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COAL RESOURCES OF THE KYUNE QUADRANGLE
CARBON AND UTAH COUNTIES, UTAH

By

AAA Engineering and Drafting, Inc.

This report has not been edited for conformity
with U.S. Geological Survey editorial standards
or stratigraphic nomenclature.

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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."

Published and unpublished public information were used as data sources for this study.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 Kyune 7½-minute quadrangle is located at the west end of the Book Cliffs coal field in Carbon and Utah Counties in east central Utah. The quadrangle is approximately 11 miles (18 km) northwest of the city of Price, the county seat of Carbon County. The city of Provo is the county seat of Utah County and is 42 miles (68 km) northwest of the quadrangle. The city of Helper is 8.5 miles (13.7 km) south of the quadrangle.

Accessibility

U.S. Highway 6-50 and a main line of the Denver and Rio Grande Western Railroad cross the quadrangle diagonally from the northwest corner to the southeast corner. The railroad and highway generally run parallel to the Price River in Price Canyon where the gently topographic gradient has provided a fairly uniform grade for the 800-ft (24-m) rise of the road beds across the quadrangle.

A gravel road extends eastward from U.S. Highway 6-50 in the center of the quadrangle to the east side of the quadrangle. A dirt road runs southward from U.S. Highway 6-50 near the center of the quadrangle to radio transmitting towers on a high peak in the southwest corner of the quadrangle. Several dirt roads and jeep trails provide access into some of the mountainous areas, although many of the canyons are inaccessible to vehicular traffic.

The Denver and Rio Grande Western Railroad provides rail connections to Salt Lake City, Utah and Denver, Colorado.

Physiography

The Kyune quadrangle lies in the mountainous upland area on the north side of the Book Cliffs escarpment which is approximately 5 miles (8 km) south of the Kyune quadrangle in the adjoining Standardville quadrangle. The Book Cliffs form a broad band of barren sandstone cliffs and steep-sided canyons extending eastward from the Standardville quadrangle to the Utah-Colorado state line. The Book Cliffs intersect the north-south trending Wasatch Plateau on the west side of the Standardville quadrangle.

Except in Price Canyon, most of the Kyune quadrangle lies at an altitude in excess of 7,300 feet (2,197 m). Much of this high country is covered with sagebrush, native grasses, and stands of aspen, juniper, and

spruce. Total relief in the quadrangle is over 3,400 feet (1,036 m). The highest elevation is 9,804 ft (2,988 m) on a peak on Ford Ridge in the southwest corner of the quadrangle.

Price River flows across the quadrangle from northwest to southeast and, with its tributaries, constitutes the principal drainage system in the area. Price river flows in a deep canyon which has been cut down to an elevation of less than 6,400 feet (1,953 m) where it leaves the southeast corner of the quadrangle.

Climate

The normal annual precipitation in the Kyune quadrangle area ranges from 15 to 25 inches (38 to 64 cm) (U.S. Dept. of Commerce, (1964)). The temperatures in the quadrangle are relatively cool because of the high elevations and range approximately from 85 degrees F (29 degrees C) in the summer to -30 degrees F (-34 degrees C) in the winter.

Land Status

The Kyune quadrangle covers approximately 5,115 acres (2,070 ha) of the west end of the Book Cliffs Known Recoverable Coal Resource Area (KRCRA). The lands within the KRCRA include 80 acres (32 ha) of non-Federal land, 2,090 acres (846 ha) under Federal coal leases, and 2,945 acres (1,192 ha) of unleased Federal coal land. The locations of these lands are shown on plate 1 of this report.

GENERAL GEOLOGY

Previous Work

Clark (1928) mapped the geology and coal outcrops in the western part of the Book Cliffs coal field and his work is the most detailed original work presently available. Spieker (1931) mapped the Wasatch Plateau coal field to the west, and the northern part of his mapping is a westward continuation of Clark's map. The stratigraphy is further described by Abbot

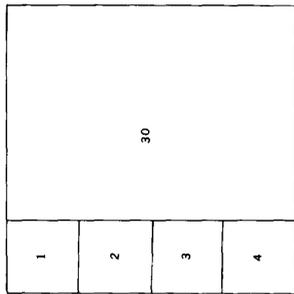
EXPLANATION

KRCRA

KNOWN RECOVERABLE COAL RESOURCES AREA BOUNDARY - Label within KRCRA boundary.



