OPEN-FILE REPORT 85-545
PLATE 1

Base from U.S. Geological Survey, Nicholia, 1:62,500, 1956; Scott Peak, 1:62,500, 1957; and Edie Ranch, 1:62,500, 1957

Geology by Betty Skipp, 1980-82; assisted by Nancy R. Williams, 1980, Jean M. Weaver, 1981, and Ann E. Lahoe, 1982. Geology of Nite Ranch Quadrangle modified from Schulien and Ramsperk (1979). Geology of Eightmeenth Peak area and Birch Creek Mining district modified from Scholten and Ramsperk (1968). Fault scarps along eastern margin of Birch Creek Valley adapted from photogeologic interpretation by Ruth Ann Strickland (1980). Geology of Scott Peak Quadrangle modified from Schulien (1983). Geology of Eightmeenth Peak area and Birch Creek Mining district modified from Scholten and Ramsperk (1968). Fault scarps along eastern margin of Birch Creek Valley adapted from photogeologic interpretation by Ruth Ann Strickland (1980)

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

GEOLOGIC MAP AND CROSS SECTIONS OF THE ITALIAN PEAK AND ITALIAN PEAK MIDDLE ROADLESS AREAS, BEAVERHEAD COUNTY, MONTANA, AND CLARK AND LEMHI COUNTIES, IDAHO

By
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1984

Figure 1.—Location map of Italian Peak Roadless Areas in Beaverhead Mountains, Beaverhead County, Montana, and Clark and Lemhi Counties, Idaho.

This map is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards.

Figure 2.—Generalized geologic map of the Italian Peak Roadless Areas and vicinity.

EXPLANATION FOR FIGURE 2

LIST OF MAP UNITS

Quaternary and Tertiary rocks, undivided

Eocene Challis Volcanics

Ordovician Beaverhead Mountains pluton

Archean(?) Dillon Granite Gneiss of Heinrich (1953)

LIST OF THREST PLATES

Rocks of Hawley Creek thrust plate

Rocks of Fritz Creek thrust plate

Slide blocks from Fritz Creek(?) thrust plate

Rocks of Cabin thrust plate

Rocks of Medicine Lodge thrust plate

Rocks of Tendoy thrust plate

CONTACT

FAULT—Dotted where concealed. Bar and ball on downthrown side where mostly normal slip. Arrows indicate mostly strike-slip

THRUST FAULT—Dotted where concealed. Sawteeth on upper plate

REVERSE FAULT—Dotted where concealed. K on upthrown side

APPROXIMATE OUTLINE OF ROADLESS AREAS

CONODONT COLOR ALTERATION INDEX VALUE—From Epstein and others (1977)

CORRELATION OF MAP UNITS

AUTOCHTHONOUS ROCKS AND DEPOSITS

Qa Alluvium (HOLOCENE)—Unconsolidated, poorly sorted deposits of fluvial sand, silt, sand, and gravel

Qc Colluvium (HOLOCENE)—Unconsolidated locally derived rubble obtainable at base of steep slopes; includes talus

Qac Alluvium and colluvium (HOLOCENE)

Qf Alluvial fan deposits (HOLOCENE)—Fan-shaped deposits of unconsolidated gravel, sand, and silt

Qfr Beaverhead (HOLOCENE)—Mounds and terraces of travertine localized along faults in sec. 13, T. 11 S., R. 21 E.

Ql Landslide deposits (QUATERNARY)—Unsorted and partly consolidated deposits of coarse, mostly angular, locally derived rubble

Qg Glacial deposits of Pinedale Glaciation (UPPER PLEISTOCENE)—Loosely consolidated to unconsolidated, coarse to fine, subangular to round, nonsorted to moderately sorted pebble to boulder gravel in matrix of silty sand to clayey sandy silt; includes some fluvial deposits; includes some ice-stick disturbed; badly fissured; large near south of Willow Creek in Harkness Lake area

Qrg Rock Glacier Deposits (LATE PLEISTOCENE)—Unconsolidated, locally derived, largely angular rubble with interstitial ice; includes some deposits of small glaciers

Qoa Old alluvium (PLEISTOCENE)—Unconsolidated deposits of fluvial gravel, sand, and silt present in dry or nearly dry canyons in southeastern part of map area

Qty Tendoy Terrace Gravel (UPPER PLEISTOCENE)—Fan-shaped, gently sloping deposits of relatively compact, moderately sorted fluvial gravel, sand, and silt; Tendoy Terrace gravel present at elevations from about 30 to 100 ft above present stream level along Willow and Nicholia Creeks in northwestern part of map

