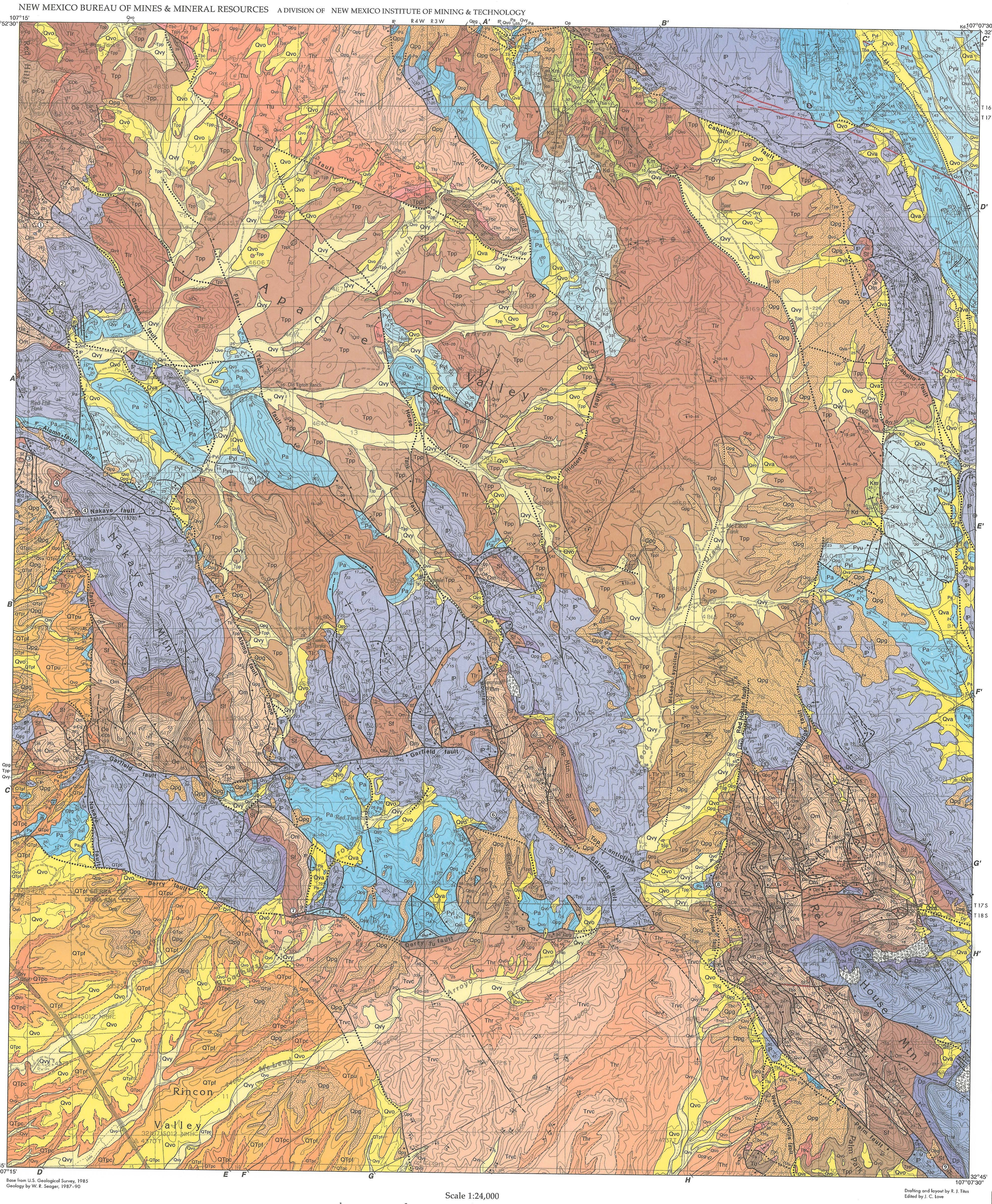


Base from U.S. Geological Survey, 1985
Geology by W. R. Seager, 1987–90

Scale 1:24,000

1 .5 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

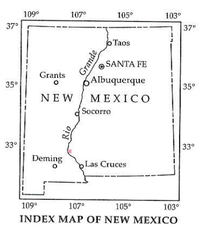
1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FT

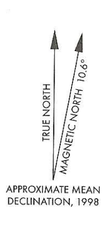
Drafting and layout by R. J. Titus
Edited by J. C. Love

