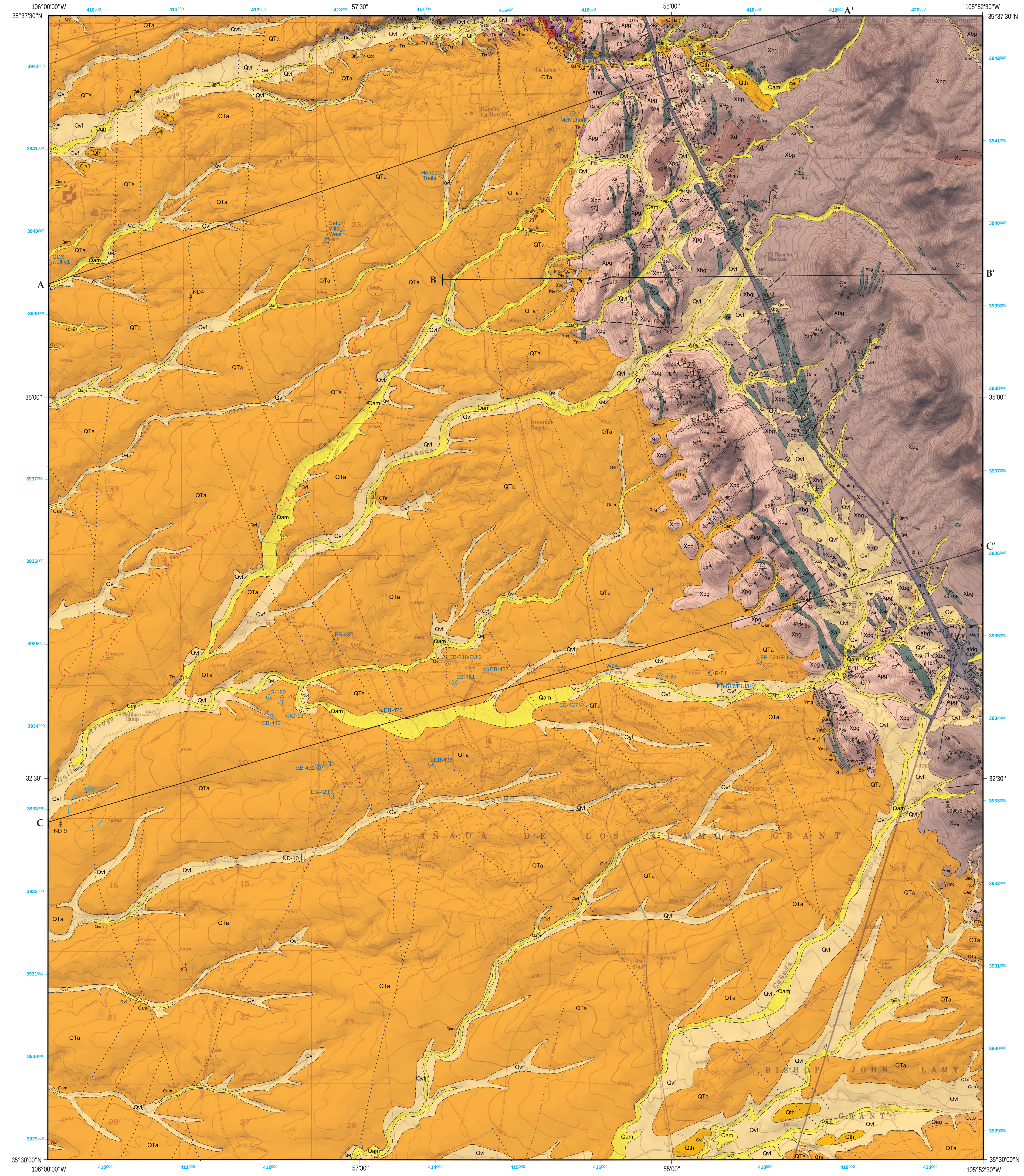


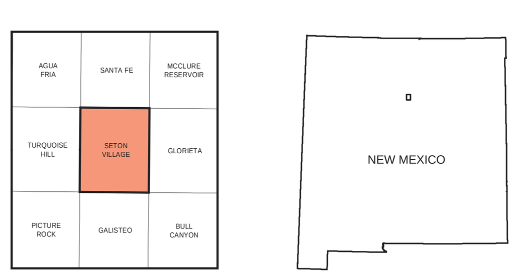
Base map from U.S. Geological Survey 1993, from photographs taken 1951 and updated 1990, field checked in 1990.
1927 North American datum, New Mexico coordinate system, central zone (Transverse Mercator). Reprojected to UTM projection -- zone 13.
1000-meter Universal Transverse Mercator grid, zone 13, shown in blue.

