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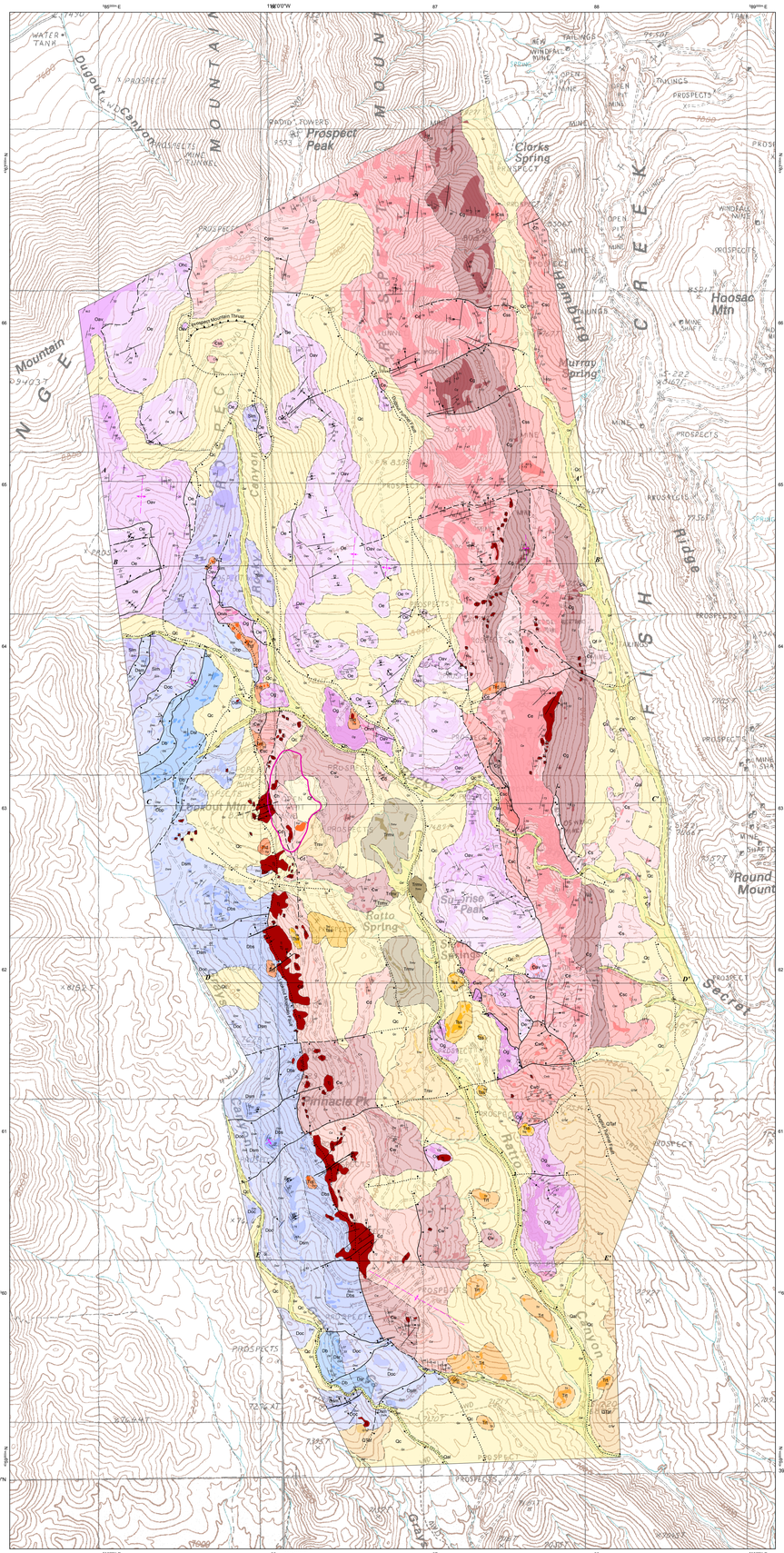

PRELIMINARY GEOLOGIC AND ALTERATION MAPS OF LOOKOUT MOUNTAIN, RATTO RIDGE AND ROCKY CANYON, SOUTHERN EUREKA MINING DISTRICT, EUREKA COUNTY, NEVADA

Plate 1 of 2

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Qf **Artificial fill** Tailings and dump material from open pit mining.

