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COAL RESOURCE OCCURRENCE MAPS AND COAL DEVELOPMENT POTENTIAL OF THE SOUTHWEST QUARTER OF THE KEMMERER 15-MINUTE QUADRANGLE, LINCOLN COUNTY, WYOMING

[Report includes 2 plates]

Prepared for

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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Purpose

This text is to be used in conjunction with Coal Resource Occurrence Maps of the northwest quarter of the Kemmerer 15-minute quadrangle, Lincoln County, Wyoming. This report was compiled to support the land planning work of the Bureau of Land Management (BLM) to provide a systematic coal resource inventory of Federal coal lands in Known Recoverable Coal Resource Areas (KRCRA's) in the western United States. This investigation was undertaken by Dames & Moore, Denver, Colorado, at the request of the U.S. Geological Survey under contract number 14-08-0001-17104. The resource information gathered for this report is in response to the Federal Coal Leasing Amendments Act of 1975 (P.L. 94-377). Published and unpublished public information available through April, 1978, was used as the data base for this study. No new drilling or field mapping was performed, nor was any confidential data used.

Location

In this report, the term "quadrangle" refers only to the southwest quarter of the Kemmerer 15-minute quadrangle which is located in southern Lincoln County, Wyoming, approximately 4 miles (6 km) west of Kemmerer and 11 miles (18 km) east of Sage, Wyoming via U.S. Highway 30N. Fossil, an abandoned Union Pacific Railroad loading station, is located on the west-central edge of the quadrangle. In general, the area is unpopulated.

Accessibility

The Oregon Shortline Railroad, a branch of the Union Pacific Railroad, passes through the town of Kemmerer, connecting Pocatello, Idaho, with the Union Pacific Railroad main line at Granger, Wyoming.

U.S. Highway 30N runs east-west through the center of the quadrangle. The remainder of the quadrangle is accessible by a few improved light-duty roads, unimproved dirt roads and trails.

Physiography

The southwest quarter of the Kemmerer 15-minute quadrangle lies on the southeastern edge of the Wyoming Overthrust Belt. The landscape within the quadrangle is characterized by buttes, ridges and valleys. Fossil Butte, 7,570 feet (2,307 m) high and part of the Fossil Butte National Monument, is located north of U.S. Highway 30N along the northwestern edge of the quadrangle. Fossil Ridge, 7,423 feet (2,263 m) high, lies south of the highway along the southwestern edge of the quadrangle. Altitudes range from approximately 6,630 feet (2,021 m) along Twin Creek near the northwestern edge of the quadrangle to 7,720 feet (2,353 m) in the southeastern corner of the quadrangle.

Twin Creek, a branch of the Bear River west of the quadrangle, and its tributaries flow westerly, draining the quadrangle. All streams within the quadrangle are intermittent, flowing mainly in response to snowmelt in the spring.

Climate and Vegetation

The climate of southwestern Wyoming is semiarid, characterized by low precipitation, rapid evaporation, and large daily temperature variations. Summers are usually dry and mild, and winters are cold. The annual precipitation averages approximately 10 inches (25 cm) and is fairly evenly distributed throughout the year (Wyoming Natural Resources Board, 1966).

The average annual temperature of the area is 39° F (4° C). The temperature during January averages 17° F (-8° C) and typically ranges from 4° F (-16° C) to 30° F (-1° C). During July, the average temperature is 62° F (17° C), and the temperature typically ranges from 43° F (6° C) to 82° F (28° C) (Wyoming Natural Resources Board, 1966; U.S. Bureau of Land Management, 1978).

Winds are usually from the west and west-southwest with an average annual velocity of 15 miles per hour (24 km per hr) (U.S. Bureau of Land Management, 1978).

The principal types of vegetation in the quadrangle include grasses, sagebrush, greasewood, saltbush, winterfat, serviceberry, juniper, aspen, and willow (U.S. Bureau of Land Management, 1978).