1:24,000

CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

Magnetic Declination
October, 2003
10º 04' East
At Map Center



QUADRANGLE LOCATION

New Mexico Bureau of Geology and Mineral Resources
New Mexico Tech
801 Leroy Place
Socorro, New Mexico
87801-4796

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This and other STATEMAP quadrangles are available for free download in both PDF and ArcGIS formats at:

http://geoinfo.nmt.edu?

New Mexico Bureau of Geology and Mineral Resources
Open-file Geologic Map 23

Mapping of this quadrangle was funded by a matching-funds grant from the STATEMAP program of the National Cooperative Geologic Mapping Act, administered by the U. S. Geological Survey, and by the New Mexico Bureau of Geology and Mineral Resources, (Dr. Charles E. Chapin, *Director and State Geologist*, Dr. Paul W. Bauer, *Geologic Mapping Program Manager*).

Geologic map of the Seton Village quadrangle, Santa Fe County, New Mexico

May 1999

by

Adam S. Read, John B. Rodgers, Steven Ralser, Brad R. Ilg, Shari Kelley, and Daniel J. Koning

New Mexico Bureau of Geology and Mineral Resources, 801 Leroy Place, Socorro, NM 87801

MAP SYMBOLS

Location of geologic cross section.

Geologic contact. Solid where exposed or known, dashed where approximately known, dotted where concealed.

Gradational geologic contact.

Normal fault. Solid where exposed, dashed where exposed. Bar-ball on downthrown side.

Trace of concealed monocline showing direction of plunge.

Buried intrusions interpreted using aeromagnetic data (Grauch et al., 2009; U.S.G.S. et al., 1999).

Linear fracture zone. Dotted where concealed.

Linear breccia zone.

Minor fault plane showing dip. Trend and plunge of slickenlines where mapped.

Minor dike showing dip.

Strike and dip of inclined joints or fractures.

Vertical joints or fractures.

Strike and dip of inclined bedding.

Inclined S1 foliation of metamorphic rocks.

Vertical S1 foliation of metamorphic rocks.

Water well.

Uranium exploratory well.

COMMENTS TO MAP USERS

A geologic map displays information on the distribution, nature, orientation, and age relationships of rock and deposits and the occurrence of structural features. Geologic and fault contacts are irregular surfaces that form boundaries between different types or ages of units. Data depicted on this geologic quadrangle map are based on reconnaissance field geologic mapping, compilation of published and unpublished work, and photogeologic interpretation. Locations of contacts are not surveyed, but are plotted by interpretation of the position of a given contact onto a topographic base map; therefore, the accuracy of contact locations depends on the scale of mapping and the interpretation of the geologist(s). Any enlargement of this map could cause misunderstanding in the detail of mapping and may result in erroneous interpretations. Site-specific conditions should be verified by detailed surface mapping or subsurface exploration. Topographic and cultural changes associated with recent development may not be shown.

The map has not been reviewed according to New Mexico Bureau of Geology and Mineral Resources standards. Revision of the map is likely because of the on-going nature of work in the region. The contents of the report and map should not be considered final and complete until reviewed and published by the New Mexico Bureau of Mines and Mineral Resources. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the State of New Mexico, or the U.S. Government. Cross-sections are constructed based upon the interpretations of the authors made from geologic mapping, and available geophysical (regional gravity and aeromagnetic surveys), and subsurface (drillhole) data.

Cross-sections should be used as an aid to understanding the general geologic framework of the map area, and not be the sole source of information for use in locating or designing wells, buildings, roads, or other man-made structures.

DESCRIPTION OF MAP UNITS

Anthropogenic Deposits

af — **Artificial fill (historical)** — Silt, sand, and gravel. Sediment is poorly sorted and lacks bedding. Sediment is loose and of variable thickness.

afdg — **Artificial fill and disturbed ground (historical)** — Artificial fill (see *af* above) and disturbed ground associated with Interstate highway 25.

