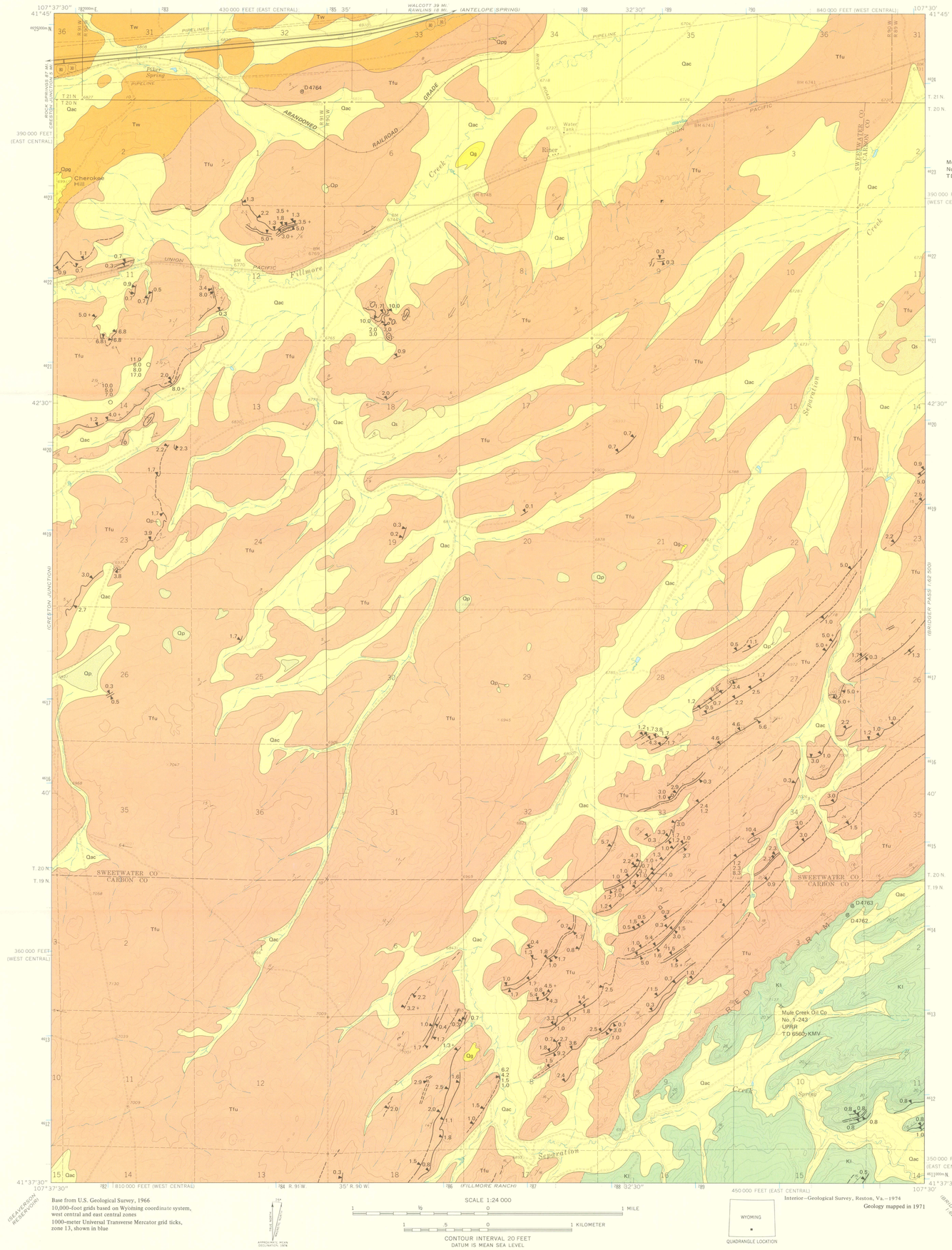
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

