

DESCRIPTION OF MAP UNITS

BYRNE CREEK 7.5-MINUTE QUADRANGLE, MONTANA

Qa1

FLOOD PLAIN AND CHANNEL ALLUVIUM (HOLOCENE)--Yellowish-brown and gray gravel, sand, silt and clay deposited in flood plains and channels of active streams. Deposits are well to poorly stratified and moderately well sorted. Thickness not measured; estimated to be as much as 5 m (15 ft).

Q1s

LANDSLIDE DEPOSITS (HOLOCENE)--Slumps and earthflow deposits that may be stable or unstable and generally consist of chaotic mixtures of clay- to boulder-size clasts but may be rotated blocks of bedrock that have retained internal integrity. Color, texture and lithology reflect that of parent rock. Thickness not measured; estimated to be generally less than 15 m (50 ft).

Qc1

COLLUVIUM AND SHEETWASH ALLUVIUM (HOLOCENE and PLEISTOCENE?)--
Poorly sorted and poorly stratified to nonstratified gravel, sand, silt and clay deposited on slopes. Includes significant component of windblown silt and fine-grained sand. Color and texture reflect that of parent rock. Thickness not measured; estimated to be as much as 4.5 m (15 ft).

Qdf

DEBRIS FLOW DEPOSITS (PLEISTOCENE?)--Dissected sheets of poorly sorted sediment with abundant angular and subangular locally derived clasts that range from pebble to boulder size and are supported

by, and embedded in a fine-grained matrix of predominantly mud. Thickness not measured; estimated to range from 3 to 15 m (10 to 50 ft).

Qoa

OLDER QUATERNARY ALLUVIUM (PLEISTOCENE?)--Light-brown to light-gray crudely to well stratified and moderately to well sorted sand and gravel that occurs at higher altitude than channels of active streams. Includes dissected sheets of predominantly coarse sediment derived from the Highwood and Little Belt Mountains. Locally covered by windblown sand and silt. Thickness approximately 12 m (40 ft).

Tls(Kmu)

Tls(Kmk)

LANDSLIDE DEPOSITS (EOCENE)--Large block glide deposits up to several km in width, that have gravitationally slid on a decollement plane probably in the bentonitic lower part of the Kevin Member of the Marias River Shale. Blocks have maintained internal integrity but have in most cases rotated so beds strike at angles to and generally have dips from 5° to 35° greater than adjacent, undisturbed rock. Tls(Kmu) indicates block glide deposits composed of Montana Group (undivided) rocks. Tls(Kmk) indicates block glide deposits composed of the upper Kevin Member. Many Eocene dikes were transported and rotated with the block glides. Age inferred from later Eocene dikes that cut across the blocks.

Tum

QUARTZITE, SILTITE AND HORNFELS (EOCENE)--Upper Cretaceous rocks of the Montana and upper Colorado groups that have been metamorphosed to quartzite, siltite and hornfels by underlying intrusives. In

transitional areas sandstone is unchanged, but shale is hornfelsed. Up to 600 m (2000 ft) of section metamorphosed in adjacent quadrangles, but only a small area of this unit is exposed in the northwest corner of this quadrangle.

Kmu

MONTANA GROUP, UNDIVIDED (UPPER CRETACEOUS, CAMPANIAN)--Alternating

yellowish-gray to light-gray-weathering fine- to medium-grained planar- or trough-crossbedded sandstone and dark-gray- to dark-greenish-gray-weathering shale. Sandstone beds range from 40 cm (8 in) to 15 m (50 ft) thick and are separated by 15 cm (5 in) to 23 m (75 ft) of shale. Sandstone beds are generally cemented by calcite or very light-gray clay; they are micaceous to nonmicaceous quartz arenite and litharenite with fine- to medium-grained organic fragments and have a "salt and pepper" appearance. Shale is moderately to poorly fissile and weathers into granule-size chips. Local carbonaceous beds, nodular-weathering limestone beds, thin ferruginous beds, brown-weathering ferrocalcareous concretions and grayish-purple- and moderate-yellowish-brown-weathering mudstone and siltstone beds are present. A medium-gray micrite bed approximately 4 m (12 ft) thick is present in several areas. Thickness of unit at least 210 m (700 ft). Formations not individually mapped in Montana Group of this area because of facies changes.

