

Summary of the Overthrust Belt in Parts of Wyoming, Utah, and Idaho

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SUMMARY OF THE OVERTHRUST BELT
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By

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INTRODUCTION

The uncertainty in sustained international oil supplies and the higher price for oil on the world market have stimulated petroleum exploration in the United States. One of the most promising areas for exploration in the continental United States is the Overthrust belt that encompasses parts of Wyoming, Utah, and Idaho.

Although oil has been extracted from the Overthrust belt for over a century, only in the past few years have major new fields been discovered. The first significant discovery was made in 1975 at Pineview, Utah. By the end of 1979, eleven new oil and gas fields had been found in Wyoming and Utah. The potential production from these fields has been estimated at 500 million barrels of recoverable oil and 5.5 trillion cubic feet of recoverable gas. Because the Overthrust belt is still considered very much a frontier in petroleum exploration, its full potential as an extensive hydrocarbon resource remains unknown.

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OVERTHRUST BELT

The Overthrust belt of Wyoming-Utah-Idaho is part of a single tectonic element, termed the Cordilleran orogenic belt, that extends from northern Alaska to Central America. The Overthrust belt is characterized by a linear band of very thick sedimentary rocks that have undergone intensive folding and thrust faulting. Two segments of the North American part of the Cordilleran orogenic belt are already oil and gas producers: the Canadian foothills thrust belt and the Wyoming-Utah-Idaho Overthrust belt.

An appropriate geologic analog to the relatively unexplored Wyoming-Utah-Idaho Overthrust belt is the extensively explored Canadian foothills thrust belt. Both areas share many common characteristics, including general structural configuration, trap types, reservoirs, stratigraphy, timing of migration of hydrocarbons, depth of burial, and age of tectonic movement. The two areas differ in their major source rocks and paleothermal histories. In the 55 years since the first discovery at Turner Valley in the Canadian foothills, 32 fields have been found in the Canadian foothills thrust belt, and they are estimated to contain 9.3 trillion cubic feet of initially recoverable gas, 143 million barrels of natural gas liquids, and 132 million barrels of oil.

PETROLEUM POTENTIAL OF IDAHO

There are three prerequisites for the formation of a commercial oil and gas pool: (1) a source rock, which has been subjected to a specific

thermal history; (2) a permeable reservoir rock, which will yield oil and gas rapidly enough to make drilling profitable; and (3) an impermeable trap to retain the oil and gas below the ground. Traps may be either stratigraphic or structural.

The structural setting of the Overthrust belt is similar in Wyoming, Utah, and Idaho (Figure 1). Therefore, structural traps should be present and similar in all three states.

The source rock for petroleum occurrences in Utah and Wyoming appears to be marine shales, which were deposited in a narrow, north to south-trending seaway during Cretaceous time (136-65 million years ago). Unfortunately, these rich marine shales are not present in Idaho. However, the U. S. Geological Survey has identified other potential source rocks in Idaho that have thermal histories conducive to hydrocarbon migration. These source rocks include the Deseret Formation of Mississippian age, the Phosphoria Formation of Permian age, and the Thaynes Formation of Triassic age.

Major reservoir rocks in Wyoming and Utah include the Nugget Sandstone and Twin Creek Limestone of Jurassic age. Both formations are present in Idaho. However, reservoirs in closer association with potential Triassic, Permian, and Mississippian source rocks also occur in Idaho and include the Phosphoria Formation of Permian age, the Wells Formation of Pennsylvanian age, and the Mission Canyon Limestone of Mississippian age.

It appears that deeper potential stratigraphic reservoirs must be sought in Idaho. To date, most drilling has been fairly shallow, although recent drilling has been considerably deeper (greater than 10,000 feet). The location of oil and gas exploration wells since 1976 in the Idaho portion of the Overthrust belt are shown in Figure 2.

In summary, the Idaho portion of the Overthrust belt appears to possess the major requirements for a hydrocarbon province:

1. The presence of dominant regional structural trends which appear favorable for hydrocarbon accumulation.
2. Rich, thermally mature source rocks.
3. The existence of thick, porous, and permeable clastic and carbonate reservoir rocks.
4. The discovery of significant oil and gas fields in adjacent areas.