GENERALIZED COLUMNAR SECTION

SYSTEM	SERIES	STRATIGRAPHIC UNIT	LITHOLOGY	DESCRIPTION
QUATERNARY	Holocene and Pleistocene	Surficial deposits		**Qac** ALLUVIUM AND COLLUVIUM UNDIVIDED – Mainly unconsolidated poorly sorted argillaceous silt but locally reflects lithologies of adjacent units
				Qs WINDBLOWN SAND – Unconsolidated, well-sorted, light-brown, fine-grained. Generally associated with friable sandstone lenses in middle part of Fort Union Formation
				Qp PLAYA LAKE DEPOSITS – Light-gray-brown compact expandable clay, the surface of which is seasonally "whitened" by alkali salts. Quartz or ganister ventifacts 1–2 inches in diameter litter surface of playa but not adjacent colluvial areas
	Pleistocene	Pediment gravel		**Qg** GRAVEL – Unconsolidated, poorly sorted; composed of subrounded quartzite, granite, and dark chert pebbles similar to those of Qpg from which they are probably derived. In part as terrace remnants 55–85 feet above Separation Creek
TERTIARY	Eocene	Wasatch Formation		
		Disconformity		
			D 4764	**Qpg** GRAVEL – Unconsolidated, poorly sorted, reddish-brown, tuffaceous, sandy; composed of 0.5- to 1.0-inch subrounded polished pebbles of granite, quartzite, dark chert, and jasper. Caps Cherokee Hill and terrace remnants of similar altitude (6,980–7,150 ft) to the west and north. Apparent source is hill in sec. 26, T. 20 N., R. 92 W., 6.5 miles to southwest. Approximately 20 feet thick
				Tw ARKOSE AND SHALE, INTERTONGUING – Arkose is in coarse-grained to granulitic white to yellowish-white beds and in brown ferruginous granulitic lenses. Shale is dark gray, gray green, or black; locally contains numerous plant fragments. Base of formation placed at lowest occurrence of ferruginous lenses or base of massive white arkose bed. In part lithologically equivalent to the Battle Spring Formation. About 200 feet present
				SILTSTONE, SANDSTONE, SHALE, AND THICK COAL BEDS – Siltstone is gray brown and argillaceous; sandstone is brown and micaceous. Coal, lignitic to subbituminous C rank, in persistent seams as much as 25 feet thick. Most outcropping beds have a low sedimentary dip component to the northwest, making thickness determination difficult. Steeply dipping fore-set beds and current-bedded tubular sandstone bodies are dominant in part of section. Plant fossils locally abundant. Approximately 600 feet thick
				SILTSTONE AND SHALE – Poorly exposed interval apparently consisting mainly of arenaceous siltstone and carbonaceous shale; includes dark-gray, white-weathering bentonitic carbonaceous shale. Estimated thickness 700–800 feet
	Paleocene	Fort Union Formation		**Tfu** SILTSTONE, SANDSTONE, SHALE, AND COAL – Complexly interbedded commonly lenticular or discontinuous sequence of beds. Sandstone, light-colored, argillaceous, fine- to medium-grained; commonly contains ferruginous concretions. Siltstone, light-brown to orange, commonly ferruginous, argillaceous. Shale, light- to dark-gray, locally maroon; locally contains numerous plant fossils. Coal beds are generally thin and discontinuous with lenticular thickenings to as much as 9 feet. Plant, Uniolid pelecypod, viviparid gastropod, turtle, and crocodilian fossils locally numerous. Approximately 1,500 feet thick
				SANDSTONE – Light-gray (weathers pink, red, or brown), thick-bedded to massive, medium- or coarse-grained, generally crossbedded; contains well-rounded 0.5-inch chert pebbles. Chert pebbles are common in stringers in basal units. Dark-gray shales separate the generally disconformable sandstones locally. Approximately 500–600 feet thick
		Disconformity		
			D 4763	
			D 4762	
CRETACEOUS	Upper	Lance Formation		**Kl** SANDSTONE AND SHALE – Interbedded light-gray sandstone and medium- to dark-gray and gray-green shale. Plant fragments are locally numerous in the shale. Upper 100 feet contains pebble-bearing white sandstone lithologically similar to the basal beds of the Fort Union Formation from which it can be distinguished by its less massive nature, by the presence of large bone fragments (rare), and by an overlying unit of 20 feet of greenish-gray shale. Approximately 3,800 feet thick
			EXPOSED	
			DRILLED	
		Lewis Shale		SHALE – Light- to medium-gray in part calcareous or silty. Marine molluscs present. Approximately 2,000 feet thick
		Mesaverde Formation		SANDSTONE, SHALE, AND COAL – Alternating gray to brown sandstone, dark shale, and coal



Base from U.S. Geological Survey, 1966
10,000-foot grids based on Wyoming coordinate system, west central and east central zones
1000-meter Universal Transverse Mercator grid ticks, zone 13, shown in blue

