

NEW MEXICO BUREAU OF GEOLOGY AND MINERAL RESOURCES A RESEARCH AND SERVICE DIVISION OF NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY





Magnetic Declination

September 2023 8° 49' East

At Map Center

Quadrangle Location



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

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Correlation of Map Units

New Mexico Bureau of Geology and Mineral Resources **Open-File Geologic Map 314**

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Geologic Map of the Coyote Canyon 15-Minute Quadrangle, Navajo Nation and McKinley









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map may be based on any of the following: reconnaissance field geologic mapping, a compilation of published and unpublished work, and photogeologic interpretation.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 may not be shown due to recent development. Cross sections are constructed based upon the interpretations of the author made from geologic mapping and available geophysical and subsurface (drill hole) 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 human-made structures.

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30-031-05301 (T.D. 2109 m)

and geologic unit depth; shows API number.

Description of Map Units

Artificial fill (Quaternary)—Clay, silt, sand, and gravel for the construction of dams, berms, and roads. af Includes sediment on upstream sides of dams. Color and composition is variable throughout the map area and dictated by the properties of the source of the unit at each location. Where exposed in outcrop by erosion, this unit lacks bedding. Does not effervesce in 10% HCl. Unit is 1 to 5 m thick.

Mixed bedrock and unconsolidated sediments. Includes mudstone, siltstone, sandstone, conglomerate, carbonaceous shales, and coal. Abundant, highly deformed, white to gray weathering light-gray, bentonitic and carbonaceous sandy siltstone are present. Within any given landslide polygon there may be multiple generations of

Older landslide deposits, undivided (Quaternary)–Unconsolidated mudstones, sandstone, and conglomerate with Toreva blocks. Heavily dissected by subsequent sliding but minimally dissected by integrated streams, smooth to moderately rough surface texture. Grades into high terrace at eastern end of landslide where raised surface representing landslide-terrace transition zone is preserved. Unit is 10

Recent landslide deposits, undivided (Quaternary)—Unconsolidated with variable consistency of jumbled mudstones, sandstone, and conglomerate with occasional intact but rotated Cretaceous strata. Blocks are up to 10 m. Individual slides occupy small areas where accommodation has been generated recent geomorphic processes. Minimally dissected, negligible soil formation. Unit is approximately 3 to 12 m thick.

Young landslide deposits, undivided (Quaternary)—Intact and deformed bedrock with unconsolidated sediments. Exhibits crosscutting relationships with pre-existing intermediate to older landslides and bedrock. Moderate to very rough surface texture with low to moderate incision. Distinct from younger rotational and earthflow landslide deposits due to lack of discernable morphological features and small

Young earthflow landslide deposits (Quaternary)—Matrix supported sandstone and mudstone blocks; hummocky; topographically inset and exhibiting cross-cutting relationships with existing intermediate to older aged earth flow, rotational, and undivided slides. Deposits consist of sandstone in matrix of muds, silts, and sands. Grades into pediment-terrace deposits (**Qptw**). Unit is 10 to 20 m thick.

Young rotational landslide deposits (Quaternary)—Rotational blocks of deformed, mixed, and occasionally intact bedrock with material from pre-existing mantle of older and intermediate aged landslide. Mantle material is hummocky and mixed into rotational blocks. Material consists of bedrock block as well as sandstone, siltstone, mudstone, and conglomerate in matrix of muds, silts, and sands. Unit

Intermediate landslide deposits, undivided (Quaternary)-Intact and deformed bedrock with unconsolidated sediments. Exhibits cross-cutting relationships with pre-existing older landslides and bedrock. Smooth to rough surface texture with moderate to high incision. Distinct from intermediate rotational and earthflow landslide deposits due to lack of morphological features and small areal extent.

Intermediate Earthflow Landslide Deposits (Quaternary)—Matrix supported sandstone and mudstone blocks. Consists of jumbled, blocky, and rotated bedrock with poorly sorted muds. Lower reaches have been re- worked by subsequent mass wasting. Well dissected (10 to 15 m deep channels), moderately smooth surface texture, and common flow parallel ridges. Unit is 1 to 30 m thick.

Intermediate Rotational Landslide Deposits (Quaternary)-Blocks of intact, deformed, and mixed material from pre-existing landslide. Back rotation decreases with distance from head scarp. Material is ungraded, poorly sorted, and consists of bedrock blocks as well as sandstone, siltstone, mudstone, and congomerate in a fine matrix of poorly sorted muds, silts, and sands. Unit is 50 to 150 m thick.

