Geologic Map of the Pine Creek Ridge Quadrangle, Lemhi County, Idaho

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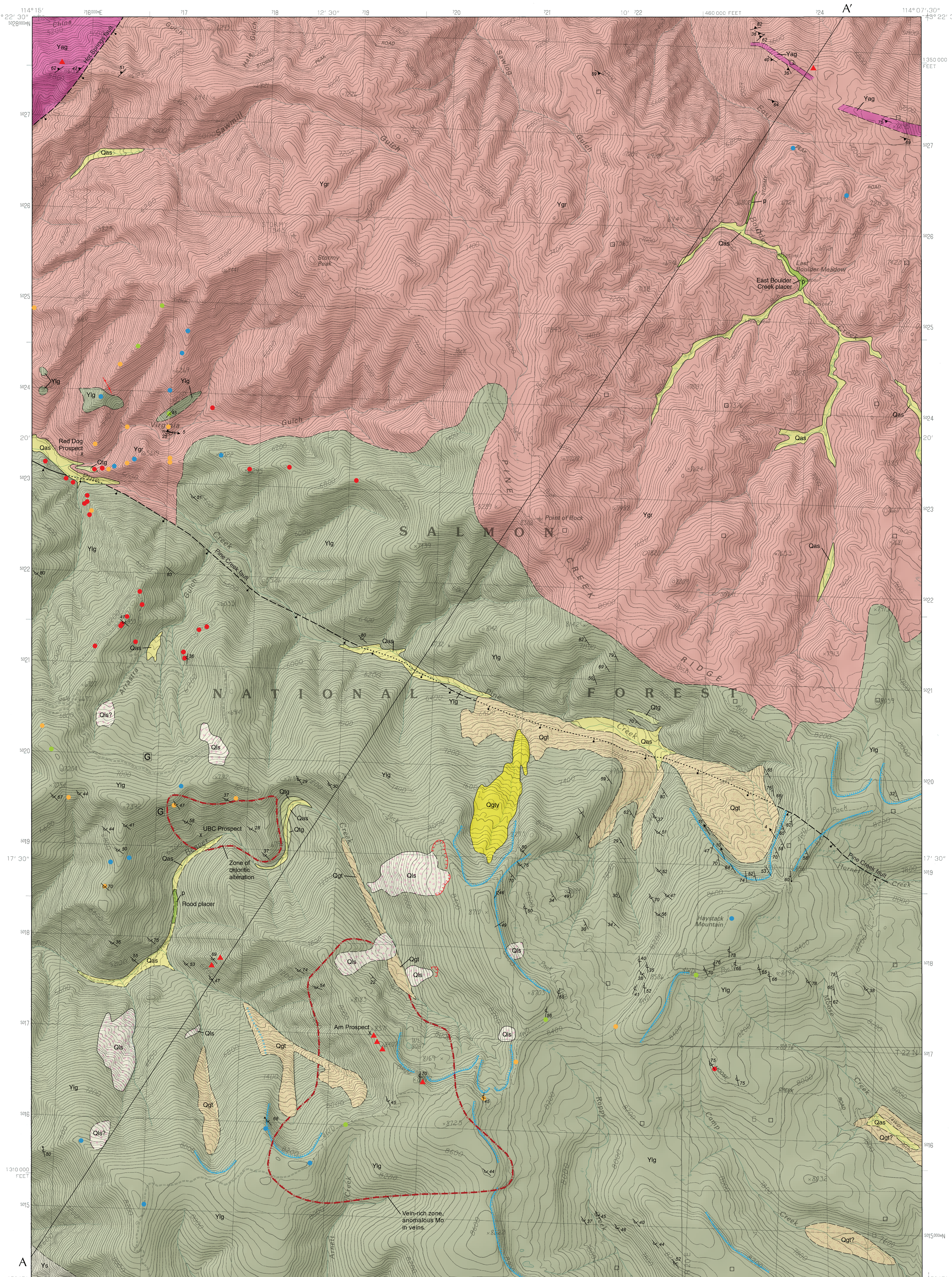
2023



Base Map Credit

Topographic base modified from digitally scanned 1:24,000-scale USGS paper map, compiled from aerial photographs taken in 1985. Field checked in 1988. Map edited 1991.

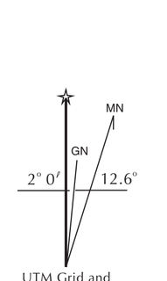
Transverse Mercator projection. 1927 North American Datum.

10,000-foot grid ticks: State Plane Coordinate System, Idaho Central Zone.

1000-meter grid ticks: Universal Transverse Mercator, zone 11.

Shaded relief from 10 m DEM.

Declination from NOAA National Geophysical Data Center.



UTM Grid and 2023 Magnetic North Declination at Center of Map

SCALE 1:24,000

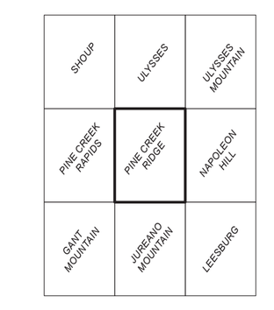
1 0.5 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0.5 0 1 KILOMETER

Contour interval 40 feet

QUADRANGLE LOCATION



ADJOINING QUADRANGLES

Field work conducted 2014-2023.

This geologic map was supported by the U. S. Geological Survey, National Cooperative Geologic Mapping Program, under assistance Award No. G22AC00357. 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.

