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SURVEY NOTES

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THRUST BELT ONLY THE BEGINNING

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THRUSTS AND PLATES

The Thrust Belt is an area of distinct geological structure which extends north-south through the central and southwestern part of Utah (figure 1). It is interrupted in the northern part of the state by the Uinta Mountain Arch which is folded across the Thrust Belt. South of the Wasatch Mountains it reappears and coincides with and is complicated by the "Hingeline", another distinct geological structure which extends, with the Thrust Belt, south and southwesterly into southern Nevada and thence southeasterly into Arizona. The Thrust Belt as seen in Utah, western Wyoming, and southeast Idaho is actually only a small segment of a nearly continuous belt of similar structure which extends from the north slope of Alaska to southern Mexico.

The Thrust Belt was formed by compressive forces of the North American plate moving from east to west against the Pacific plate on the west. Along the zone of collision, the rocks were extensively ruptured and crumpled with formation of a style of structure characterized by thin plates of massive, competent rocks (sandstones and limestones) thrust up and over or down and under each other. The principal movement appears to have been down and under, thus the term "overthrust" is not technically correct. The simpler term, Thrust Belt, is preferred by most structural geologists in the region.

From east to west, and in increasing age of formation, the principal thrust faults and thrust plates (or sheets) are named as follows (applies north of Uinta Arch to Idaho-Utah boundary) (figure 2):

Hogsback Thrust
Hogsback Plate (or sheet)

(continued on page 2)

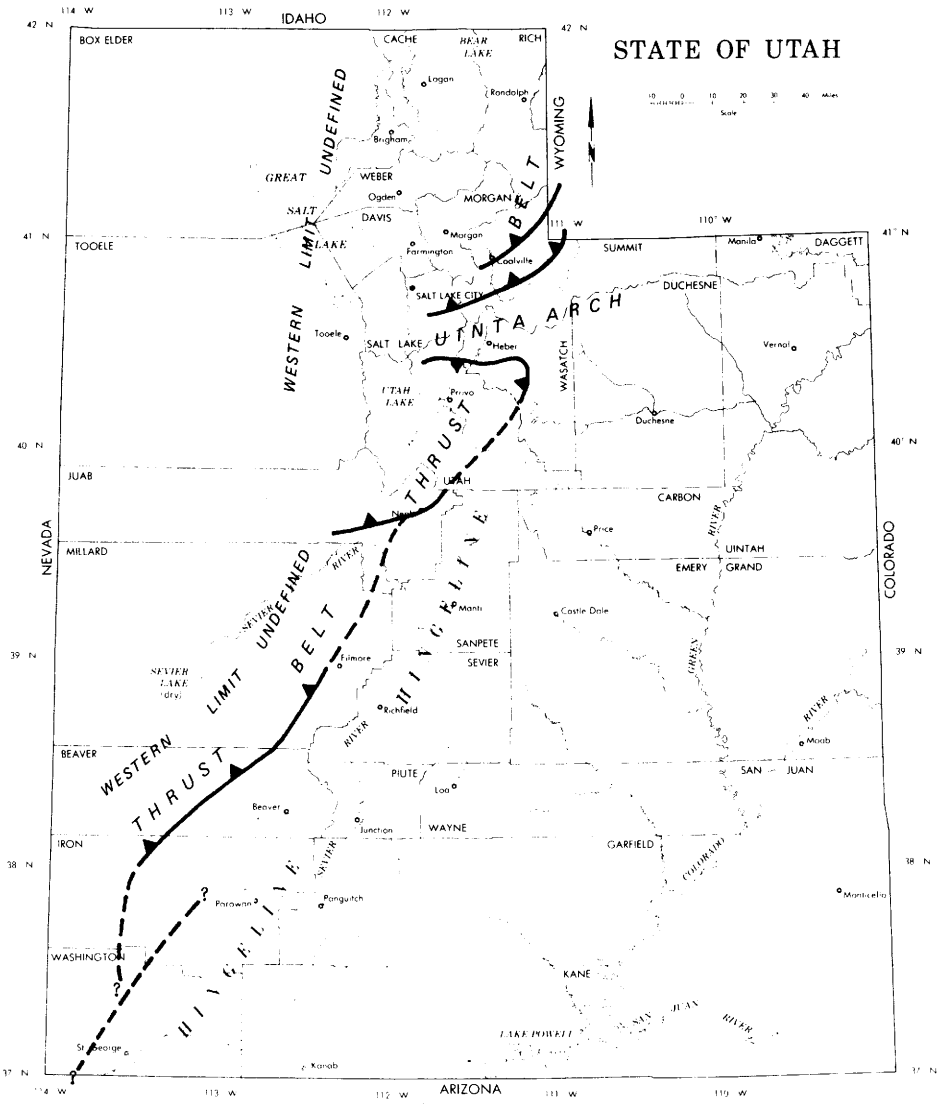

Figure 1. Index map, Thrust Belt and Hingeline, Utah

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Absaroka Thrust
Absaroka Plate

Tump (or Tunp) Thrust - Medicine Butte (in Evanston area)
Tump (or Tunp) Plate

Crawford Thrust
Meade-Crawford Plate

Willard Thrust
Willard Plate

The Hogsback and Absaroka Plates are thrust eastward over the Green River Basin. Each older thrust plate (bottom to top, above) is in turn thrust eastward over a younger plate beneath.