Cenozoic Rocks

Qam — **Alluvium confined to modern drainages (Holocene)** — Sand and gravel of modern channel. May include low terraces

Qc — **Colluvium (uppermost Pleistocene to Holocene)** – Deposited on steeper slopes than *Qvf* with generally angular heterolithic clasts. Hillslope processes appear to dominate. Possible intertongues of alluvium.

Qvf — **Valley fill (uppermost Pleistocene to Holocene)** – Locally derived, unconsolidated, matrix-supported, alluvium and colluvium along margins of active drainages between Ancha ridges/interfluves. Includes low terraces/terrace deposits. Primarily consists of reworked Ancha material moving downslope.

Qaf — **Alluvial fans (uppermost Pleistocene to Holocene)** – Locally derived, unconsolidated gravel, sand, silt, and clay deposited at the mouths of steep minor tributary drainages of Arroyo Hondo.

Qth — **Quaternary fluvial terrace deposits of Arroyo Hondo (Pleistocene to Holocene)** – Undifferentiated.

Qth_5 — **Youngest Arroyo Hondo terrace gravel (upper Holocene?)** — Fill terrace gravel with treads approximately 10 feet above the modern grade of Arroyo Hondo.

Qth_4 — **Younger Arroyo Hondo terrace gravel (middle to upper Holocene?)** — Fill terrace gravel with treads approximately 20 feet above modern grade.

Qth_3 — **Young Arroyo Hondo terrace gravel (middle to upper Holocene?)** — Fill terrace gravel with treads approximately 35 feet above modern grade.

Qth_2 — **Older Arroyo Hondo terrace gravel (upper Pleistocene to lower Holocene?)** — Strath terrace gravel with treads approximately 60 feet above modern grade.

Qth_1 — **Old Arroyo Hondo terrace gravel (middle to upper Pleistocene?)** — Strath terrace gravel with treads approximately 80 feet above modern grade.

Qao — **Older alluvium (Pleistocene)** – Sandy gravel east of Eldorado similar in composition and texture to the Ancha Formation in that area but occupying a lower geomorphic position. 1-10? m thick.

Qbt — **Lower Bandelier Tuff (Pleistocene)** – Pumice/ash layer with an age of 1.66 ± 0.030 Ma (Jeff Winick, 1999 NMGRL unpublished report). Outcrops are covered by ~1 m of Ancha Formation along Arroyo Hondo.

QTa — **Ancha Formation (lower Pliocene(?) to lower Pleistocene)** – Sand, muddy sand, gravel, silt, and clay that collectively represent a relatively thick, extensive, aggradational sediment fill in the Santa Fe Embayment south of the Santa Fe River. These unconsolidated to poorly consolidated sediments are locally derived (shed from the foothills and the Sangre de Cristo Mountains), and are of alluvial origin (predominately fan material). The Ancha formation is generally more than 10 m thick, and has a gentle south-westward dip of ~5°. Contacts with underlying units are generally poorly exposed, but typically form a distinct angular unconformity with the more steeply dipping Tesuque formation. The Ancha Formation is generally a beige-colored unit that becomes lighter in color near the upper surface from calcium carbonate-rich soils. The underlying Tesuque Formation is reddish which helps to distinguish it from the lithologically similar Ancha Formation. The Ancha formation contains *Qbt* in upper 1-2 meters in places along Arroyo Hondo which places a minimum age of 1.66 ± 0.030 Ma on most of the unit and an approximate age for the formation of the Ancha constructional before net incision of the region occurred in the early Pleistocene. Aggradation appears to have continued into the middle to late Pleistocene in some canyons along the mountain front (Koning, Connell, Pazzaglia, and McIntosh, 2002).

QTa-QTt — **Ancha Formation - Tuerto gravel, undifferentiated (lower Pliocene(?) to lower Pleistocene)** – Cross section C-C′ only. Sand, muddy sand, silt, and clay interbedded with gravelly sand and sandy gravel. Tuerto gravel is poorly to moderately sorted and is primarily derived from hypabyssal intrusive rocks of the Cerrillos Hills and Ortiz Mountains (see Koning and Hallett, 2002, rev. 2013).