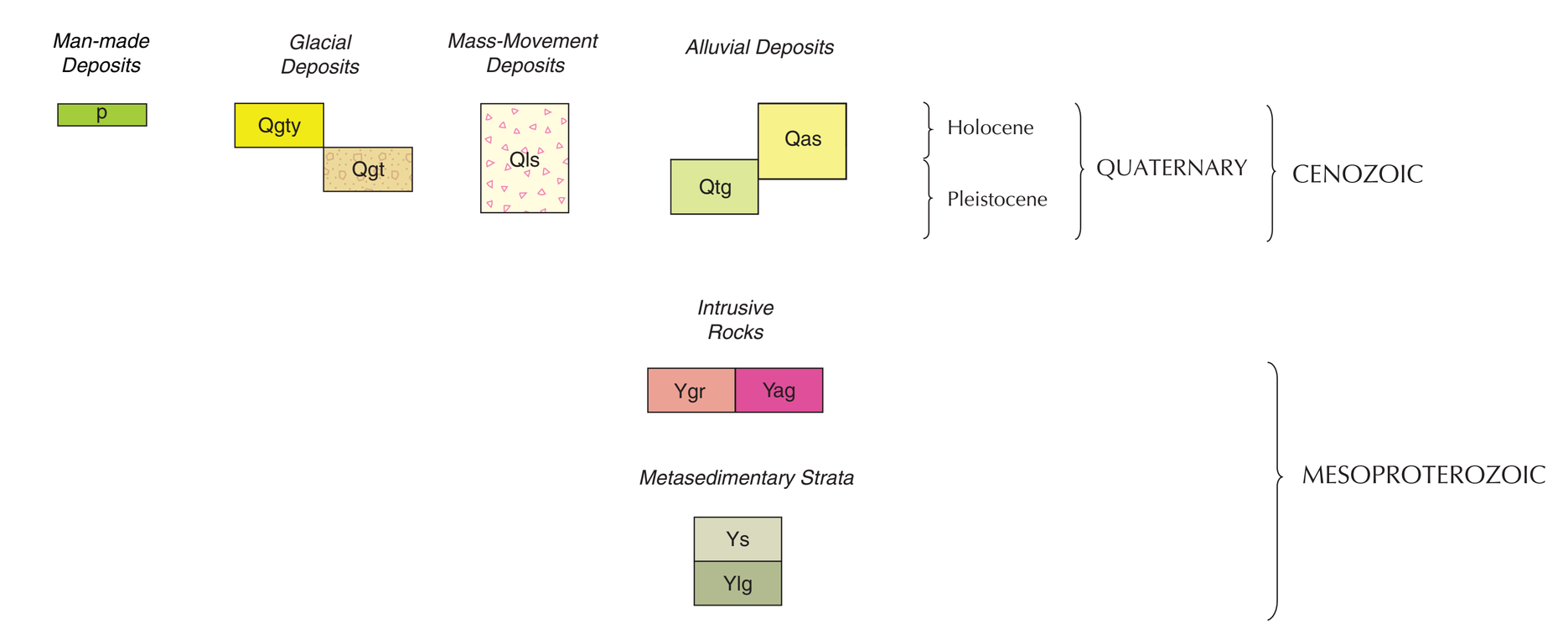
Digital cartography by David Vohra at the Idaho Geological Survey's Digital Mapping Lab.

Technical review by Russell Di Fiori and Claudio Berti.

Map version 10-30-2023.

This map can be downloaded in PDF format from www.idahogeology.org.

CORRELATION OF MAP UNITS



INTRODUCTION

This map is the result of field work that spanned 2014 through 2023. Many concepts for these geologic units were developed while mapping the Beaverhead Mountains to the east as part of a 1:24,000-scale collaborative mapping project started in 2007 by the Idaho Geological Survey and the Montana Bureau of Mines and Geology. That led to publication of the western (Burmester and others, 2016a) and eastern (Lonn and others, 2019) parts of the Salmon 30' x 60' quadrangle east of this map, which is shown by a green outline in Figure 1. Attitudes from Hillesland (1982) and Jordan (1984) were used to supplement the structural data collected by the authors; descriptive information of the alteration and mineralization in the quadrangle is largely from Hillesland (1982). Magnetic susceptibilities were measured with KT-9 and KT-10 Kappameters from Exploranium G.S. Ltd. and Terraplus Inc., typically on 10 measurements per exposure and averaged (Table 1). Results are summarized as a histogram in Figure 2.

GEOLOGIC SUMMARY

The oldest rocks in the quadrangle are Mesoproterozoic metasedimentary and intrusive rocks. The former are Lemhi subbasin units of the Belt Supergroup, which is more widespread to the north; the latter are parts of a bimodal intrusive suite that includes A-type granites and mafic rocks. The Mesoproterozoic rocks are cut by the southwest striking Pine Creek fault of uncertain age and the northeast striking Hot Springs fault, which is possibly Eocene. Upland areas in the southern part of the map have been modified by glaciation and landslides.

LOCATION OF FIELD OBSERVATIONS

Pine Creek Ridge Quadrangle

Extent of LiDAR coverage as of 10/2023

SYMBOLS

- Contact: dashed where approximately located.
- Normal fault: solid where certain; dashed where approximately located; dotted where concealed; ball and bar on downthrown side.
- 58 Strike and dip of bedding.
- Strike of vertical bedding.
- 65 Strike and dip of overturned bedding based on stratigraphic succession or position.
- 60 Strike and dip of inclined bedding where top direction is known from sedimentary structures.
- 68 Strike and dip of overturned bedding based on sedimentary structures.
- 36 Strike and dip of foliation.
- 25 Strike and dip of mylonitic foliation.
- 10 Trend and plunge of lineation, type unknown.
- 5 Trend and plunge of mineral lineation within a mylonite.
- Zone of alteration or veining noted by Hillesland (1982).
- Moraine crest.
- Cirque headwall; hachures point into the cirque.
- Head or main scarp of landslide; hachures point downscarp.
- x Prospect.
- Tectonic breccia.
- G Observed garnet in metamorphic rock.
- Soil chemistry sample (Jordan, 1984).
- Magnetic susecptibility measurements (Table 1) reported in SI units (x 10^{-3})
  - 0.03 - 1.00
  - 1.01 - 2.00
  - 2.01 - 10.00
  - 10.01 - 65.00