Other thrust plates intervene to the north and different names apply - Prospect, Darby, Meade and Paris. South of the Uinta Arch, only one thrust fault and sheet - the Strawberry - is known with much certainty. It is possibly equivalent to the Absaroka. Other thrust faults and plates undoubtedly exist to the south but are concealed.

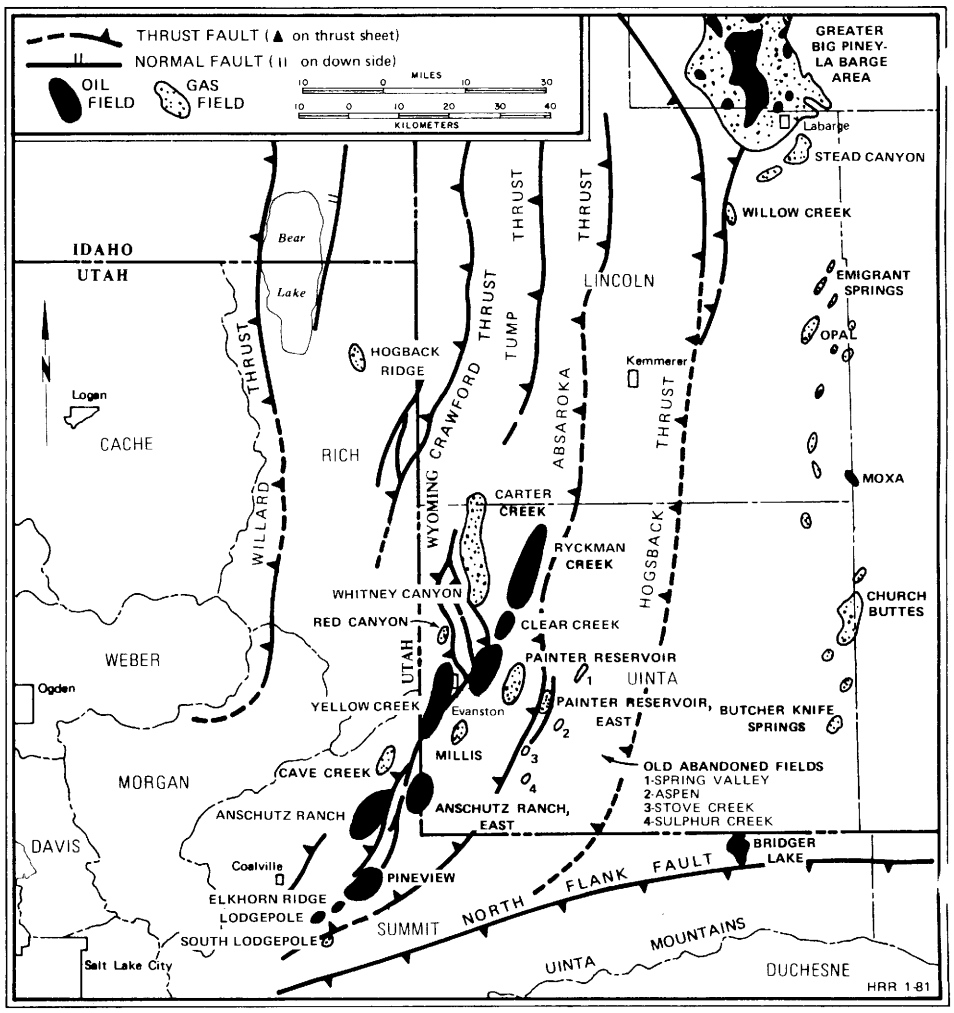


Figure 2. Map showing location of fields in relation to the principal thrust faults, Wyo., Idaho & Utah.

THE OIL AND GAS "PLAY"

The Thrust Belt oil and gas play in Utah, Wyoming and Idaho continues to capture the attention and imagination of the petroleum industry and investors large and small. The discovery of the Pineview field 15 miles east of Coalville in Summit County, Utah in 1975 set off the play; and the action quickly spread to adjacent Uinta County, Wyoming. A succession of spectacular discoveries from 1976 through 1980 has made this area one of the top targets for exploration drilling in the U. S. (figure 1), and the newly discovered oil and gas fields have had a significant impact on oil and gas reserves in the "Lower 48" and a tremendous impact on the oil and gas industry in the Rocky Mountain Region (table 1). Uinta County, Wyoming and its county seat, Evanston, have become the focus of most of this activity and have borne the brunt of the socio-economic problems that have resulted.

PIPELINES AND PLANTS

The cluster of fields in this corner of southwest Wyoming and adjacent Summit County, Utah has attracted an investment in capital of very major magnitude (figure 2). Projects directly connected with the Thrust Belt include four major pipelines: Trailblazer (gas), 800 miles, 36 inch, southwest Wyoming to Beatrice, Nebraska, Trans-Anadarko (gas), connection from southwest Wyoming via CIG lines to Monroe, Louisiana; Rocky Mountain Pipeline (gas), 583 miles, 30 inch (tentative), southwest Wyoming, through central Utah to southern Nevada and Los Angeles; MAPCO (natural gas liquids), 1196 miles, 4 to 10 inch, Rock Springs, Wyoming to Seminole, Texas. The MAPCO line went into operation in December 1980; others are in various stages of proposal, permitting, and planning.

