UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Text to accompany:

Open-File Report 79-1003

1979

COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE FERRON CANYON QUADRANGLE SANPETE AND EMERY COUNTIES, UTAH

(Report includes 8 plates)

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INTRODUCTION

Purpose

This report was compiled to support the land planning work of the Bureau of Land Management and to provide a systematic coal resource inventory of Federal coal lands in Known Recoverable Coal Resource Areas (KRCRA's) in the Western United States. It supplements the land planning requirements of the Federal Coal Leasing Amendments Act of 1976 (Public Law 94-377) sec. (3)(B) which states, in part, that "Each land-use plan prepared by the Secretary [of the Interior] (or in the case of lands within the National Forest System, the Secretary of Agriculture pursuant to subparagraph (A)(i)) shall include an assessment of the amount of coal deposits in such land, identifying the amount of such coal which is recoverable by deep mining operations and the amount of such coal which is recoverable by surface mining operations."

This text is to be used in conjunction with the Coal Resource Occurrence (CRO) Maps (7 plates) and the Coal Development Potential (CDP) Map (1 plate) of the Ferron Canyon quadrangle, Sanpete and Emery Counties, Utah (U.S. Geological Survey Open-File Report 79-1003).

Published and unpublished public information were used as data sources for this study. No new drilling nor field mapping were done to supplement this study. No confidential nor proprietary data were used.

Location

The Ferron Canyon Quadrangle lies in the central part of the Wasatch Plateau coal field in Sanpete and Emery Counties, Utah. The southeast corner of the quadrangle is 6.5 miles (10.5 km) northwest of the town of Ferron. The city of Manti is the county seat of Sanpete County and is 14 miles (22.5 km) west of the quadrangle. Castle Dale, the county seat of Emery County, is 12 miles (19 km) east of the quadrangle.

Accessibility

The Ferron Canyon quadrangle lies in the high central part of the Wasatch Plateau where there are only light-duty graveled roads, dirt roads, and jeep trails for accessibility. A light-duty road comes up Ferron Canyon and enters the southeast corner of the quadrangle. It circles Dry Mountain, leaves, and then enters the quadrangle 2 miles (3 km) to the west. The road cuts across the southwest corner of the quadrangle and continues on westward for 27 miles (43 km) to the town of Mayfield. Another light-duty road enters the central east side of the quadrangle, turns north, and then leaves the northwest corner of the quadrangle where it continues northward 3.8 miles (6.1 km) to Joes Valley Reservoir and Utah Highway 29.

The nearest railhead is at Manti which is on a branch line of the Denver and Rio Grande Western Railroad.

Physiography

The Wasatch Plateau is a high and deeply dissected tableland. The eastern margin forms a sweeping stretch of barren sandstone cliffs some 80 miles (129 km) long. The strata have gentle dips generally less than 10 degrees and erosion has produced ledges and cliffs along the plateau front and on steep-walled re-entrant canyons.

The Ferron Canyon quadrangle area is mountainous. The outstanding physiographic feature is Ferron Canyon with steep walls which rise up to 1,200 ft (366 m) above Ferron Creek. Southwest of the canyon, Ferron Mountain lies in the extreme southwest corner of the quadrangle and in the adjoining quadrangles to the south and southwest. This mountain is well over 10,000 ft (3,048 m) in elevation and the southwest corner of the quadrangle reaches 10,600 ft (3,231 m). Total relief in the quadrangle is over 4,120 ft (1,256 m). Coal is exposed in the canyon walls at about 6,800 ft (2,073 m) above sea level.

Much of the upland area is gently-sloping topography with surface gradients less than 10 degrees.

The main drainage system in the quadrangle area is Ferron Creek and its tributaries. Ferron Creek drains into the San Rafael River approximately 10 miles (16 km) east of the quadrangle.

Climate

The climate of the Wasatch Plateau varies with altitude from semi-arid in the lowest elevations to alpine in the highest. The annual precipitation in the Ferron Canyon quadrangle ranges from less than 12 inches (30.5 cm) in the southeast corner to more than 25 inches (63.5 cm) in the northwest and southwest corners (U.S. Department of Commerce,(1964)).

Temperatures on the high plateau are cool in summer and cold in the winter. Summer temperatures in the highlands may reach 80 degrees F (27 degrees C) and in the winter drop to -20 degrees F (-29 degrees C).

Land Status

The quadrangle lies in the west central part of the Wasatch Plateau Known Recoverable Coal Resource Area (KRCRA). Approximately 12,000 acres in the quadrangle are covered by the KRCRA including about 1,500 acres of non-Federal land and 10,500 acres of unleased Federal coal land. There were no Federal coal leases in the KRCRA of the quadrangle at the time the land status was reviewed for this report (1977). See plate 2.

