Geologic Map of the San Felipe Mesa 7.5-Minute Quadrangle, Sandoval County, New Mexico

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Open-File Geologic Map OF-GM 219

Scale 1:24,000

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EXECUTIVE SUMMARY

The San Felipe Mesa quadrangle occupies the central and eastern Rio Puerco valley southeast of Loma Prieta Mesa, about 30 km northwest of Rio Rancho and 35 km north of where I-25 crosses the valley. The area encompasses the western boundary of the Albuquerque Basin. Northeast-striking, southeast-dipping (4-10° SE) Cretaceous rocks outcrop in the western quadrangle. These strata include, in ascending order: the Jackpile Sandstone Member of the Morrison Formation, various tongues of the Dakota Sandstone interfingering with Mancos Shale, the middle part of the Mancos Shale, Gallup Sandstone, and the Mullato Tongue of the Mancos Shale. Near the Moquino fault (a major north- to northeast-striking, east-dipping normal fault), one can observe Cretaceous strata between fault strands that are otherwise cut-out by the larger fault zone: the Dalton Sandstone and Gibson Coal-bearing Members of the Crevasse Canyon Formation, Point Lookout Sandstone, and the Satan Tongue of the Mancos Shale. The Dilco Member of the Crevasse Canyon Formation, although observed in the next quadrangle to the south (Benavidez Ranch), does not appear to be present on this quadrangle. West of the Moquino fault lies Late Cretaceous Menefee Formation overlain by 300-500 m-thick Santa Fe Group strata, interpreted to be 22-10 Ma. Near the northern quadrangle border, reddish gravelly sandstones of the Galisteo Formation are observed between the Menefee Formation and the Santa Fe Group, but these Paleogene strata are not present to the south. Several sand-dominated units, and one mud-dominated unit, of the Santa Fe Group can be readily differentiated.

Cretaceous strata tell a fascinating story of alternating marine transgressions and regressions associated with the Western Interior Seaway. After a period of fluvial deposition in the Late Jurassic, erosion or non-deposition ensued in the Early Cretaceous, leaving no stratigraphic record. Fluvial deposition (Encinal Canyon Member of the Dakota Sandstone) heralded the start of 15 m.y. of Late Cretaceous deposition. Deposition of Encinal Canyon strata was followed by nearshore sedimentation characterizing most of the Dakota Sandstone in this area (Oak Canyon, Cubero, Paguate, and TwoWells Members of the Dakota Sandstone) that alternated with deeper marine depositional environments (e.g., Clay Mesa Shale and Whitewater Arroyo Shale Tongues of the Mancos Shale). Above the highest nearshore facies of the Dakota Sandstone, the Twowells Tongue, lies ~160-180 m of gray to brown, fissile mudstone of the middle Mancos Shale. Gradationally overlying the middle Mancos Shale lies a single, regressive tongue of the Gallup Sandstone deposited in a nearshore environment (15-40 m thick). Following the next marine transgression, Mancos Shale deposition was remarkably sandy and silty (~95 m-thick Mullato Tongue), perhaps because of high sediment input from a nearby delta. The ~550 m thick Menefee Formation records deposition by river channels and associated floodplains on a coastal plain alongside the Western Interior Seaway.

The gravelly nature of the Galisteo Formation allows it to hold up ridges, whose east-trending trend is consistent with paleoflow derived from clast imbrication. This unit is conspicuous because of its light orange color and lack of volcanic clasts in its gravel fraction. The orientations of discontinuous outcrops, paleoflow data, thick accumulations

under ridges (~20 m), and general lack of preservation suggest aggradation in east-trending, discontinuous paleovalleys rather than sheet-like geometries.

