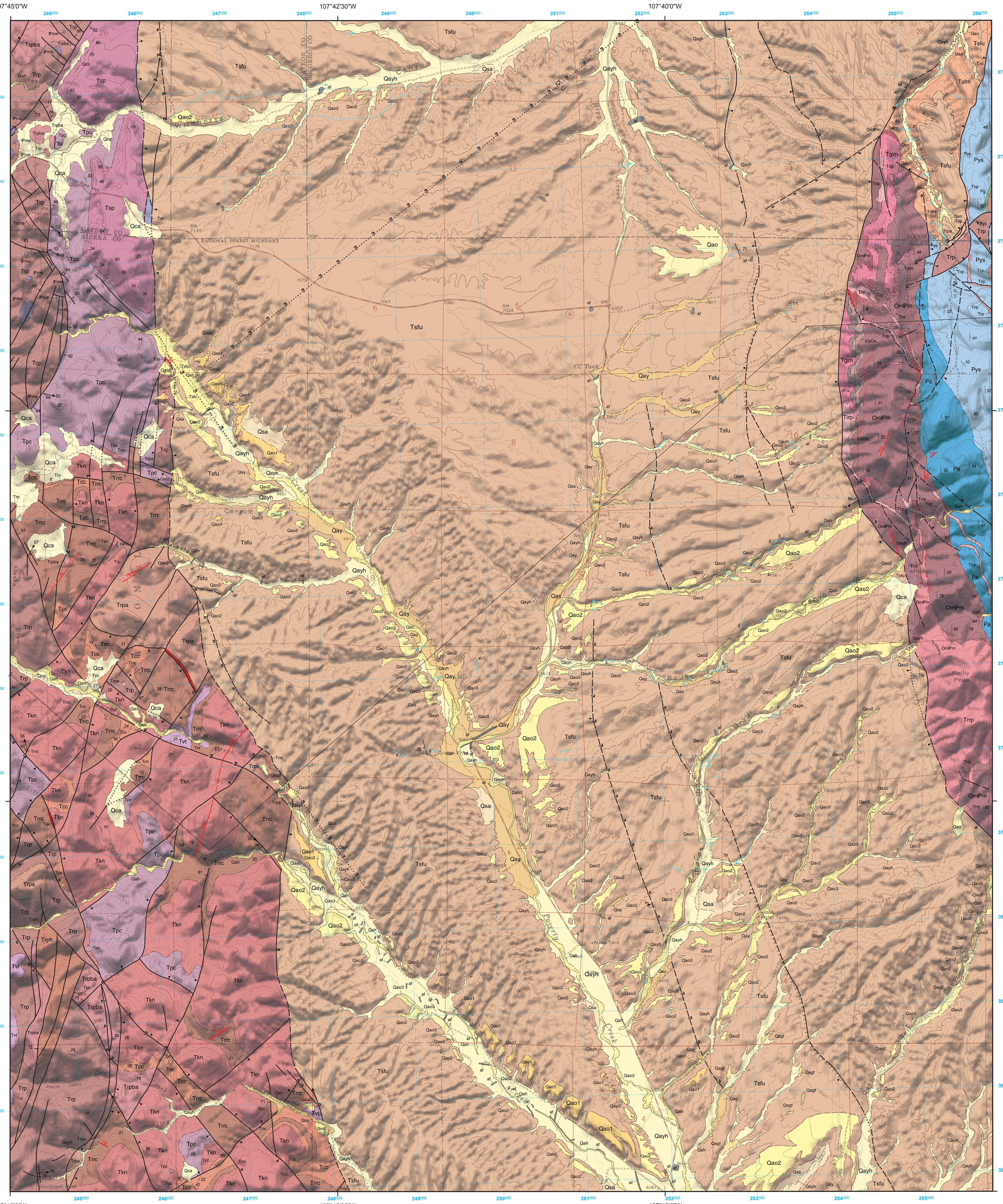


Map Unit Descriptions

QUATERNARY

af — **Artificial fill–**Compacted sand, silt, and gravel, mainly of earthen dams. 0–2 m thick.

