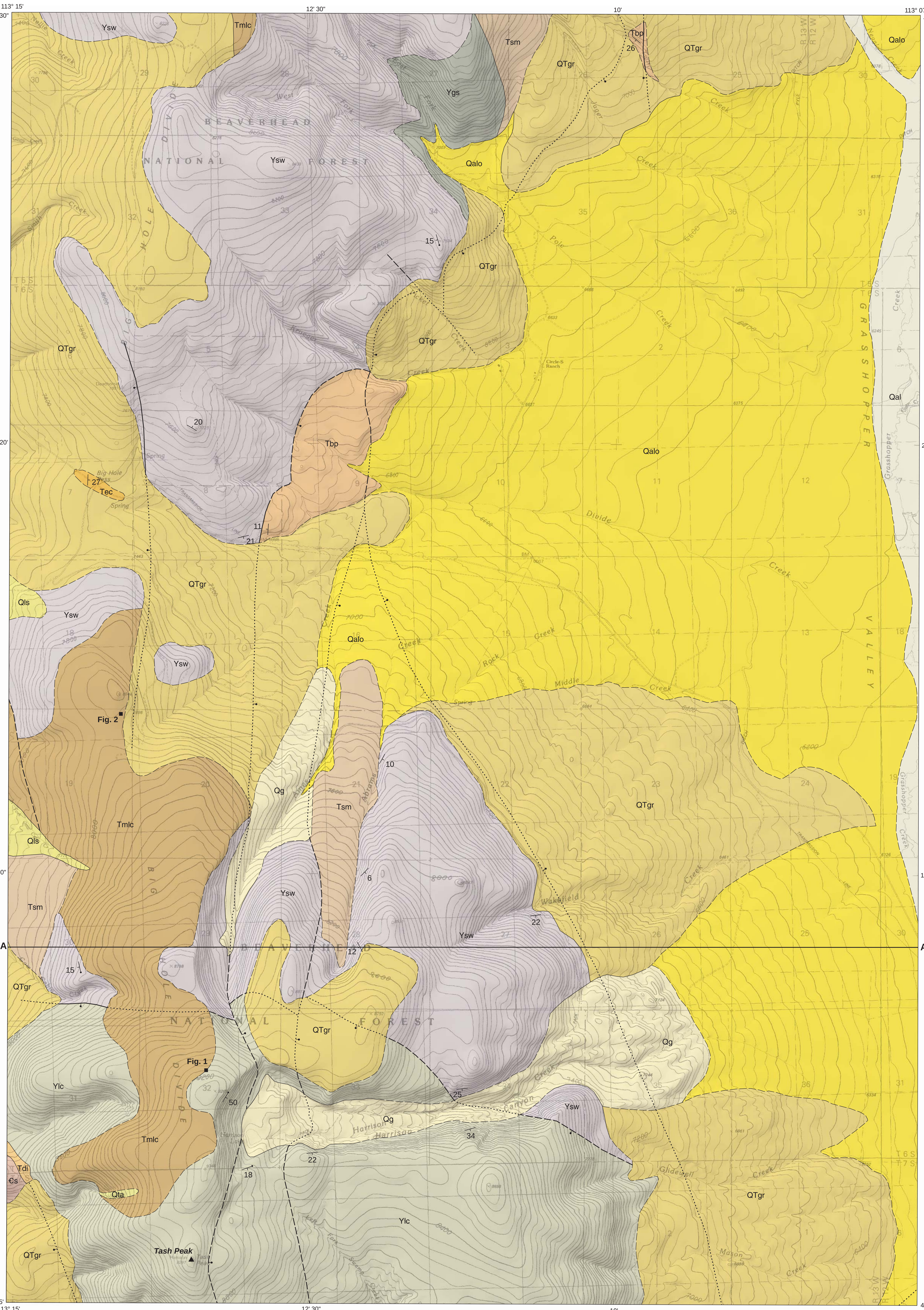


Base map produced by the United States Geological Survey
Tash Peak 1:24,000 scale quadrangle map
Control by: USGS, NOS/NOAA
Compiled from aerial photographs taken 1956
Field checked: 1959
Map edited: 1988
Projection: Lambert Conformal Conic
Grid:1000 meter Universal Transverse Mercator Zone 12
UTM grid declination: 1°33' West
1988 Magnetic North Declination: 16°30' East
Vertical Datum: National Geodetic Vertical Datum of 1929
Horizontal Datum: 1927 North American Datum

