GEOLOGIC MAP OF THE COLBURN QUADRANGLE, BONNER COUNTY, IDAHO

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2007

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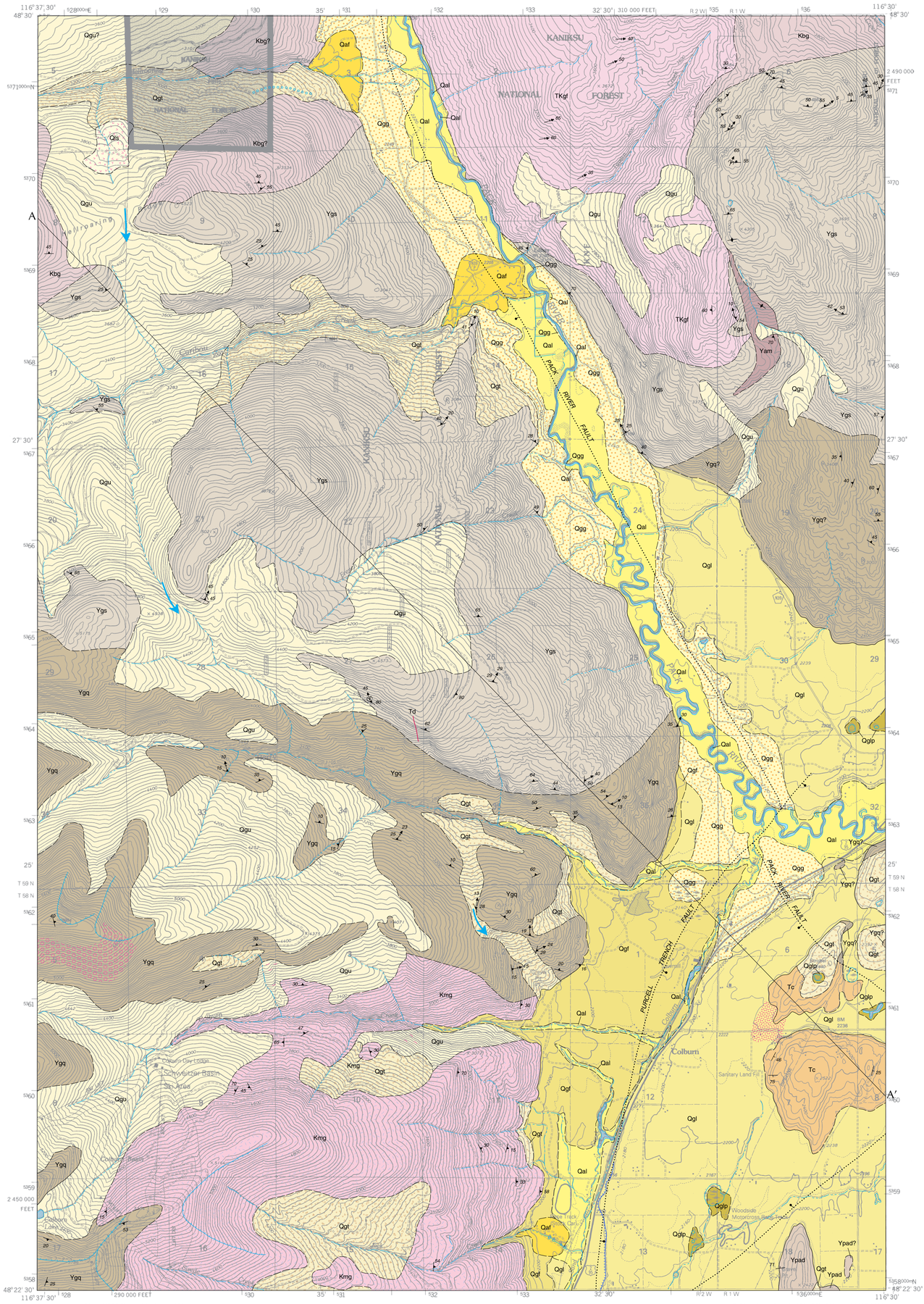

Base map scanned from USGS film-positive base, 1996.
Revision by USDA Forest Service 1996.
Topography by photogrammetric methods from aerial photographs taken 1966. Planimetry derived from imagery taken 1992. Public Land Survey System and survey control current as of 1996.
Transverse Mercator. 1927 North American Datum.
10,000-foot grid ticks based on Idaho coordinate system, west zone.
1000-meter Universal Transverse Mercator grid ticks, zone 11.
National geodetic vertical datum of 1929.

UTM Grid and 1996 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.
Supplemental contour interval 20 feet.