Qal **Alluvium** Unconsolidated slope wash debris and river/stream alluvium; exhibits active incision.

Qc **Colluvium** Talus and slope-covering unconsolidated sand to large (3m) boulder-sized clasts, eroded from proximal bedrock outcrops.

QTaf **Alluvial fan** Composed of subangular to rounded, coarse-sand to cobble clasts of proximal Paleozoic units with carbonate cement. Strongly dissected and deeply incised. Unconsolidated to poorly-consolidated outcrops are rare and usually slope forming.

J **Jasperoid** Fine-grained quartz replacement contemporaneous with dissolution of carbonate host rock; localized in fault zones. Exhibits a fine-sucrosic to smooth crypto-crystalline texture. Ridge and cliff forming; crops out well.

Trmv **Richmond Mountain dacite and andesite (Late Eocene)** Porphyritic dacite, volcaniclastic deposits, and aphanitic andesite lava flows. Flows and dikes weather dark brown to dark red, and are similar to lighter in color on fresh surfaces. Phenocrysts of plagioclase and mafic minerals, with large hornblende and pyroxene. Contains glassy components (<1 cm to 20 cm in diameter) and abundant vesicles and vugs. Age: 36.18±0.07 Ma, $^{40}Ar/^{39}Ar$, plagioclase; 36.5±1.3 Ma, K-Ar, hornblende (Long et al., 2014).

Pinto Peak rhyolite (Late Eocene) Rhyolite lava flows, dikes, volcanic breccias, and ash-fall tuff deposits. $^{40}Ar/^{39}Ar$ age of 37.34 ±0.26 Ma (Long et al., 2014); ~3-7 meters thick.

Tsp **Sierra Springs tuff member** Welded tuff, with red to brown matrix with interstitial black framme, ranging in size from 2–15 cm (long axis). Exhibits distinct flow banding, with orientation likely related to paleo-topography.

Trt **Pinto Basin tuff member** Light gray to white, ash fall, crystal-lithic lapilli ash tuff. Weathered outcrops can be pale green and pale pink/red with rare biotite phenocrysts. Fluvial reworking yields planar bedding, normally graded, with rare clasts (sand to small gravel) of proximal Paleozoic rock units.

Trd **Rhyolite dikes** Decameter to meter scale rhyolitic intrusions. Outcrops weather pale red to medium gray. Dikes exhibit weak to moderate flow banding.

Trav **Ratto Springs rhyodacite (Late Eocene)** Flows and intrusive bodies consisting of 30-40 % plagioclase, hornblende, biotite phenocrysts with rare (<5%) quartz. $^{40}Ar/^{39}Ar$ age of ca. 37 Ma (Long et al., 2014).

Nevada Formation (Lower-Middle Devonian)

Dbs **Bay State Dolomite member (Middle Devonian)** Fossiliferous, fine-medium grained dolostone, which weathers gray to dark gray/brown, and brown to olive-gray where freshly broken. Bedding is locally thin, massive, and uniform (Nolan et al., 1956). Exhibits abundant characteristic white, elongate, cylindrical "spaghetti" corals (Cladopora) as well as abundant, large (2-6 cm) Stringocephalus brachiopods. Bedding is more distinct and color is typically lighter and more uniform than Dem. Forms bluffy and cliffy exposures. 215 meters thick.

Dem **Sentinel Mountain Dolomite member (Middle Devonian)** Fine to coarse grained, alternating medium gray-brown/yellow and light-gray-weathering dolostone with similar, to darker color on fresh surfaces (Nolan et al., 1956). Decameter to meter-scale strata-bound color alteration is diagnostic; cm-scale mottling is common in light-gray, thick-bedded, massive dolostone, and the medium gray-brown to yellowish-brown dolostone is generally medium-thick bedded with rare interstitial laminations. Forms rugged, knobby slopes and cliffs; petroliferous when broken. 136-215 meters thick.

Doc **Oxyoke Canyon Sandstone member (Middle Devonian)** Thick to very thick-bedded, fine to medium-sand grained sized dolomitic sandstone with thin crystalline dolomite interbeds (Nolan et al., 1956). Weathers light-gray, brown, and tan, and is tan to gray where freshly broken. Interbedded dolomitic quartzose sandstone is fine to coarse-grained, subangular to rounded, moderately graded, and commonly cross-bedded. Iron-oxide staining parallel with bedforms is common. Forms cliffy to rugged exposures depending on abundance of quartz-sandstone and dolomite. 107 meters thick.

