

**Geologic Map of the
Black Mountain 7.5' Quadrangle
Southwestern Montana**

Compiled and Mapped

by

Richard B. Berg

Montana Bureau of Mines and Geology

Open File Report MBMG 587
2009

Research supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program under USGS award number 08QAG0085. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

Introduction

The Black Mountain quadrangle is situated west of Helena and east of the Continental Divide and is transected by U.S. Highway 12 from east to west (Figures 1 and 2). The bedrock geology shown on this map was essentially compiled from Knopf (1963) with minor changes made to conform to a more accurate topographic base map than was available in 1963. Some terminology was changed to agree with modern usage and in several instances there are changes in geologic interpretation. Plutonic units are those described and mapped by Knopf with change in name where appropriate to those now in common usage (Streckeisen, 1976). Surficial deposits were mapped and described in more detail than shown on Knopf's map. Colors of some rocks are reported using the Munsell color scheme (Geological Society of America, 1995). Descriptions of Phanerozoic sedimentary rocks apply to those exposed in this quadrangle, which are almost without exception metamorphosed by plutons of the Boulder batholith.

Geologic Summary

The oldest rocks in this quadrangle are metasedimentary rocks of the Mesoproterozoic Belt Supergroup. In ascending order they are Helena Formation, Snowslip Formation, and the lower part of the Shepard Formation. The metamorphism recognized in these formations is thought to be generally regional and not contact metamorphism. The Flathead Formation unconformably overlies the formations of the Belt Supergroup and is strongly metamorphosed by the plutons of the Boulder batholith. The Phanerozoic sequence in ascending order is Flathead Formation, Wolsey Shale, Meagher Formation, Park Shale, Hasmark Dolomite, Red Lion Formation, Jefferson Formation, Three Forks Formation, and Madison Group. The Amsden, Quadrant, and Phosphoria Formations unconformably overlie the Madison Group; of these only the quartzite of the Quadrant Formation typically is exposed. Metamorphosed Paleozoic formations are well exposed both along the east side of Nelson Gulch south of Ten Mile Creek and along Blue Cloud Creek north of Ten Mile Creek between metasedimentary rocks of the Belt Supergroup and plutonic rocks to the west. Jurassic and Cretaceous formations have been metamorphosed to such an extent that they cannot be distinguished. Exposures of these formations are predominately ledge-forming quartzite. Many specimens of the Elkhorn Mountains Volcanics show a somewhat splotchy coloration that is attributed to contact metamorphism. High-angle northeast-striking faults were recognized in the sedimentary formations in the eastern part of the Black Mountain quadrangle where these units are well exposed. The lack of mapped faults in plutons may result from the difficulty of recognizing faults in these igneous rocks.

Both the eastern contact of the porphyritic granodiorite (Kpgr) with the Jefferson (Dj) and Three Forks (MDt) formations, and the western contact north of Tenmile Creek where it intruded the Elkhorn Mountains Volcanics (Kem) are steep to vertical. The contact of the porphyritic granodiorite pluton with metamorphosed Jurassic and Cretaceous formations in the area east of the north-flowing section of Tenmile Creek is

