



GEOLOGIC MAP AND CROSS-SECTIONS OF THE SILVER CITY RANGE, GRANT COUNTY, NEW MEXICO

BY

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Unit Descriptions:

QTg Gila Conglomerate (Miocene-Pleistocene?): consists of semi-consolidated conglomerates, sandstones, and minor amounts of mudrocks. Estimated thickness up to 300 meters; deposited in part as syntectonic (Basin and Range) alluvial fan, river, and lacustrine deposits. Best developed on LS Mesa and in the bolson fill of the Mangas Valley. Includes some small areas of undifferentiated Holocene alluvial and colluvial deposits (Trauger, 1972).

Tb Basaltic rocks (Neogene): consists of basalt and basaltic andesite lava flows and thin dikes, locally scoriaceous and filled with zeolites, interbedded with and intruding Tertiary gravels (QTg). Age uncertain, but may range from mid-Miocene to early Pleistocene? (Trauger, 1972).

Angular unconformity

Tbm Bear Mountain Intrusive Complex (Mid-Late Tertiary?): quartz–latite porphyry forming a large, concordant to semi-concordant laccolith (up to 200 m thick) at Bear Mountain. Approximately 77-84% cryptoperthitic groundmass (~80%) with anhedral to subhedral plagioclase phenocrysts 0.5 to 3mm. Age uncertain, however it post-dates most, if not all of the volcanic rocks mapped as Tr (Peterson, 1979).

Tr Volcanic rocks (Eocene): This unit consists of a basal unit of volcanoclastic conglomeratic deposits (possibly lahars), overlain by a thick sequence (up to 900 meters?) of undifferentiated felsic (rhyolite-latite), crystal-rich ash-flow and air-fall tuffs and interbedded volcanoclastic sandstones and conglomerates. An ash flow tuff at the base of the unit gives an $^{40}\text{Ar}/^{39}\text{Ar}$ date of 34.9 ± 0.4 Ma; another tuff at the top of the sequence gives a $^{238}\text{U}/^{206}\text{Pb}$ age of 34.7 ± 0.4 Ma (Copeland *et al.*, submitted).

Thp Hornblende Porphyry (Late Cretaceous–Early Tertiary?): semi-concordant intrusive hornblende andesite (microdiorite) porphyry, containing 3-8mm euhedral hornblende phenocrysts. Age uncertain (Peterson, 1979).

Ti Intrusive (Late Cretaceous–Early Tertiary?): light pink to tan holocrystalline, slightly porphyritic microgranite containing a few percent euhedral to subhedral quartz phenocrysts, 1-3 mm in length; mainly occurs in a sill. Age uncertain (Peterson, 1979).

Angular (?) unconformity

- Kc Colorado Formation** (Cretaceous): Ranges from 0-30 meters in the study area, but thickens to several 100 meters to the east. The lower 5 meters consists of fissile, dark-gray shale. This is overlain by ~10 meters of horizontally laminated and cross-stratified thin beds of siltstone and fine-grained sandstone. This sequence is overlain by burrowed, calcite-cemented, glauconitic siltstone and sandstone, locally intercalated oyster-rich limestone beds. These sediments reflect an overall transgressive sequence from deltaic prodelta to open shelf deposits (Chafetz, 1982).
- Kb Beartooth Sandstone** (Cretaceous): Approximately 30-meter thick sequence of sandstone and siltstone deposited on paleokarst formed on Paleozoic carbonates. The lower part consists of ~12 meters of interbedded clayey very fine quartzarenite and siltstone; sandstone beds tend to thicken upwards in the section. This unit is overlain by ~4 meters of relatively massive bedded, trough cross-stratified fine- to medium-grained, submature to mature sublitharenite. The Beartooth was deposited within a prograding, deltaic environment (Chafetz, 1982).

Angular unconformity

- Ip Oswaldo Formation** (Pennsylvanian): Ranges from 0-70 meters thick in the study area, and disconformably overlies the Lake Valley. The basal unit is red to black, limy, fissile shale 0-6 meter thick. That is overlain by a fossiliferous, finely to coarsely crystalline gray limestone, distinguished in part from the underlying Lake Valley by red chert and fusulinid-rich horizons.

Disconformity

- Mlv Lake Valley Limestone** (Early to Middle Mississippian): ranges from 25-145 meter thick in the map area due to pre-Cretaceous tilting and erosion. It conformably overlies the Percha. A thin basal unit consists of heterolithic skeletal calcirudite, locally cross-stratified, typically 3-7 meters thick. It is overlain by up to 70 meters of wavy bedded, bioturbated pelmicrite to biomicrite interbedded with thin layers of shale. The upper unit, up to 40 meters thick, consists mainly of wavy bedded and cross-stratified, crinoid-rich biomicrite. The Lake Valley was deposited as part of a transgressive carbonate ramp system cut by tidal channels. It is capped in the southern part of the map area by up to 30 meters of extensive silicified paleokarst deposits and *terra rossa* paleosol. Although only seen developed on the Lake Valley in the study area, it seems likely that the karst formed during the post Oswaldo-pre Beartooth uplift and erosion (Chafetz, 1982; Myers, 1983).
- Dp Percha Shale** (Late Devonian-Early Mississippian?): Approximately 100-115 meters at Bear Mt. The basal section at Bear Mountain consists of ~10 meters of silty shale and laminated carbonaceous limestone. That is overlain by ~60 meters of dark gray, fissile shale grading upward to more regularly laminated interbedded siltstone and mudstone, which grades into ~15 meters of lenses of skeletal calcilutite interbedded with shale. The uppermost portion consists of up to 30 meters of rippled and flaser-bedded crinoidal-bryozoan biosparite and intrasparite. The Percha was deposited as part of a transgressive sequence from tidal flat to shallow lagoon to carbonate platform (Kocurek, 1977).