Tta — **Lithosome A of Tesuque Formation (lower to middle Miocene)** — Cross sections only. Very fine- to very coarse-grained sandstone; minor silty-clayey sandstone and pebbly sandstone; sand size is mostly very fine- to medium-grained. Sand is arkosic, subangular to subrounded, poorly to well sorted, and lacks chert and Paleozoic detritus. Colors range from light yellowish brown to light brown to dull orange to dull reddish brown to pink. Pebbles are composed of granite. Unit deposited on an alluvial slope by streams draining granitic terrain.

Ttaml — **Lower tongue of lithosome A, Nambé Member, Tesuque Formation (upper Oliogcene to lower Miocene)** – Tannish pebbly sandstone with an estimated 3-5% silt-clay. Beds are medium to thick and tabular, with local internal beds that are very thin to thin and lenticular. Most beds are matrix-supported. Gravel includes minor cobbles (up to 8x8 cm; a and b axes) and is poorly sorted, subrounded to subangular, and composed of granite with 1-7% quartzite, 1-6% Paleozoic sandstone and siltstone, 1-4% vein quartz, and 0-3% dark chert. Sand is very fine- to very coarse-grained (mostly very fine- to medium-grained), subangular to subrounded, poorly to very poorly sorted, and arkosic. This unit is well-consolidated and underlies fine-grained lithosome S. It grades northward into coarser-grained sandy pebble-cobble conglomerate. Thickness of 75-120 m. Description is from Read *et al.* (2000, rev. 2010).

Ttas — **Gradational zone between lithosomes A and S of the Tesuque Formation, closer to lithosome A (lower to middle Miocene)** — Cross sections only. Fine-grained lateral gradation between lithosomes A and S; unit is laterally closer to lithosome A than lithosome S; predominantly fine sandstone, silty sandstone, and mudstone. Description is from Koning and Read (2010).

Ttasl — **Lower tongue of mixed lithosome A and S sediment (Upper Oligocene to lowest Miocene)** — Cross sections only. Reddish brown clayey-silty fine sandstone and sandy claystone; minor pebbly sandstone. Sand is very fine- to very coarse-grained (mostly very fine- to medium-grained), moderately to well sorted, angular to subrounded, and arkosic (but with locally trace chert, sandstone, and siltstone grains).

Tts — **Lithosome S of the Tesuque Formation (lower to middle Miocene)** – Pebbly sand channel-fill deposits and fine sandstone, siltstone, and mudstone floodplain deposits associated with a large drainage exiting the Sangre de Cristo Mountains near the modern Santa Fe River. Unit is recognized by its clast composition (35-65% granite, 3-40% Paleozoic clasts, 5-30% quartzite, including a distinctive black quartzite, and 1-8% chert), reddish color (particularly compared to the tan deposits of unit Ttal), and high-energy-flow deposits in very broad, thick channel complexes that possess very thin to medium, planar to lenticular internal bedding Lithosome S is coarser-grained near the axis of its associated alluvial fan and near the mountain-front, and becomes finer-grained to the south, southwest, northwest, and north. Coarse-grained strata include pebbly sandstone (most common), sandy conglomerate, and sandstone. The coarse strata exhibit stacked channel-fill complexes. There is relatively high connectivity of the channel-fills and channel-fills may fine-upwards. Gravel consists of pebbles with subordinate cobbles. Channel-fill gravel is clast-supported, poorly to moderately sorted, and mostly subrounded (but granitic clasts may be subangular). The sand fraction is an arkose composed of quartz, 10-30% potassium feldspar, trace to 7% yellowish Paleozoic siltstone, sandstone, or limestone grains, and trace to 5% chert and dark quartzite grains. Channel-fill sand is commonly light brown (7.5YR 6/3), fine- to very coarse-grained, poorly to well sorted, and subrounded to subangular. Well consolidated, pink to very pale brown, silty-clayey very fine- to fine-grained sand beds like that seen in lithosome A are uncommon. Cementation of channel-fills is variable. Channel-fills are weakly to moderately consolidated and weakly to non-cemented in overall coarser strata but 10-50% of the channel-fill complexes may be moderately to strongly cemented by calcium carbonate in overall finer strata. Finer-grained strata of lithosome S are in very thin to medium, tabular beds with internal horizontal-planar to wavy laminations; locally, this sediment is massive. Overbank sediment consists of light brown to reddish yellow and pink to very pale brown siltstone, very fine- to coarse-grained (generally fine-grained) sandstone, and silty to clayey sandstone. Within the fine sediment are local very thin to medium, lenticular channel-fills. There are also variable amounts of reddish brown to yellowish red to light reddish brown mudstone and sandy mudstone. Maximum thickness of ~11000 m on this quadrangle. Description is from Read et al. (2000, rev. 2010).