1	2	3	1. Caballo 2. Apache Gap 3. Upham 4. Garfield 5. Alivio 6. Arroyo Cuervo 7. Hatch 8. Rincon
4		5	
6	7	8	

ADJOINING 7.5' QUADRANGLE NAMES



INDEX MAP OF NEW MEXICO

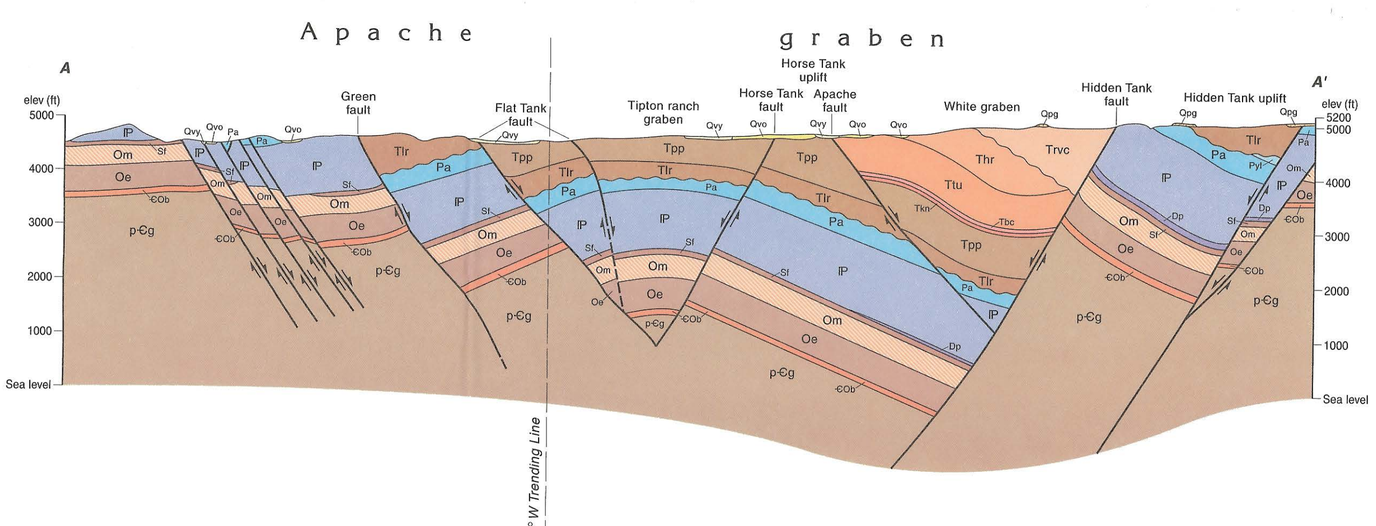


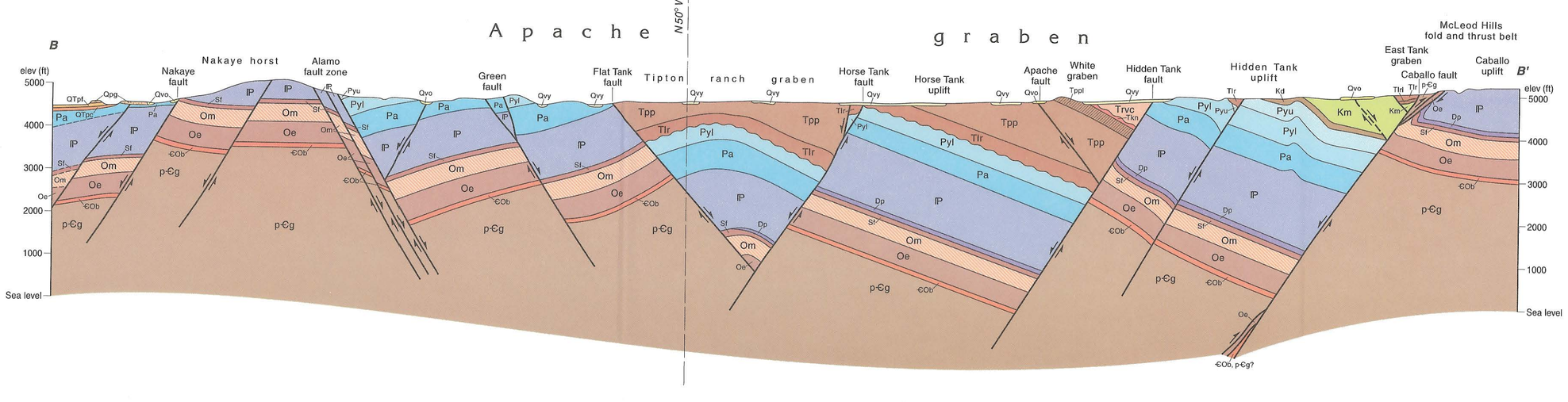
APPROXIMATE MEAN DECLINATION, 1998

Geology of McLeod Tank quadrangle, Sierra and Doña Ana Counties, New Mexico

by William R. Seager and Greg H. Mack, 1998

Department of Geological Sciences, New Mexico State University, Las Cruces, New Mexico 88003





REFERENCE

McAnulty, W. N., 1978, Fluorspar in New Mexico: New Mexico Bureau of Mines and Mineral Resources, Memoir 34, 61 pp.

MAP SYMBOLS

Contact—Dashed where uncertain or approximately located

Normal fault—Ball on downthrown side; short arrow shows direction and angle of dip; long arrow shows azimuth and plunge of striations on fault surfaces; dashed where approximately located, dotted where buried

Thrust fault—Barbs on upthrown side; arrow shows direction and angle of dip; dashed where approximately located, dotted where buried

Strike-slip (tear) fault

Anticlinal hinge—Showing plunge direction

Synclinal hinge—Showing plunge direction

Overturned anticlinal hinge—Showing plunge direction

Overturned synclinal hinge—Showing plunge direction

Monoclinal hinge

Strike and dip of beds

Estimated strike and dip of beds

Horizontal beds

Strike and dip of overturned beds

Strike of vertical beds

Landslide masses

Mines or prospects

1. Lorraine prospects
2. Alvarez prospects
3. Alamo shaft
4. Nakaye Group
5. Bowman–Holt prospect
6. Gar–Spar prospects
7. Woodrow Wilson mine
8. Velarde prospect
9. Palm Park mine

CORRELATION OF UNITS

Qvy, Qva, Qvo — Holocene; Upper Pleistocene
unconformity
QTpf, Qpg, QTpu, QTpc — Middle Pleistocene to upper Pliocene
unconformity
Trvc — Miocene
unconformity