COLORADO GROUP

MARIAS RIVER SHALE

Kmk

KEVIN MEMBER (UPPER CRETACEOUS, CONIACIAN and SANTONIAN)--

Dark-gray, fossiliferous shale with abundant gray septarian limestone concretions. The lower part of the member contains

numerous thin bentonite beds and medium-gray or moderate-yellowish-brown limestone concretions. The upper part of the member contains ferruginous concretions and beds, and thin siltstone beds near the top. Thickness of member approximately 200 m (650 ft).

Kmfe

FERDIG MEMBER (UPPER CRETACEOUS, TURONIAN)--Noncalcareous, dark-gray-weathering fissile shale that contains lenticular-bedded siltstone and fine-grained sandstone and distinctive reddish-orange or reddish-brown ferruginous dolostone concretions that weather into small chips. A fine-grained, planar-bedded sandstone is present from 12 to 24 m (40 to 80 ft) above the base of the member. Thickness of member approximately 61 m (200 ft).

Kmc

CONE MEMBER (UPPER CRETACEOUS, CENOMANIAN and TURONIAN)--Lower part dark-gray calcareous shale that contains a persistent bentonite bed. Upper part thin bedded or platy, medium-gray- or grayish-orange-weathering petroliferous limestone, that contains blue fish scales and pelecypod fragments. Thickness of member approximately 18 m (60 ft).

Kmfl

FLOWEREE MEMBER (UPPER CRETACEOUS, CENOMANIAN)--Dark-gray-weathering fissile shale that contains several thin beds of siltstone and fine-grained sandstone, some of which are wavy- and lenticular-bedded, and light-yellowish-gray, low-swelling bentonite beds. Locally contains septarian concretions and

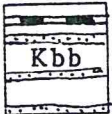
limonitic dolostone concretions that produce small chips similar to those in the Ferdig Member. Thickness of member approximately 18 (60 ft).



Arrow
Creek Bed

MOWRY FORMATION (LOWER CRETACEOUS, ALBIAN)--Basal Arrow Creek Bed, labeled on the map, consists of very light-gray (nearly white) and yellowish-gray porcellanite, tuff, and swelling bentonite that is overlain by dark-gray weathering-lenticular- and wavy-bedded siliceous shale, siltstone and flaser-bedded, fine-grained sandstone. Uppermost part of formation consists of pale-yellowish-brown to light-olive-gray-weathering, medium-grained, relatively resistant, thin-bedded sandstone that locally contains fish scales and bones. Formation equivalent to upper part of Bootlegger Member of Blackleaf Formation to west. Thickness of formation approximately 12 m (40 ft).

BLACKLEAF FORMATION



BOOTLEGGER MEMBER (LOWER CRETACEOUS, ALBIAN)--Contains two to six relatively prominent sandstone beds about 3 to 12 m (10 to 40 ft) thick separated by 15 to 30 m (50 to 100 ft) of shale that contains numerous bentonite beds. The fine- to medium-grained, light-brown- to moderate-yellowish-brown-weathering sandstones are commonly flaser-bedded or ripple-laminated with abundant trace fossils on bedding surfaces. Trough and hummocky bedding also occurs higher in the section, and fish scales and bones are common in the upper sandstones. Locally the tops of sandstone beds contain black chert pebbles. Sandstone beds

persist over many square kilometers. Thickness of member approximately 18 m (60 ft).

Kbt

TAFT HILL MEMBER (LOWER CRETACEOUS, ALBIAN)--Medium-dark-gray- to medium-light-gray-weathering bentonitic, silty shale. Thickness of member approximately 30 m (100 ft).

Kbf

FLOOD MEMBER (LOWER CRETACEOUS, ALBIAN)--Black- to dark-gray- weathering fissile shale. Lacks the two prominent sandstone beds present in Great Falls area. Thickness of member approximately 40 m (130 ft).


base of Colorado Group


KOOTENAI FORMATION

Kk₅

FIFTH MEMBER (informal map unit) (LOWER CRETACEOUS, APTIAN AND ALBIAN)--Dominantly moderate-red mudstone that contains lenses of sandstone and limestone. The uppermost part of the member consists of massive, color-banded, greenish-gray, grayish-red-purple, moderate-red and very-dark-red mudstone with lenses of fine- to medium-grained trough-crossbedded, greenish-gray- weathering sandstone. Base of member not exposed in map area.

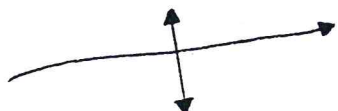
MAP SYMBOLS

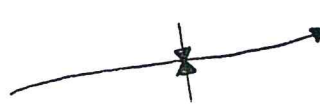
 CONTACT--Dashed where approximately located;
short-dashed where inferred.


