

**GEOLOGIC MAP OF THE FORSYTH 30' x 60' QUADRANGLE,
EASTERN MONTANA**

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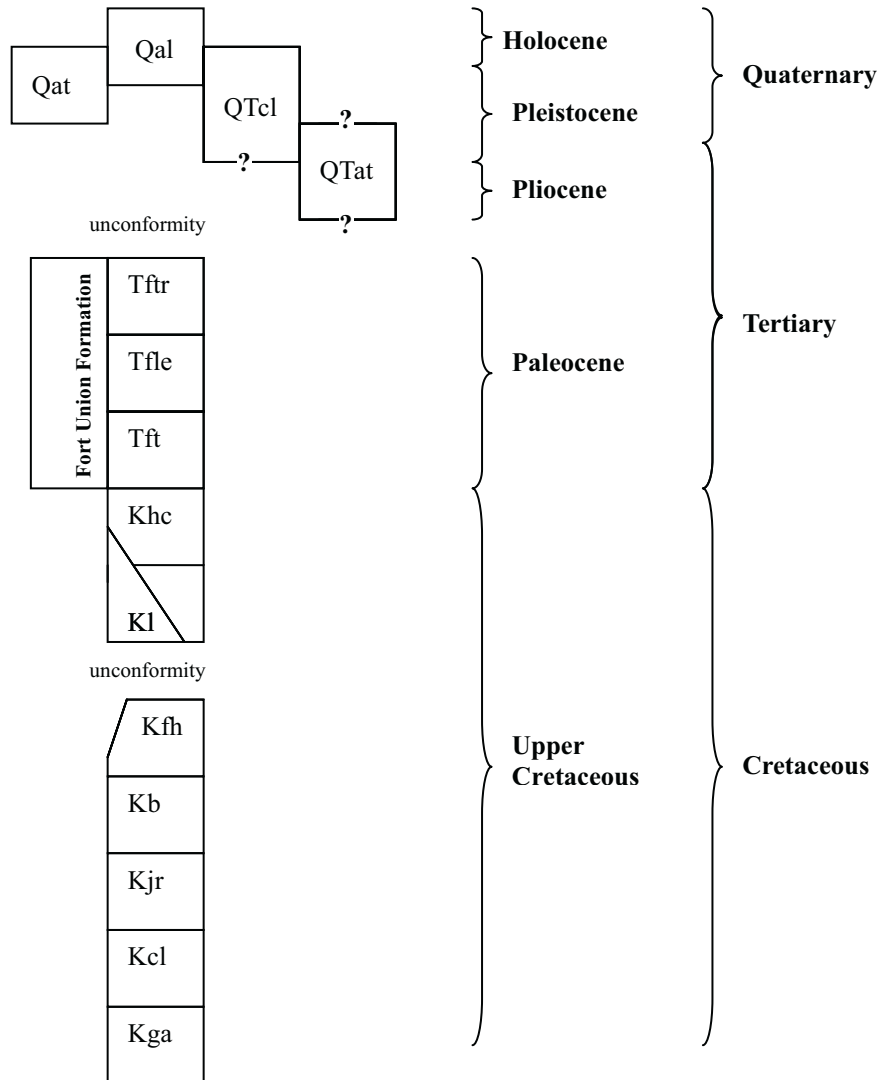
2001

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This report has had preliminary reviews for conformity with Montana Bureau of Mines and Geology's technical and editorial standards.

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CORRELATION DIAGRAM
 FORSYTH 30' x 60' QUADRANGLE



DESCRIPTION OF MAP UNITS FORSYTH 30'x 60' QUADRANGLE

Note: Thicknesses are given in feet because original field maps were on 7.5' quadrangles with contour intervals in feet. To convert feet to meters (the contour interval unit on this map) multiply feet x 0.3048.

