

DESCRIPTION OF MAP UNITS

ARMINGTON 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)--Slump 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).

Qat

ALLUVIAL TERRACE DEPOSITS (HOLOCENE)--Light-brown to light-gray, crudely to well stratified, and well sorted sand and gravel present at various elevations from 6 to 18 m (20 to 60 ft) above Belt Creek. Proportion of sand and gravel variable. Thickness of deposits as much as 3 m (10 ft) but generally approximately 2 m (6 ft).

Qaf

ALLUVIAL FAN DEPOSITS (HOLOCENE)--Poorly sorted and stratified to moderately sorted and stratified sandy gravel in small fans at mouths of streams. Thickness not measured; estimated to be as much as 15 m (50 ft).

Qc1

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

Qg1

GLACIAL LAKE DEPOSITS (PLEISTOCENE)--Dark-gray, brown, and reddish-brown massive, laminated or varved clay, silt and sand that contains scattered granules, pebbles and cobbles. Thickness as much as 8 m (25 ft).

Ta

ALLUVIAL TERRACE DEPOSITS (PLIOCENE?)--Light-brown to light-gray crudely to well stratified and well sorted locally well cemented deposits of coarse sand and gravel from 67 to 85 m (220 to 280 ft) above Belt Creek. Thickness of deposit as much as 12 m (40 ft) but generally 6 m (20 ft).

COLORADO GROUP

BLACKLEAF FORMATION

Kbf

FLOOD MEMBER (LOWER CRETACEOUS, ALBIAN)--Black to dark-gray-weathering fissile shale that contains pods and lenses of bioturbated sandstone at its base. Lacks the two prominent sandstone beds present west of the map 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 45 to 60 m (150 to 200 ft) 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. Thickness of member approximately 37 m (120 ft).

Kk₄

FOURTH MEMBER (informal map unit) (LOWER CRETACEOUS, APTIAN)-- Dusky-red or pale-reddish-brown fine- to medium-grained, thin- to medium-bedded micaceous, argillaceous, platy-bedded sandstone with abundant plant fragments, interbedded with very dark-red mudstone. A persistent ostracod-rich moderate-reddish-brown limestone bed occurs in the middle of the member. Basal contact is transitional with Third member and contains interbedded medium-gray or dusky-red siltstone and mudstone. Lowest sandstone beds are light-brown or moderate yellowish-brown-weathering, becoming dusky-red or pale-reddish-brown higher in the section. Low amplitude ripple marks, which are locally interference ripples, commonly occur on bedding surfaces. Thickness of member approximately 30 (100 ft).

Kk₃

THIRD MEMBER (informal map unit) (LOWER CRETACEOUS, APTIAN)--Well sorted resistant quartz arenite with interspersed limonite

specks. Scour base, locally containing rip-up clasts and chert pebbles, cuts into Second member. Up to 20% dark chert is present at base, but higher in section it disappears almost entirely. Primary sedimentary structures include planar, tabular crossbedding with sets generally 20 to 40 cm (8 to 16 in) thick and planar-bedded fine-grained sandstone and siltstone in 2 to 10 cm (.8 to 1.8 in) thick beds separating sets. Sinuous and straight-crested wave and interference ripple marks occur on bedding surfaces. Interbedded sandstone, siltstone and shale occur in planar beds near the top of the member with abundant invertebrate trace fossils on bedding surfaces and within beds. Thickness of member approximately 12 m (40 ft).

Kk₂

SECOND MEMBER (informal map unit) (LOWER CRETACEOUS, APTIAN)--Poorly resistant red mudstone that overlies the First member with a sharp contact. Mudstone contains dense medium-gray micrite and argillaceous, light-brownish-gray micrite concretions that laterally become lenticular, irregular beds. Thin, lenticular chert-rich quartz arenite beds occur locally. A bed of intraformational-micrite-clast conglomerate occurs near the top of the member. Thickness of member approximately 30 m (100 ft).

Kk₁

FIRST MEMBER (informal map unit) (LOWER CRETACEOUS, APTIAN?)--Dominantly resistant, festoon-crossbedded, moderately well sorted quartz arenite with 20 to 50% black, dark- and light-gray chert. Coarse-grained sandstone, chert-granule conglomerate or chert-pebble conglomerate occurs at scour base, typically

containing rip-up clasts of coal and plant fragments and impressions. Grain size fines upward with upper part of member generally fine- to medium-grained. Thickness of member approximately 3 to 37 m (10 to 120 ft).

Jm

MORRISON FORMATION (JURASSIC, KIMMERIDGIAN)--Light-greenish-gray-

weathering mudstone and shale with interbedded lenses of medium-gray micrite and fine- to medium-grained calcareous thin-bedded, moderate-yellowish-brown-weathering sandstone with subbituminous coal bed at the top of formation. Thickness of formation approximately 30 m (100 ft).

Je

ELLIS GROUP

SWIFT FORMATION (JURASSIC, OXFORDIAN)--Grayish-orange-weathering calcareous, glauconitic fine- to coarse-grained sandstone containing interbeds of shale and chert-pebble conglomerate. Thickness of formation approximately 24 m (80 ft).

