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

By

Bruce Allen

May 2006

New Mexico Bureau of Geology and Mineral Resources
Open-file Digital Geologic Map OF-GM 117

Scale 1:24,000

This work was supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program (STATEMAP) and the New Mexico Bureau of Geology and Mineral Resources.

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

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

Bruce D. Allen*

May 2006

(Modified September 2011)

*New Mexico Bureau of Geology and Mineral Resources, New Mexico Tech, Socorro, NM 87801

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

Bruce D. Allen, May 2006

General

The King Draw 7.5-minute quadrangle is located northeast of the Albuquerque metropolitan area and north of interstate highway 40 in Santa Fe county, New Mexico (see location map). The quadrangle lies on the northern side of the ~5000 km^2 Estancia topographic basin, and is just to the south of the drainage divide with the Galisteo valley, which drains westward to the Rio Grande. The town of Stanley and state highway 41 are located a few km east of the quadrangle.

The map area contains up to ~120 m of unconsolidated, valley- and basin-fill alluvium. Soils over much of the area are on relatively young alluvial and eolian deposits, are moderately deep and generally well-drained, and are vegetated by grasses. Grass-covered slopes in the northeastern part of the quadrangle are underlain at shallow depths by older alluvium with well-developed pedogenic carbonate and petrocalcic horizons.

Surface runoff from the area drains southward in draws toward the lowest part of the Estancia topographic basin which, during the last glacial episode, supported a large perennial lake (Pleistocene Lake Estancia) whose shorelines reached an elevation of about 1890 m (6200 ft). There are no perennial streams in the map area and water for agriculture, stock, and domestic use is obtained from groundwater supplies. Relatively high-yield water wells in the south-central part of quadrangle, where unconsolidated deposits are thickest, utilize the unconsolidated basin-fill aquifer system. In other areas, where saturated thickness of the basin-fill aquifer is minimal, water wells are completed in bedrock aquifers. Relatively large agricultural operations utilize groundwater for irrigation along the southern edge of the quadrangle and southward. Average annual precipitation in the area is on the order of 30 cm.

Geology

The King Draw quadrangle is covered by unconsolidated deposits that bury tilted, Paleozoic-Cenozoic sedimentary rocks in the subsurface. Uplands to the west of the map area (South Mountain and San Pedro Mountains) are underlain by Paleozoic sedimentary rocks intruded by a complex of Paleogene stocks and laccoliths (Ortiz porphyry belt). Associated igneous intrusions are also exposed in the dissected Galisteo valley to the north of the map area. Unconsolidated deposits in the map area are thought to be underlain at depth by the west limb of a beveled, north-plunging, synclinal bedrock structure that forms the southern end of the Paleogene (Laramide) Galisteo structural basin (Broadhead, 1997), but detailed subsurface data are lacking. The area south of the Galisteo valley, including the map area, was uplifted and eroded during (?) and following the Paleogene Laramide orogeny, as indicated by removal of thick portions of the Paleozoic-Cenozoic section over much of the Estancia Basin.

Neogene tectonic events in the region resulted in extension 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 rift-axis basins, the modern Estancia Basin is a relatively shallow feature, 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 (e.g., Smith, 1957).

An important element of the latest Tertiary-early Quaternary history of the Estancia Basin is represented by the deposits informally referred to here as the alluvium of the ancestral Estancia valley (map unit QTev), in the northeastern part of the map area. These deposits rest on the beveled bedrock surface underlying the basin, are generally coarser-grained than younger alluvial deposits of the western piedmont slopes, and contain gravel clasts derived from the Sangre de Cristo Mountains to the north. These observations, coupled with the apparent thinness (~30 m thick) of lacustrine deposits (indicating basin closure) in the southern part of the basin, suggest fluvial deposition and a through-flowing drainage system with headwaters as far north as the southern Sangre de Cristo Mountains. Gravel deposits with Sangre de Cristo sources are present at even higher levels of the basin, several kilometers to the east of the map area. Incision of the Galisteo valley and downcutting of the modern Pecos River valley some distance to the northeast have drastically changed drainage patterns in the region since deposition of these higher level gravels.