DESCRIPTION OF MAP UNITS

This geologic map of the Pine Creek Ridge quadrangle shows rock units exposed at the surface or underlying a thin surficial cover of soil and colluvium. Igneous rocks are classified using International Union of Geological Sciences nomenclature (Le Bas and Streckeisen, 1991). Grain size classification of unconsolidated and consolidated sediment employs the Wentworth scale (Lane, 1947). Bedding thicknesses are after McKee and Weir (1953). Time scale is the Geological Society of America version 6.0 (Walker and Geissman, 2022). Grain sizes and bedding thicknesses are given in abbreviation of metric units (e.g., dm=decimeter). Unit thicknesses, distances, and elevations are in both metric and English units. Multiple lithologies within a rock unit description appear in order of decreasing abundance, and descriptions of stratigraphic units are from bottom to top where possible.

MAN-MADE DEPOSITS

p **Placered ground (late Holocene)**—Areas along East Boulder Creek and Beaver Creek that were placer mined for gold (Lorain and Metzger, 1939). See Alteration and Mineralization section below for more details.

ALLUVIAL DEPOSITS

Qas **Side-stream alluvium (Holocene to Late Pleistocene)**—Subangular to rounded, moderately sorted and stratified pebble to boulder sandy gravel in modern stream drainages.

Qtg **Terrace gravel (Pleistocene)**—Subangular to rounded, moderately sorted and stratified pebble to boulder sandy gravel in terraces above Pine Creek and Beaver Creek.

MASS-MOVEMENT DEPOSITS

Qls **Landslide deposits (Holocene to Pleistocene)**—Unstratified silt, sand, cobbles, and boulders. For some deposits, the map also shows the landslide scarp and the headwall (steep surface adjacent to and below the landslide scarp) from which material broke away (see Symbols).

GLACIAL DEPOSITS

Qgty **Young glacial and periglacial deposits (Holocene?)**—Poorly sorted angular to subangular boulder gravel and till. Restricted to the south-central part of the map to a single drainage where a rock glacier is well developed. Cliffs on both sides of the drainage appear to have contributed to rock glacier development. Smaller, more widespread pro-talus ramparts of similar age are visible on LiDAR-derived imagery but are too small to show at map scale.

Qgt **Till (Late Pleistocene)**—Poorly sorted cobble and boulder till with gravel in a sand to clay matrix. Clasts subangular to subrounded, some with glacial striations (Figure 3). Yields weakly developed soils.

INTRUSIVE ROCKS

Ygr **Granite (Mesoproterozoic)**—Light-gray, medium- to coarse-grained, variously porphyritic granite. Contains megacrysts, typically blocky, from 3 to 8 cm in length. Some are entirely microcline; others are microcline rimmed with albite (rapakivi texture). Exposures north of Pine Creek at the western edge of the map are equigranular to weakly porphyritic and were mapped separately as biotite granite by Hillesland (1982) but are not here because we were unable to confirm their mapped outlines. Plagioclase phenocrysts are smaller and characterized by aligned inclusions of white mica and equant crystals of epidote. Subordinate amounts of equigranular, fine- to medium-grained granite, tonalite, or trondhjemite (Figure 4). Aside from fault contacts, all contacts with Mesoproterozoic strata are intrusive, with inclusions near the contacts (Figures 4 and 5). See Hillesland (1982), Spence (1984), and Jordan (1984) for detailed descriptions of this unit. Magnetic susceptibility at 19 exposures of *Ygr* ranged from 0.08 to 17.08 averaging 4.42 ± 2.81 (all × 10^{-3} SI). Zircons from an outcrop along the road northwest of East Boulder Meadow in the northeast part of the map yielded a concordia age of 1,377 ± 4 Ma (Aleinikoff and others, 2012, locality C). Zircons from a *Ygr* outcrop along Moose Creek 9.5 km (6 mi) southeast of East Boulder Meadow (off this map in the Napoleon Hill quadrangle; Lewis and others, 2023) yielded a weighted average age of 1,359 ± 7 Ma (MSWD = 1.59) from 11 of 12 SHRIMP analyses (Aleinikoff and others, 2012, locality D). Zircons from that same outcrop had previously yielded a TIMS age of approximately 1,367 Ma (Evans and Zartman, 1990). Zircons from a sample of the Deadwater granite augen gneiss about 6 km (4 mi) east-northeast of locality C yielded a U-Pb concordia age of 1,383 ± 4 Ma (Aleinikoff and others, 2012, locality A).

Yag **Augen gneiss (Mesoproterozoic)**—Granite (*Ygr*) with well-developed foliation exposed in the northwest corner of the map, in the footwall of the Hot Springs fault, and in two narrow zones in the northeast part of the quadrangle.

METASEDIMENTARY STRATA

Mesoproterozoic metasedimentary rocks constitute much of the bedrock in the quadrangle. Most are a southwest-facing section of middle and lower Lemhi subbasin strata in the footwall of the Poison Creek fault. Unit names follow the revised stratigraphic nomenclature (Burmester and others, 2016b) that uses the coarsest unit, the Swauger Formation, to distinguish otherwise similar rocks that occur above and below it. The units can be traced from surrounding areas (Figure 1).

Ys **Swauger Formation (Mesoproterozoic)**—White to pale-orange, very fine to fine- and rare medium-grained, poorly sorted quartzite with less feldspar than underlying *Ylg*. Exposed only in the southwest corner of map. Where better and more completely exposed, potassium feldspar is typically more abundant than plagioclase, quartz grains are typically well rounded, and feldspar grains are interstitial or blocky (e.g., Lewis and others, 2022). Alternates with thin-bedded, green, very fine grained quartzite, siltite and argillite off the map to the southwest.

