GEOLOGIC MAP OF THE EKALAKA 30’ x 60’ QUADRANGLE, EASTERN MONTANA AND ADJACENT NORTH AND SOUTH DAKOTA

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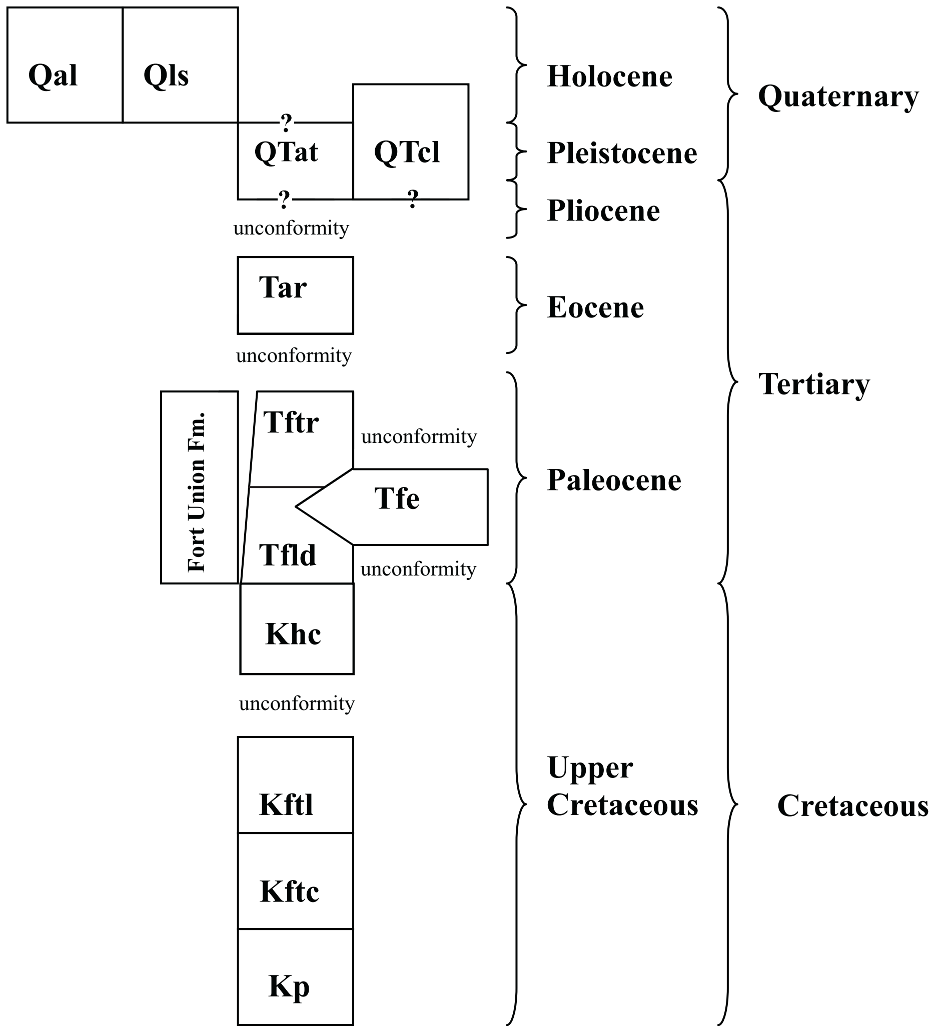
CORRELATION DIAGRAM
EKALAKA 30’ x 60’ QUADRANGLE



DESCRIPTION OF MAP UNITS
EKALAKA 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-gray to tan gravel, sand, silt, and clay deposited in stream and river channels and on flood plains. Clasts are subangular to well rounded. Deposits are poorly to well stratified and poorly to well sorted. Thickness generally less than 20 ft but as much as 30 ft.

Qls **Landslide deposit (Holocene and Pleistocene?)**—Mass-wasting deposit of stable to unstable, unsorted mixtures of sediment primarily as rotated or slumped blocks of bedrock and surficial sediment. Color and lithology reflect that of parent rock and transported surficial deposits. Thickness as much as 70 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 and within the quadrangle. Thickness generally less than 10 ft, but locally as much as 35 ft.

QTcl **Clinker (Holocene, Pleistocene, and Pliocene?)**—Red, pink, orange, black, and yellow, very resistant metamorphosed shale, siltstone, and sandstone of 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 20 ft or less.