Land Status

The southwestern quarter of the Kemmerer 15-minute quadrangle lies on the northeastern edge of the Kemmerer Known Recoverable Coal Resources Area (KRCRA). Approximately one third of the eastern portion of the quadrangle lies within the KRCRA boundary and the Federal government owns the coal rights for approximately three quarters of this area. Two active coal leases present within the KRCRA boundary as shown on plate 2.

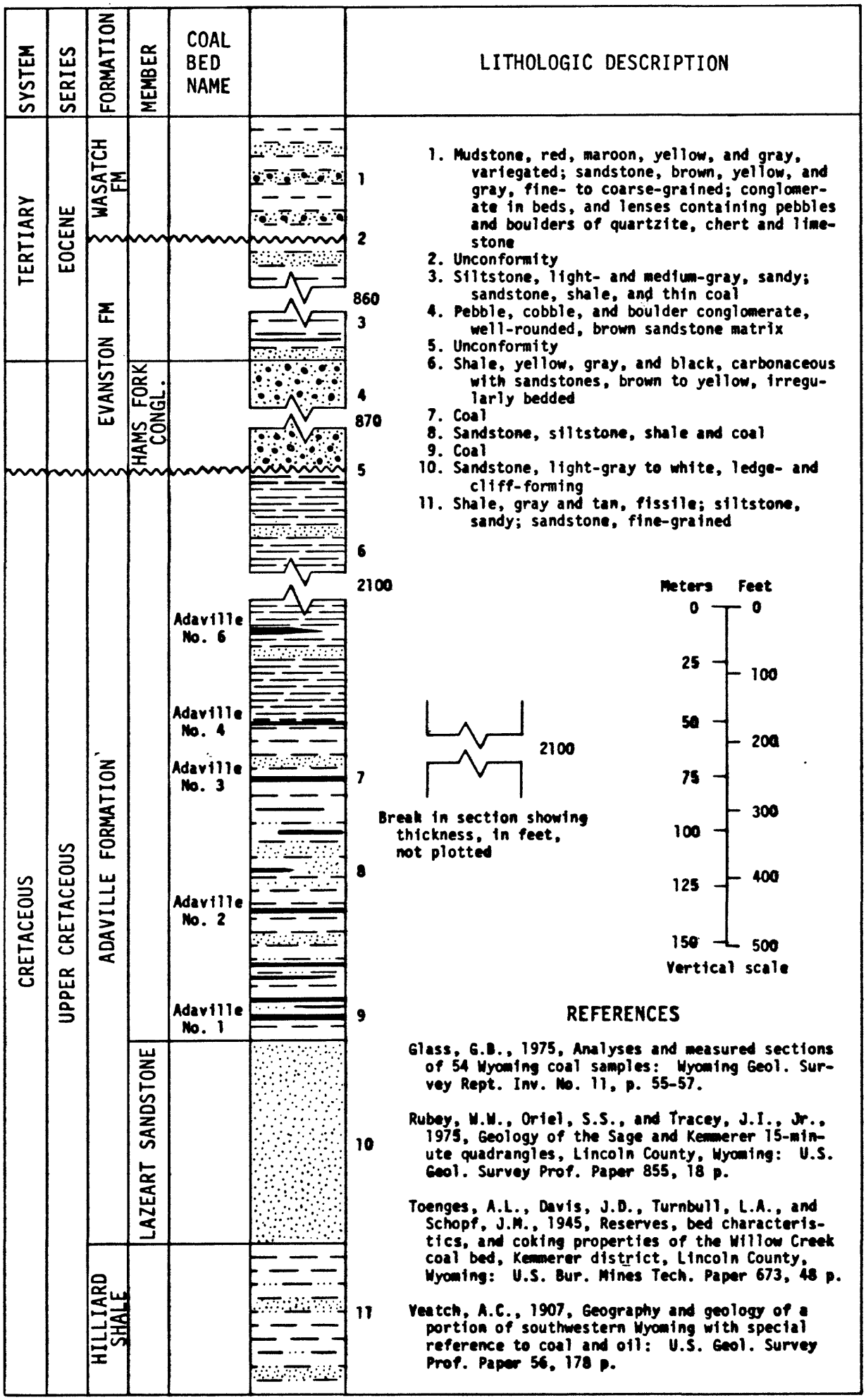
GENERAL GEOLOGY

Previous Work

Veatch (1907) the geology and economic resources of a large part of Lincoln and Uinta counties in southwestern Wyoming. Schultz made an investigation of the geology and coal resources in the northern part of the Kemmerer coal field in 1914. The Evanston, Wasatch, and Green River Formations in the Kemmerer area were described by Oriel and Tracey in 1970. Rubey and others (1975) also described the stratigraphy and structure in the Kemmerer and Sage 15-minute quadrangles. Coal analyses and measured sections of Adaville Formation coals in the Elkol and Sorensen strip mines in the Kemmerer coal field were reported by Glass in 1975. Roehler and others (1977) described the geology and coal resources of the Hams Fork coal region, including the Kemmerer coal field. Glass (1977) also reported analyses and described the coal-bearing formations and coal beds present in the Hams Fork coal region.

Stratigraphy

The formations exposed in the southwest quarter of the Kemmerer 15-minute quadrangle range in age from Late Cretaceous to Eocene. Only the Adaville Formation, cropping out in the southeastern corner of the quadrangle, is known to contain coal in this quadrangle. A generalized columnar section is shown in figure 1.



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The Hilliard Shale of early Late Cretaceous age is present in the subsurface in the quadrangle. It is composed of a thick sequence of dark-gray, gray and tan fissile marine claystone; light- to medium-gray, partly argillaceous and partly lignitic sandy siltstone; white to dark-gray, thin-bedded, very fine grained to gritty sandstone and white to gray bentonite. The Hilliard Shale is approximately 6,600 feet (2,012 m) thick (Rubey and others, 1975).