Dsr **Sadler Ranch member (Lower Devonian)** Fossiliferous packstone and wackestone, weathers brown-gray to dark-gray, and gray-blue when fresh, and exhibits abundant Gackoceras bisuale bovale-cirroides. Interbedded with crinoid-rich, finer-grained gray to light gray limestone. Petroliferous odor if broken. Forms subdued slopes. 32 meters thick.

Dlp **Bartine member of the McCoy Canyon Formation (Lower Devonian)** Fossiliferous thin to medium-bedded micrite. Weathers medium-gray to khaki-tan and dark gray where fresh. Abundant fossil hash typically consists of shell and crinoid fragments; fossiliferous interstitial packstones and wackestones are also common. Interbedded with tan to red (lessaging banding) weathering, thin-bedded, silty limestone and siltstone. Crops out poorly, forming platy, float-covered slopes. Strong petroliferous odor if broken. 38–78 meters thick.

Dlsp **Beacon Peak Dolomite (Lower Devonian)** Fine-medium crystalline to porcellaneous dolostone packstone with interbedded tan, arenaceous, well-laminated bedding. Weathers light gray to white, cream, yellow, olive green, and locally pinkish; fresh surfaces vary from gray, brown-gray to light gray. Medium to thin, well-developed bedding. Locally, rounded dolomite grains are observed, as well as locally abundant rounded quartz grains (both clastic in origin) (Nolan et al., 1956). Forms subdued benches.

Slm **Lone Mountain Dolomite (Middle Silurian)** Thick bedded, coarse crystalline dolostone. Weathers light-gray to buff, and white to light gray where freshly broken. Recrystallized dolomite rhombohedrons form a diagnostic, coarse, "sugary" texture. Massive, poorly bedded, often stitched and strongly brecciated; commonly vuggy. Forms blocky float and light gray to buff ridges and knobby cliffs. Full stratigraphic thickness not exposed in map area; estimated full thickness from Nolan et al. (1956) is 457 meters.

Ohc **Hanson Creek Formation (Upper Ordovician/Lower Silurian)** Dark-gray to black, fine-crystalline, massive-weathering dolostone. Commonly densely fractured and brecciated. Forms centimeter to decimeter scale blocky float and subdued ridges; only exposed in the northwest corner of map area. Full stratigraphic thickness is not exposed in the map area; estimated full thickness from Nolan et al. (1956) is 61 meters.

Ow **Eureka Quartzite (Middle Ordovician)** White, fine-medium grained, well-graded, well-sorted quartzite; commonly strongly brecciated. Rare laminations and distinctive cross-bedding in lower part of section; lower contact is sharp, but could be due to structural modification (Long et al., 2012). Common fracture-controlled iron oxide (red-brown) staining. Coarse-grained sand and interfingering conglomerate lenses are rare. Forms distinct white cliffs and prominent ridges and end weathers to large, rounded boulder-sized float. 122 meters thick.

Pogonip Group (Lower-Middle Ordovician)

Oav **Antelope Valley Formation** Thin to thick bedded, bluish gray, fine-grained, wackestone and packstone with interbedded, medium gray, micritic limestone. Abundant characteristic "Lebesconte" and "Leptodonta" brachiopods (Coles). cm-scale Maclurites gastropod shells are diagnostic (Nolan et al., 1956). Local tan, brown, and white diagenetic chert nodules; less chert in contrast with the Goodwin Formation. Outcrops well, forming blocky ridges and slopes. Interfingering lower contact with Onm; at least 305 meters thick.

Onm **Ninemile Formation** Thin-bedded to platy, porcellaneous calcareous shale; weathers tan-green to tan-gray and is olive-green to greenish-gray when freshly broken (Nolan et al., 1956). Surficial red-brown iron-staining is common. Rare, thin (<1 cm), tan, well-bedded silty limestone are common. Debris from similar units by being arenaceous (Nolan et al., 1956). Slope forming; does not crop out well. 92–122 meters thick.

