

**PRELIMINARY GEOLOGIC MAP OF THE
BIG HOLE PASS—LOST TRAIL PASS AREA
SOUTHWESTERN MONTANA**

by

David A. Lopez, J. Michael O'Neill, and Edward T. Ruppel

Montana Bureau of Mines and Geology

Open File Report MBMG 522

2005

This map has been reviewed for conformity with technical and editorial standards of the Montana Bureau of Mines and Geology.

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.

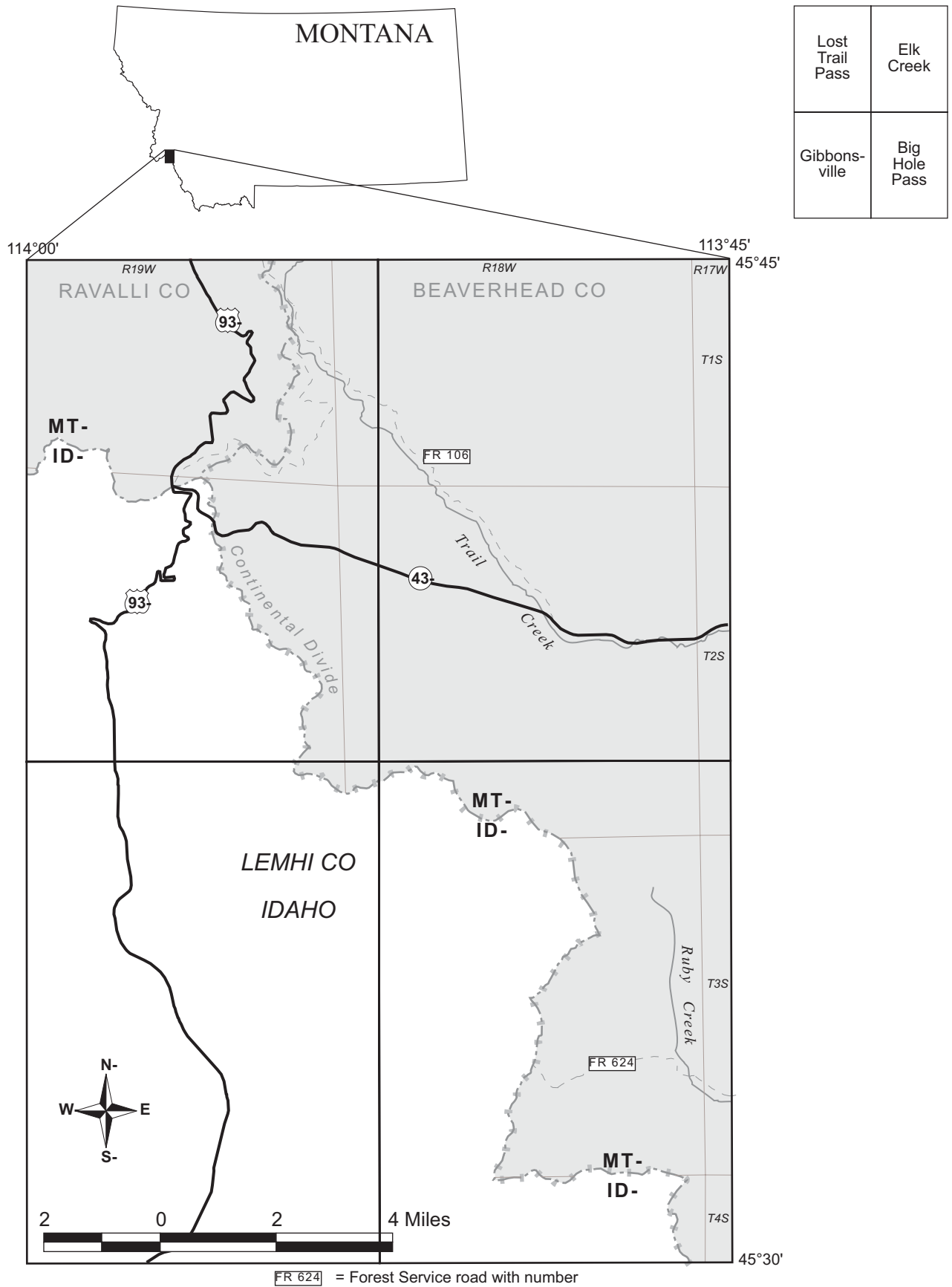
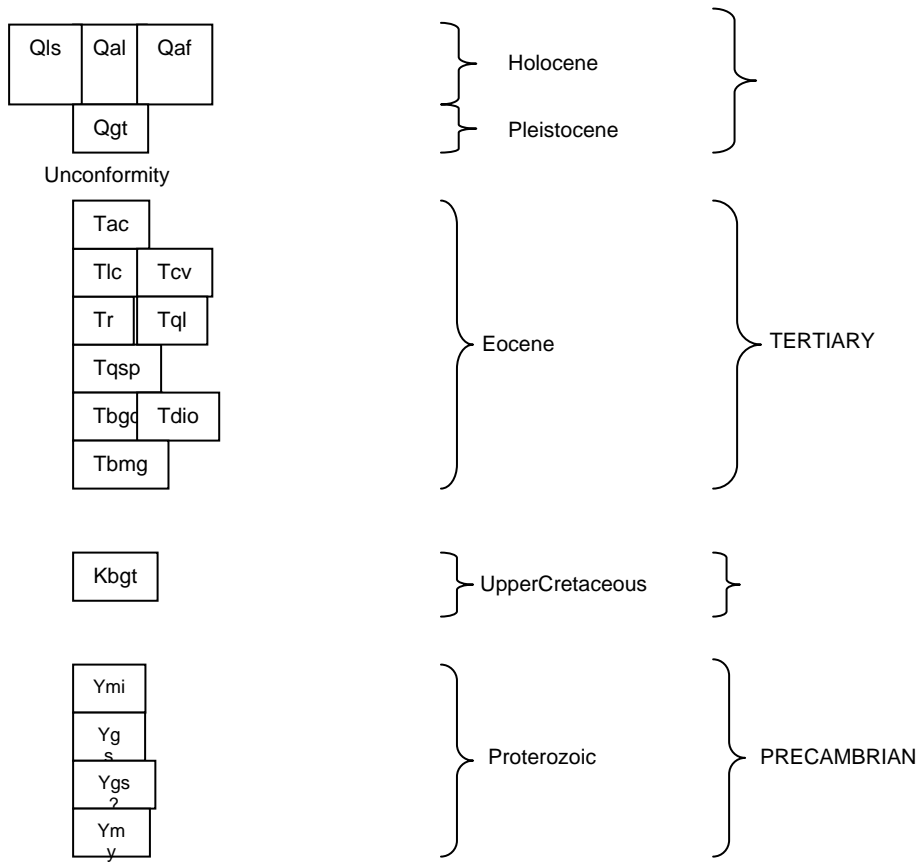


