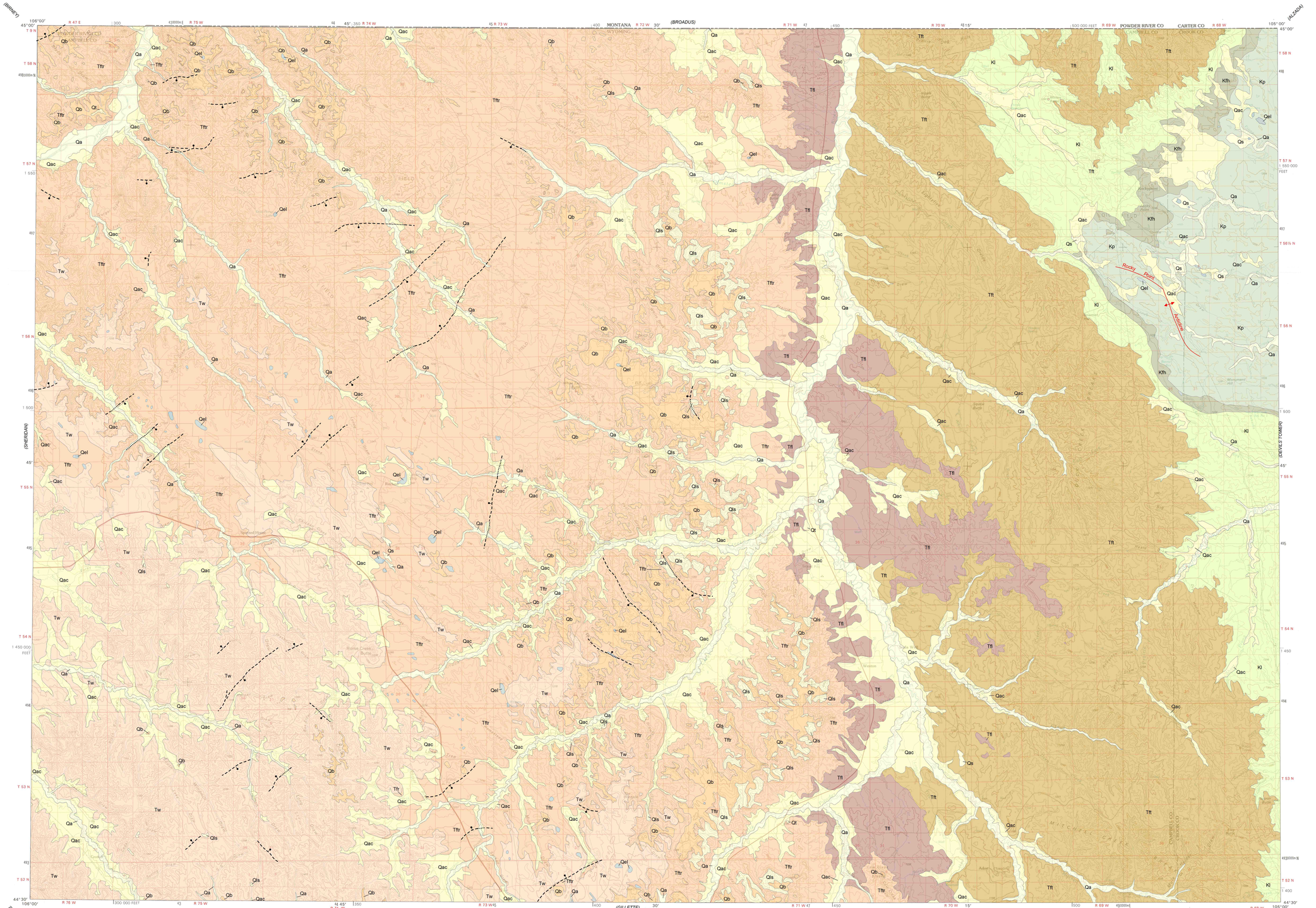
WYOMING STATE GEOLOGICAL SURVEY
Lance Cook, State Geologist
Laramie, Wyoming

Geology – Interpreting the past to provide for the future

Prepared in cooperation with the U.S. GEOLOGICAL SURVEY

MAP SERIES 60
Recluse 1:100,000 - scale Geologic Map



Projection: Universal Tranverse Mercator (UTM), zone 13
North American Datum of 1927 (NAD 27)
10,000-meter grid ticks: UTM, zone 13
50,000-foot grid ticks: Wyoming State Plane Coordinate system, East zone

0 1 2 4 6 8 10 12 14 16 18 20 KILOMETERS
0 1 2 3 4 5 6 7 8 9 10 11 12 MILES

SCALE 1:100,000
Contour Interval 20 meters

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000 Meters
0 5,000 10,000 15,000 20,000 25,000 30,000 35,000 40,000 45,000 50,000 55,000 60,000 65,000 Feet

Prepared in cooperation with the U.S. Geological Survey, National Cooperative Geologic Mapping Program, under Cooperative Agreement Number 01HQAG0109.