Within the producing areas several hundred miles of gas and crude oil gathering lines have been laid or are under construction. Chevron has begun construction of a 4½ inch pipeline for transport of 1000 tons of molten sulfur daily from a plant in the Whitney Canyon gas field, Wyoming to a rail terminal near Kemmerer, Wyoming.

Sour (sulfur-rich) gas which has been found in great abundance will be treated in three plants, two in Wyoming and one proposed in the Cave Creek field in Utah. One sweet gas plant (Champlin) went on line in the Yellow Creek area, Summit County, Utah, in November 1980, and a second by Amoco in Wyoming is in early stages of construction. Amoco also operates a plant to recover natural gas liquids in the Ryckman Creek field, Wyoming, and Chevron operates plants recovering nitrogen and natural gas liquids at Painter Reservoir, Wyoming.

RESERVES (Table 1)

A reserve study by Amoco Production Company in late 1980 estimates that 914 million barrels of producible oil,

Table 1. **UTAH THRUST BELT FIELDS (thru September 1980)**

Field	Disc. Date	Prod. Wells	Shut in Wells	Production Sept. 1980	Average BOPD Sept. 1980	Production 1979	Cumulative Production Thru 1979	Cumulative Production Thru 9-80	Wells Drilling or Testing	Producing Formations (Geologic Age)	Remarks	Reserve Estimate* Oil Gas
Anschutz Ranch	1978	0	9	None reported					2	Twin Creek (Jur.) Nugget (Jur.)	Not on production Report Sept. 80	15 Million Bbls. 49 Billion cf
Anschutz Ranch East	1980	0	1	None reported					4	Nugget (Jur.)	Not on production	
Cave Creek	1980	0	2	None					0	Phosphoria (Perm.) Weber (Penn.) Madison (Miss.)	H_2S Gas (Sour) waiting on Amoco Gas plant at Whitney Canyon Field in Wyo.	
Elkhorn	1977	1	1	Oil (Bbls) 404 Gas (MCF) 27	13	Oil (Bbls) 28,312 Gas (MCF) 7,572	Oil (Bbls) 165,406 Gas (MCF) 61,974	Oil (Bbls) 179,079 Gas (MCF) 66,328	0	Twin Creek (Jur.)		14 Million Bbls. 6 Billion cf
Hogback Ridge	1977	1	0	Oil (Bbls) 0 Gas (MCF) 64,689		Gas (MCF) 2,418,839	Gas (MCF) 3,443,600	Gas (MCF) 5,258,202	0	Dinwoody (Tri.) Phosphoria (Perm.)		194 Billion cf
Lodgepole	1977	4	2	Oil (Bbls) 7,432 Gas (MCF) 1,324	248	Oil (Bbls) 90,906 Gas (MCF) 26,988	Oil (Bbls) 188,636 Gas (MCF) 52,835	Oil (Bbls) 257,911 Gas (MCF) 65,383	0	Twin Creek (Jur.) Nugget (Jur.)		18 Million Bbls. 6 Billion cf
Lodgepole South	1978		1	None					0	Kelvin (Cret.)	1 well gas field no outlet	
Pineview	1975	30	9	Oil (Bbls) 241,670 Gas (MCF) 298,449	8,056	Oil (Bbls) 3,872,304 Gas (MCF) 4,213,109	Oil (Bbls) 14,326,175 Gas (MCF) 14,909,409	Oil (Bbls) 16,247,955 Gas (MCF) 16,567,596	0	Kelvin (Cret.) Stump (Jur.) Twin Creek (Jur.) Nugget (Jur.)		71 Million Bbls. 71 Billion cf
TOTALS		35	23	Oil (Bbls) 249,506 Gas (MCF) 364,489	8,317	Oil (Bbls) 3,991,522 Gas (MCF) 6,666,508	Oil (Bbls) 14,680,217 Gas (MCF) 18,467,818	Oil (Bbls) 16,684,945 Gas (MCF) 21,957,509	6			118 Million Bbls. 326 Billion cf

*Figures from Oil & Gas Journal, May 12, 1980 BOPD = barrels oil per day MCF = 1000's cubic feet (Tri.) = Triassic (Jur.) = Jurassic (Cret.) = Cretaceous (Penn.) = Pennsylvanian (Perm.) = Permian

lease condensate and natural gas liquids, and 9,700 billion (9.7 trillion) cubic feet of producible gas has been discovered in the Utah-Wyoming Thrust Belt to date. Of this 118 million barrels of oil (12%) and 326 billion cubic feet of gas (3%) is in Utah. The tremendous reserve of gas attributed to the Whitney Canyon-Carter Creek field in Wyoming greatly weights the proportion of gas reserves in favor of Wyoming. These reserve figures are considered conservative and will undoubtedly be revised upward as new discoveries and development proceed. For example, the 1980 discovery at Painter Reservoir, East field, Wyoming appears to have found a reserve larger than the original field to the west. In Utah only a token reserve has been assigned to Anschutz Ranch and none to Anschutz Ranch, East and Cave Creek. These fields, when properly evaluated, will undoubtedly more than double Utah's Thrust Belt reserves.

PRODUCTION (Table 1)

In October 1980, production from the Utah-Wyoming Thrust Belt area totalled 33,000 barrels of oil and liquids and 65 million cubic feet of gas per day. About 8,200 barrels and 11.5 million cubic feet per day were from Utah. With augmented processing facilities and new pipelines, production is expected to rise dramatically, particularly in Wyoming.