Thr, Ttu, Tu, Tba — Miocene; Lower Miocene to upper Oligocene
Tbt7, Tbc, Tkn, Tbt5 — Oligocene
Tppl, Tpp, Tlr, Tlrl — Lower Oligocene to upper Eocene; Eocene
unconformity
Km, Kd — Upper Cretaceous
unconformity
Pyu, Pyl, Pa — Permian
IP — Pennsylvanian
unconformity
M — Mississippian
minor unconformity
Dp — Devonian
unconformity
Sf — Silurian
unconformity
Om — Ordovician
unconformity
Oe, €Ob — Ordovician and Cambrian
unconformity
p-€g — Precambrian

DESCRIPTION OF UNITS

Qvy **Younger valley-fill alluvium**—Arroyo, fan, and terrace deposits (from boulder gravel to clay–silt) associated with surfaces graded to or within a few feet of the modern Rio Grande floodplain. As much as 15 m (50 ft) thick

Qvo **Older valley-fill alluvium**—Arroyo, fan, and terrace deposits and erosion-surface veneers (from boulder gravel to silt–clay) associated with graded surfaces formed during at least three major episodes of valley entrenchment and partial backfilling. Pedogenic carbonate cements uppermost parts of deposits, especially the older (higher) ones. As much as 30 m (98 ft) thick

Qva **Undifferentiated Qvo and Qvy**

Qpg **Palomas Formation, upper piedmont-slope facies**—Boulder to pebble conglomerate and gravel with zones of stage III or IV pedogenic carbonate as much as 0.8 m (2.6 ft) thick, especially at the top. Unit is 20 m (65 ft) or more thick near mountain fronts, thinning basinward

QTpf **Palomas Formation, fluvial and associated facies**—Light-gray, yellow, and pink to tan sand, sandstone, gravel, conglomerate, conglomeratic sandstone, and mudstone representing fluvial-channel and overbank deposits of the ancestral Rio Grande as well as adjacent alluvial-flat and eolian environments. Tongues of piedmont-slope conglomerate (*QTpc*) are interbedded locally with the unit. As much as 100 m (328 ft) thick