Figure 1. Location of study area, shown in gray.

CORRELATION OF MAP UNITS



GEOLOGIC MAP OF THE BIG HOLE PASS—LOST TRAIL PASS AREA

DESCRIPTION OF MAP UNITS

- Qal Alluvium (Holocene)**—Gravel, sand, silt, and clay along active channels of rivers, creeks, and tributaries.
- Qaf Alluvial fan deposits (Holocene and Pleistocene)**—Gravel, sand, silt, and clay deposited in fans being formed by modern streams along major valley margins. Display characteristic fan-shaped map pattern and convex-upward profile. Typically grade upstream into Qal. Thickness ranges from very thin at toe to as much as 50 ft at head of fans.
- Qls Landslide deposits (Holocene and Pleistocene)**—Unconsolidated mixture of soil and blocks of bedrock transported down steep slopes by mass wasting. Characteristic hummocky surface with concentric swales and ridges near down-slope limits. Common along steep slopes beneath resistant rocks but can be found where steeper slopes and higher moisture content produce unstable conditions.
- Qgt Glacial till (Holocene and Pleistocene)**—Unsorted mixture of clay- to boulder-size material transported and deposited by glaciers. Characteristic hummocky surface form. Clasts are predominantly local Proterozoic quartzite with lesser amounts of igneous rocks.
- Tac Anaconda Conglomerate (Eocene)**—Poorly exposed conglomerate consisting mainly of locally derived cobbles of Proterozoic quartzites. Tuffaceous matrix of sand, silt, and clay. Correlated with similar deposits near Anaconda, Montana named by O'Neill (2005). Occurs in fault-bounded basin in southern part of map

area. Interpreted as syntectonic sediment related to the development of the Chief Joseph metamorphic core complex (Desmarais, 1983; O'Neill and others, 2005).

