# Geologic map of the west-central part of the Grant Range, Nye County Nevada

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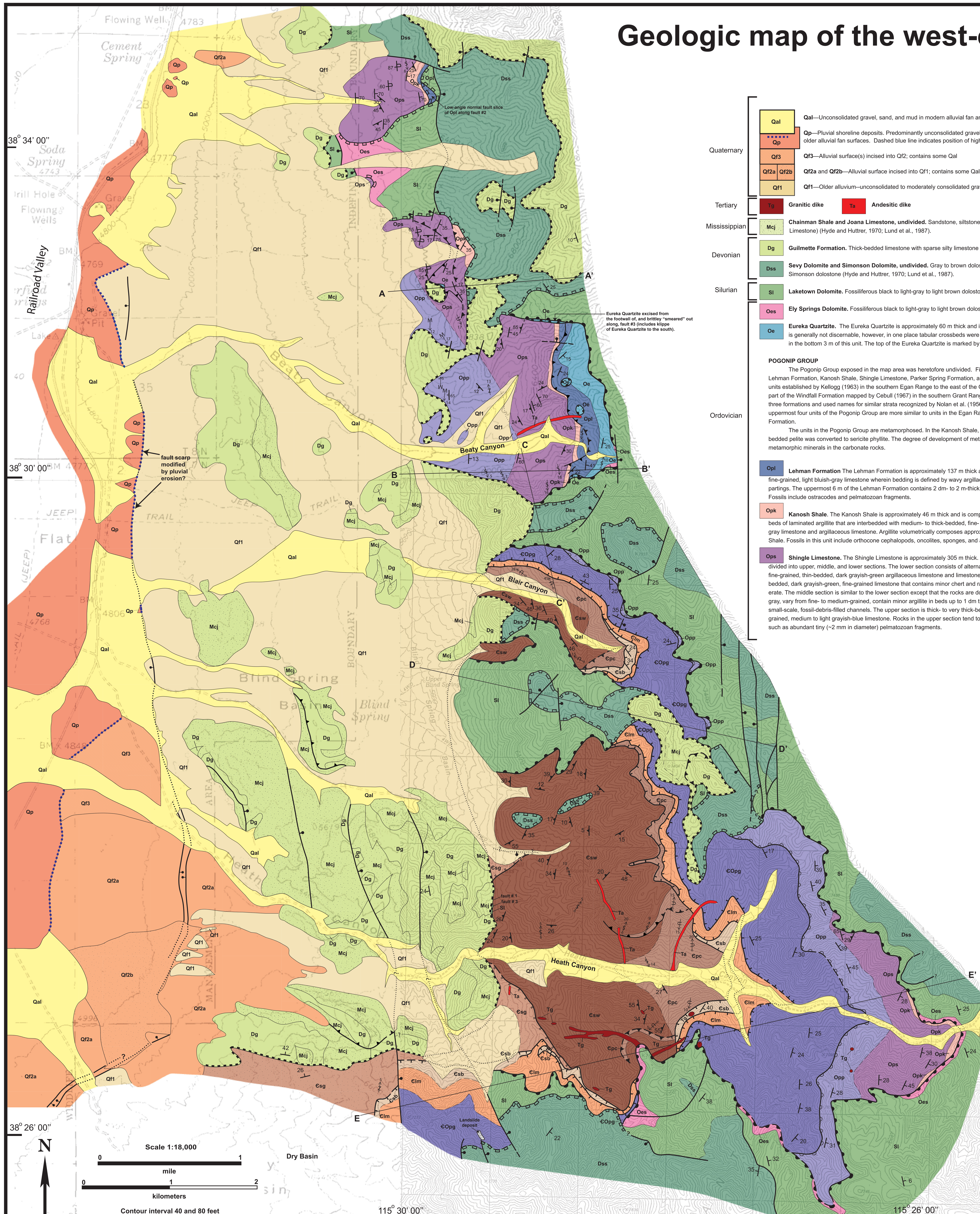



## Quaternary

**Qal**—Unconsolidated gravel, sand, and mud in modern alluvial fan and stream deposits

**Qp**—Pluvial shoreline deposits. Predominantly unconsolidated gravel, with minor sand and mud. This unit consists of a series of shoreline deposits superimposed on older alluvial fan surfaces. Dashed blue line indicates position of highstand shoreline at ~ 4870' elevation.

