# GEOLOGIC MAP OF THE PRESCOTT VALLEY SOUTH 7 ½' QUADRANGLE, YAVAPAI COUNTY, ARIZONA

Arizona Geological Survey Digital Geologic Map
DGM-103, Version 1.0
Scale 1:24,000

by
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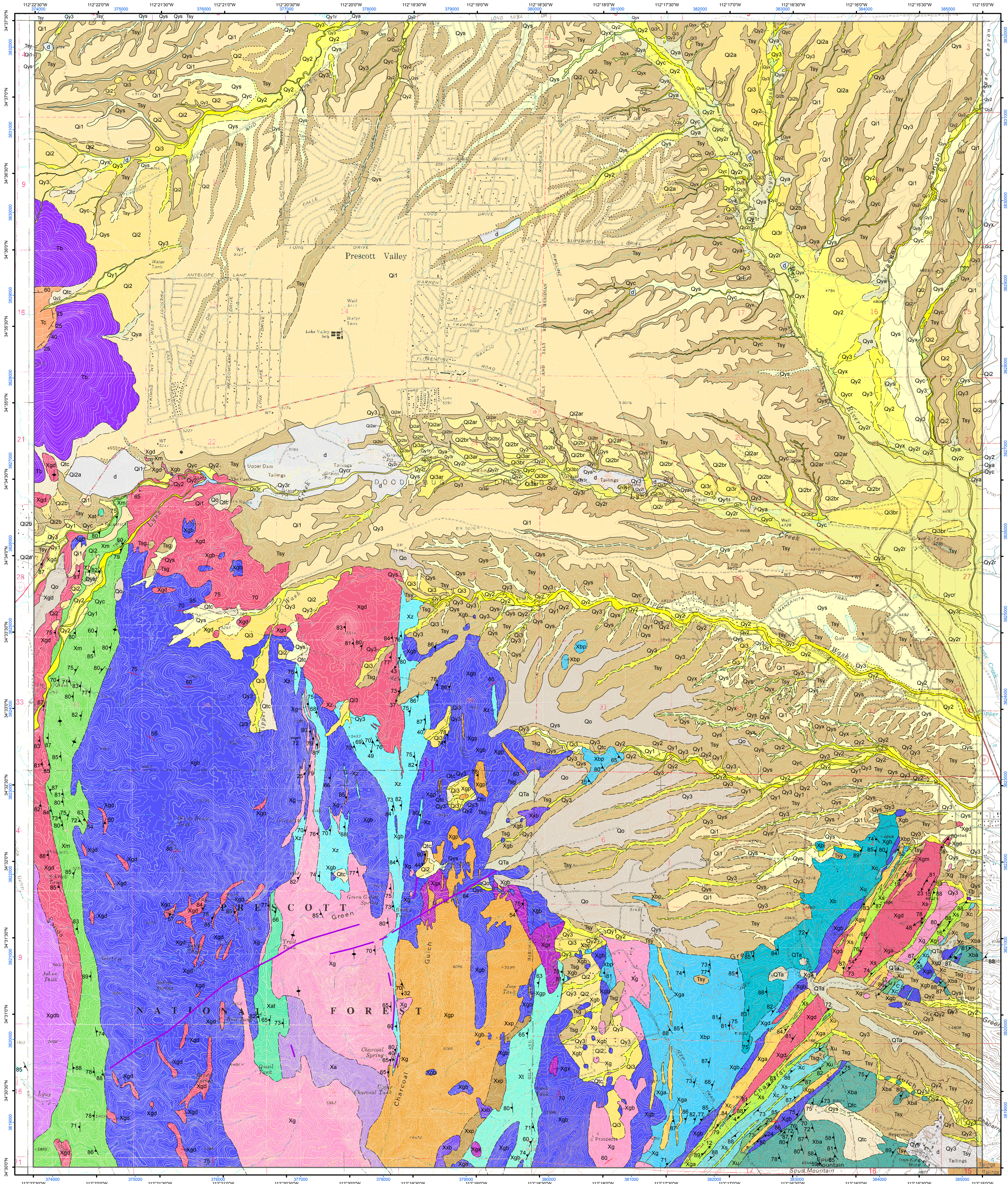
## Introduction

The Prescott Valley South 7 ½' Quadrangle is located east of Prescott in Yavapai County in central Arizona. New geologic mapping and map compilation for the entire quadrangle, presented here, were done under the joint State-Federal STATEMAP program, as specified by the National Geologic Mapping Act of 1992. Mapping was jointly funded by the Arizona Geological Survey and the U.S. Geological Survey under STATEMAP assistance award G11AC20455. This map was compiled digitally using ESRI ArcGIS software.

The Prescott Valley South 7 ½' Quadrangle coincides with the southeast quarter of the Prescott 15' Quadrangle, which was mapped by Krieger (1965) at 1:48,000 scale. To prepare this new quadrangle map, new mapping was done at 1:24,000 scale to field check and improve upon the previous mapping. Previous mapping did not significantly differentiate Quaternary map units. For this mapping investigation, Quaternary units were differentiated in detail for the entire map area. Georeferenced aerial-photograph imagery was used extensively for mapping Quaternary deposits.