- Tlc Lowland Creek Volcanics? (Eocene)**—Rhyolitic ash-flow tuff and tuffaceous pebble conglomerate, light-brownish-gray.
- Tcv Challis Volcanics? (Eocene)**—Gray to yellow-gray porphyritic rhyodacite or dacite tuffs and breccias; red to pink porphyritic rhyolite flows, tuffs, and welded tuff, and some black obsidian; about 2,000 feet thick (Desmarais, 1983).
- Tr Rhyolite (Eocene)**—Rhyolite and rhyodacite dikes, tan to light-gray, porphyritic, containing euhedral to subhedral phenocrysts of quartz, potassic feldspar, and minor plagioclase.
- Tql Quartz latite (Eocene)**—Quartz latite dikes, light-brownish-gray, phenocrysts of biotite, quartz, and potassic feldspar.
- Tqsp Quartz syenite porphyry (Eocene)**—Medium- to coarse-grained, massive to slightly porphyritic quartz syenite, medium-gray; phenocrysts of potassic feldspar, plagioclase, quartz, amphibole, biotite, and pyroxene (Desmarais, 1983).
- Tbgd Biotite granodiorite (Eocene)**—Porphyritic, fine- to medium-grained, gray, dark-gray to gray-green, biotite granodiorite. Phenocrysts of pink and white orthoclase, plagioclase, and rounded, glassy quartz. Also includes some granite and hornblende granodiorite to diorite (Desmarais, 1983).
- Tbmg Biotite-muscovite granite (Eocene)**—Light-gray, medium- to coarse-grained, porphyritic, locally equigranular, granite to granodiorite. Phenocrysts of

orthoclase, microcline, and locally plagioclase. Matrix of feldspar, quartz, biotite, and muscovite (Desmarais, 1983).

Tdio Diorite (Eocene)—Dark-greenish-gray, fine- to medium-grained diorite to gabbro with phenocrysts of plagioclase and pyroxene.

Kbgt Biotite granodiorite/tonolite (Upper Cretaceous)—Medium- to coarse-grained, medium- gray, equigranular, hornblende, biotite granodiorite. Includes some diorite and quartz diorite (Desmarais, 1983).

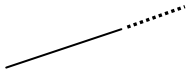
Ymi Missoula Group (Proterozoic)—Light-gray, medium- to coarse-grained quartzite, locally with slight pink cast. Minor amounts of feldspar.

Ygs Gunsight Formation (Proterozoic)—Medium-gray to brownish-gray, fine-grained quartzite; containing as much as 40% feldspar. Parallel laminated and ripple cross-laminated.

Ygs? Gunsight Formation, inferred (Proterozoic)—Quartzite like the Gunsight but so intensely fractured that positive identification is difficult.

Ymy Mylonitic rocks (Proterozoic)— Medium-dark-gray to greenish-gray, penetratively deformed (cleavage developed and original bedding mostly destroyed) phyllite and schist. Protolith probably quartzite and siltite, but formation unknown.

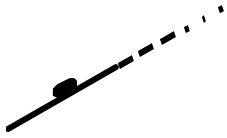
MAP SYMBOLS



Contact--Dotted where concealed.



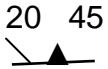
Normal fault--Dashed where approximately located, dotted where concealed. Bar and ball on down-thrown side, where known.



Detachment fault—Decorations on upper plate; dashed where inferred, dotted where concealed.



