UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Open-File Report 79-1016

1979

COAL RESOURCES OF THE SOUTHWEST QUARTER OF THE RANGE CREEK 15-MINUTE QUADRANGLE, EMERY COUNTY, UTAH

By

AAA Engineering and Drafting, Inc.

CONTENTS

FIGURE

Page

TABLE

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 land 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."

Published and unpublished nonproprietary information were used as data sources for this study.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

Location

The southwest quarter of the Range Creek 15-minute quadrangle is located in the northeast part of Emery County in east central Utah. The quadrangle is approximately 18 miles (29 km) north of the town of Green River, and about 34 miles (55 km) southeast of the city of Price, Utah. The city of Castle Dale, the county seat of Emery County, is 42 miles (68 km) west of the quadrangle.

Accessibility

No highways nor improved gravel roads occur in the quadrangle area. Unimproved dirt roads and jeep trails provide accessibility into Range Creek canyon, Turtle Canyon, and Trail Canyon. Most of the quadrangle is rugged and mountainous, and is generally inaccessible to vehicular traffic.

U.S. Highway 6 runs northwestward from the town of Green River and passes within 5 miles (8 km) of the west side of the quadrangle. The highway continues northwestward to the city of Price. The town of Green River also lies next to U.S. Interstate Highway 70 which runs eastward from Green River to Grand Junction, Colorado and westward to Salina, Utah.

A main line of the Denver and Rio Grande Western Railroad passes through the town of Green River and provides rail connections to Salt Lake City, Utah and Denver, Colorado.

Physiography

The quadrangle lies at the southeastern end of the Book Cliffs coal field and the western end of the Sego coal field. The quadrangle is located in the central part of the physiographic feature called the Book Cliffs. This prominent feature is a steep escarpment about 180 miles (290 km) long extending from near the 111° meridian just west of Helper, Utah to Grand Junction, Colorado. The southwest quarter of the Range Creek 15-minute quadrangle is approximately one-third of that distance from the western end of the Book Cliffs. In the adjoining quadrangle to the west (Woodside) the Book Cliffs form a bold westward-facing escarpment of barren sandstone cliffs approximately 1,000 ft (305 m) high. The line of cliffs extends in a north-south direction through the

central part of that quadrangle. The area east of the cliffs in the southwest quarter of the Range Creek 15-minute quadrangle is rugged and mountainous with surface elevations ranging up to 8,551 ft (2,606 km) in the northwest corner of the quadrangle. The lowest point is approximately 4,710 ft (1,436 m) in the southwest corner of the quadrangle in the Little Pack Wash.

The northern two-thirds of the quadrangle drains into Range Creek which flows into the Green River in the adjoining southeast quarter of the Range Creek 15-minute quadrangle to the east. The southern third of the quadrangle drains southward into the Price River which also flows into the Green River.

Climate

The Book Cliffs coal field is located in a mid-latitude steppe climate. Semiarid conditions prevail in the lower elevations. The normal annual precipitation ranges from about 9 inches (23 cm) in the southwestern part of the quadrangle to a maximum of 15 inches (38 cm) in the higher mountainous area in the northwest corner (U.S. Department of Commerce, (1964)).

Temperatures are also a function of altitude and the maximum summertime temperatures range from about 100 degrees F (38 degrees C) at the lower elevations to 90 degrees F (32 degrees C) in the higher areas. The minimum winter temperatures range from approximately -20 degrees F (-29 degrees C) in the lower elevations to -30 degrees F (-34 degrees C) in the highest areas.

Land Status

The south end of the Book Cliffs Known Recoverable Coal Resource Area (KRCRA) lies in the adjoining quadrangle to the west (the southeast

quarter of the Woodside 15-minute quadrangle), but does not cover any part of the subject quadrangle. Approximately 3,900 acres (1,578 ha) or 10.6 percent of the quadrangle is covered by non-Federal land and there are no Federal coal leases (1978). The unleased Federal coal land covers approximately 32,900 acres (13,314 ha) in the quadrangle.