DRILLING

On November, 1, 1980 there were 46 wells being drilled in the three Wyoming Thrust Belt counties (Uinta, Lincoln and Sublette) and 15 in Utah, 11 in Summit and 4 in Rich. Of the 15 wells in Utah, 6 were development wells in established fields and the remainder wildcats.

PROSPECTS

The Thrust Belt area of Summit and Rich Counties and adjacent areas in Wyoming seems destined to become one of the most oil-rich areas of the Rocky Mountain Region. As drilling extends northward into western Wyoming, following the narrow belt of structure along the leading edges of the Absaroka and Tump /Medicine Butte thrust plates, the prospects for new major oil and gas fields is extremely good. The optimum combination of source beds, reservoir rocks, and large, intact traps is at its best here. To the west as older thrust plates and older rocks become involved, discovery success has been nil and drilling has yielded only slight shows.

Farther south through central Utah where the Thrust Belt reappears after being interrupted by the Uinta Arch, it is further complicated by the "Hingeline" structure, another geologic story in itself. But the organic source beds are there with reservoir rocks and traps, if the latter can be found intact. Dozens of deep wells are boldly probing this complex geologic province, and only time will tell whether the multi-million dollar gamble will pay off.

IMPACTS

Total expenditures to date for leasing, exploration, drilling, production and processing facilities and ancillary facilities are estimated at more than $4.8 billion by industry sources in late 1980. The stakes are high. Utah's largest field to date, Pineview, measured in 1981 dollars and prices, will produce 3.5 to 4.0 billion dollars in oil, gas and gas liquids until depletion some decades in the future. Other fields, particularly those in Wyoming, are known to be much larger.

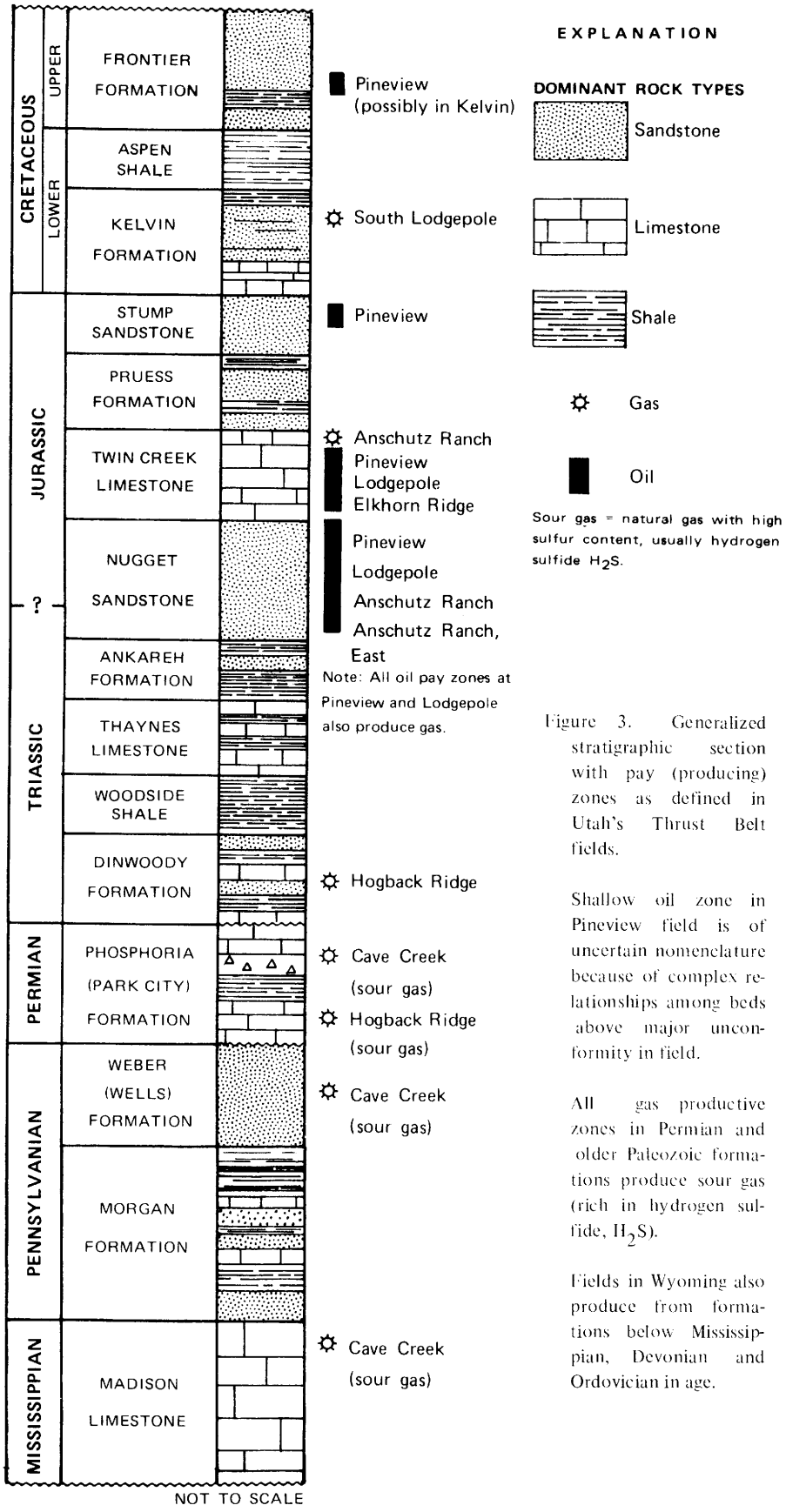


Figure 3. Generalized stratigraphic section with pay (producing) zones as defined in Utah's Thrust Belt fields.