PIPER FORMATION (JURASSIC, BATHONIAN)--Grayish-green shale, dusky-red and grayish-red-purple gypsiferous shale and gray limestone beds. Thickness of formation approximately 6 m (20 ft).

BIG SNOWY GROUP

Mo

OTTER FORMATION (MISSISSIPPIAN, CHESTERIAN)--Brilliant green-moderate-yellowish-green- and dark-greenish-gray-weathering shale and siltstone with thin platy micrite beds that locally contain black chert, stromatolites, and other algal structures. Thick-

ness of formation approximately 90 m (300 ft).

Mk

KIBBEY SANDSTONE (MISSISSIPPIAN, CHESTERIAN)--Moderate-red or

pale-red siltstone and fine-grained sandstone. Base not exposed
in map area.

MAP SYMBOLS



CONTACT--Dashed where approximately located.



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



ANTICLINE--Showing trace of crestline and direction of plunge; dotted where concealed. Direction of plunge unknown where plunge arrow is omitted.

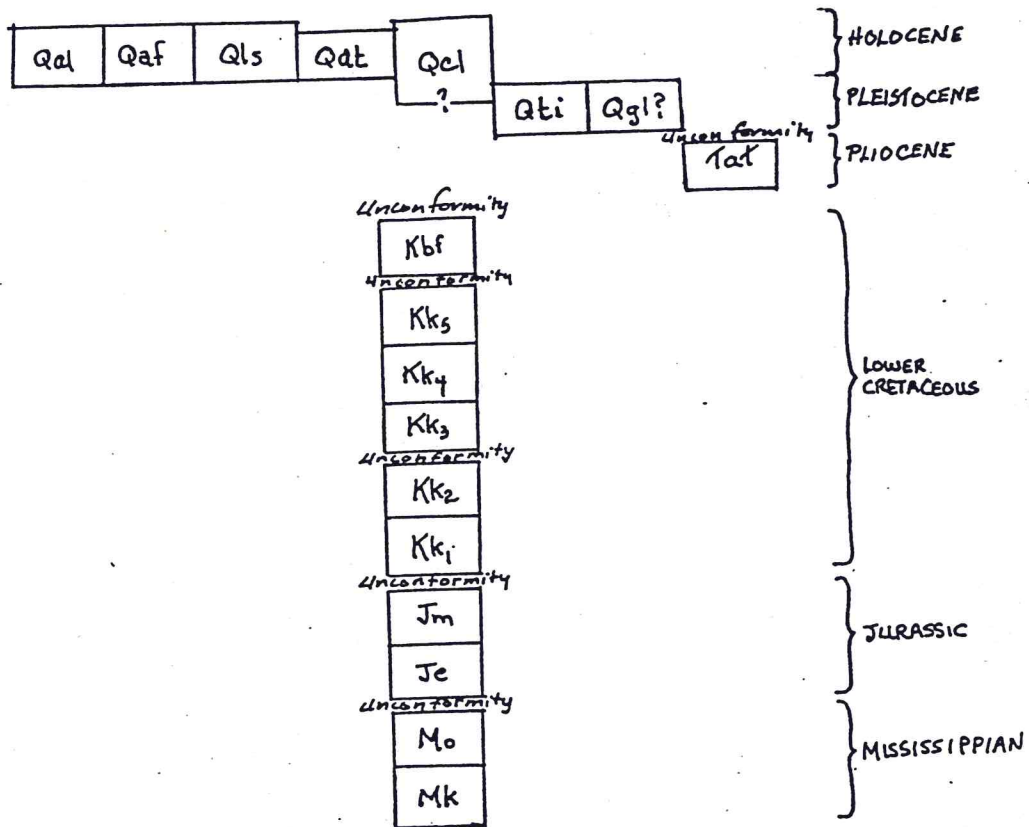


SYNCLINE--Showing trace of troughline and direction of plunge, dotted where concealed. Direction of plunge unknown where plunge arrow is omitted.



SANDSTONE BED--Thickness approximate, not all sandstone beds shown on map. Dashed where approximately located.

CORRELATION OF MAP UNITS
 ARMINGTON 7.5-MINUTE QUADRANGLE



PREVIOUS GEOLOGIC MAPPING, ARMINGTON 7.5-MINUTE QUADRANGLE

- Alden, W. C., 1932, Physiography and glacial geology of eastern Montana and adjacent areas: U.S. Geological Survey Prof. Paper 174.
- Calhoun, F. H. H., 1906, Montana lobe of the Keewatin ice sheet: U.S. Geological Survey Prof. Paper 50.
- 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.
- Fischer, C. A., 1909a, Geology of the Great Falls coal field, Montana: U.S. Geological Survey Bull. 356.
- Fischer, C. A., 1909b, Geology and water resources of the Great Falls region, Montana: U.S. Geological Survey Water-Supply Paper 221.
- U.S. Dept. of Agriculture, 1982, Soil survey of Cascade County area, Montana.
- Weed, W. H., 1899, Fort Benton Folio, Montana: U.S. Geological Survey Folio 55.