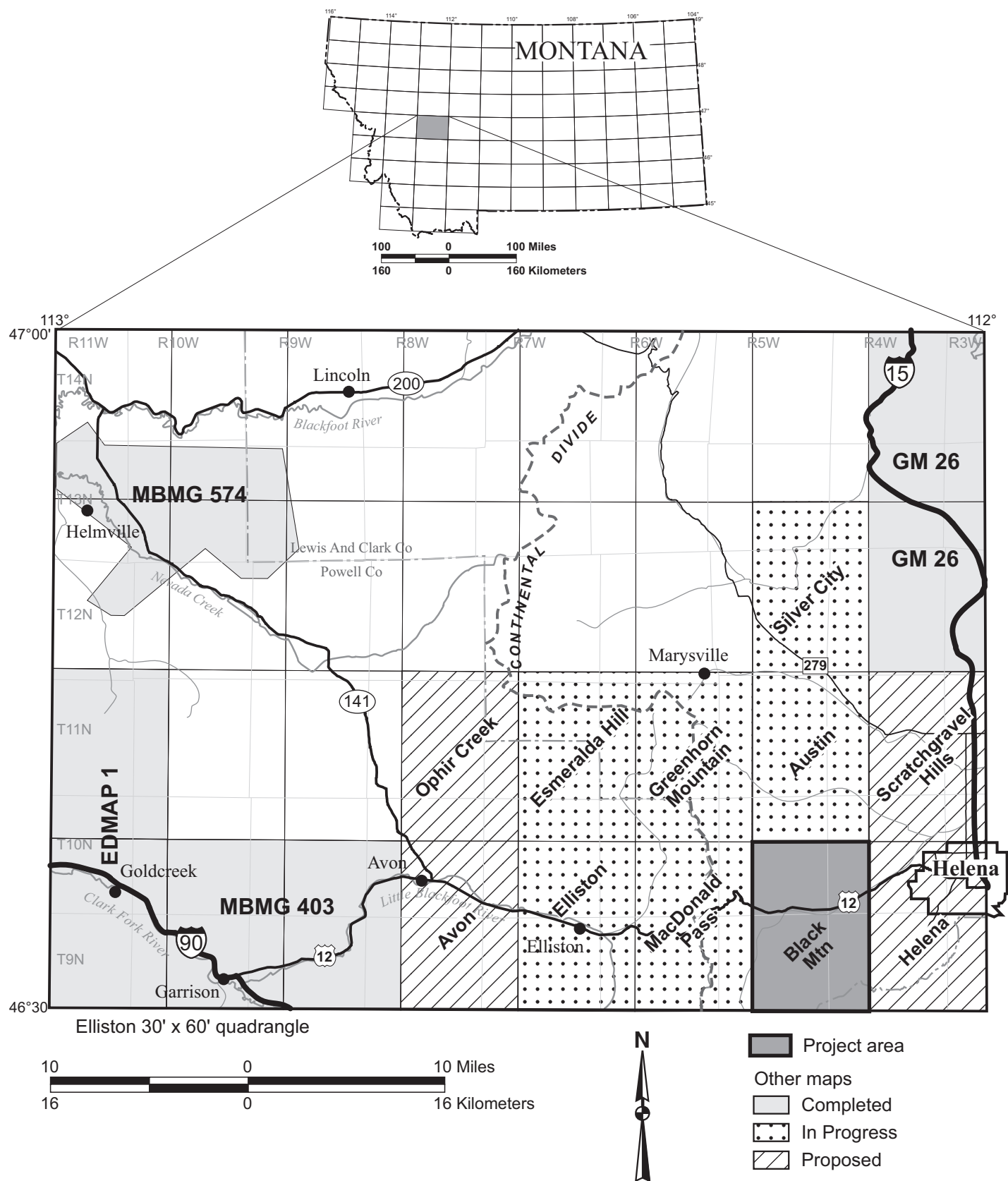


Figure 1. Location map of the Black Mountain 7.5' quadrangle. Completed maps (MBMG 403 and 574, and EDMAP 1) are available at the Montana Bureau of Mines and Geology Publications Office and online at www.mbmng.mtech.edu. GM 26 is only available in paper format.

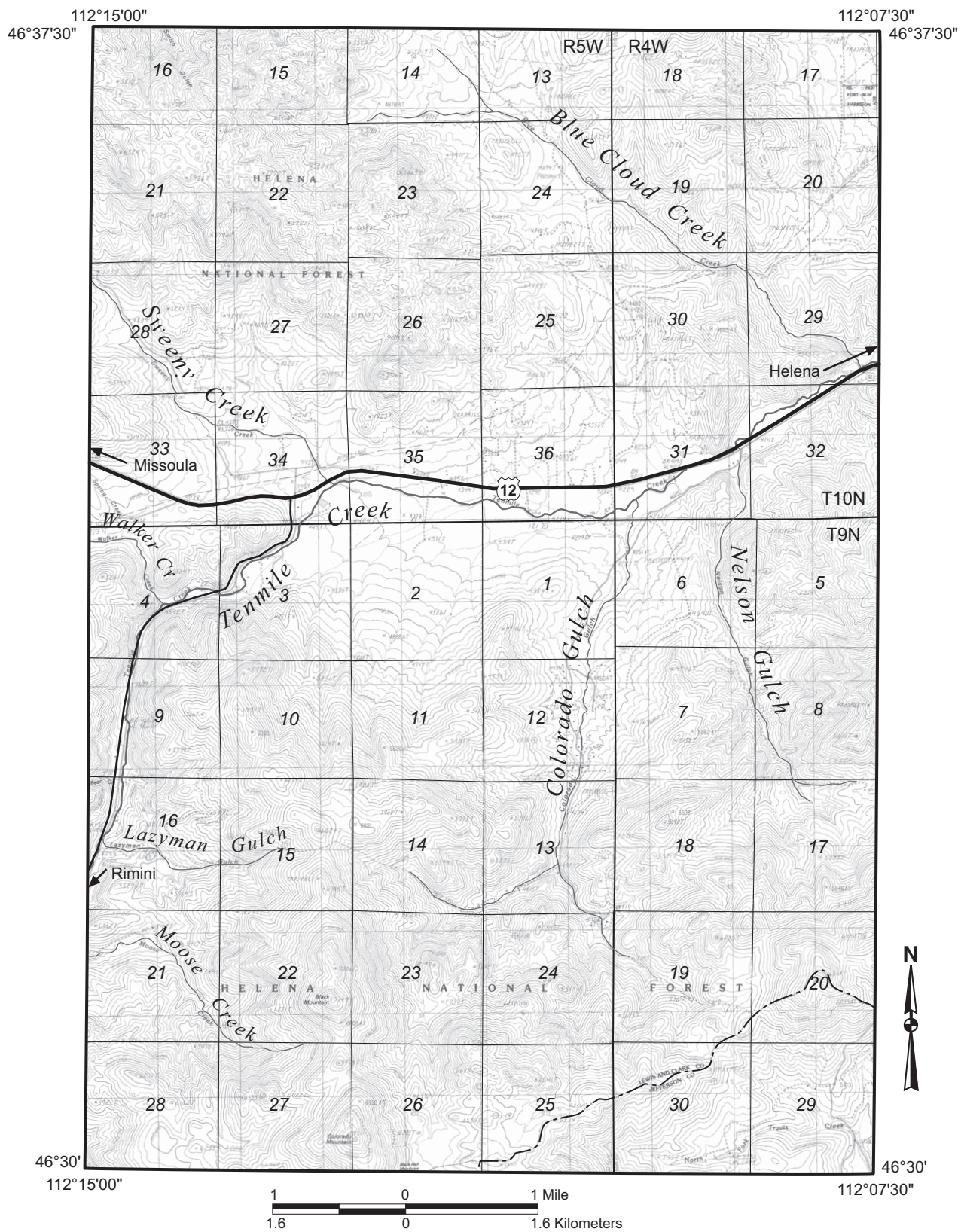


Figure 2. Black Mountain 7.5' quadrangle. Base adapted from U.S.G.S. 1:24,000 scale map.

probably gently inclined to the west. This attitude is suggested by the widespread metamorphism of these sedimentary rocks and also by porphyritic granodiorite that is exposed in the NE¼ sec.10, T. 9 N., R. 5 W. where a small gulch also exposes Jurassic and Cretaceous formations below the granodiorite.

