphy of the transition zone between the Great Basin and the Colorado Plateau (see U.G.S. Guidebook No. 4,) died at the age of 83 in Columbus, Ohio. Mr. Spieker was a research professor of geology at Ohio State University from 1952 to 1965; a director of the National Science Foundation summer institute in geology from 1962 to 1973, and a geologist with the U.S. Geological Survey from 1917 to 1965. (from Geotimes, 1978)

LEVEL OF GREAT SALT LAKE LOWEST IN FIVE YEARS

After a continual rising trend from 1963 to 1976, the elevation of the lake is now in its second year of decline. It has been five years since the elevation of the lake has been this low at this time of year.

Gage heights recorded by the U.S. Geological Survey are:

Date	Boat Harbor (south arm)	Saline (north arm)
May 1	4200.10	4198.60
May 15	4200.20	4198.60
June 1	4200.25	4198.60
June 15	4200.20	4198.60
July 1	4199.95	4198.40
July 15	4199.60	4198.25



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CORRECTION

Oops - we goofed. In the May, 1978 issue of *Survey Notes* we confused Mt. Nebo with Nebo Mountain (did you know there were two? We do, now!) Mt. Nebo has an altitude of 11,871 feet, 121 feet higher than Mt. Timpanogos; Nebo Mountain is only 11,680 feet high.

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