IDAHO
QUADRANGLE LOCATION

Field work conducted 1988-1989, 1994, and 2005-2006.

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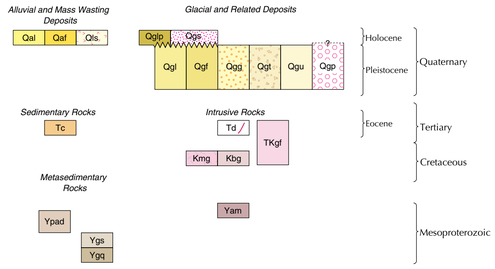
Digital cartography by Jesse S. Bird and Jane S. Freed at the Idaho Geological Survey's Digital Mapping Lab.

Note on printing: The map is reproduced at a high resolution of 600 dots per inch. The inks are resistant to run and fading but will deteriorate with long-term exposure to light.

PDF map (Acrobat Reader) may be viewed at www.idahogeology.org.

Map version 12-4-2007.

CORRELATION OF MAP UNITS



INTRODUCTION

Quaternary deposits on this 1:24,000-scale Colburn quadrangle were mapped in 1988-1989 and 2006 by R.M. Breckenridge. Surficial mapping of part of the quadrangle by A.F. Harvey III (1984b) aided our compilation. S.E. Box mapped the bedrock in this and adjoining quadrangles to the west and southwest in reconnaissance in 1994. Additional bedrock mapping in 2005-2006 by R.S. Lewis, R.F. Burmester and M.D. McFaddan was augmented with structural data from Doughty (1995).

Low metamorphic grade metasedimentary rocks of the Mesoproterozoic Belt-Purcell Supergroup occupy the southeastern part of the Colburn quadrangle. Intermingled amphibolite facies metasedimentary rocks from probable Mesoproterozoic protoliths and granitic rocks of Cretaceous and Tertiary (?) age are widespread to the west and northwest. Separating them is the unexposed Purcell trench fault that was active in the Eocene. Intermediate metamorphic grade metasedimentary rocks are exposed north of the Pack River fault near the eastern map boundary.

The geomorphic subsections of the quadrangle include parts of the Selkirk Range and the Selle Lowlands (Savage, 1967). During Pleistocene glaciations a lobe of the Cordilleran Ice repeatedly advanced southward from Canada along the Purcell Trench. Tributary valley glaciers from the Selkirk Range on the west side of the trench and the Cabinet Range on the east side contributed to the main ice stream. The Pack River drainage was the source of a major tributary valley glacier in the Selkirks. The ice blocked the Clark Fork valley, formed Glacial Lake Missoula, and deeply scoured the Pend Oreille Lake basin. Glacial deposits of the Selle Lowland fill the depression of the Purcell Trench. After retreat of the continental ice, alpine glaciers persisted until nearly 13,000 years ago in the higher cirques of the Selkirk Range. Holocene alluvium, colluvium, and lacustrine sediments are mostly the product of reworked glacial deposits.

DESCRIPTION OF MAP UNITS

Intrusive rocks are classified according to IUGS nomenclature using normalized values of modal quartz (Q), alkali feldspar (A) and plagioclase (P) on a ternary diagram (Streckeisen, 1976). Mineral modifiers are listed in order of increasing abundance for both igneous and metamorphic rocks. Grain size classification of unconsolidated and consolidated sediment is based on the Wentworth scale (Lane, 1947). Bedding thicknesses and lamination type are after McKee and Weir (1963), and Winston (1986). Thicknesses and distances are given in abbreviation of metric units (e.g., dm=decimeter). Multiple lithologies within a rock unit description are listed in order of decreasing abundance. Soil series are from Weisel and others (1982). Unified Soil Classifications of the surficial units are from Harvey (1984a).

ALLUVIAL AND MASS WASTING DEPOSITS

Qal **Alluvium (Holocene)**—Varied silt, sand, and gravel deposits in active stream drainages. Coarser near the Selkirk Mountains and finer in the Selle Lowland. Moderately sorted to well sorted silt, sand and pebble and cobble gravels with occasional boulders. Mostly reworked glacial deposits in the lowland channel ways and post glacial colluvium in the mountain streams. Typical soils are silty loam to sandy- and gravelly-loam. Unified Classification is GP-GM and SP-SM Soil series of Hoodoo and Wrencoe. Thickness up to several meters.

Qaf **Alluvial fan deposits (Holocene)**—Mixed pebble to cobble gravel deposited as fans at the mouths of local drainages. Mostly subangular to angular clasts derived locally from colluvium and glacial deposits on steep slopes. Unified Classification is GM and SM. Soils mainly of the Colburn, Pend Oreille, and Bonners series. Thickness 1-10 m (3-33 feet).