There are several Santa Fe Group units that likely extend eastwards in the subsurface under the western Albuquerque Basin (listed from lower to upper): Zia Formation, Cerro Conejo Formation, and the Arroyo Ojito Formation. The three members of the Zia Formation record a transition from eolion-dominated conditions during 22-18 Ma (Piedra Parada Member, 80 m thick), sand-sheet fluvial or alluvial deposits 18-17 Ma (Chamisa Mesa Member, <35 m thick), and 17.5-16.5 Ma playa and playa-margin conditions inferred to be controlled by syndepositional subsidence along the Moquino fault (Cañada Pilares Member, <40 m thick). No obvious disconformity was noted at the top of the Zia Formation; rather, we interpret a compressed section for the lower 40-50 m of the overlying Cerro Conejo Formation (spanning 16.5-15.0 Ma).

The lower 150 m of the Cerro Conejo Formation was deposited in the distal reaches of a south-sloping piedmont or proximal basin floor by south-flowing paleo-drainages between 15 and 13.2 Ma. Distinctive, very thin-tabular bedded sand bodies and laterally extensive greenish mudstones (interpreted to be lacustrine) are consistent with basin floor deposition. Laterally continuous, tabular, internally massive to horizontal-planar laminated sand beds likely reflect deposition on a south-sloping distal piedmont.

A piedmont depositional environment is also inferred for the upper 120 m of the Cerro Conejo Formation, interpreted to be 13.2-11 Ma, but this piedmont was sourced from the northwest and had a southeast paleo-slope. The upper Cerro Conejo Formation exhibits a distinctive orangish color, interfingers with minor clayey sand beds, has southeast to south paleoflow indicators, and coarsens upwards so that chert conglomerates are present in the uppermost part of the piedmont lithofacies assemblage. We interpret this orangish sediment to have been deposited on a distal piedmont derived from drainages flowing southeastward into the Albuquerque Basin. This orange lithofacies assemblage is stratigraphically lower towards the west, indicating that it intertongues laterally with most of the lower 150 m of the Cerro Conejo Formation .

The uppermost subunit of the Cerro Conejo Formation (orangish piedmont lithofacies assemblage) grades upward over ~20 m into the overlying Navajo Draw Member of the Arroyo Ojito Formation (>100 m thick). The latter is notably browner than the Cerro Conejo Formation and is interpreted to be deposited by several relatively small, southeastward flowing rivers draining the San Juan Basin. Tongues of orangish sand with chert-dominated conglomerates are common in the western extent of the Navajo Draw Member, reflecting input from the same piedmont streams that were transporting chert into the upper Cerro Conejo Formation.

Northeast-striking faults, paralleling stratal strikes, are the most common structural element. Over the central and western parts of the quadrangle, these have poorly understood kinematics and their throw values are minor (typically <100 m). By far the largest structure is the north- to northeast-striking (10-40° azimuth) Moquino fault, where kinematic indicators indicate left-oblique normal slip consistent with east-west extension.

Stratigraphic displacement near the southern end of the fault on this quadrangle is on the scale of several hundred meters. The north to northeast trending Pilares fault, located 3 km to the east of the Moquino fault, exhibits west-down normal throw and 100 m of stratigraphic displacement. In the northeastern quadrangle, the Moquino fault merges with the northwest-striking Navajo fault.

On the hanging wall of the Navajo fault on this quadrangle, the Zia Formation and much of the Cerro Conejo Formation are 30-40% thinner than correlative strata near the southern border of the quadrangle. The reduction is thickness is likely due to relatively lower accommodation space on the higher part of a south-dipping ramp between the Navajo Draw-Moquino fault and the adjacent Sand Hill fault (located to the east). On this ramp, the Cañada Pilares Member is absent and the presence of the Chamisa Mesa Member is questionable. Near the Navajo fault, the Zia Formation strata and lowest Cerro Conejo Formation strata dip much more than higher strata (~30° vs. ~5°). This implies higher rates of hanging wall subsidence to the south along the Moquino fault during 18-16 Ma, consistent with playa deposition of the Cañada Pilares Member, and increased displacement rates along the Navajo fault after ~14 Ma.

Stratigraphic fence diagram of the Santa Fe Group on the San Felipe Mesa quadrangle