Transitional deposits between older landslides and pediment-terrace of the Ear Rock surface Quaternary)—Unconsolidated sand through boulders on an isolated mesa near the northern map boundary adjacent to Salt Springs Wash. This surface likely graded laterally up into deposits of **Qlso** and these inferred gradational boundaries. Thickness of unit is 10 to 30 m.

Active alluvium (Quaternary)—Light-yellowish-brown, to light-gray unconsolidated sand and silty sand with subordinate pebbly silty sand, sandy silt, pebbles, and silty clay. Contains trace pebble- through boulder-sized rounded to spherical clasts of mud. Contains anthropogenic detritus at the surface and at a east of Highway 491 near Tohatchi. Type locality is at 35.853075°, -108.726638°. Unit thickness is up to 9 m, depth of up to 2 m. Includes minor eolian dunes. No reaction with HCl. Thickness of unit is up to 5.2 m.

Alluvium and slopewash (Quaternary)-Unconsolidated sediment in active alluvial channels and CRETACEOUS floodplains with input from slopewash. Mottled grayish brown to light brownish gray. Forms flat to subdued topography with moderately to deeply incised channels. Slope wash sediments are brown to dark reddish brown. Coarsen and slope upwards towards hillslopes. Abundant near landslide scarps.

Older alluvium (Quaternary)—Clay, silt, sand, and gravel underlying terraces 3 to 15 m above the active stream bed. Brown to yellowish-brown, loosely to moderately consolidated sand with subordinate silty sand, pebbly silty sand, and sandy silt, with trace sandy gravel. Includes debris fans, canyon-mouth fans, colluvium, and minor sheetwash alluvium. Thickness of unit is up to 14 m.

Alluvial fan deposits (Quaternary)—Poorly consolidated silty sand, sand, and pebbly sand with trace pebbles and cobbles. Pale brown, light brown, light vellowish brown, or brownish vellow. Does not react with 10% HCl. Up to 1 m of channel and swale topography on the surface of this deposit. Interfingers with

Older alluvial fan deposits (Quaternary)—Weakly consolidated silty sand, sand, and pebbly sand with trace pebbles and cobbles in a higher landscape position than adjacent younger fan deposits. Surface of this unit is smoother than that of **Qfa**. Very weak effervescence in 10% HCl. Thickness of unit is <10 m.

Lacustrine deposits (Quaternary)—Unconsolidated clay, silt, and sand in shallow depressions. Pale QI brown, light yellowish brown, very pale brown, and light gray with dark brown organic content; minor eolian and slope wash input. Mudcracks and bioturbation are common. Does not react with 10% HCl.

Eolian deposits derived from sand-bed arroyos and in valley bottoms (Quaternary)—Unconsolidated silt and sand, light yellowish brown, pale brown, brownish yellow, and white. Grains are subrounded to subangular. No frosting observed. Dunes of this deposit sometimes divert or impound drainages. Does not react with 10% HCl. Sharp contact with underlying deposits; interfingers with adjacent eolian and

Linear, parabolic, and rising dunes (Quaternary)-Unconsolidated very well-sorted fine- to medium-grained sand, light brown to very pale brown. Includes linear dunes up to 3 km in length. Active deposits, smaller dunes, and dunes on the lee sides of topographic features do not react with 10% HCl. Sharp contact with underlying deposits; sometimes interfingers with adjacent alluvial deposits. Thickness

Discontinuous eolian deposits (Quaternary)—Weakly consolidated light-brown to brownish-yellow Cross Section ONLY UNITS coarse-grained silt through medium grained sand in discontinuous sheets overlying older deposits. Underlying units are exposed by erosion or by discontinuous eolian deposition in 25 to 75% of the area included in this unit. Weak to no reaction with HCl. No soil development observed. Thickness of unit is <6 m.

Eolian Sediments and Slopewash (Quaternary)—Unconsolidated clays, silts, and sands deposited on raised topographic surfaces or in small shallow basins containing windblown sediments that are reworked, and with input from slope wash. May have minor degree of incision but no source for alluvial input or drainage. Dune forms subdued but present and contain sediments with higher degree of sorting.