Shallow oil zone in Pineview field is of uncertain nomenclature because of complex relationships among beds above major unconformity in field.

All gas productive zones in Permian and older Paleozoic formations produce sour gas (rich in hydrogen sulfide, H_2S).

Fields in Wyoming also produce from formations below Mississippian, Devonian and Ordovician in age.

The southwestern Wyoming and northern Utah Thrust Belt region has already experienced increases in population and traffic, and economic and social disruptions. However, examples of what may be expected in increasing tax base in the area are already surfacing. Champlin's Yellow Creek gas processing facility is expected to contribute $80,000 annually in taxes to Summit County, Utah. The Rocky Mountain Pipeline Project (Pacific Gas Transmission Company) is expected to have a capital investment of $22.3 million in Lincoln County, Wyoming, $323.4 million in Utah, and $129.5 million in Nevada. Utah counties which will be traversed by the line will receive $3.7 million annually in taxes, $468,000 to Rich County and $450,000 for Summit, estimated at 1980 tax rates. A well recently completed on a State lease in the Pineview field, Summit County, is paying $45,000 in royalties monthly into the state treasury.

The amount of tax income being generated through royalties on Federal and State leases, severance taxes, ad valorem taxes, property taxes, corporate and individual income taxes, "windfall profits?" taxes, etc., boggles the mind. And the Overthrust Industrial Association, an organization of the major oil companies in the "play", headlined its first newsletter in December 1980: "ONLY THE BEGINNING".

NEW FIELDS REPORT PRODUCTION

Production from Anschutz Ranch and East Anschutz Ranch fields in Utah's Thrust Belt has begun to be reported by Amoco Production as of October 1980.

Field	No. Wells	Production	Oct. 80	Annual All-time Cumulative
Anschutz Ranch	3	oil (Bbls)	11,920	93,095
		gas (Mcf)	611,706	3,691,260
East Anschutz Ranch	1	oil (Bbls)	31,726	218,228
		gas (Mcf)	150,913	966,007

The single well in the East Anschutz Ranch field, No. 1 Bountiful Livestock, is producing at an average rate of 1,000 barrels per day.

