

ECONOMIC GEOLOGY

The Lay quadrangle was mapped as a part of the U.S. Geological Survey's program of classifying and evaluating mineral lands in the public domain. The primary resources of economic interest within the quadrangle include subbituminous and bituminous coal and uranium. Oil and gas may occur at depth. Sand and gravel are found within the quadrangle.

Coal

Coal beds greater than 4 ft (1.2 m) are found locally within two formations in the Lay quadrangle: the Williams Fork and Fort Union Formations. Locally, subeconomic, thin coal beds were found in the Iles and Lance Formations, but were not mapped because of their lenticularity.

The coal beds within the Williams Fork Formation are less lenticular and of better quality than those in the Fort Union Formation and range in thickness from less than 1 ft (0.3 m) to 20 ft (6.1 m). Fenneman and Gale (1906) described several coal beds in the Williams Fork (sec. 31, T. 7 N., R. 93 W.). An entry (Sweeney tunnel) on the lowest stratigraphic coal seam exposed 7 ft 10 in. (2.3 m) of coal, separated into two nearly equal parts by a 1-ft (0.3-m) stringer of impure coal, is located in the Lay SE quadrangle about 1,300 ft (396 m) northeast of the Wallihan mine (SEKSM, sec. 31, T. 7 N., R. 93 W.). About 100 ft (30.5 m) above the Sweeney coal bed is the Peacock coal bed, 12-13 ft (3.7-4.0 m) thick (measured coal sections 26, 27, and 28). One hundred ft higher, in the Wallihan mine, a 20-ft bed is exposed.

Within the Fort Union Formation, coal beds occur locally at several stratigraphic intervals from the bottom to the top of the formation and range in thickness from less than 1 ft to 27 ft (0.3 m to 8.2 m). Locally, they may contain shaly partings and may pinch out or grade laterally into carbonaceous shale. The Fort Union coal beds generally thin to the west and most pinch out before reaching the western border of the quadrangle. In general, the coal beds cannot be traced for more than a half mile (0.8 km) along the outcrop. The Emerson coal bed (measured coal sections 17 and 23) attains a maximum thickness of 27 ft (8.2 m) in U.S. Geological Survey drill-hole Lay 1. The Emerson bed was named for the thick coal bed found in Lay SE quadrangle (Brownfield, 1979). A seam, called Blevins coal bed, has a thickness of 13.5 ft (4.1 m) at the Blevins mine and has a maximum thickness of 15 ft (4.6 m) in Lay quadrangle (measured coal sections 7 and 11). The Blevins bed is named for the mine (OWS, sec. 28, T. 8 N., R. 93 W.) in the Lay SE quadrangle (Brownfield, 1979).

Coals within Lay quadrangle vary slightly in quality between the two coal-bearing formations but they are generally considered to be subbituminous and bituminous in rank. Two analyses are available of Williams Fork coals from south of Lay Colo.: average heating value, 11,355 Btu/lb on an air-dried basis; ash content, 6.43 percent; and sulfur content, 1.09 percent. An analysis from Blevins mine (Fort Union Formation): heating value, 10,290 Btu/lb on an air-dried basis; ash content, 7.59 percent; and sulfur content, 1.21 percent.

At the present time no coal mining is being done within the Lay quadrangle. Several coal prospects and abandoned mines (sec. 31, T. 7 N., R. 93 W.) in Williams Fork Formation were described by Fenneman and Gale (1906, p. 63). In the Wallihan mine, a 20-ft-thick (6.2 m) coal bed mined by the Wisconsin Fuel and Mining Company which shipped the coal to Hayden, Colo., 40 mi (64.4 m) to the east, for use by blacksmiths. In Lay SE quadrangle (Brownfield, 1979), 2 mi (3.2 km) northeast of the Fort Union Formation outcrop, the old Blevins mine (sec. 28, T. 8 N., R. 93 W.) supplied coal for a placer dredge and steam pumping plant at Great Divide, 13.5 mi (22 km) north of the mine.