APPROXIMATE MEAN DECLINATION, 1974

SCALE 1:24 000
1 0 1 MILE
1 .5 0 1 KILOMETER
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

WYOMING
QUADRANGLE LOCATION

Interior—Geological Survey, Reston, Va.—1974
Geology mapped in 1971

GEOLOGIC MAP AND COAL RESOURCES OF THE RINER QUADRANGLE, CARBON AND SWEETWATER COUNTIES, WYOMING

By
Robert B. Sanders

1974

COAL INVESTIGATIONS
MAP C-68

LINE SYMBOLS

- 1.2 — COAL BED – Dashed where approximately located; short dashed where inferred or indefinite. Outcrop thickness, in feet, measured at triangle; where more than one bed, thicknesses are shown in stratigraphic order with youngest bed at top.
- BURNED COAL BED – Approximately located
- CONTACT – Approximately located; dashed where inferred or indefinite
- ATTITUDE OF BEDS – Broken where approximate; short dashed where based on subsurface data
- COMPONENT OF DIP
- PALEOCURRENT DIRECTION – Interpreted from sedimentary structures
- PROSPECT PIT
- VERTICAL SHAFT, ABANDONED
- Mule Creek Oil Co No. 1-243 UPRR T D 6560, KMV — OIL TEST HOLE, ABANDONED – Showing designation, total depth in feet, and deepest formation penetrated
- @ D4764 — FOSSIL LOCALITY, POLLEN AND SPORES – U.S. Geological Survey collection number. (Denver catalogue)
- 10.0 / 5.0 / 7.0 — CORE HOLE – Showing thickness of coal beds with youngest bed at top

FOSSIL COLLECTION

[Palynomorphs identified by R. H. Tschudy]

Number	Location	Age	Fossils
D4762	Sec. 3, T. 19 N., R. 90 W., at 7,226 feet	Late Cretaceous	*Proteacidites*, 2 sp.; *Classopollis*; *Gunnera*?; *Liliacidites complexus*; *Ephedra*; *Gleicheniidites*; *Wodehouseia*; *Abietineaepollenites*; *Aquilapollenites quadrilobus*; *A. pyriformis*.
D4763	Sec. 3, T. 19 N., R. 90 W., at 7,296 feet	- - -do. - - - - - - -	*Proteacidites*, 2 sp.; *Liliacidites complexus*; *Wodehouseia*; *Balmeisporites*; *Schizosporis reticulatus*; *Erdtmanipollis*, small sp.; *Aquilapollenites quadrilobus*; *A. pyriformis*; *A. delicatus* var. *collaris*; *A. delicatus* var. *delicatus*; *A. reticulatus*; *A. bertillonites*; *A. attenuatus*; *Osmundacidites*.
D4764	Sec. 32, T. 21 N., R. 90 W.	Late Paleocene	*Abietineaepollenites*; *Pistillipollenites*; *Carya*, large and small sp.; *Polyporopollenites*, 4 and 5 pored sp.; *Alnus*, 5 pored sp.; *Symplocospollenites*; *Erdtmanipollis*, large sp.; *Syncolporites minimus*; *Ulmipollenites*.

GENERAL GEOLOGY

The Riner quadrangle was mapped as part of the U.S. Geological Survey program of classifying and evaluating mineral lands in the public domain. The use of subsurface data acquired by Pacific Power and Light Company is gratefully acknowledged.

The quadrangle lies near the Continental Divide in the Red Desert, south-central Wyoming. In the main, the surface of the area is gently rolling hills with small areas of badlands and dunes. The most pronounced topographic features are the Red Rim, a 200-foot hogback underlain by the basal sandstones of the Fort Union Formation, and Cherokee Hill, the remnant of a terrace capped by Pleistocene gravels. Surface drainage of the area is poor, and all streams are intermittent.

The area lies on the south flank of the Wamsutter arch—a broad low structure separating the Great Divide and Washakie Basins—and west of a line of uplifts marked by the Rawlins uplift, Hatfield dome, Miller Hill-Lake Valley anticline, and Espy anticline. These uplifts comprise the dominant element from which the bedrock formations of the Riner quadrangle dip homoclinally northwest. Dips decrease progressively from 24° at Red Rim to 2°–3° near Cherokee Hill. In the upper part of the Fort Union Formation most outcrops are sandstone beds which dip more steeply than underlying shales and coals owing to an original sedimentary dip component. This is best illustrated in sec. 14, T. 20 N., R. 91 W., where both surface and subsurface data are given.