Ylg **Lemhi Group (Mesoproterozoic)**—Gray biotite-feldspar quartzite, minor siltite, and argillite, in sparse and discontinuous exposures. Quartzite is very fine to fine grained, generally well sorted, in 1 to 5 dm beds. Potassium feldspar is absent or much less abundant relative to plagioclase. Some bedding surfaces are covered with muscovite flakes or have argillite in ripple troughs. Cross-lamination is scattered throughout the area but commonly masked by lichen or weathering. Siltite is darker gray, as separate parallel-laminated beds 4 cm to 4 dm thick, and as graded tops, or less commonly bases of quartzite beds, 1 to 3 dm thick (Figure 6). Argillite, generally dark but also light gray, is present as graded or discrete tops of quartzite or siltite beds, as siltite and argillite couplets, and as rare 1 to 3 cm discrete layers. White spots indicative of scapolite (or scapolite replaced by albite) scattered throughout (Figure 7). Locally phyllitic and garnetiferous in southwest part of map (Figure 8). Specific localities containing garnet are noted with a "G" on the map (see Symbols).

Hillesland (1982) subdivided *Ylg* in the western part of this map and the west-adjacent Pine Creek Rapids quadrangle. The lowest part is a very fine-grained, micaceous quartzite with abundant biotite, and minor carbonate. Above that is less micaceous and biotitic fine-grained quartzite with laminations of biotite and magnetite about 1 mm thick. Within this laminated quartzite is a phyllitic quartzite, commonly with idioblastic magnetite, and garnet in more micaceous interlayers (Figure 8). The laminated quartzite above this phyllitic quartzite is less micaceous than the quartzite below, and has undulatory laminations of symmetrical ripples, which are rare in the lower part. Exposures mapped as klippen of Hoodoo Formation on the upper laminated quartzite by Hillesland (1982) and perpetuated by Evans and Green (2003) as Swauger Formation, are interpreted here as coarser quartzite intervals within *Ylg* or, in some areas, hydrothermally altered (bleached) *Ylg*. All contacts are gradational. See also Jordan (1984) for attempts to subdivide unit.

Our less detailed view of this unit over 8.8 km (5.5 mi) between its contact with *Ygr* near Haystack Mountain and the southwest corner of the map crosses the southeast projection of Hillesland's (1982) map. Crossbedding or cross-lamination was found both above and below the poorly exposed phyllitic quartzite but less abundant than flat or parallel lamination. Mud chips in meter-thick quartzite below were not found above.

Magnetic susceptibility values from 49 exposures and one hand sample range from 0.25 to 64.39 × 10^{-3} SI (Figure 2), averaging 15.16 ± 8.40 × 10^{-3} SI. Some samples with high susceptibility have visible magnetite. The main quantifiable difference among Hillesland's units where we have sampled them or their extrapolations to the southeast is that the lower laminated quartzite has higher magnetic susceptibility than strata higher or lower in the section. However, susceptibility is uncommonly high at the west edge of the map near Pine Creek, where some *Ygr* susceptibilities are also high. This may indicate that magnetite content is not stratigraphically controlled, or that *Ylg* strata are not laterally continuous.

Upper contact is gradational into Ys with a decrease of dark siltite and argillite, a decrease in sorting, an increase in grain size, and interbeds that contain pink grains, and rusty holes that are common in Ys elsewhere. Thickness and lower contact of Ylg unknown. Previously mapped to the south as the upper part of the upper unit of the Yellowjacket Formation (Connor and Evans, 1986). Named here Lemhi Group, stratigraphically equivalent to the Yellowjacket Formation, based on more widespread usage of the term Lemhi Group. Formations defined in the Lemhi Range by Ruppel (1975) were not recognized.

STRUCTURE

PINE CREEK FAULT

Jordan (1984) mapped a fault along upper Pine Creek whereas Hillesland (1982) did not. Evidence for faulting includes cataclasite immediately south of Pine Creek at the west edge of the quadrangle, slickenlines on quartzite float at the upper end of the creek, and the linear nature of the creek itself. Also, the orientation of the *Ygr-Ylg* contact at the west edge of the map and further west into the Pine Creek Rapids quadrangle is indicative of fault truncation of the *Ygr* body and, assuming that the *Ygr* is at lower levels in the crust, suggestive of down-on-the-south normal motion.

HOT SPRINGS FAULT

The Hot Springs fault likely crosses the northwest corner of the map striking northeast based on projection from work by Hillesland (1982) in the adjacent quadrangle to the west. More highly deformed varieties of the Mesoproterozoic granite (*Yag*) present on the northwest side of this structure and less or undeformed *Ygr* on the southeast indicate that movement along the fault was likely dip-slip, down-to-the-southeast. This relative motion brought deeper, more highly deformed augen gneiss up on the northwest side.