NON-FEDERAL COAL LAND - Land within the KRCRA boundary for which the Federal Government does not own the coal rights.



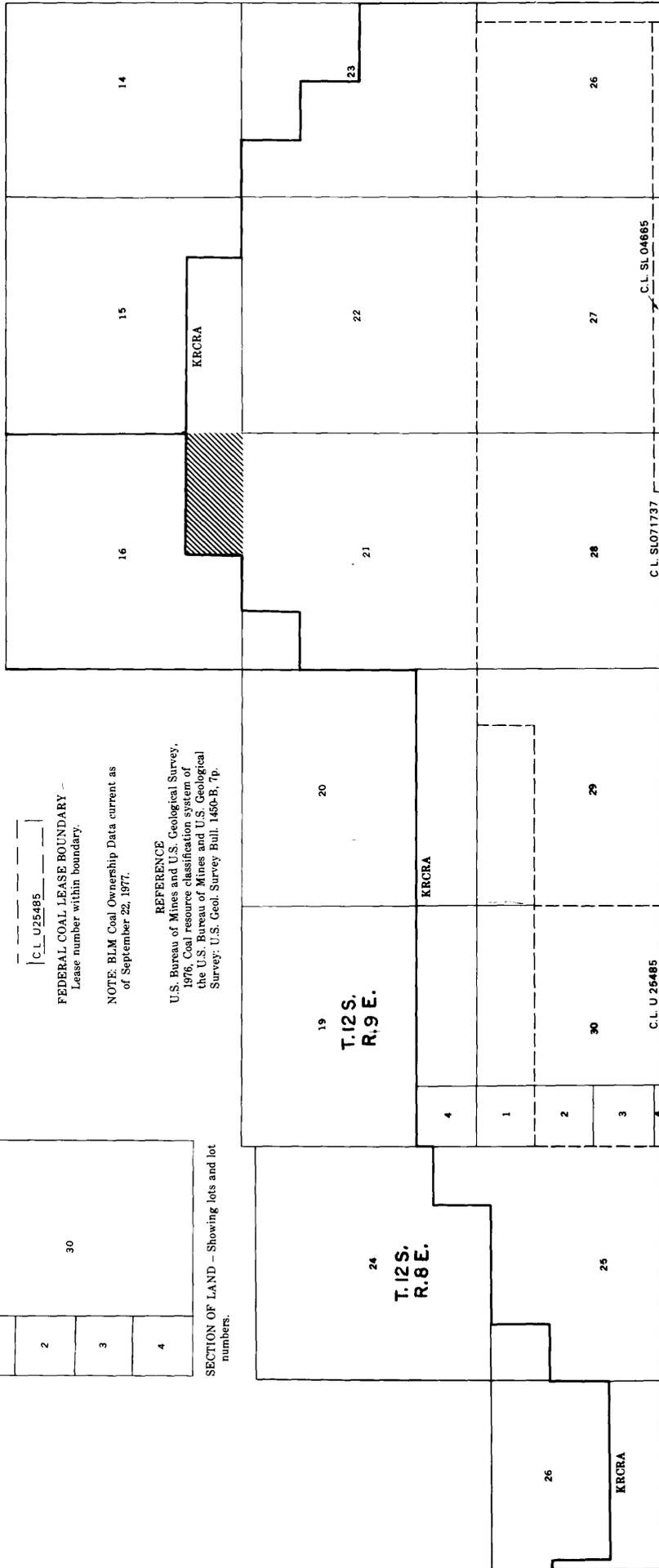
SECTION OF LAND - Showing lots and lot numbers.

C.L. U25485

FEDERAL COAL LEASE BOUNDARY - Lease number within boundary.

NOTE: BLM Coal Ownership Data current as of September 22, 1977.

REFERENCE
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, P.



Base from U.S. Geological Survey, 1968

scale 1" = 1/2 mile

1 MI

Compiled in 1977

and Liscomb (1956), Fisher, Erdmann, and Reeside (1960), Katich (1954), and Young (1955, 1957, and 1966). Doelling (1972) has summarized the geology and updated the coal data described by the earlier workers.

