

## **Paleoseismites in San Juan Basin Fluvial Sedimentary Rocks Indicate Syndepositional Seismicity in the Paleocene and Eocene**

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### **Abstract**

Paleoseismites in eastern and central San Juan Basin are observed in Paleocene–Eocene fluvial siliciclastic sedimentary rocks proximal to the basin-bounding Nacimiento fault and up to 50 km inboard, near the basin axis. Features include clastic dikes, convolute and overturned bedding, diapir-like structures, vents, anastomosing vein-like structures, and potential thixotropic bowls the early Paleocene (ca. 66.0 Ma) Ojo Alamo Sandstone, early to middle Paleocene (ca. 65.8 – 62.3 Ma) Nacimiento Formation, and early Eocene (ca. 56.0 Ma) Cuba Mesa Member and Regina Member of San Jose Formation. The lithologic compositions most affected are fine- to medium-grained feldspathic arenites and mud-clast conglomerates. Mud-clast conglomerates seem especially likely to become injectites: they make up less than 1% of the Regina Member of San Jose Formation yet comprise approximately 50% of injectites in that member. Convolute bedding is often truncated by overlying beds, indicating soft-sediment deformation occurred at or near the surface before deposition of overlying strata. While these features are most prevalent near the Nacimiento Fault on the eastern basin margin, the presence of clastic dikes in Eocene sediments near the basin axis suggests that significant basin-central syndepositional seismicity occurred during accommodation associated with Laramide flexure.

Basinwide, clastic dike measurements thus far reveal two major strike orientations: 055° (dominant) and 160° (subsidiary). The dominant clastic dike orientation is sub-parallel to prior estimates of Cretaceous– Paleogene WSW-ENE intraforeland (i.e., Laramide) shortening at the local to regional scale. Cross-cutting planar features that strike 020° may post-date the clastic dikes, but their relationship is not yet clear. The presence of paleoseismites in earliest Paleocene (Puercan North American Land Mammal Age) through early Eocene (Clarkforkian–Wasatchian age) indicates that seismicity occurred for at least approximately 10 million years in the Paleogene San Juan Basin, consistent with stratigraphic evidence of tectonism at this time. The presence of San Juan Basin paleoseismites could suggest early Cenozoic intraforeland earthquakes on the order  $M \geq 5$  that disrupted sedimentary structures prior to lithification. These preliminary data suggest a 10 m.y. episode of intermittent seismicity associated with the Cenozoic structural and depositional evolution of the San Juan Basin during the Laramide orogeny. Results from this work will be integrated into regional studies on the paleoenvironmental, depositional, and Laramide tectonic development of the area.

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