Disconformity

Oscf For mapping purposes we have combined the Cutter Member of the Montoya Formation (Late Ordovician) and Fusselman Formation (Silurian), as did Hildebrand et al. (2008).
Fusselman Formation: approximately 46 meters thick at Bear Mountain, consisting of gray to brownish gray, aphanitic to finely crystalline, massive dolostone. Calcite vugs are common, as are zones of silicified brachiopods and horn corals. The contact with the underlying Cutter locally appears to be a disconformity. The top is highly brecciated and mineralized zone several meters thick, probably representing a paleo-karst surface.
Cutter Member: approximately 60 meters thick at Bear Mountain, consisting of light-gray, finely crystalline massive dolostone. The unit is largely unfossiliferous, however there are a few locally fossil-rich zones near the base. *Favosites sp.* is a prominent fossil approximately 1/3 of the way from the bottom of the unit, which is not seen in any other of the units in the map area.

Om For mapping purposes we have combined the Aleman, Upham, and Cable Canyon Members of the **Montoya Formation** (Ordovician).
Aleman Member: approximately 22 meters thick in the map area. The lower 16 meters consists of pinkish grey, finely crystalline, massive to laminated dolostone with thin layers of ribbon chert (chert ~40%); stromatolitic structures and intraclasts relatively common. The upper 5 meters consists of medium crystalline rippled dolostone with nodular chert (chert ~25%); contains abundant silicified fossil hash. A silicified brachiopod hash at the base of the Cutter marks the top of the Aleman (Geeslin, 1980; Geeslin & Chafetz, 1982).
Upham Member: approximately 20-25 meters thick in map area. Consists of light-medium grey, fine-medium crystalline dolostone gradationally overlying the Cable Canyon. Lower portion is coarsely crystalline with scattered granular-sized quartz grains decreasing up-section; locally echinoid-rich; thin, well-defined planar bedding where not bioturbated. Upper portion is finely crystalline dolostone with scattered, laterally continuous horizons of nodular chert; skeletal fossil fragments in thin, discontinuous channel-fill deposits. Top of unit marked by 5-25 cm thick silicified skeletal hash. The Upham records a shoaling-upwards sequence of open to very shallow subtidal marine deposition (Bruno, 1987).
Cable Canyon Member: approximately 5-11 meters thick in map area. Consists of bioturbated medium-grained quartzarenite with dolomite cement. Moderately – poorly sorted, with horizons of patchy silica cement and abundant fossils fragments. Basal contact is a sharp, planar erosional surface, overlying the El Paso. Deposited during a major regional transgression as a sandwave complex on a current- and tide-dominated siliciclastic shelf (Bruno, 1987).

Disconformity (?)

Oep **El Paso Formation** (Ordovician): Approximately 130-170 meters thick, gradationally overlying the Bliss Formation (Meredith, 1972). It is informally subdivided into three members (not differentiated on the map).

The **upper dolostone unit** is ~70-80 meters thick, and consists of gray, thin-thick bedded, fine- to medium-crystallized dolostone, with rip-up clasts, elongated nodules and stringers of chert, and local collapse (?) breccias. Deposited predominately in an intertidal to shallow sub-tidal environment.

The **middle limestone unit** is ~35-45 meters thick, and consists of light bluish gray, thin bedded, microcrystalline limestone, locally dolomitized; contains abundant carbonate mounds, high-relief stromatolites, scoured channels, intraclasts, and pellets; deposited predominately in an intertidal to supratidal environment. This unit is less resistant to weathering compared to the two dolostone units.

The **lower dolostone member** is ~25-35 meters thick, and consists mainly of dark gray, thin-medium bedded, mottled dolostone; locally hematite-stained, with abundant silicified burrow traces on bedding planes and rare scattered chert nodules; deposited predominately in a shallow carbonate shelf environment.

- Cb Bliss Formation** (Cambrian to Ordovician?): Approximately 60 meters of interbedded siliciclastic and carbonate rocks. A thin (~4 meters) transgressive unit of coarse-grained arkose grading upwards into quartz arenite nonconformably overlies the underlying Precambrian rocks. This basal unit is overlain by up to four progradational sequences (from 2 – 30 meters thick) consisting of bioturbated biosparite and biomicrite grading upwards into laminated dolostone. These carbonates grade upwards into fine- to medium-grained glaucarenites which, in turn, grade upwards into massive bedded, trough cross-stratified, very coarse to pebbly quartzarenites, typically cemented by hematite at the top of the sequence. For the purpose of mapping we defined the top of the Bliss as the top of the youngest sandstone unit. This overall transgressive unit includes a basal beach deposit, overlain by a series of regressive packages consisting of shallow shelf to tidally influenced shoreface and tidal flat deposits (Chafetz et al., 1986).

Nonconformity

- Xg Granite** (Early? Proterozoic): consisting of equant, subhedral, 1-3mm crystals of quartz, K-feldspar, and plagioclase. Locally cut by thin basalt, aplite, and pegmatite dikes (not differentiated).
- Xm Metamorphic rocks** (Early Proterozoic): an undifferentiated assemblage of high-grade metamorphic rocks including: medium-grained amphibolite, medium- to coarse-grained quartzite, and quartz-mica schist, some with kyanite and andalusite; probably meta-sedimentary and meta-volcanic.

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