Qfy Fritz Terrace Gravel (UPPER PLEISTOCENE)—Fan-shaped, gently sloping deposits of relatively compact, moderately sorted fluvial gravel, sand, and silt; Fritz Terrace gravel present at elevations from about 30 to 100 ft above present stream levels along Willow and Nicholia Creeks in northwestern part of map

Qto Hawley Terrace Gravel (LATE PLEISTOCENE)—Steep-sided, gently sloping deposits of relatively compact, moderately sorted fluvial gravel, sand, and silt, locally preserved at elevations from about 80 to 120 ft above present stream levels along Willow and Nicholia Creeks in northwestern part of map

Qto Older Terrace Gravels (UPPER PLEISTOCENE)—Steep-sided, gently sloping deposits of relatively older consolidated to unconsolidated gravel, sand, and silt, locally preserved at elevations from about 80 to 120 ft above present stream levels along Willow and Nicholia Creeks in northwestern part of map

Qtb Bouldery Terrace Gravel (LOWER PLEISTOCENE TO PLIOCENE)—Fan-shaped, gently sloping deposits, dissected, of nonconsolidated to poorly consolidated gravel, sand, and silt; mapped only in Birch Creek Valley area; includes some bouldery facies

Qtrv Gravel (LOWER PLEISTOCENE AND PLIOCENE)—Fan-shaped, gently sloping deposits of relatively compact, moderately sorted, subangular to rounded gravel, sand, and silt; probably dissected old alluvial or alluvial fan deposits; includes high-level terrace deposits at mouth of Medicine Lodge; extensive older gravels beneath glacial deposits in Medicine Lodge valley; includes high-level gravels at Beneath Peak and south Medicine Lodge Creek, and cemented gravels that locally overlie the tuff of Kilgore south of Black Mountain; locally disrupted by fault scarps

AUTOCHTHONOUS ROCKS

Tk TUFF OF KILGORE (PLIOCENE)—Rhyolite ashflow tuff, lightgray, pink, light-pink, red, and brown; weathers gray, grayish red, light brown, and pink; moderately welded, devitrified; contains abundant lithophysal zone, characteristic narrow zone of spherulites throughout; Phenocrysts range from 5 to 7 percent at base to about 1 percent at top, and consist of mainly plagioclase, and minor sanidine, quartz, biotite, hornblende, and opaque minerals. Description modified from McKenna (1965), Morgan and others (1980); same as tuff of Spencer (Skipp and others, 1983). Thickness from depositional or erosional edge to 200 ft

Tbs BASALT OF INDIAN CREEK (MIOCENE)—Basalt, dark to medium-gray; hypersthene and contains sparse, up to 2 percent, phenocrysts of plagioclase, hypersthene, and olivine in diktytaitic groundmass; crystal flows reversed magnetic polarity; K-Ar age 3.2±0.9 m.y. (G. Brown, Skipp, and Schlicker, written commun., 1979)

Tbr TUFF OF BLACK CREEK (MIOCENE)—Rhyolite ashflow tuff, nonwelded, light-gray, black, tan, and brown; weathers light gray; contains quartz, brown, smoky, and black crystal grains; densely welded, devitrified to glassy, aphyroitic to lithophysal; Tuff contains an average 1 percent sodic plagioclase phenocrysts, 1 percent biotite, 1 percent clinopyroxene, and minor opaque minerals. Thin black vitrophyre zone locally forms cliffs. Description modified from McKenna (1981). Thickness from depositional or erosional edge to 590 ft

Tb TUFF OF BLACKTAIL BUTTE (MIOCENE)—Rhyolite ashflow tuff, light-gray, brown, tan, pinkish-gray, and light-brown; weathers pale-orange, and light-brown; densely welded, crystal-rich, glassy to devitrified; aphyroitic to lithophysal. Phenocryst content is 15 percent or less and about 5 percent at top, and includes sanidine, plagioclase, quartz, biotite, augite, hypersthene, and opaque minerals. Relative amount of augite content increases upward in unit; locally forms cliffs. Description modified from McKenna (1981) and Morgan and others (1984); same as Edie School Rhyolite of Skipp and others (1983). Thickness from depositional or erosional edge to 130 ft

