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

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IN PARTS OF WYOMING, UTAH, AND IDAHO

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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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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.
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.
Figure 1. Index map of the Wyoming-Utah-Idaho Overthrust belt.