GeoNote 21

The Search for Oil and Gas in Idaho

The story of oil and gas exploration in Idaho is an ongoing saga of near successes and shattered expectations. Almost 90 years of searching has thus far not yielded a single commercial discovery. Deep drilling, however, has provided a wealth of geologic, geophysical, and engineering data that have revealed areas where conditions are favorable for the generation and preservation of hydrocarbons. In addition, this exploration has uncovered new sources of ground water, geothermal energy, and minerals that may one day prove significant.

Since 1903, about 145 wells, the most recent completed in 1988, have been drilled throughout the state to find hydrocarbons. Exploration has mainly been in two areas: the southeast Idaho thrust belt and the western Snake River Plain. Additional scattered test wells occur in the Cassia and Beaverhead-Centennial mountains, the eastern margin of the Columbia Plateau, and the Idaho Panhandle. Other regions of the state may be prospective but are as yet untested. Some other wells, drilled to explore principally for geothermal or mineral resources, may also have had oil and gas as secondary objectives. The state's deepest test is the Exxon Meyers Federal Unit No. 1, taken to a depth of 18,540 feet in 1982.

The generation and preservation of oil and natural gas require a discrete set of geologic conditions. Source beds, such as shales or other fine-grained sedimentary rocks, typically of marine origin, preserve organic matter from destruction in an anaerobic (oxygen-free) environment. Heat and pressure transform this organic matter into hydrocarbon molecules, creating mostly liquids at first, then gas as temperature and pressure increase. Permeability, the capacity of a medium to transmit fluids, allows disseminated liquid or gaseous hydrocarbons, which are less dense than water, to move through the rock. Porosity, the intergranular pores, fractures, solution cavities, and other voids developed within the rock, makes the space for oil or gas to pool in an underground reservoir. A seal, created over the reservoir by an impermeable caprock, blocks the upward leakage of hydrocarbons and the downward infiltration of fresh water from the earth's surface. Finally, a trap is formed by an anticline, fault, pinchout, unconformity, or other geologic feature that, in concert with a seal, prevents lateral and vertical leakage.

Some of these geologic conditions occur in every area that has been tested. Even when all conditions are present, however, and oil or gas is discovered, the deposit must be large enough to justify the expense of developing it. Beyond the drilling cost, well expenses include casing, perforation, cleaning, and stimulation of the producing bed as well as the subsequent installation of surface production facilities. Oil may be stored temporarily in on-site tanks, but eventually it must be trucked to a petroleum refinery. Natural gas must be piped to a processing plant and then into another pipeline system for distribution and sale. The cost of transporting gas from the well to an existing pipeline may ultimately determine whether the resource can be economically produced.

Many tantalizing indications or "shows" of oil and gas have encouraged exploration in the state. In 1927, the Teton Valley Land and Leasing No. 1 well, drilled to about 1,300 feet deep, hit a pocket of natural gas that ignited and burned the drilling rig. Five nearby wells, however, the most recent drilled in 1980, were unsuccessful in establishing production. In the western Snake River Plain, several wells have blown out, or flowed natural gas to the surface, only to cease after a brief time. In these cases, the reservoir was not large enough for commercial development.

Although drilling has yet failed to locate economic hydrocarbon deposits, some wells have instead discovered important potential sources of potable ground water, geothermal energy, and mineral resources. A 5,701-foot exploratory test, drilled east of Lewiston in 1983, found a significant fresh-water aquifer beneath the Columbia River basalts. Oil and gas tests south of the Nampa-Caldwell area have helped delineate a widespread low-temperature geothermal aquifer and other fresh-water sources. Deep exploratory wells in the southeast Idaho thrust belt have found potable ground water, formation temperatures in excess of 400°F, thick layers of salt and phosphate rock, and brine. Although not all of these resources can be economically developed at present, their identification is an important addition to our knowledge of the subsurface resources in the state.