Digital cartography by Justin M. Mulbay, Justin T. Carreno, Robin W. Lyons, and Joseph M. Huss

GEOLOGIC MAP OF THE RECLUSE 30' x 60' QUADRANGLE, CAMPBELL AND CROOK COUNTIES, WYOMING AND SOUTHEASTERN MONTANA

Compiled and mapped by

Laura L. Hallberg, Robert M. Lyman, Cynthia S. Boyd, Richard W. Jones, and Alan J. Ver Ploeg

2002

GN MN 14° 0°24' 249 MILS 7 MILS

UTM GRID CONVERGENCE (GN)
1981 MAGNETIC DECLINATION AT CENTER OF SHEET
DIAGRAM IS APPROXIMATE

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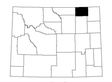
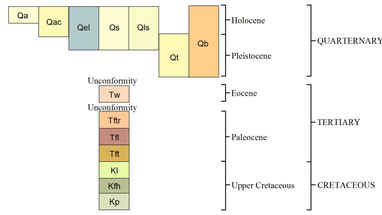


EXPLANATION

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qa **Alluvium (Holocene)**—Unconsolidated silt and sand on the floors of the major stream valleys. Interbedded with clay or gravel in some places. Gravel contains pebbles of sandstone, ironstone, and baked and fused rock. Includes stream-channel and flood plain deposits, and low-level alluvial terrace deposits generally less than 20 feet (6 m) above the present level of stream channel floors. Thickness 1.6 to 16 feet (0.5 to 5 m). Description and thickness from Reheis and Williams (1984) and Kent and Berlage (1980)

Qac **Terrace alluvium, sheetwash alluvium, and fan and pediment deposits (Holocene)**—Terrace alluvium is sand, silt, and clay; may contain buried soil horizons rich in clay and organic material. Upper 3.3 feet (1 m) commonly indurated by clay and calcium carbonate. Highest terrace 16.4 to 32.8 feet (5 to 10 m) above stream beds; thickness 4.9 to 26.3 feet (1.5 to 8 m). Description and thickness from Reheis and Williams (1984). Sheetwash alluvium is sand, silt, and clay containing minor interbeds of reworked material derived from higher slopes. Found in gently sloping valley bottoms and upland depressions. From 3.3 to 9.8 feet (1 to 3 m) thick. Description and thickness from Reheis and Williams (1984). Fan and pediment deposits consist of sheetwash alluvium at the surface grading down into alluvial deposits of sand and silt containing small lenses of angular to subangular gravel composed of baked and fused rock, sandstone, and ironstone. Thickness from 3.3 to 52.5 feet (1 to 16 m). Description and thickness from Reheis and Williams (1984)

Qel **Lake sediments (Holocene and Pleistocene?)**—Massive gray clay and silt; alkaline in some places. Deposited by sheetwash and wind into ephemeral lakes. Thickness 1.6 to 23 feet (0.5 to 7 m). Description and thickness from Reheis and Williams (1984)

Qs **Eolian deposits (Holocene and Pleistocene?)**—Windblown sand and silt in generally stabilized dunes or in irregular sheets; massive to faintly bedded. Thickness 1.6 to 23 feet (0.5 to 7 m). Description and thickness modified from Reheis and Williams (1984)

Qls **Landslide deposits (Holocene and Pleistocene?)**—Blocks of sandstone, siltstone, and baked and fused rock that have been moved, broken, and mixed with finer sediments. Characterized by hummocky terrain bounded upslope by crescentic scarps and downslope by lobate toes. Thickness 23 to 99.3 feet (7 to 33 m). Description and thickness modified from Reheis and Williams (1984)

Qt **Older terrace alluvium (Pleistocene)**—Gravel and sand containing minor silt. Units higher than 82 feet (25 m) above present Powder River contain gravel of sandstone, chert, chalcedony, fossil wood, and quartz, and well-rounded igneous and metamorphic rocks from the Bighorn Mountains. Locally cemented and crusted with iron and manganese oxides or calcium carbonate. Caps hills and ridges near Little Powder River and the Powder River. Thickness 1.6 to 19.7 feet (0.5 to 6 m). Description and thickness from Reheis and Williams (1984)