Qca — **Colluvium and alluvium, undivided–**Gravel, sand, and silt burying geologic features. Includes gravity-, slopewash-, and minor channel-transported material. 0–2 m thick.

Qsa — **Slopewash alluvium–**Silt and lesser sand forming low-gradient aprons that conceal underlying geologic features. Includes small fine-grained fans, slopewash, and minor gully-transported material. 0–1 m thick.

Qah — **Historic alluvium (0-500 years BP)–**Gravel, sand, and silt associated with historic flows of active channels. Includes low terraces up to 1 m above the channel floor, with no soil development. 0-2 m thick.

Qagf — **Gully-mouth fans–**Gravel, sand, and silt associated with active gully-mouth fans. No soil development. 0–1 m thick.

Qay — **Younger alluvium–**Interbedded pebbly silty sands and pebbly channels, with weak soil development. Weak buried soils are common, and distinguished by darkened A horizons. Carbonate horizon development up to Stage I+ in active and buried soils. Colors of 10YR 4/2 to 6/3 common, local 7.5YR hues. Underlies terrace treads up to 3 m above local channels. 0-4? m thick.

Qayh — **Younger and historic alluvium, undivided–**Combination of units **Qah** and **Qay**. See individual descriptions for more detail.

Qao3 — **Older alluvium, youngest subunit–**Very-poorly-exposed gravels underlying terrace treads inset upon treads of **Qao2**. Surfaces dominated by pebbles with rare carbonate coats. Tread heights are 3–10 m above local channel floors, decreasing upstream. 0–2 m thick.

Qao2 — **Older alluvium, intermediate subunit–**Sandy pebbles and cobbles with well developed soils underlying terrace treads 6–25 m above local channels. Tread height increases downstream from mountain fronts. Dominantly medium pebbles, with a few percent cobbles. Carbonate horizon development up to Stage III, with local small clay films on gravels above the carbonate horizon. Rare buried soils with carbonate horizon development up to Stage II. Colors as red as 5YR 5/4, typically 7.5YR 7/2 to 7/3. 3 to 8 m thick.

Qao1 — **Older alluvium, oldest subunit–**Poorly exposed gravels underlying terrace treads inset upon by those of **Qao2**. Pebbles and cobbles underlying treads 25–40 m above local channels, decreasing upstream. 0–8? m thick.

Qao — **Older alluvium, undivided–**Used where specific unit correlation is not clear or feasible. 0–3 m thick.

TERTIARY

Santa Fe Group

Tsfu — **Upper Santa Fe Group–**Interbedded sandy pebbles to cobbles and silty sands filling the Winston graben. Derived from both the Black Range to the west and Sierra Cuchillo to the east. Western gravels are volcaniclastic, matrix-poor, generally poorly cemented, but with local carbonate accumulations up to Stage III as buried soils. Gravels are mainly andesite porphyries, with lesser rhyolites, aphyric lavas, and sparse limestone. Eastern gravels typically contain more matrix material with lighter colors, as well as more abundant limestone, felsic phaneritic and porphyritic rocks, and red siltstones. At the surface, the eastern and western facies meet at the Deep Well fault, a continuous scarp that may be an erosional feature. Local southward pebble imbrications along this trend suggest a southward axial drainage.

Tsfm — **Middle Santa Fe Group–**Moderately-dipping pebble to cobble conglomerates locally exposed in the Havill embayment. Dominantly consists of poorly-sorted andesitic lava clasts with lesser limestone gravels. Variably cemented, with a light-brown to light-pink color.

Tsfl — **Lower Santa Fe Group–Cross-section only.** Rhyolite pebble to cobble conglomerates, tuffaceous sandstones, and tuffs. Includes the 27.73±0.14 Ma South Canyon Tuff, which erupted from the Mt Withington caldera to the NNE of the quadrangle (Harrison, 1990, 1994; age from McIntosh et al., 1991). Where exposed to the south, unit is variably incised into the Vicks Peak Tuff (Harrison and Cikoski, 2012), and hence the two units are combined on the cross-section.