- Qal Alluvium (Holocene)**—Light-brown and gray gravel, sand, silt, and clay deposited in stream and river channels and on flood plains. Clasts are well rounded to subrounded. Deposits are poorly to well stratified. Thickness as much as 26 ft under flood plain of Yellowstone River and less than 13 ft under flood plains of tributaries.
- Qat Alluvial terrace deposit (Holocene and Pleistocene)**—Light-gray to light-brown gravel, sand, silt and clay in terrace remnants at elevations from 2 to 350 ft above rivers and streams. Along the Yellowstone River unit includes colluvium and a few small alluvial fan deposits. Clasts are generally well sorted and most are well rounded. Deposits are poorly to well stratified and poorly to well sorted. Thickness generally less than 15 ft, but locally as much as 50 ft.
- QTcl Clinker (Holocene, Pleistocene, and Pliocene?)**—Red, pink, orange, black, and yellow, very resistant metamorphosed sandstone, siltstone, and shale of the Fort Union Formation. Bedrock was baked by natural burning of underlying coal, and collapsed into voids created by burning. Locally, baked rock was melted and fused to form buchite, a black, glassy, vesicular or scoriaceous rock. Thickness generally about 20 ft, but locally as much as 50 ft.
- QTat Alluvial terrace deposit (Pleistocene and Pliocene?)**—Light-brown and light-gray gravel and sand at elevations generally from 2,880–3710 ft. Clasts are generally well sorted and most are well rounded. Deposits are moderately to well sorted. Thickness about 30 ft.
- Fort Union Formation (Paleocene)**
- Tftr Tongue River Member**—Yellow, orange, or tan, fine-grained sandstone with thinner interbeds of yellowish brown, orange, or tan siltstone, and light-colored mudstone and clay. Clay dominantly nonswelling. Sandstone may contain rare lenses as much as 50 ft long (Smith, 1956) of intraformational breccia with pebble- and cobble-size clasts of sandstone. In the map area, the Rosebud, McKay, Terret, and Burley are the most prominent of the coal beds in this member. In part of the map area (shown with hachure pattern) the lower part of the member contains a unit characterized by thin, orange silty limestone beds that serve as caprocks and are associated with light-colored or white siltstone and mudstone beds that may contain white- or light gray-weathered silcrete and other paleosols. The silcrete and other paleosols characteristically contain molds of plant stems and roots, and

range from 1 to 6 inches thick. Upper part of member was removed by erosion in map area. Thickness of as much as 540 ft exposed in map area.

- Tfle** Lebo Member—Gray, smectitic shale and mudstone that contains lenses of gray and yellow, very fine- to medium-grained sandstone, and ironstone concretion zones from 1 to 12 inches thick. The Big Dirty coal bed is at or near the base of the member. In part of the map area (shown with hachure pattern) the upper part of the member contains a unit characterized by thin, orange silty limestone beds that serve as caprocks, and light-colored or white siltstone and mudstone beds that may contain white- or light gray-weathered silcrete and other paleosols. The silcrete and other paleosols characteristically contain molds of plant stems and roots, and range from 1 to 6 inches thick. Thickness of member 95–200 ft.
- Tft** Tullock Member—Light-yellow and light-brown, planar-bedded very fine- to medium-grained sandstone and much less gray shale. Contains two or three coal beds in the upper 110 ft of member, and in many places, a coal bed at the base. Thickness of member 240–260 ft.
- Khc** **Hell Creek Formation (Upper Cretaceous)**—Dominantly gray and grayish brown sandstone, smectitic, silty greenish brown or gray shale, and mudstone, and a few thin beds of lignite or carbonaceous shale. Sandstone is fine- or medium-grained. Calcium carbonate-cemented concretions are typical in the fine-grained sandstone. Thickness 200–300 ft.
- Kl** **Lance Formation (Upper Cretaceous)**—Light-orange or light-tan, medium-grained, massive to crossbedded sandstone in lenses and channels interbedded with light-gray or greenish yellow sandy shale. Crossbedded conglomerate lenses at the base contain quartzite and limonite pebbles up to 1 inch in diameter and armored claystone balls up to 9 inches in diameter. Thickness 0–300 ft.
- Kfh** **Fox Hills Formation (Upper Cretaceous)**—Light-brown or light-orange, thin- to thick-bedded, micaceous, fine- to medium-grained sandstone in the upper part and thin-bedded siltstone and silty shale in the lower part. Thickness 0–200 ft.
- Kb** **Bearpaw Shale (Upper Cretaceous)**—Dark brownish gray, montmorillonitic fissile shale, with numerous thin bentonite beds and zones of calcareous and less common ferruginous concretions. Most bentonite beds are less than 6 inches thick but some are as much as 4 feet thick in the Vananda area just west of the map area (Berg, 1970). Thickness 800–950 ft.
- Kjr** **Judith River Formation (Upper Cretaceous)**—Upper light-gray, thin- to thick-bedded, fine- to medium-grained sandstone that weathers light grayish white from 72 to 92 ft thick. Middle dark-gray thin- to thick-bedded shale unit