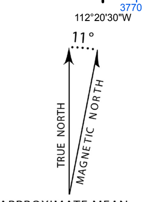
The Prescott Valley South 7 ½' Quadrangle is at the north end of the Bradshaw Mountains, which are underlain by bedrock of mainly Paleoproterozoic age. The rocks include gabbro, granodiorite, and granite plutons with intervening supracrustal belts of metavolcanic and metasedimentary schist. For the most part the belts and plutons define a northerly striking structural grain. Tectonic foliation in the supracrustal rocks and in deformed parts of the plutons strikes northerly and dips steeply west throughout most of the map area. A notable exception is the Chaparral shear zone (Bergh and Karlstrom, 1992), a northeast-striking dextral shear zone 1 km wide of mylonitic and phyllonitic rocks that transects the northerly trending structures in the southeast corner of the quadrangle. Within this zone, foliation is nearly vertical and a lineation defined by mineral streaks is gently plunging. Metamorphic grade in the Chaparral shear zone is lower greenschist facies (chlorite zone). Outside of the shear zone, rocks in more northerly exposures were metamorphosed in middle greenschist (biotite zone) to possibly amphibolite facies. Deformation and metamorphism in the northern Bradshaw Mountains mainly occurred from 1710 to 1690 Ma (Anderson, 1989).

Gently tilted Miocene volcanic rocks that unconformably overlie the Proterozoic rocks are exposed on Glassford Hill, along the western margin of the quadrangle (Krieger, 1965).




Topographic base from USGS 1:24,000 Quadrangle Series; generated using iGage All Topo Pro software
Contour interval: 10 feet (low relief areas), 40 feet (high relief areas)

Projection: UTM Zone 12N
Datum: NAD83



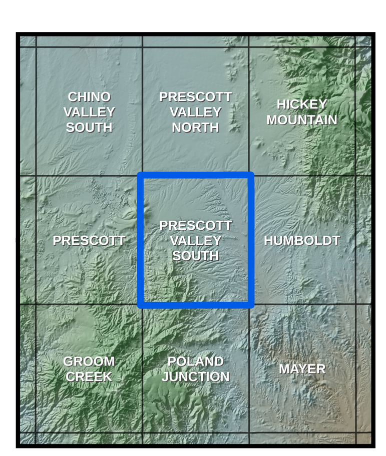
APPROXIMATE MEAN DECLINATION, 2013

scale 1:24,000
1000 500 0 1000 2000 3000 4000 5000 6000 7000 Feet
1 0.5 0 1 Miles
1 0.5 0 1 Kilometers

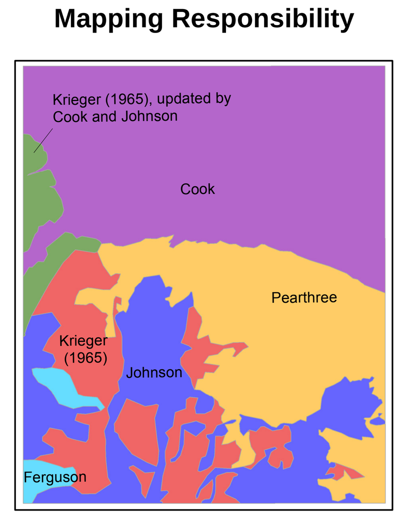
### Lines and Structure Symbols

| | |
|---|---|
| Accurate contact | Inclined bedding, showing strike and dip |
| Approximate contact | Inclined cumulate foliation, showing strike and dip |
| Concealed contact | Inclined tectonic foliation, showing strike and dip |
| | Vertical tectonic foliation, showing strike |
| Plagioclase porphyry dike | Inclined mineral lineation, showing trend and plunge |
| | Incined quartz vein, showing strike and dip |

### Location Map




### Mapping Responsibility




## Map Unit Description

d **Disturbed ground** - Heavily disturbed or altered ground due to aggregate mining, extensive excavation, construction of earth dams, residential developments, and highways.

w **Lakes, bodies of water** - Areas inundated by standing water, artificially dammed drainages, and reservoirs

Qtc **Colluvium and talus** - Unconsolidated to weakly consolidated, locally derived, very poorly sorted angular to subangular rock debris deposited on and at the base of bedrock slopes and mantling highly eroded bedrock hills.

**Piedmont alluvium**

Qyc **Active channel deposits** - Qyc deposits are composed of unconsolidated, very poorly sorted sand to cobbles in lightly-vegetated piedmont channels. Channels may be flat-bottomed or exhibit bar and swale microtopography with bars composed of coarser sediments. Qyc deposits are generally devoid of vegetation and exhibit no soil development although small shrubs and grasses may be found on slightly elevated in-channel bars. Qyc deposits commonly become submerged during moderate to extreme flow conditions and can be subject to deep, high velocity flow and lateral bank erosion. Channels are generally incised 1 to 5 ft (0.25-1.5 m) below adjacent Holocene alluvium and may be incised into adjacent Pleistocene alluvium by 2 meters or more.

Qyx **Active arroyos** - Areas where valley-bottom deposits are being eroded due to arroyo development. Includes flat-bottomed to undulating channels with sand and gravel deposits, and eroded, typically fairly steep slopes. Arroyos are developing almost entirely in relatively fine-grained Holocene deposits, and are up to 10 ft (3 m) deep. Many arroyo areas are too small to depict at the map scale.

Qy3 **Deposits in small channels and adjacent low terraces** - Piedmont alluvium located along active drainages including small channels, adjacent low terraces or floodplain areas. Qy3 deposits are composed of unconsolidated, unvarnished sand, gravel, and silt deposits. Qy3 drainages are often wider, lower energy, and more heavily vegetated than the Qyc channels they drain into. The gradient of some Qy3 channels draining high standing Tsy deposits may be significantly steeper than similar channels lower in the piedmont yet incision is generally absent or mild. Infiltration capacity appears high in these broad, gentle swales. Surface flow likely only occurs after soil saturation has been achieved. Grass growing along the low center of many swales is often a shade greener due to greater available soil moisture. Soil development is generally absent or incipient on Qy3 deposits which exhibit pale buff to light brown (10 YR) surface coloration.

