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COAL RESOURCES OF THE HILGARD MTN. QUADRANGLE SEVIER COUNTY, 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 surface mining operations."

Published and unpublished public information were used as data sources for this study. No new drilling or field mapping was done to supplement this study. No confidential or proprietary data were used.

Location

The Hilgard Mtn. 7½-minute quadrangle is located at the south end of the Wasatch Plateau coal field in south Central Utah. The quadrangle lies in the eastern part of Sevier County. The city of Richfield, the county seat of Sevier County, is 25 miles (40 km) west of the quadrangle. The city of Salina is 19 miles (31 km) northwest and the town of Emery is 18 miles (29 km) northeast of the quadrangle.

Accessibility

Hilgard Mtn. quadrangle is in a rugged mountainous area and no paved roads cross the quadrangle. However, U.S. Interstate Highway 70 lies 2 miles (0.8 km) north of the quadrangle boundary. In the northeast corner

of the quadrangle two unimproved dirt roads, one in Pole Hollow and one Red Creek Canyon, run northeastward to connect with U.S. Interstate Highway 70. Another unimproved dirt road runs from Water Flat in the southwest corner of the quadrangle northward to Sheep Valley in the north central part of the quadrangle. Several jeep trails and pack trails provide access to other parts of the quadrangle.

The nearest railhead is at the city of Salina approximately 19 miles (31 km) northwest of the quadrangle and is reached via U.S. Interstate Highway 70. A branch line of the Denver and Rio Grande Western Railroad runs through Salina and Sanpete Valley at the base of the western side of the Wasatch Plateau. The railroad passes through or near most of the towns on the west side of the plateau and provides rail connections to Salt Lake City, Utah and Denver, Colorado.

Physiography

The eastern margin of the Wasatch Plateau is approximately 80 miles (129 km) long and consists of sparsely vegetated sandstone cliffs and steep shale slopes cut by numerous steep-walled canyons. The rocks are gently dipping, generally less than 10 degrees.

Hilgard Mtn. quadrangle lies in the high, mountainous central part of the Wasatch Plateau. More than 90 percent of the surface area of the quadrangle is over 9,000 ft (2,743 m) above sea level. Many of the mountains on the south, west, and north sides of the quadrangle are over 10,000 ft (3,048 m) high and Hilgard Mtn. reaches an elevation of 11,533 ft (3,515 m). The lowest surface elevation is 7,990 ft (2,435 m) where North Creek leaves the northeast corner of the quadrangle. The relief in the quadrangle is 3,543 ft (1,080 m). Much of the area is forested. There are numerous small lakes in The Potholes area on the west central side of the quadrangle and

a reservoir is impounded in the north end of Sheep Valley. The quadrangle is in the Colorado River drainage system.

Climate

The climate of the Wasatch Plateau varies with altitude from semi-arid in the lowest elevations to alpine in the highest. The normal annual precipitation in the Hilgard Mtn. quadrangle ranges from 19 inches (46 cm) in the northeast corner of the quadrangle to over 30 inches (76 cm) in the high area around Hilgard Mtn. (U.S. Department of Commerce (1964). Much of the precipitation falls as snow during winter. Cloudburst storms sometimes occur in late summer.

Temperatures in the quadrangle are expected to range from an approximate summer high of 85 degrees F (29 degrees C) to a winter low of -30 degrees F (-34 degrees C) or lower.

Land Status

Quadrangle lies at the south end of the Wasatch Plateau Known Recoverable Coal Resource Area (KRCRA). Approximately 3,700 acres (1,497 ha) of the quadrangle area lies within the KRCRA as shown in figure 1. At the date of the land check for this report (1977) the entire quadrangle KRCRA consisted of unleased Federal land.

GENERAL GEOLOGY

Previous Work

Spieker (1931) mapped and described the geology and coal occurrence of the Wasatch Plateau. The stratigraphy of the area has been described by Spieker and Reeside (1925), Spieker (1949), Katich (1954), and Hayes and others (1977). In 1972 Doelling compiled the geology and available coal data for the coal field. The geology of nearby quadrangles to the northeast, Flagstaff Peak, and Emery West were recently mapped by Sanchez and Hayes