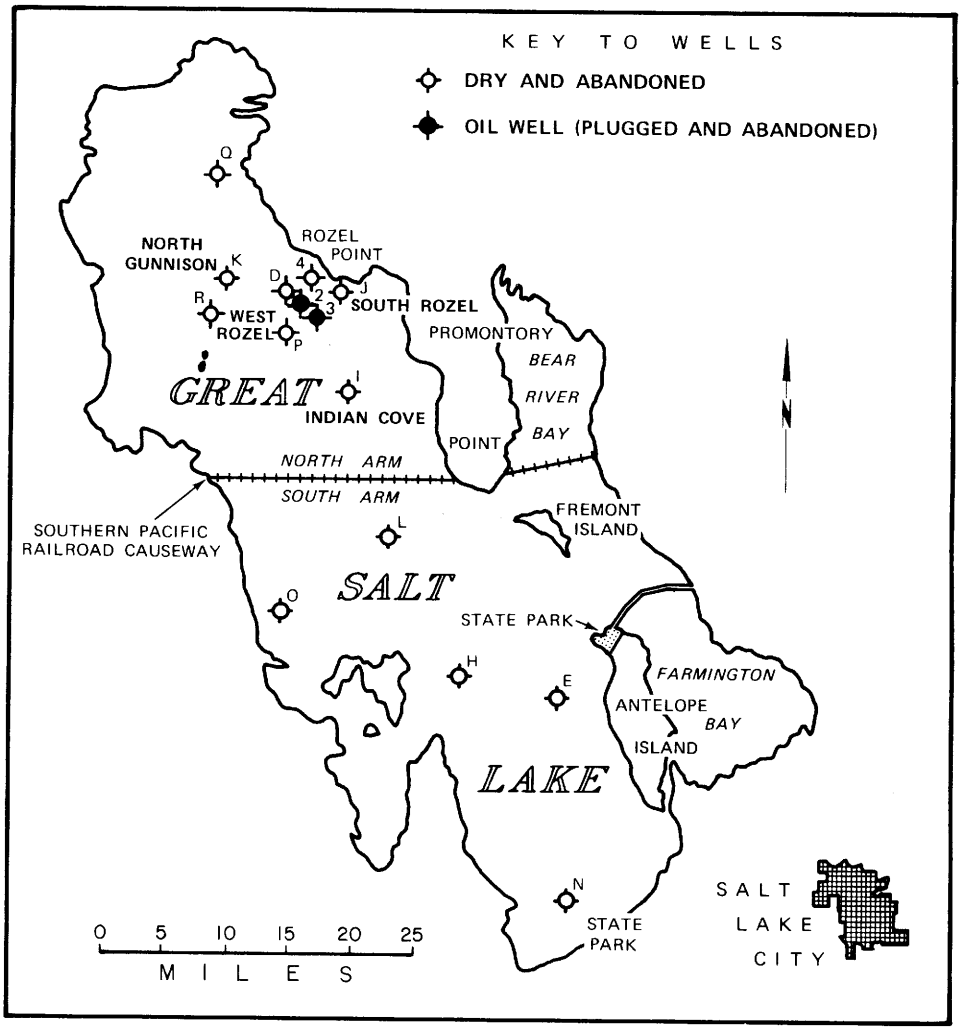
AMOCO COMPLETES GSL EXPLORATION ACTIVITY

Amoco Production Company of Denver, Colorado has announced the completion of the drilling phase of its exploratory evaluation program in its search for oil beneath the Great Salt Lake. The drilling phase of this program has lasted 2½ - 3 years resulting in the drilling of 15 wells at a cost of approximately $55 million. See the following table for the location, date of drilling and the total depth of each hole.

Location	Date	Depth (ft.)
NORTH ARM		
State of Utah "I"	4-78	12,470
State of Utah "D"	10-78	8,500
State of Utah "J"	11-78	6,802
State of Utah "K"	11-78	4,492
West Rozel 2	5-79	2,704
SOUTH ARM		
State of Utah "E"	10-79	10,419
State of Utah "H"	12-79	4,971
State of Utah "L"	3-80	12,070
State of Utah "O"	4-80	2,450
State of Utah "N"	5-80	7,864
NORTH ARM		
West Rozel 3	8-80	2,790
State of Utah "P"	10-80	7,843
West Rozel 4	11-80	2,210
State of Utah "Q"	11-80	4,883
State of Utah "R"	12-80	1,716

Sufficient oil to warrant extensive production zone testing was found only in the West Rozel No. 2 and No. 3 wells. During this testing phase in late 1980, a total of 32,000 barrels was produced from the West Rozel No. 2 well during a six week period. The West Rozel No. 3 well produced 33,000 barrels during a nine week period. All holes and wells have been properly plugged and abandoned according to Utah regulations as of mid-January 1981. The Great Salt Lake site will be deactivated pending complete evaluation of the data collected to date. This evaluation is estimated to be completed by April 1, 1981.

(Source: Amoco presentation to Great Salt Lake Technical Meeting 1-26-81).



TAR SAND LEASING – DTSA's

The Bureau of Land Management will make Federal lands available for the leasing of tar sand after a lapse of 15 years. A moratorium on the issuance of such leases was instituted in 1965 pending legal definition of the substances covered by oil and gas and "bituminous sandstone" leases. After more than a decade without definition, urgent need for development of the nation's tar sand resource, much of it located in Utah, has prompted fast (relatively) action to make tar sand leases available again.

Using maps largely developed by UGMS, the U. S. Geological Survey has begun drawing boundaries of DTSA's, "Designated Tar Sand Areas". Within these, BLM is expected to issue "all-hydrocarbon" leases with provisions similar to Utah's "all-hydrocarbon" leases instituted in 1967. It is proposed that existing Federal oil and gas leases in DTSA's will be convertible to the new leases. Since many of these areas are liberally "wall-papered" with oil and gas leases, the amount of unleased land that will be open for filing is problematical. Instituting the new leasing policy is expected to continue through 1981.

GREAT SALT LAKE LEVEL

Date	Boat Harbor (So. Arm)	Saline (N. Arm)
November 1	4199.00	4197.70
November 15	4199.10	4197.75
December 1	4199.25	4197.80
December 15	4199.35	4197.85
January 1	4199.50	4198.05
January 15	4199.65	4198.10

November continued to mark the low point of the lake's yearly cycle at an elevation of 4199.00 for the south arm and 4197.70 for the north arm. As of January 15, the south arm elevation was 1.80 feet higher and the north arm 1.25 feet higher than at the same time one year ago. Under normal water condition, the lakes elevation could be expected to easily exceed last years south arm peak elevation of 4200.55. With the below normal precipitation thus far this winter, however, it is difficult to predict the peak elevation of the lake by May or June of 1981.

TAR SAND CORING

The Laramie Energy Technology Center, U. S. Department of Energy reported completion of seven coreholes in the P. R. Spring oil-impregnated sandstone deposit during August and September 1980. These ranged in depth from 170 to 445 feet and yielded 2,178 feet of core. Sites for the coreholes were selected in cooperation with the UGMS Petroleum Section and were interspersed with existing coreholes and measured sections to yield maximum information. One hole on the southeast edge of the deposit was barren and established a definite limit on the extent of the deposit. All coreholes were on Federal (BLM) lands.

Results of the coring will be released through LETC/DOE and UGMS as soon as the analysis of 282 core samples have been completed.

FELT EARTHQUAKES

An earthquake "swarm" has been identified by the University of Utah Seismograph Stations during the last quarter as occurring in southwestern Utah, near the Washington/Iron County line. Three events have been felt in an area about 7 miles SSE of Kanarraville, 17 miles south of Cedar City. The felt events had a Richter Magnitude of 3.2 to 3.6 and took place on December 21st and January 16th. Similar swarms have occurred in southern Utah in recent decades, such as in 1926 and 1927 near Orderville, in the Panguitch vicinity in 1937 and near Cedar City in 1942 - 1943 and in 1971.