Stratigraphy

The coal beds of economic importance in the Book Cliffs field are Upper Cretaceous in age and are confined to the Blackhawk Formation of the Mesaverde Group. This group includes, in ascending order, the Star Point Sandstone, Blackhawk Formation, Castlegate Sandstone, and Price River Formation. The Upper Cretaceous Mancos Shale underlies the Mesaverde Group and consists of gray marine shale and an upper sequence of alternating and interfingering shale and sandstone members.

The lowest unit of the Mesaverde Group, the Star Point Sandstone, is barren of coal and consists of three sandstone tongues which extend eastward and which are separated by westward-projecting tongues of Mancos Shale. The eastward-thinning sandstone tongues are, in ascending order, the Panther, Storrs, and Spring Canyon. In the Standardville quadrangle to the south the Panther Tongue is 100 to 125 ft (30 to 38 m) thick along the west edge of the quadrangle. Some 150 ft (46 m) above the Panther are 15 to 30 ft (5 to 9 m) of sandstone assigned to the Storrs Tongue, and about 100 to 125 ft (30 to 38 m) higher is the Spring Canyon Tongue which is nearly 150 ft (46 m) thick in Spring Canyon.

The Blackhawk Formation overlies the Star Point Sandstone and contains the important coal beds. The Blackhawk consists of 900 to 1,300 ft (274 to 396 m) of massive gray to buff sandstone, sandy shale, shale, and coal beds. The coal beds occur in two groups, the Spring Canyon and the Castlegate groups. The lower, or Spring Canyon, group is underlain by the Spring Canyon Tongue of the Star Point Sandstone and is overlain by the