**Qf3**—Alluvial surface(s) incised into Qf2; contains some Qal

**Qf2a** and **Qf2b**—Alluvial surface incised into Qf1; contains some Qal

**Qf1**—Older alluvium--unconsolidated to moderately consolidated gravel, sand, and mud in inactive alluvial fans; contains some Qal

## Tertiary

**Tg** Granitic dike

**Ta** Andesitic dike

## Mississippian

**Mcj** **Chainman Shale and Joana Limestone, undivided.** Sandstone, siltstone, shale, and limestone (Chainman Shale), and tan to gray crinoidal limestone with tan to pink chert (Joana Limestone) (Hyde and Huttrer, 1970; Lund et al., 1987).

## Devonian

**Dg** **Guilmette Formation.** Thick-bedded limestone with sparse silty limestone and dolostone (Hyde and Huttrer, 1970; Lund et al., 1987).

**Dss** **Sevy Dolomite and Simonson Dolomite, undivided.** Gray to brown dolostone with pink to gray chert near the base (part of Sevy Dolomite) and quartzose dolostone at the base of the Simonson dolostone (Hyde and Huttrer, 1970; Lund et al., 1987).

## Silurian

**Sl** **Laketown Dolomite.** Fossiliferous black to light-gray to light brown dolostone (Hyde and Huttrer, 1970).

## Ordovician

**Oes** **Ely Springs Dolomite.** Fossiliferous black to light-gray to light brown dolostone (Hyde and Huttrer, 1970).

**Oe** **Eureka Quartzite.** The Eureka Quartzite is approximately 60 m thick and is composed of thin- to very thick-bedded, white to black to reddish-brown quartzite. Sedimentary structure within beds is generally not discernable, however, in one place tabular crossbeds were observed. Argillite (up to 3 dm thick) and sericite phyllite layers (less than 3 cm thick) are interbedded with quartzite in the bottom 3 m of this unit. The top of the Eureka Quartzite is marked by a 3 dm-thick bed of brownish red quartzite and the contact with the overlying Ely Springs Dolomite is sharp.

### POGONIP GROUP

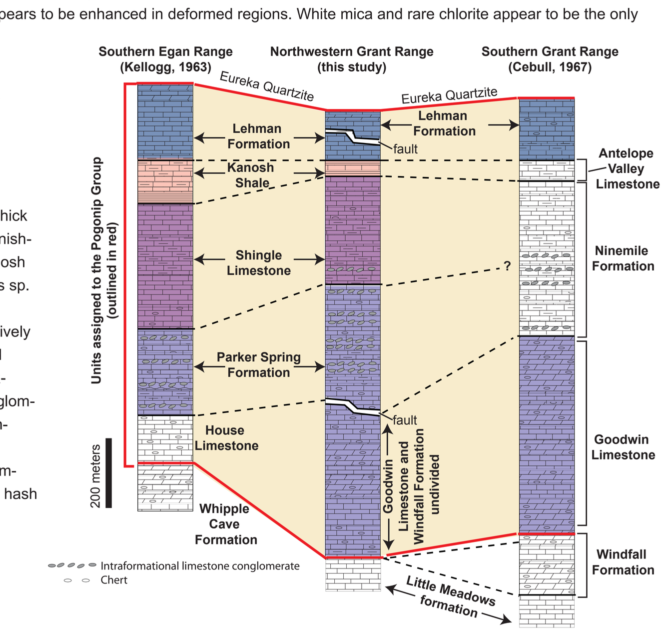
The Pogonip Group exposed in the map area was heretofore undivided. Five mappable units with the Pogonip Group are recognized. In descending stratigraphic order they are the Ordovician Lehman Formation, Kanosh Shale, Shingle Limestone, Parker Spring Formation, and the Ordovician-Cambrian Goodwin Limestone. The stratigraphically four highest units are correlated with similar units established by Kellogg (1963) in the southern Egan Range to the east of the Grant Range, but the lowest unit is more similar to, and hence correlated with, the adjacent Goodwin Formation and part of the Windfall Formation mapped by Cebull (1967) in the southern Grant Range (see adjacent correlation diagram). In the southern Grant Range, Cebull (1967) divided the Pogonip Group into three formations and used names for similar strata recognized by Nolan et al. (1956) in the Eureka area; the Antelope Valley Limestone, Ninemile Formation, and Goodwin Limestone. Although the uppermost four units of the Pogonip Group are more similar to units in the Egan Range, they are broadly correlative with what Cebull (1967) mapped as the Antelope Valley Limestone and Ninemile Formation.

