# Tectonics of the Central Rio Grande Rift: Results From an Integrated Geophysical and Geological Approach

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Structural connections ("accommodation zones") between basins in continental rifts are of different types, typically with different orientations even within a single rift. They play an important role in controlling distribution and facies of syntectonic sediments and magmatic rocks, and therefore resources such as groundwater, hydrocarbons, and minerals. Because these zones are commonly buried beneath rift-filling sediments, geophysical methods are of paramount importance in characterizing and understanding them. In the *Summer of Applied Geophysical Experience* (SAGE) program we focussed on the eastern part of the complex "Santo Domingo accommodation zone," a major structural zone of the central Rio Grande rift. This margin comprises a right-echelon stepover from the southern Española basin (EB) to the larger Albuquerque basin (AB) to the south. Within this zone, recent and currently active structures are superimposed across those of earlier periods of deformation (e. g., Laramide). We integrated existing geological mapping and borehole information with geophysical data acquired by industry surveys and by SAGE to understand timing and kinematic development of this complex zone.

The eastern margin of the broad Santo Domingo zone comprises at least three right-stepping relay faults (La Bajada, San Francisco, and Rincon faults), separated by plunging ramps trending parallel with the axes of the major basins and progressively downthrown toward the rift axis. These faults "relay" extension between the main EB and AB. From our data we tentatively estimate that ~3.2 km of vertical offset and an unknown amount of lateral slip has occurred on the prominent La Bajada fault zone. Significant flexural uplift has occurred on the footwall of the fault, producing shoulder uplift adjacent to the Española basin. On the San Francisco fault >1 km of vertical slip has occurred where imaged within the basin, but offset increases southward. We estimate that extension across these two faults is at least 2.5 km. Uplift of the Sandia block, combined with overlap of the La Bajada and San Francisco faults and greater vertical offset along the southern San Francisco fault, created a narrow, northward-plunging synform (Hagan basin) on the hanging wall of the La Bajada fault.

West of the San Francisco and Rincon faults lies the deep Santo Domingo basin, which gravity data suggest may be 6 km deep. We find no evidence in the Santo Domingo accommodation zone for any significant northeast trending faults, in contrast with the prominent Embudo fault zone separating the San Luis and Española basins.

Because lower Tertiary sedimentary rocks in the Hagan basin are deformed concordantly with underlying Paleozoic and Mesozoic rocks, we infer that structures in the accommodation zone formed together in the middle to late Tertiary, concurrently with uplift of the Sandia Mountains ~15-10 Ma. Growth over a substantial period of time is compatible with vertical offset along the La Bajada fault of ~3200 m on Precambrian rocks but only 200-300 m on 2.8 my old basalt. The pattern of relay faulting expressed within the Santo Domingo accommodation zone is compatible with left-lateral shearing along the axis of the Rio Grande rift.

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