Qls **Landslide deposit (Holocene)**—Poorly sorted and poorly stratified sandy cobble and boulder gravel mixed with sand. Mass-movements mainly associated with till, outwash, and glaciolacustrine sediments deposited on glaciated bedrock surfaces. Soils of the Bonner and Dufort series. Thickness 10-30 m (30-100 feet).

GLACIAL AND RELATED DEPOSITS

Qgs **Sand deposits (Pleistocene to Holocene)**— Sand deposits mostly formed from reworking of glaciofluvial (*Qgf*) and glaciolacustrine (*Qgl*) units. The soil type is Selle-Elmira. Thickness varies from 2 m to 6 m. SP-SM of the Unified Soil System. Shown as a pattern.

Qglp **Peat deposits (Pleistocene to Holocene)**—Organic muck, mud and peat bogs in lakes, kettles and poorly drained paleoglacial outwash channels of the Selle Lowland. Interbedded with thin layers of fine sand, silt and clay. Soils of the Pywell series and Pt in the Unified Soil System. Thickness varies from 1 m to 5 m.

Qgp **Periglacial patterned ground deposits (Pleistocene and Holocene)**—Coarse angular cobble and boulder deposits including stone stripes, felsenmeer, frost wedges and glacial pavement. Shown as a pattern.

Qgu **Glacial deposits, undivided (Pleistocene)**—Mostly loose cobbly silty sand with a silty fine sand matrix; pebble-to boulder-sized gravel; includes deposits of till and associated proglacial outwash and glacial sediments. Occasional large boulders on bedrock and in till. Unstratified to poorly bedded, unsorted to moderately sorted. In tributary drainages and on slopes composed of discontinuous remnants of till and kame terraces; on steeper unstable slopes may take the form of mass movements. May include some interbedded lake sediments. Soils mainly silt loam of the Pend Oreille series. Thickness varies from several to tens of meters.

Qgt **Till deposits (Pleistocene)**—Dense silty pebble and cobble till with local boulders. In this map area, mostly deposited by valley glaciers tributary to the Purcell Trench Lobe of the Cordilleran Ice sheet. Includes some till deposited at the margin of the lobe as lateral moraines or kame terraces. In the trench subsurface (shown in drill holes), includes poorly stratified compact basal till and some interbedded proglacial deposits. Soils include silty loams and gravelly silt loams of the Pend Oreille and Vay-Ardtoo series. GM and SM classes in the Unified Soil Classification. Thickness varies; may exceed 50 m (160 feet).

Qgg **Deposits of glacial outwash gravels (Pleistocene)**—Sandy cobble boulder gravel mostly preserved as terrace deposits from alpine valley glaciers in the Pack River valley probably underlies *Qgf* in the Selle lowland, includes kame terraces of the Purcell Trench Lobe along the east slopes of the Selkirk Mountains. Soils of the Bonner-Kootenai series. SP-SM and ML classes in the Unified Soil Classification. Thickness varies; may exceed 50 m (160 feet).

Qgl **Glaciolacustrine deposits (Pleistocene to Holocene)**—Massive to finely laminated clay, silt, and sand deposited in ice marginal and post glacial lakes (*?*) occupying the Purcell Trench. Exhibits well developed rhythmites and beds of sand and silt. This unit includes deposits in the Selle Lowlands and discontinuous terraces in tributary valleys at about 732 m (2400 feet) and as high as 792 m (2600 feet). Mostly well sorted and finely laminated. Contorted bedding and loading structures are common. Overlain by glaciofluvial outwash deposits on terraces and in tributary valleys. Soils are silt loam and silty sandy loams of the Mission-Cabinet-Odenson series. CL to ML and SM classes in the Unified Soil Classification. Thickness tens of meters to over hundreds of meters in drill holes of the Selle Lowlands.

Qgf **Glaciofluvial deposits (Pleistocene)**—Coarse silt, sand, and gravel deposits derived from glacial outwash. Mostly stratified sands and rounded gravels. Commonly occurs in channels within and interbedded with *Qgl*. Soils are gravelly silt loam to gravelly sand loam of Bonner-Kootenai series. Unified Soil Classification GM, GP, and SM. Thickness a meter to over tens of meters.