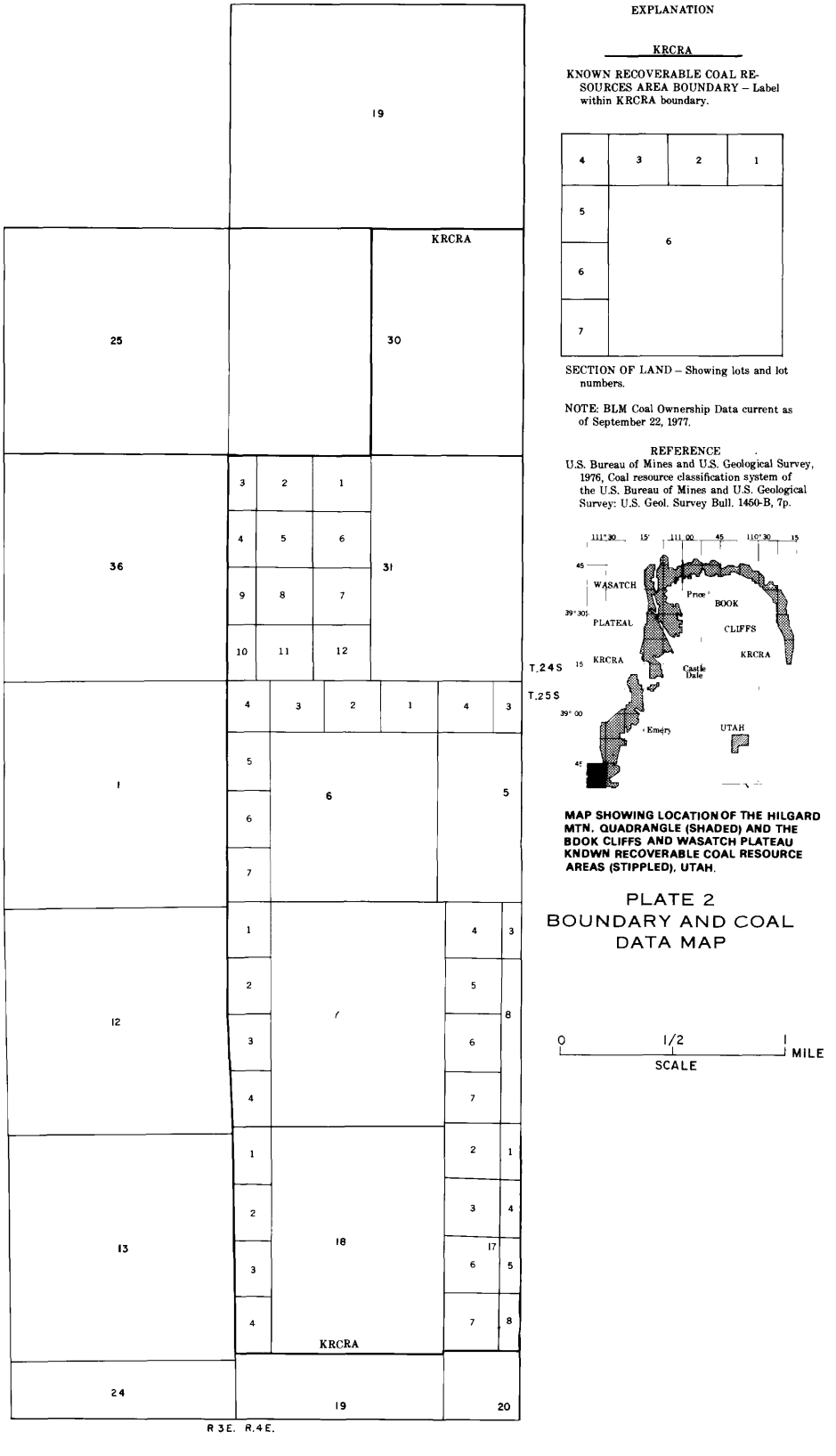


FIGURE I. Boundary map, Hilgard Mtn. Quadrangle, Sevier County, Utah.

(1977) and Hayes and Sanchez, (1977). Also in that area detailed measurements and descriptions of closely spaced stratigraphic sections of the upper part of the Star Point Sandstone and the lower part of the Blackhawk Formation were made by Marley and Flores (1977). Marley, Flores, and Cavaroc (1978) presented in preliminary form a discussion of despositional environments and origin of rocks within the Blackhawk Formation and the Star Point Sandstone in the Wasatch Plateau. A detailed description of the lithostratigraphy of portions of these two formations was presented by Marley (1978).

AAA Engineering and Drafting, Inc. (1979a and 1979b) prepared coal resource occurrence and coal development potential maps for the adjoining Old Woman Plateau and Johns Peak quadrangles.

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. This group includes, in ascending order: Star Point Sandstone, Blackhawk Formation, Castlegate Sandstone, and Price River Formation. The Upper Cretaceous Mancos Shale underlies the Star Point Sandstone, and the North Horn Formation (Upper Cretaceous and Paleocene) overlies the Price River Formation. The North Horn Formation is overlain by the Flagstaff Limestone of Paleocene age.