The Adaville Formation of Late Cretaceous age crops out in the southeastern corner of the quadrangle and lies conformably on the Hilliard Shale. The Adaville Formation consists of interbedded gray sandstone, siltstone, carbonaceous clay, and the Adaville Coal Zone, which may contain up to 32 subbituminuos coal beds (Glass, 1977). The sandstone, which weathers to yellow and brown, is calcareous, fine to coarse-grained, thin-bedded to massive, and is partly conglomeratic in the upper part of the formation. At the base of the Adaville Formation is the Lazeart Sandstone Member which is approximately 300 feet (91 m) thick and is composed of light-gray to white, fine- to coarse-grained sandstone. Numerous coal beds, including the extensively mined Adaville No. 1 coal bed, are present in the lower part of formation. The Adaville Formation is approximately 2,900 feet (884 m) thick (Rubey and others, 1975).

The Evanston Formation crops out along the southeastern edge of the quadrangle and lies unconformably on the Adaville Formation. The Hams Fork Conglomerate Member of latest Cretaceous age comprises the lower part of the formation. This member ranges up to 1,000 feet (305 m) thick and consists of boulder-conglomerate beds with gray to brown cross-bedded sandstone and gray mudstone. The main body of the Evanston Formation, which is Paleocene in age, consists of approximately 1,000 feet (305 m) of gray siltstone, red mudstone, carbonaceous claystone, gray carbonaceous sandstone, dark-brown concretionary ironstone, and lignite (Oriel and Tracey, 1970; Rubey and others, 1975).

The Wasatch Formation of Eocene age unconformably overlies the Evanston Formation and crops out over the western three quarters of the

quadrangle. The Wasatch formation is composed of red, maroon, yellow, and gray variegated mudstone; yellow, brown, and gray, fine- to coarse-grained sandstone; and a sequence of stream-channel conglomerate beds containing boulders, cobbles, and pebbles of quartzite, chert, and limestone. According to Oriel and Tracey (1970), the maximum thickness of the Wasatch Formation is approximately 2,100 feet (640 m).