Tm MEDICINE LODGE BEDS OF SCHOLTEN AND RAMSPERK, 1968 (MIOCENE)—Tracevitrine limestone, tuffaceous lacustrine mudstone, airfall tuff, and gravel. Tracevitrine limestone, light-gray, pale-orange, and pinkish-gray (yellowish-gray); plagioclase phenocrysts as much as 165 ft high at top of unit; commonly forms cliffs and steep slopes. Tuffaceous lacustrine mudstone, light-brown, and light-gray (yellowish-gray); susceptible to landsliding; makes up most of the lower part of the unit; contains at upper part of sequence. Locally derived conglomerate wedges present near margins of the depositional basin, such as southeast of Black Mountain. Thickness from depositional or erosional edge to 1,000 ft

Tcg CHALLIS VOLCANICS (EOCENE)—Unconsolidated to consolidated gravel, sand, and silt; locally interbedded with Miocene volcanic and sedimentary rocks; from depositional or erosional edge to 200 ft thick

Tv CHALLIS VOLCANICS (EOCENE)—Rhyodacite tuff and volcanic breccia, tuffaceous sandstone and conglomerate, and lattic flows. Rhyodacite tuff, light-gray and yellowish-gray; weathers the same; largely friable; fine to coarse grained; crudely bedded; composed of hydrated glassy pumice and fragments of volcanic and country rock; contains abundant quartz phenocrysts. Light-colored, waterlaid tuffaceous sandstone and conglomerate interbedded with the tuffs are composed largely of volcanic clasts and locally are crossbedded. Rhyodacite lapilli breccia, medium-gray and grayish green; weathers light gray; poorly sorted; contains abundant fragments of pumiceous rhyodacite and few fragments of country rock including granite of the Beaverhead Mountains pluton (Scholten and Ramsperk, 1968). Rock is dense, hard, and massive and forms cliffs. Rhyodacite, medium-gray, brownish gray rind; weathers pale-brown; contains 1-3 percent sanidine phenocrysts of pyroxene, plagioclase, and a few large olivine pseudomorphs altered to serpentine, in a hyalopilitic matrix. Rhyodacite occurs as dikes and sills (called Medicine Lodge intrusive sill on Hilgenone to Moscow(?) age by Schori and Scholten (Scholten and Ramsperk, 1968); Scholten and Ramsperk, 1968). K-Ar ages determined by R. F. Marvin, R. L. Armstrong, L. L. Brandt, and Kyoto Futa (written commun., 1979) are 51.4± 1.5 m.y. for a biotite from rhyodacite of Black Creek (Fig. 17,J in 1.5 m.y. on hornblende from a rhyodacite breccia flow (Locality 16), 59.0 ± 3.0 m.y. and 51.4± 3.1 m.y. on two sample of hornblende and biotite from a rhyodacite breccia (Locality 4). Thickness from erosional or depositional edge to about 2,000 ft

Tdi DIKE ROCKS (EOCENE)—Intermediate to basic intrusive rocks; dark gray to light gray; aphanitic to porphyritic. Original minerals include plagioclase, pyroxene, augite, olivine, opaque iron oxides, biotite, and accessory apatite. Altered to hydrothermally altered to serpentine, chlorite, epidote, calcite, opaque iron oxides, and other minerals. Dikes have weather gray, yellowish brown, and produce an olive-green soil. Dikes produce small bodies, several tens of feet long, in the vicinity of the Scottsbluff Dike in the northern part of the area, that may be related to the Medicine Lodge Volcanics (Scholten and Ramsperk, 1968)

ALLOCHTHONOUS ROCKS

BEAVERHEAD FORMATION (UPPER CRETACEOUS)

Kbs Divide quartzite conglomerate unit (Upper Cretaceous)—Interbedded sandstone, mudstone, and minor carbonaceous shale. Conglomerate consists of boulders as small as 3 ft in diameter of quartzite, sandstone, limestone, chert, conglomerate, volcanic rocks of intermediate and felsic composition, and Paleozoic limestone in decreasing order of abundance. Interbedded sandstone, olive-gray; coarse grained to conglomeratic; weathers with brown weathering "cannon ball" concretions; thick-bedded; crossbedded in places. Paleomagnetic collected by R. Ewing, Skipp, and Schlicker (1979) from the bed in the Elk Creek area, Locality 2, K-Ar, and identified by R. R. Tschudy (written commun., 1983) indicate a late (post-Santonian) Cretacous age. Unit includes some of the Kinnikinic conglomerate unit (Kki), and forms barren red beds of Scholten and Ramsperk (1968)