Tar **Arikaree Formation (Miocene)**—Greenish gray to light-gray crossbedded or massive sandstone that is tuffaceous or calcareous and may contain tubular or round concretions. Sandstone is interbedded with a few laminated ash beds as much as 12 ft thick. Formation also includes subordinate rip-up clast conglomerates, dolomite, siltstone, and shale and is generally capped by several feet of resistant greenish orthoquartzite with a few scattered small quartz pebbles and granules. In the map area, the Arikaree Formation rests unconformably on the Fort Union or Hell Creek Formation, and in the southern Long Pine Hills, it locally rests on thin unmapped remnants of the Chadron or Brule Formation (Denson and Gill, 1965, plate 15). Thickness of Arikaree Formation 200–250 ft.

White River Group (Oligocene)(Outcrop pattern too narrow to show at scale of this map.)

Brule Formation—May only be present in the quadrangle at Capitol Rock (SE ¼ sec. 17, T. 3 S., R. 62 E.) as an erosional remnant beneath the unconformable base of the Arikaree Formation. Massive pinkish gray, calcareous, clayey siltstone; tuffaceous siltstone; nodular claystone; and channel sandstone (Denson and Gill, 1965). Contains abundant vertebrate fossils. Thickness 0–30 ft.

Chadron Formation—Preserved as erosional remnants beneath the unconformable base of the Arikaree Formation in the southern Long Pine Hills in the southeastern part of the quadrangle, and conformably beneath the Brule Formation at Capitol Rock (SE ¼ sec. 17, T. 3 S., R. 62 E.). Basal conglomeratic sandstone overlain by beds 10 to 15 ft thick of dark-gray bentonite and cream-colored tuffaceous siltstone (Denson and Gill, 1965). Rests unconformably on Fort Union or Hell Creek Formation. Thickness 0–100 ft.

Fort Union Formation (Paleocene)

Tfe Ekalaka member (informal)—Orange, yellow or tan, fine- to medium-grained sandstone with some thin mudrock and shale interbeds that locally contain thin lignite beds. Member represents a facies change from the Ludlow Member and possibly part of the lower Tongue River Member. The sandstone may be thinly bedded and rippled, massive, or crossbedded in thick sets. Soft-sediment deformation is prominent in some areas. Clays are dominantly non-swelling, and analcime is abundant in parts of the member. A paleoslump and megabreccia horizon, several silcrete beds, many other paleosols, and numerous brackish-water trace fossils occur within the member. It is bounded by unconformities and rests progressively southward on the upper Ludlow to middle Hell Creek Formation in the eastern part of the quadrangle. Thickness 0–180 ft. (Belt and others, in review).

Tfld Ludlow Member—Dominantly gray and gray-brown sandstone, siltstone, and mudstone interbedded with yellow or orange, fine-grained sandstone beds as much as 100 ft thick. Some medium-grained grayish brown channel sandstones are more resistant than surrounding rock so show up well on aerial photographs and in the field as mound-like ridges of sandstone in a straight or meandering pattern. In contrast to the dominantly nonswelling clays in the Ekalaka member, abundant smectite in the Ludlow Member produces characteristic “popcorn” weathering. In part of the map area, the member contains a paleosol unit (shown with hachure pattern) that includes silcrete beds. The Ludlow Member is somewhat similar to the

Hell Creek Formation, but generally exhibits more tabular and persistent bedding and contains thicker, more numerous and more persistent lignite beds than the Hell Creek. Thickness of member 82–245 ft.

Khc **Hell Creek Formation (Upper Cretaceous)—**Gray and greenish gray, structureless, smectitic, silty mudstone with "popcorn" weathering. Grayish yellow to moderate-yellowish brown crossbedded and ripple-laminated, micaceous, fine- to medium-grained channel sandstone with less than 1 percent gravel-size clasts of gray claystone and lesser amounts of fossil bone fragments, petrified and carbonized wood fragments, and ironstone. Gravel-size clasts generally found along paleochannel margins. Lesser amounts of carbonaceous shale and rare thin lignite beds are interspersed with mudstone and sandstone. A yellowish brown sandstone that caps the northeast-striking ridges in the western part of the quadrangle is mapped as Hell Creek Formation based on dinosaur fossils found in the sandstone (E.S. Belt, personal communication). A similar sandstone bed at the same stratigraphic position within the southeastern corner of the nearby Broadus 30' x 60' quadrangle contains Cretaceous palynomorphs (D. Nichols, USGS, written communication) as well as dinosaur fossils (U.S. Bureau of Land Management data, Miles City). In the Ekalaka 30' x 60' quadrangle, this ridge-capping sandstone was previously shown as Fort Union Formation on some maps (for example, Stoner and Lewis, 1980). Thickness of formation 350–500 ft.