Uranium

Several hundred thousand tons of uranium ore, averaging 0.2 percent U₃O₈, were mined in the Lay quadrangle from the Browns Park Formation by the Union Carbide Corp. during the 1950's. Several open pit mines (Sage, Gertrude, and Marge mines) were developed. At the present time Union Carbide Corp. is mining low-grade uranium ore by a leaching process. The lenticular ore bodies are located near the axis of the Lay syncline (Bergin, 1959), possibly a depositional rather than a structural feature. The ore bodies parallel the bedding and range in thickness from 1 to 25 ft (0.3 to 8 m). Faults in the Browns Park Formation in the vicinity of the uranium mines have been shown by shallow refraction studies conducted during the mid-1950's by the U.S. Geological Survey (D. L. Healey, oral commun., 1977) to be of greater extent than previously thought. The uranium minerals present in the oxidation zone are autunite and uranophane; in the primary zone they are uraninite and coffinite. Ground-water movement toward the axis of the basin may have transported the uranium minerals and formed the roll-type uranium deposits found in the Union Carbide mines.

Oil and gas

A few unsuccessful oil-and-gas tests have been drilled within the quadrangle. Primary exploration targets are sandstones within the Lance Formation, Williams Fork Formation of Mesaverde Group, and the upper Mancos shale.

Nonmetallic minerals

The Quaternary deposits generally supply adequate sand and gravel for road building; particularly valuable are the alluvial gravels found along Lay Creek. The basal conglomerate of the Browns Park Formation is also a valuable source of sand and gravel. Baked mudstone found above burned coal beds has been used for road metal in the region. Within the Fort Union Formation there are exposures of baked rock which might be used for road metal (secs. 1, 2, and 3, T. 7 N., R. 94 W.).

SELECTED REFERENCES

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Miller, S. C., 1976, Lithologic and geophysical logs of seven holes drilled in 1975 in the Yampa and Danforth Hills coal fields, northwestern Colorado: U.S. Geological Survey Open-File Report 76-383, 180 p.
Sears, J. D., 1925, Geology and oil and gas prospects of part of Moffat County, Colorado, and southern Sweetwater County, Wyoming: U.S. Geological Survey Bulletin 751-G, p. 269-319.

CONVERSION TABLE		
To convert	Multiply by	To obtain
ENGLISH UNITS		METRIC UNITS
Feet	0.3048	Meters
Miles	1.609	Kilometers

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

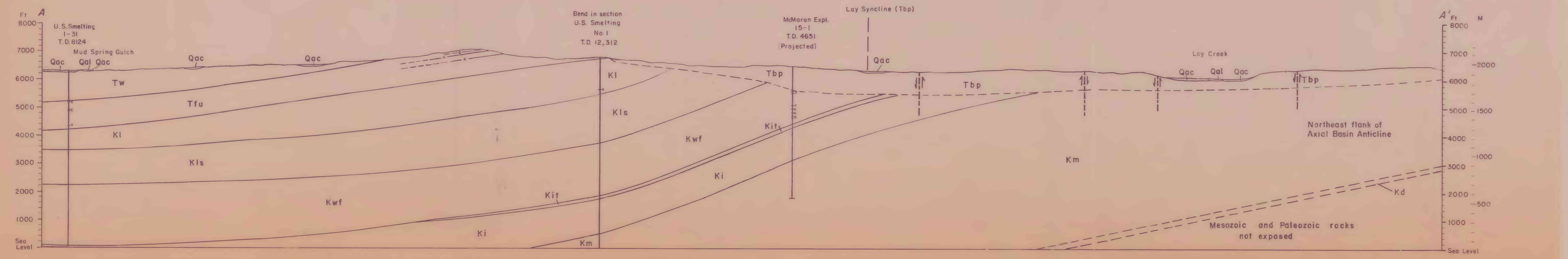


CORRELATION OF MAP UNITS

Map Unit Code	Geological Period	Time Period
Qal	Holocene	QUATERNARY
Qoc		
Tbp	Miocene	TERTIARY
Tw		
Tfu	Paleocene	
Kl	Upper Cretaceous	CRETACEOUS
Kls		
Kwf		
Ki		
Kit		
Km	Lower Cretaceous	
Kd		

