Geologic Map of the Stanley Quadrangle, Santa Fe County, New Mexico.

By

Bruce Allen

May 2007

New Mexico Bureau of Geology and Mineral Resources
Open-file Digital Geologic Map OF-GM 143

Scale 1:24,000

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Description of Map Units to Accompany Geologic Map of the Stanley 7.5-Minute Quadrangle

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General

The Stanley 7.5-minute quadrangle (Fig. 1) is located about 50 km east of the Albuquerque metropolitan area and north of interstate highway 40 in Santa Fe county, New Mexico. The quadrangle lies on the northern edge of the ~5000 km^2 Estancia topographic basin. Its northeast corner extends into the southern Galisteo valley, which drains westward to the Rio Grande. The town of Stanley and state highway 41 are located along the western side of the quadrangle.

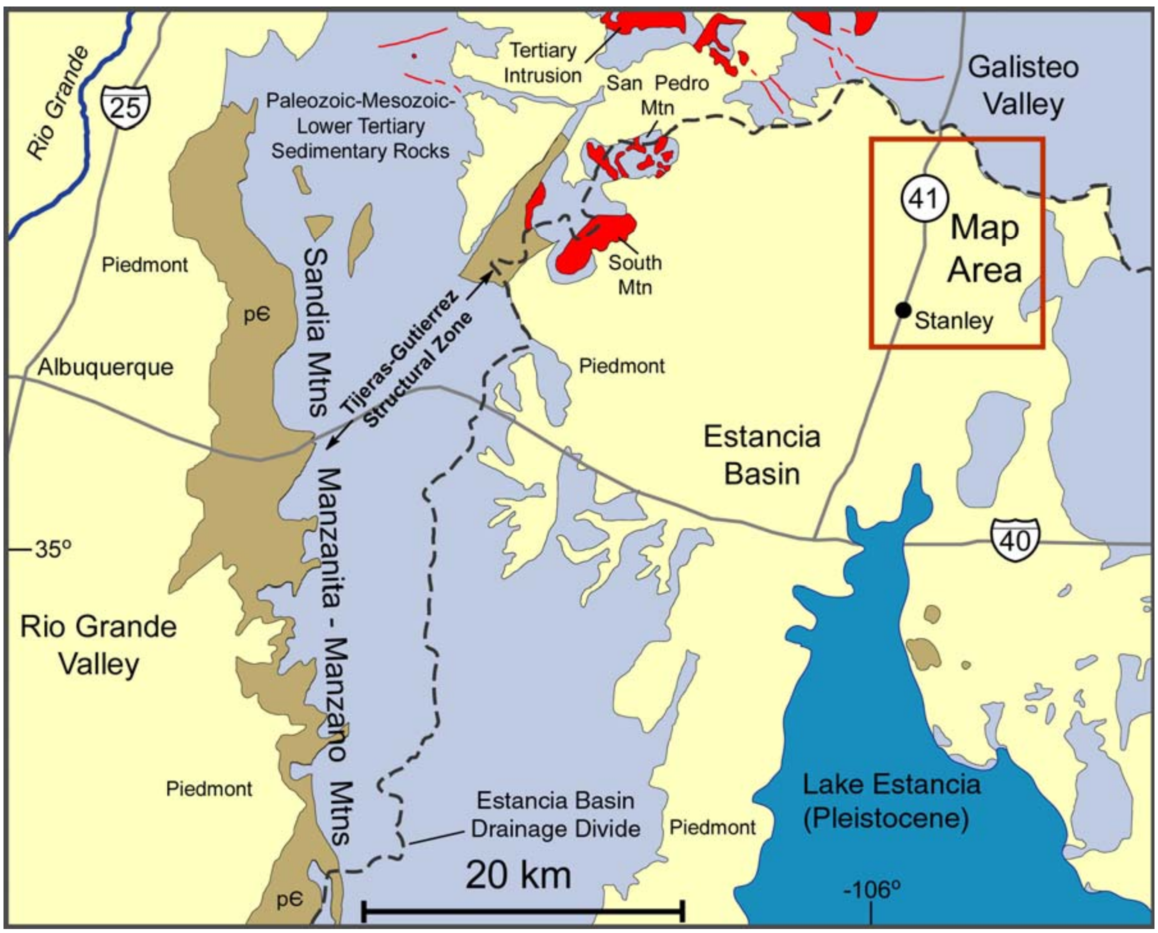

Figure 1. Index map showing location of Stanley 7.5' quadrangle, generalized geology,and physiographic features.