Fox Hills Formation (Upper Cretaceous)

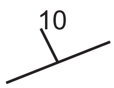
Kftl Timber Lake Member—Brownish gray siltstone, and fine- to medium-grained, coarsening-upward sandstone that weather to moderate-brown. Hummocky beds and trough crossbeds are characteristic of member, and locally it contains *Ophiomorpha* burrows and selenite crystals, and may have a sulfurous odor. Thickness of member 49–70 ft.

Kftc Trail City Member—Interbedded light-gray siltstone that coarsens upward to fine-grained sandstone, and dark-gray shale. Member is a transitional zone between the underlying Pierre Shale and the sandy Timber Lake Member. Thickness of member 30 ft.

Kp **Pierre Shale (Upper Cretaceous)—**Dark-gray to brownish black bentonitic claystone and shale that contain large fossiliferous limestone concretions and thin beds of bentonite. Base of formation not exposed in the map area. Exposed thickness 265 ft.

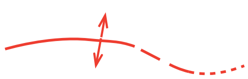
MAP SYMBOLS
EKALAKA 30’ x 60’ QUADRANGLE

Contact— Dotted where concealed.



Strike and dip of bedding— Number indicates amount of dip.

Fault— Ball and bar on downthrown side, dashed where approximately located, dotted where concealed. Reversal of movement is interpreted on northeast-striking faults along Boxelder Creek from the opposing sense of movement of units older than the Ekalaka member (informal) relative to that of the Ekalaka member. Reactivation of a basement fault is interpreted for these faults based on the coincidence in trend and position of a basement terrane boundary between the Wyoming Archean Province and Trans-Hudson Province beneath the northeast-striking fault zone of this quad.



(red)

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

(red)

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

Paleosol interval—Zone of thin, orange limestone beds, light-colored beds, and paleosol beds. Zone is better developed north of the map area.

Silcrete bed—Siliceous paleosol bed.

GEOLOGIC MAP SOURCES and INDEX OF 7.5' QUADRANGLES
EKALAKA 30' x 60' QUADRANGLE

105°, 46° (upper left) — 104° (upper right) — 45°30' (lower left)

5 Black-tail Creek NW	5 Board Corral Creek	3, 5 Beaver Flats North	1, 3, 5 Ekalaka	1, 3 Terrell Creek	1 Dutch-mans Creek	1 Flasted Hill	1, 2, 4 Snider Hill
5 Black-tail Creek SW	5 Black-tail Creek SE	3, 5 Beaver Flats South	1, 3, 5 Stag-ville Draw	1, 3 Camp Need More	1 Lamp-kin Gulch	1 Mill Iron	1, 4, 6 Hum-bolt Hills
5 Davis Creek West	5 Davis Creek East	3, 5 Chalk Buttes	3, 5 Dead Boy Divide	1, 3 Taylor Hills	1, 3 Bell-tower	1, 3 Rustler Divide	1, 3, 6 North Slick Creek
Poco-chichee Butte	W L Butte	Dutch-man Creek	Ikey Creek	1 School Section Creek	1, 3 Bell-tower Butte	1, 3 Timber Hill	1, 3 Capitol Rock

Numbers below correspond to index map above.

1. Bauer, C.M., 1924, plate 33, scale 1:125,000.

2. Carlson, C.G., 1983, plate 1, scale 1:126,760.

3. Denson, N.M., and Gill, J.R., 1965, plates 15, 16, and 17, scale 1:62,500.

4. Erickson, H.D., 1956, scale 1:62,500.

5. Miller, 1979, plate 1, scale 1:126,270.

6. Schulte, J.J., 1957, scale 1:62,500.

<u>Entire map</u>
Bergantino, R.N., 1980, scale 1:250,000.

Colton, R.B., Whitaker, S.T., Ehler, W.C., Holligan, J., and Bowles, C.G., 1978, 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., Wilde, E.M., Bergantino, R.N., and Colton, R.B., 1989, scale 1:100,000.

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