Ttsm — **Medium-grained Lithosome S of the Tesuque Formation (lower to middle Miocene)** — Cross-section A-A′ only. Fluvial deposits characterized by clay, silt and very fine- to fine-grained sand intercalated with subequal medium- to very coarse-grained, arkosic sand and gravelly sand channel-fills (see Koning and Hallett, 2002, rev. 2013).

Tte — **Tesuque Formation, lithosome E (upper Oligocene to lower Miocene)** — Cross section C-C′ only. Brownish gray to light gray pebbly sandstone and sandy conglomerate, with minor clay, silt, and tuff in the matrix. The gravel is composed of latite, andesite, and tuffaceous-pumiceous sandstone eroded from the Espinaso Formation (*Te*), in addition to variable basaltic rocks eroded from the Cieneguilla basanite (*Tc*). In the subsurface, this unit interfingers eastward with arkosic sand of the Tesuque Formation derived from the Sangre de Cristo Mountains (subsurface units *Tts* and *Tta*). In general, the unit is interpreted to have been deposited on east-sloping alluvial fans flanking volcanic paleo-highlands near the western quadrangle border. Since lithosome E lies at the base of the Santa Fe Group, it probably is no younger than lower Miocene in the Santa Fe embayment (see Koning and Hallett, 2002, rev. 2013).

Tebl — **Bishops Lodge member of the Espinaso Formation (upper Oligocene?)** – White tuffaceous mudstone, gray pebbly volcaniclastic sandstone and pebble to cobble conglomerate. Clasts of light to dark gray pyroxene (+ biotite) latite as large as 50 cm but typically 5-20 cm.

Tla — **Latite/Andesite (Oligocene)** – Lava flows exposed in Arroyo Hondo and in scattered outcrops along I-25 and near Seton Village contain hornblende and plagioclase phenocrysts in an aphanitic dark-brown matrix. K-Ar date of 29.3 ± 0.6 Ma (Baldridge et al., 1980).

Te — **Espinaso Formation (Oligocene)** – Distinctly red volcaniclastic unit exposed in Arroyo Hondo. An $^{40}Ar/^{39}Ar$ date of 31.48 ± 0.33 Ma (Peters, 1999, NMGRL unpublished report) was obtained from an ash layer found near the base of the Espinaso Formation exposed on the flanks of the Sunlit hills. This middle-Espinaso age date indicates that the lower Espinaso did not reach the mountain front.

Tg — **Galisteo Formation (Eocene?)** – Brick red sandstone and conglomerate unconformably overlies Proterozoic basement in the vicinity of Arroyo Hondo and I-25. No volcanic clasts are present in this section overlain by the Espanaso Formation. These rocks may not be Eocene and could represent younger sediments consisting of reworked Galisteo Formation (Cather, 1992).

Paleozoic Rocks

Mzu-Pzu — **Mesozoic and Paleozoic rocks, undifferentiated** – Cross sections only.

IPlp — **La Posada Formation (Pennsylvanian)** – Grey limestone exposed in scattered small outcrops near Seton Village. Appears to overlie or be inter-bedded with arkosic sandstone. In the type section at Dalton Bluff (Kues, 2001), the lower portion of the unit is dominantly clastic.

IPlp — **La Posada Formation, sandstone (Pennsylvanian)** – Coarse arkosic sandstone in a small lone outcrop near Seton Village. All Paleozoic outcrops on the quadrangle are close proximity to the Proterozoic basement and this sandstone is similar to basal Sandia Fm. outcrops in other ranges. However, that nomenclature is not appropriate for the Southern Sangre de Cristo Mountains (Kues, 2001). This unit is identified separately only because of the limited exposure and to highlight the exposed contact between the overlying limestone.