The southwest side of the quadrangle is underlain by up to 80 m or more of valley- and basin-fill alluvium. The thickness of these largely unconsolidated deposits thins to the north and east across the quadrangle, and in the northeast corner of the map area (in the Galisteo valley) bedrock is present at shallow depth beneath the land surface. Much of the quadrangle within the Estancia Basin is underlain at shallow depth by coarse-grained alluvium with well-developed pedogenic carbonate horizons. This older alluvium is covered to varying degrees by a thin veneer of mixed eolian, alluvial, and colluvial deposits.

Average annual precipitation in the area is on the order of 30 cm. Surface runoff in the Estancia Basin drains southward in draws toward the lowest part of the topographic basin which, during the late Pleistocene, contained a large perennial lake (Lake Estancia) whose shorelines reached an elevation of about 1890 m. There are no perennial streams in the map area and water for agriculture, stock, and domestic use is obtained from groundwater supplies. In most of the map area water wells are completed in bedrock aquifers, although wells along the southwest side of the quadrangle derive relatively high yields from the unconsolidated fill.

Geology

The general bedrock structure beneath the northern Estancia Basin is a north-plunging syncline (e.g., Broadhead, 1997, Fig. 6). The Stanley quadrangle lies on the eastern limb of this structure and the overall dip of bedrock units is probably a few degrees or more to the northwest. Mesas to the southeast of the map area are capped by Triassic sedimentary rocks. The northeast corner of the quadrangle exposes Mesozoic strata ranging in age from Triassic through late Cretaceous. North-trending systems of faults with apparent down-to-the-west displacement are present in the northeast corner of the map area, and in an area along the southeast margin of the quadrangle. Individual faults are closely spaced, and slivers of bedrock belonging to different formations are in some cases separated by only a few meters. Thus, the depiction of these structures at the scale of the map is generalized. Uplands to the west of the map area, (South Mountain and San Pedro Mountains) are underlain by Paleozoic sedimentary rocks that are intruded by a complex of Paleogene laccoliths and stocks (Cerillos-Ortiz-San Pedro porphory belt). Associated igneous intrusions (dikes and sills) are exposed in the dissected Galisteo valley to the northeast of the quadrangle.

The region south of the Galisteo valley, including the map area, was uplifted and eroded during the (Paleogene) Laramide orogeny, as indicated by removal, to varying degrees, of Paleozoic and Mesozoic sedimentary rocks over much of the Estancia Basin. Neogene tectonic events in the region resulted in opening of the Rio Grande rift and development of footwall uplifts (e.g. Sandia Mountains) to the west of the map area, and deposition of the Santa Fe Group in deep (thousands of meters), rift-axis basins. In comparison with the axial basins of the Rio Grande rift, the Quaternary Estancia Basin is a relatively shallow structure, containing only a hundred meters or so of unconsolidated fill. The timing of closure of the topographic basin is not well constrained, but it is generally speculated that closure occurred late in the history of the Rio Grande rift.

A poorly studied facet of the late Tertiary-early Quaternary history of the Estancia basin is represented by the deposits referred to here as the alluvium of the ancestral Estancia valley (map unit QTev), which underlies much of the map area at shallow depth. These deposits rest on the beveled bedrock surface underlying the basin, are comparatively coarse grained, and contain, in part, red granitic clasts likely derived from the Sangre de Cristo Mountains to the north. Excavation of the present-day Galisteo valley, and incision of the modern Pecos River valley some distance to the northeast, have subsequently left the Estancia Basin stranded from northern (Sangre de Cristo) sediment sources.

Younger unconsolidated surface deposits in the quadrangle are divided into four map units: alluvium and colluvium along drainage side slopes in the Estancia Basin (Qc), alluvium and colluvium overlying relatively shallow bedrock in the Galisteo valley (Qac), eolian loessal silt and sand (Qe), and valley-floor alluvium in modern drainages (Qa).

Description of Map Units

Unconsolidated Deposits

Qa Valley-floor alluvium. Holocene. Silt, sand, clay, and gravel underlying modern drainages and floodplains. Deposits are inset into older alluvial deposits (units QTev and Qac), and interfinger with younger deposits of units Qc, Qe, and Qac along drainage foot slopes. Generally less than 3 m thick.

Qc Alluvial, colluvial, and eolian deposits mantling side slopes of drainages and terraces. Upper Pleistocene (?) to Holocene. Derived from erosion of older alluvium (QTev), and from sources of eolian silt and sand. Includes unmapped deposits of unit QTev, and interfingers with valley-floor alluvium (Qa) along drainage foot slopes. Estimated thickness is 5 m or less.