The oldest unit exposed in the quadrangle is the Castlegate Sandstone which crops out in the bottom of North Creek canyon on the eastern edge of the quadrangle (Hintze and Stokes, 1964). The underlying Blackhawk Formation is exposed in the adjoining quadrangles to the east and northeast.

The Blackhawk Formation consists of very fine- to medium-grained sandstone, siltstone, shale, and coal. The formation is approximately 750 ft (229 m) thick in the Johns Peak quadrangle (Doelling, 1972). The coal beds

occur in the lower part of the formation. Marley and Flores (1977, p. ii and iii) report that "the Blackhawk Formation interfingers laterally with and locally unconformably overlies the Star Point Sandstone. . . The characteristics of the rock types of the Blackhawk Formation suggest that they represent delta-plain desposits, which grade (seaward) into the underlying delta-front and prodelta deposits of the Star Point Sandstone."

The Castlegate Sandstone overlies the Blackhawk Formation and is a massive, cliff-forming, yellow to gray sandstone unit. The overlying Price River Formation is similar to the Castlegate but the bedding is less massive and is composed of fine- to medium-grained sandstone with some interbedded shale. In the adjoining guadrangle to the east the total thickness of the Castlegate-Price River sequence is approximately 800 ft (244 m) (Doelling, 1972). The Price River Formation is less resistant to erosion than the Castlegate Sandstone and forms step-like ledges in its outcrop pattern.

The North Horn Formation overlies the Price River Formation and is Upper Cretaceous and Paleocene in age. It consists of nearly 1,500 ft (457 m) of variegated shale and subordinate conglomerate, sandstone, and limestone. The Flagstaff Limestone overlies the North Horn Formation and crops out in a small area in the southwest corner of the Hilgard Mtn. quadrangle on the west side of UM Creek (Hintze, 1963). The formation is composed of light-colored resistant limestone with subordinate amounts of interbedded sandstone and shale.

The Bullion Canyon volcanics of Tertiary age cover a large part of the central and southern areas of the quadrangle and shield an extensive area underlain by Upper Cretaceous formations. The volcanics effectively terminate the Wasatch Plateau coal field.