The petroleum industry has focused on two regions where the geology is believed to be most favorable for the formation and preservation of hydrocarbons. One of these regions, the western Snake River Plain, is underlain by interbedded sediments and volcanic rocks that were formed while an enormous fresh-water body covered much of southwest Idaho from about 8 million to 2 million years ago. Deep seismic exploration profiles, produced by sound waves reflected from subsurface rock layers, show large fault blocks that could create hydrocarbon traps. Potential porous reservoir rocks are interbedded with clay that could form seals; and natural gas shows are common in deeper parts of the basin. The scarcity of thick, organic-rich source beds, however, as well as the possibly destructive effects of past high temperatures on

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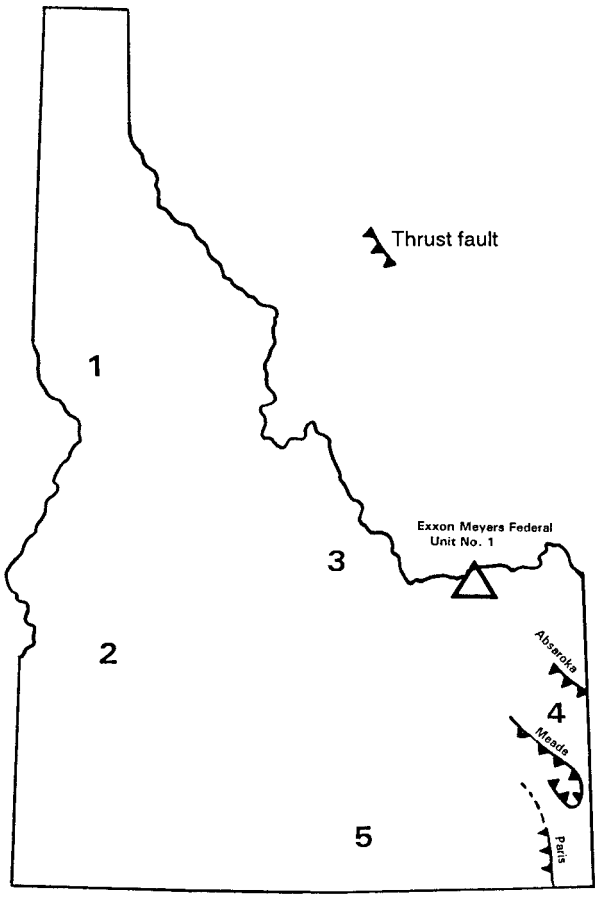
buried hydrocarbons, has led many explorationists to conclude that the potential for commercial production in shallower reaches is low. Nevertheless, it is possible that deeper, older sedimentary formations, as yet not penetrated by drilling, may be the best prospect for hydrocarbon reserves.

The other and more extensively explored region of industry interest is the thrust belt of southeast Idaho. This area is distinguished by the prominent thrust faults evident at the surface. In Idaho, three major faults are present: Paris, Meade, and Absaroka. The surface expression of each fault is thought to mark the boundary of a major thrust plate or sheet. These complex faults were formed by the compression of the earth's shallow crust from west to east that caused the sheets to override one another. Numerous other faults are present throughout the area, in evidence both at the surface and in the subsurface. Exploration has targeted buried or surface structures, such as anticlines and faults, within and beneath these sheets.

In Wyoming and Utah, the thrust belt yields prolific oil and gas from rocks ranging in age from Ordovician through Cretaceous. The closest producing area to Idaho is the now-abandoned one-well Hogback Ridge field, about 10 miles from the Idaho border in Rich County, Utah. This well produced gas for about 3 years from Permian and Triassic formations.

Although hydrocarbon shows have frequently been recorded in southeast Idaho, there are still many impediments to exploration in the thrust belt. Drilling may be difficult due to structural complications or the sheer depth of the targeted formations. Seismic profiles can be inaccurate or misinterpreted, causing operators to miss objective formations. The subsurface structural geology is complex, and drilling reveals more faults than expected or known. Finally, stratigraphic seals are not well developed in some areas, causing hydrocarbons to escape and fresh water to infiltrate from the surface.

Despite these obstacles, however, the thrust belt is still the most geologically prospective province in the state. All of the conditions necessary for the formation, emplacement, and preservation of hydrocarbons are present in some areas. Yet the Idaho part of the thrust belt is sparsely explored compared with that in adjacent producing states. Careful and innovative geologic work, advances in geophysical and geochemical technology, and favorable economics suggest that commercial hydrocarbon production may one day be established in Idaho. These factors will also encourage future exploration in other areas of the state, where the subsurface geology is unknown, and in the process reveal ground-water, geothermal, and mineral resources.



Principal areas of oil and gas exploration in Idaho: (1) eastern margin of Columbia River plateau; (2) western Snake River Plain; (3) Lemhi Range/Beaverhead Mountains area; (4) southeast Idaho thrust belt; and (5) Cassia Mountains area. Note locations of major thrust faults and the site of the state's deepest well.

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