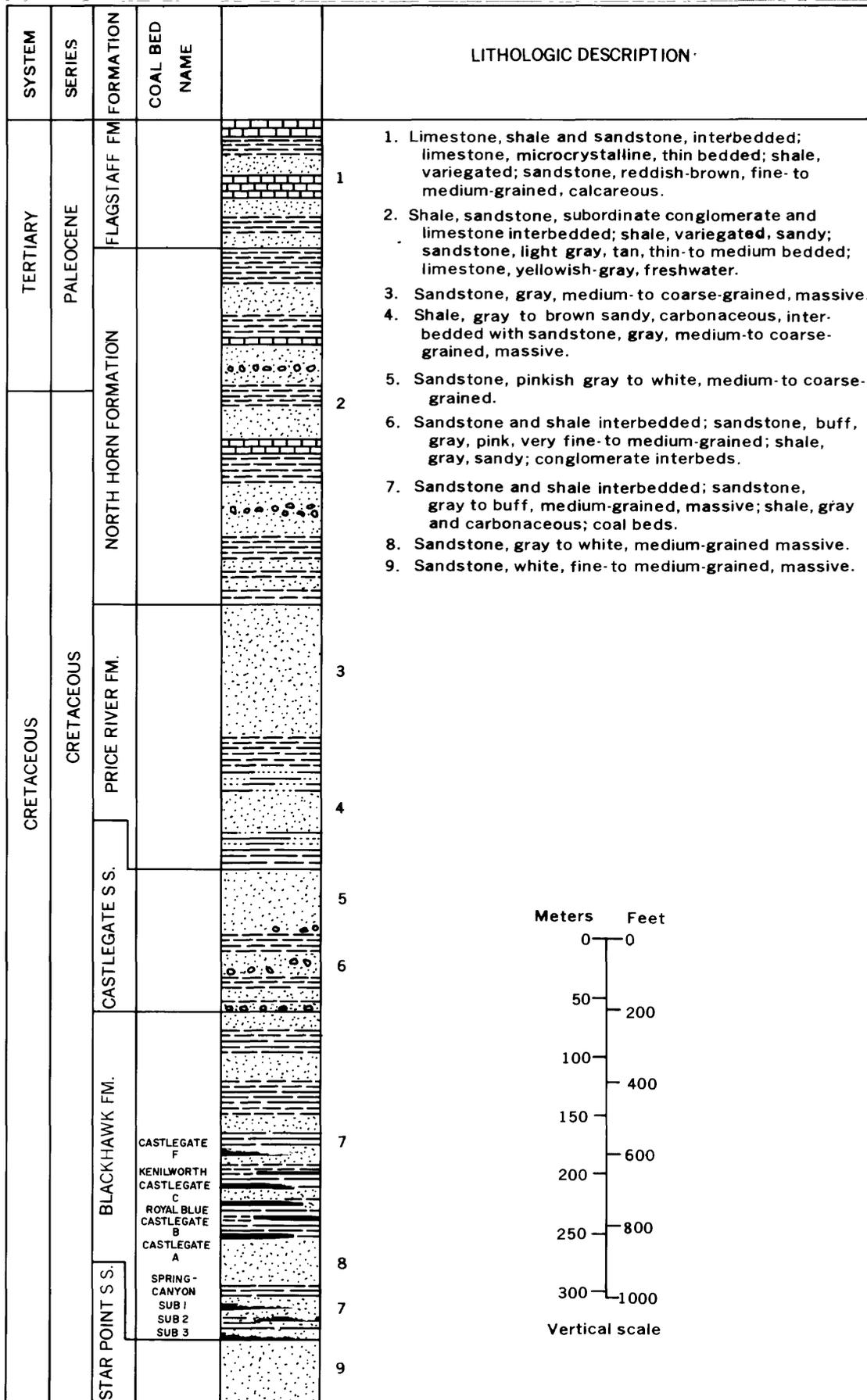


PLATE 2. Composite columnar section, Kyune quadrangle, Carbon and Utah Counties, Utah.

Aberdeen Sandstone Member of the Blackhawk Formation. The Castlegate coal group overlies the Aberdeen Sandstone and is overlain by the Kenilworth Sandstone Member. In this area few significant coal beds occur in the upper part of the Blackhawk Formation which is mainly sandstone.

The oldest rocks exposed in the Kyune quadrangle are those of the uppermost part of the Blackhawk Formation which crop out in a small area in the bottom of Price Canyon in the southeast corner of the quadrangle.

The Castlegate Sandstone in the Standardville quadrangle is 450 to 500 ft (137 to 152 m) thick and disconformably overlies the Blackhawk Formation. The Castlegate consists of massive, gray to yellowish-gray, brown-weathering sandstone.

The Castlegate Sandstone is overlain by 900 to 1,000 ft (274 to 305 m) of Price River Formation. This formation consists of alternating resistant gray to yellowish-gray sandstone and non-resistant gray to olive-green shale.

The North Horn Formation of Cretaceous and Tertiary ages overlies the Price River Formation and consists of variegated shale, sandstone, and subordinate conglomerate and freshwater limestone. The North Horn Formation is overlain by the Flagstaff Limestone of early Tertiary age. The Flagstaff crops out in the higher parts of the wouth half of the Kyune quadrangle and consists of light gray and cream colored limestones, variegated shale, and reddish-brown, fine-grained calcareous sandstone.

In the central part of the quadrangle the shallow east-west trending upland valley called Emma Park is a strike valley developed in the Colton Formation. This formation is Eocene in age and consists of non-resistant fluvial red beds with channel sandstones. The area north of Emma Park is

underlain by the Green River Formation which is composed of greenish-gray and white claystone and shale with minor sandstone and marlstone.

Structure

The Book Cliffs coal field lies on the north-dipping south flank of the Uinta Basin. Based on the dip of the sedimentary strata in the adjoining Standardville quadrangle, the regional dip of the beds in the area ranges from 4 to 6 degrees northward. Variations from these dips may occur in the vicinity of minor structural flexures. No faults have been mapped within the KRCRA of the Kyune quadrangle area.

COAL GEOLOGY

Eight main coal beds have been mapped and described in the adjoining quadrangle to the south (Standardville). These beds occur in two main groups and an upper bed. The Spring Canyon Group is overlain by the Castlegate Group and the Kenilworth bed. In ascending order, the Spring Canyon Group includes: the Spring Canyon Sub 3, Spring Canyon Sub 2, and Spring Canyon Sub 1 beds. The Castlegate Group includes: the Castlegate "A", Castlegate "B", Royal Blue, and Castlegate "C" beds. The Kenilworth sometimes called the Castlegate "D" bed, lies above the Castlegate Group.