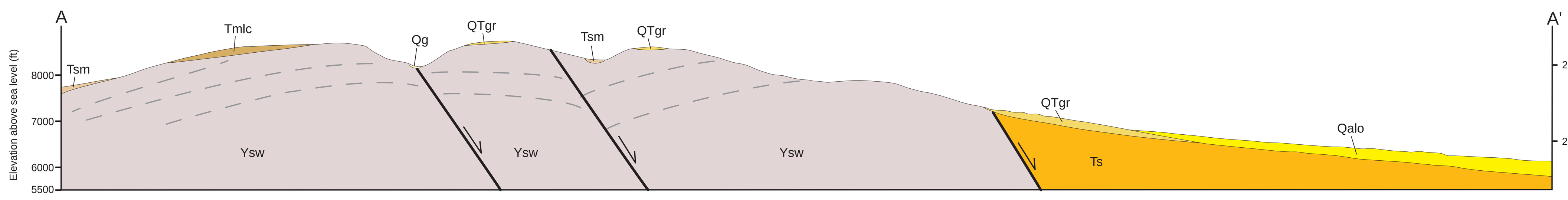
Shaded relief created from 10 meter DEM from
U.S.G.S. National Elevation Dataset

SCALE 1:24,000

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Maps may be obtained from: Publications Office
Montana Bureau of Mines and Geology
1300 West Park Street
Butte, Montana 59701-8997
Phone: (406) 496-4174
Fax: (406) 496-4451
http://www.mbmg.mtech.edu

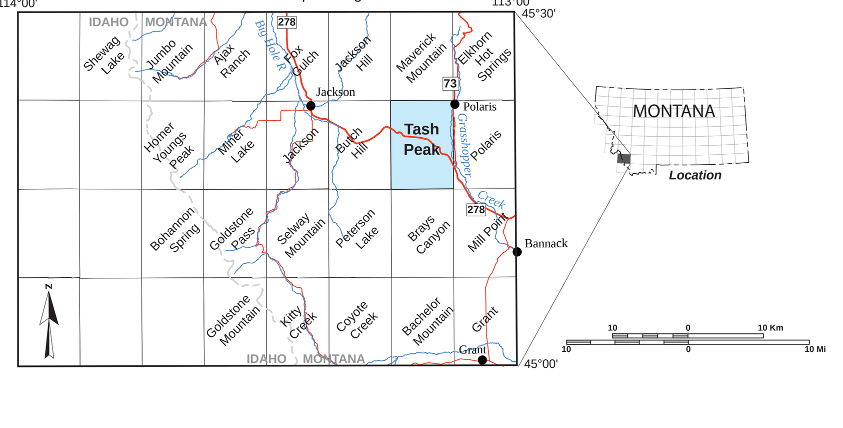
Cross Section A–A'



No vertical exaggeration

SCALE: 1:24,000

Ts Sediments, undifferentiated (Tertiary); cross section only



Research supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number G13AC00210. The views and conclusions contained in this document are those of the author and should not be interpreted as representing the official policies, either expressed or implied, of the U.S. Government.

GIS production: Yiwen Li and Paul Thale, MBMG. Map layout: Susan Smith, MBMG.

INTRODUCTION

On the Tash Peak 7.5' quadrangle, Montana Highway 278 crosses the the Big Hole Pass between the headwaters of the Big Hole River on the west and the Grasshopper Valley on the east. The topography is dominated by gently sloping ranch land that rises westward to forested public land. The area was selected for detailed mapping to clarify the relationship between the Mesoproterozoic Lemhi Group exposed along the Idaho–Montana border and Belt Supergroup quartzites exposed in the Pioneer Mountains north of the Tash Peak quadrangle. Ruppel and others (1993) mapped all Mesoproterozoic rocks in the quadrangle as Missoula Group of the Belt Supergroup. Reexamination of Mesoproterozoic stratigraphy in southwest Montana, however, indicates that the bedrock of Tash Peak is part of the Lemhi Group (Lonn and Lewis, 2012; Burmester and others, 2013).