Qys **Fine-grained valley deposits** - Laterally extensive, unconsolidated fine-grained alluvium in valley bottoms and mantling the lower parts of adjacent slopes. These sediments are dark brown to light gray in color and consist of sand, silt, clay and gravel. In valley axes, these deposits are primarily silt and sand beds, and dark, weakly developed buried soils are common. Gravel makes up a small percentage of these deposits and typically gravel beds are thin and discontinuous. Along a few larger washes, thicker and more extensive gravel beds were observed. Qys deposits mantle the toes of slopes formed on bedrock and eroded older basin deposits. In these areas, Qys deposits are commonly more gravel-rich. Occasionally weakly channelized flow occurs but minor gradient changes or vegetation cause aggradation that leads again to sheetflow or infiltration. Grasses growing in the low center of the swale sometimes appear slightly larger or greener due to locally more abundant soil moisture. Surface soil development is weak.

Qya **Active alluvial fan deposits** - Low relief splays and fine-grained distributary alluvial fan deposits comprising the active portion of alluvial fans where channel flow becomes unconfined. Qya deposits are typically found at the downstream outlet of discontinuous ephemeral channels and gullies. Qya deposits are extremely prone to flooding and channel migration. Sediments are unconsolidated and consist of very poorly sorted sand to small cobbles. Vegetation on Qya deposits consists of bunch grass, small shrubs, and weeds.

Qy2 **Low piedmont terrace deposits** - Qy2 deposits consist of terrace deposits located primarily along the flanks of incised drainages and low-relief terraces inset into Pleistocene age fan or river deposits. These deposits consist of predominantly fine grained unconsolidated to weakly consolidated sediments with sub-rounded to sub-angular pebble to cobble bars on the surface and beds and lenses in cross section. Where inset into older alluvium, Qy2 deposits are planar with remnant bar and swale microtopography. Soil development on Qy2 deposits is minor, characterized by incipient stage I-II calcium carbonate accumulation in the form of small filaments and medium brown (10 YR) surface coloration. Vegetation on Qy2 surfaces consists of small shrubs, weeds, bunch grass, and occasional yucca and prickly pear cactus. These surfaces are subject to inundation during moderate to extreme flow conditions when channel flow exceeds capacity or due to channel migration on low-relief portions of broad distal fan deposits. Planar Qy2 terraces are typically elevated from 1 to 5 ft (30 cm - 1.5 m) above active channels.

Qy1 **Young remnant terrace deposits** - Qy1 deposits consist of planar terraces along larger piedmont drainages that are 3-6 ft (1-2 m) higher in the landscape than adjacent Qy2 terraces. Qy1 deposits are composed of sandy to pebbly swales with coarser unvarnished to very lightly varnished pebble to cobble bars, and partially overlie Pleistocene deposits in some areas. Bar and swale microtopography is somewhat muted by eolian deposition and vegetation mounding. Pebbles and cobbles exposed in cross section exhibit stage I-II calcium carbonate accumulation within a medium brown matrix of fine sand to silt. Qy1 surfaces are generally isolated from flooding associated with the modern drainage system, Vegetation on Qy1 deposits is similar to that found on Qy2 deposits; small shrubs, weeds, bunch grass, and occasional yucca and prickly pear cactus.

Qi3 **Low-intermediate terrace and alluvial fan deposits** - Broadly planar terrace and fan deposits standing up to 7 ft (2 m) above adjacent Holocene (Qyc, Qy3, and Qys) deposits. Surface soil on Qi3 deposits is mildly reddened (7.5 YR) and overall fine grained. Most Qi3 deposits appear to overlie highly eroded Tsy deposits and are likely less than several meters thick. Vegetation on Qi3 deposits is composed of bunch grass ground cover with widely spaced cholla and yucca. Qi3 deposits located near the Agua Fria River grade towards similarly aged Qi3r deposits.

Qi2 **High-intermediate terrace and remnant alluvial fan deposits** - Broadly planar to moderately rounded pebble to cobble dominated terrace and fan deposits capping underlying Tsy deposits. Qi2 deposits are elevated 6 to 10 ft (2-3 m) above adjacent Holocene piedmont deposits. Qi2 deposits commonly cap long linear ridges atop Tsy basin filling sediments. These broadly rounded caps are reddened (5-7.5 YR 4/3) relative to uncapped Tsy deposits observed elsewhere. Widespread incision and denudation into uncapped Tsy deposits has resulted in Qi2 capped ridges standing higher in the landscape than uncapped Tsy deposits. Vegetation on Qi2 deposits ranges from grassy ground cover with occasional small shrubs and weeds to grassy hills dotted with prickly pear, yucca, and small mesquite.

Qi2b **High-intermediate terrace deposits, younger member** - Younger member, terraces occupy slightly lower positions in the landscape than Qi2a terrace remnants.

Qi2a **High-intermediate terrace deposits, older member** - Older member, terraces occupy slightly higher positions in the landscape than Qi2b terrace remnants.

Qi1 **High-standing relict alluvial fan deposits** - Qi1 deposits are relict alluvial fan remnants overlying Tsy sediments that stand higher in the landscape than Qi2 and younger deposits. Qi1 surfaces are planar to broadly rounded and exhibit deeply incised mature tributary drainage networks. Tsy sediments overlain by Qi1 deposits are protected from erosion by the coarse pebble and cobble cover deposited by Lynx Creek and smaller tributary drainages. Coarse gravel and cobble lag derived from the Qi1 cap also covers the flanks of finer grained Tsy deposits. Where well-preserved, soils are clay rich and reddened (2.5 - 5YR 3/6). Vegetation on Qi1 deposits consists of grasses, small shrubs, cholla, prickly pear, scrub oak clusters and isolated juniper predominantly on the north facing eroded edges of terrace remnants. Qi1 deposits are isolated from the modern drainage system, occupying and helping preserve high ridge tops in the landscape, yet numerous drainages deeply incised into underlying Tsy deposits have undermined capping deposits resulting in a branching or dendritic appearance in plan view.