No direct information regarding the age of the older alluvial deposits (QTev) in the northern Estancia Basin exists, hampering time-stratigraphic correlations with named formations in neighboring areas to the west, north, and east (i.e., Tuerto, Ancha, Ogallala formations). Antiquity of the Estancia Basin QTev deposits is suggested by well-developed calcic soil horizons on the highest remnants and on inset terraces. Barring significant post-depositional structural movement, present-day topographic relations suggest that QTev deposits are older than the youngest deposits of the Tuerto and Ancha formations. These deposits to the west and north of the map area grade to an ancestral Galisteo valley that had probably already incised enough to leave the Estancia area stranded from northern (Sangre de Cristo) sediment sources.

Younger unconsolidated surface deposits in the quadrangle are divided into four map units: western piedmont alluvium (Qp), alluvium along drainage side slopes (Qc), eolian loessal silt and sand (Qe), and valley-floor alluvium in modern drainages (Qa). A thin eolian mantle covers much of the quadrangle. The thickness of surface deposits with significant contributions from eolian sources increases to the southeast of the map area. At the latitude of the King Draw quadrangle, the distinction between the ubiquitous eolian mantle (which is ignored in the mapping) and unit Qe is rather arbitrary.

Description of Map Units

Neogene Deposits

Qa Valley-floor alluvium. Holocene. Silt, sand, gravel, and clay underlying modern drainages and floodplains. Deposits are inset into older alluvial deposits (units Qp and QTev), and interfinger with recent deposits of units Qc and Qe 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 piedmont surface deposits (Qp) and older alluvium (QTev), and from sources of eolian silt and sand. Includes unmapped deposits of units Qp and 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, southeast portion of the map area. Upper Pleistocene (?) to Holocene. Wind-deposited silt and sand, locally modified by alluvial processes. Includes unmapped patches of older alluvium that are present at or very near the surface. Southeast of the map area, these deposits are up to ~4 m thick; accumulations are thinner within the map area.

Qp Piedmont-slope alluvium and colluvium. Middle Pleistocene (?) to Holocene. Includes alluvial aprons bordering the western uplands of the Estancia basin and younger, inset alluvial fills. Bedrock sources include Tertiary porphyries and Pennsylvanian to Permian age shale, limestone, and sandstone. Probably includes significant contributions of eolian sediment in some areas. Predominantly sand and silt, with coarser grained deposits dominated by sand and gravel present along high-order drainages and increasing toward the uplands to the west. Unit ranges in thickness from a few meters or less where it forms a thin mantle over bedrock (west of the map area), to perhaps 30 m or more in lower parts of the quadrangle, where it overlies older, generally coarser grained deposits of unit QTev in the subsurface. The deposits were previously subdivided into four map units (Qp1-4) on the adjacent San Pedro quadrangle to the west. This division has been simplified to include a single, undivided map unit (Qp) along the upper piedmont slopes, and 3 levels of inset fills (units Qp1-3):

> Qp3 Piedmont alluvium, inset into older deposits of unit Qp. Upper Pleistocene to Holocene (?). Estimated thickness is 3 m or less.
>
> Qp2 Piedmont alluvium, inset into older deposits of Qp and QTev. Middle to upper Pleistocene (?). Estimated thickness is 3 m or more; some areas mapped as Qp2 may be straths, with little accumulation of associated fill.
>
> Qp1 Piedmont alluvium, underlies highest interfluvial summits along the middle piedmont slope of the western Estancia basin. Middle to upper Pleistocene (?). Unit has been extensively incised in the vicinity of major

drainages, and is underlain by older deposits of unit QTev toward the topographic axis of the basin.