 FAULT--Showing relative movement, U on upthrown
side; D on downthrown side. Dashed where
approximately located.


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STRIKE AND DIP OF BEDDING--Showing direction and
amount of dip.

 ANTICLINE--Showing trace of crestline and direction
of plunge. Direction of plunge unknown or not
plunging where plunge arrow is omitted.

 SYNCLINE--Showing trace of troughline and direction
of plunge. Direction of plunge unknown or not
plunging where plunge arrow is omitted.

 DIKE (EOCENE)--Alkalic intrusive with high-angle
attitude and thickness typically less than 4 m
(13 ft). Arrow and number indicate direction
and attitude of dikes rotated in Eocene block
glide desposits.

 SILL (EOCENE)--Alkalic intrusive that parallels or
subparallels bedding.



SANDSTONE BED--Thickness approximate, not all sandstone beds shown on map. Dashed where approximately located. Queried at limit of mapping.



SILL (EOCENE)--Intruded on top of sandstone bed.

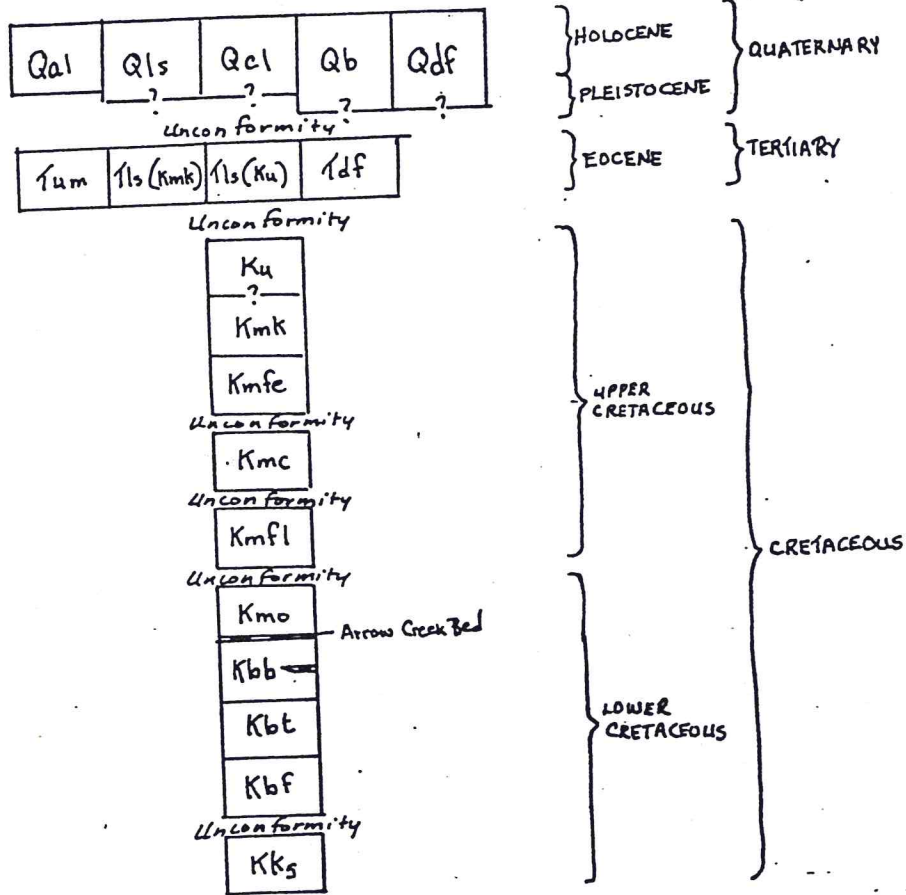


PORCELLANITE or PORCELLANITE and BENTONITE (CRETACEOUS, ALBIAN)--Arrow Creek Bed, labelled on map occurs at base of Mowry Formation. Another porcellanite and bentonite bed occurs in the upper Bootlegger Member of the Mowry Formation.



Surface

CORRELATION OF MAP UNITS
BYRNE CREEK 7.5-MINUTE QUADRANGLE



PREVIOUS GEOLOGIC MAPPING, BYRNE CREEK 7.5-MINUTE QUADRANGLE

Cannon, J. L., 1966, Outcrop examination of paleocurrent patterns of the Blackleaf Formation near Great Falls, Montana: Billings Geological Society, 17th Ann. Field Conference Guidebook, p. 71-111.

Weed, W. H., 1899, Fort Benton Folio, Montana: U.S. Geological Survey Folio 55.