QTpc **Palomas Formation, piedmont-slope fanglomerate**—Well to moderately cemented, tan to reddish-brown boulder to cobble–pebble conglomerate and conglomeratic sandstone. Derived from various fault blocks in the Caballo Mountains. Intertongues with *QTpf* downslope and is gradational upward into *Qpg* upslope; unconformable with underlying formations. At least 50 m (164 ft) thick

QTpu **Palomas Formation, Qpg and QTpc undifferentiated**—100 m (328 ft) or more thick

Trvc **Rincon Valley Formation, conglomerate facies**—Reddish-brown conglomerate and conglomeratic sandstone derived largely from Paleozoic strata; volcanic clast component increases down section. Strata represent "early rift" alluvial-fan deposits derived from ancestral Caballo Mountains. As much as 335–447 m (1,100–1,400 ft) thick

Thr **Hayner Ranch Formation**—Light-gray to brown conglomerate, conglomeratic sandstone, and mudstone derived largely from Tertiary volcanic rocks. Content of Paleozoic clasts increases upward in section. Unit interfingers downward with the Thurman Formation and is unconformable beneath Rincon Valley Formation. Formation represents "early rift" alluvial-fan deposits derived from an early stage of uplift of the Caballo Mountains. As much as 335 m (1,100 ft) thick

Ttu **Thurman Formation**—White to light-tan to light-gray, parallel-bedded sandstone and mudstone; very tuffaceous. Unit is interpreted to be a central basin facies of an "early rift" basin. As much as 335 m (1,100 ft) thick

Tba **Dikes**—Altered basaltic-andesite dikes 1–4 m (3–12 ft) thick

Tu **Uvas Basaltic Andesite**—Medium-gray, fine-grained vesicular basaltic-andesite flows(?) that are present only in fault slices and as clasts in Hayner Ranch and younger conglomerates in the McLeod Tank quadrangle. As much as 30 m (98 ft) thick

Tbt7 **Bell Top Formation, ash-flow tuff 7**—Fine-grained, gray, vitric ash-flow tuff; very discontinuous and local in distribution; 1–2 m (3–6 ft) thick

Tbc **Bell Top Formation, conglomerate member**—Red–brown to tan boulder–cobble conglomerate, conglomeratic sandstone, and red mudstone derived from a variety of felsic and intermediate-composition volcanic rocks, including Kneeling Nun Tuff and Palm Park Formation; unit contains as much as 10% Paleozoic limestone clasts. Approximately 47 m (154 ft) thick

Tbt5 **Bell Top Formation, ash-flow tuff 5**—Gray, crystal- and pumice-rich ash-flow tuff probably correlative with *Tkn*; less than 30 m (98 ft) thick; mapped only in southern part of quadrangle

Tkn **Kneeling Nun Tuff**—Grayish-pink, crystal- and pumice-rich ash-flow tuff; approximately 30 m (98 ft) thick

Tpp **Palm Park Formation**—Basal unit of cobble–boulder conglomerate contains a large proportion of porphyritic intermediate-composition lava or hypabyssal intrusive clasts and lesser amounts of Paleozoic and Precambrian clasts. Several such beds totalling 100 m (328 ft) or more are present in the McLeod Tank quadrangle. The rest of the formation consists of finer-grained, purple, gray, green, and red mudstone, sandstone, and laharic breccia, although fresh-water algal limestone beds (*Tppl*), as much as 35 m (115 ft) thick, are discontinuously present at the top of the formation. The formation is essentially andesitic in composition. As much as 457 m (1,500 ft) thick

Tppl

Tlr **Love Ranch Formation**—Reddish-brown to reddish-gray cobble–boulder conglomerate, conglomeratic sandstone, siltstone, and arkosic sandstone, siltstone, and mudstone; derived largely from Paleozoic carbonate and sandstones and Precambrian granite, and to a lesser extent from intermediate-composition porphyritic rocks. Locally, fresh-water limestone beds (*Tlrl*), as much as 15 m (50 ft) thick, form the base of the formation. As much as 550 m (1,804 ft) thick in the Red Hills where it fills paleocanyons cut into Precambrian granite; 200 m (656 ft) thick or less elsewhere in the quadrangle where it may unconformably overlie any older formation

Tlrl

Km **Mancos Shale**—Thin-bedded limestone, yellow marine siltstone and shale, brown to olive-brown sandstone, and thick beds of crossbedded sandstone in upper part; upper half of unit may be correlative with **Tres Hermanos Formation** and **Gallup Sandstone**; as much as 300 m (984 ft) thick