GENERAL GEOLOGY

Previous Work

Spieker (1931) mapped the geology and coal outcrops of the Wasatch Plateau and his maps represent the most detailed original work presently available. The stratigraphy of the area has also been described by Spieker and Reeside (1925), Katich (1954), and Hayes and others (1977). Doelling (1972) has summarized the geology and updated the coal data.

Stratigraphy

The coal beds of economic importance in the Wasatch Plateau coal field are Upper Cretaceous in age and are confined to the Blackhawk Formation of the Mesaverde Group. The Mesaverde includes the following four formations in ascending order: the Star Point Sandstone, Blackhawk Formation, Castlegate Sandstone, and the Price River Formation. The Upper Cretaceous Mancos Shale underlies the Mesaverde Group but is not exposed in the quadrangle area.

The Tertiary strata overlying the Mesaverde Group consist of two formations in the quadrangle: the North Horn Formation (Upper Cretaceous and Paleocene) and the Flagstaff Limestone of Paleocene Age.

The oldest unit exposed in the quadrangle is the Star Point Sandstone which crops out in the central part of Ferron Canyon and in Stevens Canyon. The formation consists of massive yellowish-gray sandstone.

The coal-bearing Blackhawk Formation crops out in the walls of Ferron Canyon and in some of the fault blocks in the southeast corner of the quadrangle. The formation is about 750 ft (229 m) thick in Ferron Canyon and the coal beds are confined to the lower part of the formation.

The upper rim of Ferron canyon is formed by the resistant, cliff-forming Castlegate Sandstone which ranges from 90 to 150 ft (27 to 46 m) thick. It consists of massive white to gray coarse-grained and gritty sandstone. The overlying Price River Formation is composed of medium-grained sandstone with some interbedded shale. The Price River Formation in this area ranges from 300 to 400 ft (91 to 122 m) thick.

The North Horn Formation ranges from 1,600 to 2,000 ft (488 to 610 m) thick and consists of variegated shale with subordinate amounts of sandstone, conglomerate, and fresh water limestone. The Flagstaff Limestone caps the higher mountains and is composed of resistant ledge-forming

yellowish-gray limestone which weathers white to very pale gray. The upper part of the formation is eroded and the total thickness deposited in the quadrangle area is unknown, but probably exceeded 900 ft (274 m).

Structure

The most significant structural feature in the Ferron Canyon quadrangle is the Joes Valley fault zone which is about 2 to 2.5 miles (3.2 to 4.0 km) wide in the southeast corner of the quadrangle. The system is complex and consists of at least nine prominant faults in that part of the quadrangle. Displacements range up to 1,200 ft (366 m) (Doelling, 1972). The rocks between the east and west bounding faults have mostly collapsed to form a series of grabens and horsts.

Strata may be more steeply inclined in the fault blocks than in the unfaulted areas but generally in and outside the fault zone the beds dip less than 5 degrees.

COAL GEOLOGY

The area of coal outcrop is small in the quadrangle and there is an absence of non-proprietary drilling data.

Hiawatha Coal Zones

Two coal beds or zones, the Hiawatha and the Upper Hiawatha, are found in this quadrangle. These include several sub-beds as shown on plate 3. The Hiawatha bed or zone is found at the base of the Blackhawk Formation and above the Star Point Sandstone. The closely spaced sub-beds or splits, H-1 and H-2, were combined to make the isopach map, plate 4.

The Upper Hiawatha coal also consists of several sub-beds which range from less than 1.0 ft (0.3 m) to several feet in thickness. Generally, these sub-beds are less than 5.0 ft (1.5 m) thick, but in one measured section, index number 4 on plate 1, a bed that is questionably Upper Hiawatha, is 5.1 ft (1.6 m) thick.

Other Coal Beds

Two other coal beds, the Blind Canyon and the Slide Hollow, occur in adjoining quadrangles to the east and south but have not definitely been identified in the Ferron Canyon quadrangle. The Blind Canyon bed is believed to occur about 40 to 45 ft (12 to 14 m) above the Hiawatha bed (Doelling, 1972). The Slide Hollow bed is about 150 ft (46 m) above the Blind Canyon bed and has been found on Birch Creek just south of the quadrangle in the fault zone. The bed is 8 ft (2.4 m) thick at that point and it is possible that the coal bed extends into the Ferron Canyon quadrangle (Doelling, 1972).

Intervals reported as "bony coal," "bone," "shaly coal," or other similar terms in the data sources are shown as "rock" intervals in this report on plates 1 and 3. These intervals were not included in the coal thicknesses used to construct the coal isopach map.

Chemical Analyses of the Coal

No coal analyses are available for the Ferron Canyon quadrangle. Several proximate analyses of coal samples taken from the Hiawatha coal bed in the adjoining quadrangle to the east (the Northwest Quarter of the Castle Dale 15-minute quadrangle) show that the Hiawatha coal is high volatile B bituminous in rank (Doelling, 1972).