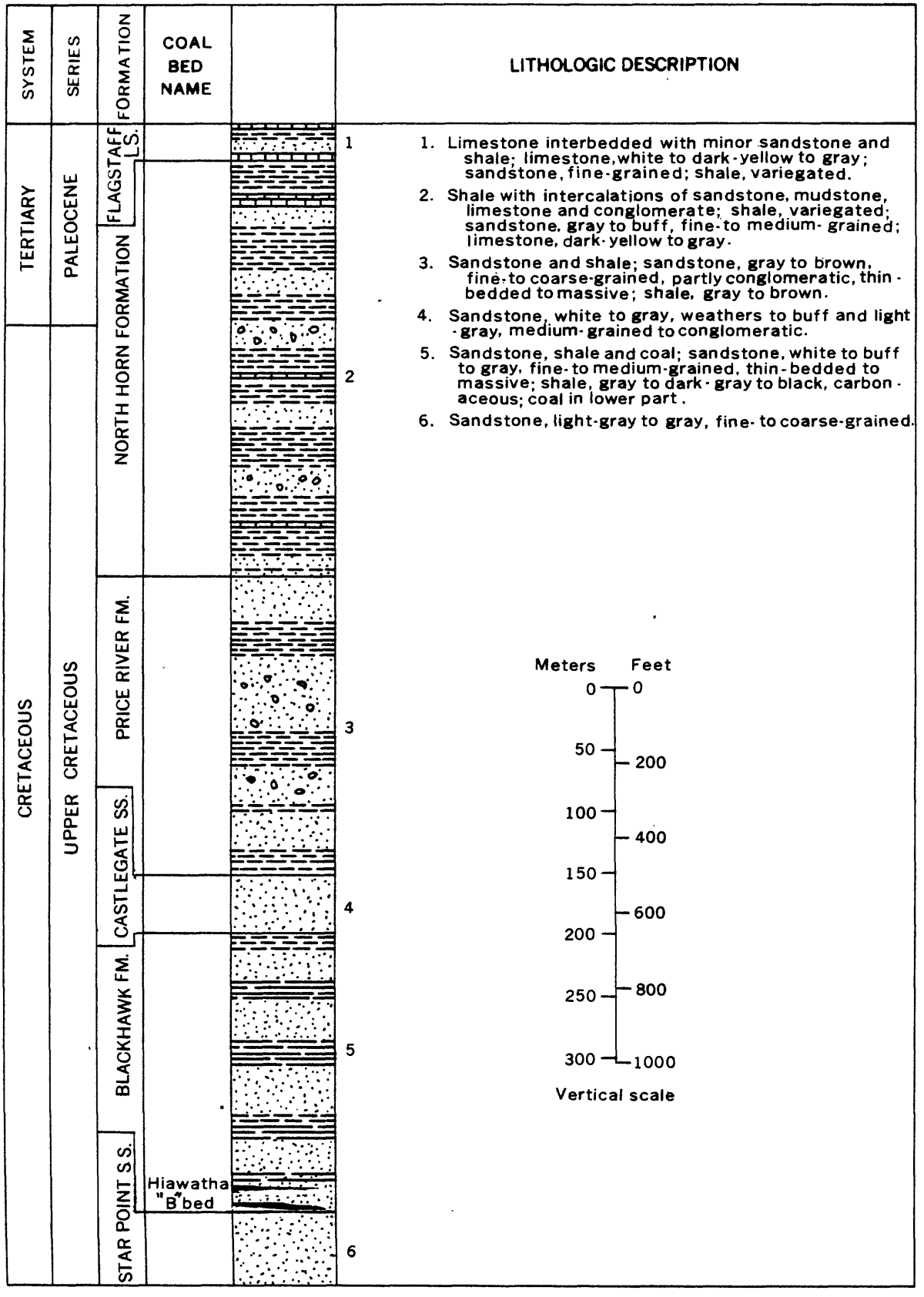


FIGURE 2. Composite columnar section, Hilgard Mtn. Quadrangle, Sevier County, Utah.

An area on the east side of the quadrangle south of North Fork Clear Creek is covered with Quaternary gravel which also shields an extensive area underlain by Upper Cretaceous formations. The gravel is composed of volcanics, quartzites, chert, and limestone, and occurs at elevations well above 9,000 ft (2,743 m).

Structure

Several north-south trending normal faults occur in the southern and western parts of the quadrangle and involve volcanic rocks (Hintze and and Stokes, 1964, and Hintze, 1963). The vertical displacement of the faults are not known. The sedimentary rocks in the adjoining quadrangles to east and northeast have gentle westward and northwestward dips of less than 10 degrees and it can reasonably by expected that the rocks on the east side of the Hilgard Mtn. quadrangle will have a similar inclination.

COAL GEOLOGY

The chief coal beds in the southern part of the Wasatch Plateau coal field occur in the lower part of the Blackhawk Formation. In the Johns Peak quadrangle Spieker (1931) and Doelling (1972) list the following coal beds in ascending order: Hiawatha, Upper Hiawatha, Ivie, Upper Ivie, and some thin local coal beds.