Qo **Very high, deeply dissected coarse alluvial fan deposits** - Weakly to moderately-consolidated sand, gravel, cobble and boulder deposits forming elevated strath terraces and saddles overlying bedrock approximately 100 to 180 ft (35-50 m) above the modern channels. Where surfaces are well-preserved, soil development is strong, with clay-rich reddish brown argillic horizons and moderate carbonate accumulation. Qo surfaces typically are fairly smooth except where eroded at their margins.

QTa **High standing proximal alluvial fan deposits** - Medium brown to reddish brown, poorly to very poorly sorted, slightly indurated, coarse gravel and sand deposits. Exposures are generally poor, but based on surface lags these deposits consist of subangular to subrounded pebbles, cobbles and boulders, and sand, silt and clay. Deposits are proximal to mountain source areas and typically cap very high ridges; thus they are the highest preserved late Cenozoic deposits in the area. They are generally a few feet to less than 20 ft (5 m) thick, and overlie finer-grained basin-fill deposits or bedrock. Soil development is variable and depends strongly on surface preservation. On more planar surface remnants, soils are reddish brown and clay rich. On rounded ridges, soil clay may be modest or absent.

**Lynx Creek and Agua Fria River alluvium**

Qycr **Active river channel deposits** - Deposits are dominantly unconsolidated, very poorly sorted sandy to cobbly beds exhibiting bar and swale microtopography but can range from fine silty beds to coarse gravelly bars in meandering reaches based on position within the channel. Clasts are typically well-rounded but may be angular to sub angular. Qycr deposits are typically unvegetated to lightly vegetated and exhibit no soil development. Qycr deposits are entrenched up to 15 ft (6 m) below adjacent early historical floodplain deposits depending on location, geomorphic relationship, and local channel conditions. These deposits are the first to become submerged during moderate to extreme flow events and can be subject to deep, high velocity flow and lateral bank erosion. In some areas, channel deposits are very thin to discontinuous exposing underlying bedrock. Extent of channel deposit and exposed bedrock varies and shifts with significant flooding.

Qy3r **Low river terrace, floodplain, and meander deposits** - Terrace deposits that occupy elevations from 3 to 6 ft (1-2 m) above Qycr deposits and are inset below the pre-incision historical floodplain. Qy3r surfaces are generally planar but exhibit bar and swale microtopography. No soil development is present but small shrubs and weeds sparsely inhabit the surface. Fine grained vegetation mounds or small nebkhas are present beneath many of the shrubs present on the surface. Sediments composing these deposits are poorly sorted silt, sand, pebbles and cobbles. Pebbles and cobbles are well-rounded to sub-angular. Trough crossbedding, ripple marks, and stacked channel deposits observable in modern channel walls indicate deposition in a low to moderate energy braided to meandering stream environment with some episodes of rapid flood erosion and deposition. These deposits are prone to flooding during extreme flow events, and undercutting and rapid erosion of Qy3r surfaces is possible during larger flow events.

Qy2r **River terrace and floodplain deposits** - Broadly planar surfaces that stand up to 6 to 10 ft (2-3m) above modern Qycr deposits. Qy2r surfaces are predominantly fine grained at the surface, but include interfingering sandy to pebbly braided channel deposits and fine sand, silt and clay floodplain deposits. Weak soil development is evident in surface soils, with weak cambic horizons and incipient calcium carbonate accumulation in some pebbly beds and lenses. Scrub oak is the dominant shrub and short bunch grass provides ground cover on the majority of the surface. Clusters of scrub oak forming vegetated mounds are found along the edges of Qy2r surfaces. Qy2r deposits are typically not subject to inundation by river floods where the active channel is moderately to deeply incised, but they may be flood-prone in areas with less channel incision. Qy2r deposits are subject to rapid erosion and bank failure due to undercutting and lateral erosion during floods and large flow events.

Qy1r **Elevated river terrace and former floodplain deposits** - Deposits associated with slightly higher terraces that represent either higher elements of the early historical floodplain or remnants of older Holocene aggradation periods. Qy1r deposits are broadly planar with mild to moderate undulation in areas where internal drainage patterns have developed. Vegetative cover consists of a bunch grass ground cover with sparsely spaced 3 to 6 ft (1-2 m) brushy oak trees concentrated on the rounded edges of the surface. Qy1r surfaces are generally sandy to pebbly on the surface with more heavily vegetated areas retaining more windblown silts, sometimes forming vegetation mounds. Soil development is generally weak. A light dusting (incipient stage I) calcium carbonate accumulation is evident on the undersides of some buried clasts. Qy1r surfaces stand 10 to 15 ft (3-4 m) above the modern channel.

Qi3r **Intermediate terrace deposits** - Qi3r deposits consist of widespread planar river terraces standing up to 10 ft (3m) above adjacent Holocene river deposits. The extensive planar portion of Qi3r deposits is fine grained at the surface and covered by small bunch grasses with approximately 3 ft (1m) spacing, 2 ft (0.5m) tall cholla with 10-15 ft (3-4m) spacing, and 3 ft (1m) tall scrub oak clusters forming vegetated mounds. The fine to coarse sandy surface soil mantling Qi3r deposits is medium brown (5-7.5 YR 4/4) in color with no significant clay or calcium carbonate accumulation evident near the surface. The rounded edges of Qi3r terraces nearest Lynx Creek and the Agua Fria River are populated by 3 to 10 ft (1-3m) tall oak trees. Incision into the margins of these deposits exposes abundant well rounded cobbles to small boulders. Clast composition is largely composed of granite, gneiss, intermediate metamorphic rocks, and some vesicular basalt. Qi3r terraces have been incised into by tributary drainage networks initiating higher in the piedmont. Qi3r deposits are inset into adjacent piedmont alluvial deposits, basin fill remnants, reworked basin fill deposits, or older river gravel terraces. Locally, late Pleistocene river terraces are subdivided into 2 members (Qi3ra and Qi3rb) that have similar physical characteristics.