Glacial features are recognizable along the north-flowing section of Tenmile Creek near the western boundary of the Black Mountain quadrangle. Evidence for glacier development has not been recognized in the Black Mountain quadrangle, but the glacier that flowed down Tenmile Creek probably formed to the southwest at the head of Tenmile Creek where elevation is as much as 2,250 m (7,400 ft). The northern extent of this glacier in the Tenmile Creek valley can only be inferred from the change in valley profile from a fairly broad valley to a much narrower valley near the northern boundary of sec. 9, T. 9 N., R. 5 W. Glacial till containing large granodiorite boulders is present up to an elevation of 1,633 m (5,360 ft) just south of Lazyman Gulch, indicating that in this section of Tenmile Creek the glacier must have been at least 150 m (500 ft) thick. The meadow about 1 km (0.6 mile) south of Lazyman Gulch along Moose Creek was part of a glacial lake formed when lower Moose Creek was blocked by this glacier. Also blockage of the outlet of Lazyman Gulch by this glacier diverted flow for about 1 km through a channel to the north to form a large alluvial fan along Tenmile Creek at the mouth of this small unnamed creek. This alluvial fan is much larger than would be expected at the mouth of a small creek. Although not apparent on the topographic map, a prominent ice-marginal channel is recognizable just north of Lazyman Gulch. Also an ice marginal channel has been recognized on the west side of Tenmile Creek in this same area (Mike Cannon, oral communication, 2009). A large volume of outwash was deposited in the Tenmile Creek Valley east of the point where Tenmile Creek emerges from its canyon and enters a broad valley. A braided pattern is prominent in the western part of this outwash deposit where granitic boulders as large as 1.3 m (4 ft) have been excavated. These boulders are of nonporphyritic granodiorite consistent with the bedrock source being either the Unionville granodiorite (Kugd) or Clancy granodiorite (Kcgd), both exposed along Tenmile Creek 6.5 km (5 miles) upstream from the western boundary of the Black Mountain quadrangle.

A small alluvial fan deposit of large granitic boulders at the mouth of a small gulch in the E ½ sec. 3, T. 9. N., R. 5 W. is attributed to an unusual event that provided a large amount of water over a short interval. The largest granitic boulder seen in this alluvial deposit is 3.1 m (10 ft) long.

Descriptions of Map Units in the Black Mountain 7.5' Quadrangle

Qal Alluvium of modern channels and flood plains – Gravel, sand, silt and clay along Tenmile Creek and its tributaries. Alluvium along Tenmile Creek south of the confluence of Walker Creek near the western boundary of the Black Mountain quadrangle consists of reworked glacial till in which much of the finer material has been carried downstream leaving granitic (Unionville

granodiorite) boulders deposited by the glacier or glaciers that occupied this valley. Near the eastern border of the Black Mountain quadrangle, alluvium along Tenmile Creek consists mainly of pebbles and cobbles of nonporphyritic granodiorite, probably reworked glacial outwash.

- Qac Alluvium and colluvium, undivided** – Mainly soil containing poorly sorted rocks of local sources that were deposited by sheetwash and to a lesser extent fluvial action. Generally insufficient concentrations of lithologies to make an inference as to underlying bedrock.
- Qaf Alluvial fan deposit** – Small deposits of locally derived detritus along Tenmile Creek at the mouths of several gulches near the eastern boundary of this quadrangle. These deposits were identified from their morphology.
- Qao Alluvium, older, undivided** – Remnants of alluvial sediment that form benches along Nelson Gulch 3-5 m (10-15 ft) above the level of modern alluvium. This unit consists of clay and silt interbedded with angular pebbles derived from local sources. A white bed about 1 cm (4 in) thick contains abundant volcanic ash, possibly Mount Mazama ash.
- Qafo Alluvial fan deposit, older** – Alluvial fan along Tenmile Creek in SW $\frac{1}{4}$ sec. 9, T. 9 N., R. 5 W. formed when the Tenmile glacier blocked the present outlet of Lazyman Gulch and water was forced to flow along a small gulch to the north depositing this alluvial fan.
- Qgo Glacial outwash deposit** – Glacial outwash covers a large part of the broad Tenmile Creek valley in the central and eastern part of the Black Mountain quadrangle. In the upper part of this outwash deposit (NW $\frac{1}{4}$ sec. 3, T.10 N., R.5 W.) large granitic boulders as large as 1.2 m (4 ft) in maximum dimension have been excavated from the outwash during construction. To the east, smaller granitic boulders form low east-trending ridges.
- Qgl Glacial lake deposit** – A meadow along Moose Creek east of Tenmile Creek was inferred to have been occupied by a small glacial lake when a glacier along Tenmile Creek blocked Moose Creek.
- Qgt Glacial till** – Granitic boulders, some as much as 3 m (10 ft) across, are scattered over Elkhorn Mountains Volcanics bedrock in a small area east of Tenmile Creek. The maximum elevation of this till is approximately 1,630 m (5,360 ft). Evidently the smaller material has been removed by erosion leaving these large boulders.
- Qp Pediment deposit** – The pediment south of Tenmile Creek has a thin veneer of gravel that consists of quartzite and siltite cobbles of metamorphosed Jurassic and Cretaceous units and also Elkhorn Mountains Volcanics.