IMA GEM

SANDY STEWART

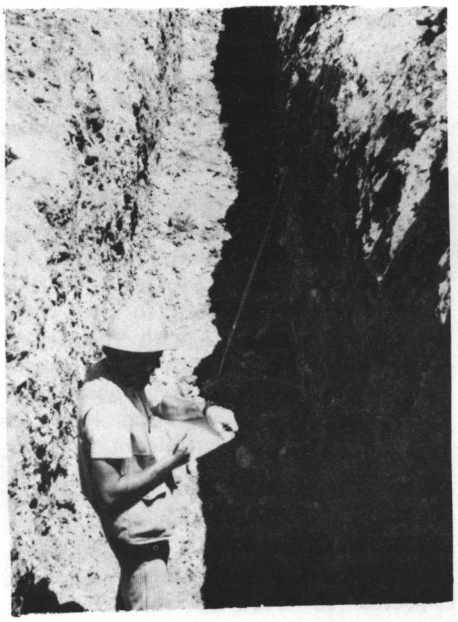
WASATCH SPRINGS PLUNGE BUILDING INVESTIGATED FOR RESTORATION

Because of recent controversy over the restoration and conversion of the old Wasatch Springs Plunge building to a children's museum, Mayor Ted Wilson and the Salt Lake City Planning and Zoning Office contacted the Utah Geological and Mineral Survey to request that a study be done to evaluate the geologic and seismic hazards that may be associated with that property.

A detailed field reconnaissance, including the excavation of four exploratory trenches ranging from 71 to 300 feet in length and from seven to 18 feet in depth, was undertaken by UGMS geologist Harold Gill.

No faulting or deformation affecting the strata directly below the Wasatch Plunge building was encountered in the trench which was excavated adjacent and parallel to the building. Therefore, it is believed that the structure and the immediate site vicinity may expect to experience strong ground shaking in the event of an earthquake, but fault rupture beneath the foundation is unlikely.

Consequently, the restoration project was approved for federal HUD money totaling $350,000; conversion of the building to a children's museum is scheduled to begin in the near future.



WHO WILL BUY UTAH COAL?

An estimated one and one half million tons of Utah coal have not been sold and are stockpiled in the state. This is about 12 percent of 1979's total production of 12.1 million tons. About 60 percent of the coal mined in Utah is burned by companies that control the mines; the other 40 percent is sold on the open market.

Why has this much coal, equivalent to at least two million barrels of oil, not been sold?

One reason is that all of the coal presently mined in Utah comes from underground mines. It costs from 17 to 25 dollars to mine a ton of coal. Most of the coal from neighboring states is from strip mines, and can be mined for about 7 to 10 dollars a ton. Utah's coal can compete because we have, at the moment, no severance tax, and because the coal has a very low sulfur content and a higher heat content than the strip-mined coal.

SHOCKS UNDER M6.0 NOT PEANUTS

Information on destructive earthquakes in California published by that state's Division of Mines and Geology (California Geology, January, 1981) indicates that less-than-moderate magnitude earthquakes may be quite damaging. Of a total of 34 destructive events listed for the 168 years between 1812 and 1981, 12 are $\leqslant$5.9 on the Richter scale; remarkable as it seems this is a full 35%. Four lives and $45 million in damage (not current dollars) resulted from these 12 events. These figures amount to .4% of the total lives lost and 4% of the total dollar losses.

Three events (9% of total) are listed with magnitude <4.0. Though no lives were lost in these low magnitude tremors, they do account for $15 million (pre-1956 dollars) in damages, or about 1¼% of total dollar losses.

Conclusion: it may be assumed that significant losses can result from minor to moderate earthquakes - anywhere!

IN MEMORIAM

Arthur L. Crawford 1899-1980

Arthur L. Crawford, who served as first Director of the Utah Geological and Mineral Survey from 1949 to 1961, died of pneumonia at Bountiful, Utah, on November 22, 1980.

Arthur was born in the small community of Washington in southwestern Utah. He studied at Brigham Young University, receiving his bachelor's degree in 1924, and went on to Stanford University which awarded him a master's degree in 1926.

After completing his schooling Arthur taught geology and mineral technology successively at Brigham Young University, the University of Wyoming, and the University of Utah. While at the University of Utah he became Director of the Cooperative Microscopic Research Laboratories and subsequently was appointed Geologist and Mineral Technologist for the University of Utah Engineering Experiment Station.

During World War II Arthur secured a furlough from the University of Utah to serve as Raw Materials Engineer for the newly established Geneva Steel Company at Provo. In March, 1946, he was appointed as one of three commissioners of the Utah Department of Publicity and Industrial Development with responsibility for raw materials and research.

Although the Utah Geological and Mineralogical Survey had been established by the state legislature in 1931 it was not a functioning agency until 1949 when Arthur L. Crawford was named the first Director and given a small appropriation to work with. From that time forward his main interest lay in building the Survey, always with very limited funds, by soliciting geologic manuscripts from professors and graduate students which could be published and sold at a profit to the Survey.

He was a member of the Geological Society of America, American Mineralogical Society, Utah Geological Society, American Institute of Mining and Metallurgical Engineers, American Association of Petroleum Geologists, American Institute of Professional Geologists, Utah Geological Association (honarary member), Utah Academy of Science, Arts & Letters, Utah Historical Society, American Geographical Society, Sigma Xi, and Phi Kappa Phi and served as an officer of several. He belonged to the American Association of State Geologists and was elected to honorary membership after his retirement. He was a lifelong member of the Church of Jesus Christ of Latter-Day Saints, the Mormon faith.