Og **Goodwin Formation** Thick, well bedded limestone and wackestone with interbeds of medium-bedded, silty, fine–grained limestone weathering light to medium blue-gray and dark gray where fresh (Nolan et al., 1956). Gray-brown, white, and black diagenetic chert nodules are common in lower and upper parts of section (Nolan et al.,1956). Middle part of section primarily consists of thinner-bedded limestone with undulating bedding with common silty partings and interbeds of medium-bedded limestone. Forms rugged slopes, ridges, and prominent cliffs and cliffs where strongly brecciated and dolomitized. Upper contact with Onm is gradational. 381 meters thick.

Ow **Windfall Formation undivided (Upper Cambrian)** Well bedded fossiliferous wackestone and packstone, weathering light gray/brown/tan-gray to tan/red. Up to 198 meters thick, but this may be the result of structural thickening by meter-scale folding. Locally divided into:

Owb **Bullwacker member** Thin, well-bedded, sandy to shaly fine-grained moderately fossiliferous limestone, weathering tan, light-brown, and red and medium-dark gray where fresh. Contains local interbeds of thinly-laminated, buff-tan/red sandy-shaly partings and thick-bedded, sparse, massive gray-blue limestone beds (Nolan et al., 1956). Locally contains gray to white diagenetic chert nodules that do not correspond to bedding planes. Fossil hash consists of trilobite, crinoid, and brachiopod fragments. Slope-forming with tan-red platy float; rarely crops out. 122 meters thick.

Cd **Dunderberg Shale (Upper Cambrian)** Very thinly-laminated, non-calcareous shale, which weathers gray to brown/khaki and dark gray/blue when fresh, with diagnostic interbedded cm-scale lenticular limestone (Nolan et al., 1956), and exhibiting hummocky bedforms. Contemporaneous bedforms in shale form around nodular limestone discs. Bedded limestone often exhibits dense, fine trilobite hash. Less carbonate and silt than Csc. Pervasive meter-scale folding makes determination of true unit thickness difficult. Thickness is ca. 107 meters.

Ch **Hamburg Dolomite (Middle and Upper Cambrian)** Medium to coarse grained, uniform, thick-bedded, gray to brown dolostone weathering brown to light-medium gray. Exhibits mottled white calcite stringers that help define bedding, and white rod-like 'blue bird' structures (Nolan et al., 1956). Commonly altered, strongly brecciated, dissolved, and/or replaced by amorphous silica (Tjb); can be porous and vuggy due to these alteration processes. Bedding is poorly defined, and dolostone is lighter gray-brown than that of Cs. Forms prominent ridges and high-relief cliffs. 350 meters thick.

Cs **Secret Canyon Shale undivided (Middle Cambrian)** Locally consists of an upper limestone member and a lower shale member (Css). Where members cannot be defined, unit is denoted as undivided. Relatively thick shale beds resembling lower Css possibly dispersed throughout Cs. True thickness is indeterminate due to pervasive meter-scale deformation. Apparent thickness is as much as 213 to 275 meters. Locally divided into:

Csc **Clarks Spring member** Thin-bedded to laminated gray to tan limestone with distinctive contrasting yellow-brown mottling and brown-red argillaceous partings (Nolan et al., 1956). Limestone is very fine-grained, bioturbated, and silty, and is tan to blue-gray when fresh. Bedding is laminated to very thinly bedded, and well-stratified. Individual limestone beds are ~2-7 cm thick. Iron-oxide banding is common. Gradational contact with Css forms platy yellow-green float covered slopes. 152 to 183 meters thick.

Css **Lower shale member** Brown, olive, and tan, calcareous, fossiliferous, fissile shale with rare interbedded, thin-bedded limestone, particularly near the upper contact with Csc. The upper contact with Csc is gradational. Poorly-exposed and slope-forming, commonly shows up as chips in float. 61 to 92 meters thick.

Cg **Geddes Limestone (Middle Cambrian)** Thin to medium-bedded, well-bedded, dark-blue to black carbonaceous limestone with pervasive calcite veins, weathering red/brown to gray, and interbedded with cm-decimeter scale red to tan (iron-oxide) shale beds (Nolan et al., 1956). Black and distinct bedding is diagnostic. Localized ~2-15 cm black chert nodules, are common. Meter-scale, pervasive folding is common and is accompanied by strong fracture controlled white calcite veining. Gradational lower contact with Ce. Outcrops support steep-slopes and bluffs. 61–152 meters thick.