Qe Eolian, alluvial, and colluvial deposits, southern portion of map area. Upper Pleistocene (?) to Holocene. Wind-deposited silt and sand, augmented and modified by alluvial processes. Includes unmapped patches of older alluvium (unit QTev) that are present at or very near the surface. South of the map area, these deposits are up to 4 m thick or more; accumulations are thinner within the map area.

Qac Undivided alluvium, colluvium, and residuum underlain at relatively shallow depth by bedrock in the northern Galisteo valley (northeast corner of map area). Middle Pleistocene (?) to Holocene. Predominantly silt, sand, and clay grading into relatively coarse-grained deposits along valley backslopes. Unit consists of older valley-floor deposits and younger inset fills. Includes residuum on relatively flat-laying areas derived from weathering of underlying bedrock. Also includes areas of unmapped bedrock exposure. Thickness ranges from a meter or less over bedrock highs, to an estimated 5 m or more along trunk drainages. Estimated thickness is 4 m or less.

QTev Alluvium of the ancestral Estancia valley. Pliocene (?) to Lower Pleistocene (?). Gravel, sand, silt and clay derived largely from fluvial systems that headed in uplands to the west and north. Deposits unconformably overlie bedrock. Unit is present at or very near the surface over large areas along the northern and eastern margins of the northern Estancia topographic basin, and is buried elsewhere by younger, generally finer-grained deposits. Coarse-grained clasts are dominantly igneous porphyries and Paleozoic-Mesozoic sedimentary rocks derived from uplands to the west and northwest (e.g., Ortiz, San Pedro, and South Mountains). Pink granitic clasts, probably derived from the Sangre de Cristo Mountains, are also present, and in some areas gravel clasts consisting of (Pennsylvanian?) limestone are abundant. Clast ratios are locally variable. Although igneous porphories are generally the dominant clast lighology, some deposits consist of >50 % granitic clasts, while others contain >50 % limestone clasts. The deposits are generally unconsolidated; however, the basal meter or more of the unit, where it is exposed, is commonly a calcite-cemented conglomerate. Soils on the deposits exhibit well-developed pedogenic carbonate horizons. Incision and stripping of the unit has resulted in the development of terraces and deposition of inset fills, which are included in the map unit. Thickness ranges from a few meters in stripped remnants along the northern and eastern margins of the Estancia Basin, to perhaps 80 meters in the southwestern part of the map area where it covered by a thin eolian-alluvial mantle.

Bedrock Units

Note:

Bedrock units are exposed in the map area in the northeast corner and along the east margin in sec. 28, T10E, R11N. In both areas exposed bedrock units are faulted and complete sections of individual formations are not available. Formation thicknesses are estimates based on recent mapping on adjacent quadrangles to the north and west of the map area (e.g., Lisenbee, 2000), and reports on the geology of the northern Estancia Basin (e.g., Johnpeer et al., 1987; Broadhead, 1997). The structural distribution of bedrock units, as well as the thickness of overlying fill, are generalized and based on limited subsurface information. More detailed discussions of the rock units described below are provided by Kelley and Northrop (1975), Lucas and others (1999a, 1999b), and Myers (1973).

Due to the small size of bedrock exposures in the map area, some outcrops containing more than one formation are labeled on the mylar using compound symbols. For example, "Jm-Kd" indicates an outcrop of rocks pertaining to the Summerville-Morrison

Formations and overlying Dakota Sandstone. Similarly, space does not permit placement of strike-and-dip symbols on the mylar without obscuring the underlying linework. Therefore, the geology in the two areas of the quadrangle containing bedrock exposures was mapped digitally, allowing better cartographic depiction of structure symbols (faults, strike-and-dip symbols) and the distribution of individual formations. These digital maps are included as an integral part of this map in Figures 2 and 3 below.

Given uncertainties in the thicknesses of bedrock units, coupled with a paucity of subsurface information, it is felt that delineation of formation-rank units on the cross section is unwarranted. Therefore, bedrock units on the cross section are differentiated by geologic system.

Cretaceous System (K on cross section)

Km Mancos Shale, undivided. Upper Cretaceous. Marine shale, siltstone, sandstone, and limestone. Represented in the map area by the lowermost part of the Mancos Shale, including the basal Graneros Shale (poorly exposed, dark gray shale with minor sandstone beds and calcareous concretions near the base, ~50 m thick) and the Greenhorn Limestone (locally subdivided- see below). Younger, overlying deposits of the lower part of the Mancos shale, including dark gray to olive gray shale and yellowish brown, calcareous siltstone and sandstone, are poorly exposed in small drainage cuts and in isolated hillslope exposures to the east of outcrops of the Greenhorn limestone in the map area.