QTev Alluvium of the ancestral Estancia valley. Pliocene (?) to lower Pleistocene (?). Sand, gravel, silt, and clay derived largely from fluvial systems that headed in uplands to the west and north. Deposits unconformably overlie bedrock in the subsurface. 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. Within the map area, coarse-grained clasts are dominantly igneous porphyries and Paleozoic-Cenozoic sedimentary rocks derived from uplands to the west and northwest (Ortiz-San Pedro-South Mountain igneous intrusive complex). Pink granitic clasts derived from the western side of the southern Sangre de Cristo Mountains to the north become increasingly abundant east of the map area, and are present in subordinate amounts at least as far west as state Highway 41. The deposits are generally unconsolidated; however, groundwater-related calcite cementation has been observed locally in nearby (off of the map area) exposures of the basal part of the unit. Soils on the deposits exhibit well-developed pedogenic carbonate horizons. Quaternary incision and stripping of the unit has resulted in the development of progressively lower terraces and the probable deposition of local inset fills, which are included in the map unit. Thickness ranges from a few meters in eroded remnants along the northern edge of the Estancia Basin, to perhaps 100 meters in the southern part of the map area where it is buried by younger deposits.

Cross Sections

Neogene

Neogene deposits on the cross sections, because they are relatively thin in comparison to the bedrock units underlying the area, are undifferentiated and are therefore collectively referred to as "**QT**"

Bedrock Units

Bedrock units on the cross sections are differentiated by geologic system. Lithologic characteristics, thicknesses, and the structural distribution of bedrock units, as well as the thickness of overlying fill, are highly generalized and based on limited subsurface information. Overall geologic structure and thickness of bedrock units are extrapolated from recent mapping on adjacent quadrangles to the north and west of the map area. The overall geologic structure is based on the report by Broadhead (1997), which contains no subsurface data for the map area. Paleogene igneous intrusive bodies that may be present in the subsurface are not depicted. More detailed discussion of the rock units briefly described below are provided by Kelley and Northrop (1975), Lucas and others (1999a, 1999b), and Myers (1973). These reports are based on studies in neighboring areas to the south, west, and north of the King Draw quadrangle.

K Cretaceous rocks in the area consist of a thick sequence of marine to marginal marine shale, sandstone, and minor limestone. Cretaceous rocks are the youngest bedrock units exposed along the northern margin of the Galisteo valley, a few kilometers to the north of the map area.

J Jurassic rocks include, in ascending order, the Entrada Sandstone, laminated limestone and gypsum of the Todilto Formation (only a few meters thick in the northern Galisteo valley), sandstone, siltstone, and gypsum of the Summerville Formation, and terrestrial deposits dominated by mudstone and sandstone of the Morrison Formation. A total thickness for the Jurassic system of 800 feet (244 m) was used to construct the cross sections.

TR Triassic rocks in the area consist of terrestrial red beds dominated by mudstone and sandstone. Assumed total thickness 1400 feet (427 m).

P Permian rocks in the area include, in ascending order, red-bed mudstone and sandstone of the Abo Formation and marine and marginal marine sandstone, mudstone, limestone, and evaporites of the Yeso, Glorieta, and San Andres Formations and rocks assigned to the Artesia Group. Assumed total thickness 2000 feet (610 m).

IP 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 1600 feet (488 m) in western part of map area, thinning toward the east and a northern extension of the Ancestral Rocky Mountain-Pedernal landmass.

X Proterozoic crystalline rocks.

References Cited

Broadhead, R.F., 1997, Subsurface geology and oil and gas potential of Estancia Basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Bulletin 157, 54 p.

Kelly, V.C., and Northrop, S.A., 1975, Geology of Sandia Mountains and vicinity, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Memoir 29, 123 p.

Lucas, S.G., Estep, J.W., and Anderson, O.J., 1999a, Correlation of Jurassic strata from the Colorado Plateau to the High Plains, across the Rio Grande rift, north-central New Mexico: New Mexico Geological Society, Guidebook 50, p. 317-326.

Lucas, S.G., Heckert, A.B., and Estep, J.W., 1999b, Correlation of Triassic strata across the Rio Grande rift, north-central New Mexico: New Mexico Geological Society, Guidebook 50, p. 305-310.

Myers, D.A., 1973, The upper Paleozoic Madera Group in the Manzano Mountains, New Mexico: U.S. Geological Survey Bulletin 1372-F, 13 p.

Smith, R.E., 1957, Geology and ground-water resources of Torrance county, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Ground-water Report 5, 186 p.