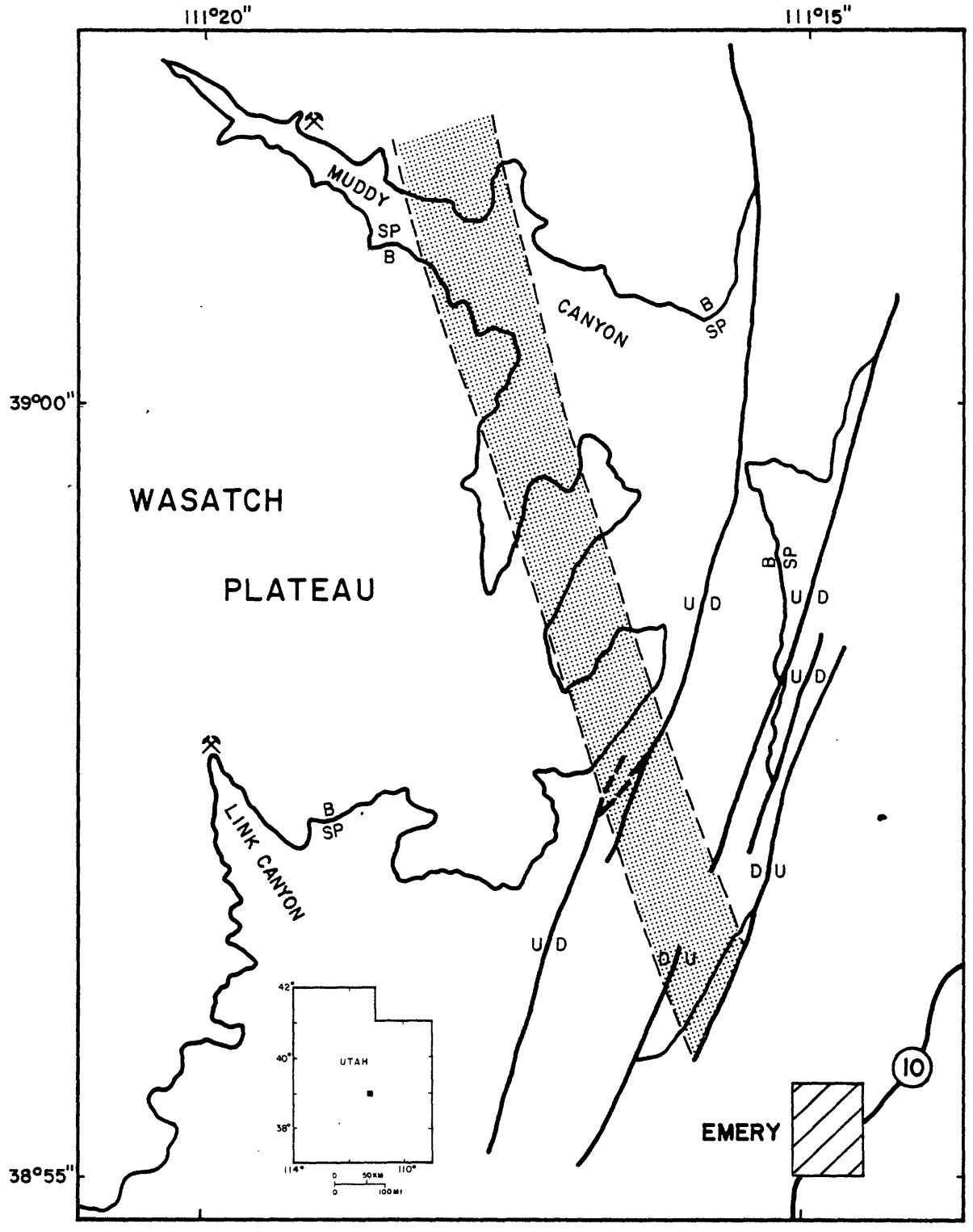
Spieker (1931, p. 196) reports that, "The country adjacent to Ivie Creek consists largely of rounded slopes, and natural exposures of coal are rare... South of Ivie Creek exposures of coal diminish sharply, and apparently no important beds are present between Ivie Creek and Last Chance Creek. Near the head of Last Chance Creek exposures of coal return for a short space, but farther south the rocks in general are very poorly exposed. In most of the area the coal is not exposed." Several coal test holes have been drilled in

the Johns Peak quadrangle which have shed some light on the coal occurrence behind the outcrop area (AAA Engineering and Drafting, Inc. 1979b).

Sanchez and Hayes (1977) mapped the geology of the Flagstaff Peak and Emery West quadrangles and Marley and Flores (1977) made detailed measurements and descriptions of closely-spaced stratigraphic sections of the upper part of the Star Point Sandstone and the lower part of the Blackhawk Formation. A zone of intertonguing between these two formations was observed at several localities within a 6-mile (10-km)-long and 0.6-mile (1-km)-wide belt extending south-southeastward from the north wall of Muddy Creek Canyon to near the town of Emery (figure 3). "As a result of this intertonguing, the contact between the two formations is about 20 m (66 ft) higher to the east than it is to the west and the coal-bed correlations of Spieker (1931) must be modified." (Flores and others, 1978).

As a result of the recognition of the intertonguing, a revision of the correlations of the lower Blackhawk Formation coal beds between the two sides of the intertonguing zone was suggested by Flores and others (1978). They point out, for example, that "the upper bed in the abandoned mine of Muddy Canyon and referred to as Muddy No. 2 coal bed by Spieker (1931) is apparently the Hiawatha coal bed. . ." and that, "The coal bed mined in the abandoned Link Canyon mine. . .and identified by Doelling (1972) as the Upper Hiawatha coal bed merges laterally eastward into the Star Point Sandstone and must be about 20 m below the stratigraphic position of the Upper Hiawatha coal bed of areas to the east of the zone of intertonguing" (Flores and others, 1978). Generalized cross sections through the zone of intertonguing are shown in figure 4.