> Kg Greenhorn Limestone. Upper Cretaceous. Decimeter-scale interbeds of resistant, ledge-forming light gray limestone and dark gray shale. Exposures up to ~6 m thick are present in the map area.

Kd Dakota Sandstone. Upper Cretaceous. Marine to marginal marine sandstone. Brown to yellowish brown and gray on weathered surfaces. Generally bioturbated, but cross-stratified beds are present in some exposures. Unit appears to be thin (a few meters thick), with no thick interbeds of shale, but the few exposures present in the map area may represent incomplete slivers of Dakota between faults.

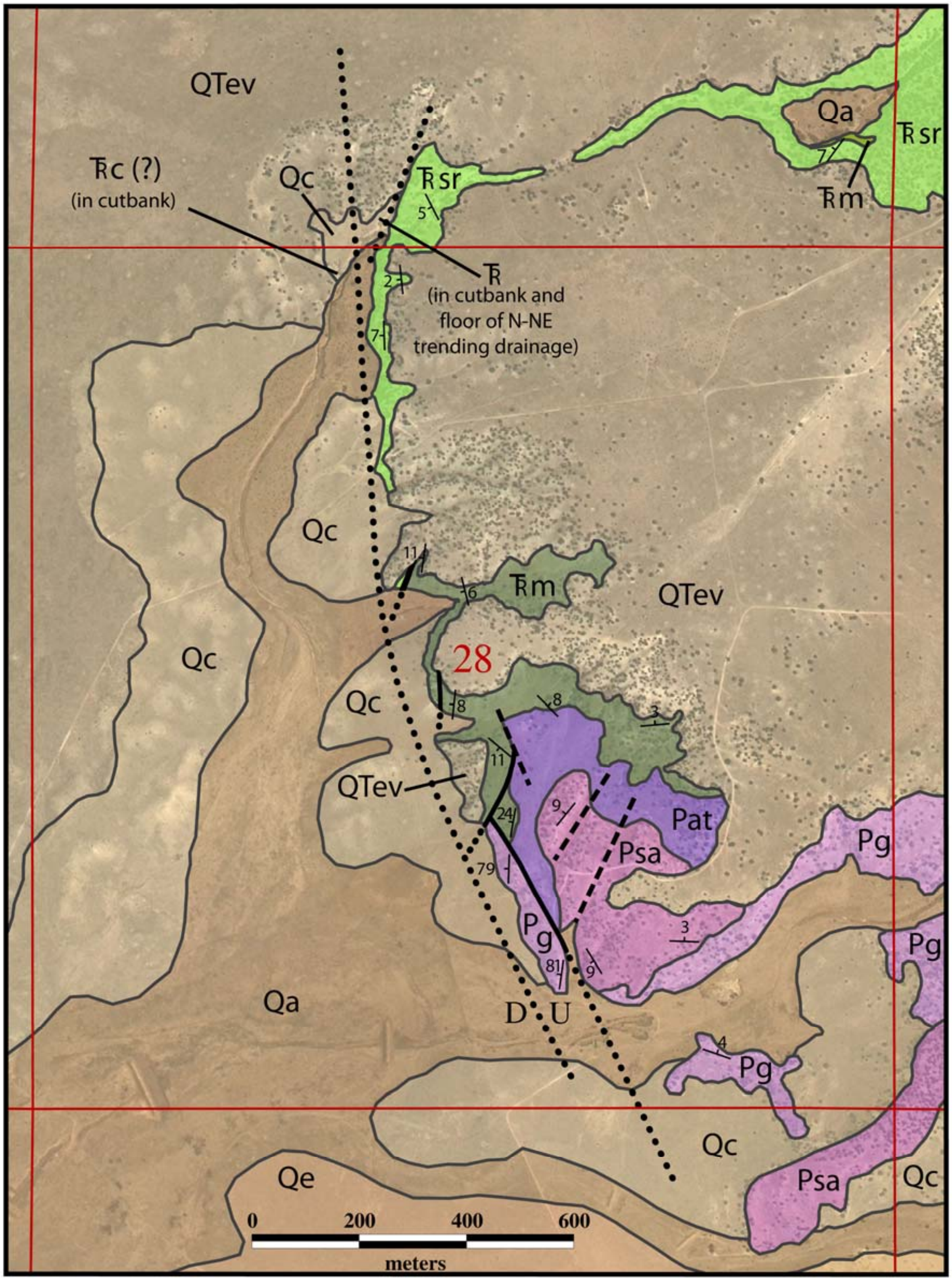

Figure 2. Geologic map of section 28, T11N, R10E and vicinity, Santa Fe County, NM (section boundaries indicated by red lines).

