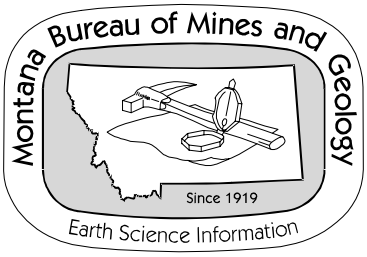
GEOLOGIC MAP OF THE MELSTONE 30’ x 60’ QUADRANGLE, EASTERN MONTANA

Compiled and mapped by Susan M. Vuke and Edith M. Wilde

Montana Bureau of Mines and Geology
Open File Report MBMG 513

2004



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

Partial support has been provided by the STATEMAP component of the National Cooperative Geologic Mapping Program of the U.S. Geological Survey under contract Number 04HQAG0079. .

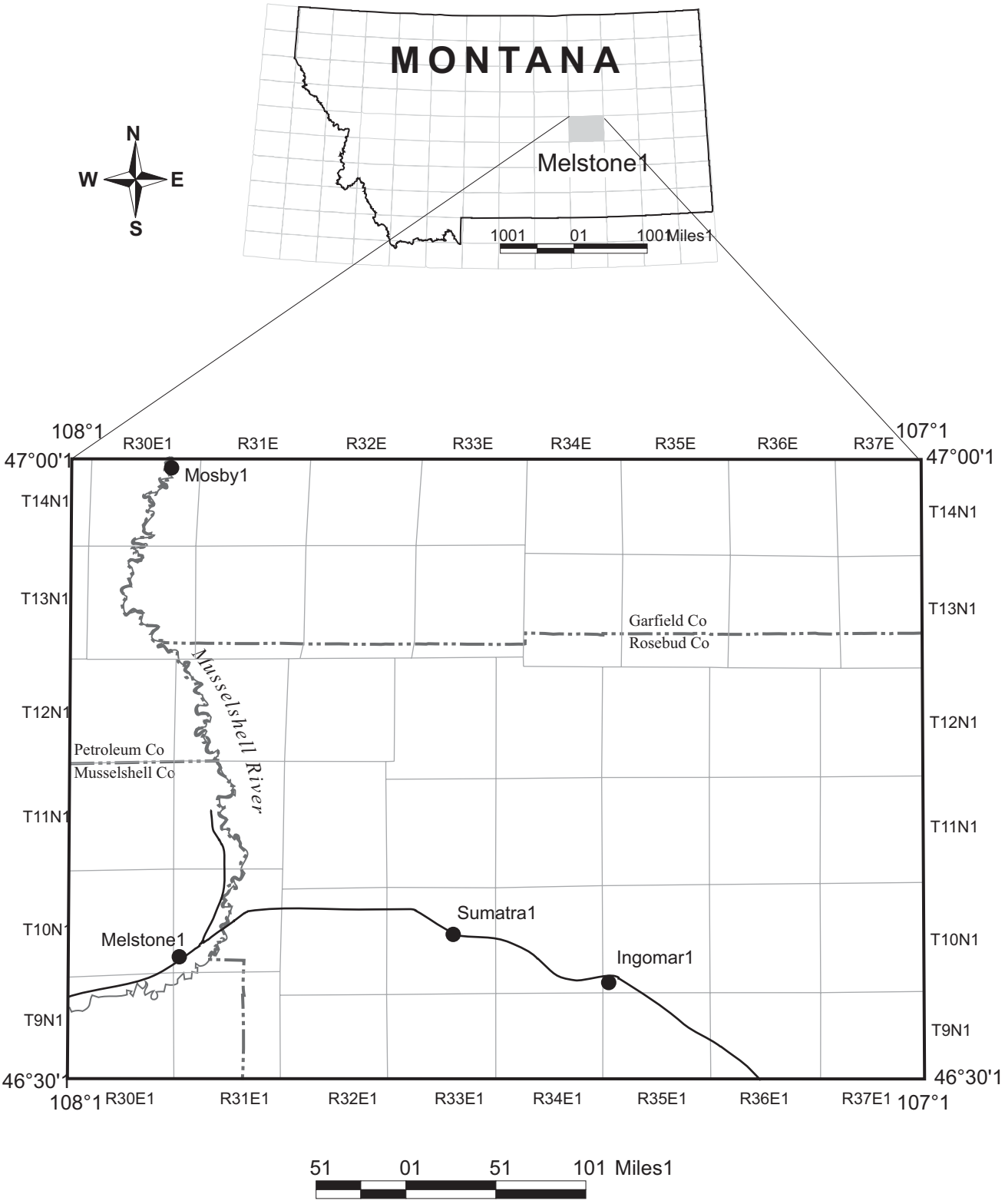
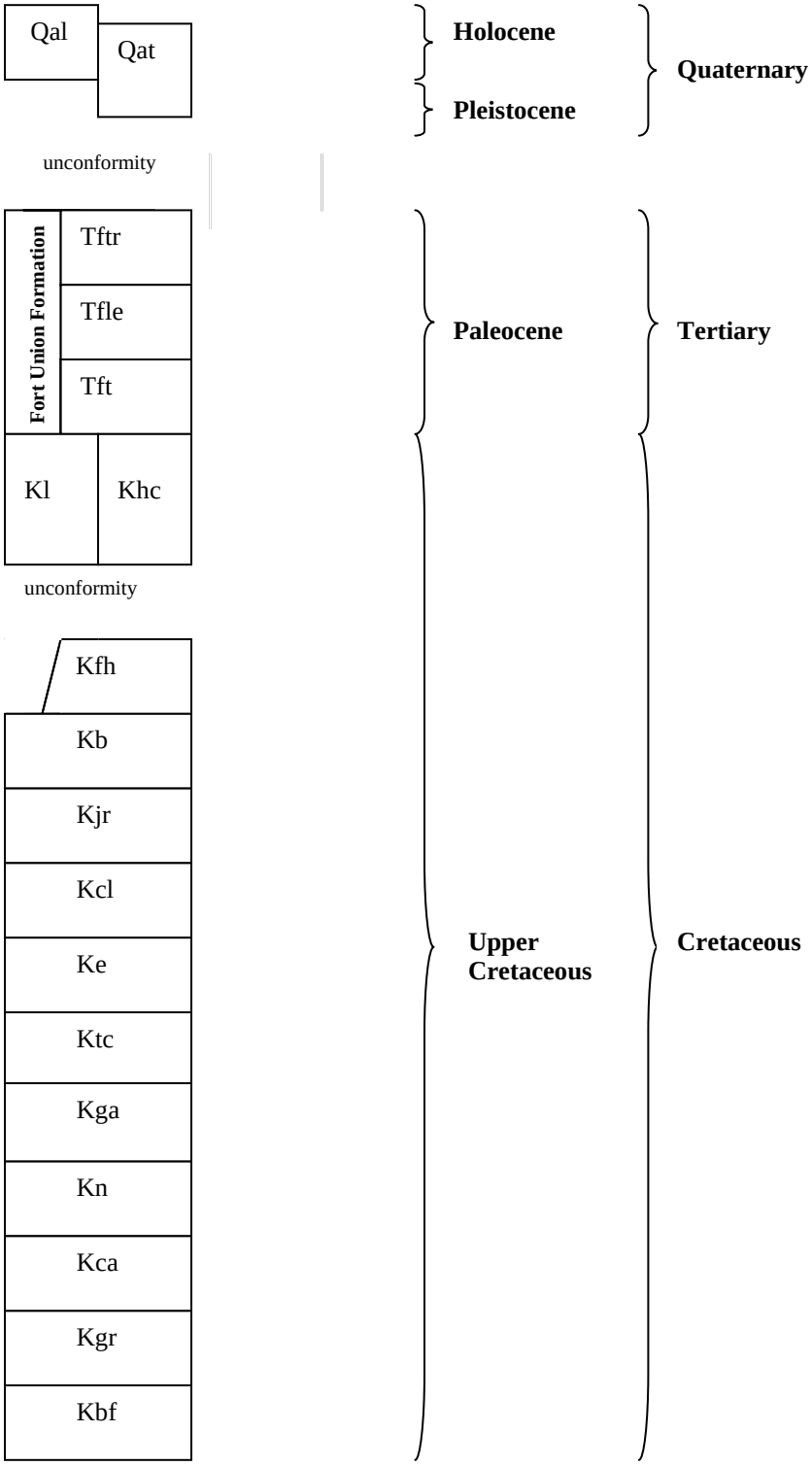


Figure 1. Location of Melstone 30'x60' quadrangle, eastern Montana.