Kbl Divide limestone conglomerate unit (Upper Cretaceous)—Interbedded sandstone and limestone. Conglomerate clasts as much as 3 ft in diameter of limestone, quartzite, sandstone, and quartzite, in decreasing order of abundance

Kbm Interbedded sandstone, mudstone, and grayish-orange-pink; fine grained to conglomeratic; calcareous; thin to thick bedded (beds up to 20 ft thick); local largescale foreset bedding. Unit weathers light brownish gray and grayish orange; forms ledges and steep slopes; cliffs, in interbedded with the Divide quartzite conglomerate unit, and has an intermediate contact with underlying Mesozoic rocks. About 4,700 ft may be measured in Black Mountain area (1983)

Kb BLACKTAIL FORMATION (LOWER CRETACEOUS)—Sandstone, mudstone, and tuff. Sandstone, tuff, brownish-gray, light-gray, and pale-green; fine grained; thin bedded; weathers light-gray, light-brown, and light-green; tuffaceous, argillaceous, partly calcareous and bioturbated; thin bedded; weathers dark greenish gray and yellowish brown; forms ledges and steep slopes. Light-brown, pale-green, and pale-yellow mudstone, bioturbated; weathers light-gray and light brownish gray; mostly fine to medium grained; massive; thick bedded; forms ledges and steep slopes. Unit forms slopes with numerous landslides, and has an intermediate contact with overlying Beaverhead Formation. Paleomagnetic collected by Kostenzel Rosenberg and Skipp (1983) indicate Formation is upper part of Aptian Formation of Scholten and others (1955). Early Cretaceous age determined from pollen identified by Tschudy (1983). Thickness varies from an erosional edge to greater than 1,000 ft

Kf FORTNEY FORMATION (LOWER CRETACEOUS)—Interbedded sandstone, mudstone, limestone, and conglomerate. Northeastern part of Beaverhead Mountains is underlain by a thick, coarsening-upward sequence of fine-grained sandstone, gray and tan; thin to medium bedded; mudstone, and minor limestone is present in lower part. Lower limestone, light-gray and light-brown; thin bedded; weathers light gray, and produces a yellowish-brown soil. Upper limestone, light-gray; thick-bedded; weathers light gray, and produces a yellowish-brown soil. Sandstone, light-gray to medium-gray; fine grained to conglomeratic; thick bedded; weathers light-brown; forms ledges and steep slopes. Conglomerate, light-gray; thick-bedded; weathers light-brown; forms ledges and steep slopes. Unit has an intermediate contact with underlying Beaverhead Formation. Paleomagnetic collected by Kostenzel Rosenberg and Skipp (1983) indicate Formation is upper part of Aptian Formation of Scholten and others (1955). Early Cretaceous age determined from pollen identified by Tschudy (1983). Thickness varies from an erosional edge to greater than 1,000 ft

Kki KINNIKINIC QUARTZITE (MIDDLE CRETACEOUS)—Orthoquartzite, light-gray to medium-gray; relatively pure; medium to thick bedded; weathers light-gray; forms ledges and steep slopes; generally well sorted, composed almost entirely of subrounded to well rounded clear quartz grains cemented by authigenic quartz; contains trace amounts (3 percent grains of zircon, tourmaline, titanaugite, and alkalic feldspar (Scholten and Ramsperk, 1968). Brown or yellowish-brown limonite; stains or blotches common; forms cliffs and ledges. Overlies Middle(?) Proterozoic sandstones with a moderate angular discordance (Scholten and Ramsperk, 1968). Thickness from erosional feather edge to a minimum 1,000 ft; removed by pre-Jefferson erosion through much of the area

Ss SANDSTONE (MIDDLE ? PROTEROZOIC)—Sandstone, quartzite, and conglomerate. Sandstone, mostly pale red; grayish-green, and light-gray; medium to very coarse grained; weathers reddish brown to light gray; medium to thick bedded; locally crossbedded or laminated, exhibits ripple marks, slump structures, and mudcracks (Scholten and Ramsperk, 1968); locally conglomeratic; quartzose, feldspathic, or micaceous; contains some conglomerate consist largely of quartz, 10-30 percent altered feldspar, mostly alkali feldspar, some calcite plagioclase, and little fragments including chert, argillite, and limestone. Matrix is mostly sericite, clay, and chlorite, and some calcite. Weathers light-gray; forms ledges and steep slopes. Contains a few thin beds of limestone and tuff. Overlies Middle(?) Proterozoic sandstones. Thickness of the unit as defined varies from not being present at a measured section to 325 ft