- QTgr Gravel** – Poorly sorted, matrix-supported gravel with much dark brown clay at least 10 m (30 ft) thick. Contains cobbles of pale green siltite of the Belt Supergroup and less abundant white quartzite, hornfels, and marble. Granitic clasts were not recognized. This gravel has been mined locally for gold along Blue Cloud Creek and also along a tributary to the west.
- Tda Dacite** – Dacite bodies range from small dikes to what appear to be bodies of irregular shape on the basis of float. Crumbly exposures weather reddish brown. Sparse quartz and feldspar (K feldspar?) phenocrysts in a dense, fine-grained ground mass.
- Kgp Granodiorite porphyry and related porphyries** – Dikes and sills that range in composition from tonalite to granite are included in this category. Some of these porphyries have large phenocrysts of plagioclase, orthoclase, and quartz in a fine-grained, microcrystalline groundmass (Knopf, 1963).
- Kgd Granodiorite undivided** – Best exposures are in roadcuts along U.S. Highway 12. It is similar to the porphyritic granodiorite to the east (Kgdp), but lacks the prominent K-feldspar phenocrysts.
- Kdip Diorite porphyry** – Stocks, dikes, and sills that are composed of andesine and less conspicuous hornblende and biotite phenocrysts in a microcrystalline groundmass (Knopf, 1963).
- Kal Alaskite and aplite** – Two 1-m (3-ft) thick aplite dikes north of Tenmile Creek form low ridges because of their greater resistance to erosion than the surrounding granodiorite. These alaskite dikes consist of a granular mixture of quartz and alkali feldspar.
- Kqm Quartz monzonite** – Biotite adamellite of Knopf (1963). The plagioclase content is approximately equal to the K-feldspar content of this rock that also contains biotite.
- Kgdp Porphyritic granodiorite** – The bedrock of much of the Black Mountain quadrangle is porphyritic granodiorite that is characterized by prominent euhedral K-feldspar megacrysts that range up to 3 cm in length. Smedes, Klepper, and Tilling (1988) reported that an average modal composition for this rock is 40 percent plagioclase, 24 percent alkali feldspar, 24 percent quartz, 7 percent biotite, 3 percent hornblende, and a total of one percent for the accessory minerals magnetite, titanite, apatite, and zircon. Aplite dikes and mafic xenoliths although present are sparse. Closely spaced joints, particularly in the sparsely timbered area north of Sweeney Creek, produce slabby outcrops. The drainage pattern developed in the porphyritic granodiorite north of Tenmile Creek is characterized by abrupt changes in south-flowing creeks to northeast and northwest orientation presumably caused by well-developed joints. This unit was quarried for

dimension stone at numerous small quarries near the eastern limit of exposures north of Tenmile Creek.

- Kng Nonporphyritic granodiorite** – This minor unit is exposed adjacent to the eastern contact of the porphyritic granodiorite and is considered to be an equigranular equivalent of the porphyritic granodiorite (Knopf, 1963).
- Kcgd Clancy granodiorite** – The Clancy granodiorite as designated by Knopf (1963) was equated with the Butte quartz monzonite by Smedes, Klepper, and Tilling (1988). The Clancy granodiorite is a hornblende-biotite granodiorite with conspicuous quartz (Knopf, 1963).
- Kugd Unionville granodiorite** – An augite-hornblende-biotite granodiorite that is typically medium grained and equigranular. Locally a dark gray, hypersthene granogabbro near contacts (Smedes, Klepper, and Tilling, 1988).
- Kem Elkhorn Mountains Volcanics** – A variety of lavas, tuffs, and breccias that range in composition from basalt and andesite to rhyodacite. Dark, greenish gray with recognizable plagioclase and pyroxene phenocrysts in some outcrops. Xenoliths of Kem occur in porphyritic granodiorite next to the contact with Kem. Weak foliation of Kem next to contact with porphyritic granodiorite is attributed to contact metamorphism.
- KJs Sedimentary rocks, undivided** – Metamorphosed sedimentary rocks considered to be Jurassic and Cretaceous on basis of comparison to unmetamorphosed sedimentary rocks of this age to the east (Knopf, 1963). Light olive gray (5Y5/2) to light gray (N6) medium-grained, feldspathic quartzite with prominent biotite porphyroblasts (?) forms ledges and is the most prominent lithology of this unit. Subrounded detrital quartz grains are generally recognizable and fine-grained intergranular material is probably chlorite. Hornfels generally occurs only as float.
- PMpa Phosphoria, Quadrant, and Amsden Formations, undivided** – The Quadrant Formation is 110 m (370 ft) thick east of the Black Mountain quadrangle (Knopf, 1963). Contact metamorphism of the Quadrant Formation has produced an extremely hard, flinty quartzite in which individual detrital quartz grains are barely recognizable. This quartzite is much harder than metamorphosed Flathead Formation quartzite. The Phosphoria and Amsden Formations are poorly exposed in this area and have not been described.
- Mm Madison Group, undivided** – The Madison Group is 400 m (1,300 ft) thick in this area and consists essentially of limestone (Knopf, 1963). In the Black Mountain quadrangle contact metamorphism has produced a crumbly, sucrosic marble that forms rounded outcrops medium gray (N5) to white (N9). Actinolite is reported in the lower unit that is 90 m (300 ft thick) (Knopf, 1963).

- MDt Three Forks Formation** – The Three Forks Formation is 105 m (350 ft) thick and consists in ascending order of 75 m (240 ft) of green shale, 8-15 m (25-50 ft) of limestone, 10-30 m (35-90 ft) of blue black shale, and 15 m (50 ft) of light-bluish gray scapolite-diopside hornfels (Knopf, 1963). The most distinctive lithology is the scapolite-diopside hornfels that forms a low ridge composed of blocky outcrops with small grooves several millimeters thick and weathers orange (10R 6/6) to very pale orange (10YR 8/2). A fresh surface of this hard, flinty hornfels is very light gray (N 8). Dark gray (N 3) chips of the blue-black shale poorly exposed next to this hornfels, appear to lack evidence of metamorphism.
- Dj Jefferson Formation** – The Jefferson Formation is 230 m (750 ft) thick and consists of interbedded limestone and dolomite. Periclase and brucite formed by contact metamorphism in some of the dolomite, have weathered out leaving many small cavities several millimeters across (Knopf, 1963). Coarsely crystalline calcitic marble weathers medium dark gray (N4) to dark gray (N3), forms rounded outcrops, and in some exposures contains light gray and dark gray streaks. The dolomitic marble is yellowish gray (5Y 8/1) and also forms rounded outcrops with local development of dolomite sand. The calcitic marble has a slightly fetid odor on a fresh fracture and the dolomitic marble has a stronger fetid odor.
- Erl Red Lion Formation** - The Red Lion Formation is 50 m (160 ft) thick and consists in ascending order of 6 m (20 ft) of thin-bedded calc-hornfels, 15 m (45 ft) of cordierite hornfels, and 30 m (100 ft) of interbedded limestone and dolomite. Crinkly filaments of chert occur in a zone 8-15 m (25-50 ft) thick in the upper limestone and dolomite unit (Knopf, 1963).
- Eh Hasmark Dolomite** – The Hasmark Dolomite is 140 m (450 ft) thick and is an unusually pure dolomite as based on 29 chemical analyses (Knopf, 1963). Contact metamorphism of the Hasmark Formation has produced sucrosic marble that forms rounded outcrops with gray and white splotches on a weathered surface. On a fresh surface marble is white (N9).
- Ep Park Shale** – The Park Shale is 55-60 m (180-200 ft) thick (Knopf, 1963) and has been metamorphosed to a very hard cordierite-bearing hornfels that breaks with a conchoidal fracture. Color on a fresh surface is brownish black (5YR2/1) and it is medium dark gray (N 4) on a weathered surface.
- Em Meagher Formation** – The Meagher Formation is 195 m (640 ft) thick and where unmetamorphosed consists of pure limestone 85 m (280 ft) thick in the upper part and 110 m (360 ft) of thin-bedded siliceous dolomitic limestone below this (Knopf, 1963). Where metamorphosed the lower diopside-calcite marble forms a distinctive surface where calcite has weathered out leaving lenticular solution pits 1-2 cm wide. Diopsidic layers are greenish gray (5G 6/1) and calcitic layers are very light gray (N8).