The units in the Pogonip Group are metamorphosed. In the Kanosh Shale, Shingle Limestone and Parker Spring Formation, pelitic layers greater than 3 cm thick are argillite, whereas thinner bedded pelite was converted to sericite phyllite. The degree of development of metamorphic white mica appears to be enhanced in deformed regions. White mica and rare chlorite appear to be the only metamorphic minerals in the carbonate rocks.

**Opl** **Lehman Formation** The Lehman Formation is approximately 137 m thick and is composed of very fine-grained, light bluish-gray limestone wherein bedding is defined by wavy argillaceous/carbonaceous partings. The uppermost 6 m of the Lehman Formation contains 2 dm- to 2 m-thick beds of tan dolostone. Fossils include ostracodes and pelmatozoan fragments.

**Opk** **Kanosh Shale**. The Kanosh Shale is approximately 46 m thick and is composed of 1 cm- to 3 dm-thick beds of laminated argillite that are interbedded with medium- to thick-bedded, fine- to coarse-grained, greenish-gray limestone and argillaceous limestone. Argillite volumetrically composes approximately 20% of the Kanosh Shale. Fossils in this unit include orthocone cephalopods, oncolites, sponges, and abundant Receptaculites sp.

**Ops** **Shingle Limestone.** The Shingle Limestone is approximately 305 m thick. This unit can be qualitatively divided into upper, middle, and lower sections. The lower section consists of alternating sets of interbedded fine-grained, thin-bedded, dark grayish-green argillaceous limestone and limestone that alternate with thick-bedded, dark grayish-green, fine-grained limestone that contains minor chert and rare intraformational conglomerate. The middle section is similar to the lower section except that the rocks are dominantly medium bluish-gray, vary from fine- to medium-grained, contain minor argillite in beds up to 1 dm thick and contain sparse small-scale, fossil-debris-filled channels. The upper section is thick- to very thick-bedded, coarse- to medium-grained, medium to light grayish-blue limestone. Rocks in the upper section tend to contain abundant fossil hash such as abundant tiny (~2 mm in diameter) pelmatozoan fragments.




### POGONIP GROUP CONTINUED

**Opp** **Parker Spring Formation**. The minimum tectonic thickness of the Parker Spring Formation is 355 m. This unit consists of thin- to medium-bedded, light grayish-green, fine-grained limestone and argillaceous limestone intercalated with thin (1 mm to 1 cm thick) sericite phyllite. Limestone contains irregular-shaped chert that tends to transect bedding. Chert ranges in morphology from lenticular to crescent shaped. Phyllite is a minor constituent, but this as well as intraformational conglomerate are distinctive of this unit.

**€Opg** **Goodwin Limestone.** The Goodwin Limestone is bounded above by low-angle normal fault # 4, and in places, low-angle normal fault # 5 forms the base of the formation. Its minimum tectonic thickness is 396 m. This unit has been variably altered to dolostone, particularly in proximity of low-angle normal fault # 5. The Goodwin Limestone can be grossly divided into three sections. The upper section consists of thin-bedded, light gray limestone with bedding-parallel chert lenses and nodules. The middle section consists of very thick-bedded, light gray, massive limestone with minor chert. Gastropod fossils are present near the bottom of the middle section. The lower section has a variable thickness (0 to 30 m) and is cut out in places because it lies above a low-angle normal fault associated with fault # 5. The bulk of the lower section consists of thin-bedded, light gray-blue limestone (mostly hydrothermally altered to dolostone) and bedding-parallel chert lenses. However, near the base of the lower section, the limestone is black to dark gray and laminated, and chert appears to preferentially occur as partial to complete replacement of orange-weathering laminated dolomitic layers.