about 130 ft thick. Lower light-gray thin- to thick-bedded fine- to medium-grained sandstone that weathers light grayish white. Thickness about 100 ft.

Kcl Claggett Shale (Upper Cretaceous)—Dark-gray, thin-bedded shale with zones of calcareous concretions and bentonite beds. Zone of septarian concretions at top about three feet thick. Prominent bentonite zone (Ardmore bentonite of Gill and Cobban, 1973) at base. Thickness 270–580 ft.

Kga Gammon Shale (Upper Cretaceous)—Light-gray shale, silty shale, and lesser siltstone and fine-grained sandstone, with thin beds of calcareous concretions, ferruginous concretions, and bentonite scattered throughout the formation. Lower part of formation not exposed in map area. Exposed thickness 250 ft.

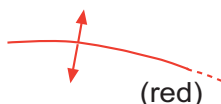
MAP SYMBOLS



Contact—Dotted where concealed.



Strike and dip of bedding—Indicating direction and amount of dip.



Anticline—Showing trace of axial plane; dotted where concealed.



Syncline—Showing trace of axial plane; dotted where concealed.



Fault—Ball and bar on downthrown side.



Paleosol interval—Zone of thin orange limestone beds, light-colored beds, and paleosol beds including silcrete.



Silcrete bed—Siliceous paleosol bed within paleosol interval.

GEOLOGIC MAP SOURCES AND INDEX OF 7.5' QUADRANGLES FORSYTH 30' x 60' QUADRANGLE

107°

106°

46°

1. Donleys Reservoir	2. Finch NE	3. Black Coulee	4. Schultz Coulee	5. Box Canyon Coulee & Sand Buttes	6. Hathaway NW & Butterfly Creek	
7. Finch	8. Nichols	9. Forsyth	10. Orinoco	11. Rosebud & Thurlow	12. Hathaway	13. Horton
14. Griffen Coulee NW & Griffen Coulee NE		15. Smith Creek & Smith Creek NE		16. Rosebud Buttes & Indian Creek	17. Miller Creek NW	18. Moon Creek School
19. Griffen Creek SW & Griffen Coulee		20. Sheep Creek Camp & McKerlich Creek		21. Mitchell Coulee & Crain Place	22. Miller Creek SW	23. Miller Creek

46°30'

Numbers below correspond to numbers on 7.5' quadrangle index on previous page.

Map scale 1:24,000 unless otherwise indicated.

1. Colton, R.B., Klockenbrink, J.L., and Grout, M.A., 1987b.
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Field mapping by above authors, E.M. Wilde, and S.M. Vuke.

Entire quadrangle

Bergantino, 1977, scale 1:250,000

Bergantino, R.N., Wilde, E.M., Vuke, S.M., and Colton, R.B., 1990, scale 1:100,000.

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Stoner, J.D., and Lewis, B.D., 1980,

Compilation at 1:100,000 scale by R.N. Bergantino and S.M. Vuke

FORSYTH 30' x 60' QUADRANGLE
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