DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

COAL INVESTIGATIONS
MAP C-114

MAP SHOWING PRINCIPAL COAL BEDS AND BEDROCK GEOLOGY OF THE BUFFALO CREEK-CLEAR CREEK AREA, CENTRAL POWDER RIVER BASIN, WYOMING AND MONTANA

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CORRELATION OF MAP UNITS

Tw	Eocene	TERTIARY
Tft	Paleocene	

DESCRIPTION OF MAP UNITS

Tw **Wasatch Formation (Eocene and Paleocene)**—Yellowish sandstone and siltstone, gray mudstone, dusky-red-brown carbonaceous shale, extensive and local coal beds, and thin lenses of limestone. Exposed thickness about 1,000 ft. Contact between Wasatch Formation and Fort Union Formation shown on base of Arvada coal bed except near fault in extreme northwest corner of map where base of Roland coal bed is used as contact because Arvada is missing (For discussion of this contact see "Stratigraphy" section of text)

Tft **Fort Union Formation (Paleocene), Tongue River Member**—Grayish sandstone and siltstone, gray mudstone, dusky-red-brown carbonaceous shale, extensive and local coal beds, and thin lenses of limestone. Exposed thickness about 700 ft

—*S*— **Coal bed**—Approximately located. Drawn on base of coal bed or coal zone or on base of clinker. Wasatch Formation coal beds (descending order): *U1*, Ulm 1 (Walters); *U2*, Ulm 2 (Healy); *AS*, Arkansas; *T*, Truman; *A*, Arvada. Fort Union Formation coal beds (descending order): *R*, Roland (of Baker, 1929); *S*, Smith; *AN*, Anderson; *C*, Canyon. *L* denotes a local, unnamed coal bed. *L* does not imply that all beds labeled *L* correlate to each other. Local beds are depicted on this map only in places where they were used for stratigraphic control in the interval between principal coal beds

—*S*— **Coal bed not shown where buried by alluvial deposits**

—*S*— **Approximate extent of coal bed because of apparent pinchout or splitting into minor coal beds**

—*S*— **Isolated coal bed or clinker correlated with same coal bed nearby**

Area of clinker—Rocks baked and fused by the burning of underlying coal beds. Shown only in places of major areal extent. Dashed line indicates approximate limit of clinker

Fault—U, upthrown side; D, downthrown side. Dashed where inferred

INTRODUCTION

The study area is part of the Powder River Basin, a large, northerly trending structural depression between the Black Hills on the east and the Bighorn Mountains on the west, within the Northern Great Plains physiographic province (see fig. 1). The Powder River Basin is an asymmetric syncline with a long, gently dipping eastern flank and a steeply dipping western flank. The study area occupies the approximate geographic center of the basin; however, because of the basin's asymmetry, the area is on the long, gently westward-dipping eastern flank of the structure.

Strata typically dip less than 1° in a westerly direction. However, several small-scale structures cause local increases in dip and changes in dip direction. Near some faults, dip increases to as much as 50° for short distances. Intervals between the strata are relatively consistent over large areas but can change quickly over small distances.

Most of the study area is within Sheridan County, Wyo.; however, the extreme northern edge of the map includes parts of Big Horn and Powder River Counties, Mont.; the extreme eastern edge of the map includes part of Campbell County, Wyo.

The study area includes parts of the Spotted Horse, Powder River, Sheridan, and Moorhead coalfields. Coal in the study area is either subbituminous or lignite.

This map is a product of both field mapping and photogrammetric mapping techniques.

PREVIOUS INVESTIGATIONS

Approximately half of the study area (Tps. 56–58 N., and Rs. 76–78 W.) was mapped by Olive (1957) as part of the northern part of the Spotted Horse coal field. The geology was published at a scale of 1:63,360 on a planimetric basemap. A small part of the study area within T. 55 N., Rs. 76–78 W., was included as part of Stone and Lupton's (1910) report on the Powder River coal field. That report contained a map showing coal beds at approximately 1:250,000 scale on a planimetric base. Some preliminary coal bed mapping west of R. 78 W. was depicted at approximately 1:250,000 scale on a planimetric basemap in Taff's (1909) report on the Sheridan coal field. Bryson and Bass (1973) mapped the Moorhead coal field on a planimetric base at 1:63,360 scale and included the small part of the study area that is within Montana. Preliminary coal-bed mapping of certain areas was done in 1979 and 1980 at 1:24,000 scale by Bion H. Kent of the U.S. Geological Survey and has been incorporated into this map. Hinrichs (1984) mapped the surficial geology of the Sheridan 30′ × 60′ quadrangle, which includes the study area.