In the Standardville quadrangle, the Spring Canyon Sub 3 and Spring Canyon Sub 2 beds are separated by a non-coal interval ranging from 7 to 75 ft (2 to 23 m) with an average separation of 24 ft (7 m). The Spring Canyon Sub 2 and Spring Canyon Sub 1 beds are separated by a non-coal interval ranging from 15 to 40 ft (5 to 12 m) with an average of 27 ft (8 m). The non-coal interval between the Spring Canyon Sub 1 and the Castlegate "A" coal beds ranges from 80 to 170 ft (24 to 52 m) and includes the Aberdeen Sandstone Member of the Blackhawk Formation. The Castlegate "A" bed is successively overlain by: a non-coal interval approximately 25 ft

(8 m) thick; the Castlegate "B" bed; a non-coal interval about 25 ft (8 m) thick; the Royal Blue bed; a non-coal interval about 60 ft (18 m) thick; the Castlegate "C" bed; a non-coal interval about 80 ft (24 m) thick and the Kenilworth bed.

Spring Canyon Sub 3 Coal Bed

In the western part of the Standardville quadrangle the interval containing the Spring Canyon Group of coal beds lies between two prominent sandstones, the Spring Canyon Sandstone below and the Aberdeen Sandstone above. These sandstone beds are approximately 80 to 124 ft (24 to 38 m) apart. The distance between the two sandstones decreases eastward, and east of Price River the units merge and the coal beds pinch out. The Spring Canyon Sub 3 bed is the basal coal bed in the Spring Canyon Group and correlates with the Hiawatha bed in the northwest quarter of the Scofield 15-minute quadrangle immediately to the southwest of the Kyune quadrangle.

In the Standardville quadrangle (AAA Engineering and Drafting, Inc., 1979) the Spring Canyon Sub 3 bed ranges in thickness from less than 1 ft (0.3 m) to more than 7 ft (2 m) in surface exposures. However, a hole drilled in the north part of Section 4, T. 13 S., R. 9 E., approximately 1.3 miles (2.1 km) south of the Kyune quadrangle, found the bed 14.8 ft (4.5 m) thick with a very thin rock parting. The bed has been mined in the area of the drill hole. Spieker (1931, p. 79) postulates that the Spring Canyon Sub 3 (Hiawatha) bed may disappear to the north, but Doelling (1972) believes that the coal continues northward. The coal in this bed is bright, hard, and breaks into large oblong blocks. It burns to a bright red ash and does not clinker. It is softer than the Castlegate "A" coal, but is a premium domestic coal.

Spring Canyon Sub 2 Coal Beds

The Spring Canyon Sub 2 zone or coal beds include those in the middle part of the Spring Canyon Group between the Spring Canyon Sub 1 and Sub 3 beds. The beds are typically thin and lenticular. Doelling (1972) reports that individual beds occur up to 7 ft (2.1 m) thick in the Standardville quadrangle. These were once present in the areas that are now extensively mined out. The Sub 2 coal is bright, hard, and breaks into large cubical blocks. It has been regarded as a fine domestic coal. A coal isopach map of the main bed in this zone (AAA Engineering and Drafting, Inc., 1979) thins northward in the Standardville quadrangle and may be less than 5 ft (1.5 m) thick in the south part of the Kyune quadrangle.

Spring Canyon Sub 1 Coal Bed

The Spring Canyon Sub 1 coal bed attains a thickness of 8.8 ft (2.7 m) in the Standardville quadrangle, but the bed has been considered to be irregular in value in most of that quadrangle area except at the west end of Spring Canyon. The bed apparently thins northward into the Kyune quadrangle (AAA Engineering and Drafting, Inc., 1979).

The Sub 1 coal breaks into large irregular blocks and contains abundant resinous material. Although the coal has been considered to be marginal in value, that which has been mined in the northwest part of the Standardville quadrangle is reported to have been an excellent domestic and railroad coal that burns to a light red ash leaving little clinker (Doelling, 1972).

Castlegate "A" Coal Bed

Of the five coal beds that make up the Castlegate Group in the Standardville quadrangle, only the Castlegate "A" bed and the Castlegate "B" bed attain thicknesses greater than 5 ft (1.5 m) at points where they have been measured.

The Castlegate "A" bed extends westward to the Wasatch Plateau coal field. The thickest section of the bed measured in the Standardville quadrangle is 16.9 ft (5.2 m) in Spring Canyon where the bed has been extensively mined. The available information (AAA Engineering and Drafting, Inc., 1979) suggests that the "A" bed thins northward from the mined-out areas on the north side of Spring Canyon and may be less than 5.0 ft (1.5 m) at the south side of the Kyune quadrangle.