SCOTTS PEAK FORMATION (UPPER MISSISSIPPIAN)—Limestone, dolomite, and minor shale. Limestone, light-gray; very fine to coarse grained; dark-gray; very fine to coarse grained; sandy and silty in the Beaverhead Mountains; contains fossiliferous; chert common in layers and nodules; weathers medium to light gray; mostly thick bedded, but includes thin and medium bedded zones; forms ledges and steep slopes. Dolomite, light-gray; calcareous. Local diagenetic magnesian limestone and formation of dolomite occurs locally on both Frist Creek and Scott Peak quadrangles (Skipp and others, 1983). Dolomite, medium-dark-gray and brownish-gray; finely crystalline; weathers light-gray; locally to coarsely crystalline and coarse. In magnesian limestone, dolomite has replaced most of original limestone clasts. Formation forms cliffs and steep slopes covered with talus and rubble. Overlying sedimentary rocks rest on gneiss of Heinrich (1953) and on Paleozoic rocks modified from Scholten and Ramsperk (1968). Unit exposed only along north-central edge of map area; possible Archean age extrapolated from radiometric ages published for basement crystalline rocks in southwestern Montana by Jones and Hedge (1980). Thickness of the unit is unknown

MIDDLE CARBON FORMATION (UPPER AND LOWER MISSISSIPPIAN)—Chert, limestone with silty and sandy partings. Limestone, medium-to-light-gray; sandy; fine grained; contains some coarse-grained oncolitic layers; thin to medium bedded; forms ledges. Chert, in layers and nodules; weathers medium to light gray; mostly thick bedded, but includes thin and medium bedded zones; forms ledges and steep slopes. Silty and sandy limestone, calcareous. Local diagenetic magnesian limestone and formation of dolomite occurs locally on both Frist Creek and Scott Peak quadrangles (Skipp and others, 1983). Unit exposed only along north-central edge of map area; possible Archean age extrapolated from radiometric ages published for basement crystalline rocks in southwestern Montana by Jones and Hedge (1980). Thickness of the unit is unknown

MOUNTAIN CREEK FORMATION (LOWER MISSISSIPPIAN AND DEVONIAN)—Limestone and dolomite. Limestone, light-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Dolomite, light-gray to medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Limestone, medium-gray; locally coarse grained; thick bedded; weathers light-gray; forms ledges and steep slopes. Unit has an intermediate contact with underlying Middle Devonian rocks. About 1,000 ft may be measured in Black Mountain area (1983)

Mdm MIDDLE DEVONIAN (MIDDLE DEVONIAN)—Dolomite, dolomitic limestone, limestone-dolomite mixture, and minor shale. Dolomite, light-gray to medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Limestone, medium-gray; locally coarse grained; thick bedded; weathers light-gray; forms ledges and steep slopes. Limestone-dolomite mixture, medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Shale, dark-gray; fissile; weathers light-gray; forms slopes. Unit has an intermediate contact with underlying Devonian rocks. About 1,000 ft may be measured in Black Mountain area (1983)

MCDONALD FORMATION (UPPER DEVONIAN)—Limestone, dolomite, and minor shale. Limestone, light-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Dolomite, light-gray to medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Shale, dark-gray; fissile; weathers light-gray; forms slopes. Unit has an intermediate contact with underlying Devonian rocks. About 1,000 ft may be measured in Black Mountain area (1983)

Dj JEFFERSON FORMATION (UPPER DEVONIAN)—Dolomite, dolomitic limestone, limestone-dolomite mixture, and minor shale. Dolomite, medium-light-gray to medium-dark-gray; finely crystalline; medium bedded; weathers light-gray; forms ledges and steep slopes. Limestone, medium-gray; locally coarse grained; thick bedded; weathers light-gray; forms ledges and steep slopes. Limestone-dolomite mixture, medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Shale, dark-gray; fissile; weathers light-gray; forms slopes. Unit has an intermediate contact with underlying Devonian rocks. About 1,000 ft may be measured in Black Mountain area (1983)

Dp PORTNEUF FORMATION (LOWER DEVONIAN)—Dolomite, limestone, and minor shale. Dolomite, medium-light-gray to medium-dark-gray; finely crystalline; medium bedded; weathers light-gray; forms ledges and steep slopes. Limestone, medium-gray; locally coarse grained; thick bedded; weathers light-gray; forms ledges and steep slopes. Limestone-dolomite mixture, medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Shale, dark-gray; fissile; weathers light-gray; forms slopes. Unit has an intermediate contact with underlying Devonian rocks. About 1,000 ft may be measured in Black Mountain area (1983)