DESCRIPTION OF MAP UNITS

- SURFICIAL DEPOSITS (HOLOCENE)**
- Qal** Alluvium—Clay, silt, sand, and fine to cobble gravel along present main stream channels
 - Qoc** Alluvium, colluvium, and slope wash—Unconsolidated clay, silt, sand, and angular talus deposits
- BROWNS PARK FORMATION (MIOCENE)**—Light-gray to chalky-white, fine- to medium-grained tuffaceous quartz sandstone, generally crossbedded; some gray cherty coarse-grained flat beds near base. Excellent crossbedded facies in upper part can be seen in open pit uranium mines in western part of quadrangle. Persistent basal conglomeratic sandstones consist of subrounded to subangular pebbles of mafic and felsic igneous and metamorphic rocks, red and white quartzite, varicolored chert, and quartz. 0-850 ft (0.259 m) thick
- WASATCH FORMATION (Eocene)**—Variegated shale or claystone, siltstone, and conglomeratic sandy mudstone; with gray and yellowish-brown sandstone, conglomeratic arkosic sandstone and conglomerate; few beds of carbonaceous shale. 1,000-1,500 ft (305-457 m) thick
- FORT UNION FORMATION (PALEOCENE)**—Gray shale, brown carbonaceous shale, coal, gray massive crossbedded sandstone, and yellow-brown lenticular crossbedded sandstone. Basal conglomeratic sandstone, 0-40 ft (0-12.2 m) thick, consists of subrounded to rounded pebbles of felsic igneous and metamorphic rocks, red, white, and dark-gray quartzite, multicolored chert, quartz, limestone, and petrified wood in a matrix of dark-yellow-brown quartzose sandstone. Conglomerate wedges out to west. 800-1,100 ft (244-335 m) thick
- LANCE FORMATION (UPPER CRETACEOUS)**—Light-gray and yellowish-brown massive resistant sandstone separated by soft beds of muddy sandstone, siltstone, gray shale, carbonaceous shale, and thin coals; 600-1,400 ft (183-427 m) thick, 1,100 ft (335 m) exposed in quadrangle
- LEWIS SHALE (UPPER CRETACEOUS)**—Dark-gray calcareous marine shale with thin calcareous sandstone. Shale thins to west. Shown in section only. 1,200-1,700 ft (366-518 m) thick
- WILLIAMS FORK FORMATION (UPPER CRETACEOUS)**—Brown, gray, and white thick massive resistant lenticular sandstone; gray and brown claystone, siltstone, mudstone, brown carbonaceous shale, and coal. About 2,000 ft (610 m) thick
- ILES FORMATION (UPPER CRETACEOUS)**—Gray, white, and brown massive sandstone; some gray shale, siltstone, carbonaceous shale, and thin coal beds. 1,300-1,400 ft (396-427 m) thick
- Trout Creek Sandstone Member**—White massive sandstone at top of Iles Formation. 0-100 ft (0-30 m) thick
- MANCOS SHALE (UPPER AND LOWER CRETACEOUS)**—Dark-gray marine shale and lenticular sandstone in upper and lower parts. Includes Frontier Sandstone Member (Upper Cretaceous) and Mowry Shale Member (Lower Cretaceous). About 5,500 ft (1,677 m) thick. Shown in cross section only
- DAKOTA SANDSTONE (LOWER CRETACEOUS)**—Yellowish-brown medium- to coarse-grained, carbonaceous; in places, quartzitic and (or) conglomeratic lenticular sandstone, and variegated mudstone. Shown in section only. About 170 ft (52 m) thick



GEOLOGIC MAP AND COAL SECTIONS OF THE LAY QUADRANGLE, MOFFAT COUNTY, COLORADO
By
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1979

- COAL BED**—Dashed where approximately located; thickness, in feet, measured at triangle. Circled number refers to measured section. C, coal bed, shown in section only
- BURNED COAL BED**—Approximately located
- CONTACT**—Dashed where approximately located
- FAULT**—Dashed where approximately located; dotted where covered. U, upthrown side; D, downthrown side
- FAULT**—Interpreted from shallow seismic survey (D. L. Healey, unpublished data, oral commun., 1977). U, upthrown side; D, downthrown side
- SYNCLINE**—In Browns Park Formation only; dotted where covered
- MENOCLINE**—Dotted where concealed
- STRIKE AND DIP OF BEDS**
- STRUCTURE CONTOUR**—Approximately located. Dashed where datum eroded. Drawn on base of Fort Union Formation. Contour interval 200 ft (61 m)
- McMoran Exploration 15-1 T.D. 4651** DRY HOLE—Showing name of operator, or lease name, and total depth, in feet
- Lay 5 T.D. 739** U.S. GEOLOGICAL SURVEY DRILL HOLE—Showing hole number and total depth, in feet
- *** ABANDONED MINE—(Coal and (or) uranium)
- x** PROSPECT—(Coal and (or) uranium)