SEDIMENTARY ROCKS

Tc **Sandpoint Conglomerate (Eocene)**—Moderately to poorly sorted conglomerate containing angular to subrounded clasts of Mesoproterozoic mafic sills and laminated siltite and argillite, siltite, and quartzite of the Prichard Formation. Abundant chlorite and epidote in matrix. Mafic blocks up to 1 m across; other lithologies smaller, typically 2-20 cm. Bedding defined by green silt and fine sand. No rocks of high metamorphic grade or plutonic origin observed. Possible rare lamprophyre clasts but no porphyries (e.g., *Td*), although Doughty and Price (2000) reported and dated two porphyry clasts from the conglomerate exposures southeast of Colburn ($^{40}Ar/^{39}Ar$ biotite plateau ages of 51.5 ± 0.5 Ma and 49.7 ± 0.3 Ma). A third sample they dated gave a disturbed Cretaceous spectrum for potassium feldspar and is likely a Cretaceous porphyry such as found on Packsaddle Mountain southeast of Sandpoint (Harrison and Jobin, 1965).

INTRUSIVE ROCKS

Td **Dacite dike (Eocene)**—Porphyritic dacite dike. A single dike was mapped north of Berry Creek in the central part of the area.

TKgf **Fine-grained granite and granodiorite (Eocene or Cretaceous)**—Fine- to medium grained biotite and muscovite-biotite granodiorite and granite exposed in a single mass in the northeast part of the map. Eastern border of unit is poorly defined, but drawn where medium-grained biotite granodiorite and tonalite of *Kbg* unit exceeds fine-grained phases. Muscovite-bearing phase locally lineated. Both muscovite-biotite and biotite-only phases contain subhedral to euhedral plagioclase that is moderately to strongly zoned, suggestive of relatively rapid cooling.

Kmg **Biotite-muscovite granite and granodiorite (Cretaceous)**—Massive to foliated biotite-muscovite and muscovite-biotite granite and granodiorite. Foliation only formed locally; where present, is typically mylonitic. Plagioclase is weakly zoned. Includes rocks mapped as "mixed granitic rocks of Camels Prairie" (Miller and others, 1999).

Kbg **Biotite granodiorite and granite (Cretaceous)**—Massive to foliated and lineated biotite granodiorite and granite. Biotite tonalite found at one locality in the northeastern corner of map. Locally contains lenses of metasedimentary rock. Includes both medium- and fine-grained phases; the later is subordinate and may be related to the *TKgf* unit. Plagioclase is weakly zoned; myrmekite is common. Includes rocks mapped as "granodiorite of Falls Creek" (Miller and others, 1999).

Yam **Amphibolite (Mesoproterozoic)**—Foliated to massive amphibolite sill intruding gneiss and schist unit (*Ygs*) in the northeast part of area. Presumably a metamorphic equivalent of mafic sills present in the Prichard Formation. Small unmapped bodies within *Ygs* nearby and west of the Pack River may have same origin.

BELT-PURCELL SUPERGROUP

Ypad **Prichard Formation, members a, b, c and d (Mesoproterozoic)**—Rusty weathering, dark gray siltite and argillite couplets, siltite, and rare lighter quartzite. Exposed in a small area near the southeast corner of the map where siltite (dm thick) and argillite (mm thick) couples alternate with mm thick siltite and argillite couplets. See Lewis and others (2006) for description of individual units in the Trout Peak quadrangle to the southeast.

METASEDIMENTARY ROCKS OF THE PRIEST RIVER COMPLEX

Ygs **Gneiss and schist (Mesoproterozoic)**—Muscovite-biotite-plagioclase-quartz gneiss, muscovite-biotite schist, and biotite-muscovite schist. Rusty weathering common. Layering on cm scale may be relict bedding. Includes unmapped amphibolite, locally with garnet to 2 cm, and (or) biotite replacing hornblende. Gneiss is considered to be equivalent to the Hauser Lake gneiss (Weis, 1968; Weisenborn and Weis, 1976) and was considered metamorphosed Prichard Formation by Miller and others (1999). Pegmatite-rich east of Tavern Creek in the northeast part of area; massive pegmatites there tens of meters across form cliffs and large talus blocks.

Ygq **Granofels and quartzite (Mesoproterozoic)**—Layered biotite-quartz-feldspar granofels and feldspathic biotite quartzite. Granofels has gneissic layering, but lacks a strong foliation. Most feldspar is plagioclase; local potassium feldspar. Garnet present on the south side of Berry Creek in the southeast part of section 34. Unit is more widely exposed in the Mt. Casey quadrangle to the west where it also contains thin intervals of calc-silicate rock. Assignment of rocks east of the Pack River fault to this unit is uncertain.