GENERAL GEOLOGY

Previous Work

Clark (1928) mapped and described the geology of the western part of the Book Cliffs coal field from the Standardville 7½-minute quadrangle on the west to the Patmos Head quadrangle on the east. Fisher (1936) mapped the Book Cliffs south and east of Clark's area to the Utah-Colorado State line. The geology and coal deposits in the area have also been described by Abbot and Liscomb (1956), Fisher, Erdmann, and Reeside (1960), Hayes and others (1977), and Young (1955, 1957, and 1966). Doelling (1972) compiled the geology and coal data for the coal field. Osterwald and Mayberry (1974) closely examined the faults and developed an engineering geologic map for the adjoining Woodside quadrangle on the west. AAA Engineering and Drafting, Inc. (1979a and 1979b) prepared coal resource occurrence and coal development potential maps for the adjoining quadrangles to the west and northwest.

Stratigraphy

The coal beds of economic importance in the Book Cliffs coal field are Upper Cretaceous in age, and are confined to the Blackhawk Formation of the Mesaverde Group. In the area of the Range Creek quadrangle the Mesaverde Group includes the following formations in ascending order: Blackhawk Formation, Castlegate Sandstone, and Price River Formation. The

Upper Cretaceous Mancos Shale underlies and intertongues with the Blackhawk Formation. The Mancos Shale was deposited in an offshore marine environment and the Blackhawk Formation in a mixed marine and continental environment. The Castlegate Sandstone and the Price River Formation were formed in a continental environment.

The bluish-gray shale of the Mancos Shale crops out on the west half of the adjoining quadrangle to the west (southeast quarter of the Woodside 15-minute quadrangle) and several hundred feet are exposed in the slope above the base of the Book Cliffs. Sandstone beds of the Blackhawk Formation crop out in steep and precipitous cliffs and ledges above the Mancos Shale.

Fisher (1936, p. 22) divided the Blackhawk Formation into the following four members in ascending order: the Lower Sandstone Member, 221 ft (67 m) thick; the Middle Shale Member, 121 ft (37 m) thick; the Middle Sandstone Member, 165 $\pm$ ft (51 $\pm$ m) thick; and the Upper Member which Fisher (1936, p. 14) estimated to range from 70 to 230 ft (21 to 70 m) in thickness. This member is dominantly shale but contains an upper sandstone bed in areas south and east of the quadrangle.

The Lower Sandstone Member is correlated with the Kenilworth sandstone to the west (Doelling, 1972) but thins eastward and cannot be traced east of Green River. the Middle Shale Member is apparently a tongue of the Mancos Shale and cannot be distinguished from the Mancos east of the Green River. The Sunnyside coal zone lies in the upper part of the Middle Sandstone Member. Young (1955) delineates the Grassy and Desert members of the Blackhawk Formation above the Middle Sandstone Member. These two

members are probably equivalent to the Upper Member of Fisher (1936) and consists of sandstone, shale, and lenticular coal beds.

The Castlegate Sandstone thins eastward from 500 ft (152 m) of conglomeratic sandstone in the northern part of the Wasatch Plateau to a feather edge of siltstone near the Utah-Colorado State line (Fisher, 1936). In the adjoining quadrangle to the west the Castlegate is approximately 100 ft (30 m) thick. Fisher (1936) referred to the Castlegate as a member of the Price River Formation. The Castlegate is overlain by the Buck Tongue of the Mancos Shale which is poorly developed in the quadrangle area, but which thickens eastward toward the Utah-Colorado state line where it is 350 ft (107 m) thick. The Price River Formation lies above the Castlegate Sandstone where the Buck Tongue is not present. Fisher (1936) described three members of the Price River Formation above the Buck Tongue in the eastern part of the Book Cliffs, but which are not recognized northwest of the Beckwith Plateau. In this quadrangle the Price River Formation consists of interbedded sandstone, shale, carbonaceous shale, and coal streaks.

The oldest rocks exposed in the quadrangle area are the upper beds of the Price River Formation which crop out in Trail Canyon and Water Canyon on the south side of the quadrangle and in Turtle Canyon and Range Creek canyon on the east side of the quadrangle (Hintze and Stokes, 1964).