Mb BIG SHOW FORMATION (UPPER MISSISSIPPIAN)—Mudstone, limestone, limestone-dolomite mixture, and sandstone. Mudstone, medium-gray and grayish-black; largely noncalcareous; shaly; weathers dark gray to black; contains lenses of sandy limestone and calcareous concretions; makes up slightly less than half of the formation. Limestone, medium-light-gray to grayish-black; very fine to very coarse grained; sandy and silty; nodular to thick bedded (up to 2 ft); weathers gray and pale red. Limestone conglomerate common in lower part; medium-light-gray; contains subrounded to rounded limestone pebbles as much as 1 in. in diameter; makes up about 10 percent of the limestone in middle part, medium-gray; very fine to fine grained; thin bedded; gray and medium gray; commonly thin bedded; fine grained; contains ripple marks, slump structures, and mudcracks (Scholten and Ramsperk, 1968); locally conglomeratic; quartzose, feldspathic, or micaceous; contains some conglomerate consist largely of quartz, 10-30 percent altered feldspar, mostly alkali feldspar, some calcite plagioclase, and little fragments including chert, argillite, and limestone. Matrix is mostly sericite, clay, and chlorite, and some calcite. Weathers light-gray; forms ledges and steep slopes. Contains a few thin beds of limestone and tuff. Overlies Middle(?) Proterozoic sandstones. Thickness of the unit varies from not being present at a measured section to 325 ft

Ma MAYBE FORMATION (UPPER MISSISSIPPIAN)—Limestone, limestone-dolomite mixture, and minor shale. Limestone, medium-light-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Dolomite, medium-light-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Shale, dark-gray; fissile; weathers light-gray; forms slopes. Unit has an intermediate contact with underlying Devonian rocks. About 1,000 ft may be measured in Black Mountain area (1983)

Mdmt MOUNTAIN CREEK FORMATION (LOWER MISSISSIPPIAN AND DEVONIAN)—Limestone and dolomite. Limestone, light-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Dolomite, light-gray to medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Limestone, medium-gray; locally coarse grained; thick bedded; weathers light-gray; forms ledges and steep slopes. Limestone-dolomite mixture, medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Shale, dark-gray; fissile; weathers light-gray; forms slopes. Unit has an intermediate contact with underlying Devonian rocks. About 1,000 ft may be measured in Black Mountain area (1983)

Ob BEAVERHEAD FORMATION OF SCHOLTEN AND RAMSPERK, 1968 (MIDDLE ORDOVICIAN)—Limestone, dolomite, limestone-dolomite mixture, and minor shale. Limestone, medium-light-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Dolomite, medium-light-gray to medium-dark-gray; finely crystalline; medium to coarse grained, medium bedded; weathers light-gray; forms ledges and steep slopes. Limestone-dolomite mixture, medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Shale, dark-gray; fissile; weathers light-gray; forms slopes. Unit has an intermediate contact with underlying Middle Ordovician and overlying Middle Cambrian rocks. Thickness of the unit varies from 230-1,230 ft

Obg GALLIGER PEAK(?) SANDSTONE MEMBER (UPPER ORDOVICIAN)—Sandstone, quartzite, and minor limestone. Sandstone, medium-light-gray; quartzose; very fine grained to fine grained; thin bedded; weathers medium light gray and light brown; in nearly thin beds. Quartzite, medium-light-gray; medium-gray; sandy; medium bedded. Member is present in the Beaverhead Mountains southeast part of map area (Skipp and others, 1983). Member has sandstone possibly may be a correlative of the Kinnikinic Member. Estimated thickness 100 ft

Pwb Wise Member (Upper and Middle Pennsylvanian)—Limestone and interbedded sandstone, mudstone, and minor shale. Limestone, medium-light-gray and light brownish gray; mostly fine to medium grained; thin bedded; weathers light-gray; contains banded stromatolite mounds and yellowish-brown chert in nodular and layer. Fossiliferous. Interbedded thin sandstone and mudstone, medium-light-gray; very fine grained; calcareous; forms slopes; weathering in the lower part. Member is medium to thin bedded, contains abundant scattered ledges and ridges, and grades into the Scott Peak Quartzite Member of the Beaverhead Mountains Formation. Estimated thickness about 1,000 ft