Proterozoic Rocks

Ymg — **Megacrystic granitoid (Mesoproterozoic?)** – Coarse unfoliated granite contains quartz, biotite, and large (up to 10cm) K-spar megacrysts. Looks quite similar to the Sandia Granite. High magnetic susceptibility suggests that this rock may be responsible for the pronounced magnetic high in this area (Mark Hudson, personal communication, 2003).

Ypeg — **Pegmatite (Mesoproterozoic?)** – Simple pegmatite veins and pods, unfoliated.

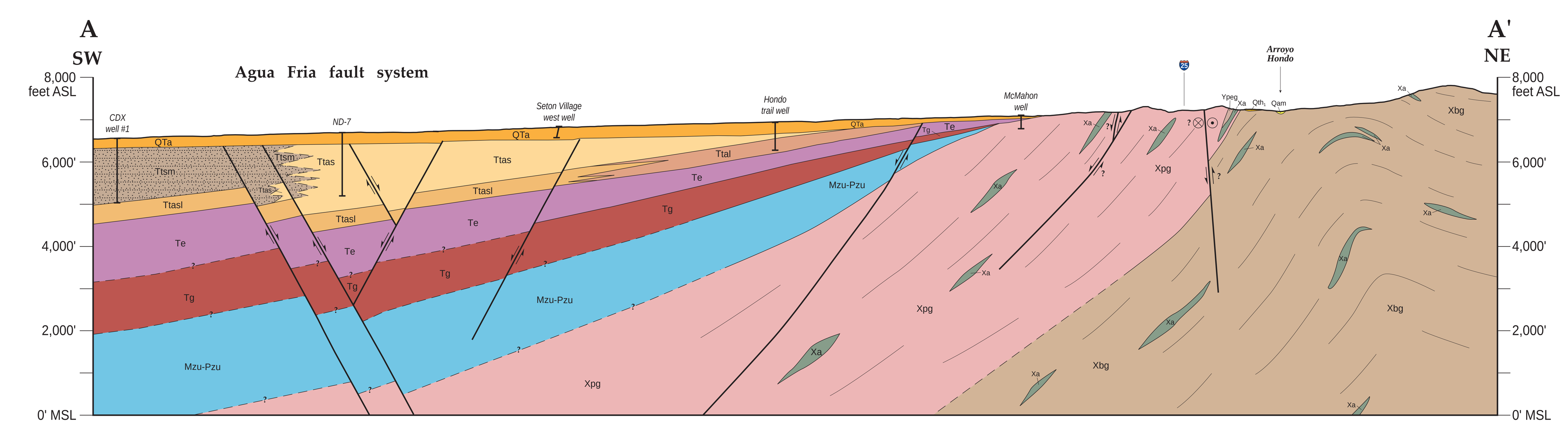
Xd — **Granodiorite to Diorite (Paleoproterozoic?)** – Generally medium-grained dark, weakly foliated-to-unfoliated massive diorite. Forms pod-like bodies within surrounding gneisses suggesting late emplacement. Cut by *Ypeg*.

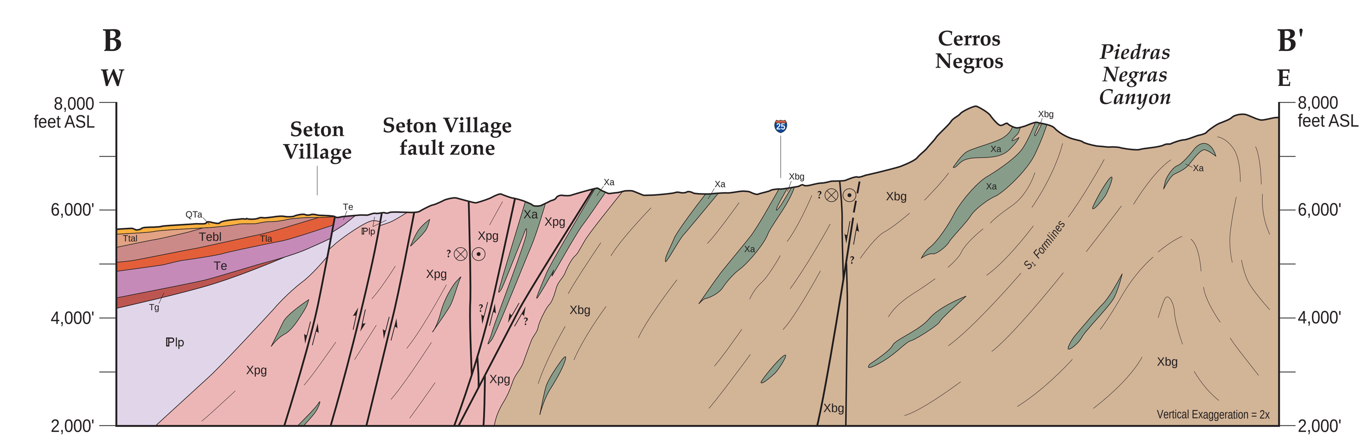
Xpg — **Pink Granitic Gneiss (Paleoproterozoic)** – Fine-grained quartz-Kspar mylonitic gneiss is distinctly pink in outcrop. This rock appears to be more resistant to weathering than the coarser biotite-bearing gneisses and forms the bulk of the Sunlit Hills.