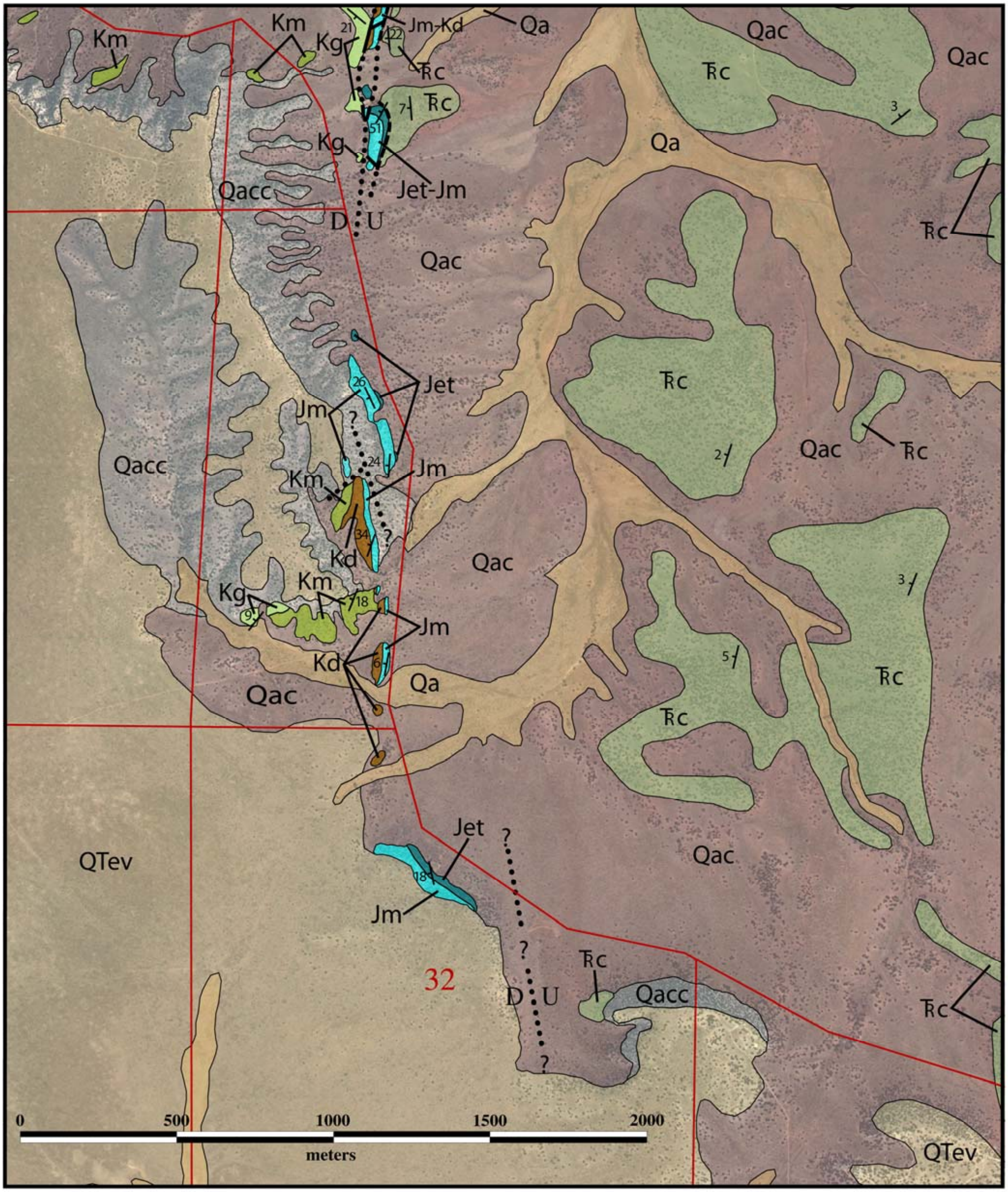

Figure 3. Geologic map of northeast corner of Stanley 7.5' quadrangle, Santa Fe County, NM (section boundaries indicated by red lines).