CORRELATION DIAGRAM
MELSTONE 30’ x 60’ QUADRANGLE



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

108 °

107 °

47 °

Mosby 5, 7	Hill Ranch 5, 7	Dutton Ranch 5, 7	McWilliams Springs 2, 5, 7	McGinnis Butte 1, 2	Emma Butte 1, 2	School Butte 1, 2	Kramer Ranch 1, 2
Maxwell Ranch 5, 7	Mosby SE 5, 7, 8	Kinche-loe Ranch 5, 7, 8	Regnal Coulee 2	McGinnis Butte SW 1, 2	McGinnis Butte SE 1, 2	Hole-in-the-Rock 1, 2	Acorn Flats 1, 2
Melstone NW 3	Melstone NE 3, 8	Grebe Ranch 6, 8	Hecker Ranch 6, 8	Yablon-ski Ranch 8	Black Sea Reservoir 1	Hagen Ranch 1	Brown Coulee 1
Queens Point 3, 9	Melstone 3, 9	Guth-ridge Ranch 6, 8	Sumatra 6, 8	Ingomar West 8	Ingomar East 1, 4	Thebes 1	Zempel Lake 1

47 ° 30'

Numbers above correspond to numbers in list below:

1. Bowen, C.F., 1916, scale 1:250,000.
2. Bowen, C.F., 1921, scale 1:250,000.
3. Ellis, A.J., and Meinzer, O.E., 1924, scale 1:250,000.
4. Heald, K.C., 1927, scale 1:63,360.
5. Johnson, W.D., Jr., and Smith, H.R., 1964, scale 1:63, 360.
6. Pepper, M.W., 1955, scale 1:62, 500.
7. Reeves, Frank, 1927, scale 1:125, 000.
8. Smith, H.R., 1962, scale 1:62,500.
9. Woolsey, L.H., Richards, R.W., and Lupton, C.T., 1917, scale 1:62,500.

DESCRIPTIONS OF MAP UNITS
MELSTONE 30’ x 60’ QUADRANGLE

Qal **Alluvium (Holocene)—**Light-brown and gray gravel, sand, silt, and clay deposited in stream and river channels and on flood plains. Clasts well-rounded to subrounded. Deposits are poorly to well stratified. Thickness probably less than 15 ft.

Qat **Alluvial terrace deposit (Holocene and Pleistocene)—**(from Johnson and Smith, 1964) Gravel composed of subangular to rounded clasts dominantly of pebbles with subordinate cobbles. Composition of clasts primarily igneous rocks and limestone with some sandstone, chert, ironstone, quartzite, and shale. Generally unconsolidated, but locally cemented by calcium carbonate. Eight terrace levels (some combined on present map) range from 40 to 635 ft above the Musselshell River. Thickness generally about 8 ft, but ranges from a veneer to more than 60 ft.

Fort Union Formation (Paleocene)

Tftr **Tongue River Member—**Yellow, orange, or tan, fine- to medium-grained sandstone with thinner interbeds of yellowish-brown, orange, or tan siltstone, light-colored mudstone and clay, brownish-gray carbonaceous shale, and coal. Clay dominantly nonswelling. Upper part of member was removed by erosion in map area. Exposed thickness of member about 60 ft.

Tfle **Lebo Member—**Gray, greenish-gray, smectitic shale and mudstone that contains lenses and interbeds of gray and yellow, very fine to medium-grained, poorly resistant sandstone. The Big Dirty coal bed and associated dark-gray or grayish-brown carbonaceous shales are at or near the base of the member. Thickness of member about 150 ft.

Tft **Tullock Member—**Light-yellow and light-brown, planar-bedded very fine to medium-grained sandstone and subordinate gray shale with thin beds of dark-brown to black carbonaceous shale and coal. Thickness of member about 265 ft.

Khc **Hell Creek Formation (Upper Cretaceous)**—Dominantly gray, grayish-brown, and dusky-yellow, fine- to medium-grained, locally cross-bedded, locally calcium carbonate-cemented sandstone with subordinant orangish-brown sandstone, smectitic, silty, greenish-brown or gray shale and mudstone, and a few thin beds of carbonaceous shale. Brown calcium carbonate-cemented concretions with round, irregular, or cylindrical shapes are typical in the fine-grained sandstone. Ferruginous clay pebbles are present locally. Thickness 0-300 ft.

Kl **Lance Formation (Upper Cretaceous)—**Light-orange or light-tan, fine- to coarse-grained, massive to cross-bedded sandstone in lenses and channels interbedded with light-gray or greenish-yellow sandy shale. Calcium carbonate-cemented concretions occur locally in fine-grained sandstone. The Lance Formation represents a facies change from the Hell Creek Formation and is almost entirely lacking dark smectitic

shale and mudstone which is characteristic of the Hell Creek Formation. Sandstone in the Lance Formation is dominantly orange or tan and coarse-grained with few interbeds of finer-grained deposits, whereas sandstone in the Hell Creek Formation is dominantly gray and medium- to fine-grained with relatively thick interbeds of smectitic shale and mudstone. Thickness of Lance Formation 0-300 ft.