- €w Wolsey Shale** – The Wolsey Shale is estimated to be 40 m (130 ft) thick along the ridge between Nelson and Colorado Gulches where it is a hornfels, but not nearly as hard as the hornfels produced by metamorphism of the Park Shale. Color on a fresh surface is greenish black (5GY 2/1) and brownish black (5Y 2/1) on a weathered surface.
- €f Flathead Formation** – The Flathead Formation ranges in thickness from 26 to 63 m (86 to 206 ft) in the Helena area (Knopf, 1963). Where metamorphosed the quartzite forms outcrops that are strongly joint controlled and the weathered surface is somewhat greasy. Individual rounded quartz grains are easily recognizable on both weathered and fresh surfaces and cross stratification is recognizable. Color is grayish orange pink (5YR 7/2) to light brown (5YR 5/6) on a weathered surface and white (N 9) on a fresh fracture.
- Yss Shepard and Snowslip Formations, undivided** – This unit of the Shepard and Snowslip Formations was shown as the Marsh Formation in earlier work by Knopf (1963). The approximate thickness of the stratigraphic interval between the Helena Formation on the east and the Cambrian Flathead Formation on the west along the north side of Tenmile Creek is approximately 700 m (2,300 ft). Because the reported thickness of the Snowslip Formation is about 400 m (1,300 ft) and the overlying Shepard Formation is about 335 m (1,100 ft) thick (Schmidt and others, 1994), it appears that both the Snowslip Formation and the lower part of the Shepard Formation are exposed here. Exposures are dark gray (N3) siltite that contains 1 mm to 1 cm thick, greenish gray (5GY6/1) argillaceous laminae that weather more rapidly than the surrounding siltite to accentuate small sedimentary structures. White, spherical porphyroblasts of an unidentified mineral are locally present.
- Yh Helena Formation** – Mainly light olive gray (5Y6/1) very fine-grained dolomite that forms blocky outcrops and frequently breaks with a conchoidal fracture. Typically grayish orange (10YR7/4) to brown (5YR4/4) on a weathered surface. Dolomite weathers to form a fluted surface with millimeter-wide to centimeter-wide ridges and in some outcrops irregular elongate pits. The fluted surfaces are caused by solution of calcitic laminae in some instances and in other instances the ridges are caused by quartz laminae. Abundant argillaceous beds as much as several meters thick typically show well-developed cleavage and form irregular outcrops. The Helena Formation is 1,200 m (4,000 ft) thick (Knopf, 1963).

Acknowledgments

Ideas proposed by Bob Bergantino, Mike Cannon, and Chad Wittkop concerning the glacial deposits along Tenmile Creek have contributed significantly to my understanding of the glacial history of this area. Reviews by Bob Bergantino, Phyllis Hargrave, Susan Vuke, John Metesh, and Ed Deal improved this report and are appreciated.

References

Geologic maps for Black Mountain quadrangle and adjoining areas

Knopf, A., 1963, Geology of the northern part of the Boulder batholith and adjacent area, Montana: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-381, scale 1:48,000.

Lewis, R.S., 1988, [compiled and mapped by] Geologic map of the Butte 1° x 2° quadrangle, southwestern Montana: Montana Bureau of Mines and Geology Open-file Report MBMG 363, scale 1:250,000.

Smedes, H.W., Klepper, M.R., and Tilling, R.I., 1988, Preliminary map of plutonic units of the Boulder batholith, southwestern Montana: U.S. Geological Survey Open-file Report 88-283 and Montana Bureau of Mines and Geology Open-file Report 201, scale 1:200,000.

Schmidt, R.G., Loen, J.S., Wallace, C.A., and Mehnert, H.H., 1994, Geology of the Elliston region, Powell and Lewis and Clark Counties, Montana: U.S. Geological Survey Bulletin 2045, 25 p., scale 1:62,500.

Stickney, M.C., 1987, Quaternary geologic map of the Helena Valley, Montana: Montana Bureau of Mines and Geology Geologic Map 46, scale 1:50,000.

Thamke, J.N., and Reynolds, M.W., 2000, Hydrology of the Helena area bedrock, west-central Montana, 1993/98: U.S. Geological Survey Water-Resources Investigations Report 00-4212, 119 p. (with a section on geologic setting and a generalized bedrock geologic map by M.W. Reynolds, scale 1:100,000).

Other publications including those referred to in Figure 1.