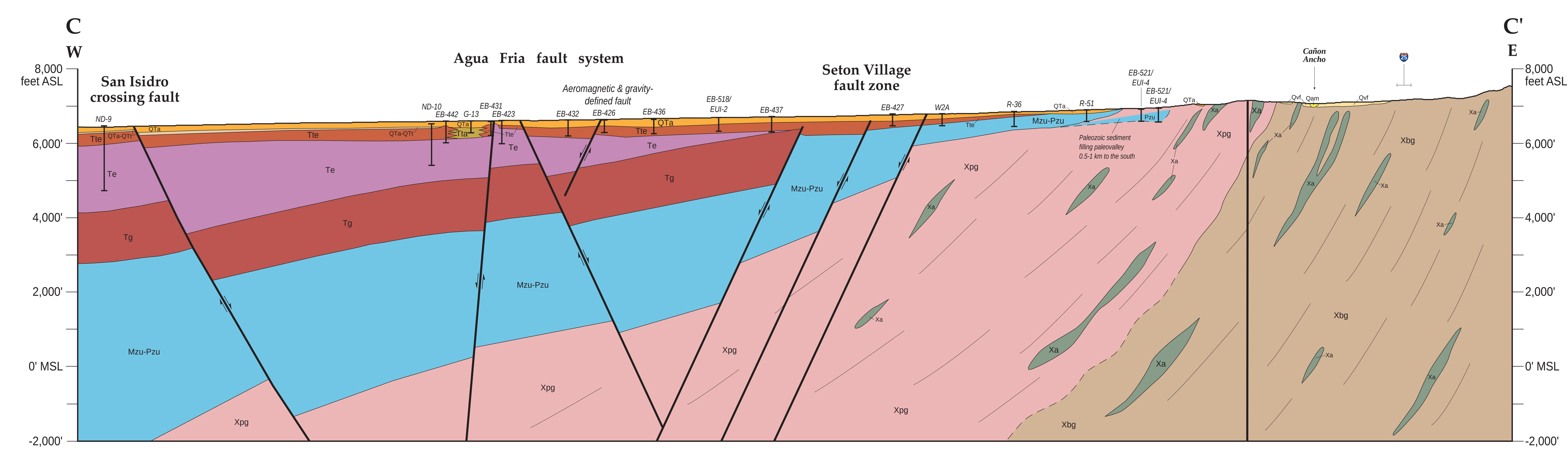
Xbg — **Biotite-rich granitic gneiss (Paleoproterozoic)** – Coarse grained strongly foliated biotite-bearing gneiss often contains microcline augen and appears to be less resistant to weathering than Xpg. Forms much of the broad valley east of the Sunlit hills that I-25 travels along. Unit is broadly generalized due to poor exposure.

Xa — **Strongly foliated amphibolite and mafic schist (Paleoproterozoic)** -- may include *Xd* in places. Mafic units tend to weather poorly and are often mantled by *Ymg* and *Xbg* float. Consequently, Xa and other mafic units are probably vastly under-represented on the map.