The Tertiary strata successively overlying the Price River Formation include the Tuscher, North Horn, and Wasatch Formations. The Tuscher and North Horn Formations consist of sandstone, shale, and minor conglomerate.

The Tuscher Formation thins westward and the North Horn Formation thins eastward. The combined thickness of these two formations in the quadrangle area is unknown, but is probably much greater than shown in figure 1. The basal part of the Wasatch Formation caps the high mountainous area in the northwest quarter of the quadrangle and consists of variegated shale, sandstone, and limestone.

Structure

The rocks dip generally eastward to northeastward from 4° to 10° except possibly in the vicinity of some faults where the dips may be greater.

Several east-west trending and north-south trending normal faults occur in the west half of the quadrangle (Hintze and Stokes, 1964). Numerous faults in the adjoining quadrangle to the west were mapped and studied by Osterwald and Mayberry (1974). The displacements of the faults in the adjoining quadrangle range from a few feet up to 150 ft (46 m).

COAL GEOLOGY

Fisher (1936, p. 45) reports that "On the basis of age of coal, as well as other features, the Book Cliffs coal field of Utah may be divided conveniently into two subfields. The Sunnyside subfield includes the part west of the Green River; it carries no Price River coals but contains essentially all the coals in the Blackhawk Formation. The Thompsons subfield lies east of the river; it carries all the Price River coals but only very minor amounts of the older Blackhawk coals." This quadrangle lies on the west side of the Green River in the east part of Clark's "Sunnyside subfield."

