GEOLOGIC MAP OF THE BAKER 30' x 60' QUADRANGLE, EASTERN MONTANA AND ADJACENT NORTH DAKOTA

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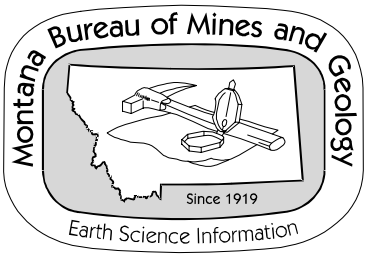

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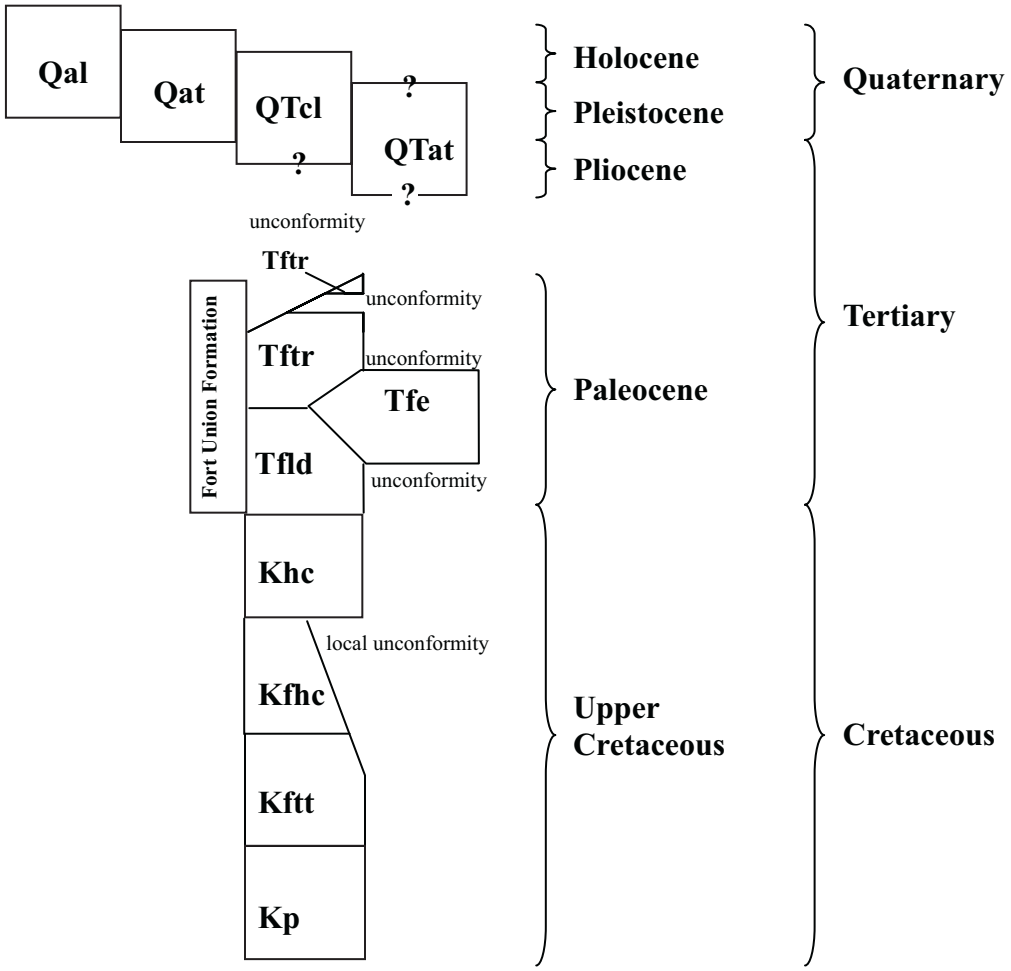
CORRELATION DIAGRAM
BAKER 30' x 60' QUADRANGLE



DESCRIPTION OF MAP UNITS
BAKER 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 and Pleistocene)—**Light-brown, reddish brown, yellowish brown, grayish brown, olive, gray, and light-gray gravel, sand, silt, and clay deposited in stream and river channels and on flood plains. Clasts are subangular to well rounded and are as much as 2 ft in diameter. Deposits are poorly to well stratified and poorly to well sorted. Thickness generally less than 20 ft but as much as 40 ft.

Qat **Alluvial terrace deposit (Holocene and Pleistocene)—**Light-brown, grayish brown, and light-gray gravel, sand, and silt in terrace remnants at elevations from 2 to 360 ft above O'Fallon and Little Beaver Creeks and their tributaries. Clasts are moderately to well rounded. Deposits are poorly to well stratified and poorly to well sorted. Thickness less than 10 ft.

QTcl **Clinker (Holocene, Pleistocene, and Pliocene?)—**Red, pink, orange, black, and yellow very resistant metamorphosed shale, siltstone, and sandstone of Fort Union and Hell Creek Formations. 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 20 ft, but locally as much as 75 ft.