Kfh **Fox Hills Formation (Upper Cretaceous)**—Light-brown or light-yellowish-gray, thin- to thick-bedded, micaceous, fine- to medium-grained sandstone with ferruginous concretions in the upper part and thin-bedded siltstone and silty shale in the lower part. Apparently thinned or cut out by erosion in southwestern part of quadrangle because it is not present in west-adjacent Musselshell 30' x 60' quadrangle. Thickness 0-100 ft.

Kb **Bearpaw Shale (Upper Cretaceous)—**Dark-gray and dark-brownish-gray, bentonitic, fissile shale, and mudstone, with numerous thin bentonite beds and zones of calcareous and less common ferruginous concretions. Several intervals contain fossiliferous gray limestone concretions. Thickness 1100 ft.

Kjr **Judith River Formation (Upper Cretaceous)**—Upper: Very fossiliferous, light-brown, to light-gray, thin- to thick-bedded, fine- to medium-grained, cross-bedded sandstone that weathers tan, gray, and brown and contains lenses of resistant calcium carbonate-cemented sandstone. Lower: Interbedded gray to tan micaceous, noncalcareous, locally cross-bedded sandstone and olive-gray shale and silty shale. Local invertebrate fossil zones and trace fossils include *Ophiomorpha*. Local gray limestone concretions and brown ferruginous limestone concretions. Thin layer of black phosphate nodules and rounded bone fragments at base (Gill and others, 1972). Thickness of formation 215-275 ft.

Kcl **Claggett Shale (Upper Cretaceous)—**Dark-gray, thinly bedded, poorly resistant and poorly exposed shale with calcareous concretions, numerous bentonite beds, and some thin, lenticular, fine-grained sandstone beds. Shale bedding planes and fracture surfaces coated with jarosite and limonite. Numerous closely spaced dark-gray, brown-weathering, septarian limestone concretions, about 5 ft in diameter near top. Ardmore bentonite (Gill and others, 1972) near the base. Thickness 350-400 ft.

Ke **Eagle Sandstone (Upper Cretaceous)—**Yellowish-gray sandy shale with some thin yellowish-gray sandstone beds. Thickness 200 ft.

Ktc **Telegraph Creek Formation (Upper Cretaceous)—**Light-olive-gray to yellowish-gray sandy shale and sandstone with ironstone concretions in the lower part. Thickness 150 ft.

Kga **Gammon Shale (Upper Cretaceous)**—Light-gray, noncalcareous shale, silty shale, and lesser siltstone and fine-grained sandstone lenses, with thin beds of calcareous concretions, ferruginous concretions, and bentonite scattered throughout the

formation. Sandstone and shale more abundant near the top of the formation. Thickness about 350 ft.

Kn **Niobrara Shale (Upper Cretaceous)—**Upper: Interbedded dominantly calcareous and subordinately noncalcareous, poorly resistant, fissile, dark-gray shale, that contains siltstone beds, thin bentonite beds, and gray or orangish-brown calcareous or ferruginous concretions. Lower: Noncalcareous, poorly resistant, fissile, dark-gray shale with a few thin bentonite beds. Thickness of formation 250-380 ft.

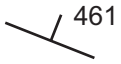
Kca **Carlile Shale—**(from Smith and Johnson, 1964) Dark-gray, sandy shale; upper two-thirds contains abundant limestone concretions that weather light gray and yellowish-orange. Zone of abundant ironstone concretions in the lower part. Thickness 310 ft.

Kgr **Greenhorn Formation—**Dark gray, calcareous shale that weathers very light gray. A thin, persistent bed of gray septarian limestone concretions occurs at the top of the formation, and a widespread bentonite bed about 1 m thick occurs one meter above its base. Thickness 25 ft.

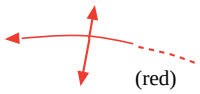
Kbf **Belle Fourche Formation—**Dark gray, locally silty or sandy, noncalcareous shale. Base of formation not exposed in map area. Exposed thickness 20 ft.

MAP SYMBOLS

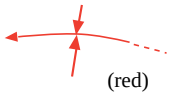
Contact—Dotted where concealed.



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



Anticline—Showing trace of axial plane and plunge arrows on Alice Dome and Cat Creek Anticline. Dotted where concealed.



Syncline—Showing trace of axial plane. Dotted where concealed.

Fault—Ball and bar on downthrown side. Dotted where concealed.

(red)

Johnson Ranch intrusions—Dikes and a diatreme of Tertiary aillikite (Irving and Hearn, 2003)

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