The Green River Formation of Eocene age conformably overlies the Wasatch Formation. The Green River Formation consists of buff laminated limestone and marlstone, gray calcareous siltstone, claystone, brown to black oil shale, thin beds of tuffaceous ash, and abundant fossils. The Green River Formation is approximately 400 to 480 feet (122 to 146 m) thick (Oriel and Tracey, 1970).

Holocene deposits of alluvium cover the stream valleys of Twin Creek and its tributaries; terrace gravel remnants border the Twin Creek valley.

The Upper Cretaceous formations in the southwest quarter of the Kemmerer 15-minute quadrangle indicate the transgressions and regressions of a broad, shallow north-south seaway that extended across central North America. Sediments accumulated near the western edge of the Cretaceous sea, and reflect the location of the shoreline (Weimer, 1960 and 1961).

The marine sediments of the Hilliard Shale indicate the transgression of the Cretaceous sea and the minor fluctuations of the shoreline as a sequence of shale, claystone, and sandstone were deposited (Roehler and others, 1977).

The Lazeart Sandstone Member at the base of the Adaville Formation is a beach deposit marking a transition from the marine deposition of the Hilliard Shale to the continental coastal plain deposition of the Adaville Formation. The sandstone, siltstone, and coals of the Adaville Formation were deposited in flood plains and swamps along the coastal plain (Roehler and others, 1977).

After the final withdrawal of the Cretaceous sea, thick sections of detrital material, eroded from older deposits to the west, were deposited by large streams as the conglomerates of the Hams Fork Conglomerate Member of the Evanston Formation. Environments of deposition for the main body of the Evanston Formation included streams, marshes, and, probably, ponds (Oriel and Tracey, 1970).

The main body of the Wasatch Formation is composed of continental sediments. The bright-colored mudstones were probably deposited on a flood plain and then cut by stream channels now filled with well-sorted conglomerate (Oriel and Tracey, 1970).

Sediments of the Green River Formation were deposited in a lacustrine environment (Oriel and Tracey, 1970).

Structure

The southwest quarter of the Kemmerer 15-minute quadrangle lies on the southeastern edge of the structurally complex Wyoming Overthrust Belt. Folded Paleozoic and Mesozoic rocks are thrust eastward over folded Cretaceous-age rocks with younger Cretaceous- and Tertiary-age rocks resting unconformably on top of the older rocks. Coal-bearing strata crop out in eroded limbs of folds as long narrow belts bounded on the west by major thrust faults (Roehler and others, 1977).

The axial trace of the asymmetric Lazeart syncline trends north-south along the eastern edge of the quadrangle. Cretaceous-age beds dip about 30° on the eastern limb of the syncline and are vertical or overturned on the western limb. Both the western limb of the syncline and its axial trace are covered by thick Tertiary-age sediments (Rubey and others, 1975).

Three major thrust faults, the Absaroka fault, the Commissary fault, and the Beaver Creek fault, lie west of the Lazeart syncline and parallel the trace of the synclinal axis.

The Absaroka fault, an extensive thrust fault mapped for a linear distance of 205 miles (330 km) in Wyoming and Idaho, brings Paleozoic strata in contact with the Upper Cretaceous-age Hilliard Shale in this quadrangle. At and near the surface, the fault dips steeply to the west (about 70°). According to Rubey and others (1975), the dip of the fault probably becomes much less as the depth of the fault increases to the west. Stratigraphic throw along the fault is about 15,000 feet (4,572 m) and the eastward movement or lateral displacement along the fault is at least 3 miles (4.8 km) within the Kemmerer 15-minute quadrangle. Major movement along the Absaroka fault occurred in very late Cretaceous time with probable minor movement in the Paleocene (Rubey and others, 1975).

The Commissary fault, running north-south through the center of the quadrangle, and the Beaver Creek fault about one mile (1.6 km) to the west of the Commissary fault, are thought to be upward slices or branches of the Absaroka fault at depth. Several other unnamed fault slices lie west of the Beaver Creek fault on the north side of Fossil Butte. Stratigraphic throws along these faults are as much as 10,000 feet (3,048 m), and lateral displacement may be at least several miles. The minimum displacement along the Beaver Creek fault is 7 miles (11.3 km) (Rubey and others, 1975).