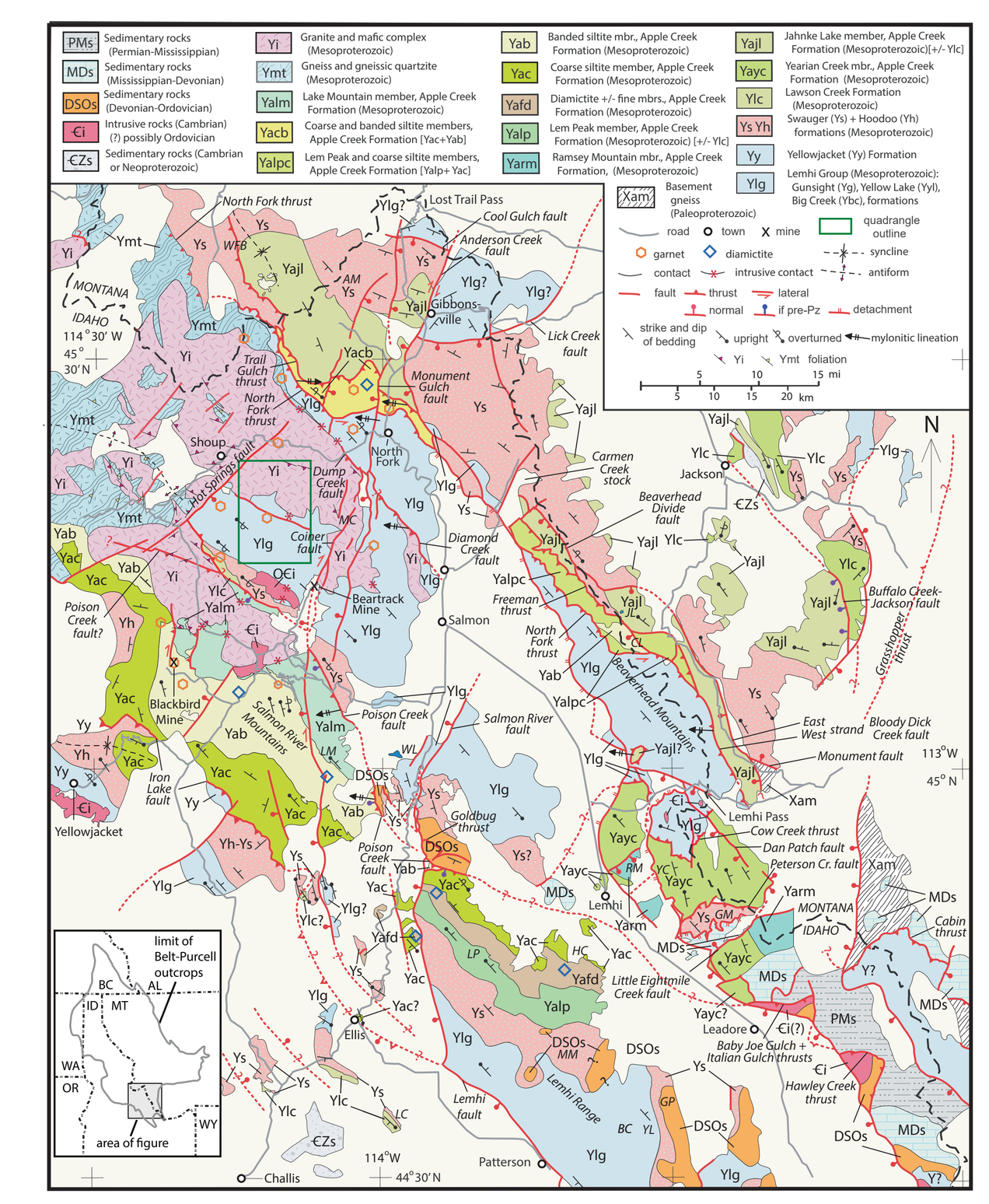


Figure 1. Pre-Mesozoic bedrock geology around Salmon, Idaho. The coarsest clastic unit (Ys = Yh) separates lower formations of the Lemhi Group (in blue) from higher Lawson Creek and Apple Creek formations (greens and yellows). Units are combined where scale or previous mapping makes separating them impractical. Geographic locations are in italics; those for type or reference sections have units in parentheses: *AM*—Allan Mountain; *BC*—Big Creek (Ybc); *CL*-Cowbone Lake; *GM*-Goat Mountain; *GP*—Gunsight Peak (Yg); *HC*—Hayden Creek (Yafd (Yaf+Yad), Yac); *JL*—Jahnke Lake (Yajl); *LC*—Lawson Creek (Ylc); *LM*—Lake Mountain (Yalm); *LP*—Lem Peak (Yalp); *MC*—Moose Creek; *MM*—Mogg Mountain (Ys); *PM*—Phelan Mountain; *RM*—Ramsey Mountain (Yarm); *WFB*—West Fork Bitterroot River; *WL*—Williams Lake; *YC*—Yearian Creek (Yayc); *YL*—Yellow Lake (Yyl). Modified after Burmester and others (2020) to include observations during field work in 2020 through 2022.

ALTERATION AND MINERALIZATION

No lode mineral production is reported from within the quadrangle, but the area has been prospected for copper and molybdenum. Anaconda Copper Company explored the area in the late 1970s and early 1980s, and the thesis by Hillesland (1982) was one product of that work. Additional information regarding this effort is archived in the Anaconda Geological Documents Collection at the University of Wyoming. Minor production of placer gold is reported (Lorain and Metzger, 1939).

Hillesland (1982) mapped a chlorite-altered zone in upper Beaver Creek in the vicinity of the BC prospect outlined on the map (see Symbols). He also noted an association of quartz-pyrite-magnetite veins. Some of the quartzite we observed in the area is light green (Figure 9), possibly reflecting chloritic alteration. More noticeable in the area, however, is iron-oxide staining, both moderate (Figure 10) and extreme (Figure 11). This zone of iron-oxide staining extends to the northwest beyond the mapped chloritic zone toward the Copper King mine 2.5 km (1.6 mi) west of this map and may also continue to the southeast toward the Arn Mo prospect discussed below.

In addition to the references listed, unpublished maps and documents for a few of the individual properties below are available by examining "Property Details" through the interactive map ("Mines" web app) on the Idaho Geological Survey website (https://www.idahogeology.org/webmap). Property codes (e.g., EC1128) are given below to assist with website searches.