Qb **Baked and fused rock (Holocene and Pleistocene)**—Bedrock altered by natural oxidation and burning of coal beds in the Wasatch and Fort Union formations. Mostly hard, dense, red-to-orange baked shale and siltstone (porcellanite). Black, bubbly, sometimes glassy rock (buchite); resembles volcanic rocks and slag formed by melting of rocks. A 2- to 7.9-inch (5 to 30 cm)-thick layer of gray or white coal ash occurs at base of or within porcellanite zone. Thickness 9.8 to 99.3 feet (3 to 33 m). Description and thickness modified from Reheis and Williams (1984)

Tw **Wasatch Formation (Eocene)**—Yellowish-gray to pale-brown and very light-gray, friable, very fine to fine-grained, thin- to thick-bedded, locally crossbedded feldspathic sandstone, light-gray micaceous siltstone (locally calcareous), light-gray shale, dusky-red carbonaceous shale, and coal. West of R. 74 W., the contact with the underlying Fort Union Formation is placed at beds of coquinoid limestone which lie from 120 to 260 feet (36 to 78 m) above the Smith coal bed. In R. 74 W., and to the east, the contact is placed at the base of a sandstone unit from 150 to 200 feet (46 to 60 m) thick, which underlies the Felix coal bed and is unconformable on underlying rocks. Exposed thickness about 1000 feet (300 m). Description and thickness from Kent and Berlage (1980)

Fort Union Formation (Paleocene)

Tftr **Tongue River Member**—Light-gray to pale yellowish-brown, very fine to fine-grained feldspathic sandstone, light-gray siltstone and mudstone, light-gray shale, dusky-red carbonaceous shale, and thick beds of coal. North of T. 53 N., the contact with the underlying Lebo Shale Member is placed at the base of a coal bed from 300 to 400 feet (90 to 120 m) below the Canyon coal bed. In T. 53 N., and to the south, the contact is based on projected stratigraphic position of the same coal bed below the Canyon. Exposed thickness about 1200 feet (360 m). Description and thickness modified from Kent and Berlage (1980)

Tfl **Lebo Shale Member**—Light-gray fine-grained sandstone, light- and dark-gray claystone and shale, dusky-red carbonaceous shale, and thin beds of coal. South of T. 57 N., the contact with the underlying Tullock Member is placed at the base of a coal bed (or its projected stratigraphic position) overlying a unit of light yellowish-gray sandstone. Exposed thickness about 250 feet (75 m). Description and thickness modified from Kent and Berlage (1980)

Tft **Tullock Member**—Light-gray and yellowish-gray fine-grained sandstone, gray sandy or silty shale, dusky-red carbonaceous shale, and thin beds of coal. The contact with the underlying Lance Formation is placed at the base of the lowest coal bed, overlying a unit of massive sandstone. Exposed thickness about 1000 feet (300 m). Description and thickness from Kent and Berlage (1980)

Kl **Lance Formation (Upper Cretaceous)**—Yellowish-gray sandstone, gray sandy shale, carbonaceous shale, and claystone. The contact with the underlying Fox Hills Sandstone is placed at the base of the lowest bed of brown carbonaceous shale. Exposed thickness about 700 feet (210 m). Description and thickness from Kent and Berlage (1980)

Kfh **Fox Hills Sandstone (Upper Cretaceous)**—Brownish-gray sandstone, siltstone, and sandy shale. Locally, the lowermost 10 to 70 feet (3 to 21 m) of sandy shale grades downward to dark-gray sandy shale in topmost part of Pierre Shale. Exposed thickness about 200 feet (60 m). Description and thickness from Kent and Berlage (1980)

Kp **Pierre Shale (Upper Cretaceous)**—Dark brownish-gray silty or sandy shale, dark-gray and black shale locally bentonitic, light-gray bentonitic shale with thin beds of bentonite and limestone, black shale with yellowish-brown limestone concretions, and light-gray claystone with ferruginous concretions and lenses of siderite. Exposed thickness about 1100 feet (330 m). Description and thickness from Kent and Berlage (1980)

MAP SYMBOLS

	Contact	Approximately located
	Fault	Approximately located; dotted where concealed; ball and bar on downthrown side
	Anticline	Trace of axial plane and direction of plunge compiled from source mapping or determined by field dip measurements and by air photograph interpretations

REFERENCES

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