Mogollon Group

Tvp — **Vicks Peak Tuff–**Light-gray to light-brown, massive, moderately-to densely-welded, crystal-poor ash-flow tuff. Phenocrysts of sanidine (1–3%) and sparse quartz. Bears conspicuous, large, elongate pumices, most of which bear a granular texture from vapor-phase mineralization and recrystallization. Erupted from the Nogal Canyon caldera, NE of quadrangle; single-crystal sanidine $^{40}Ar/^{39}Ar$ age of 28.93±0.12 Ma (McIntosh et al., 1991).

Tsp — **Rhyolite of Sawmill Peak–**Dark-red-brown porphyritic alkali rhyolite lavas. 10% phenocrysts of large sanidine up to 1.5 cm across. Trace biotite and quartz. Includes local, discontinuous pyroclastic rocks.

Tpc — **Basaltic andesite of Poverty Creek–**Gray-to dark-gray, aphanitic-to sparsely-porphyritic basaltic andesites. As much as 10% phenocrysts of plagioclase, pyroxene, and rare biotite, generally under 1 mm across. Belongs to the widespread SCORBA suite of Cameron et al. (1989). Includes rare interbedded volcaniclastic rocks.

Datil Group

Tkn — **Kneeling Nun Tuff–**Light-gray to gray to tan to pink, poorly-to moderately-welded, crystal-rich ash-flow tuff. 20–45% phenocrysts of quartz, sanidine, plagioclase, and biotite. Normally zoned, with more abudant quartz and sanidine at the base, and more abundant biotite toward the top. Erupted form the Emory caldera, SSW of the quadrangle; single-crystal sanidine $^{40}Ar/^{39}Ar$ age of 35.34±0.10 Ma (McIntosh et al., 1991).

Tcc — **Cliff Canyon Sandstone–**Purplish to white, fine-grained and well-sorted arkosic to quartzose volcaniclastic sandstones. Grains are typically subrounded to rounded and of quartz, sanidine, plagioclase, and minor biotite. Includes purple to blue-gray siltstones, and a basal conglomerate. Poorly-consolidated and exposed.

Trrc — **Tuff of Rocque Ramos Canyon–**Moderately-to poorly-welded, moderately-crystal-rich ash-flow tuff. 10–20% phenocrysts of subequal sanidine and plagioclase, and 1–2% biotite. Common small (1.5–2 cm across) devitrified pumice. Rare andesitic lithic fragments. Correlated to the Bell Top 4 tuff by Ar/Ar age and paleomagnetic data; single-crystal sanidine 40Ar/39Ar age of 35.41±0.08 Ma (McIntosh et al., 1991).

Tvt — **Tuff of Victoria Tank–**Moderately-to densely-welded, lithic-rich, pumice-rich, crystal-poor ash-flow tuff. Up to 10% phenocrysts of plagioclase, sanidine, and biotite. 20–40% subangular lithic fragments of red and gray-black aphanitic lavas, up to 6 cm across. May correlate to the tuff of Luna Park and the tuff of Farr Ranch (McIntosh et al., 1991), or may be a local unit (Harrison, 1990). As much as 100 m thick.

Trpa — **Rubio Peak Formation, andesitic lavas–**Plagioclase ± hornblende ± pyroxene andesitic porphyry lavas. Multiple flows overlying the debris flows of the lower Rubio Peak Fm.

Trph — **Rubio Peak Formation, hornblende phyric lavas–**Plagioclase + hornblende ± pyroxene andesitic porphyry lavas. Multiple flows overlying debris flows of the lower Rubio Peak Fm.

Trpba — **Rubio Peak Formation, basaltic andesite lavas–**Dark, aphanitic, intermediate lavas. Multiple flows overlying the debris flows of the lower Rubio Peak Fm.

