REPORT ON GEOLOGICAL POTENTIAL OF THE AREAS
ADJACENT TO THE PROPOSED
OURAY–INTERSTATE 70 HIGHWAY

February 14, 1992
By Charles Bishop
Utah Geological Survey
Introduction

The area affected by the development of the highway (hereafter referred to as the study area) consists of approximately 1,824,000 acres of land that contain known and potential mineral and energy resources. The study area is located in the east-central and southeastern Uinta Basin, and the lowlands south of the Book Cliffs. The study area is defined generally as an area that could be impacted by the proposed highway. The area extends from the Book Cliffs on the south to the Red Wash oil field on the north; the west boundary is the Green River which forms a natural barrier, the easter boundary is approximately the Utah-Colorado border, east of this border access can easily be made by other means. The main access in the study area will likely come from the proposed highway. Figure 1 shows the proposed highway location and the study area. The benefit to the area would be improved accessibility provided by the proposed Ouray-Interstate 70 highway.

The Uinta Basin contains a number of conventional and alternative energy resources. As conventional oil and gas reserves are depleted, interest in new exploration and alternative fuel sources should increase. Some of the most promising alternative fuel sources are large and widespread in the study area. During the high oil prices of the early 1980's this area attracted many energy development projects. Figure 2 shows the locations of proposed oil shale and tar sands projects and the location of the proposed highway.

Geological Setting

The Uinta Basin is underlain by Mesozoic marine, deltaic and continental sedimentary rocks and early Tertiary fluvial and lacustrine rocks. Late Tertiary uplift of the Colorado Plateau resulted in dissection and removal by erosion of some of the Tertiary rocks in the basin proper and formation of several steep escarpments such as the Book Cliffs and Roan Cliffs along the southern margin of the basin. South of the Book Cliffs are lowlands that are underlain by older pre-Tertiary rocks. The Book Cliffs and Roan Cliffs consist of Cretaceous and Tertiary sedimentary rocks, which dip gently northward into the basin.

Tar Sands

P. R. Spring Deposit

The P. R. Spring tar sand deposit is located on the southeastern flank of the Uinta Basin in Uintah and Grand county. Figure 3 shows the P. R. Spring location. It consists of oil impregnated sandstones of the Eocene Green River Formation. The P. R. Spring deposit is the third largest deposit in the state, with resource estimates as low as 3.3 billion barrels and as high as 4.3 billion barrels (Clem, 1984; Campbell and Ritzma, 1979; IOCC,
1984). The potential tar sand resource covers an area of more than 185,000 acres. The topography is rugged, characterized by valleys and steep cliffs and accessibility to the area is difficult. The deposit is one of the most remote of all the tar sand deposits of Utah, (Byrd, 1967). The deposits has a maximum thickness of 100 feet and a maximum grade of about 50,000 barrels per acre-foot. The tar sands occur in five major zones and additional minor zones, all within the Green River Formation (Clem, 1984; Campbell and Ritzma, 1979). Definition and characterization of the deposit is based on sparse data (only 30 core holes) and has given rise to speculative estimates of the amount of resource present. The areal distributions and stratigraphic positions of the deposit is still poorly defined. Undoubtedly, there are tar sand resources beyond the measured resources, but this cannot be defined or characterized with the available data.

Hill Creek Deposit

The Hill Creek tar sand deposit is located west of the P. R. Spring deposit (figure 3). The deposit covers an area of approximately 87,000 acres. The deposit is remote, and occurs in a highly dissected terrain. Its geological setting is similar to P. R. Spring, but tar sands are only present in two primary zones of the Green River Formation. Estimates of the resources present at the Hill Creek deposit range from 0.88 to 1.16 billion barrels of oil (Campbell and Ritzma, 1979; IOCC, 1984).

Potential and Previous Work

Oil production from tar sands deposits is occurring in other countries and many people consider the commercial production of oil from Utah tar sands to be economically viable. This interest is reflected by the request to convert oil and gas leases to combined hydrocarbon leases, received by the Bureau of Land Management in the early 1980's. Companies that have done development work on the P. R. Spring deposit are Texaco, Phillips Petroleum, Enercor, C&A Company, Big Horn Oil Company, and T.J. Murphy. Only a small amount of the area would be minable by surface methods; most of the area would be exploited by an in-situ recovery method. There are several such methods being tested on other tar sand deposits throughout the world (Clem, 1984). An open-pit operation, using an experimental mining technique and a surface extraction plant has produced a limited amount of oil at P. R. Spring.