Jurassic System (J on cross section)

Jm Morrison and Summerville Formations (undifferentiated). Upper Jurassic. Largely terrestrial sandstone, siltstone, and mudstone. The Morrison Formation in the map area includes, in ascending order, the Salt Wash Member (pale yellowish brown sandstone), Brushy Basin Member (poorly exposed mudstone with lesser siltstone and sandstone), and the Jackpile Member (white to pinkish white, relatively friable sandstone). The underlying Summerville Formation consists of interbedded mudstone and siltstone grading up to more resistant sandstone beds near the top. The base of the Summerville Formation locally contains a thin, relatively resistant, light gray sandy limestone bed, and an abundance of red siliceous nodules. Due to poor exposure and structural complications, a composite thickness for these units is difficult to estimate, but may be less than the 220 m assumed for the cross section.

Jet Todilto and Entrada Formations (undifferentiated). Middle Jurassic. The Todilto formation is represented in the map area by ~2 m of dark gray to brownish gray, delicately interlaminated limestone and thinner sapropelic layers. Exposures of the upper few meters of the underlying Entrada Formation consist of light yellowish brown, generally structureless, friable sandstone. The Todilto Formation is generally the more resistant of the two formations in the map area. A cumulative thickness of 25 m for the Todilto and Entrada Formations is assumed in the accompanying cross section.

Triassic System (TR on cross section)

TRc Chinle Group, undivided. Upper Triassic. Terrestrial red beds dominated by reddish brown , purple, and gray mudstone and shale, with reddish brown sandstone, siltstone, and minor pebble conglomerate. The upper part of the Chinle Group underlies much of the northeastern corner of the map area at shallow depth, where exposures are largely limited to resistant, reddish brown sandstone beds. Small drainage-cut exposures to the west of the fault system in sec. 28, T11N, R10E contain purple and dark gray shale that may pertain to older deposits of the upper Chinle Group. A total thickness of 390 m is assumed in the cross section.

> TRsr Santa Rosa Sandstone (lower part of Chinle Group). Upper Triassic. Yellowish brown, cross-stratified sandstone, with minor thin interbeds of reddish brown and olive gray mudstone and shale. Basal ~10 m of unit is exposed along the western margin of the map area.

TRm Moenkopi Formation. Middle Triassic. Reddish gray to reddish brown, cross-stratified sandstone with lesser interbeds of siltstone and mudstone. A drainage-cut just east of the map area, in sec. 21, T11N, R10E exposes ~1.5 m of reddish purple mudstone with carbonate nodules between the uppermost Moenkopi Formation and basal Santa Rosa Sandstone. Assumed to be 35 m thick for cross section.

Permian System (P on cross section)

Pat Artesia Group. Middle Permian (Guadalupian). Reddish brown to orange mudstone, siltstone, and sandstone, with minor, pale-colored, dolomitic limestone beds. Evaporitic gypsum beds were not observed in the map area. Approximately 5-10 m of unit is exposed in the map area..

Psa San Andres Formation. Lower to Middle Permian (Leonardian-Guadalupian). Light gray to pale-colored limestone and dolomitic limestone, with poorly exposed interbeds of reddish brown and gray mudstone and siltstone. Less than 10 m is exposed in the map area.

Pg Glorieta Sandstone. Lower Permian (Leonardian). Yellowish brown to gray, thick bedded to structureless quartz sandstone. Exposures up to several meters in thickness are present in the map area.

Yeso and Abo Formations (not exposed in map area). Lower Permian (Wolfcampian-Leonardian). Terrestrial to marginal marine deposits of the Yeso Formation in the region consist of brown to weak red sandstone and mudstone, with thick intervals of anhydrite and minor limestone beds. The underlying terrestrial Abo Formation consists of reddish brown mudstone, siltstone, and sandstone. A total thickness of 570 m for all Permian strata is assumed along the western side of the quadrangle. The cross section depicts the Permian sequence thinning to the east, where it is assumed that a northern extension of the Ancestral Rocky Mountain-Pedernal landmass existed.

Pennsylvanian System (IP on cross section)

IP Madera Group and Sandia Formations (not exposed in map area). Middle to Upper Pennsylvanian. Pennsylvanian strata in the area consist of marine and marginal marine carbonates and siliciclastics of the Sandia Formation and overlying Madera Group. A thin (up to 10s of meters) sequence of limestone and shale deposited during the Mississippian (?) may be present between the Sandia Formation and Proterozoic crystalline rocks. Assumed total thickness 300 m in western part of map area; depicted on the cross section as thinning to the east and an assumed northern extension of the Ancestral Rocky Mountain-Pedernal landmass.