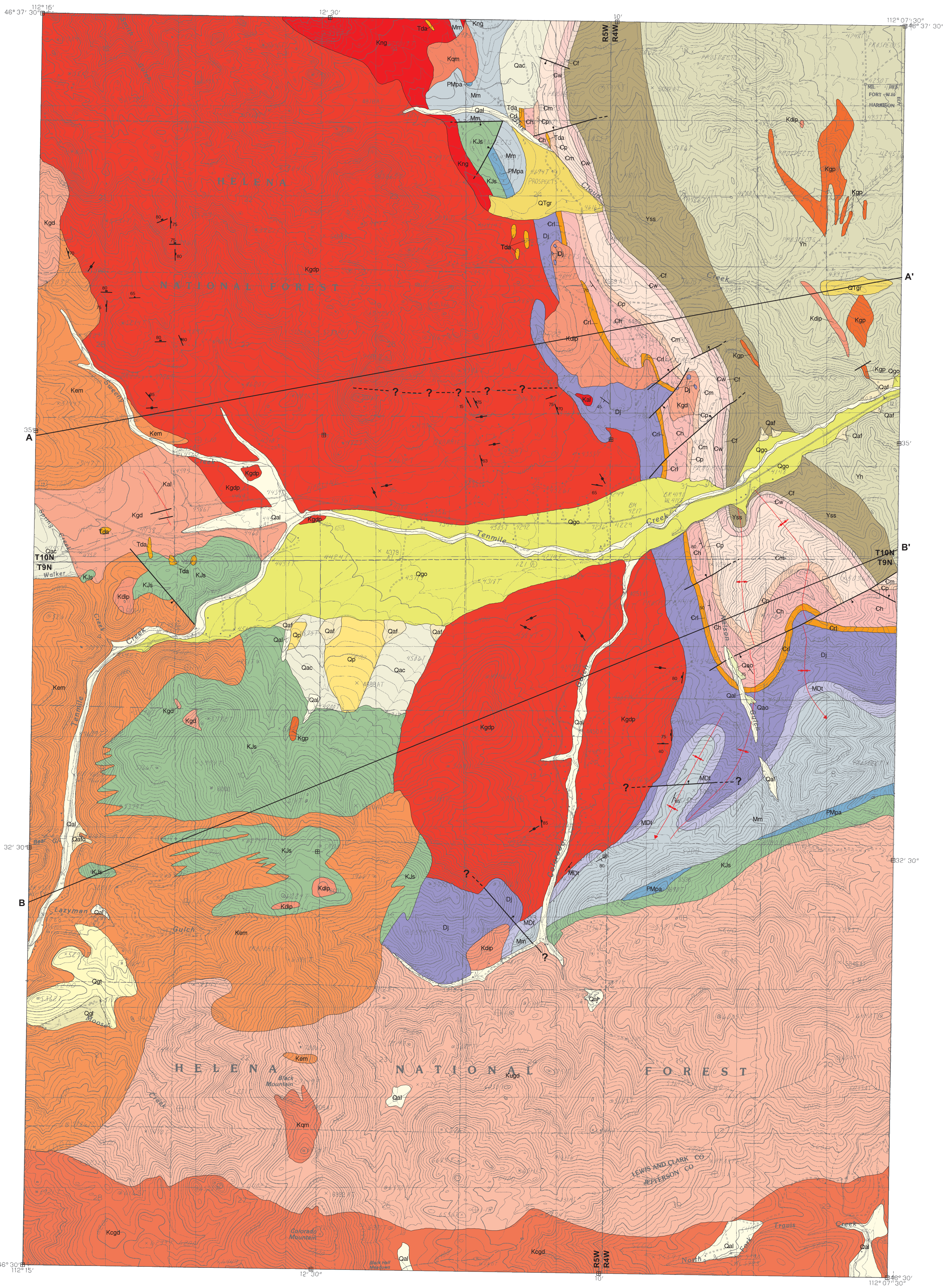
Bregman, M.L., 1981, Structural geology of the Sheep Creek and Rattlesnake Mountain Quadrangles, Lewis and Clark County, Montana: Montana Bureau of Mines and Geology, Geologic Map GM 26, scale 1:24,000.

Brooks, J.A., and Sears, J.W., 2009, Geologic maps of the Griffin Creek and Bailey Mountain Quadrangles, Montana Bureau of Mines and Geology EDMAP 1, Scale 1:24,000.

Geological Society of America, 1995, Rock-Color Chart, with genuine Munsell color chips (8th printing): Boulder, CO, Geological Society of America.

Knopf, A., 1957, The Boulder batholith of Montana: American Journal of Science, v. 255, p. 81-103.