STRUCTURE

PURCELL TRENCH FAULT

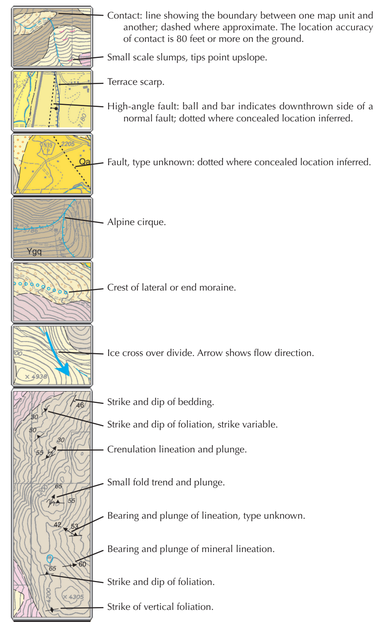
The Purcell trench fault is nowhere exposed in the Colburn quadrangle, but its existence is inferred from contrast of metamorphic grade and deformation in bedrock exposures in the southwest and southeast parts of the quadrangle (Miller and others, 1999; Doughty and Price, 1999). The fault is inferred to dip steeply eastward with normal displacement (Section A-A'). Local mylonitic fabrics in the footwall west of Colburn are presumed to be associated with the fault. Within 1 km of the valley there are steeply east-dipping mylonitic shear bands spaced at intervals of about 2-4 cm in the granitic rocks (Doughty and Price, 2000). Alternatively, these mylonites could be the diffuse upper boundary to the Spokane dome mylonite zone that is better developed north of Big Creek about 15 km southwest of Colburn.

Biotite-muscovite and biotite granitoids and amphibolite facies paragneiss and granofels on the west side of the quadrangle contrast sharply with greenschist-facies Prichard Formation on the east side near the southern map boundary. There the Prichard shows low-grade burial metamorphism so that sedimentary structures and features are well preserved. Cretaceous granitic rocks east of the fault yield Cretaceous potassium-argon ages, but west of the fault yield Eocene cooling ages (Miller and Engels, 1975), reflecting Eocene relative uplift of the west side (Doughty and Price, 1999). Biotite from the *Kmg* unit 2 km southwest of Colburn and west of the fault yielded a 48.7 ± 0.7 Ma $^{40}Ar/^{39}Ar$ plateau (Doughty and Price, 1999). Fillipone (1993) obtained a 51-53 Ma $^{40}Ar/^{39}Ar$ age spectrum from biotite in a granitic dike northwest of Walsh Lake, and Miller and Engels (1975) reported a 49 Ma biotite age (recalculated with present decay constants) from a granitic rock near the mouth of Tavern Creek. Older ages (56 Ma on muscovite and 58 Ma on biotite) are reported from the area of moderate metamorphic grade (*Ygq* unit) 1.5 km east of the map area (Doughty and Price, 1999) suggesting a multi-stage uplift history along this portion of the trench. Continuation of the Purcell trench fault north of the Pack River is uncertain. Our current interpretation is that it steps east and forms the west-bounding fault to deposits of the Sandpoint conglomerate in the adjoining Elmira quadrangle to the east.

PACK RIVER FAULT

The herein named Pack River fault is a northwest-striking structure in the southeastern part of the Colburn quadrangle. Eocene Sandpoint conglomerate (*Tc*) and Prichard Formation (*Ypad*) are downfaulted on the southwest side of this structure. Metasedimentary rocks on the northeast side (*Ygg*) are higher in metamorphic grade than the Prichard Formation (*Ypad*) south of the fault. The fault is projected to the northwest along the Pack River Valley, but offset there is poorly contrained.

SYMBOLS



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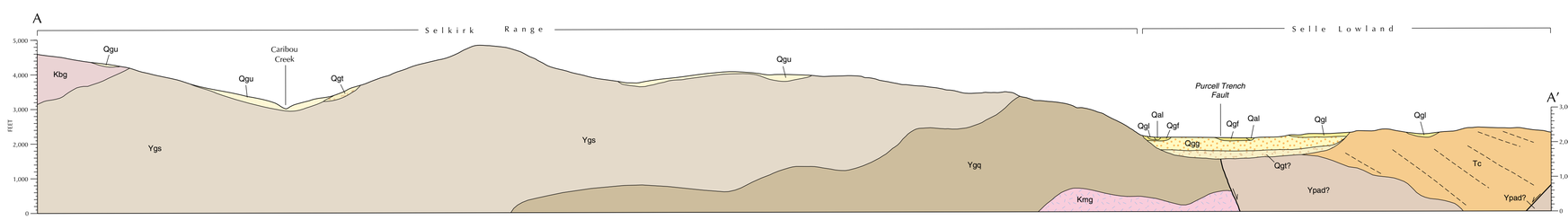

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