QTat **Alluvial terrace deposit (Pleistocene and/or Pliocene)—**Light-brown to light-grayish orange, coarse sand with lenses of gravel, and lenses and beds of clay, silt and fine-grained sand in terrace remnants approximately 100 ft above modern flood plain of Little Beaver Creek. Clasts are generally well sorted, and most are well rounded. Deposits are generally well stratified. Dominant clast lithology is pale-yellow quartzite. Other lithologies are sandstone, igneous and metamorphic rocks, clinker, and tuff or chalcedony from the Miocene Arikaree Formation exposed south of the quadrangle. Thickness generally less than 10 ft, but locally as much as 33 ft.

Fort Union Formation (Paleocene)

Tftr Tongue River Member—Yellow, orange, or tan fine-grained sandstone and thinner interbeds of yellowish brown, orange, or tan siltstone, and light-colored mudstone and clay. Clay dominantly nonswelling. Contains thick to thin beds of poorly cemented fluvial sandstone that locally weathers into badland topography. Plant impressions occur in some beds, and Tiffanian mammal fossils have been found in the member within the quadrangle (Archibald, and others, 1987; Hartman and Kihm, 1992). Contains several prominent coal beds. An angular unconformity is present between two of these beds, the Dominy and the Knobloch, as indicated on the map

(see explanation of map symbols). In part of the map area (shown with hachure pattern), the lower part of the unit contains orange silty limestone beds associated with light-colored to white siltstone and mudstone beds that may contain white- or light gray-weathering silcrete and other paleosols. These paleosols characteristically contain molds of plant stems and roots, range from 1 inch to 1.5 ft thick, and locally weather to rubbly clasts ranging from pebble to boulder size. The relatively resistant orange silty limestone beds form flat-topped caprocks, that result in a characteristic topography. Orange or yellow, trough-crossbedded fluvial sandstone dominates in some areas. Upper part of member removed by erosion in map area. Exposed thickness as much as 460 ft.

Tfe Ekalaka member (informal)—Orange, yellow, or tan, fine- to medium-grained sandstone with occasional thin mudrock and shale interbeds that locally contain thin lignite beds. Member represents a facies change of the Ludlow Member and possibly part of the lower Tongue River Member. Much of the sandstone is thin-bedded and rippled; some is crossbedded. Clays are dominantly nonswelling. A paleoslump and megabreccia horizon, several silcrete beds, and other paleosols occur within the member. Torrejonian 3 mammal fossils have been found in the member within the quadrangle (Archibald, and others, 1987; Hartman and Kihm, 1992) as well as numerous brackish-water trace fossils. The member is bounded by unconformities. Thickness 0–180 ft.

Tfld Ludlow Member—Dominantly gray and grayish brown sandstone, siltstone, and mudstone interbedded with thinner yellow or orange, fine-grained sandstone as much as100 ft thick. In some areas, the gray and grayish brown sandstone, siltstone, and mudstone are interbedded in tabular beds. In other areas, gray, crossbedded, lenticular, fine-grained, clay-rich sandstone that contains abundant calcium carbonate-cemented concretions is abundant. The member is generally poorly cemented and weathers to badland topography. In contrast to the dominantly nonswelling clays in the Tongue River Member and Ekalaka member, abundant smectite in the Ludlow Member produces characteristic “popcorn” weathering. In part of the map area (shown with hachure pattern on the map), the member contains a paleosol unit as described above in the lower Tongue River Member. Although similar to the underlying Hell Creek Formation, the Ludlow Member generally exhibits more tabular and laterally persistent bedding and contains thicker, more numerous and more persistent lignite beds than the Hell Creek. Yellowish orange or brownish orange sandstone usually less than 30 ft thick that overlies a lignite bed or beds, is characteristically present at the base of the member. Late Puercan mammal fossils have been found in the Ludlow Member within the quadrangle (Archibald, and others,1987). Thickness of member 82–245 ft.

Khc **Hell Creek Formation (Upper Cretaceous, Maastrichtian)**—Dominantly gray and grayish brown sandstone, smectitic, silty shale and mudstone, and a few thin beds of lignite or carbonaceous shale. Sandstones are fine- or medium-grained, and calcium carbonate-cemented concretions are typical in the fine-grained sandstone. The beds

are generally poorly cemented and weather to badland topography. Swelling clays produce characteristic "popcorn" weathering. The top of the formation occurs at the base of a lignite bed that persists throughout exposures in the map area except where cut into and replaced by Ludlow Member channel deposits. Dinosaur fossils may be present below the upper contact, but not above (Brown, 1907). In the Cedar Creek Anticline area, the base of the formation is a brownish orange, medium- to coarse-grained sandstone with rip-up clasts overlying a scour base. In general, it rests unconformably on progressively older Fox Hills Formation beds toward the axis of the Cedar Creek Anticline, down to lower Trail City Member. Away from the axis of the anticline, the base of the Hell Creek Formation rests with apparent conformity on the Colgate Member of the Fox Hills Formation. Thickness approximately 260 ft.