Pwb BLAKLEAD MOUNTAIN FORMATION (UPPER PENNSYLVANIAN AND UPPER MISSISSIPPIAN)—Sandstone, with minor interbedded limestone and dolomite. Sandstone is light-gray to medium-gray; very fine grained to medium grained, angular to subrounded; quartzose; contains up to 5 percent feldspar, mostly altered to clay minerals; contains some muscovite, biotite, mica, zircon, and chert in a calcareous or siliceous cement; thin to medium bedded; locally crossbedded; weathers moderate yellowish brown to light brown; secondarily silicified near Bannack Pass; forms ledges and steep slopes. Limestone and dolomite, in beds 5 ft thick, largely fine grained, and locally fossiliferous; forms some of the cliffs or ledges and is gradational from the underlying Big Snowy Formation into overlying Amsby Gorge Formation. Estimated thickness 300-500 ft

Mbm BIG SNOWY FORMATION (UPPER MISSISSIPPIAN)—Mudstone, limestone, limestone-dolomite mixture, and sandstone. Mudstone, medium-gray and grayish-black; largely noncalcareous; shaly; weathers dark gray to black; contains lenses of sandy limestone and calcareous concretions; makes up slightly less than half of the formation. Limestone, medium-light-gray to grayish-black; very fine to very coarse grained; sandy and silty; nodular to thick bedded (up to 2 ft); weathers gray and pale red. Limestone conglomerate common in lower part; medium-light-gray; contains subrounded to rounded limestone pebbles as much as 1 in. in diameter; makes up about 10 percent of the limestone in middle part, medium-gray; very fine to fine grained; thin bedded; gray and medium gray; commonly thin bedded; fine grained; contains ripple marks, slump structures, and mudcracks (Scholten and Ramsperk, 1968); locally conglomeratic; quartzose, feldspathic, or micaceous; contains some conglomerate consist largely of quartz, 10-30 percent altered feldspar, mostly alkali feldspar, some calcite plagioclase, and little fragments including chert, argillite, and limestone. Matrix is mostly sericite, clay, and chlorite, and some calcite. Weathers light-gray; forms ledges and steep slopes. Contains a few thin beds of limestone and tuff. Overlies Middle(?) Proterozoic sandstones. Thickness of the unit varies from not being present at a measured section to 325 ft

Ma MAYBE FORMATION (UPPER MISSISSIPPIAN)—Limestone, limestone-dolomite mixture, and minor shale. Limestone, medium-light-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Dolomite, medium-light-gray to medium-dark-gray; finely crystalline; medium bedded; weathers light-gray; forms ledges and steep slopes. Limestone, medium-gray; locally coarse grained; thick bedded; weathers light-gray; forms ledges and steep slopes. Limestone-dolomite mixture, medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Shale, dark-gray; fissile; weathers light-gray; forms slopes. Unit has an intermediate contact with underlying Devonian rocks. About 1,000 ft may be measured in Black Mountain area (1983)

Mdmt MOUNTAIN CREEK FORMATION (LOWER MISSISSIPPIAN AND DEVONIAN)—Limestone and dolomite. Limestone, light-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Dolomite, light-gray to medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Limestone, medium-gray; locally coarse grained; thick bedded; weathers light-gray; forms ledges and steep slopes. Limestone-dolomite mixture, medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Shale, dark-gray; fissile; weathers light-gray; forms slopes. Unit has an intermediate contact with underlying Devonian rocks. About 1,000 ft may be measured in Black Mountain area (1983)

Dj JEFFERSON FORMATION (UPPER DEVONIAN)—Dolomite, limestone, limestone-dolomite mixture, and minor shale. Dolomite, medium-light-gray to medium-dark-gray; finely crystalline; medium bedded; weathers light-gray; forms ledges and steep slopes. Limestone, medium-gray; locally coarse grained; thick bedded; weathers light-gray; forms ledges and steep slopes. Limestone-dolomite mixture, medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Shale, dark-gray; fissile; weathers light-gray; forms slopes. Unit has an intermediate contact with underlying Devonian rocks. About 1,000 ft may be measured in Black Mountain area (1983)

Dp PORTNEUF FORMATION (LOWER DEVONIAN)—Dolomite, limestone, limestone-dolomite mixture, and minor shale. Dolomite, medium-light-gray to medium-dark-gray; finely crystalline; medium bedded; weathers light-gray; forms ledges and steep slopes. Limestone, medium-gray; locally coarse grained; thick bedded; weathers light-gray; forms ledges and steep slopes. Limestone-dolomite mixture, medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Shale, dark-gray; fissile; weathers light-gray; forms slopes. Unit has an intermediate contact with underlying Devonian rocks. About 1,000 ft may be measured in Black Mountain area (1983)