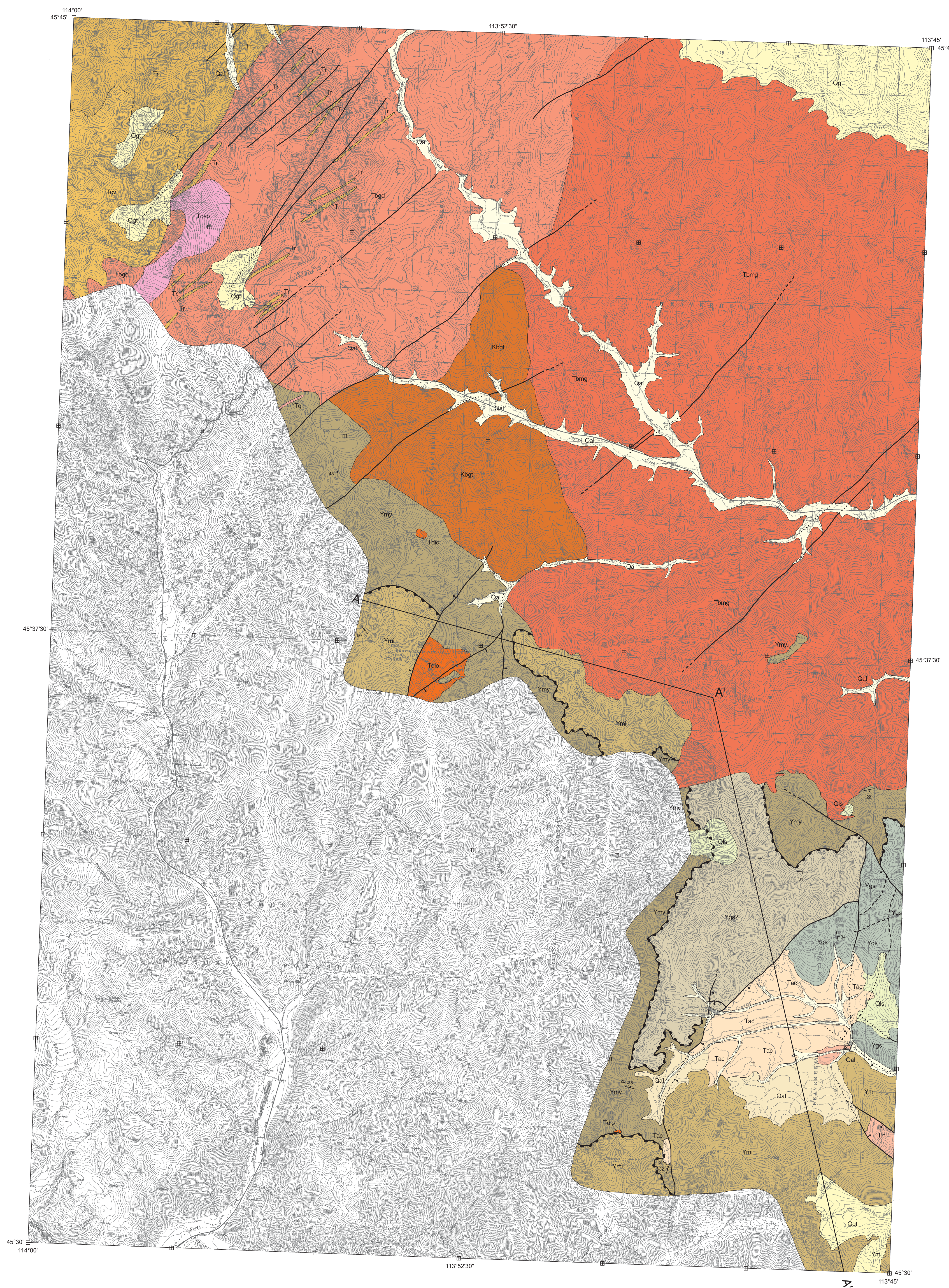
Strike and dip of beds



Strike and dip of foliation, showing direction and plunge of lineations.

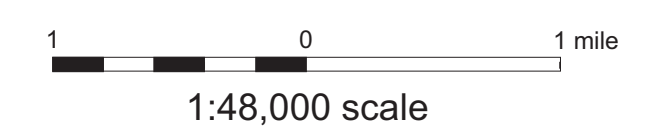
REFERENCES

- Desmarais, N.R., 1983, Geology and geochronology of the Chief Joseph plutonic-metamorphic complex, Idaho-Montana: Seattle, University of Washington, Ph.D. dissertation, 143 p., 1 plate.
- O'Neill, J.M., 2005 (in press), Syntectonic Anaconda Conglomerate (New Name)—A stratigraphic record of early Tertiary brittle-ductile deformation and uplift in southwestern Montana, *in* Stratigraphic studies in southwestern Montana and adjacent Idaho—Lower Tertiary Anaconda Conglomerate and Mesoproterozoic Gunsight Formation: U.S. Geological Survey Professional Paper 1700, Chapter A, p. 1-14.
- O'Neill, J.M., Ruppel, E.T., and Lopez, D.A., 2005, Newly recognized Chief Joseph metamorphic core complex and younger structures in the north-central Beaverhead Mountains, Idaho and Montana—Expanding the temporal and spatial limits of post-contractinal extension in the northern Rocky Mountains: Geological Society of America, Abstracts with Programs, vol. 37, no. 6, p. 4.
- Ruppel, E.T., O'Neill, J.M., and Lopez, D.A., 1993, Geologic map of the Dillon 1° x 2° quadrangle, Idaho and Montana: U.S. Geological Survey Geologic Map I-1803-H, scale 1:250,000.