The Castlegate "A" coal is massive, brittle, and bright but contains dull bands of coal and numerous partings of bone and shale. The bed shows few or no bedding marks, has prominent joints, and locally has streaks of resin and sulfur balls in it (Doelling, 1972).

Castlegate "B" Coal Bed

The Castlegate "B" coal bed has been mined in the northeast quarter of the Standardville quadrangle where it reaches a thickness over 10 ft (3 m). In a drill hole 0.6 mile (1.0 km) south and 0.6 mile (1.0 km) west of the southeast corner of the Kyune quadrangle the Castlegate "B" bed was 8.7 ft (2.7 m) thick (AAA Engineering and Drafting, Inc., 1979). The bed apparently thickens northward from the northeast quarter of the Standardville quadrangle. In physical characteristics, the "B" bed coal is very much like the Castlegate "A" coal.

Other Coal Beds

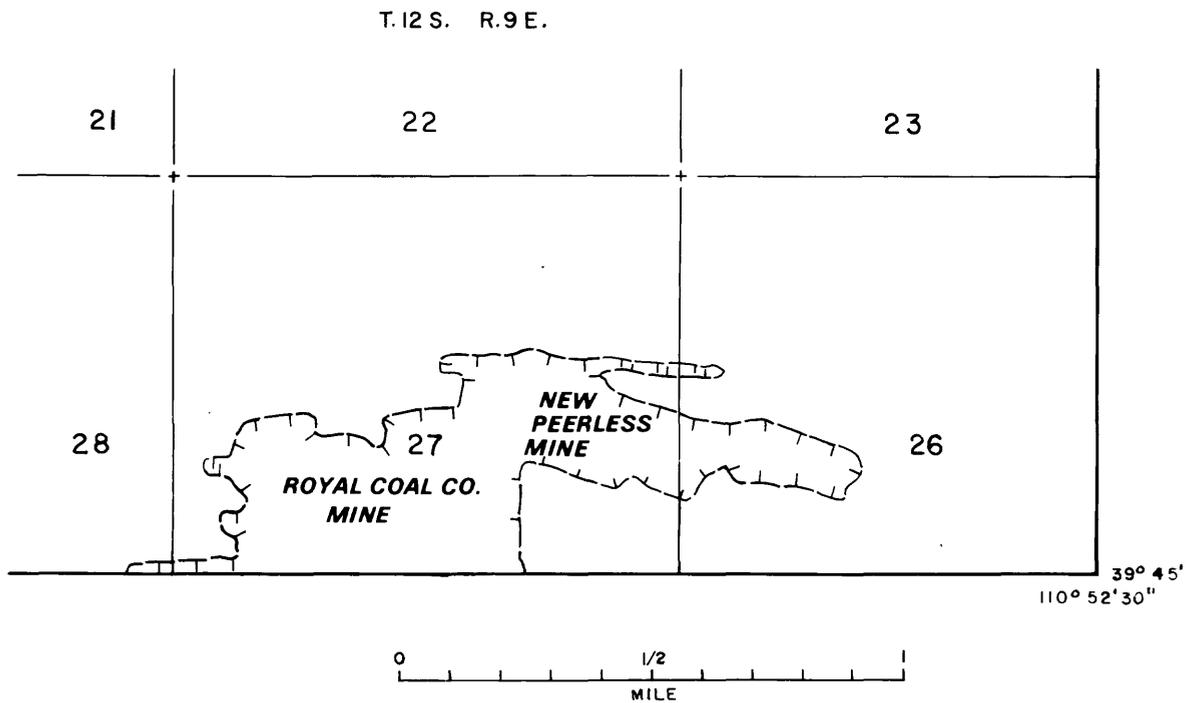
The Royal Blue and Castlegate "C" coal beds are generally less than 5.0 ft (1.5 m) thick in the Standardville quadrangle and there is no evidence of their thickening or thinning toward the Kyune quadrangle.