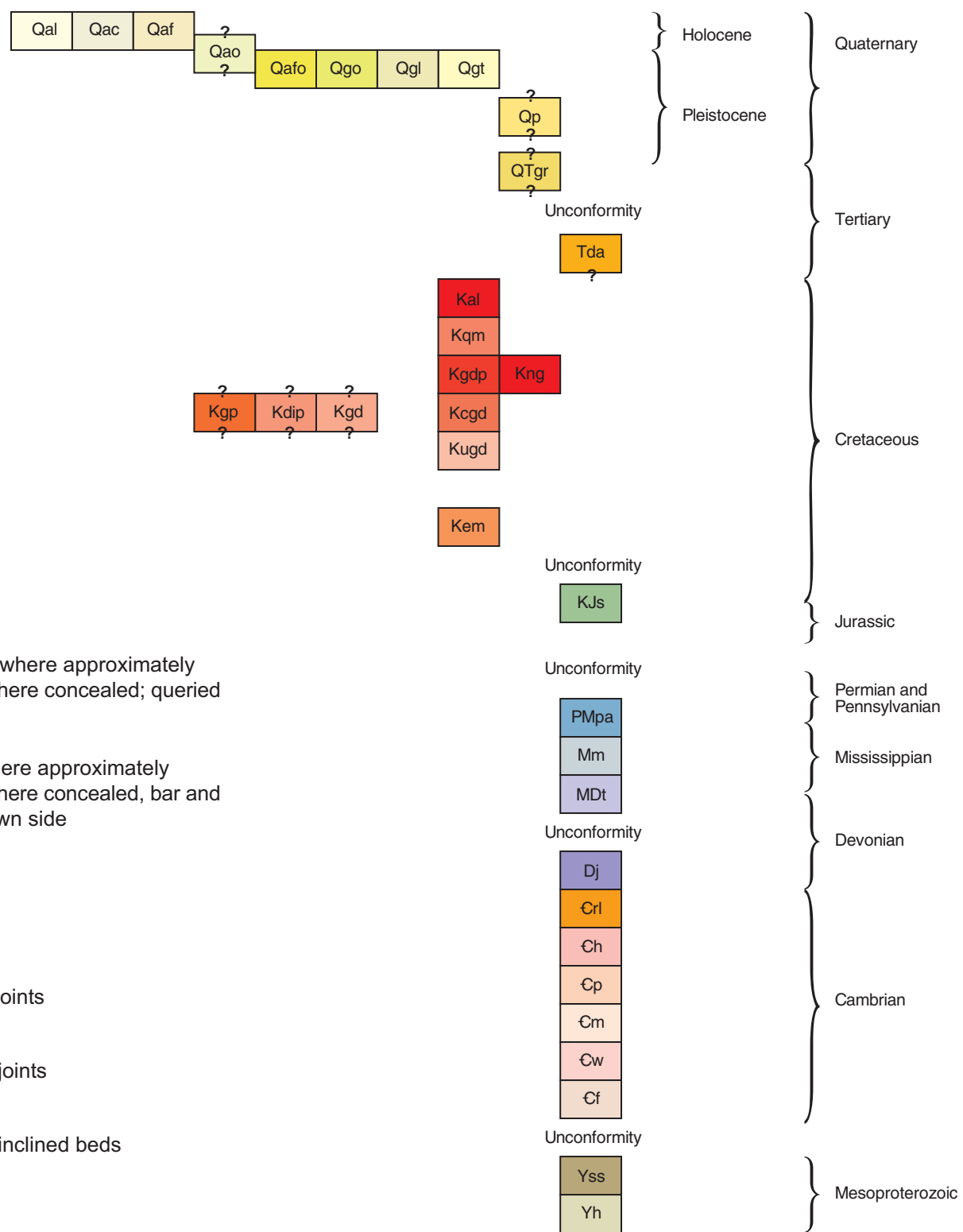
- McCune, J.G., and Hendrix, M.S., 2009, Geologic map of the Helmville basin, west-central Montana, Montana Bureau of Mines and Geology Open-file Report MBMG 574, scale
- Schmidt, R.G., 1986, Geology, earthquake hazards, and land use in the Helena area, Montana – A review: U.S. Geological Survey Professional Paper 1316, 64 p.
- Sears, J.W., Webb, B., and Taylor, M., 2000, Bedrock geology of the Garrison and Luke Mtn. 7.5' Quadrangles, Powell Co., Montana: Montana Bureau of Mines and Geology Open-file Report MBMG 403, scale 1:24,000.
- Streckeisen, A., 1976, To each plutonic rock its proper name: Earth-Science Reviews, v. 12, p. 1-33.



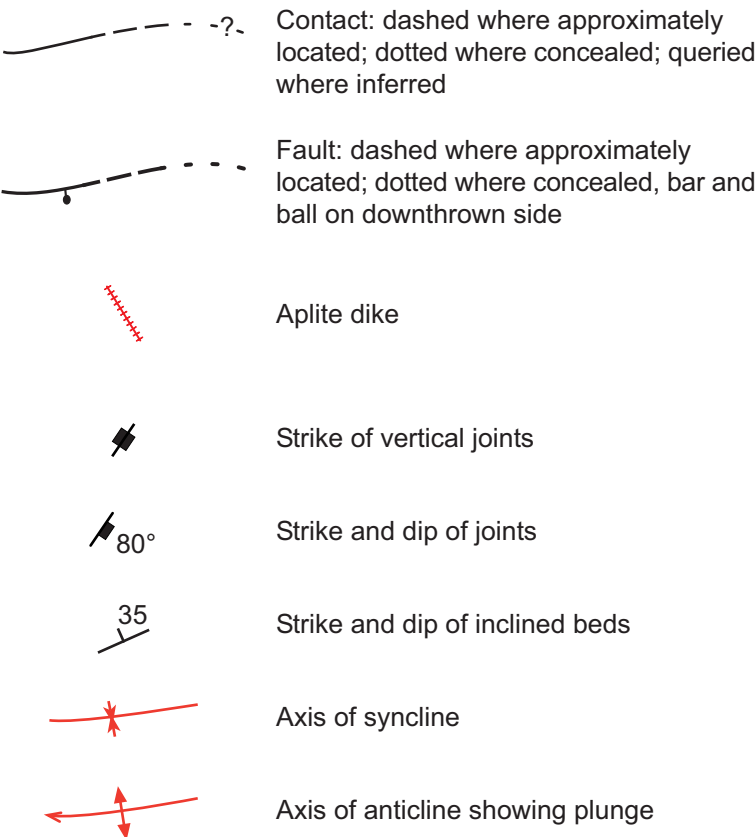
MAP UNITS	
Qal	Alluvium of modern channels and flood plains
Qac	Alluvium and colluvium, undivided
Qaf	Alluvial fan deposit
Qao	Alluvium, older, undivided
Qalo	Alluvial fan deposit, older
Qgo	Glacial outwash deposit
Qgl	Glacial lake deposit
Qgt	Glacial till
Qp	Pediment deposit
QTgr	Gravel
Tda	Dacite
Kgp	Granodiorite porphyry and related porphyries
Kgd	Granodiorite, undivided
Kdp	Diorite porphyry
Ksa	Alaskite and apfite
Kqm	Quartz monzonite
Kgp	Porphyritic granodiorite
Kng	Nonporphyritic granodiorite
Kgdp	Clancy granodiorite
Kugd	Unionville granodiorite
Kem	Elkhorn Mountain volcanics
Kls	Cretaceous and Jurassic, undivided
PMpa	Phosphoria, Quadrant and Anaden Formations, undivided
Mm	Madison Group, undivided
MDi	Three Forks Formation
Dj	Jefferson Formation
Cr	Red Lion Formation
Ch	Haskam Dolomite
Cp	Park Shale
Cm	Meagher Formation
Cw	Wolsey Shale
Cf	Flathead Formation
Yss	Shepard and Snowslip Formations, undivided
Yh	Helena Formation

For a more detailed description of the map units and symbols, please refer to the text accompanying this map.