Proterozoic Erathem (X on cross section)

X Proterozoic crystalline rocks (not exposed in map area).

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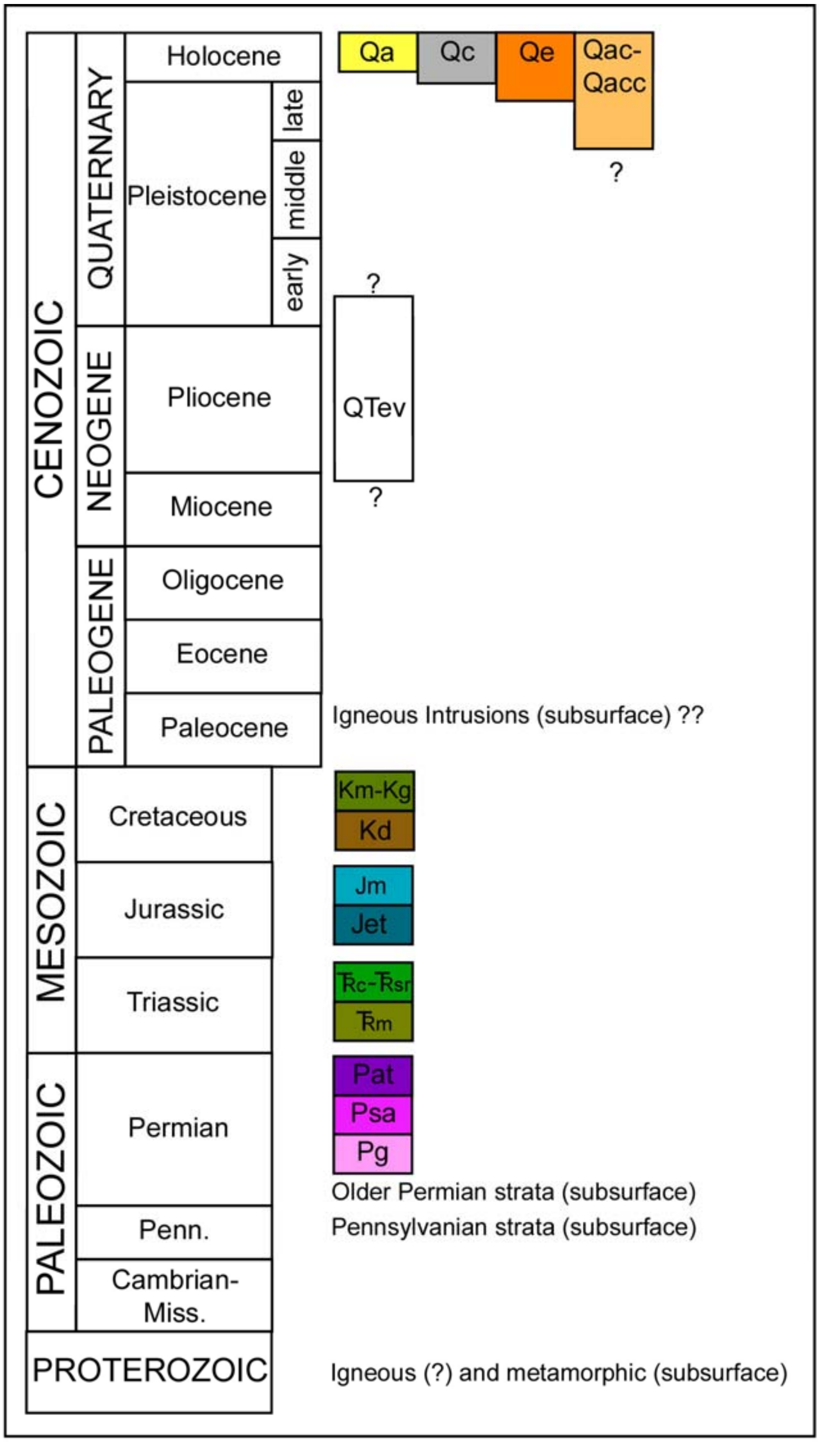
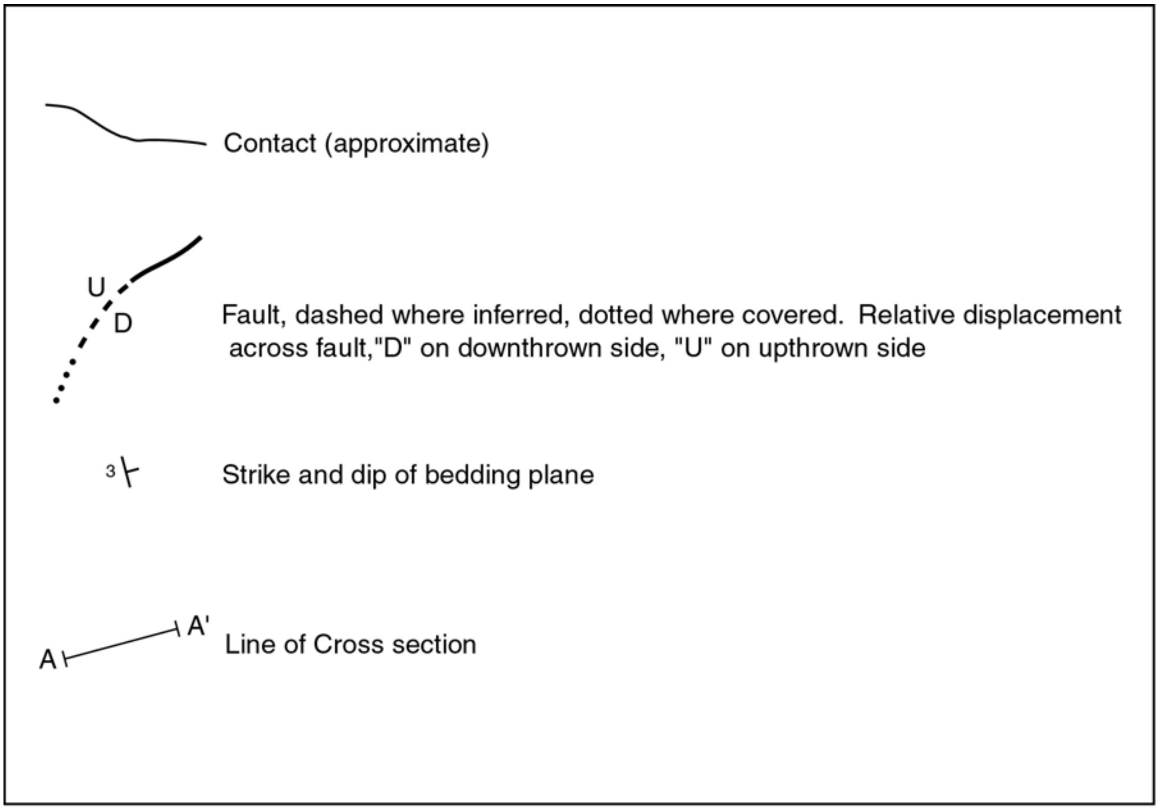
Addenda (cross section A-A' is submitted as a separate file)