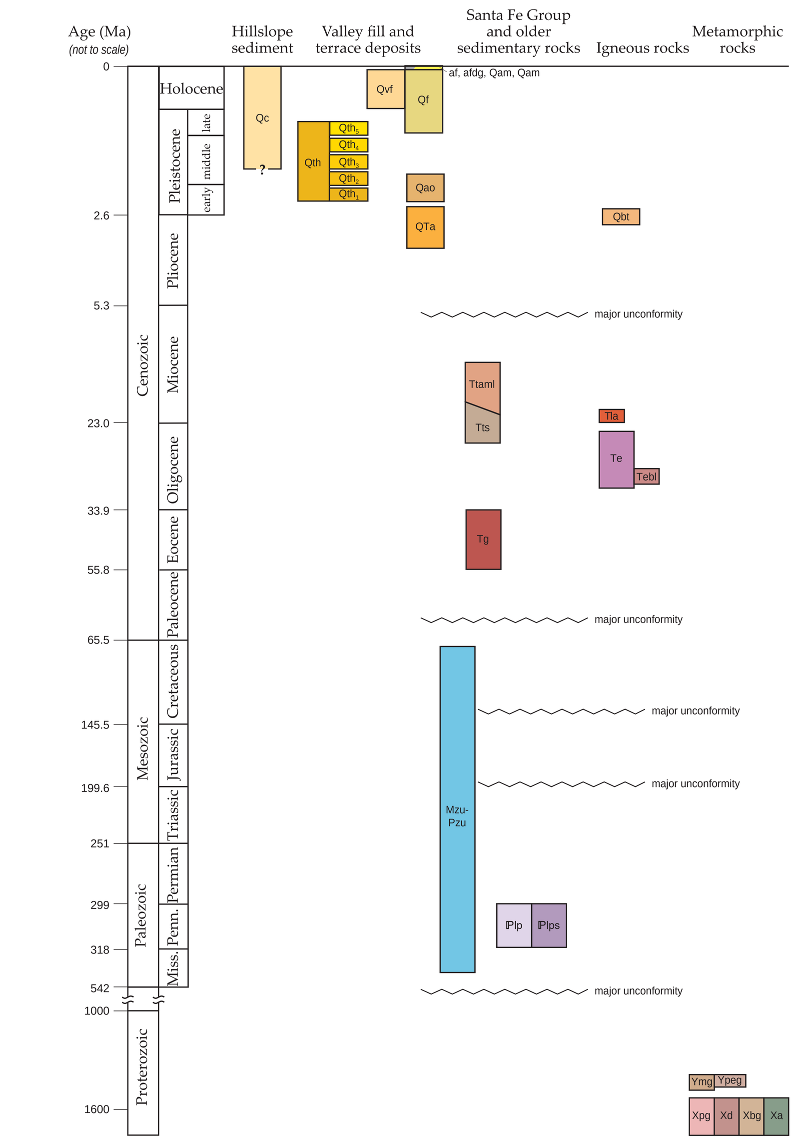
GEOLOGIC CROSS SECTIONS





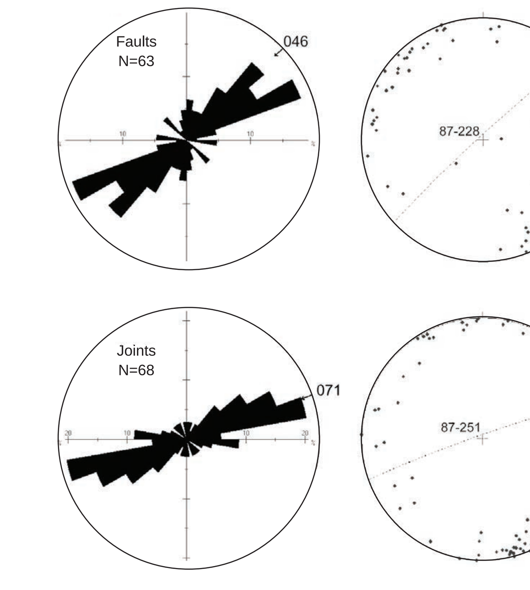


CORRELATION OF MAP UNITS



FAULT AND JOINT ORIENTATIONS

Sunlit Hills Area - Seton Village 7.5-minute Quadrangle



FAULT AND SLICKENLINE ORIENTATIONS

Sunlit Hills Area - Seton Village 7.5-minute Quadrangle