Qi3br **Intermediate terrace deposits, younger member** - Younger member, terraces occupy slightly lower positions in the landscape than Qi3ar terrace remnants. Typically 20 to 30 ft (6-10m) above the Holocene floodplain.

Qi3ar **Intermediate terrace deposits, older member** - Older member, terraces occupy slightly higher positions in the landscape than Qi3br terrace remnants. Typically 30 to 60 ft (10-20m) above the Holocene floodplain.

Qi2r **High terrace deposits** - Terrace deposits are similar to Qi3r deposits but occupy higher positions in the landscape, up to 160 ft (50m) above the modern channel. Terrace surfaces are planar where laterally extensive and slightly to moderately rounded near the edges. Clast composition is diverse. Well-rounded pebbles to cobbles with stage I-II calcium carbonate accumulation armor Qi2r surfaces and otherwise easily eroded underlying Tsy deposits. Vegetative cover is low and consists of closely spaced short bunch grass and isolated 1 ft (30cm) tall cholla. Soil on Qi2r surfaces is medium brown to reddish (5-7.5 YR 5/4) in color. The eroded edges and flanks of Qi2r terraces are covered by well rounded cobbles and boulders. Qi2r terrace remnants are typically inset into Tsy deposits and isolated from one another by incised drainages grading towards Lynx Creek or Agua Fria River. Qi2r terraces deposited atop Tsy deposits are inset below and closer to the valley axis than older PleistoceneQi1r terrace remnants. Qi2r deposits are subdivided into older and younger members in most areas along Lynx Creek.

Qi2br **High terrace deposits, younger member** - Younger member, terraces occupy slightly lower positions in the landscape than Qi2ar terrace remnants. Typically 100 to 120 ft (30-35m) above the Holocene floodplain.

Qi2ar **High terrace deposits, older member** - Older member, terraces occupy slightly higher positions in the landscape than Qi2br terrace remnants. Typically 120 to 160 ft (35-48m) above the Holocene floodplain.

**Basin Fill deposits**

Tsy **Basin fill deposits** - Weakly to moderately consolidated silt, clay, sand, and gravel deposited in basins during and after late Cenozoic faulting. Tsy deposits are generally light to medium brown to tan (7.5 YR 6/4) in color. They commonly form high rounded hills and ridges in modern basins, and locally form prominent bluffs when overlain by more consolidated, erosion resistant deposits (unit Qi2r, Qi2, and Qi1). These deposits form gently rolling, low relief hills throughout the map area broadly dissected by tributary drainage networks (unit Qy3, Qyx, and Qys). Exposures are generally poor, but locally a gravelly member is subdivided (Tsg). Everywhere else, broadly rounded basin fill hills and swales were mapped as unit Tsy. Vegetation on Tsy deposits ranges from bunch grass ground cover and small shrubs in lowlands to yucca, prickly pear, and scrub oak on predominantly well rounded north facing slopes and swales on high standing Tsy deposit capped by Pleistocene river or piedmont cobbles.

Tsg **Basin fill deposits, gravel facies** - Poorly exposed, light to medium gray to buff-colored, poorly sorted, subangular to slightly rounded sand and gravel alluvial fan deposits that are usually found high in the landscape, adjacent to mountainous terrain. These deposits are moderately to deeply dissected.

**Tertiary bedrock units**

Tp **Plagioclase-porphyritic dikes** - Plagioclase porphyry dikes (dacite or andesite) containing up to 20% plagioclase phenocrysts (subhedral to euhedral, 2-5 mm) in light-purple aphanitic groundmass. Krieger (1965) reported that some andesite dikes of this suite contain hornblende and biotite phenocrysts in addition to plagioclase.

Tb **Olivine basalt** - Locally vesicular basalt lava flows containing 3-5% olivine phenocrysts up to 1 mm. Some flows also contain phenocrysts of augite and plagioclase up to 7 mm (Krieger, 1965).

Tc **Basaltic cinder cone** - Cinder cone composed of bedded deposits of crystal, lithic, and vitric fragments of basaltic origin, ranging in size from fine ash to blocks and bombs (Krieger, 1965).

**Proterozoic intrusive units**

Xgp **Fine-grained granite** - Fine-grained leucocratic granite suite comprised of numerous tabular intrusions, the bulk of which form a composite intrusive mass along, and east of, Charcoal Gulch. Many of the intrusions contain 2-4-mm K-feldspar phenocrysts (locally >10%), and some also contain sparse (<1%) quartz phenocrysts up to 4 mm. In many areas the granite grades to fine-grained protomylonite and mylonite with 1-2-mm porphyroclasts of quartz and feldspar.

Xxp **Fine-grained granite contaminated with other units** - As mapped by Krieger (1965)

Xga **Fine-grained granite of Chaparral Gulch** - Fine-grained, orange-pink, leucocratic granitic rocks resembling granite of unit Xgp but of uncertain correlation. The unit includes some granitic mylonite and local quartz-feldspar-sericite schist and phyllite that grade to granitic mylonite.

Xgm **Fine-grained granitic rocks of uncertain correlation** - Fine-grained granitic mylonite; includes local quartz-feldspar-sericite schist and displays gradational sheared contacts with adjacent granitic and phyllitic units. Rocks have been assigned to this unit only where correlation with a specific granitic protolith (e.g., Xga or Xgd) is uncertain.