Fox Hills Formation (Upper Cretaceous, Maastrichtian)

Kfhc Colgate Member—White or light gray, micaceous, fine- to medium-grained sandstone that contains carbonaceous shale or lignitic carbonaceous shale beds up to 2 ft thick in upper part of member. Sandstone is composed of angular quartz, feldspar, and volcanic rock fragments, and scattered flakes of muscovite, and is cemented by white sericite and illite that give the sandstone its light color. Tabular and trough crossbeds are well developed. Channel bases in the sandstone display well-developed scour features including large rip-up clasts composed of carbonaceous shale or mudstone. Characteristically weathers into high-angle, fluted surfaces. Thickness 0–130 ft.

Kftt Trail City and Timber Lake Members, undivided

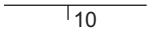
Timber Lake Member—Brownish gray siltstone and fine-grained sandstone that weather to a moderate brown. Hummocky beds and trough crossbeds are characteristic of member, and locally it contains *Ophiomorpha* burrows. Thickness 49–70 ft.

Trail City Member—Interbedded light-gray siltstone and dark-gray shale. Member is a transitional zone between the underlying Pierre Shale and the sandy Timber Lake Member. Thickness about 33 ft.

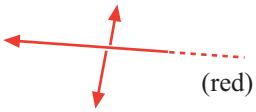
Kp **Pierre Shale (Upper Cretaceous)—**Dark-gray and black bentonitic mudstone and shale with thin jarosite stringers, and fossiliferous limestone concretions that contain marine ammonites and pelecypods. Lower part of formation not exposed in map area. Exposed thickness about 210 ft.

EXPLANATION OF MAP SYMBOLS

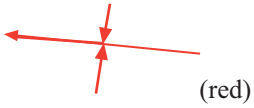
Contact—Dotted where concealed.



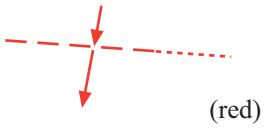
Strike and dip of bedding—Indicating direction and amount of dip.



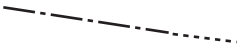
Asymmetric anticline—Showing trace of axial plane and direction of plunge. Shorter arrow on more steeply dipping limb. Dotted where concealed.



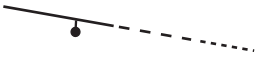
Syncline—Showing trace of axial plane.



Anticlinal flexure of monocline—Showing trace of axial plane. Approximately located; dotted where concealed.



Lineament—Indicating a line of abrupt change in degree of bedding dip, evident regionally on aerial photographs. Dotted where concealed.



Fault—Dashed where inferred; dotted where concealed. Ball and bar on downthrown side.

Paleosol unit—Zone of thin orange limestone beds, light-colored beds, and paleosol beds, including silcrete**.** Unit occurs within the upper Ludlow or lower Tongue River Members.

Silcrete bed—Siliceous paleosol bed within paleosol interval.

Unconformity—Regionally angular, within the Tongue River Member of the Fort Union Formation.

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

105° 104°

46°30’

2, 6 **Bracket Butte**	2, 6 **Ismay South**	2, 6 **West-more**	2, 6 **Plevna**	2, 6 **Baker NW**	2, 6 **Baker NE**	2, 6 **Morris Butte**	2, 5, 6 **Badland Draw**
2, 6 **Founda-tion Spring**	2, 6 **Bracket Butte SE**	2, 6 **TG Creek**	2, 6 **Little Pine Creek**	2, 6 **South Sandstone Reservoir**	2, 4, 6 **Baker**	2, 4, 6 **Buffalo Reservoir**	2, 4, 6 **Water-hole Creek**
2, 6 **Hooky Dam**	2, 6 **Nelson Butte**	2, 6 **Harmon Butte**	2, 6 **Seven-Up Butte**	2, 6 **Sportman Pond**	2, 6 **Willard**	2, 3, 6 **Webster NW**	2, 3, 6 **Webster NE**
5 **North Fork Alkali Creek**	5 **Skunk Creek**	1, 5 **Piney Butte SW**	1, 5 **Piney Butte**	1 **Medicine Rock State Park**	1 **Willard SE**	1, 3 **Webster**	1, 3, 4 **Scole School**

46°

Numbers correspond to index map.

1. Bauer, C.M., 1924, plate 33, scale 1:125,000.
2. Bowen, C.F., 1912, plate XV, scale 1:125,000.
3. Dobbin, C.E., and Larsen, R.M., 1934, scale 1:63,360.
4. Hares, C.J., 1928, plate 1, scale 1:125,000.
5. Miller, W.R., 1978, plate 1, scale 1:126,270.
6. Taylor, O.J. 1965, plate 1, scale 1:225, 280

Entire quadrangle

Bergantino, R.N., 1977, scale 1:250,000.

Ellis, M.S., and Colton, R.B., 1994, scale 1:500,000.

Stoner, J.D., and Lewis, B.D., 1980, scale 1:500,000.

Vuke, S.M., 1989, scale 1:100,000.

Vuke-Foster, S.M., Colton, R.B., Stickney, M.C., Wilde, E.M., Robocker, J.E., and Christensen, K.C., 1986, scale 1:100,000.

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