MAP UNITS

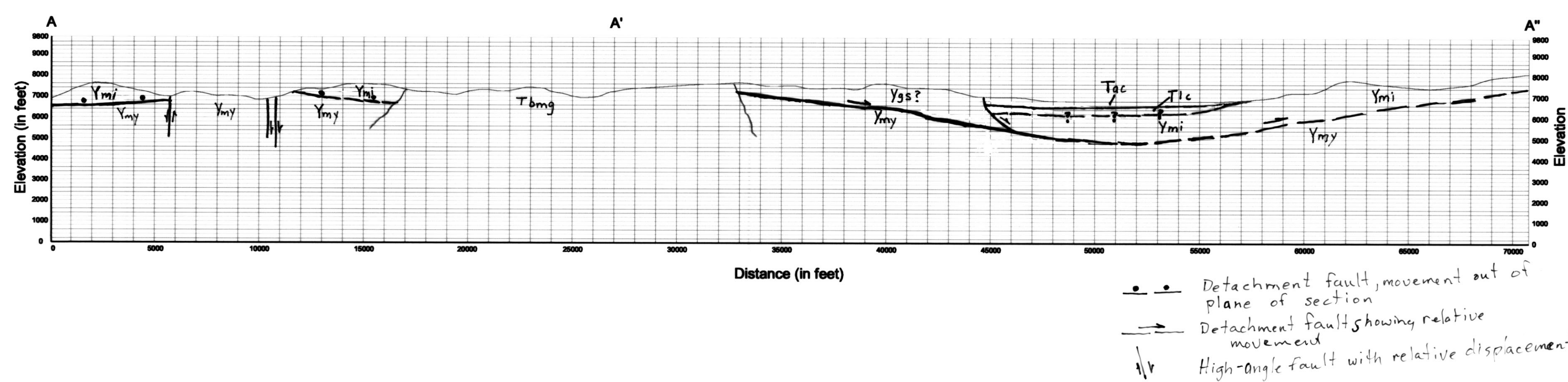
Qal	Alluvium of modern channels and flood plains
Qls	Landslide deposit
Qaf	Alluvial fan deposit
Ogt	Glacial till
Tac	Anaconda beds, informal
Tlc	Lowland Creek Volcanics
Tcv	Challis Volcanics Group
Tr	Flyville
Tq	Quartz latite
Tqsp	Quartz syenite porphyry
Tbgt	Biotite granodiorite
Tdo	Diorite
Tbrng	Biotite-muscovite granite
Kbgt	Biotite granodiorite/tonalite
Ymi	Missoula Group
Ygs	Gunsight Formation of Lemhi Group
Ygs?	Gunsight Formation (inferred)
Ymy	Mylonite (parent rock unknown)



Lost Trail Pass	Elk Creek
Gibbonsville	Big Hole Pass

1:24,000 scale base maps reduced by 50% to 1:48,000 scale
Base maps from U.S. Geological Survey 7.5' quadrangles:
Lost Trail Pass 7.5' topographic quadrangle
Map date: 1988, revised 1994
Projection: MT-south; Lambert Conformal Conic
UTM zone 12; 1927 NAD
Elk Creek 7.5' topographic quadrangle
Map date: 1966
Projection: Polyconic
UTM zone 12; 1927 NAD
Gibbonsville 7.5' topographic quadrangle
Map date: 1966
Projection: Polyconic
UTM zone 12; 1927 NAD
Big Hole Pass 7.5' topographic quadrangle
Map date: 1994
Projection: ID central; Transverse Mercator
UTM zone 12; 1927 NAD

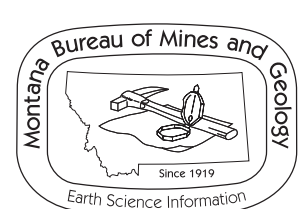
Cross Section A-A'-A''



MBMG Open File No. 522

Preliminary Geologic Map of the Big Hole Pass-Lost Trail Pass Area
Southwestern Montana

David A. Lopez, J. Michael O'Neill, and Edward T. Ruppel



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.mbgm.mtech.edu

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 04HGA0079.
GIS production: Ken Sandau and Paul Thale, MBMG. Map layout: Susan Smith, MBMG.