RED DOG PROSPECT (EC1470)

The Red Dog prospect is located north of Pine Creek near the western edge of the map. Hillesland (1982) described two small adits that follow a zone of gossan that strikes 240° and dips 30° northwest. The mineralized zone is about 30 ft (9 m) thick and 500 ft (150 m) long and is in a non-porphyritic phase of *Ygr*. Molybdenite is present in quartz veins and torbernite (a copper-uranium phosphate) has been found along fractures at one locality. According to Hillesland (1982) the entire mineralized zone displays anomalous counts of gamma radiation two to four times background values.

TRAMWAY PROSPECT (EC1471)

The Tramway Prospect is reported by Hillesland (1982) to be 1,700 ft (520 m) south of the Red Dog prospect, but this area of his map in our collection is not legible so the location is uncertain. Apparently, a steel cable tramway about 500 ft (150 m) long connected the mine with a small mill along Pine Creek. Mineralized rock in the mine dump below the caved portal consists of altered quartzite (*Ylg*) cut by numerous quartz veins. The vein quartz is white, coarsely crystalline, and associated with pyrite, magnetite, and molybdenite. Hillesland (1982) also reported small amounts of malachite and chrysocolla on rock from the mine dump.

UBC PROSPECT (EC1469)

The UBC prospect is located north of Beaver Creek in the southwest part of the quadrangle. According to Hillesland (1982) the host rock is phyllitic quartzite that is bleached and silicified and much of the biotite is altered to chlorite. The mineralized zone is as much as 20 ft (6 m) wide and strikes northerly. It consists of small subparallel quartz veins. A small dump below a collapsed adit contains oxidation products of iron and copper along with pyrite. The prospect is within a chlorite-altered zone mapped by Hillesland (1982) and shown on the map (see Symbols).

ARN PROSPECT (EC1468)

The Arn prospect is located southwest of Haystack Mountain in the southern part of the quadrangle. Workings are limited to a few shallow pits in *Ylg*. The prospect area outlined by Hillesland and shown on the map (see Symbols) consists of a zone of relatively abundant quartz veins, some with selvages of muscovite and goethite pseudomorphs of pyrite and magnetite. Several of the veins were determined to be strongly anomalous in molybdenum (Hillesland, 1982).

EAST BOULDER CREEK PLACER (EC1123)

The East Boulder Creek placer is located in the northeast part of the quadrangle within a relatively low-relief area draining *Ygr*. According to Lorain and Metzger (1939), test pits have been sunk at scattered points along the creek and some of these are presumably the "prospects" noted on the USGS base map for the quadrangle. The northern workings are apparently the oldest. The site was visited by William Staley of the University of Idaho in 1948 (see IGS website). He reported monazite and zircon in addition to gold and noted a high concentration of zircon in the panned concentrates.

ROOD PLACER (ALSO CALLED MAE BELLE PLACER; EC1128)

The Rood placer is located along Beaver Creek in the southwestern part of the quadrangle. According to Lorain and Metzger (1939) the first placer production by the Rood brothers was in 1938. They washed off bedrock with a 3-inch nozzle and found moderately coarse nuggets. In addition, many pieces of massive iron sulfide were discovered, indicating that an area of lode mineralization is not far.

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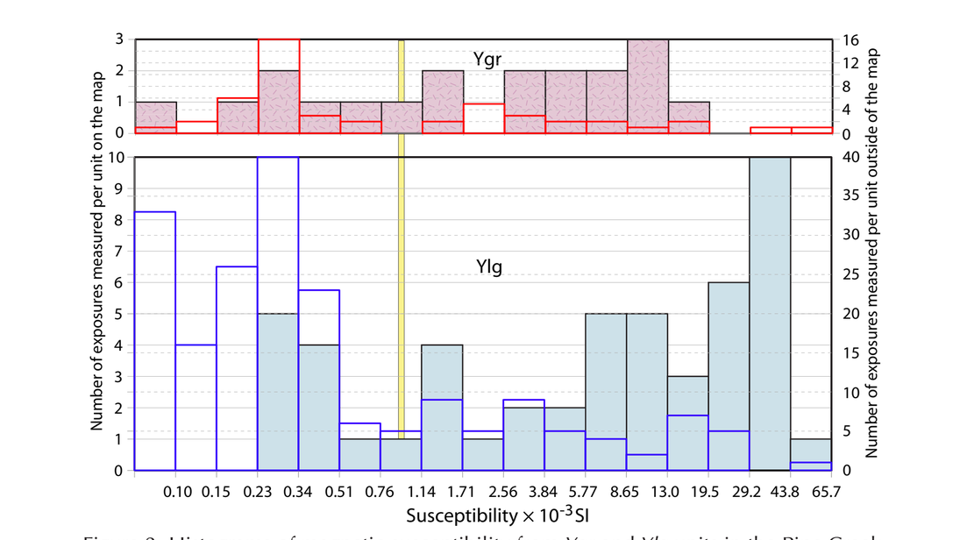


Figure 2. Histograms of magnetic susceptibility from *Ygr* and *Ylg* units in the Pine Creek Ridge quadrangle. Susceptibility (x) axis uses geometric progression with factor of 1.5. The yellow bar approximates the susceptibility for a quartzo-feldspathic rock with 50 percent biotite and no magnetite. Filled red and blue areas are for measurements within the quadrangle for *Ygr* and *Ylg*, respectively, with scales on the left. Areas outlined in red for *Ygr* and blue for *Ylg* with scales on the right show susceptibilities measured through 2022 from the rest of the Salmon River Mountains. Many of the higher values for both units are from the west-adjacent Pine Creek Rapids quadrangle indicating that the area in common is anomalously rich in magnetite.

