

# **Geologic Map of the Las Vegas NW 7.5' Quadrangle, San Miguel County, New Mexico**

by

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## **INTRODUCTION**

Las Vegas NW Quadrangle extends from the northern limits of the town of Las Vegas northward to Sapello Creek. Skotnicki (2003) incorporates information regarding the area from the Las Vegas Chamber of Commerce as follows.

The City of Las Vegas sits at the old juncture between the north-south Spanish Empire and the east-west American Empire. Poised at the confluence of two major streams, Gallinas Creek and Arroyo Pecos, the area has been a locus of trade since at least the early 16<sup>th</sup> century. The chance meeting between a band of Missouri traders led by William Becknell and a battalion of Mexican soldiers under the command of Captain Pedro Ignacio Gallego near Puerto del Norte ('the northern door') in 1821 led to the opening of the Santa Fe Trail. Although weathered, ruts from wagons heading west on the Trail can still be seen today...In 1879 the Atchison Topeka and Santa Fe Railroad reached Las Vegas and drastically reduced the travel time from the east. Old wagon roads were widened and improved in the beginning of the 20th Century to accommodate the growing demand for roads suitable for automobile travel, eventually leading to the building of Interstate Highway I-25.

The Santa Fe Trail, the Burlington-Santa Fe Railroad (formerly the Atchison, Topeka and Santa Fe) and Interstate Highway I-25 cross the southeastern portion of the quadrangle.

Upper Cretaceous units of shale and minor sandstone and limestone, intruded by intermediate dikes in the Late Tertiary, underlie the quadrangle area. Gravel cover in alluvial fans or terrace deposits formed during Pliocene(?) and Quaternary down cutting by streams exiting the nearby Sangre de Cristo Mountains. This quadrangle was mapped concurrently with mapping immediately to the south in the Las Vegas 7.5' quadrangle (Skotnicki, 2003). Fieldwork was carried out during July of 2002.

## **STRATIGRAPHY**

Sedimentary units exposed within the quadrangle, or present in the subsurface, formed in three differing geologic settings. Dominantly clastic Cretaceous units were deposited in the western portion of the Western Interior Cretaceous Seaway, a downwarp of the North American continent extending from the Gulf of Mexico to the Arctic Ocean. Triassic and Jurassic strata formed under continental conditions related to westerly flowing streams. Paleozoic strata are dominated by thick marine clastic sequences formed in basins separating segments of the Pennsylvanian aged Ancestral Rockies or in marine successor basins during the Permian: they overlie shallow marine strata formed during the Mississippian period which rest with profound unconformity upon the Proterozoic crystalline basement.

Unconsolidated deposits of Latest Tertiary(?) and Quaternary age are abundant across the quadrangle. Fine to coarse-grained debris, derived from the Sangre de Cristo Mountain Range to the west, was deposited by several streams: continued down-cutting by the streams left the deposits elevated as terraces and very broad alluvial fans. Subsequent reworking of these materials formed playa, pediment, eolian and alluvial fan deposits.

## **STRUCTURE**

### **General**

Cretaceous strata exposed in the quadrangle display an overall 3°W-6°W, homoclinal dip toward the Sangre de Cristo Range. As shown in Cross Section A-A' the quadrangle begins approximately one and one-half miles east of the structural front of the Laramide Sangre de Cristo uplift. A synclinal flexure in the southwest part of the quadrangle parallels the structural front.

### **Folds**

The Sangre de Cristo uplift is paralleled on the east by the north-plunging Las Vegas syncline, the southern segment of the axis of the Raton basin. Structural relief is approximately 2,060 m (6,800 ft) across the uplift-plains boundary at the latitude of Cross section A-A'. At the present erosional level, the core of the syncline contains the Niobrara Formation. The axis of the fold lies at the extreme southwest corner of the quadrangle.

In the central area of the quadrangle two WNW-plunging, north-facing anticline-syncline pairs, one of which is called the Graham Structure, deform the strata. Northerly dips in the limbs of these folds are generally 4°-5° and the limbs are 750 m to 1,500 m (one-half to one mile) wide. The interpretation of the folds as shown in Cross Section B-B' assumes that they are related to Laramide faulting of the basement although no direct evidence of this is available.

### **Joints**

Pervasive, closely spaced joints affect all Cretaceous units, but are best developed in more competent rocks such as the Greenhorn Limestone, and the Codell sandstone and Juana Lopez members of the Carlisle Formation. The near-vertical joints are nearly perpendicular to bedding, and commonly spaced between one and 10 centimeters (a few inches) apart, a pattern similar to spaced cleavage. They show a strongly clustered trend of N15°E.