The quadrangle was also selected to explore connections between Tertiary strata on the east and west sides of the Big Hole Pass. Janecke (1994), Roe (2010), and Barber (2013) all suggest that the Big Hole and Grasshopper basins were once linked. Distinctive fluvial sandstone bodies 6 to 16 km (3 to 9 mi) west of the Big Hole Pass that have east- and southeast-directed paleocurrent indicators (Thomas, 1995; Roe, 2010; Barber, 2013) appear to correlate with Oligocene–early Miocene beds in the Grasshopper basin east of the pass (Janecke and others, 2005; Stroup and others, 2008). Miocene gravels found high up on the Big Hole–Grasshopper divide show that the basins were linked until late Tertiary or Quaternary times.

PREVIOUS MAPPING

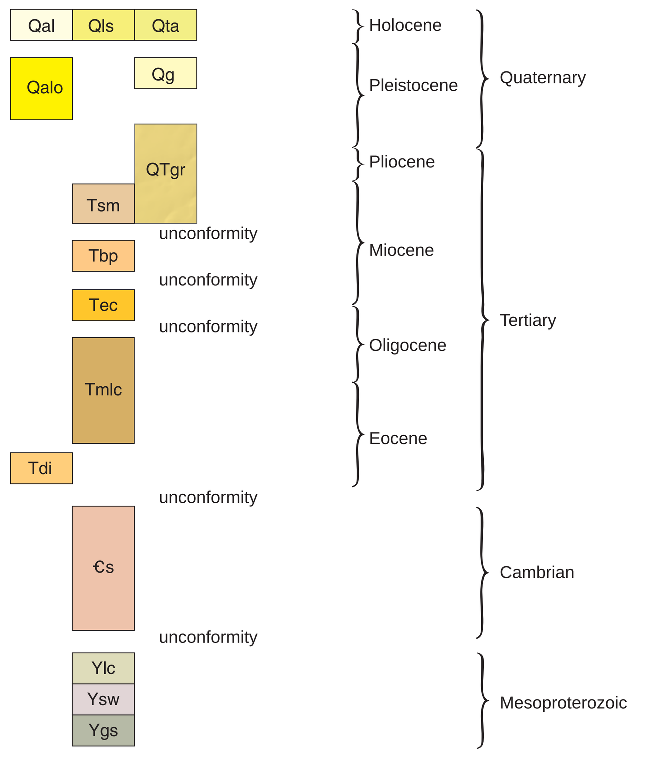
The Tash Peak 7.5' quadrangle is included in the 1:250,000-scale coverage of Ruppel and others (1993) and in the 1:100,000-scale coverage of Lonn and others (in review). Lonn and Lewis (2012) mapped the east-adjacent Polaris 7.5' quadrangle.

GEOLOGIC SUMMARY

Bedrock exposure is poor, and even at the top of Tash Peak—the highest point within the quadrangle—there is little outcrop and a great deal of colluvium. Quartzite cobbles and boulders make up both the colluvium and the alluvium in the quadrangle, making them difficult to distinguish (fig. 1). Uplands are underlain by variably oriented feldspathic quartzites of the Mesoproterozoic Lemhi Group. Bedrock is overlain by poorly exposed Tertiary and younger strata, which are mostly immature quartzite-cobble gravel and conglomerate. Quartzite-cobble conglomerate and breccia (Tmlc) along the ridge south of Highway 278 (fig. 2) resemble basal Tertiary strata in the Polaris 7.5' quadrangle (Lonn and Lewis, 2012).

The dominant structure in the quadrangle is a north-trending horst of Lemhi Group quartzite, draped with Tertiary and younger sediment. North-trending faults within Medicine Lodge conglomerate (Tmlc) in the Butch Hill 7.5' quadrangle west of the Tash Peak quadrangle suggest that the faults postdate the conglomerate. The unconsolidated younger units do not preserve structures, so the timing of faulting is not clear. Faulting most likely occurred after deposition of Eocene conglomerate (Tmlc) but before the Quaternary and Tertiary gravels were deposited, because there is no evidence that the latter are offset.

CORRELATION DIAGRAM



MAP SYMBOLS

Contact: dashed where approximately located

Fault: dotted where concealed, dashed where approximately located, bar and ball on downthrown side

6 Strike and dip of inclined beds

24 Strike and dip of bedding where stratigraphic tops were confirmed using primary sedimentary structures

Figure 1. Tash Peak ridge in the southwest corner of the quadrangle. Pink quartzite cobbles and boulders may have originated from frost-heaved Ylc bedrock or from immature Tertiary gravels and conglomerate (Tmlc).