EXPLORATION LIMITATIONS

Critical factors that limit petroleum exploration in the Overthrust belt, particularly in the Idaho portion, include:

1. A complex and poorly understood geological setting.
2. Higher than average cost of wildcat and development drilling (approximately \$1.5 million per well).
3. Limited road access from east to west across the Overthrust belt.
4. Difficult terrain in areas of drill sites.
5. High elevations.
6. Seasonal working conditions at higher elevations.
7. Demanding environmental considerations pertaining to road building and drill sites.
8. Federal land restrictions.

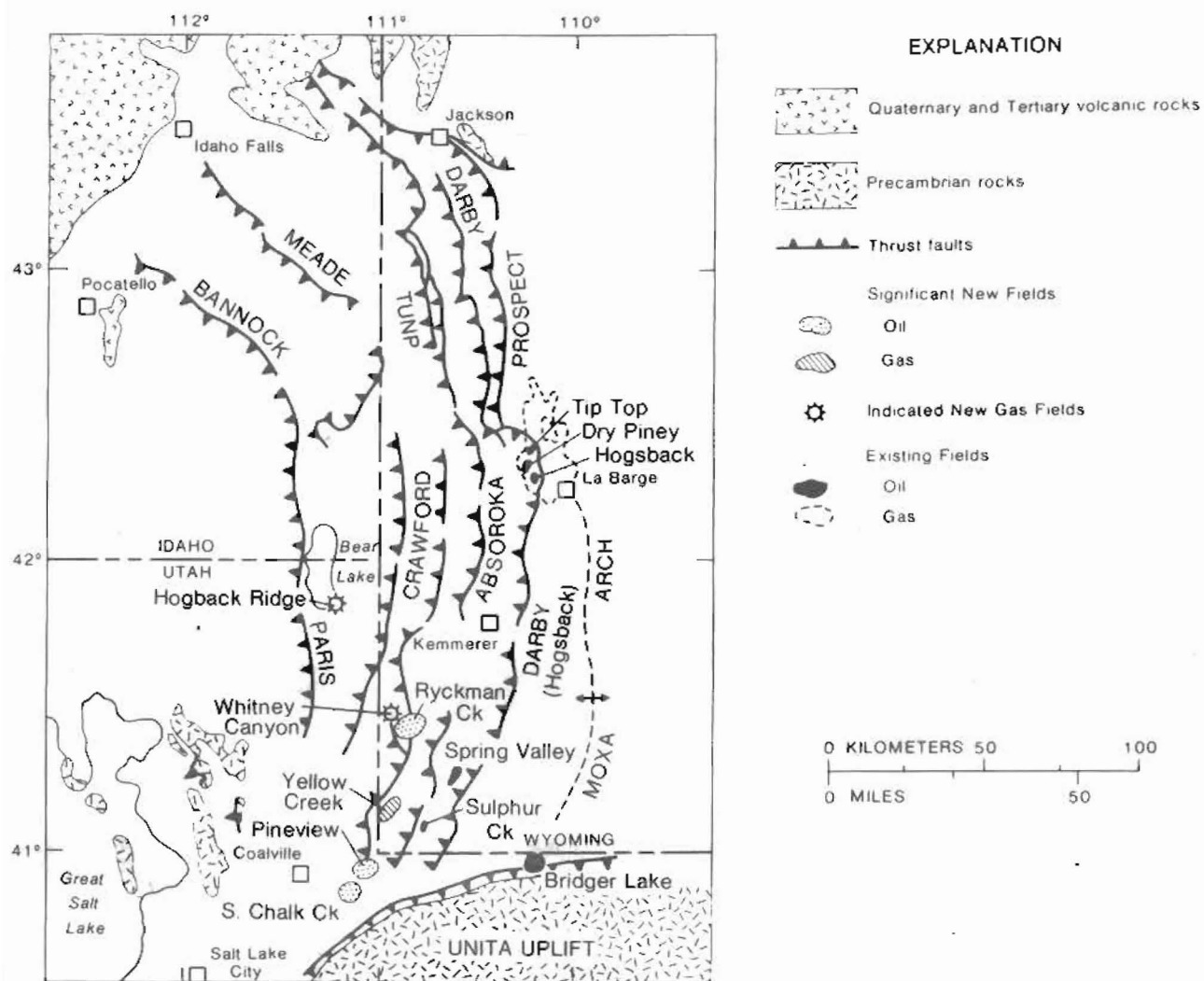


Figure 1. Index map of the Wyoming-Utah-Idaho Overthrust belt. [Source: Powers, Richard B., 1977, Assessment of oil and gas resources in the Idaho-Wyoming thrust belt: Wyoming Geological Association Guidebook, Twenty-ninth Annual Field Conference, p. 630.]

DATE	SEC.	TWP.	RGE.	LOCATION	OPERATOR	WELL NAME	DEPTH
1976	SESE 20	10S	46E	MAY PETROLEUM INC.	FEDERAL-ELK VALLEY NO. 1	3919	
1976	SWSW 31	14S	44E	J. HULME DUNFORD	99X-101	805	
1977	SWSW 36	3S	45E	AMERICAN QUASAR PETROLEUM CO.	BLACK MOUNTAIN-FEDERAL NO. 1	14,330	
1977	SESE 1	15S	43E	J. HULME DUNFORD	99X-104	809	