COAL BEDS

[See fig. 2 for position of coal beds]

Canyon (description modified from Olive, 1957)—The Canyon coal bed is thinnest in the northeastern corner of the study area (T. 58 N.). There the Canyon consists of about 6–9 ft of coal containing a 1- to 3-ft-thick parting. Elsewhere, the Canyon contains as much as 23 ft of coal and the same parting. The Canyon bed has burned along much of its outcrop, producing large areas of clinker.

Anderson (description modified from Olive, 1957)—The Anderson bed is thickest in the northeast corner of the study area where more than 25 ft of solid coal are exposed. Elsewhere, coal thickness is about 4–19 ft, either in a single bench or split by typically one parting 1–5 ft thick. In many areas, the Anderson bed has burned and has produced extensive clinker.

Smith (description modified from Olive, 1957)—West of Clear Creek, the Smith bed is typically a solid bench of coal about 3–7.5 ft thick. Between Clear Creek and the Powder River, the total coal thickness is as much as 11 ft, broken by a parting 8–30 ft thick. East of the Powder River, the Smith coal bed occurs as a solid bench about 2–6 ft thick or is as much as 13 ft of coal split by a parting typically 6 ft thick.

Roland (of Baker, 1929)—The Roland bed is about 1–12 ft thick. It is thickest in the northwest part of the study area (Roundup Draw quadrangle) and thinnest in the Clear Creek and Powder River areas. Typically, the Roland bed forms a single bench about 5–9 ft thick. However, in the area between Clear Creek and the Powder River, the Roland coal bed consists of a zone of 3–5 thinner coal beds separated by partings as much as 30 ft thick.

Arvada—The Arvada coal bed is about 1–9 ft thick. It is thinnest in the northwest part of the study area (Roundup Draw quadrangle) and thickest in the Clear Creek and Powder River areas. Typically, the Arvada bed forms a solid bench of coal 5–7 ft thick; in some places, there is one parting that is less than 0.5 ft thick.

Felix—The Felix coal bed, a major coal bed to the south and southeast of the study area, essentially pinches out within 3 or 4 mi of the southern boundary of the study area. We did not correlate local coal beds within the study area to recognized Felix outcrops outside the study area because of the distance involved and the isolated occurrences of the local coal beds. In that part of the study area that falls within the Spotted Horse coalfield, Olive (1957, p. 34 and 35) recognized only two isolated occurrences of a "Felix (?) bed ' ' " tentatively correlated with the Felix bed of the Powder River field." The two occurrences (T. 57 N., R. 78 W., secs. 28–30 and T. 56 N., R. 78 W., sec. 31) of these local coal beds are not shown on this map. The local coal beds directly south of the fault in T. 9 S., R. 44 E., secs. 31 and 32 were tentatively identified as Felix by Bryson and Bass (1973, p. 53).

On the basis of measurements south of the map area, the stratigraphic interval in which the Felix coal bed occurs is approximately 280 ft above the Arvada coal bed and 350 ft below the Truman coal bed. In the part of the Spotted Horse coalfield east and southeast of the study area, the Felix coal bed has an average thickness of about 15 ft and, at one locality, is over 28 ft thick (Olive, 1957, p. 30).

Truman—The map shows the most northwestward extent of outcrops of the Truman bed. The Truman bed was traced from the area south and southeast of the study area, where it originates (Kent and Berlage, 1980) as an upper split of the Ulm 2 bed (as used by Olive, 1957). In the study area, the Truman bed is about 4–9 ft thick and is broken by 3–4 partings, each a foot or less in thickness.

Arkansas—The Arkansas bed crops out more extensively west of the study area. Directly west of the Shuler Draw quadrangle, in the SR Springs 7 1/2-minute quadrangle, the total thickness of coal in the Arkansas bed ranges from about 4 to greater than 8 ft, typically with at least one parting (Culbertson and Klett, 1975).

Ulm 2 (Healy)—The map shows the easternmost extent of the Ulm 2 bed. The Ulm 2 thickens to the west and southwest; it is equivalent to the Healy bed as used by Mapel (1959) in the Buffalo-Lake De Smet area southwest of the study area. In the study area, the bed has burned in many places. Maximum coal thickness measured was about 6 ft, broken by a 0.6-ft parting. Minimum coal thickness is less than 2 ft. The Ulm 2 in the study area is stratigraphically higher than and not equivalent to the Ulm 2 as used by Olive (1957).