The Johns Peak quadrangle lies south and west of the zone of intertonguing and the coal-bed names used here reflect the stratigraphic correlations



EXPLANATION

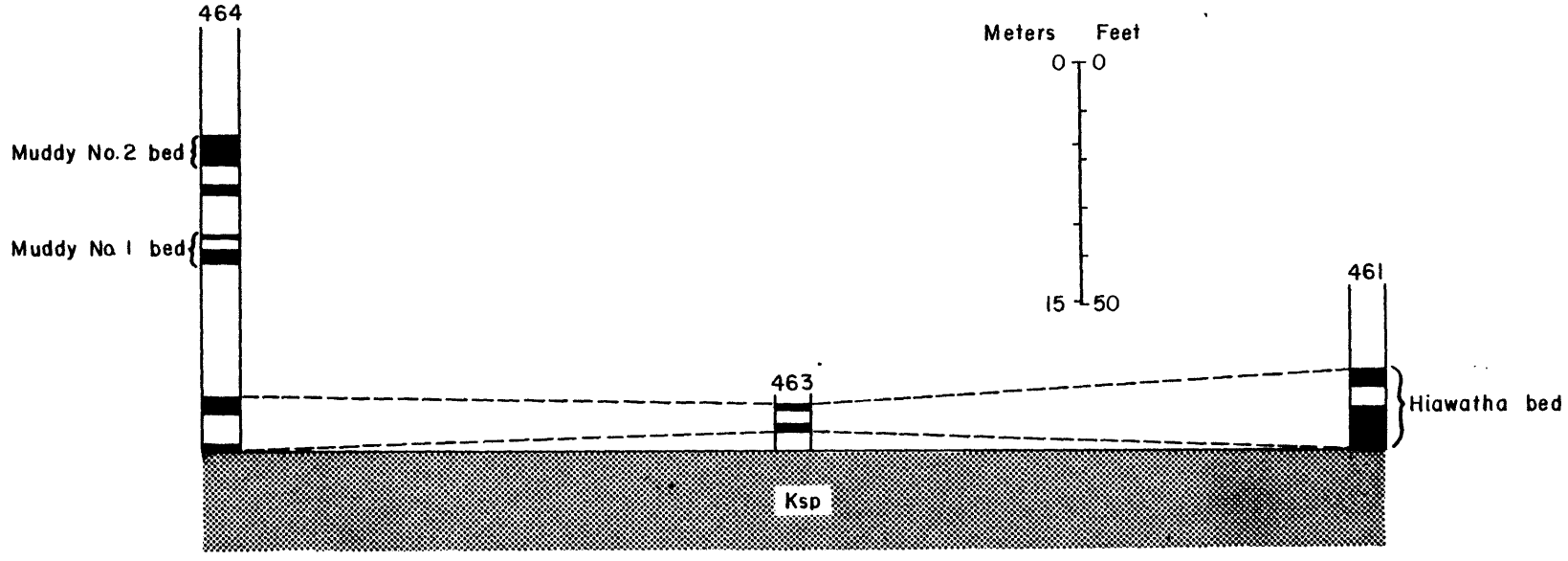
ZONE OF INTERTONGUING

COAL MINE

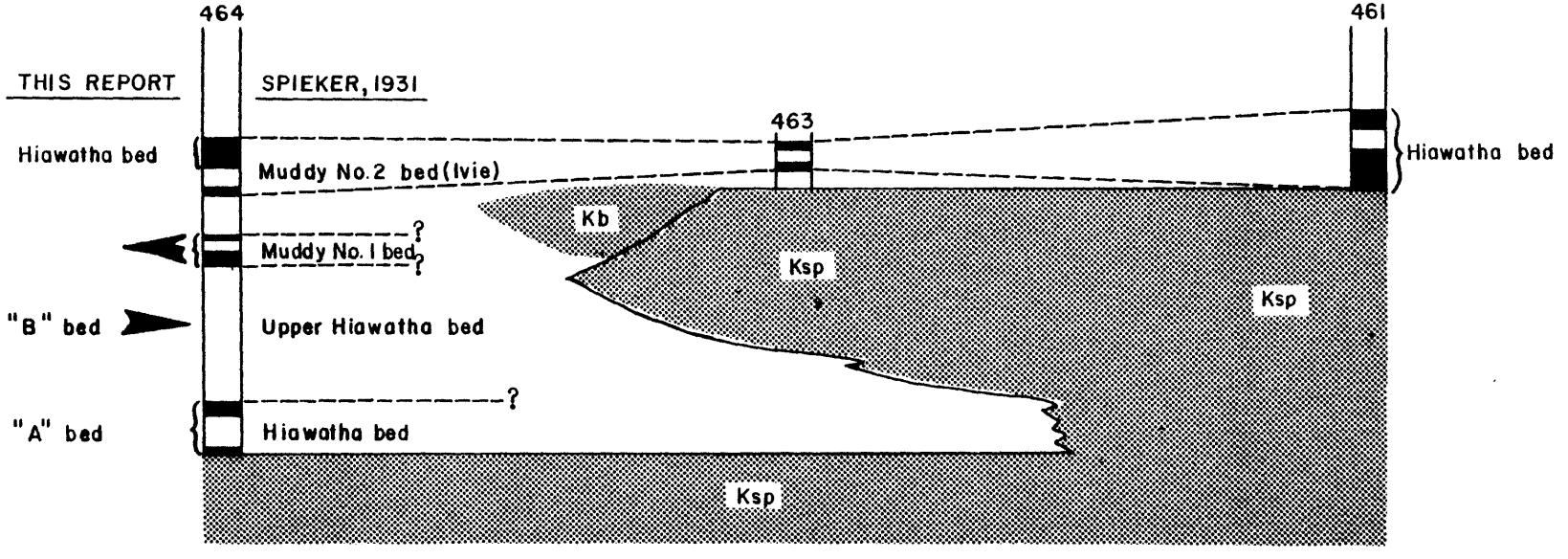
B / SP — CONTACT BETWEEN BLACKHAWK FORMATION (B) AND STAR POINT SANDSTONE (SP)