Xg **Granite** - Coarse- to medium-grained, pink, alkali-feldspar granite containing 20-35% quartz (coarse- to medium-grained, anhedral), 25-65% K-feldspar (coarse-grained up to 10 mm, euhedral to subhedral, Carlsbad-twinned, salmon-pink), 10-35% plagioclase (subhedral to euhedral, pink to yellowish, medium- to fine-grained), and 1-5% aggregates of fine-grained mafic minerals (including biotite and minor magnetite). This granite forms massive plutons west of Charcoal Gulch, which narrow into northerly elongate tabular belts. Heterogeneous protomylonite-mylonite foliation is developed in these narrow belts, along margins of the plutons, and in adjacent schist belts where schistose mylonitic granite is interfoliated with supracrustal rocks and gabbro. The mylonitic granite contains 10-20% 2-5-mm K-feldspar porphyroclasts.

Unit Xg includes both the "alaskite" and "quartz monzonite" units of Krieger (1965), the latter restricted to a small belt located 2.5 km east of Charcoal Gulch and considered genetically related to the more widespread alaskite. Analyses reported by Krieger indicated a difference in the feldspar compositions between these units; the "quartz monzonite" contains microcline and oligoclase ($An_{15}$ based on X-ray diffraction) whereas K-feldspar in the alaskite includes microcline, orthoclase, and perthite and the plagioclase is albite (normative composition $An_3$). The "quartz monzonite" unit is therefore monzogranite, whereas the appropriately named "alaskite" is true alkali-feldspar granite.

Xgd **Granodiorite** - Medium- to fine-grained biotite granodiorite containing 5-15% biotite and ranging from nearly massive to variably foliated. Granodiorite in the Chaparral shear zone typically is mylonite or protomylonite, grading to ultramylonite and phyllonite near contacts with unit Xs; these contacts are typically gradational and somewhat cryptic.

Rocks of unit Xgd were mapped by Krieger (1965) as Prescott Granodiorite and inferred as being cogenetic. Poikilitic microcline, characteristic of Prescott Granodiorite in the type area, is present only in some of the rocks in this map area, notably along Lynx Creek near Fain Lake. In most other places, primary igneous textures and composition are variably obscured by shearing and metamorphism. The possibility therefore remains that some Xgd is instead related to other intrusive suites such as the Crooks Canyon granodiorite (Anderson and Blacet, 1972a, 1972b), which forms a large pluton south of the map area. A U-Pb zircon date of ca. 1680 Ma has been reported for the Prescott Granodiorite (Wooden and DeWitt, unpublished data, 2004; cited in DeWitt et al., 2008).

Xgdb **Granodiorite intruded by abundant mafic dikes** - Poorly exposed domain in which exposures consist mainly of northerly elongate outcrops of metabasite (interpreted as mafic dikes). Granodiorite and, more commonly, grus derived from it are exposed between the dikes in a few places. This may be related to the Prescott Granodiorite, as inferred by Krieger (1965) for other granodiorite in the map area.

Xgx **Granodiorite with mafic xenoliths** - Medium-grained biotite granodiorite to quartz monzodiorite containing flattened and elongate xenoliths of fine-grained metabasite and medium-grained gabbro.

Xgb **Gabbro** - Gabbro and metagabbro, typically with clinopyroxene replaced by amphibole. Most of the unit is medium- to coarse-grained, ranging from fine-grained to locally pegmatoidal. Fine- or medium-grained gabbro locally displays commingled contacts with a nearly aphanitic phase. Medium- to coarse-grained gabbro locally grades to leucogabbro consisting of cumulus plagioclase and coarse-grained poikilitic clinopyroxene. In much of the gabbro unit clinopyroxene has been pseudomorphed by amphibole (and locally chlorite), which Krieger (1965) determined to be mostly actinolitic hornblende of metamorphic origin. No attempt was made during the current investigation to distinguish metamorphic amphibole from that of possible primary origin (i.e. whether any of the rocks are diorite, hornblende gabbro, or pyroxene-hornblende gabbro rather than true gabbro). The unit includes minor quartz diorite, especially near some contacts with granitic units. In areas of high strain, metagabbro grades to biotite-hornblende-plagioclase schist and, at lower metamorphic grade such as in the Chaparral shear zone, chloritic schist or phyllite.

Xxb **Gabbro contaminated with other units** - As mapped by Krieger (1965)

**Tectonites of Chaparral shear zone**

Xs **Quartz-feldspar-sericite schist and phyllite** - Fine-grained quartz-feldspar-sericite schist and quartz-sericite phyllite, locally with 1-2-mm K-feldspar porphyroclasts and rarely with 2-4-mm quartz porphyroclasts. These rocks are mostly weathered orange-pink to light brown, ranging to yellow-gray and white. Phyllite and schist grade to schistose sheared granitic rocks of adjacent units, and the unit includes remnants of fine-grained granite of unit Xga. Therefore, these rocks are evidently mylonite, ultramylonite, and phyllonite derived at least in part from fine-grained granitic rocks. They may also have been derived in part from rhyolite tuff as indicated by all previous workers (Anderson and Creasey, 1958; Krieger, 1965; Anderson and Blacet, 1972a; DeWitt et al., 2008), and possibly in part from clastic metasediments.

Xc **Chloritic schist and phyllite** - Light-green to olive-green chloritic phyllite and fine-grained schist, locally with relict 1-3-mm plagioclase phenocrysts (porphyroclasts). Some layers contain 1-4-mm relict plagioclase phenocrysts and have sharp contacts with phenocryst-free phyllite and schist; these probably are sheared equivalent of Spud Mountain metavolcaniclastic rocks. Other intervals contain medium-grained gabbro and fine-grained metabasite grading to chloritic schist. Some of the schist and phyllite is therefore evidently mylonite and phyllonite derived from gabbro and metabasite, rather than being strictly of intermediate tuff protolith as indicated by previous workers (e.g., Anderson and Creasey, 1958; Krieger, 1965; Anderson and Blacet, 1972a, 1972b; DeWitt et al., 2008). The unit contains minor amounts of interfoliated orange-pink sericitic phyllite.