Ulm 1 (Walters)—The map shows the easternmost extent of the Ulm 1 bed, a coal bed that crops out more extensively west and southwest of the study area. The Ulm 1 bed is equivalent to the Walters bed as used by Mapel (1959) in the Buffalo-Lake De Smet area southwest of the study area. In the study area, the Ulm 1 is largely burned, forming clinker that caps ridges and divides. Southwest of the Shuler Draw quadrangle, in the Ulm 7 1/2-minute quadrangle, the Ulm 1 is a thick coal bed, typically 11–27 ft thick, broken in some localities by several thin partings (Mapel and Dean, 1976).

STRATIGRAPHY

The coal beds belong to the Tongue River Member of the Fort Union Formation of Paleocene age and the overlying Wasatch Formation of Paleocene and Eocene age (see fig. 2). In the study area, the contact between the two formations is conformable.

Olive (1957) characterized the predominant color of the Wasatch Formation as moderate yellowish brown and the prevailing color of the Tongue River Member as yellowish gray. Both units also have widespread deposits of red-orange clinker—rocks baked and fused by the burning of underlying coal beds. Because of the similarity in color and lithology, the contact between the two formations is not obvious. Indeed, the contact between the Fort Union and Wasatch Formations is somewhat controversial. Culbertson and others (1979, p. 3) discuss the contact in the general area of the Montana-Wyoming border within the Powder River Basin

> The contact between the Fort Union and Wasatch Formations was defined by Thom and Dobbin (1924) to be at the Roland bed as identified by Taff (1909) near Sheridan, Wyoming. This bed, however, pinches out a short distance from where it was named. In Montana, Baker (1929) placed the contact at a stratigraphically higher bed, which he and Bass (1924) thought to be the Roland. This bed is now referred to as the Roland bed) of Baker (1929). Because no other contact is obvious in the gradational and changing lithologies of the Fort Union and Wasatch Formations near the Montana-Wyoming State line, most subsequent investigators in this area have used the persistent Roland coal bed of Baker (1929) as the contact between the formations " ' "

Olive (1957, p. 13) described the formational contact that was chosen within the Spotted Horse coalfield:

> Inasmuch as the Roland bed is not continuous in the Spotted Horse field and its top cannot be used as a convenient mappable horizon; the top of the [Tongue River] member was mapped on the top of a persistent, highly fossiliferous [coquinoid] unit of shale, sandstone, and limestone which occurs 5–65 feet above the Roland bed. The fossiliferous unit is in the upper part of a transition zone, 150 to 200 feet thick, within which the light-colored beds of the Tongue River member grade into lithologically similar, but darker strata of the Wasatch formation. At most places the fossiliferous unit is easily recognized because of numerous pelecypod and gastropod shells that litter its outcrops; the most conspicuous components are beds of coquinal limestone that weather into grayish-white ledge-forming blocks.

Kent and Berlage (1980) also placed the Wasatch-Fort Union contact at the top of these same beds of fresh-water mollusk fossils in the area directly east of the study area.

We also mapped the Wasatch-Fort Union contact at the top of the coquinoid beds, because they are a persistent, obvious feature and are not easily confused with other strata in the section.

In many places, the Arvada coal bed directly overlies the coquinoid beds, and, in most places, the Arvada bed is within 20 ft of the top of the coquinoid beds. At the scale of this map, both units could not be shown; thus, the base of the Arvada bed serves as the approximate contact between the Fort Union and Wasatch Formations.

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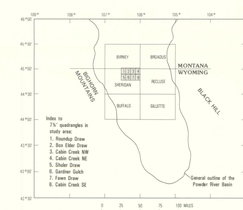

Figure 1.—Index map showing the study area (stippled) and selected 30′ × 60′ and 7½′ quadrangles.

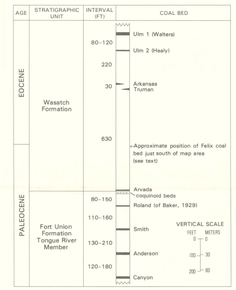

Figure 2.—Generalized stratigraphic section showing relationship of named coal beds. Figure drawn on the basis of average interval between beds. Interval range (in feet) from base of one coal bed to base of overlying coal bed is shown on left side of column. See text for description of coal beds.

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