Arthur's widow survives him as do one daughter, Mrs. Junior (Marion C.) Anderson, of Bountiful; three granddaughters; two great-grandchildren; a sister, Mrs. Ralph (Marva) Brown, of St. George, Utah; and two brothers, Carl of Orem, Utah, and George, of American Fork.

RECORD DEEP WELL BEGINS

Chevron USA, Inc. has begun operations at its 1 Cisco Canyon, NE SW Section 33, T. 16 S., R. 1 E., Sanpete County in what is scheduled to be Utah's deepest well. Proposed to 22,500 feet to Mississippian formations, the new operation is about eight miles west of the present deepest well in Utah drilled in 1980 to 21,845 feet by Placid Oil. This well encountered complex geology and some shows of gas but was suspended after extensive testing and attempts at completion. The Chevron test is 12 miles west of Ephriam in the San Pitch Mountains.

SIGHTS ON PUBLIC FACILITY SITES
No. 4

by Bruce N. Kaliser

Emergency Facilities

Certain public facilities must remain operational following a disaster, natural or man made. This class of structure includes hospitals, emergency operation centers, communication facilities, police stations and emergency vehicle garages or shelters. These are the necessary functions for saving human lives and it is understood that they must therefore withstand the shocks of earthquakes.

Sites for this type of facility must be subjected to minimal hazard. In addition to the site itself, consideration should be given to access routes for emergency vehicles. If the only route of egress for ambulances is through a double, marginally stable road cut, there could be severe trouble at time of earthquake. Though the vehicles escape damage, they may prove to be confined and useless due to poor station location with respect to geologic hazards.

Careful site selection should be able to virtually rule out the possibility for ground failure at these facilities. In areas microzoned for earthquakes or newly planned for future development there is considerable opportunity for thinking through the process of emergency facility siting. If not done early, then other factors will tend to dictate sites. Existence of a civic complex, for example, is given first consideration for any new critical public facility, provided there is room. It is easier to add on to a hospital than to start another. A poor site for the first hospital, therefore, aggravates the entire emergency response capability well into the future.

The geology of a community may indeed exert substantial control over the areal distribution of emergency facilities. The benchland along Utah's Wasatch Front, for example, proves aesthetically favorable for hospital sites. These facilities are in nicer neighborhoods, in proximity to other institutions, with views that exhilarate recuperating patients. But proximity to the active Wasatch Fault

Zone is a chief concern. If not actually built in the zone of deformation associated with earthquake faulting, the access roads do cross these zones. The potential actually exists that fault rupture from a future major earthquake event could affect much of the area's capacity to collect, convey and shelter the injured. It might well be considered that future hospital beds should be established outside of and on the valleyward side of the fault zone and where emergency traffic needn't traverse less stable sloping benchland.

Obviously, all critical facilities as considered here should be outside of potential inundation zones from failed fluid storage facilities and conveyance routes (canals, aqueducts, etc.). This is in keeping with the risk minimization rule.

The public's elected officials should assure their constituency that facilities required to assist in emergency are indeed in the position to do so - and much of that "position" rests upon the site.

LEASE SALE NETS $1.05 MILLION

Total bonus paid for State oil and gas leases was $1,047,495.80 at the January 26, 1981 sale conducted by the Division of State Lands. 60 to 62 tracts offered were sold. Average bid was $37.78 per acre and highest bid was $227.17 per acre for a section of land one mile north of the Aneth field in San Juan County.

FIRST GAZETTEER TO BE PUBLISHED

The USGS in cooperation with the U. S. Board on Geographic Names is preparing the first *National Gazetteer of the United States*. The Gazetteer will contain more than 1,500,000 place and feature names, and is to be published state by state. Contact Donald Orth, USGS, Branch of Geographic Names, 523 National Center, Reston, VA 22092. (703) 860-6331.

UTAH'S FIRST OIL SHALE DEVELOPMENT APPROVED IN UINTAH COUNTY

Geokinetics Inc. of Vernal, has received approval from the U. S. Environmental Protection Agency to build and operate five small "in-situ" oil retorts near Ouray over the next three years.

According to Roger Williams, EPA Regional Adminstrator, the approval was given as part of the EPA's policy to work together with energy companies with minimum conflict in an effort to increase energy supplies.

Geokinetic's process involves burning some oil shale below the ground to volatilize the surrounding oil which can then be pumped to the surface. The EPA's Office of Research and Development will work jointly with the company to establish emission rates and appropriate emission controls. The process creates relatively little disturbance of the ground surface.

STAFF CHANGES

Peter Murphy, Research Geologist, has taken a position with Fugro National, Inc. in Long Beach, California, where he will continue his involvement in the evaluation of low-temperature geothermal resources, as he had been doing for UGMS the past three years. Mr. Murphy's position has been filled by Robert Klauk, a former UGMS employee who left the Survey in 1979 to take a position with Chen and Associates. Mr. Klauk has returned to UGMS employment effective January 1981.

DID YOU KNOW?

The saltiness of the Great Salt Lake restricts aquatic life to algae, bacteria, protozoa, brine flies and brine shrimp.

UTAH GEOLOGICAL AND MINERAL SURVEY
SURVEY NOTES

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Address Correction Requested

Approval No. 8100047
Account No. 016103