Ok KINNIKINIC QUARTZITE (MIDDLE ORDOVICIAN)—Orthoquartzite, light-gray to medium-gray; relatively pure; medium to thick bedded; weathers light-gray; forms ledges and steep slopes; generally well sorted, composed almost entirely of subrounded to well rounded clear quartz grains cemented by authigenic quartz; contains trace amounts (3 percent grains of zircon, tourmaline, titanaugite, and alkalic feldspar (Scholten and Ramsperk, 1968). Brown or yellowish-brown limonite; stains or blotches common; forms cliffs and ledges. Overlies Middle(?) Proterozoic sandstones with a moderate angular discordance (Scholten and Ramsperk, 1968). Thickness from erosional feather edge to a minimum 1,000 ft; removed by pre-Jefferson erosion through much of the area

Ss SANDSTONE (MIDDLE ? PROTEROZOIC)—Sandstone, quartzite, and conglomerate. Sandstone, mostly pale red; grayish-green, and light-gray; medium to very coarse grained; weathers reddish brown to light gray; medium to thick bedded; locally crossbedded or laminated, exhibits ripple marks, slump structures, and mudcracks (Scholten and Ramsperk, 1968); locally conglomeratic; quartzose, feldspathic, or micaceous; contains some conglomerate consist largely of quartz, 10-30 percent altered feldspar, mostly alkali feldspar, some calcite plagioclase, and little fragments including chert, argillite, and limestone. Matrix is mostly sericite, clay, and chlorite, and some calcite. Weathers light-gray; forms ledges and steep slopes. Contains a few thin beds of limestone and tuff. Overlies Middle(?) Proterozoic sandstones. Thickness of the unit varies from not being present at a measured section to 325 ft

Ma MAYBE FORMATION (UPPER MISSISSIPPIAN)—Limestone, limestone-dolomite mixture, and minor shale. Limestone, medium-light-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Dolomite, medium-light-gray to medium-dark-gray; finely crystalline; medium bedded; weathers light-gray; forms ledges and steep slopes. Limestone, medium-gray; locally coarse grained; thick bedded; weathers light-gray; forms ledges and steep slopes. Limestone-dolomite mixture, medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Shale, dark-gray; fissile; weathers light-gray; forms slopes. Unit has an intermediate contact with underlying Devonian rocks. About 1,000 ft may be measured in Black Mountain area (1983)

Mdmt MOUNTAIN CREEK FORMATION (LOWER MISSISSIPPIAN AND DEVONIAN)—Limestone and dolomite. Limestone, light-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Dolomite, medium-light-gray to medium-dark-gray; finely crystalline; medium bedded; weathers light-gray; forms ledges and steep slopes. Limestone, medium-gray; locally coarse grained; thick bedded; weathers light-gray; forms ledges and steep slopes. Limestone-dolomite mixture, medium-gray; fine grained; thin bedded; weathers light-gray; forms ledges and steep slopes. Shale, dark-gray; fissile; weathers light-gray; forms slopes. Unit has an intermediate contact with underlying Devonian rocks. About 1,000 ft may be measured in Black Mountain area (1983)

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Ꞓ Proterozoic rocks (across section A-A'). Parts of the Proterozoic section are exposed in the Tendoy Mountains, where the section is as old as 31.5±1.4 m.a. (mega annum), and, thus, the fault must be older than 30 m.a. and younger than the Cabin thrust. An early Eocene to Paleocene age is indicated. The northwest-trending fault west of Nicholia Creek drops the Pritz Creek plate down to the southwest and is overlapped by the Eocene Challis Volcanics. Beneath Nicholia Valley, this fault is interpreted to be a listric normal fault soled on the Pritz Creek thrust (cross section A-A'). The north-trending faults near the head of Willow Creek include the one along which the Pritz prospect is located (Skipp and others, 1983). Not 2 faults are younger than faults of set 1 and are northeast-trending faults. Faults of set 2 are Eocene or younger and are generally near-vertical faults in the southern part of the area, one fault with reverse movement that crosses Italian Gorge (Devonian: California University, Riverside, Campus Museum Collection 1, p. 14-15); Scholten, Robert, 1957, Paleozoic evolution of the Beaverhead Mountains, Lemhi County, Idaho: Geological Society of America