The pervasive jointing may result from regional stresses during the Laramide Orogeny. Skotnicki (2003) notes that in folded rocks in the Las Vegas Quadrangle the joints are perpendicular to bedding, suggesting that joint development may have preceded folding.

### **Faults**

Three faults are recognized to parallel the N.15°E trend of the joints described above. All are present in the southeast quarter of the quadrangle, near to Interstate Highway 25, where they offset the Greenhorn Limestone. Strike lengths vary from one to three miles and dip separation is less than 12 m (40 ft.). Similar faults may be present, but unrecognized within the poorly exposed shale units.

## **LANDSCAPE DEVELOPMENT**

The Las Vegas NW quadrangle lies at the western margin of the Great Plains, with the western boundary essentially at the base of the Sangre de Cristo Range one and one-half to three kilometers (one to two miles) to the west. Drainages include the Sapello River on the north, Gallinas Creek at the extreme southwest, Canon Bonito on the northwest, and Arroyo Pecos and an unnamed, south-draining arroyo system in the central area. The basin divide south of the east-flowing Sapello Creek represents a continental divide: Water from the Sapello drainage ultimately flows to the Gulf of Mexico through the Mississippi River whereas that south of the divide enters the Rio Grande drainage basin.

Elevations range from 1,955 m (6,450 ft) in the south to 2360 m (7,080 ft) in the northwest corner and local relief is as much as 60 m (200 ft) in hills in the central part of the quadrangle. The higher elevations are underlain by gravel, Greenhorn Limestone and the Codell sandstone and Juana Lopez members of the Carlisle Formation. The locations and trends of valleys generally reflect an underlying shale unit, e.g., the Niobrara Shale on the west and the Carlisle Shale lower unit on the east. The more resistant Greenhorn Limestone forms a broad hill in the southeast corner of the quadrangle.

Along the southern flank of Sapello River, in the northeastern part of the map, extensive areas are underlain by gravel. These older gravels (map unit QTa) are composed of subrounded to well-rounded pebbles and cobbles derived mostly from Proterozoic quartzite and granitic rocks exposed in the Sangre de Cristo Mountains to the west. Based on the elevation above streams and the extensive development of caliche the deposits are here tentatively assigned to the late Tertiary or early Pleistocene.

The QTa gravels were likely deposited along a valley as alluvial fans, as stream terraces or, possibly as a broad pediment formed along the eastern front of the Sangre de Cristo Range. In any case, the elevation, 2070 m (6,830 ft) to 2,360 m (7,080 ft), of the base of the gravels represents a paleo-topography developed by the late Tertiary.

Portions of the Late Tertiary landscape suggested by the QTa gravel base was subsequently removed by down cutting of Gallinas Creek, Canon Bonito, Arroyo Pecos, and the large unnamed drainage in the east central part of the quadrangle. These drainages were entrenched as much as 121 m (400 ft) into the Cretaceous bed rock, forming three terraces, of probable Quaternary age, at elevations of 9-12 m (30-40

ft) (Qt1), approximately 30 m (100 ft) (Qt2), and 55 m (180 ft) (Qt3) above the present beds of these streams. The gravel caps of the terraces are similar in composition to the material found in QTa.

The margins of the gravel-capped terraces have steep slopes. Along many of these slopes, and extending outward for distances of as much as 910 m (3,000 ft), are pediment surfaces capped by reworked detritus from the adjacent terraces.

Soil is generally thin throughout the quadrangle. Locally, in the southeast, however, it is well developed on the lower shale member of the Carlisle Shale.

## **NATURAL RESOURCES**

### **Ground water**

Ground water resources are limited in this quadrangle, especially at depths to a few tens of meters (100 to 200 feet). The product of shallow wells in black Cretaceous shale is reported by local landowners to be generally usable only for livestock due to the sulphur content (recognized in the rotten egg smell). A local driller, Mr. Gordon Hays, notes, however, that drilling into the upper 10s of meters (a few hundred feet) of the quadrangle produces varying results. Some holes are dry, others contain the poor quality water noted above, and in rare instances a well only 30 meters (a hundred feet) or so from these holes may produce a few gallons per minute of drinkable water. It is likely that such wells lie along a strongly developed fracture system, although this is not proven to date.

Several water wells drilled in the central and western portions of the quadrangle encountered “white sandstone” (probably the Dakota Sandstone) at depths of 150 to 275 meters (500 to 900 feet) (Gordon Hays, oral commun., 2002). Although some holes were dry, many produced one to 10 gallons per minute of drinkable water. At depths of 300 to 330 m (1,000 to 1,100 ft), water encountered in “red sandstone” yielded as much as 11 gallons per minute in some holes.