Trp — **Rubio Peak Formation, debris flow-dominated unit–**Volcaniclastic conglomerates. Dominantly massive, heterolithic, matrix-supported debris-flow deposits, with pebbles to boulders of aphanitic and porphyritic intermediate volcanic rocks. Interbeds with sandstones to the south. Surrounds landslide blocks of limestone (IPme).

IPme — **Exotic blocks of Madera Limestone–**Exotic blocks of Pennsylvanian limestone surrounded by debris-flows of the lower Rubio Peak Fm.

Pre-volcanic

Kd — **Dakota(?) Sandstone–**Light-beige quartzose sandstone. Thin-to medium-bedded, with common cross-stratification. Preserved thickness of 0–8 m; commonly missing due to early Tertiary erosion.

Pys — **Yeso and San Andreas Formations–**Interbedded-variegated yellowish, greenish, and reddish sandstone and siltstone, and medium-to dark-gray fossiliferous limestone. Measured thicknesses of 233 m for the Yeso, and at least 213 m for the San Andreas (Jahns et al., 1978).

Pa — **Abo Formation–**Red, maroon, and yellowish-to reddish-brown siltstones, mudstones, and sandstones, with thin interbeds of fossiliferous gray silty limestone in the lower 30 m ("transition beds" of Jahns et al., 1978). Measured thicknesses of 315 m by Jahns et al. (1978).

OeIPm — **Paleozoic limestones, undivided–**Interbedded light-to medium-gray limestones and medium- to dark-gray siltstones. Commonly highly altered and faulted. Dominantly Madera Limestone, with a sequence of thinner older units apparent in measured section. Includes 54 m of El Paso Limestone, 40 m of Montoya Formation, 1 m of Fusselman Formation, 2 m of Oñate Formation, 2.5 m of Percha Formation, 31 m of Lake Valley Formation, 13 m of Kelly Limestone, 53 m of Sandia Formation, and at least 275 m of Madera Limestone (Jahns et al., 1978).

€b — **Bliss Sandstone–**Light-gray to dark-brownish-gray pebbly quartz-rich sandstones, with a basal section of oolitic hematite. 38 m thick (Jahns et al., 1978).

p€u — **Precambrian, undivided–**Intercalated fine-grained to porphyritic meta-rhyolite and medium- to coarse-grained amphibolite (Jahns et al., 1978, 2006).

Intrusive rocks

Tgim — **Granite of Iron Mountain–**Light-gray to tan, fine-grained phaneritic quartz-orthoclase-biotite granitic stock. Even-grained, intergrown quartz and feldspar, with subordinate biotite. Coarsest at north end, with crystals just over 1 mm across.

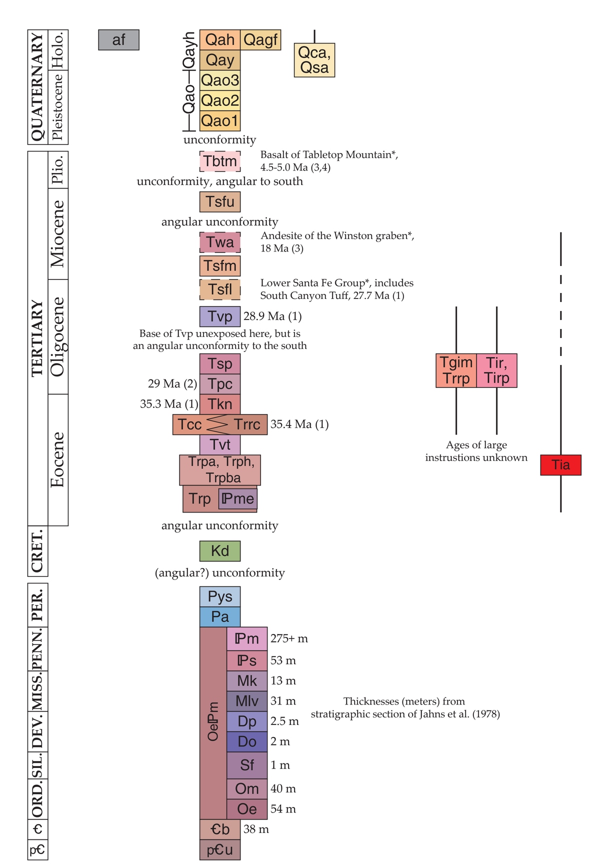
Trrp — **Rhyolite of Reilly Peak–**White to gray, fine-grained high silica rhyolite stock. Davis (1986) described thin sections with spherulitc to trachytic textures, with plagioclase as the main microphenocryst and accessory biotite, titanite, epidote, muscovite, hematite, amphibole, apatite, and magnetite.

