UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANDELARIA QUADRANGLE
NEVADA
7.5 MINUTE SERIES (TOPOGRAPHIC)


# PRELIMINARY GEOLOGIC MAP OF THE CANDELARIA QUADRANGLE, NV

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## LEGEND

* K/Ar data from Marvin and others (1977) and Speed and Cogbill (1979)

Qal youngest alluvium; deposits in major active channels

Qd eolian sediments

Tqal lowland alluvium cut by active channels

oal perched upland alluvial deposits

Tb olivine basalt; Pliocene K/Ar whole rock dates*: 2.8 and 2.9 ma

Ts lacustrine sedimentary rocks: mudstone, sandstone, tuff, and conglomerate

- Ts2 upper unit; probably Pliocene or late Miocene
- Ts1 lower unit; probably Pliocene or late Miocene
- Ts undivided

Ta andesite: lava, breccia, and sediments; K/Ar dates: 17.4 ma (hornblende) and 17.3 ma (plagioclase)

Tt Upper Oligocene Tuff of the Candelaria Hills (Speed and Cogbill, 1979)
ten K/Ar dates* of mineral separates between 22 and 25 ma

- Tt10 compacted ash-flow tuff
- Tt9 Candelaria Junction Tuff; prominent thick compacted pumiceous ash-flow tuff
- Tt8 uncompacted pumiceous tuff
- Tt7 Belleville Tuff; prominent compacted pumiceous ash-flow tuff
- Tt6b basaltic upper subunit of Tt6; whole rock K/Ar date* is 23.5 ma
- Tt6 uncompacted pumiceous ash-flow tuff
- Tt5 Metallic City Tuff; prominent ash-flow tuff with strong compaction zonation
- Tt4 uncompacted pumiceous ash-flow tuff
- Tt3 compacted pumiceous ash-flow tuff
- Tt2 moderately compacted ash-flow tuff
- Tt1 moderately compacted ash-flow tuff
- Ttu undivided

Kg granitic plutons

Trc Candelaria Formation; Lower Triassic, parautochthonous

- Trc4 unit 4; fine grained volcanigenic strata with lensoid diamictite and cherty calcarenite; slaty; slope facies
- Trc3 unit 3; sandy andpebbly volcanigenic turbidite; upper fan facies
- Trc2 unit 2; slaty muddy volcanigenic turbidite; lower fan and basin-plain facies
- Trc1 unit 1; slaty mudstone, quartz sandstone, and limestone; open-marine nonvolcanigenic strata
- Trcu undivided

Pd Diablo Formation; Permian conglomerate and calcarenite, parautochthonous

Mc limestone and dolomite of Mississippian age; parautochthonous

Allochthonous Complexes

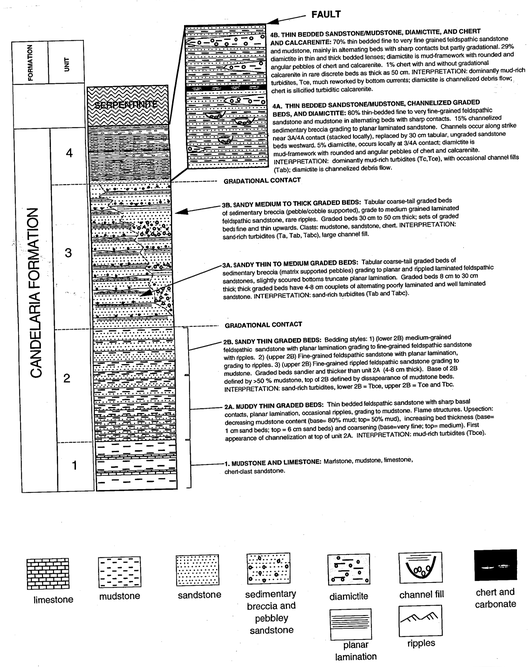
pa Pickhandle Gulch allochthon: serpentinite- matrix melange; includes schist, limestone, gabbro, basalt, quartzite, and chert

PMg Golconda allochthon: slaty mudstone, chert, and limestone in a tectonic complex; conodonts (A. Eckstein) and radiolarians (D.L. Jones) indicate Permian, Pennsylvanian, and Mississippian ages

DO Roberts Mountains allochthon: slate, basalt, chert, and limestone in a tectonic complex; radiolarians (D.L. Jones) and graptolites (J. Stewart) indicate Devonian and Ordovician ages

- bedding; facing unknown
- bedding; facing known
- bedding; overturned
- bedding; vertical
- cleavage
- compaction foliation in Tertiary tuff
- depositional and intrusive contacts
- high-angle fault; dot on downthrown wall; arrows indicate strike slip component
- thrust fault; teeth on topographically higher wall
- major fold; trace of axial surface