COAL GEOLOGY

Coal beds of the Adaville Coal Zone are mined in the Sorenson strip mine in the southeastern corner of the quadrangle, but no coal measurements are available. The dip of the beds, measured by Rubey and others (1955), averages 24° to the west-northwest with overburden thickness increasing in the same direction.

Individual beds in the Adaville Coal Zone are not persistent. According to Glass (1977), the coal beds thin, thicken, split, and coalesce over very short distances. Because of the nature of these beds, no coal data has been projected into this quadrangle from adjacent quadrangles.

Chemical analyses of coal.--Analyses of two samples of Adaville coal from the adjacent Warfield Creek and the southeast quarter of the Kemmerer 15-minute quadrangles are included in table 1 (Glass, 1975). The coal of the Adaville Formation is low in sulfur and generally ranks subbituminous B or C on a moist, mineral-matter-free basis according to ASTM Standard Specification D 388-77 (American Society for Testing and Materials, 1977).

COAL RESOURCES

Coal resources may exist within the non-leased Federal sections in this quadrangle, but were not evaluated because of limited data. Therefore, no Reserve Base or Reserve information is available for this quadrangle.

COAL DEVELOPMENT POTENTIAL

Areas where coal beds of Reserve Base thickness (5 feet or 1.5 meters) are overlain by 200 feet (61 m) or less of overburden are ordinarily considered to have potential for surface mining. Areas considered to have a development potential for conventional subsurface mining methods include those areas where coal beds of Reserve Base thickness are between 200 and 3,000 feet (61 and 914 m) below the ground surface and have dips of 15° or less. Coal beds of Reserve Base thickness lying between 200 and 3,000 feet (61 and 914 m) below the ground surface, dipping greater than 15°, are considered to have a development potential for in-situ mining methods.

The lack of Reserve Base information in this quadrangle prevents accurate evaluation of development potential, and unknown development potential has been assigned to the unleased Federal lands within the KRCRA boundary for both surface and subsurface mining methods. Because the dips of all known coal-bearing formations within the KRCRA boundary in this quadrangle exceed 15°, the unleased Federal land areas may have development potential for in-situ mining methods. However, the development potential for in-situ mining methods in these areas has also been rated as unknown because of the lack of Reserve Base information.

Table 1. Chemical analyses of coals in the southwest quarter of the Kemmerer 15-minute quadrangle, Lincoln County, Wyoming.

LOCATION	COAL BED NAME	Form of analysis	Proximate				Ultimate					Heating value	
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrocarbon	Carbon	Nitrogen	Oxygen	Calories	Btu/lb
SE¼, NE¼, sec. 19, T. 21 N., R. 116 W. (Sorensen Mine - Glass, 1975)	Adaville No. 5	A	17.5	35.1	43.7	3.7	0.4	-	-	-	-	-	10,180
		C	0.0	42.5	53.0	4.5	0.4	-	-	-	-	-	12,330
NW¼, SW¼, sec. 3, T. 20 N., R. 117 W. (Sorensen Mine - Glass, 1975)	Adaville No. 10	A	20.5	33.0	39.6	6.9	0.9	-	-	-	-	-	9,410
		C	0.0	41.5	49.8	8.7	1.2	-	-	-	-	-	11,840

Form of analysis: A, as received
C, moisture free

Note: To convert Btu/pound to kilojoule/kilogram, multiply by 2.326.

Table 2. -- Sources of data used on plate 1

Plate 1 Index Number	Source	Data Base
1	Hoxsey Oil Co.	Oil/gas well No. 1 Government
2	Palisade Petroleum Co.	Oil/gas well No. 1 Government
3	Amerada Petroleum Corp.	Oil/gas well No. 1 Unit-Fossil

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