Ce **Eldorado Dolomite (Middle Cambrian)** Medium-dark gray to blue, very thick-bedded medium to coarse crystalline dolostone, often speckled with common white stringers/spots contrasting with the dark dolostone, giving the unit a diagnostic foresta("blue bird") appearance (Nolan et al., 1956). Dark dolostone locally alternates with light-gray, rough-textured, thin-bedded, silty dolostone. Rare, thin (<1 cm), tan, well-bedded silty limestone is present at lower and upper stratigraphic intervals. Localized meter-scale bands of strong brecciation are common and are commonly correlative with cm-decimeter scale calcite fracture controlled veining. Upper contact with Cg is gradational; contact placed at highest occurrence of massive, thick-bedded blue-gray dolostone. Forms high-relief cliffs, ~648 meters thick.

Cc **Pioche Shale (Lower Cambrian)** Dominantly thin-bedded, micaceous, locally-sandy shale, which is buff-green, and less commonly, red to orange (Nolan et al., 1956). Generally calcareous with minor arenaceous interbeds. Contains thin interbeds of red-brown (iron-oxide) quartz-arenite and also thin beds of mottled, dark-blue to gray limestone with abundant trilobite 'hash', which can closely resemble Csc ~69 meters thick.

Cpm **Prospect Mountain Quartzite (Lower Cambrian)** Well-graded, well sorted, white, pink and tan, fine grained quartzite that weathers white, pink, tan, gray, and brown (iron-oxide). Decimeter-scale cross-bedded lamination is diagnostic. Cm to decimeter-scale micaceous to sandy shale interbeds, common in the lower section (Nolan et al., 1956). Rare thin pebble conglomerate lenses. Forms sharp cliff and ridge outcrops, with characteristic pink-brown blocky float. No lower contact is exposed; at least ~549 meters thick.

NOTE: solid fill indicates outcrop, shaded fill indicates interpreted extent of stratigraphic unit.

Map Location

References

Nolan, T.B., Merriam, C.W., and Williams, J.S., 1956, The stratigraphic section in the vicinity of Eureka, Nevada: U.S. Geological Survey Professional Paper 276, 77 p.

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Suggested Citation

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Adjoining 7.5' quadrangle names

	1	2	3	4
	5	6	7	8
	9	10	11	12

1 Hay Ranch
2 Devon Peak
3 Eureka
4 Diamond Peak
5 Combs Peak
6 Spring Valley Summit
7 Pinto Summit
8 Sheep Creek Mountain
9 West of Bellevue Peak
10 Bellevue Peak
11 Pinto Summit SW
12 Black Point

UTM GRID AND 1990 MAGNETIC NORTH

Scale 1:10,000

0 0.125 0.25 0.5 Kilometers

0 0.125 0.25 0.5 Miles

0 500 1,000 2,000 Feet

CONTOUR INTERVAL 40, 20 FEET

Projection: Universal Transverse Mercator, Zone 11, North American Datum 1927 (m)

Base map: U.S. Geological Survey Spring Valley Summit 7.5' quadrangle (1990)
Base map: U.S. Geological Survey Pinto Summit 7.5' quadrangle (1990)
Base map: U.S. Geological Survey Pinto Summit SW 7.5' quadrangle (1990)
Base map: U.S. Geological Survey Bellevue Peak 7.5' quadrangle (1990)

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University of Nevada, Reno

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DRAFT
Preliminary geologic map
Has not undergone office or field review

Edited by Sean Long
Cartography and map production by Russell Di Fiori
Cartography and map production in ESRI ArcGIS v10.1 (ArcGeology v1.3) by Russell Di Fiori, Jennifer Vican and Katie Ryan
Symbology per FGDC-STD-013-2006
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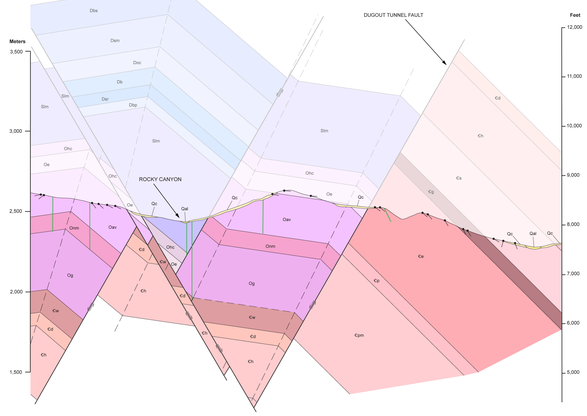