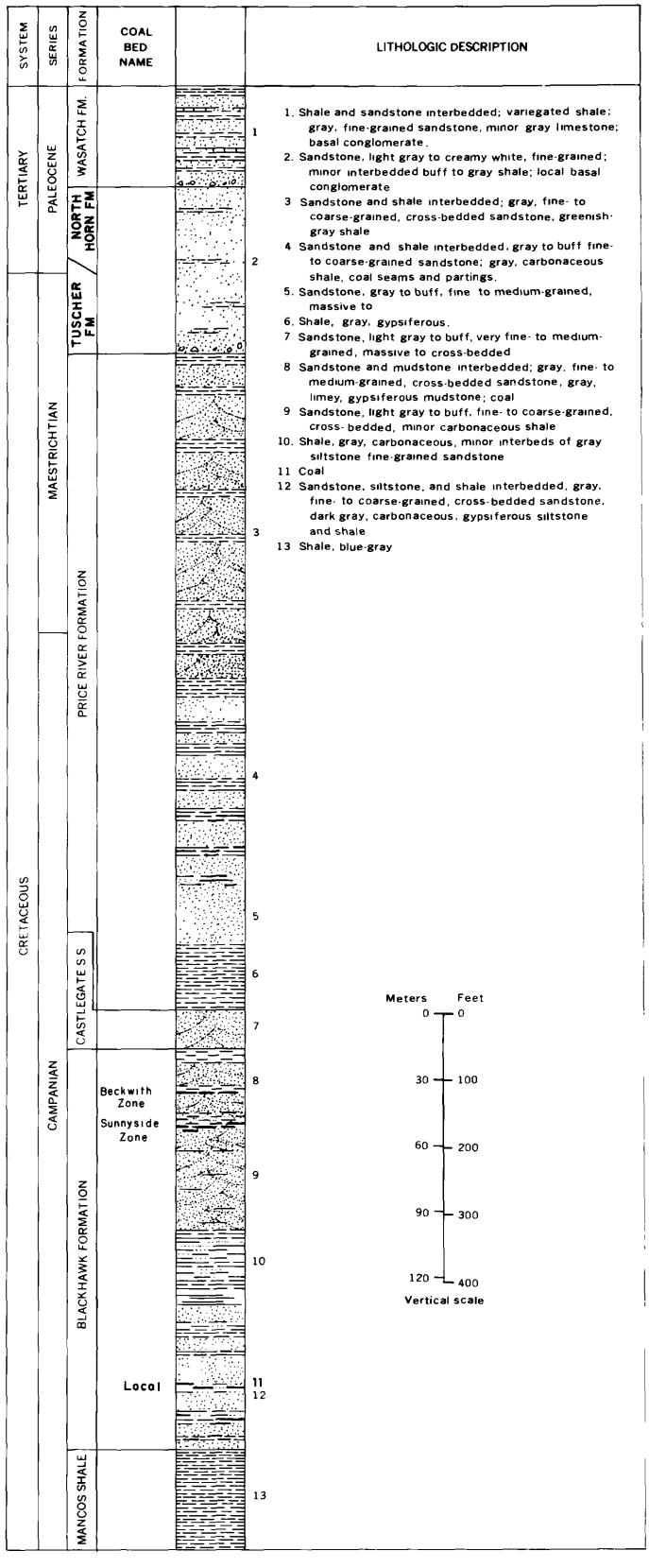

FIGURE 1. Composite columnar section, southwest quarter of the Range Creek 15-minute quadrangle, Emery County, Utah.

In this area the Blackhawk coals are thinner and more lenticular than in the quadrangles to the north and west. Two coal zones, the Beckwith and the Sunnyside, occur in the Blackhawk Formation in the quadrangle area.

Beckwith Coal Zone

In the adjoining Woodside quadrangle, the Beckwith coal zone is at least 70 ft (21 m) thick and contains several lenticular coal beds. In that area the measured coal bed thicknesses range from less than 1 ft (0.3 m) to 7.0 ft (2.1 m) (AAA Engineering and Drafting, Inc., 1979b).

Albee (1979) reported the drilling of seven coal test holes (one was abandoned) in the quadrangle area. The holes were drilled well into the Blackhawk Formation and encountered carbonaceous shale and thin coal beds in the Beckwith and Sunnyside zones. The coal beds encountered in the drill holes ranged from 0.2-2.0 ft (0.1-0.6 m) in thickness (see table 1).

A coal test well drilled by J.B. McKean and others in Turtle Canyon (see table 1) encountered three thin coal beds 1.3, 0.5, and 1.3 ft (0.4, 0.2, and 0.4 m) thick. These beds are close in elevation to the coal beds encountered in the nearby BC-9-RC hole drilled by Albee (1979) and are tentatively called the Beckwith zone.

Sunnyside Coal Zone

The Sunnyside coal zone is approximately 60 ft (18 m) below the Beckwith coal zone in the adjoining Woodside quadrangle. The Sunnyside coal beds, although somewhat lenticular, are more persistent than the Beckwith beds, in that quadrangle (AAA Engineering and Drafting, Inc., 1979b).

The Sunnyside coal zone occurs in the Middle Sandstone Member of the Blackhawk Formation. In the adjoining Woodside quadrangle the zone consists of one or more beds which range in thickness from 0.3 to 8.0 ft (0.1 to 2.4 m) or more. These beds apparently thin eastward based on the drilling results discussed above and shown in table 1.

Gulf Oil Corporation drilled the Norris Federal No. 1 oil test well in the NW¼NW¼ sec. 8, T. 18 S., R. 16 E. and encountered two thin coal beds 1.2 ft (0.4 m) and 2.5 ft (0.8 m) thick at depths of 2,060 and 2,070.5 ft (628 and 631 m). These beds occur approximately 300 ft (91 m) above the Mancos Shale and may be correlated with the Sunnyside zone.

Chemical Analyses of Coal

Doelling (1972, p. 323) reports one coal analysis from the adjoining Woodside quadrangle area. The sample was taken from the Beckwith coal zone exposed in the Peterson prospect on the south side of that quadrangle. The results of the as-received proximate analysis are:

	Percent
Moisture	4.7
Volatile matter	33.58
Fixed carbon	50.24
Ash	11.43
Sulfur	1.15

No calorific value was reported. Without additional analyses of the Beckwith coal, the above analysis cannot be regarded as typical for the zone.

Analyses of coal samples from the Lower Sunnyside coal bed in the northeast quarter of the Woodside 15-minute quadrangle show the coal is ranked as high volatile B bituminous (AAA Engineering and Drafting, Inc., 1979). The Lower Sunnyside coal bed is probably equivalent to the Sunnyside coal zone of this quadrangle (Fisher, 1936).