Tir — **Rhyolitic dikes–**Dark-gray to greenish-gray, largely aphanitic dikes. Sparse, fine-quartz phenocrysts.

Tirp — **Rhyolite porphyry dikes–**Dark-gray to greenish-gray, weathering pink and reddish-brown, quartz ± orthoclase porphyries. Thicker dikes are coarser and contain more phenocrysts.

Tia — **Andesitic dikes–**Dark-green to dark-gray to black, aphanitic to porphyritic, intermediate dikes. Phenocrysts of plagioclase and horneblende.

Correlation of Map Units



(1) $^{40}Ar/^{39}Ar$ age from McIntosh et al. (1991); ages scaled upwards by 1.3% to accommodate changes to the accepted Fish Canyon Tuff sanidine monitor age, from 27.84 to 28.201 Ma (Kuiper et al., 2008)
(2) K-Ar age from C. E. Chapin, pers. comm., cited in Harrison (1990)
(3) K-Ar age from Seager et al. (1984)
(4) $^{40}Ar/^{39}Ar$ age from McLemore et al. (in press)

* **Tbtm**, **Twa**, and **Tsfl** are exposed on the Winston and Chise quadrangles to the south; they are included here for their geochronologic importance

FIGURE 1—Upper Santa Fe Group (**Tsfu**), derived from the Black Range. Note the relative lack of matrix material, and only local lightening of the gravels by carbonate accumulation. Upper part is moderately bioturbated by Holocene biota.

FIGURE 2—View of Iron Mountain (left) and Reilly Peak (right), from the south. Iron Mountain is underlain by Paleozoic limestones and locally sandstones. Reilly Peak is underlain by a rhyolitic intrusion, the Rhyolite of Reilly Peak. Hills in front of the mountains is underlain by Santa Fe Group sediments, mostly derived from the highland in the background, but in part also derived from the Black Range, off photo to the left.

FIGURE 3—Upper Santa Fe Group (**Tsfu**) derived from the Sierra Cuchillo. Note abundance of matrix material and light color, possibly from the presence of carbonate in the matrix. Photo is looking south, and beds dip slightly to the west.

FIGURE 4—Buried soils in **Qay**. Buried soils are marked by the slight darkening of the buried A horizons. Two are readily apparent in this picture. Also note the Stage I carbonate horizon development in lowest buried soil.

Map Symbols

Contact—Well-located, approximately located, concealed. Queried where existence is uncertain. Contact attitudes shown with tick with dip value.

Fault—Well-located, approximately located, concealed. Queried where existence uncertain. Bar on down-thrown side of normal faults, shear arrows show offset of strike-slip faults. Fault plane measurements shown with ticks, giving dip value; fault striae and mullion trends shown with arrow, giving plunge value.

Fault scarp—Well-located, approximately located. Hachures point down-scarp. Queried where fault existence is uncertain.

Dikes—Well-located, intruding a fault. Dike attitudes shown with tick, showing dip value.

Inclined bedding, showing dip value.

Horizontal bedding.

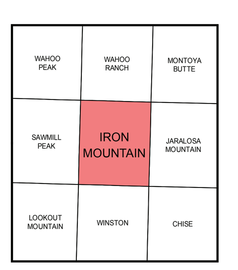
Inclined foliation, showing dip value.

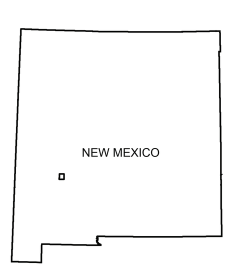
Minor fault attitude, showing dip value.