Eolian sand sheets (Quaternary)—Weakly consolidated sand in broad sheets and stabilized dune. Light-brown, reddish-yellow, or light-yellowish-brown, loosely consolidated, moderately sorted to well-sorted, subrounded, coarse-grained silt to medium-grained sand in stabilized longitudinal dunes and sand sheets on upland areas. Stabilized longitudinal dunes are up to 6 m tall. Thickness of unit is 2 to 10 m. NMBGMR Open-File Geologic Map 314 Last Modified: September 2024



Slopewash deposits (Quaternary)—Very weakly consolidated, very-pale-brown to brownish-yellow silt, sand, and gravel. Forms alluvial to colluvial aprons around steep outcrops. Erosional rills and gullies through this unit often expose underlying Cretaceous siliciclastic units. Steeper than adjacent fan deposits. Unit thickness is <2 m.

Slopewash and alluvium (Quaternary)-Unconsolidated clays, silts, sands, and gravels on flat to subdued topography with nonexistent to shallowly incised channels. Slope wash dominated sediments at margins of deposits tend to be brown to dark reddish brown. Abundant near landslide scarps and between Toreva blocks. Likely contain significant portion of eolian sands and colluvial debris. Unit

thickness is 0.2 to 8 m. **Slopewash and eolian sediments (Quaternary)**—Unconsolidated clays, silts, and sands deposited with input of windblown sediments. Light-brown to brown clays, silts, and sands with moderate organic content. Margins of deposits coarsen to pebble and cobble sized clasts transported by sheet flow from hillslopes. Dune forms not present. Unit thickness is 0 to 3 m.

Colluvium, undivided (Quaternary)—Unconsolidated boulders, cobbles, and gravels forming colluvium aprons at the angle of repose. Downslope movement causing aggradation of material by rock

fall, creep, and dry ravel. Angular, poorly sorted, non-stratified. Along cliff edges in the southern

Pediment-terrace deposits

Eight different units containing two primary compositions: clast-supported conglomerate and unconsolidated sand. ands comprise <5% of the volume of these deposits. Deposits rest upon pediplains cut into the Menefee Formation. **Pediment-terrace deposit of the Tocito Wash surface (Quaternary)**—Conglomerate containing 58% Qptw quartz arenite, 35% subarkosic arenite, 4% chert, 3% iron concretions, 1% quartzite, and trace petrified wood with surface 8 to 10 m higher than modern grade. Stage I calcic horizon. Type locality is at

Qptw 35.818371°, -108.666822°. Surface dips 0.70 to 0.87° in a generally east-northeast direction. Unit thickness

portion of the Chuska Mountain landslide. Estimated thickness of the unit is 5 m.

is 2.0 to 3.2 m. **Pediment-terrace deposit of the Salt Springs Wash surface (Quaternary)** –Conglomerate containing 76% quartz arenite, 21% subarkosic arenite, 1% iron concretions, 1% quartzite, and 1% petrified wood with surface 20 to 16 m higher than modern grade. Stage I calcic horizon. Grades upgradient into the young earthflow deposits. Type locality is at 35.992327°,-108.688016°. Unit thickness is 4.5 to 5.5 m.

Pediment-terrace deposit of the Twenty-eight Mile surface (Qptm) (Quaternary)-Conglomerate containing 84% quartz arenite, 14% subarkosic arenite, 1% iron concretions, 1% quartzite, and trace petrified wood with surface 28 to 25 m above modern grade. Stage II calcic horizon. Grades upgradient into the intermediate landslide deposits Type locality is at 35.878105°, -108.677125°. Unit thickness 1 to 4.5 m.

Pediment-terrace deposit of the Benallie's Ridge surface (Quaternary)-Conglomerate containing 24% quartz arenite, 58% subarkosic arenite, 8% iron concretions, 2% quartzite, 2% petrified wood, 1.5% quartz pebbles, 1.5% chert, and 1.5% pebbly sandstone with surface 26 to 24 m above modern grade. Soil development unknown due to limited land access. Type locality is at 35.813166°, -108.742035°. Unit thickness is 2.5 to 4.5 m.

Pediment-terrace deposit of the Buffalo Spring surface (Quaternary)-Clast composition and soil development unknown due to limited land access. Surface 31 to 35 m above modern grade. Surface dips 0.98° at azimuths of 085 to 005°, suggesting that the depositional environment was a large -Qpbs- mountain-front fan draining the area between Tocito Wash in the south and Salt Springs Wash in the north. Unit thickness is 4 m.

Pediment-terrace deposit of the Sitting Coyote Mesa surface Quaternary) —Conglomerate containing 68% quartz arenite, 27% subarkosic arenite, 3% iron concretions, 1% chert, and 1% petrified wood with surface 52 to 49 m above modern grade. Stage II calcic horizon. Exploited with quarries. Type locality at 35.806990°, -108.765468°. Surface slopes approximately 0.9° at an azimuth of 071°. Unit thickness 4 to 10.2 m.