Figure 3. Glacially striated quartzite boulder near head of Moose Creek 0.8 km (0.5 mi) south of Haystack Mountain (45.2779°N, 114.1544°W, WGS84).

Figure 4. Mostly equigranular *Ygr* with small *Ylg* inclusions on Pine Creek Ridge 2.8 km (1.7 mi) north of Haystack Mountain (45.3093°N, 114.1582°W, WGS84).

Figure 5. Megacrystic (pale blue blotches) biotite granite with small *Ylg* inclusion (bottom left of photo) northeast of Pine Creek near the west edge of the map (45.3417°N, 114.2297°W, WGS84).

Figure 6. Diffuse dark and light zoned *Ylg* siltite and quartzite near head of Moose Creek 1.6 km (1 mi) south of Haystack Mountain (45.2707°N, 114.1550°W, WGS84). Magnetic susceptibility here was about average for the quadrangle but highly varied (13.9 ± 13.7 × 10^{-3} SI, N=10).

Figure 7. Scapolite in *Ylg* siltite north of Pine Creek near west edge of map (45.3369°N, 114.2414°W, WGS84).

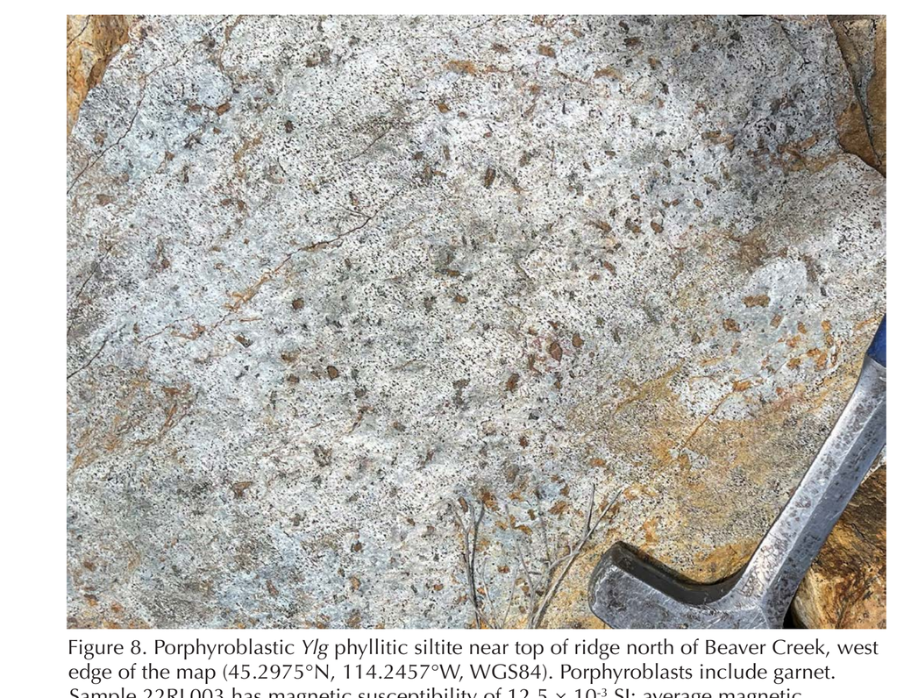


Figure 8. Porphyroblastic *Ylg* phyllitic siltite near top of ridge north of Beaver Creek, west edge of the map (45.2975°N, 114.2457°W, WGS84). Porphyroblasts include garnet. Sample 22RL003 has magnetic susceptibility of 12.5 × 10^{-3} SI; average magnetic susceptibility nearby 7.50 ± 5.86 × 10-3 SI, N=18.

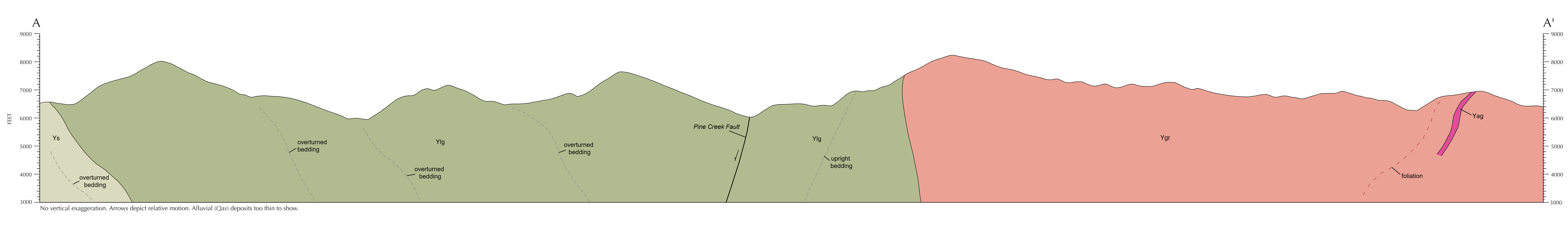
Figure 9. Laminated feldspathic silty quartzite from ridge north of Beaver Creek (45.2968°N, 114.2308°W, WGS84). Sample 22RL005 with magnetic susceptibility of 5.78 × 10^{-3} SI, slightly higher than average for nearby samples of 4.48 ± 2.36 × 10^{-3} SI, N=16. Green color may be a result of weak chloritic alteration.

Figure 10.Lemhi Group feldspathic quartzite with thick oxidation rind on ridge north of Beaver Creek (45.2958°N, 114.2427°W, WGS84).

Figure 11. Severely oxidized Lemhi Group rock on ridge north of Beaver Creek (45.2978°N, 114.2253°W, WGS84).

Table 1. Magnetic susceptibilities of rocks in the Pine Creek Ridge quadrangle. Averages are typically of 10 measurements per outcrop faces or fresh talus, or fewer for hand samples (N=1). Measured with KT-9 and KT-10 Kappameters from Exploranium G.S. Ltd. and Terraplus Inc. Values reported in SI units (× 10^{-3}).

