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# Origin of the Orogrande basin by strike-slip faulting: evidence from subsidence patterns and facies distribution

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Patterns of deposition in the Orogrande Basin of south-central New Mexico support the hypothesis that strike-slip faulting was an important factor in the tectonic origin of the basin. Previous studies have documented strike-slip kinematics along the late Pennsylvanian-Early Permian Fresnal fault and related structures on the eastern flank of the basin (Algeo, 1992; Cather, 2000). This tectonic style appears to have prevailed throughout the basin during the Pennsylvanian, as indicated by substage isopach maps, local development and distribution of conglomeratic and reefal facies, and presence of multiple local unconformities on the basin's western "Robledo Shelf".

Isopach maps of the middle and late Pennsylvanian and the Wolfcampian document evolution from a basin that initially consisted of two thick, elliptical depocenters separated by an arch or uplift in the Desmoinesian to a rhomblike depocenter with a central thick axis by the Virgilian. Local arching or uplift appears to have localized Virgilian biohermal buildups in the San Andres Mountains (Giles and Lawton, 1996). Although sparsity of data preclude precise resolution of the original basin geometry, data are sufficient to indicate that the basin is not simply an asymmetric wedge. Basin form thus does not strongly support the popular model that the Orogrande basin was a flexural foreland or intermontane feature adjacent to the Pedernal uplift (e.g., Ye et al., 1996).

Conglomeratic facies were deposited on both flanks of the basin late in its subsidence history. In the Caballo Mountains, situated on the Pennsylvanian Robledo Shelf, Bursum-equivalent (late Pennsylvanian or early Wolfcampian, depending on convention) strata consist of pebble-, cobble-, and local boulder conglomerate interbedded with shale and limestone. The strata thicken eastward (basinward) across the range and unconformably overlie truncated Pennsylvanian strata. The conglomerate was eroded from uplifted Pennsylvanian strata lying in and west of the Caballo Mountains and deposited in fan-delta, shallow-marine, and subordinate fluvial settings on the western flank of the basin. On the eastern Sacramento shelf, conglomerate of similar age and depositional setting was derived from the Pedernal uplift. Adjacent to the Fresnal fault, non-marine to marine facies distribution was controlled by a plunging growth syncline of probable wrench origin (Giles and Lawton, 1996). The local sediment sources recorded by the conglomerate do not resemble the unimodal source area predicted in a flexural, paired basin-uplift model.

Although biostratigraphic data remain insufficient to precisely define the positions and duration of unconformities in the Orogrande basin, intra- and post-Pennsylvanian hiatuses are evidently present on the Robledo Shelf. What appear to be simple low-stand deposits above a mid-Pennsylvanian sequence boundary contain recycled early Demoinesian fusulinids. The well documented sub-Bursum unconformity at the top of the Pennsylvanian section is also overlain by

detritus with recycled Desmoinesian fusulinids. These multiple unconformities and recycling of older Orogrande basin strata record repeated cycles of uplift and submergence, which we interpret as evidence of "porpoising", a subsidence style typical of strike-slip basins (e.g., Nilsen and Sylvester, 1995).

We attribute polycyclic subsidence history, polymodal source areas, intrabasinal uplift, and the overall geometry of the Orogrande basin to subsidence influenced by strike-slip deformation of the craton, probably in response to progressive suturing of Gondwana and Laurentia and probably utilizing structures of Precambrian ancestry. The underlying mechanism for the transcurrent faulting remains obscure, but the time equivalence of final Marathon suturing and late conglomerate deposition in the Orogrande basin suggest a tectonic link between the two phenomena. The collision of Australia with Indonesia is a more apt tectonic model for southern ARM tectonics than that of India with Asia. In our analog, Australia represents the overridden North American plate, with break-off of the formerly connected Iapetan slab arresting deformation prior to the development of Himalayan collisional topograpy.

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