Pediment-terrace deposit of the Ear Rock surface (Quaternary)—Conglomerate containing 88%

quartz arenite, 3% subarkosic arenite, 4% chert, and 1% each petrified wood, quartzite, iron concretions,

and quartz pebbles with surface 39 to 58 m above modern grade. Stage III calcic horizon. This deposit is laterally down into pediment-terrace deposits of **Qper**. Landscape dissection has obscured or removed — **Qper**— likely the downstream alluvial equivalent to **Qlso** and **Qlso/Qper**. Type locality is at 35.951336°, -108.623676°. Unit thickness is 3.5 to 6 m. Pediment-terrace deposit of the Ch'ooshgai surface (Quaternary)–Conglomerate containing 84% quartz arenite, 14% subarkosic arenite, and trace quartzite and iron concretions with surface 16 to 70 m above modern grade. Stage II+/III- calcic horizon. Heavily exploited for aggregate in quarries south and

thins downgradient.

Tohatchi Formation (Cretaceous)—Sandstone, mudstone, siltstone, and coal. Abundant carbonaceous material, bentonite, selenite, and fossil wood. Laterally discontinuous sandstones increase up section. Interbedded with carbonaceous shale and bentonitic horizons. Carbonaceous shales are dark gray to dark brown and black. Includes coal up to 1 m thick. Unit thickness is unknown.

Allison Member of the Menefee Formation (Cretaceous)—Yellowish-brown shale and siltstone with interbedded yellowish-brown sandstone with brown concretionary sandstone. Shale and siltstone are poorly exposed. Sandstones interfinger with encapsulating mudstones. Contact with the underlying -Kmfaunit is mapped at the approximate level of the highest observed carbonaceous shale in the Cleary Coal Member. Unit thickness is estimated to be between 450 and 550 m.

Cleary Coal Member of the Menefee Formation (Cretaceous)—Grayish-brown to ight-yellowish-brown shale and siltstone; yellow sandstone; gray carbonaceous shale, black coal, and brown concretionary sandstone. Coals are lenticular, discontinuous, and <30 cm thick where observed. Contact with the underlying Point Lookout Sandstone is sharp but interfingering. Unit thickness approximately 60 m.

Point Lookout Sandstone, main body (Cretaceous)—Pale-brown to brownish-yellow subarkose. ^(p) Bedforms include horizontal plane beds, crossbeds, herringbone beds, and undulating laminae. Includes interbeds of siltstone and shale. Separated from the Hosta Tongue of the Point Lookout Sandstone by the Satan Tongue. Intertongues with the Satan Tongue and the Gibson Coal Member. Unit thickness 42 to 75 m.

Satan Tongue of the Mancos Shale (Cretaceous) – Gray to dark-grayish-brown shale and siltstone with minor pale-brown sandstone. Contains 15 to 30% shale, 45 to 60% siltstone, and 25 to 45% sandstone. Contains bivalve and shark fossils. Interfingers with the Point Lookout Sandstone. Unit thins to the west in the quadrangle, from 14 m in Red Water Canyon, to 7 m in Big Spring Canyon, pinching out completely between Wild Berry Canyon and Coyote Canyon.

Hosta Tongue of the Point Lookout Sandstone (Cretaceous) – Same mineral and textural composition as the Point Lookout Sandstone, main body (Kpl), along with horizons of brown, very well-cemented, very fine-grained well-sorted, quartzarenites that are more fossiliferous and weathering-resistant than -Kplh other sandstones within the unit. Sharp contact with Gibson Coal. Unit thickness 15 to 42 m.

Gibson Coal Member of the Crevasse Canyon Formation (Cretaceous)—Gray to brown shale and siltstone; brownish-yellow sandstone; dark-gray shales; and black coals. Sandstones are arkosic. Coals are 20 to 85 cm thick. Lower contact not observed on this quadrangle. Occurs only at Peach Spring and -Kog Wild Berry Canyons near the southern map boundary. Maximum observed thickness of the unit on this quadrangle is approximately 60 m at Wild Berry Canyon.

Lower Cretaceous units, undivided–(Cretaceous)–Cross section only.

Jurassic units, undivided–(**Jurassic**)–Cross section only.

Friassic units, undivided—(Triassic)—Cross section only.

Paleozoic units, undivided—(Paleozoic)—Cross section only.

Proterozoic units, undivided–(**Proterozoic**)–Cross section only.