Measurement ID	Map Unit	Latitude	Longitude	Susceptibility	Std Dev.	N
22MTms221	Ygr	45.3312	-114.2356	0.08	0.07	10
21RBms179a	Ygr	45.3573	-114.1355	0.22	0.04	10
22RLms188	Ygr	45.3417	-114.2289	0.26	0.06	13
21RBms180	Ygr	45.3620	-114.1430	0.40	0.19	10
22RLms187	Ygr	45.3380	-114.2306	0.74	0.74	19
22RLms189	Ygr	45.3439	-114.2281	0.76	1.17	17
22RLms190	Ygr	45.3464	-114.2317	1.22	1.73	16
22RLms191	Ygr	45.3424	-114.2351	1.49	2.45	17
22MTms218	Ygr	45.3302	-114.2392	2.81	2.15	10
22RLms192	Ygr	45.3406	-114.2376	3.40	4.51	17
22MTms220	Ygr	45.3308	-114.2366	5.02	2.52	10
22MTms222	Ygr	45.3309	-114.2306	5.03	5.62	10
22RLms185	Ygr	45.3344	-114.2308	7.05	5.32	16
22RLms196	Ygr	45.3327	-114.2411	7.23	7.85	20
22RLms184	Ygr	45.3344	-114.2366	9.01	5.06	16
22RLms181	Ygr	45.3462	-114.2497	9.94	6.78	16
22MTms216	Ygr	45.3302	-114.2412	11.92	7.49	10
22MTms217	Ygr	45.3303	-114.2401	17.08	6.21	10
21RBms144	Ylg	45.2574	-114.2342	0.25	0.06	10
22RLms194	Ylg	45.3374	-114.2403	0.26	0.09	15
21RBms143	Ylg	45.2615	-114.2109	0.26	0.15	10
21RBms137	Ylg	45.2857	-114.1517	0.28	0.04	10
14RL022	Ylg	45.2649	-114.2171	0.30		1
21RBms150	Ylg	45.2637	-114.2430	0.34	0.05	10
22MTms219	Ylg	45.3305	-114.2384	0.38	0.25	10
22RLms158	Ylg	45.2913	-114.2389	0.39	0.21	12
22RLms160	Ylg	45.2917	-114.2363	0.45	0.47	12
22MTms224	Ylg	45.3316	-114.2234	0.53	0.16	10
22RLms164	Ylg	45.2988	-114.2290	0.87	1.03	14
21RBms139	Ylg	45.2757	-114.1778	1.40	1.75	10
21RBms136	Ylg	45.2801	-114.1567	1.55	1.55	10
22RLms186	Ylg	45.3357	-114.2307	1.64	2.28	16
22RLms165	Ylg	45.3025	-114.2472	1.64	2.02	17
21RBms142	Ylg	45.2653	-114.2059	1.78	0.85	10
22RLms166	Ylg	45.3048	-114.2485	3.46	3.29	18
22RLms159	Ylg	45.2889	-114.2397	3.67	2.19	16
22RLms161	Ylg	45.2969	-114.2300	4.48	2.36	16
22MTms210	Ylg	45.3261	-114.2416	5.53	5.72	10
21RBms141	Ylg	45.2679	-114.1865	6.39	2.83	10
22RLms163	Ylg	45.2976	-114.2213	7.17	5.62	15
22RLms157	Ylg	45.2977	-114.2448	7.50	5.86	18
21RBms140	Ylg	45.2715	-114.1820	7.61	3.58	10
22MTms223	Ylg	45.3313	-114.2306	7.78	7.17	10
21RBms138	Ylg	45.2750	-114.1680	9.03	10.53	10
22MTms175b	Ylg	45.3149	-114.2373	10.01	6.04	10
22MTms211	Ylg	45.3257	-114.2419	10.58	7.38	10
22MTms175a	Ylg	45.3149	-114.2373	11.58	4.98	10
22MTms180	Ylg	45.3121	-114.2287	11.59	5.97	10
21RBms135	Ylg	45.2708	-114.1541	13.94	13.71	10
22MTms226	Ylg	45.3304	-114.2138	16.85	7.63	10
22MTms177	Ylg	45.3363	-114.2246	18.02	10.05	10
22MTms176	Ylg	45.3156	-114.2366	22.59	9.95	10
22MTms225	Ylg	45.3302	-114.2194	23.82	8.94	6
22MTms187	Ylg	45.3127	-114.2411	25.69	11.21	10
22MTms209a	Ylg	45.3270	-114.2422	27.05	21.52	14
22MTms181	Ylg	45.3115	-114.2285	27.24	7.76	10
22MTms178	Ylg	45.3146	-114.2254	28.50	16.43	10
22MTms227	Ylg	45.3291	-114.2044	30.66	7.95	10
22MTms185	Ylg	45.3168	-114.2345	32.05	6.25	10
22MTms208	Ylg	45.3276	-114.2422	32.26	10.15	10
22MTms186	Ylg	45.3181	-114.2348	32.36	9.30	9
22MTms215	Ylg	45.3310	-114.2481	37.15	19.76	11
22MTms209b	Ylg	45.3268	-114.2426	39.86	15.81	7
22MTms174	Ylg	45.3147	-114.2375	39.87	8.13	11
22MTms212	Ylg	45.3289	-114.2442	40.26	5.17	10
22MTms184	Ylg	45.3131	-114.2354	42.92	11.50	10
22MTms179	Ylg	45.3143	-114.2265	43.75	18.07	10
22MTms213	Ylg	45.3293	-114.2452	64.39	23.19	10



No vertical exaggeration. Arrows depict relative motion. Alluvial (*Qas*) deposits too thin to show.

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