## LITHOSTRATIGRAPHY OF THE CANDELARIA FORMATION by Stephen G. Meyers




## EVENT HISTORY OF THE CANDELARIA QUADRANGLE

The earliest event was the deposition of lower Paleozoic sedimentary rocks and lava of the Roberts Mountains allochthon (DO) at unknown, probably oceanic sites. The allochthon was assembled tectonically and translated to the Candelaria area in Devonian or Early Mississippian time. The footwall of the Roberts Mountains allochthon, not exposed in the Candelaria Quadrangle, is probably the lower Paleozoic passive margin of the western North American continent. After its emplacement, the Roberts Mountains allochthon served as the floor for deposition of shallow marine sediments in late Paleozoic time, represented by the Diablo Formation in the central Candelaria Quad rangle and by unit Mc in the southernmost quadrangle.

Strata of the Golconda allochthon (PMg) were deposited at uncertain, probably oceanic, sites in Mississippian through Permian times. They were assembled tectonically and translated southward to Candelaria in Early Triassic time. The Golconda allochthon was transported on a thin sole of serpentinite-matrix melange, the Pickhandle Gulch allochthon.

The Lower Triassic Candelaria Formation was deposited on the Diablo Formation and Roberts Mountains allochthon. The lowest unit of the Candelaria Formation represents a continuation of the shelfal conditions of the Diablo Formation. The succeeding units 2-4 of the Candelaria Formation were laid down in a basinal environment with increasing proximity to sediment sources in volcanic and tectonized sedimentary terranes. Such sources were the encroaching Golconda allochthon and an adjoining late Paleozoic magmatic arc that crops 10 km north of the Candelaria Quadrangle (Speed, 1977). The basin in which Candelaria Formation units 2-4 were deposited was probably a foreland basin, caused by loading of the Golconda allochthon. The Golconda allochthon and Pickhandle Gulch allochthons ultimately overrode the Candelaria Formation. The Candelaria Formation together with its depositional basement is imbricated in thin thrust slices with southerly slip. Some slicing may be Early Triassic whereas some may be Cretaceous.

Siliceous magmatism affected the Candelaria Quadrangle in Cretaceous time. Two small plutons are exposed, and areas of contact metamorphism imply other shallowly buried plutons exist. Dikes are locally numerous (Page 1959; Thomson and others, 1995). The Cretaceous dikes are thought to be the cause of Candelaria's silver mineralization (Thomson and others, 1995)

Thrust imbrication occurred in Cretaceous time, repeating sections of older rocks. The age is based on faulting of some Cretaceous dikes but not of other plutonic bodies or their metamorphic aureoles. It is unclear whether imbrication is entirely Cretaceous or both Cretaceous and Early Triassic.

High-angle faulting began before and continued during deposition of the Upper Oligocene Tuff of the Candelaria Hills (Tt). The ash-flow tuffs were vented between 25 and 22 ma at sites outside the quadrangle, entered the quadrangle in uncertain directions, and ponded in tectonic lows in the quadrangle (Speed and Cogbill, 1979). Volcanism within the quadrangle in this interval was limited to extrusion of basalt at 23.5 ma as unit Tt6b. Faulting during this episode produced extension with a north-south component.

Widespread extrusion of Miocene andesite (Ta) occurred at 17-18 ma, well after the end of tuff deposition. No kinematic regime can be attached to this volcanism, although basin-range faulting was presumably ongoing.

Lacustrine deposition of unit Ts occurred in lows in the fault-block topography in late Miocene and Pliocene time (Stewart, 1988). Sediments included ash and gravel, of which Miocene andesite is a principal constituent. A major lake basin existed just north of the Candelaria Quadrangle, as occurs today as Rhodes Marsh. The basin extended southeast through the northeastern quadrangle, which is now a relative upland. There, unit Ts is deformed in northwesterly trending open folds. Unit Ts conceivably was more widespread in the Candelaria Quadrangle, but has been much denuded.

Olivine basalt (Tb) was extruded in late Pliocene time at sites related to changes of strike of active left-lateral faults.

The Candelaria Quadrangle is cut by high angle faults in an east-west belt that crosses the south-central part of the area. The faults are probably contemporary and comprise three conjugate sets divided by orientation and slip. Set 1, which includes the Candelaria fault, strikes ENE and has left-lateral and normal components of slip. The Pliocene basalt is localized along this set and is cut by this set. Set 2 has northerly strikes, normal throw, and uncertain strike slip. Set 3 strikes NE and has normal slip; it represents extension in simple shear between faults of set 1. The maximum principal component of strain trends between west and NW, depending on the net slip of set 2.

Alluvium is divided among three units. The oldest alluvium (oa) relates to a preexisiting topography but has escaped denudation during Neogene tectonics. The alluvium of intermediate age (Tqal) relates to current topography, covers lowland regions of the Candelaria Hills, and is undergoing erosion. The youngest alluvium (Qal) is being transported episodically in channels.

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