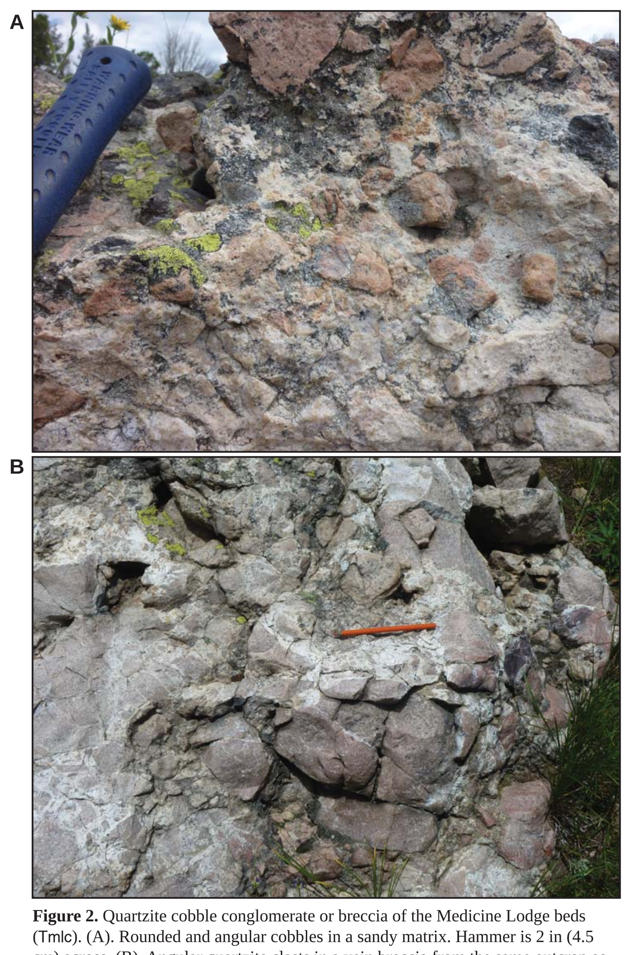


Figure 2. Quartzite cobble conglomerate or breccia of the Medicine Lodge beds (Tmlc). (A). Rounded and angular cobbles in a sandy matrix. Hammer is 2 in (4.5 cm) across. (B). Angular quartzite clasts in a vein breccia from the same outcrop as A. The pencil is 15 cm (6 in) long.

DESCRIPTION OF MAP UNITS

Qal **Alluvium (Holocene)**—Modern stream and floodplain deposits. Up to 10 m (30 ft) thick.

Qls **Landslide deposits (Holocene–Pleistocene)**—Hummocky, unsorted, mass wasting deposits with clay- to cobble-sized clasts. Thickness unknown, but probably less than 60 m (200 ft).

Qta **Talus (Holocene–Pleistocene)**—Angular and subangular cobble to boulder-size clasts at base of steep valley walls or cliffs. Thickness unknown, but probably less than 60 m (200 ft).

Qalo **Older alluvium (Holocene–Pleistocene)**—Stream and floodplain deposits that lie above the modern floodplain. Includes glacial outwash gravels, subrounded to rounded, well-sorted sandy cobble to boulder gravel and sand. Thickness unknown, but form fans that are probably less than 150 m (500 ft).

Qg **Glacial deposits (Pleistocene)**—Poorly sorted deposits of angular to subrounded, clay- to boulder-sized clasts that include end moraines, recessional moraines, lateral moraines, and kames. Thickness less than 120 m (400 ft).

QTgr **Gravel (Miocene or younger)**—Immature, unsorted quartzite cobble gravel that may be colluvium or lag deposits derived from older gravels or conglomerate (fig. 1). No bedding or primary structures are visible. Forms an apron over the east and west slopes of the highlands. Thickness up to 60 m (200 ft).

Tsm **Six Mile Creek Formation (middle to late Miocene)**—Mature gravel of well-rounded quartzite cobbles. Contact relationships in the adjacent Butch Hill 7.5' quadrangle indicate that the gravel overlies sandstone and clay of the Everson Creek beds (Tec) (Lonn and others, in review). The well-rounded cobbles and the stratigraphic position suggest correlation with the middle Miocene Six Mile Creek Formation in southwest Montana (Fields and others, 1985). Thickness unknown, but probably less than 90 m (300 ft).