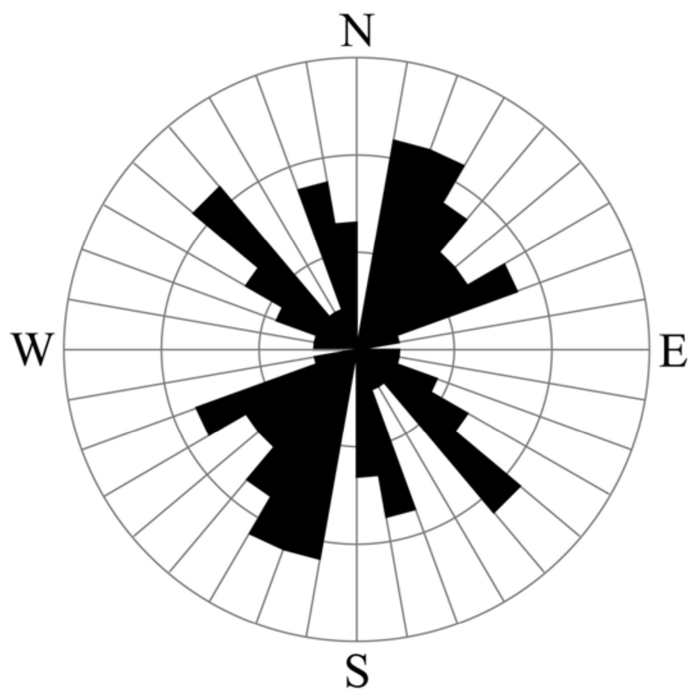


Correlation of map units, Stanley 7.5' quadrangle.



Explanation of map symbols, Stanley 7.5' quadrangle

Bedrock joint orientations
NE corner of Stanley 7.5-min quadrangle
n = 46



Bedrock joint orientations
sec. 28, T11N, R10E (Stanley 7.5-min quadrangle)
n = 76