Xu **Undivided schist and phyllite** - Heterogeneous phyllite and fine-grained schist containing variable proportions of quartz, feldspar, sericite, and chlorite and resembling a mixture of units Xs and Xc. These rocks range in color from light to medium green to olive green to light brown, with some yellow-brown, light gray, and dark gray layers. They include sheared equivalents of gabbro and granite as well as metavolcanic and probably metasedimentary rocks.

## Map Unit Description, continued...

**Supracrustal rocks and associated tectonites**

Xba **Spud Mountain volcaniclastic breccia** - The most common rock type in this unit is monomict metavolcaniclastic breccia consisting of flattened, gray- to brown-weathered, porphyritic andesite clasts in aphanitic, aphyric, orange-pink- to light-green-weathered matrix. The andesite clasts contain 15-25% plagioclase phenocrysts 1-5 mm long in an aphanitic groundmass that is typically dark green on fresh surfaces. Where least deformed, the clasts have irregular margins; flattened clasts range up to 50 cm across by 4 cm thick. Some breccias contain aphyric to sparsely porphyritic andesite clasts. Others contain both aphyric and phenocryst-rich clasts in dark-gray matrix that contains 20-25% plagioclase phenocrysts 2-5 mm long (up to 10 mm rarely). The aphyric clasts are white to yellowish to light green and epidote-stained, and likely are of felsic composition (rhyolite or dacite).

Where highly deformed, the latter type of breccia is schist that exhibits pink felsic domains, light-green epidote-rich domains, and light-gray-weathered plagioclase-phyric domains that form highly flattened lenses. The highly deformed equivalent of the monomict andesite breccia is fine-grained, light-olive-green schist with relict plagioclase phenocrysts distributed in discrete layers. In contrast, chloritic schist with uniformly distributed plagioclase crystals grades to massive plagioclase-phyric metabasite or to fine-grained gabbro. The Spud Mountain unit also contains a few intervals of light-brown to yellow sericitic phyllite and resistant layers of dark purple-gray, siliceous magnetite ironstone, which probably is ferruginous metachert. Fine-grained chloritic and sericitic schists east of Spud Mountain contain 1-3-mm fragments of feldspar phenocrysts and may be intermediate metatuff as inferred by previous workers (Anderson and Creasey, 1958; Krieger, 1965).

Xb **Metabasite** - Metabasite, in part metavolcanic (basalt, andesite) but probably includes fine-grained metagabbro and diabase. Texture ranges from aphanitic to fine-grained and from aphyric to porphyritic with plagioclase phenocrysts ranging from <1 to 4 mm. Some zones contain ~10% amphibole phenocrysts or porphyroblasts 2 to 10 mm across. Structure ranges from massive to schistose. Some intervals are vesicular and display relict flattened pillows. Pillow breccia and peperite occur locally. Andesite containing 10-20% plagioclase phenocrysts 2-8 mm long is common in the northeastern exposures of this unit. Some of the schistose intervals contain metasediments, including light-brown quartzofeldspathic schist with golden-brown biotite. Green, fine-grained, chloritic schist is locally common.

Xbp **Heterogeneous metabasite, schist and phyllite** - Heterogeneous assemblage of interfoliated metasedimentary and metavolcaniclastic rocks, metabasite, gabbro, and granitoid rocks, all of which grade locally to schist and phyllite or phyllonite. Fine-grained schist is abundant, ranging from dark-green to olive-green to light-brown to orange-pink and locally containing feldspar grains ranging from <1 to 2 mm. The matrix composition includes various combinations and proportions of plagioclase, actinolitic hornblende, zoisite, clinozoisite, quartz, K-feldspar, sericite, biotite, and chlorite (Krieger, 1965). Phyllite contains variable proportions of quartz, sericite, and chlorite and includes yellow, brown, green, and dark-gray varieties. Much of the schist and phyllite is of sedimentary or volcaniclastic origin, although there are examples of mylonitic schist and phyllonite that grade to gabbro, metabasite, and granitoid protoliths. Fine- to medium-grained feldspathic metasandstone is locally present along with sandy metasiltstone and metapelite. There are a few red-brown ironstone layers with abundant specular hematite. Fine-grained quartzofeldspathic and quartz-feldspar-sericite rocks interpreted as rhyolite or dacite metatuff contain angular feldspar phenocrysts <1 mm in size and fiamme-like weathered-out inclusions. Metavolcaniclastic breccia or lapilli tuff containing flattened, quartz-phyric felsic clasts supported in a dark-green, fine-grained matrix is locally present, though uncommon.

Xt **Dacite ash-flow metatuff** - Ash-flow metatuff of dacite composition, containing 1-15% 1-3-mm white feldspar phenocrysts and fragments, locally abundant feldspar-phyric lithic clasts up to several cm across, and locally abundant recessive-weathered clasts ranging from 2 mm to a few cm across interpreted as former pumice. The clasts are flattened and include light-gray- and dark-gray-weathered populations. They are supported in a dark-gray vitreous matrix weathered light pinkish-gray, pink, tan, or light greenish-gray. This unit is fairly homogeneous but exhibits some textural variation, ranging from moderately phenocryst-rich to aphyric and containing intervals of ash tuff or fine-grained volcaniclastic sandstone. Most intervals, including the sandstone, contain weathered-out lenticular grains 2-5 mm across interpreted as former pumice. The rocks range from massive to schistose and, for the most part, do not exhibit obvious compositional or textural layering.