1978	SESE 8	10S	46E	MAY PETROLEUM INC.	FEDERAL NO. 1-8	16,750	
1978	SWSW 22	13S	44E	AMERICAN QUASAR OF NEW MEXICO	JENSEN NO. 22-1	11,780	
1978	NWNE 26	5N	44E	AMERICAN QUASAR OF NEW MEXICO	COOK NO. 26-1	6565	
1978	SWNE 2	2S	41E	AMERICAN QUASAR OF NEW MEXICO	KING NO. 2-1	13,555	
1978	SWNW 10	16S	46E	AMERICAN QUASAR OF NEW MEXICO	GRACE-FEDERAL NO. 10-1	11,860	
1978	SWNW 34	5N	44E	SUNMARK EXPLORATION	MINER NO. 1-34	3715	
1978	SENE 8	12S	38E	NU DAY EXPLORATION	BANNOCK NO. 1-A8	1860	
1978	NENE 9	4S	42E	CONTINENTAL OIL CO.	GENTILE VALLEY NO. 1	9913	
1979	SWSE 13	10S	43E	UNION TEXAS PETROLEUM	BIG CANYON-FEDERAL NO. 1-13	11,734	
1979	SWSW 8	1S	39E	UNION OIL CO. OF CALIF.	HOFF NO. 1-8M	8942	
1980	NWNE 33	5N	44E	SUPRON ENERGY CORP.	BEVANS NO. 1	12,530	
1980	SESW 3	12S	43E	LADD PETROLEUM	BENNINGTON NO. 3-24	13,530	
1980	SWSE 29	13S	46E	CITIES SERVICE CO.	RIGBY-WILLIAMS NO. 1-A	9,800	
*1980	NWNW 21	16S	45E	AMERICAN QUASAR	NORTH EDEN-FEDERAL NO. 21-11	.	
1980	NENW 6	16S	46E	AMERICAN QUASAR	NORTH RABBIT CREEK-FEDERAL NO. 6-21	9,780	
1980	NWSE 29	5S	44E	PHILLIPS PETROLEUM CO.	STOOR "A" NO. 1	13,000	
*1980	NWNE 5	4S	45E	AMOCO PRODUCTION CO.	BALD MOUNTAIN-FEDERAL NO. 1	Not spudded	
*1980	NWNE 6	4S	45E	AMOCO PRODUCTION CO.	BALD MOUNTAIN-FEDERAL NO. 2	Not spudded	