The Kenilworth coal bed, sometimes called the Castlegate "D" bed, has been mined in the Royal No. 2 mine in the northeast quarter of the Standardville quadrangle. The mined-out area of this mine extends into the southeast part of the Kyune quadrangle (see plate 3). Because of the lack of non-proprietary data, the thickness of the Kenilworth bed in this area is unknown. The available thickness measurements for the bed in the Standardville quadrangle indicate that the bed is generally thin although the bed was mined in the Spring Canyon mines, the Royal No. 2 mine, the Carbon Fuel Company mine, and is now (1979) being mined in the Braztah No. 5 mine.

The Castlegate "F" coal bed was mined in a small area in the Utah Fuel Company No. 3 mine approximately 0.5 mile (0.8 km) south of the southeast corner of the Kyune quadrangle in the Standardville and Helper quadrangles. Two holes drilled in the northwest corner of the Helper quadrangle encountered the bed where it was 6.3 ft (1.9 m) and 9.0 ft (2.7 m) thick (AAA Engineering and Drafting, Inc., 1977a). The bed lies 50 to 90 ft (15 to 27 m) above the Kenilworth coal bed.

Chemical Analyses of the Coal

Doelling (1972) reports more than 500 analyses of coal samples from the Standardville quadrangle. The coal samples were taken from numerous mines. Many of the samples came from tipples of mines operating in more than one coal bed, which makes it difficult to separate these analyses by individual coal bed. The values of the proximate analyses have been averaged together



EXPLANATION



Subsurface coal mine showing name of mine.
Hachures point to mined out areas. Dashed
where approximately located.

PLATE 3. Mined areas in the Kyune Quadrangle, Carbon and Utah Counties, Utah.

in the following table taken from Doelling (1972, p. 348). A few coal samples from the mined area in the Kyune quadrangle may have been included in the following summary of coal analyses.

Table 1. Average proximate analysis of coals, Standardville quadrangle, Carbon County, Utah.

	No. Analyses	Average	Percent Range
Moisture	563	4.1	0.62-24.5
Volatile matter	514	43.2	31.4 -48.5
Fixed carbon	514	45.9	33.9 -52.9
Ash	534	6.8	4.3 -13.2
Sulfur	498	0.59	0.2 - 2.1
Btu/lb	551	12,863	7,045 -13,530

Based on the ASTM system of classification, the coal mined in the Standardville quadrangle is ranked as high-volatile bituminous B. (American Society for Testing and Materials, 1977).

Mining Operations

Active coal mining in the area began at least as early as 1896 in the Standardville quadrangle where numerous mines were later developed. Most of these eventually were abandoned or became inactive. In 1979 the Braztah No. 3 and Braztah No. 5 (combined with the No. 4) were the only operating mines in that quadrangle. Most of the areas behind the coal outcrops in the Standardville quadrangle have been mined in one or more beds (AAA Engineering and Drafting, Inc., 1979). The mined areas of the Royal No. 2 mine (Royal Coal Company) and the New Peerless mine extended into the southeast quarter of the Kyune quadrangle in the Kenilworth (Castlegate "D") and Castlegate "B" coal beds (see plate 3).

The coal production from the Kyune quadrangle is unknown. Doelling (1972) reported an estimated total coal production for the Standardville quadrangle of approximately 53 million short tons (48 million metric tons) and that the recoverability had been about 50 percent.

COAL RESOURCES

The absence of non-proprietary data in the Kyune quadrangle prevents an evaluation of the coal resources in this area. Recent drilling in the vicinity is proprietary information and was not available to the present authors.

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.

Development Potential for Subsurface Mining and In Situ Coal Gasification Methods

Based on a projection of the northward dip of the coal beds of 4 to 6 degrees from the adjoining Standardville quadrangle the coal beds in the Blackhawk Formation are generally expected to have an overburden of less than 3,000 ft (914 m) within the KRCRA boundary in the Kyune quadrangle. Inasmuch as the thicknesses of the coal beds in the KRCRA are not known and the beds are present at depths of less than 3,000 ft (914 m) the unleased Federal coal lands in the KRCRA in the Kyune quadrangle are classified as having an unknown development potential for conventional subsurface mining methods.

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). The criteria for the in situ classification include coal bed dips of 15 to 90 degrees and coal bed depths between 200 and 3,000 ft (61 and 914 m). Inasmuch as the coal beds dip less than 15 degrees in the Kyune quadrangle, the in situ coal gasification methods of development do not apply.

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