Xa **Mafic dike swarm?** - Poorly exposed domain in which outcrops consist entirely of fine-grained mafic rocks (metabasite), some with plagioclase phenocrysts. Mapped by Krieger (1965) as a volcanic unit, the rocks here are similar to dikes that intrude other map units, and it is possible that this domain is a swarm of mafic dikes with none of the host rock preserved (not even in the colluvial float).

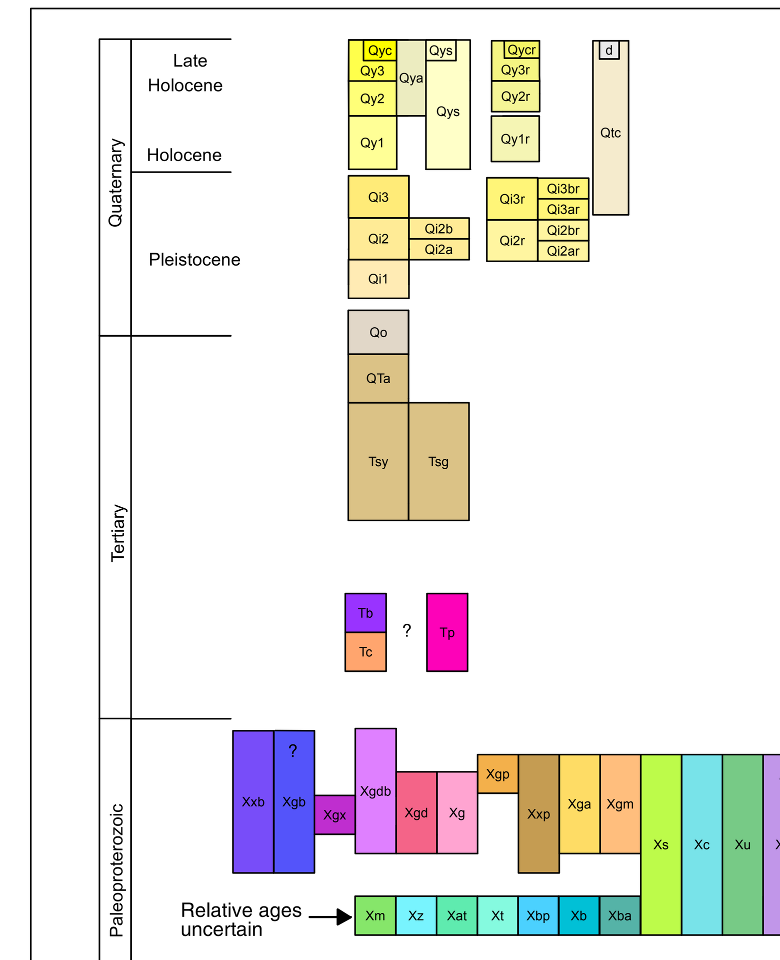
Xat **Metatuff, schist, and metabasite** - Fine- to medium-grained schist, metabasite, and felsic metatuff. Heterogeneous schists range from quartzofeldspathic to micaceous to mafic in composition and from light brown to pink to olive green to gray in color. The darker schists contain very-fine-grained biotite and the more mafic domains contain biotite-hornblende-plagioclase assemblages with epidote-rich layers or lenses. Metabasite layers are aphanitic to fine-grained and may be either lava flows or dikes. Felsic metatuff is fine-grained, gray, quartzofeldspathic schist weathered light grayish-pink and containing dark-brown-weathered, recessive, fiamme-like lenses up to a few cm across.

Xz **Heterogeneous schist and metavolcanic rocks** - Much of this unit consists of heterogeneous fine-grained schist, ranging from light brown to olive green to light gray and containing various proportions of quartz, feldspar, and biotite. Platy, light-brown, micaceous schist containing muscovite is also common. Most of these rocks are probably pelitic and semipelitic metasediments with minor impure quartzite, although some schists may be of felsic volcaniclastic origin. Medium- to dark-gray to olive-green schists composed of amphibole-plagioclase-biotite-epidote assemblages are common in some intervals and are probably of mafic or intermediate volcaniclastic origin.

The schists are interfoliated with a variety of other rocks, including metabasite, gabbro, fine- to medium-grained biotite-plagioclase-hornblende schist derived in part from sheared gabbro, and fine-grained granitoid mylonite with feldspar porphyroclasts. Contacts between different rock types are commonly gradational and obscured by transposition.

Xm **Calcsilicate, quartzite, schist, paragneiss, and metabasite** - Heterogeneous metamorphic rocks including calcsilicate, schist, paragneiss, quartzite, and metabasite exposed in a northerly trending belt along Lynx Creek. Aphanitic to fine-grained epidote-hornblende-plagioclase metabasite is massive to schistose and locally displays relict lava pillows. Fine-grained schist and (in the northern part of the belt) paragneiss are abundant, ranging from dark-gray hornblende-plagioclase-rich to light-gray and light-brown quartzofeldspathic compositions with variable proportions of quartz, feldspar, amphibole, epidote, biotite, and muscovite. Some of the schist may be of volcaniclastic protolith. The more quartzofeldspathic and micaceous intervals are metasandstone-siltstone-pelite, and some contain flattened quartz granules. Calcsilicate rocks containing epidote and amphibole are major components of the paragneiss in the northern part of the belt, including coarse-grained garnet-epidote layers in an interval that also has quartzite or metachert lenses and layers up to 5 cm thick. Fine-grained gray to dark-purple quartzite or metachert units up to 5 m thick occur locally in the metasedimentary sections.

## Map Unit Correlation Diagram

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