Mining Operations

No coal mines have been opened in the Ferron Canyon quadrangle. Several prospect pits have been dug but no significant production has come from them (Doelling, 1972).

COAL RESOURCES

The principal sources of data used in the construction of the coal isopach map, structure contour map, and the coal-data maps were Doelling (1972) and Spieker (1931).

Coal resource tonnages were calculated for measured, indicated, and inferred categories in unleased areas of Federal coal land within the KRCRA boundary. Data obtained from the coal isopach map (plate 4) were used to calculate the Reserve Base values. The coal-bed acreage (measured by planimeter) multiplied by the average isopached thickness of the coal bed times a conversion factor of 1,800 short tons of coal per acre-foot of bituminous coal yields the coal resources in short tons of coal for the isopached coal bed. Reserve Base and Reserve values for the Hiawatha bed are shown on plate 7 and are rounded to the nearest tenth of a million short tons. The Reserve values are based on a subsurface mining recoverability factor of 50 percent.

Coal Reserve Base tonnages per Federal section are shown on plate 2 and total approximately 3.6 million short tons (3.3 million metric tons) for the unleased Federal coal lands within the KRCRA boundary in the Ferron Canyon quadrangle. These data are also shown in the following tabulation.

Table 1. Coal Reserve Base data for subsurface mining methods for Federal coal lands (in short tons) in the Ferron Canyon quadrangle, Sanpete and Emery Counties, Utah.

(To convert short tons to metric tons, multiply by 0.9072)

Coal Bed Name	High development potential	Moderate development potential	Low development potential	Total
Hiawatha	3,500,000	100,000	-0-	3,600,000

AAA Engineering and Drafting, Inc. has not made any determination of economic mineability for any of the coal beds described in this report.

COAL DEVELOPMENT POTENTIAL

Development Potential for Surface Mining Methods

No development potential for surface mining methods exists in the area of this quadrangle because of the rugged topography, steep-sided canyons, extreme relief, and thick overburden. There may be very small areas where some rim stripping could be done, but in general the area is not conducive to surface mining methods.

Development Potential for Subsurface Mining and In Situ Coal Gasification Methods

The coal development potential for the subsurface mining of coal is shown on plate 8. In this quadrangle the areas where coal beds 5 ft (1.5 m) or more in thickness are overlain by less than 1,000 ft (305 m) of overburden are considered to have a high development potential for subsurface mining.

Areas where such beds are overlain by 1,000 to 2,000 ft (305 to 610 m) and 2,000 to 3,000 ft (610 to 914 m) of overburden are rated as having a moderate and a low development potential respectively. Areas that contain no known coal in beds 5 ft (1.5 m) or more thick, but coal-bearing units are present at depths of less than 3,000 ft (914 m) are classified as areas of unknown coal development potential. Areas where no coal beds are known to occur or where coal beds are present at depths greater than 3,000 ft (914 m) have no coal development potential. There are no areas of unleased Federal coal land within the KRCRA in the Ferron Canyon quadrangle that are known to fall within the low development potential classification. Approximately 200 acres are classified with a high development potential, 40 acres with a moderate potential, and the rest of the KRCRA area has an unknown development potential.

The designation of a coal development potential classification is based on the occurrence of the highest-rated coal-bearing area that may occur within any fractional part of a 40-acre BLM land grid area or lot area of unleased Federal coal land. For example, a certain 40-acre area is totally underlain by a coal bed with a "moderate" development potential. If a small corner of the same 40-acre area is also underlain by another coal bed with a "high" development potential, the entire 40-acre area is given a "high" development potential rating even though most of the area is rated "moderate" by the lower coal bed. Another possibility is a 40-acre area devoid of any coal except a small corner where a 5-ft (1.5 m) coal bed crops out. In this case the 40-acre area will have a "high" development potential rating.

The in situ coal gasification methods of development potential classification are based on the dip and depth of coal beds having a minimum thickness of 5 ft (1.5 m). There are only two development potential classifications--moderate and low. The criteria for in situ coal gasification include coal bed dips of 15 to 90 degrees and coal bed depth of 200 to 3,000 ft (61 to 914 m).

Inasmuch as the coal beds dip less than 15 degrees in the Ferron Canyon quadrangle, the criteria for the classification of in situ coal gasification methods of development potential do not apply.

Table 2. Sources of data used on plate 1.

Source	Plate 1 Index Number	Data Base Measured Section No.	Data Base Page or Plate No.
Spieker, 1931	1	428	pl. 25
	2	427	pl. 25
	3	429	pl. 25
	8	432	pl. 25
	11	434	pl. 25
	12	423	pl. 25
	13	435	pl. 25
	14	436	pl. 25
	15	439	pl. 25
	16	437	pl. 25
	17	438	pl. 25
Doelling, 1972	4	8	173
	5	4	173
	6	9	173
	7	3	173
	9	2	173
	10	11	173

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