Tbp **Bannock Pass beds (early to middle Miocene)**—Poorly exposed white to gray ashy silt. Janecke and others (2005) identified similar bioturbated ashy sediments along the west side of the Grasshopper Valley in the Bachelor Mountain quadrangle as Bannack (sic) Pass beds, which are late Arikareean, or early to middle Miocene. Tabrum (Nichols and others, 2001) identified similar sediments in the east-adjacent Polaris quadrangle as being late Arikareean. Thickness unknown.

Tec **Everson Creek beds (late Oligocene to early Miocene)**—Poorly exposed, interbedded coarse sand, silt, and clay that appears to fill a channel across the Big Hole Pass. They correlate with early Arikareean Everson Creek beds exposed to the east and west of the Tash Peak quadrangle (Lonn and others, in review). Thickness unknown.

Tmlc **Medicine Lodge beds, conglomerate and gravel (Oligocene and/or Eocene)**—Locally well-cemented, angular to rounded, quartzite cobble conglomerate (fig. 2); generally exposed as angular to rounded cobble float. Less than 90 m (300 ft) thick.

Tdi **Diorite dike (Eocene)**—Dark-colored, fine-grained, hornblende diorite dike following a fault in the southwestern corner of the map. A similar dike in the Goldstone Pass quadrangle of the central Beaverhead Range (Lonn and others, 2009) was dated at 46 Ma (U-Pb zircon) (Richard Gaschnig, written commun., 2009).

Ꞓs **Sedimentary rocks (Cambrian)**—White and pink, poorly sorted, coarse- to medium-grained quartzite containing abundant crossbeds. Quartz makes up 95 percent of the grains, with plagioclase, sericite, red chert, and black hematite. Present only in the southwestern quarter of the quadrangle in fault contact with the Mesoproterozoic Lawson Creek Formation. The high quartz content suggests correlation with either the Cambrian Flathead Formation or a quartzite interval located within or above the Cambrian Silver Hill Formation. Thickness unknown.

Ylc **Lawson Creek Formation, Lemhi Group (Mesoproterozoic)**—Intervals of couplets (cm-scale) and couples (dm-scale) of fine- to medium-grained white quartzite and purple, black, and green argillite that alternates with intervals of thick-bedded (m-scale) pink, salmon, and gray fine- to medium-grained quartzite. In the Tash Peak 7.5' quadrangle, Ylc has less argillite than does the type section in the Lemhi Range and sections exposed in the Beaverhead Range (Burmester and others, 2013). Rip-up clasts of argillite and chert are common. Feldspar grains are not obvious in hand samples of the quartzite, and quartz content ranges from 48 to 90 percent. Plagioclase is more abundant than potassium feldspar. The lower contact is a fault; upper contact not exposed in the quadrangle. Thickness is estimated at 2,150 m (7,000 ft) in the Jackson Hill 7.5' quadrangle 13 km (8 mi) to the northeast.

Ysw **Swauger Formation, Lemhi Group (Mesoproterozoic)**—Red, pink, and white poorly sorted, medium- to coarse-grained, trough and planar crossbedded quartzite in beds as thick as 2 m (6 ft). Contains small pebbles, thick black mud rip-up clasts, and abundant coarse, well-rounded quartz grains. Chalky white feldspar grains are obvious in hand sample. Feldspar content ranges from 25 to 40 percent and potassium feldspar is more abundant than plagioclase. The lower part is very coarse and contains pebbles up to 5 cm in diameter of well-rounded quartzite, and angular quartz and feldspar. Grades downward into the Gunsight Formation (Ygs) in the northernmost part of the map. The upper contact is a fault against Ylc. Gentle dips, poor exposure, and structure make thickness estimates problematic. Thickness estimated at 2,770 m (9,000 ft) on the Jackson Hill quadrangle 13 km (8 mi) to the northeast.

Ygs **Gunsight Formation, Lemhi Group (Mesoproterozoic)**—Gray to light red, moderately well-sorted, fine-grained, feldspar-rich quartzite. Characterized by flat laminations of black hematite; typically weathers into thick (8 cm) plates. Contains minor thin argillite layers that are commonly mudcracked. Also contains thin layers of coarse, well-rounded quartz grains interpreted as lag deposits. Feldspar content 35 to 40 percent, with subequal amounts of plagioclase and potassium feldspar. Exposed near the northern border of the quadrangle where it grades upward into the Swauger Formation. Thickness is unknown. Less than 300 m (975 ft) is exposed.