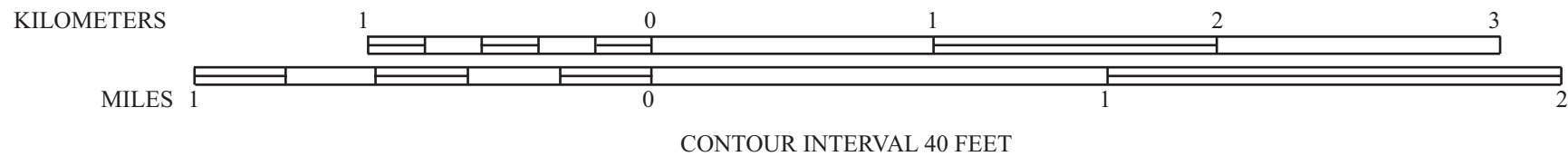
Correlation Chart of Map Units



Map symbols

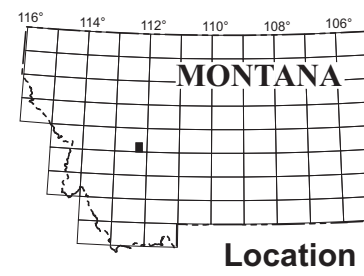


SCALE 1:24 000

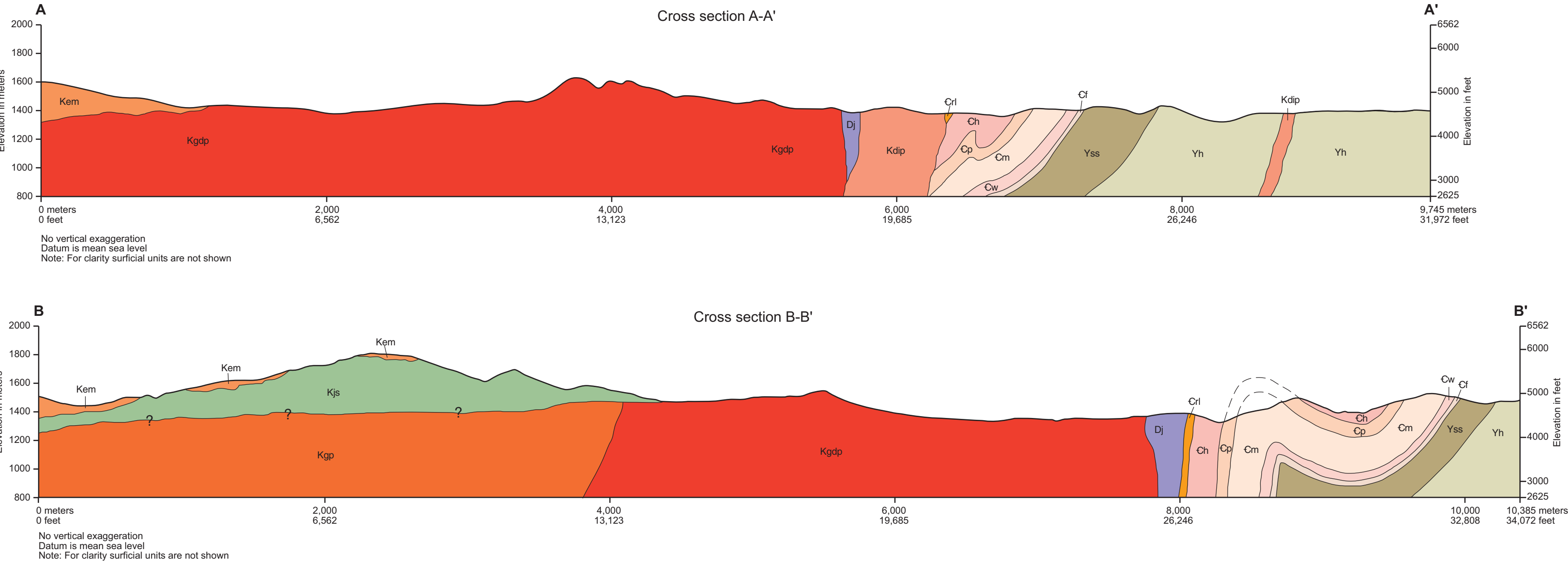


Base map from U.S. Geological Survey

Black Mountain 7.5' topographic quadrangle
Map date: 1985
Projection: Lambert Conformal Conic
UTM zone 12; 1927 NAD
UTM Grid Declination
1988 Magnetic North Declination



Location



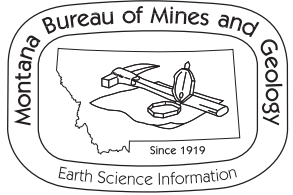
MBMG Open File 587

Geologic Map of the
Black Mountain 7.5' Quadrangle,
Southwestern Montana

Compiled and mapped by
Richard B. Berg

2009

Maps may be obtained from: Publications Office
Montana Bureau of Mines and Geology
1300 West Park Street
Butte, Montana 59701-8997
Phone: (406) 496-4167
Fax: (406) 496-4451
<http://www.mnbg.mtech.edu>



Research supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number 08HQAG0085. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.
GIS production: Ken Sandau and Paul Thale, MBMG. Map layout: Susan Smith, MBMG.