U / D — FAULT - DASHED WHERE FAULT IS INFERRED U. UPTHROWN SIDE, D. DOWNTHROWN SIDE

FIGURE 3. Map showing zone of intertonguing (after Flores and others, 1978).



Correlations of Spieker (1931)



Revised correlations

FIGURE . Generalized cross sections showing former and revised coal-bed correlations (after Flores and others, 1978).

suggested by Flores and others (1978) in the Emery West and Flagstaff Peak quadrangles.

Based on the revised correlations of coal beds to the west and south of the zone of intertonguing observed by Marley and Flores (1977) the coal-bed names used by earlier workers are revised to coincide more closely to the correlations used in the quadrangles to the east and north including the Johns Peak, Old Woman Plateau, Acord Lakes, Emery West, and Flagstaff Peak quadrangles. The names "A" Bed and "B" Bed are substituted here for the Hiawatha and Upper Hiawatha beds of Spieker (1931). Hiawatha is used in this report for the coal bed called the Ivie bed by Spieker (1931) and Doelling (1972). Spieker (1931) generally used local names for coal beds other than the Hiawatha and Upper Hiawatha. However, he stated (p. 180) that, "If names were to be extended, with our present knowledge, Ivie would be preferable for the Muddy No. 2." and that mining in certain areas may prove their equivalency. The Muddy No. 2 bed on the west side of the zone of intertonguing is correlated to the Hiawatha bed on the east side of the intertonguing as shown in figure 4. Table 1 below shows the coal bed correlations used in the Johns Peak and Emery West quadrangles.

Table 1. Correlations of coal beds on the east and west sides of the zone of intertonguing, Johns Peak and Emery West quadrangles, Sevier and Emery Counties, Utah.

West Side of Zone Intertonguing			East Side of Zone of Intertonguing
New Correlations Johns Peak Quadrangle	New Correlations Emery West Quadrangle	Spieker (1931) and Doelling (1972)	Spieker (1931) and Doelling (1972)
			Upper Ivie
			Muddy No. 2
			Muddy No. 1
	Upper Hiawatha	Upper Ivie	Upper Hiawatha
Hiawatha (absent)	Hiawatha "C" Bed	Muddy No. 2 (Ivie) Muddy No. 1	Hiawatha
"B" Bed	"B" Bed	Upper Hiawatha	
"A" Bed	"A" Bed	Hiawatha	

"A" Coal Bed

The "A" coal bed occurs on the west side of the zone of intertonguing (figure 3). The bed in this area was formerly called the Hiawatha coal bed by Spieker (1931) and Doelling (1972). Based on work by Flores and others (1978) the bed merges laterally into the Star Point Sandstone in the zone of intertonguing and is approximately 65 ft (20 m) stratigraphically below the Hiawatha coal bed on the east side of the zone. The "A" bed occurs on or near the top of the Star Point Sandstone and is thin and lenticular in the Johns Peak quadrangle. It is absent in some of the holes drilled in that quadrangle, but where encountered the bed ranges in thickness from 0.4 to 4.5 ft (0.1 to 1.4 m). The "A" bed is expected by the present authors to be absent or very thin in the Hilgard Mountain quadrangle.