REFERENCES

Barber, D.E., 2013, Implications for tectonic control on paleogeography and sediment dispersal pathway: Integrated U-Pb detrital zircon age-analysis of the Paleogene Missouri River headwater system, SW Montana: Meadville, Allegheny College, B.S. thesis, 149 p.

Burmester, R.F., Lonn, J.D., Lewis, R.S., and McFaddan, M.D., 2013, Toward a grand unified theory for stratigraphy of the Lemhi subbasin of the Belt Supergroup: Northwest Geology, v. 42, p. 1–20.

Fields, R.W., Rasmussen, D.L., Tabrum, A.R., and Nichols, R., 1985, Cenozoic rocks of the intermontane basins of western Montana and eastern Idaho; a summary, *in* Flores, R.M., and Kaplan, S.S., eds., Cenozoic paleogeography of the west-central United States: Society of Economic Paleontologists and Mineralogists, Rocky Mountain Section, Rocky Mountain Paleogeography Symposium, v. 3, p. 9–36.

Janecke, S.U., 1994, Sedimentation and paleogeography of an Eocene to Oligocene rift zone, Idaho and Montana: Geological Society of America Bulletin, v. 106, p. 1083–1095.

Janecke, S.U., Dorsey, R.J., Kickham, J., Matoush, J.P., and McIntosh, W., 2005, Geologic map of the Bachelor Mountain 7.5' quadrangle, southwest Montana: Montana Bureau of Mines and Geology Open-File Report 525, 28 p., scale 1:24,000.

Lonn, J.D., Elliott, C.G., Lewis, R.S., Burmester, R.F., McFaddan, M.D., Stanford, L.R., Janecke, S.U., and Othberg, K.L., in review, Geologic map of the Montana part of the Salmon 30' x 60' quadrangle, southwestern Montana: Montana Bureau of Mines and Geology Open-File, scale 1:100,000.

Lonn, J.D., and Lewis, R.S., 2012, Geologic map of the Polaris 7.5' quadrangle, southwestern Montana: Montana Bureau of Mines and Geology Open-File Report 621, scale 1:24,000.

Lonn, J.D., Stanford, L.R., Burmester, R.F., Lewis, R.F., and McFaddan, M.D., 2009, Geologic map of the Goldstone Pass 7.5' quadrangle, Lemhi County, Idaho, and Beaverhead County, Montana: Montana Bureau of Mines and Geology Open-File Report 584, scale 1:24,000.

Nichols, R., Tabrum, A.R., and Hill, C.L., 2001, Introduction: Cenozoic mammals, southwest Montana, *in* Nichols, R., Cenozoic vertebrate paleontology and geology of southwestern Montana and adjacent areas, *in* Hill, C.L., ed., Mesozoic and Cenozoic paleontology in the western plains and Rocky Mountains: Society of Vertebrate Paleontology 61st Annual Field Trip Guidebook, Museum of the Rockies Occasional Paper 3, p. 79–81.

Roe, W.P., 2010, Tertiary sediments of the Big Hole Valley and Pioneer Mountains, southwestern Montana: Age, provenance, and tectonic implications: Missoula, University of Montana, M.S. thesis, 117 p.

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 Miscellaneous Investigations Series Map I-1803-H, scale 1:250,000.

Stroup, C.N., Link, P.K., Janecke, S.U., Fanning, C.M., Yaxley, G.M., and Beranek, L.P., 2008, Eocene to Oligocene provenance and drainage in extensional basins of southwest Montana and east-central Idaho: Evidence from detrital zircon populations in the Renova Formation and equivalent strata, *in* Spencer, J.E., and Titley, S.R., eds., Ores and Orogenesis: Circum-Pacific Tectonics, Geologic Evolution, and Ore Deposits: Arizona Geological Society Digest, v. 22, p. 529–546.

Thomas, R.C., 1995, Tectonic significance of Paleogene sandstone deposits in southwestern Montana: Northwest Geology, v. 24, p. 237–244.

MBMG Open-File Report 678

Geologic Map of the Tash Peak 7.5' Quadrangle, Southwest Montana

Colleen G. Elliott and Jeffrey D. Lonn

2016