The lower section of the Goodwin Formation is different than the middle and upper sections in that it constitutes a distinctive zone of stratal disruption (ZSD), which is not found in stratigraphically higher rocks. The ZSD comprises breccia, disharmonic folds, and small faults. Some of the folds transition into small faults, and in places strata merge into breccia. In outcrop, in the breccias and folds, carbonate rocks commonly appear ductiley deformed and quartz and graphitic carbonate rocks are brittlely deformed. Nowhere can the folds be traced for more than 5 m and orientations of strata are both vertically and laterally chaotic: the ZSD lacks a uniform fabric. Although the rocks appear brittlely and ductiley deformed at the outcrop, evidence of brittle or ductile microstructure in minerals is generally lacking in this zone at the microscopic scale. Much of the deformation in the ZSD is probably syn-sedimentary in origin, although the proximity of fault # 5 necessarily raises the question of (1) whether or not the ZSD, or at least some of the deformation, is a consequence of movement on fault # 5 and (2) whether or not some of the deformation formed in response to earlier tectonic folding and thrust faulting. However, tectonic fabrics (e. g. foliation and lineation) such as those produced in east- or west-vergent folding are lacking. Moreover, folds in the ZSD lack a uniform orientation, a situation that might be expected as a result of syn-sedimentary slumping rather than tectonic processes. Structures in the ZSD are morphologically similar to carbonate slump and flow deposits described by Nelson and Lindsley-Griffin (1987), and those described by Cook and Taylor (1977) in coeval (?) rocks 70 km to west in the Hot Creek Range. Hence, the ZSD in the Grant Range is probably mostly primary sedimentary structure rather than tectonic. The lower section is correlative with rocks mapped as the Windfall Formation in the southern Grant Range by Cebull (1967) and in the southern White Pine Range by Moores et al. (1968). However, in the Mt. Hamilton area in the southern White Pine Range, Humphrey (1960) mapped this same lithofacies as "member one" of the Goodwin Formation. I have also included it in the Goodwin Formation but have not considered it a mappable unit because of its minor and irregular extent.

## Cambrian

**€lm** **Little Meadows formation**. The Little Meadows formation in the map area is everywhere dismembered by extensional faults so that no complete section exists. Cebull (1967) informally named the Little Meadows formation and designated a type section in the southern Grant Range. The type section is 154 m thick (Cebull, 1967), well exposed and very much like the section in the northern Grant Range. The tectonic thickness of the Little Meadows formation in the map area generally does not exceed 40 m and in most places is less than 30 m. The dominant rock types are massive, light blue-gray limestone or marble and white limestone or marble with a pinkish tinge. In the eastern part of the map area, much of the Little Meadows formation has been hydrothermally altered to dolostone. No fossils were found in the northern Grant Range but Cebull (1967) indicates that fossils in the Little Meadows formation in the southern Grant Range are Late Cambrian.

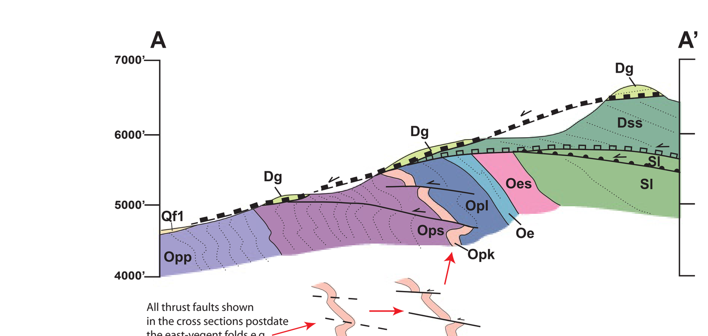
**Sidehill Spring formation**. Cebull (1967) informally named the Sidehill Spring formation for strata between the Little Meadows Formation and Pole Canyon Limestone. I have retained Cebull's (1967) nomenclature for correlative strata but have recognized three mappable units that I informally name, from stratigraphically highest to lowest, the Blue Eagle member, Grant Canyon member, and Willow Springs member. The stratigraphic thicknesses of these units are not known because the rocks are faulted and folded.

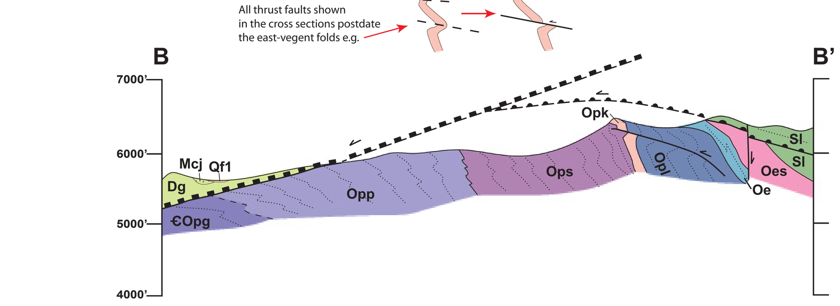
**€sb** **Blue Eagle member**. The Blue Eagle member consists of thin-bedded, fine-grained, light blue-gray limestone intercalated with resistant, orange weathering, medium gray limestone. Resistant layers are graphitic (?) and contain quartz. The Blue Eagle member contains rare intrafromational conglomerate. The best place to observe the Blue Eagle member is in Blair Canyon. The minimum thickness of this unit is 20 m. Metamorphic minerals in the Blue Eagle member are white mica and tourmaline porphyroblasts.