"B" Coal Bed

The "B" coal bed occurs on the west side of the zone of intertonguing and was formerly called the Upper Hiawatha coal bed by Spieker (1931) and

Doelling (1972). The bed is well developed along the north side of the North Fork of Last Chance Creek in Johns Peak quadrangle where it reaches a thickness of 7.8 ft (2.4 m). The bed was also encountered in holes drilled in the northwest quarter of that quadrangle where the bed was generally less than 5 ft (1.5 m) thick except in one hole where it was 6.5 ft (2.0 m) thick. The "B" bed is approximately 20 ft (6.1 m) above the base of the Blackhawk Formation.

Hiawatha Coal Bed

Based on field work by Flores and others (1978) the Hiawatha coal bed on the east side of the zone of intertonguing correlates with the coal bed formerly called the Muddy No. 2 coal bed by Spieker (1931) and Doelling (1972) on the west side of the zone. In the Ivie Creek area Spieker (1931, p. 180) suggests the equivalency of the Muddy No. 2 and the Ivie coal beds. In this report the coal bed called Hiawatha was formerly called the Ivie coal bed by Spieker (1931). The Hiawatha bed in the north half of the Johns Peak quadrangle reaches a thickness of 9.0 ft (2.7 m) in Clear Creek Canyon. The area where the coal bed is over 5.0 ft (1.5 m) thick appears to be limited to the Clear Creek area and apparently pinches out westward toward the Hilgard Mountain quadrangle.

Chemical Analyses of the Coal

Two analyses of coal from the Hiawatha bed are available for the adjoining Johns Peak quadrangle area. These are listed by Doelling (1972, table 5) and are summarized below.

Table 2. Average proximate analysis of coal samples from the Hiawatha coal bed (formerly Ivie bed of Spieker, 1931), Johns Peak quadrangle, Sevier County, Utah.*

	No. Analyses	As Received (percent) Average	Range
Moisture	2	13.4	12.9-13.9
Volatile matter	2	36.2	35.2-27.2
Fixed carbon	2	43.8	43.6-43.9
Ash	2	6.7	6.0-7.3
Sulfur	2	.6	.6
Btu/lb**	2	10,570	10,540-10,600

*After Doelling (1972, p. 96)
**To convert Btu/lb to Kj/kg multiply by 2.326

Based on the ASTM system of classification and the average analysis shown in table 3, the Hiwatha coal is ranked as high volatile C bituminous (if it is agglomerating) (American Society for Testing and Materials, 1977).

Mining Operations

No known coal mining operations have occurred in the Hilgard Mtn. quadrangle KRCRA and very little coal has been removed from the adjoining John Peak quadrangle where most of the known prospects and small coal mines are old and abandoned (Spieker, 1931). In the Johns Peak quadrangle several short adits have been found in Clear Creek Canyon, Red Creek Canyon, Last Chance Canyon, and on the West side of Paradise Valley (Doelling, 1972). The workings in Red Creek and Clear Creek Canyons are in the Hiawatha bed; those in Last Chance Canyon are in the upper zone of the Ferron coals (Ferron Sandstone Member of the Mancos Shale); and a prospect on the west side of Paradise Valley is in a coal bed in the Emery Sandstone member of the Mancos Shale. At the time of this writing (1979) there were no active coal mines within the Johns Peak quadrangle KRCRA.

COAL RESOURCES AND COAL DEVELOPMENT POTENTIAL

There are no coal bed measurements in the Hilgard Mtn. quadrangle KRCRA and no coal beds of Reserve Base thickness have been projected into the area from adjoining quadrangles. Therefore, no coal resources are shown.

Development Potential for Surface Mining Methods

No development potential for surface mining methods exists in the KRCRA of this guadrangle because of the thick overburden. Based on the depth and dip of the coal beds in the adjoining quadrangles to the northeast and east (AAA Engineering and Drafting, Inc., 1979a and 1979b), depths to the lower Blackhawk Formation coal beds are estimated to range from several hundreds of feet to 2,000 ft (610 m) in the Hilgard Mtn. quadrangle KRCRA.

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.

There are no known coal bed measurements in the Hilgard Mtn. quadrangle KRCRA. Projections of coal bed thicknesses into the quadrangle from adjoining quadrangles indicate that several coal beds probably occur in the lower part of the Blackhawk Formation on the east side of the quadrangle and that these beds may be more or less than 5 ft (1.5 m) in thickness. Even though this area may contain coal thicker than 5 ft (1.5 m) the limited knowledge of the areal distribution of the coal prevents an accurate evaluation of development potential and therefore, the unleased Federal coal land in the Hilgard Mtn. quadrangle KRCRA is classified as having an unknown development potential.

Classification of development potential for in situ coal gasification was not done because dips are less than 15 degrees within the quadrangle KRCRA. 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.

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