The Hoover et al., San Guijilla #1 petroleum test found no petroleum, but resulted in an artesian well flowing a few gallons per minute of drinkable water. Mr. Charles Norman, (oral commun., 2002) foreman of the Traylor Ranch, says that this well has flowed continuously since it was drilled in 1929. According to a well log at the New Mexico Bureau of Geology and Mineral Resources well file library, this well bottomed at 810 m (2,673 ft), apparently in sandstone of the Permian Bernal Formation.

Water is also reported from deeper oil tests on what is now the Traylor Ranch. Mr. Charles Norman stated that a driller on the Monument Energy wells, drilled in 1974, told him that a strong flow of water was encountered from the lower portion of the #1 Sue Ann well. This well was drilled to a depth of 1,525 m (5,030 ft) and water from this depth would probably have been encountered in the Pennsylvanian Madera Formation.

### **Surface water**

Several streams cross the quadrangle, generally bringing water from the Sangre de Cristo Range to the west. These include the Sapello River, Canon Bonito, and Gallinas Creek. Water in the unnamed drainage in the central and northeast part of the area seems to derive from scattered, small springs at the contact of the Carlisle Shale with Greenhorn Limestone.

Storrie Lake receives water by canal from Gallinas Creek and serves as a storage basin for irrigation water as well as a popular recreational area. Water exits the lake through Pecos Arroyo and a canal that carries water to MacAllister Lake in the Las Vegas quadrangle.

### **Hydrocarbon exploration**

Sporadic exploration for hydrocarbons occurred during the mid- to late 1920's and from 1959 to 1974 (see map). These efforts focused on the Graham Structure and the parallel anticline to the north. Wells drilled in the late 1920's generally reached depths of 200 to 625 meters (660 ft to 2073 ft), bottoming

in Jurassic strata or the Upper Permian, although the Starr Oil Co Adams # 3 drilled to 1,542 m (5090 ft) (New Mexico Bureau of Geology and Mineral Resources, petroleum well log library). Later wells drilled to depths of 1425 to 1,555 meters (4700 ft to 5130 ft), testing the Lower Pennsylvanian and, in at least one case, reaching the Precambrian basement. No production resulted, although several “shows” were reported in the early wells.

### **Sand and gravel**

Sand and gravel are abundant in the Quaternary terrace deposits (Qt<sub>1</sub>, Qt<sub>2</sub>, and Qt<sub>3</sub>) and the Quaternary-Tertiary (QTa) alluvial fan. Deposits of well-rounded boulders, cobbles, and pebbles to approximately six meters (20 ft) thick cover large areas in the northern portion of the quadrangle. Small pits indicate past production within the quadrangle and the QTa unit is currently under extensive exploitation north of Sapello River just outside the area.

## **SELECTED REFERENCES**

- Baltz, E. H., 1972, Geologic map and cross-sections of the Gallinas Creek area, Sangre de Cristo Mountains, San Miguel County, New Mexico: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-673, scale 1:24,000.
- Baltz, E. H., and O'Neil, M. J., 1986, Geologic map and cross sections of the Sapello River area, Sangre de Cristo Mountains, Mora and San Miguel Counties, New Mexico: U.S. Geological Survey Miscellaneous Investigations Series Map I-1575.
- Griggs, R. L., and Hendrickson, G.E., 1951, Geology and ground-water resources of San Miguel County, New Mexico: New Mexico Bureau of Mines and Mineral Resources Ground-Water Report 2, 117 p., 2 sheets.
- Las Vegas Chamber of Commerce, 2002, Las Vegas and San Miguel County: The official 2002-2003 Tourism and Relocation Guide, 39 p.
- Mateer, N. J., 1987, The Dakota Group of northeastern New Mexico and southern Colorado, *in* Lucas, S.G., and Hunt, A.P., (eds.), Northeastern New Mexico: New Mexico Geological Society Thirty-eighth Annual Field Conference, September 24-26, 1987, p. 223-236.
- Miller, J. P., Montgomery, Arthur, and Sutherland, P.K., 1963, Geology of part of the Sangre de Cristo Mountains, New Mexico: New Mexico Bureau of Mines and Mineral Resources Memoir 11.
- Skotnicki, S., 2003, Geologic map of the Las Vegas 7.5' quadrangle, San Miguel County, New Mexico: New Mexico Bureau of Geology and Mineral Resources, Open File Geological Map, *OF-GM 72*.