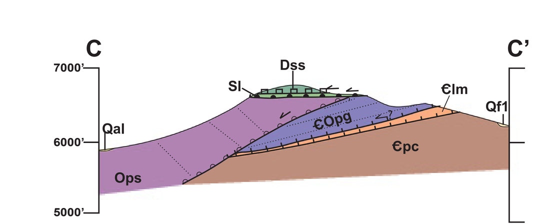
**€sg** **Grant Canyon member**. The upper part of Grant Canyon member consists of dark gray-blue limestone with orange weathering dolomitic mottling (burrows?) interbedded with thin-bedded greenish-gray limestone, phyllite (up to at least 5 cm thick) and minor intraformational limestone conglomerate. The lower part of the Grant Canyon member consists of phyllite and alternating thin-bedded, blue-gray limestone and argillaceous limestone. This unit contains a few disharmonic folds that lack tectono-metamorphic fabric and may be syn-sedimentary in origin. The Grant Canyon member is fossiliferous. Fossils include trilobites, linguloid brachiopods, and sponge spicules. The minimum thickness of the Grant Canyon member is 50 m. Phyllite contains white mica, chlorite and in some places ilmenite (?; altered to leucoxene). The limestone was not observed in thin section and thus its metamorphic mineral assemblage(s) are unknown.

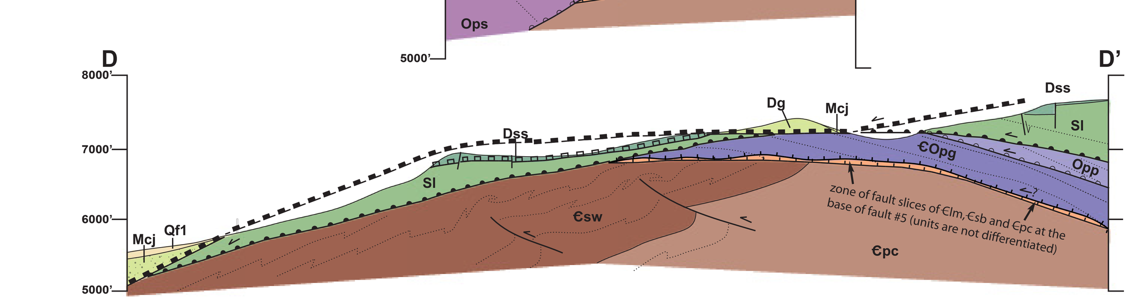
**€sw** **Willow Springs member.** The Willow Springs member consists of light grayish-green to light bluish-green to orangish-brown, thin- to thick-, but dominantly thin-bedded fine-grained calcite marble. Bedding is defined by poikiloblastic amphibole (after phlogopite) and or phlogopite-rich layers. This unit also contains minor zircon (in phlogopite) and metamorphic chlorite and white mica. Near low-angle normal faults, phlogopite is variably altered to chlorite. The minimum thickness of this unit is 100 m. Certain parts of the Willow Springs member contain a strong, thick (~3 mm) phlogopite-bearing cleavage ($S_1$) and it is in these rocks that two distinct planar elements, both bedding and cleavage, are evident. The differentiation between the two usually can be discerned because large micas are generally concentrated in cleavages whereas micas in bedding tend to be small and sparsely distributed.