Table 1.--Summary of coal beds encountered in holes drilled in the Southwest Quarter of the Range Creek quadrangle, Emery County, Utah

Reference (listed below)	Drill Hole Name	Location	Coal Bed thickness (ft)	Depth to top of Coal Bed (ft)	Dist. Below Top of Blackhawk (ft)	Coal Zone
1	BC-3-RC	NE¼SE¼ sec. 4, T. 17 S., R. 16 E.	1.0	1,650	220	Sunnyside
1	BC-4-RC	SW¼NW¼ sec. 12, T. 17 S., R. 16 E.	0.2 1.8	1,153.7 1,166.4	78.7 91.4	Beckwith Beckwith
1	BC-5-RC	(Hole abandoned)	--	--	--	--
1	BC-6-RC	SW¼SE¼ sec. 23 T. 17 S., R. 15 E.	--	(No coal reported)	--	--
1	BC-7-RC	SE¼SE¼ sec. 30 T. 17 S., R. 16 E.	0.2 0.7	951.5 955.1	66.5 70.1	Beckwith Beckwith
1	BC-8-RC	NW¼NW¼ sec. 33 T. 17 S., R. 16 E.	1.3 1.5	897 900	97 100	Beckwith Beckwith
1	BC-9-RC	SW¼NW¼ sec. 27 T. 17 S., R. 16 E.	2.0	983	93	Beckwith
2	Norris Fed. #1	NE¼NW¼ sec. 8 T. 18 S., R. 16 E.	1.2 2.5	2,060 2,070.5	(Unknown) (Unknown)	Sunnyside (?) Sunnyside (?)
3	Turtle Canyon	NW¼NW¼ sec. 27 T. 17 S., R. 16 E.	1.3 0.5 1.3	976.5 980.8 982.6	(Unknown) (Unknown) (Unknown)	Beckwith (?) Beckwith (?) Beckwith (?)

To convert feet to meters multiply feet by 0.3048

Mining Operations

Inasmuch as no coal beds are known to crop out in the quadrangle area and few holes have been drilled, no effort has been made to prospect for coal by underground mining methods. Doelling (1972) reports that the only known effort to mine coal in the adjoining Woodside quadrangle was at Peterson's prospect high on the cliff on the north side of Price River Canyon. A coal bed in the Beckwith zone was prospected through two adits located approximately at the location of the Beckwith zone. The prospect was active before 1905 and little coal was produced.

COAL RESOURCES AND COAL DEVELOPMENT POTENTIAL

The only known holes drilled in this quadrangle are listed in table 1. The coal beds encountered in these holes were less than 5 ft (1.5 m) thick which is the minimum thickness used to calculate Reserve Base tonnages. Therefore, no coal resources are shown for this quadrangle.

Development Potential for Surface Mining Methods

No development potential for surface mining methods exists in this quadrangle because of the thick overburden which is more than 800 ft (244 m) above the Beckwith zone.

Development Potential for Subsurface Mining and In Situ Coal Gasification Methods

The coal development potential for subsurface mining of coal is based on coal thickness and thickness of overburden for beds dipping less than 15 degrees. 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 classified as having 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 classified as having moderate and low development potentials, 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.

Because there are no known coal beds in this quadrangle more than 5 ft (1.5 m) thick and the knowledge of the coal deposits is very limited, the unleased Federal coal land in the southwest quarter of the Range Creek 15-minute quadrangle is classified as having an unknown development potential for subsurface mining methods.

Classification of development potential for in situ coal gasification was not done because dips are less than 15 degrees within the quadrangle. The criteria for selection of areas suitable for in situ coal gasification are a minimum coal thickness of 5 ft (1.5 m), dips of 15 to 90 degrees, and overburden greater than 200 ft (61 m) and less than 3,000 ft (914 m).

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

REFERENCES

AAA Engineering and Drafting, Inc., 1979a, Coal resource occurrence and coal development potential maps of the northeast quarter of the Woodside 15-minute quadrangle, Emery and Carbon Counties, Utah: U.S. Geol. Survey Open-File Report 79-897.