ECONOMIC GEOLOGY

Subbituminous coal and lignite are found in the upper and lower parts of the Fort Union Formation, in the Lance Formation, and at greater depth in the Mesaverde Formation.

The coal beds in the upper 600 feet of the Fort Union are thick and persistent, although not appearing to be so on the map or in the field because of their low dip and the slump of overlying beds. Exposures of coal as much as 8 feet thick are found along the trace of the beds, but core hole data supplied by Pacific Power and Light Co. indicate subcrop thicknesses of 17 feet and 22–28 feet for two of the four(?) major coal beds. Each of the four(?) major coal beds are believed to be at least 10 feet thick. These coal beds are believed to persist at least 14 miles along strike to the southwest, and they may continue northeastward beneath alluvium in Fillmore Creek. Sixteen analyses from two of these seams are summarized below (data courtesy of Pacific Power and Light Co.):

As-received basis	Range (percent)	Mean (percent)
Moisture	13.52–19.63	16.02
Ash	9.60–35.28	21.84
Volatiles	29.05–49.25	35.80
Fixed carbon	21.59–32.89	26.44
Sulfur	1.03– 5.74	3.23
Heat value	6,098–9,122 Btu	7,642 Btu

Although these values range across the lignite-subbituminous C boundary (ASTM 1937 classification), selective mining of the higher rank coal is probably not possible, and the coal beds are considered lignite. Inferred resources from these coal beds are computed at 520 million tons, of which 175 million tons lie beneath less than 200 feet of overburden; the remainder is buried to an estimated maximum depth of 800 feet. Indicated resources to the 200-foot overburden limit are 27 million tons.

The coal beds in the lower part of the Fort Union Formation are thin, discontinuous, and generally lenticular. Few beds attain a thickness of more than 5 feet, and of those that do, persistence at this thickness can generally be measured in hundreds of feet. The thickest coal bed observed, which is approximately 10 feet thick, can be traced at this thickness for only 700 feet. Because of discontinuity, resource evaluation is based on the projection of coal beds downdip through an arc having a radius equal to half the outcrop length of the bed. On this basis, indicated resources of 210 million tons are calculated for beds more than 14 inches thick, of which 48 million tons is from beds more than 28 inches thick.

The only published analytical data for coal in the lower part of the Fort Union are based on outcrop samples from 25 miles south along strike (Ball, 1909, p. 251). The value of data projected so far is questionable. Four analyses (Nos. 5298, 5342, 5448, and 5447) are summarized below:

As-received basis	Range (percent)	Mean (percent)
Moisture	20.68–26.02	23.93
Ash	6.05–9.90	7.89
Volatiles	28.49–46.74	35.32
Fixed carbon	20.71–39.41	32.85
Sulfur	0.39–1.11	0.87
Heat value	8,098–8,717 Btu	8,498 Btu

This coal is of marginal lignite-subbituminous C rank.

The only coal observed in the Lance Formation is in beds less than 12 inches thick. The historically important Lance coal beds near Rawlins are below the oldest strata exposed in the Riner quadrangle. The subbituminous coal of the Mesaverde Formation is at depths of more than 2,900 feet in the quadrangle.

Water wells in the area yield 5–40 gallons per minute from the Fort Union Formation, according to Welder and McGreevy (1966). Dissolved solids, primarily as bicarbonate and sulfate, are cited as less than 1,000 parts per million.

No oil or gas has been found in the quadrangle. The single oil test in the area, Mule Creek Oil Company 1–243 UPRR, showed traces of oil in the upper part of the Mesaverde Formation. These traces may have been derived from the drilling mud, however. Because of the thick sedimentary sequence, the area may be of interest for future oil and gas exploration.

REFERENCES CITED

Ball, M. W., 1909, The western part of the Little Snake River coal field, Wyoming: U.S. Geol. Survey Bull. 341, p. 243–255.

Welder, G. E., and McGreevy, L. J., 1966, Ground-water reconnaissance of the Great Divide and Washakie Basins and some adjacent areas, southwestern Wyoming: U.S. Geol. Survey Hydrol. Inv. Atlas HA-219.

For sale by U. S. Geological Survey
Denver, Colo. 80225 and Reston, Va. 22092, price $1.00