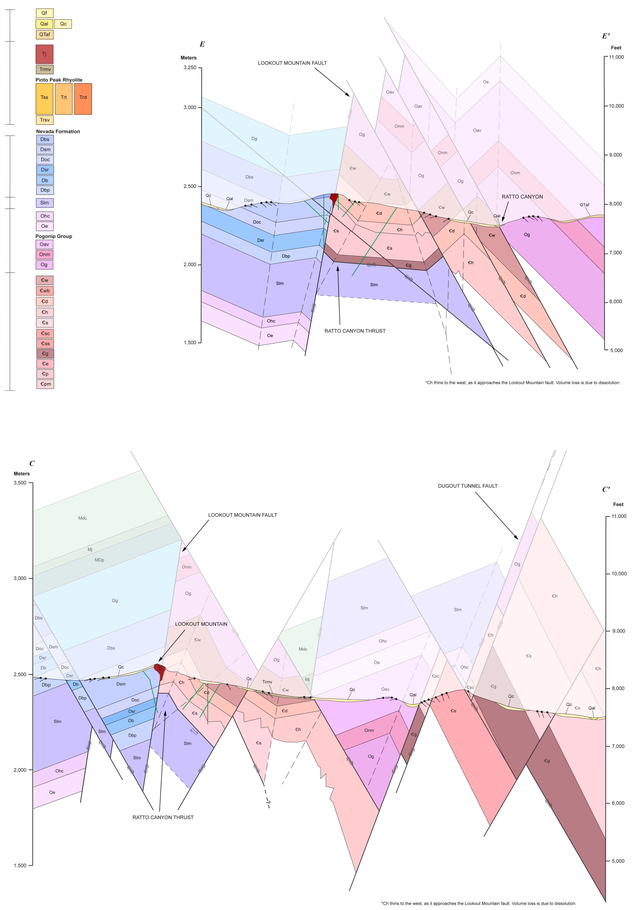

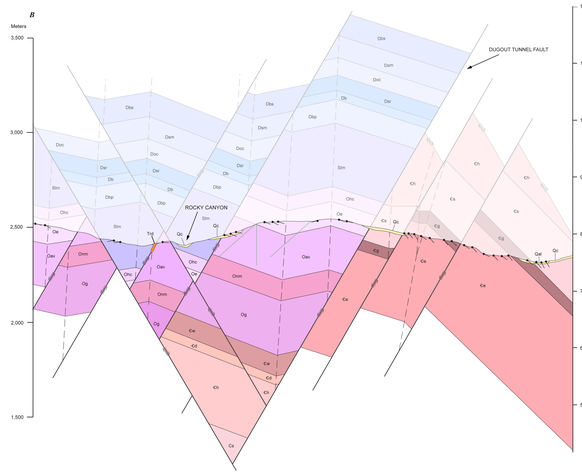

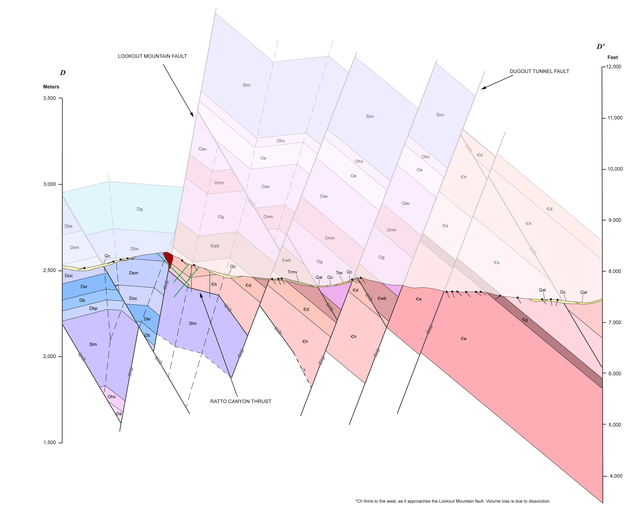

Geologic cross sections: no vertical exaggeration; translucent areas above modern erosion surface represent eroded rock