_____, 1979b, Coal resource occurrence and coal development potential maps of the southeast quarter of the Woodside 15-minute quadrangle, Emery County, Utah: U.S. Geol. Survey Open-File Report 79-898.

Abbott, W. I., and Liscomb, R. L., 1956, Stratigraphy of Book Cliffs in east central Utah: Intermtn. Assoc. Petroleum Geologists Guidebook, 7th Ann. Field Conf.

Albee, H. F., 1979, Geophysical and lithologic logs for thirteen holes drilled in the Book Cliffs coal field, Range Creek and Woodside quadrangles, Emery County, Utah: U.S. Geol. Survey Open-File Report 79-727.

American Society of Testing and Materials, 1977, Standard specifications for classification of coals by rank, in Gaseous fuels, coal, and coke; atmospheric analysis: ASTM Publication D 388-77.

Clark, F. R., 1928, Economic Geology of the Castlegate, Wellington, and Sunnyside Quadrangles, Carbon County, Utah: U.S. Geol. Survey Bull. 793.

Doelling, H. H., 1972, Book Cliffs coal field, in Doelling, H. H., Central Utah coal fields: Utah Geol. and Min. Survey Mon. Ser. no. 3.

Fisher, D. J., 1936, The Book Cliffs coal field in Emery and Grand Counties, Utah: U.S. Geol. Survey Bull. 852.

Fisher, D. J., Erdmann, C. E., and Reeside, J. B., 1960, Cretaceous and Tertiary formations of the Book Cliffs, Carbon, Emery, and Grand Counties, Utah, and Garfield and Meas Counties, Colorado: U.S. Geol. Survey Prof. Paper 332.

Gray, R. J., Patalski, R. M., and Schapiro, N., 1966, Correlation of coal deposits from central Utah, in Central Utah coals: Utah Geol. and Minerlog. Survey Bull. 80.

Gross, L. T., 1961, Stratigraphic analysis of the Mesaverde Group, Uinta Basin, Utah: Unpubl. M.S. thesis, Univ. of Utah.

Hayes, P. T., and others, 1977, Summary of the geology, mineral resources, engineering geology characteristics, and environmental geochemistry of east-central Utah: U.S. Geol. Survey Open-File Report 77-513.

Hintze, L. F., and Stokes, W. L., 1964, Geologic map of Utah, southeast quarter: Utah Geol. and Mineral Survey.

Lewis, R. S., 1914, 1915, The Book Cliffs coal field, Utah: Am. Inst. Mining Eng. Bull. 91; Am. Inst. Mining Eng. Trans., 50.

Osterwald, F. W., and Mayberry, J. O., 1974, Engineering geologic maps of the Woodside quadrangle, Emery and Carbon Counties, Utah: U.S. Geol. Survey Map I-798.

Spieker, E. M., 1925, Geology of coal fields in Utah: U.S. Bur. Mines Tech. Paper 345.

Taff, J. A., 1906, Book Cliffs coal field, Utah, west of Green River: U.S. Geol. Survey Bull. 285.

Thiessen, R., and Sprunk, G. C., 1937, Origin and petrographic composition of the lower Sunnyside coal of Utah: U.S. Bur. Mines Tech. Paper 473.

U.S. Bureau of Mines and U.S. Geological Survey, 1976, Coal resource Classification system of the U.S. Bureau of Mines and U.S. Geological Survey: U.S. Geol. Survey Bull. 1450-B.

U.S. Department of Commerce, (1964), Normal annual precipitation in inches, 1931-1960, State of Utah: U.S. Dept. of Commerce Weather Bureau Map WR-1210-A.

Young, R. G., 1955, Sedimentary facies and intertonguing in the upper Cretaceous of Book Cliffs, Utah, Colorado: Geol. Soc. Am. Bull., v. 66, p. 177-202.

_____, 1957, Late Cretaceous cyclic deposits, Book Cliffs, eastern Utah: Am. Assoc. Petroleum Geologists Bull., v. 41, p. 1760-1774.

_____, 1966, Stratigraphy of coal-bearing rocks of Book Cliffs, Utah, Colorado, in Central Utah coals: Utah Geol. and Mineralog. Survey Bull. 80, p. 7-21.