Factors that influence tar sand development are (1) the price of oil, (2) amount of information available about the deposit, (3) accessibility to the area, and (4) governmental policies. The existing road network within the area consists of primitive dirt roads. Better accessibility could increase the potential for tar sand development and might encourage testing of new experimental technologies that could lead to serious commercial efforts in the study area.
Oil Shale

The Green River Formation contains the greatest reserves of oil shale in the United States. The Green River Formation underlies a substantial part of the area of interest. Figure 4 shows the thickness and outcrop pattern of the oil shales in the Green River Formation. The oil shale crops out in many of the steep canyons in the southern part of the study area and dips gently northward beneath younger rocks. The Green River Formation contains an estimated 321 billion barrels of oil in the form of oil shale (Cashion, 1964). Within the study area the estimation of the resource can vary from 10 billion barrels of oil for 145,273 acres of land in a single zone (Dyni and others, 1991) to 154 billion barrels of oil for the entire southern Uinta Basin from multiple zones (Cashion, 1967; Picard, 1985). Most of the deposits occur in the Parachute Creek Member of the Green River Formation, with minor amounts of oil shale in the Evacuation Creek Member. The thickness of the Parachute Creek Member ranges from about 700 to 1,200 feet.

The most important deposits of oil shale in the Parachute Creek Member occur in the eastern part of the Uinta Basin. These contain the thickest and richest oil shale zones. Sporadic attempts to establish oil shale as an economic source of fuel have been made.

Oil shales of the Green River Formation that crop out in the study area are potentially economically viable. Underground techniques would most likely be used to recover oil from these rocks. Pilot projects in the area have demonstrated that oil can be produced from oil shale. Economic factors that appear to be most important in the exploitation of oil shale are: (1) extraction and processing methods, (2) locating an adequate water supply, (3) contamination of groundwater, (4) disposal of waste rock, (5) other environmental considerations, (6) the price of oil, (7) government policies and (8) infrastructure costs.

Natural Gas

There are many shows of natural gas in the Tertiary to Jurassic sedimentary rocks of the basin and surrounding areas. Gas production was established in the Uinta Basin and the surrounding area by 1948. Gas production from the southeast flank of the Uinta Basin and the northwest end of the Uncompahgre uplift could benefit from the proposed highway. Production in these areas has come from Upper Cretaceous to Late Jurassic formations. Most production has come from northwest trending anticlinal traps in the southern part of the area (Cisco area). Farther north, production is from the up dip pinch out of tight fluvial sandstone. Natural gas production depends on pipelines for transport.

In the study area, there are more than 18 gas fields that could benefit from the improved access that the proposed highway would
give for maintenance of wells and pipelines (Figure 5). More than 221,000,000 thousand cubic feet (Mcf) of gas has been produced from these fields (Utah Division of Oil, Gas, and Mining Production report, 1990).

**Coal and Coalbed Methane**

**Sego Coal Field**

The Sego coal field lies along the Book Cliffs between the town of Green River and the Colorado state line. The coal occurs in the Upper Cretaceous Price River Formation. There are generally four zones that may not be present at all locations. The coal beds are thin over much of the area, but are locally thick enough to mine. Some of the thicker coal seams have been mined in the past. Coal bearing rocks project into the subsurface beneath the Book Cliffs.

Coalbed methane from the coal beds underlying the study area has some potential. The few samples collected for desorption analysis indicated there is a some moderately gassy coal. All the samples were taken at shallow depth. If the coal is continuous beneath the Uinta basin, then a coalbed methane resource might be present at depth (Doelling and other, 1979).

**Other Resources**

**Gilsonite**

The area contains all of the known gilsonite veins in the western United States. The veins trend northwesterly for miles across the terrain, and can be as wide as 20 feet. Gilsonite mining began before the turn of the century and continues today.

**Minerals**

There has been only minor mineral exploration activity in the study area. Exploration for sandstone copper in the Eocene Uinta Formation has occurred within the study area and there has been exploration for placer gold associated with the Green River, the western boundary of the study area (Covington, 1964). There has been some exploration for uranium and vanadium but no significant deposits have been found within the study area. Light aggregate, borrow materials and small amounts of sand and gravel are present in the study area.

**Summary**

An area of approximately 1,824,000 acres could benefit from the construction of the Ouray-Interstate 70 highway. Resources located within this area could benefit by improved access for additional and more detailed work on the size and character of the deposits. The improved access would help in maintenance of pipelines, wells, and other support facilities. It would also
encourage additional exploration, and greatly reduce infrastructure costs for any proposed development.
References


IOCC, 1984, Major tar sand and heavy oil deposits of the United States: Interstate Oil Compact Commission.


Figure 1. Location of the proposed Ouray-Interstate 70 Highway. The study area, shaded, encloses energy development projects that may benefit from the highway.
Figure 2. Locations of previously proposed projects to extract resources from oil shale and tar sands (from Bureau of Land Management, 1983). The location of the proposed highway is indicated.
Figure 3. Location of P. R. Spring, Hill Creek tar sand deposits (from Ritzma, 1979) and the proposed highway.
Figure 4. Thickness, in feet, of the oil-shale beds of the Green River Formation in the study area, that will yield an average of 15 gallons of oil per ton. Stippled pattern shows outcrop area of the lower part of the Green River Formation (m). Thickness contour interval is 100 feet (from Cashion, 1967). The proposed highway is also shown.
Figure 5. Locations of gas fields (from Utah Geological and Mineral Survey Map 68, 1983) and the proposed highway.