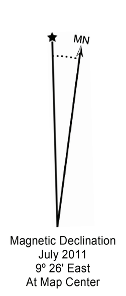
Paleocurrent direction from pebble imbrications

Areas bearing tactite mineralization

Base map from U.S. Geological Survey 1970, from photographs taken 1965, field checked in 1970, edited in 1993.
1927 North American datum, UTM projection -- zone 13N
1000-meter Universal Transverse Mercator grid, zone 13, shown in blue







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CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

Geologic map of the Iron Mountain quadrangle, Sierra County, New Mexico.

July 2012

by
Colin T. Cikoski [1], Richard W. Harrison [2], Daniel J. Koning [1], and Richard H. Jahns [3]

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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 229

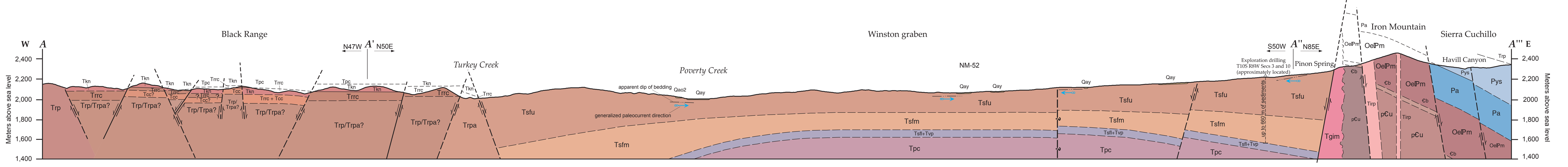
Mapping of this quadrangle was funded by a matching-funds grant from the STATEMAP program of the National Cooperative Geologic Mapping Act, administered by the U. S. Geological Survey, and by the New Mexico Bureau of Geology and Mineral Resources, (L. Greer Price, *Director and State Geologist*; Dr. J. Michael Timmons, *Geologic Mapping Program Manager*).

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 may be based on any of the following: 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.

Cross sections are constructed based upon the interpretations of the author made from geologic mapping, and available geophysical, 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

The map has not been reviewed according to New Mexico Bureau of Geology and Mineral Resources standards. The contents of the report and map should not be considered final and complete until reviewed and published by the New Mexico Bureau of Geology 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-section notes:
- Thickness of Quaternary alluvium is exaggerated.
- Thickness of interbedded Ts and Tcc is likely much more variable than shown. Thickness of ~90 m is based on exposures at the southern end of this quadrangle.
- Thicknesses of units Tpc, Trp+Trpa, and Tsfl+Tvp are unconstrained on this quadrangle. Thicknesses from cross-section A-A' on the Winston quadrangle vary from 50-190 m for Tpc, and are ~675 m and ~75 m for Trp+Trpa and Tsfl+Tvp, respectively (Harrison and Cikoski, 2012).
- P. Willard (pers. comm., cited in Harrison, 1990) reported as much as 660 m of sediments in exploration drilling due west of Iron Mountain. Neither well logs nor cuttings were available for this report, and the nature of the underlying intercepted unit is not known. It is possible the intercepted unit is the andesite of the Winston graben (or time-equivalent lava), which lay between the upper and middle Santa Fe Group units along the east side of the Winston quadrangle (Harrison and Cikoski, 2012). This unit was not observed in the Santa Fe Group in the Havill embayment, but if it is present then the sedimentary fill is substantially thicker than shown here.
- Tsfu/Tsfm contact is at an elevation of ~1865 m.a.s.l. near the graben center on the Winston quadrangle (Harrison and Cikoski, 2012). It is uncertain whether the contact rises or lowers to the north onto this quadrangle (see report). Contact location here is therefore very approximate.
- General Santa Fe Group structure projected from the Winston quadrangle to the south (Harrison and Cikoski, 2012; Cikoski and Harrison, in press).
- Only faults apparent at the surface with map-scale offsets are shown; many more faults may exist, particularly within the Winston graben, which are not apparent at the surface.