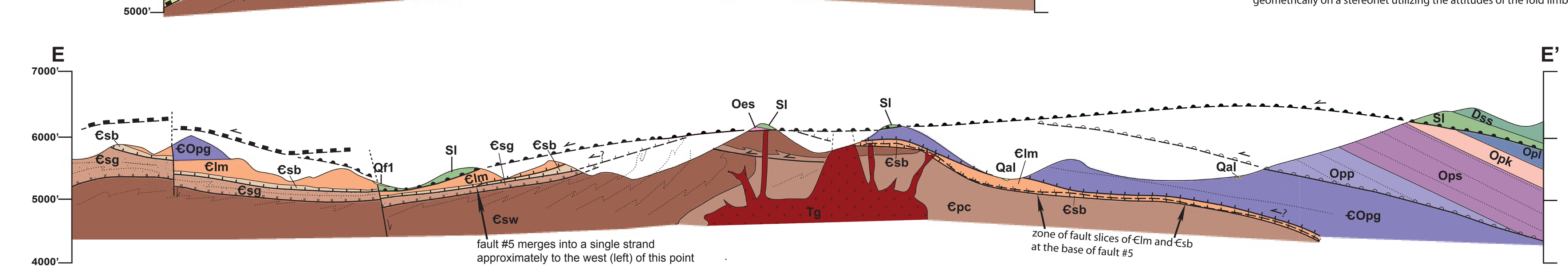
**€pc** **Pole Canyon Limestone.** The Pole Canyon Limestone (Drewes and Palmer, 1957) consists of thin- to thick-bedded, light blue-gray and dark blue-gray, fine-grained marble with subordinant tabular, resistant, reddish-brown weathering, quartzose-micaceous layers up to 2 dm thick and thin-bedded schist or phyllite. Fossils in this unit include trace fossils, and in Grant Canyon 3 km south of the map area, oncolites. Marble contains phlogopite, white mica, and chlorite. Phyllite or schist contains white mica, biotite, and chlorite, and the quartzose-micaceous layers contain biotite, white mica, and chlorite.




**Cross section note:** Trace of bedding is shown as a fine dotted line.

Fault #1
Fault #2
Fault #3
Fault #4
Fault #5*
*fault #5 may include up to three parallel fault strands
Fault #6
Low-angle normal faults (dashed where approximately located, dotted where concealed)

High-angle normal fault (ball and bar on downthrown side; dashed where approximately located, dotted where concealed)

Thrust fault (teeth on hanging wall)

Stratigraphic contact (dashed where approximately located, dotted where concealed)

Location of highstand pluvial shoreline (~ 4870' elevation)

17 Strike and dip of bedding

85 Strike and dip of overturned bedding

25 Strike and dip of $S_1$ foliation (associated with $F_1$ folds)

13 Strike and dip of $S_2$ foliation (associated with $F_{2y}$ folds)

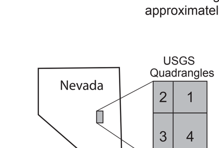
$F_1$ folds*
Minor $F_1$ fold showing trend and plunge of hinge and asymmetry (S or Z fold) viewed in the down-hinge direction
Minor $F_1$ fold showing trend and plunge of hinge

$F_{2x}$ folds*
Minor $F_{2x}$ fold showing trend and plunge of hinge and asymmetry (S or Z fold) viewed in the down-hinge direction
Minor $F_{2x}$ fold showing trend and plunge of hinge

$F_{2y}$ fold*
Minor $F_{2y}$ upright fold showing trend and plunge of hinge

Landslide deposit of Paleozoic strata

*The attitudes of fold hinges, where not measured in the field, were determined geometrically on a stereonet utilizing the attitudes of the fold limbs.




**Map construction.** Mapping of Paleozoic bedrock was primarily conducted at a scale of 1:12,000 by Camilleri (1988) on the following U.S.G.S. quadrangles that were enlarged to the 1:12,000 scale: 1:62,5000 15' Currant quadrangle with a 80 foot contour interval (area #1); 1:62,500 15' Blue Eagle Mountain quadrangle with a contour interval of 40 feet (area #2); 1:62,500 15' Troy Canyon quadrangle with a 40 foot contour interval (area #3); a preliminary copy of the 1:24,000 7 1/2' Forest Home quadrangle with a 40 foot contour interval (area #4). This map and cross sections were produced by scanning Camilleri's original 1988 map and transfering contacts on scanned images of the aforementioned quadrangles. Then, additional 1:50,000 scale mapping of upper Paleozoic strata from Lund et al. (1987,1988) and 1: 24,000 scale mapping of Quaternary units (Camileri, unpublished) was compiled and added to this map. See text and Figure 2 for additional details about sources of geologic mapping and mapping of Quaternary units.

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