Kd **Dakota Sandstone**—Upper massive, crossbedded marine sandstone overlies gray nonmarine shale and lower crossbedded fluvial sandstone and pebbly sandstone. As much as 29 m (95 ft) thick

Pyu **Upper Yeso Formation**—Upper **sandstone–limestone member**, composed of interbedded limestone and sandstone and local gypsum 27–101 m (90–331 ft) thick, overlies lower **limestone member**, which consists of approximately 24–27 m (78–88 ft) of medium-bedded, fossiliferous, gray limestone and minor yellow sandstone or siltstone

Pyl **Lower Yeso Formation**—Upper **red siltstone–dolomite member**, approximately 59–183 m (195–600 ft) thick, consists of interbedded red siltstone and dolomitic limestone; locally, unit contains solution breccia and thick beds of gypsum. Basal **Meseta Blanca Member** consists of approximately 75 m (250 ft) of brick-red sandstone and siltstone

Pa **Abo Formation**—Reddish-brown to light-brown sandstone and siltstone interbedded with grayish-red shale and claystone; 141–300 m (462–984 ft) thick

IP **Magdalena Group**—Upper **Bar B Formation**, which conformably overlies the Nakaye Formation, is composed of thick shale units interbedded with burrowed, fossiliferous limestone beds and limestone and chert pebble conglomerate; medial **Nakaye Formation** includes medium- to thick-bedded, fossiliferous, burrowed, gray cherty limestone and interbedded shale; basal **Red House Formation**, which grades up into the Nakaye, consists of gray to green shale, thin- to medium-bedded limestone, and tan sandstone and quartzite. Total thickness varies from approximately 277 m (908 ft) on western edge of quadrangle to as much as 530 m (1,738 ft) along the eastern margin

M **Lake Valley Formation**—Uppermost unit is thick-bedded limestone with conspicuous white chert of the **Tierra Blanca Member** followed, in descending order, by the **Nunn Member**, 9 m (29 ft) of soft fossiliferous limestone and calcareous shale; by 9 m (29 ft) of cliff-forming cherty **Alamogordo Member**; and by basal **Andrecito Member**, thin-bedded limestone and interbedded shale approximately 0.7 m (2.3 ft) thick. Maximum total thickness along southwestern part of quadrangle is 25 m (80 ft), but elsewhere the formation is thinner or missing due to pre-Magdalena erosion

Dp **Percha Shale**—Brown, micaceous siltstone in uppermost 10 m (32 ft) grades into greenish-gray to black, micaceous shale in lower part. Maximum thickness is 72 m (236 ft) but varies considerably due to pre-Magdalena erosion

Sf **Fusselman Dolomite**—Upper dark brownish-gray, cherty dolomite approximately 21 m (69 ft) thick overlies basal unit of tan, sandy dolomite approximately 5 m (16 ft) thick

Om **Montoya Formation**—Unit is capped by 43 m (141 ft) of light- to medium-gray, medium-bedded dolomite of the **Cutler Member**. Also present in descending order: 46 m (151 ft) of very cherty, light- to dark-gray, fine- to medium-grained dolomite of the **Aleman Member**; 21 m (69 ft) of massive, dark-gray, coarse-grained dolomite of the **Upham Member**; and approximately 6 m (20 ft) of tan to brown, coarse-grained sandstone of the basal **Cable Canyon Member**. Total thickness is approximately 116 m (380 ft)

Oe **El Paso Formation**—Upper **McKelligon Member** is 54 m (117 ft) thick and is largely light-colored, fine-grained dolomite. Medial **Jose Member**, approximately 7 m (23 ft) thick, is dark-gray, burrowed and mottled, oolitic limestone. Lower **Hitt Canyon Member** consists of approximately 91 m (298 ft) of medium-bedded, burrowed, mottled limestone, sandy at the base. Total thickness is approximately 152 m (498 ft)

€Ob **Bliss Formation**—Brown to nearly black, hematitic to glauconitic, arkosic sandstone; gray orthoquartzite; and dark-brown to greenish-brown siltstone, dolomite, limestone, and shale. Approximately 35 m (115 ft) thick

p-€g **Granite**—Red, coarse- to fine-grained microcline granite and small red syenite bodies; the latter may be Cambrian in age