* WELLS IN PROGRESS

⊙ DRY HOLE
○ WELL IN PROGRESS

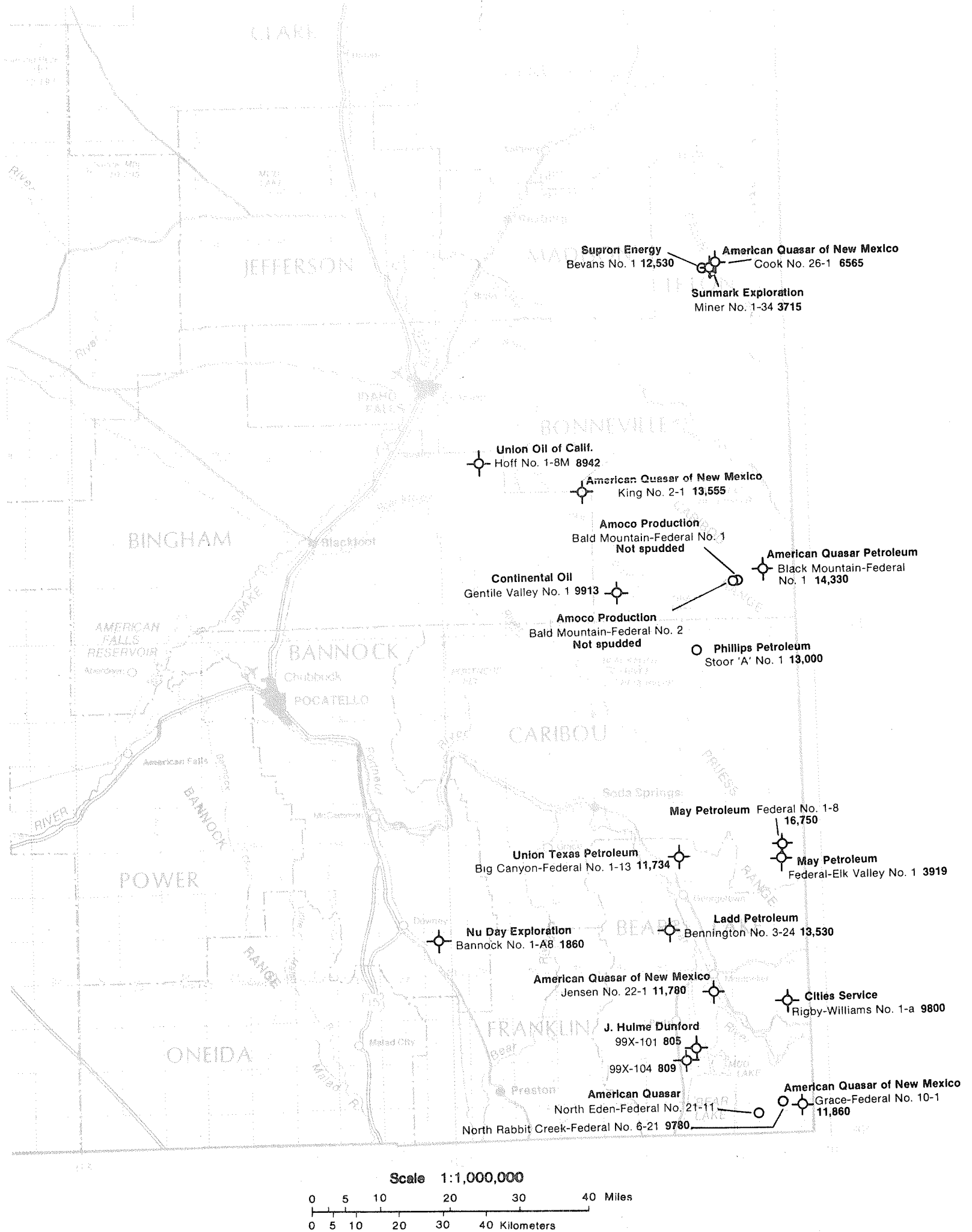


Figure 2. Current oil and gas exploration in southeast Idaho, July 1980. [Modified from Breckenridge, R. M., 1980, *Oil and Gas Exploration in Idaho, 1900-1979*: Idaho Bureau of Mines and Geology Map 2.]