Structural evolution of the Reserve graben, New Mexico: Implications for extensional tectonics at the junction of the Rio Grande Rift, Basin and Range, and Colorado Plateau

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History of strain accumulation in the transition zone between the Rio Grande Rift, the southern Basin and Range province, and the Colorado Plateau can inform the late Cenozoic tectonic history of SW North America. Study of basin fill and fault exposures in the Miocene-Quaternary Reserve graben within this transition zone is in progress to assess proposed tectonic models, and to provide additional timing and kinematic constraints on SW US extension in general. An anomalous NE-striking fault system formed the graben, which separates the relatively little-deformed Mogollon Plateau (core of the Mogollon-Datil volcanic field) from the SE Colorado Plateau. Previous workers (e.g., Chapin and Cather, 1994) predicted significant sinistral slip along Reserve graben faults, implying that the southeastern Colorado Plateau moved farther SW than the Mogollon Plateau relative to the stable Great Plains during rifting. Also, a mid-Miocene change from SW to WNW extension has been proposed for the southern and central Basin and Range (e.g., McQuarrie and Wernicke, 2005) and the Rio Grande Rift (Aldrich et al., 1986; Morgan et al., 1986), possibly driven by the evolving Pacific-North America dextral transform plate boundary. This model predicts early oblique or strike-slip on northeast-striking faults of the Reserve graben (dextral or sinistral, depending on relative motions of the Colorado and Mogollon plateaus), followed by dominantly normal dip-slip.

Fault slip-sense indicators and ⁴⁰Ar/³⁹Ar ages of volcanic and intrusive units in sedimentary basin fill inform the Reserve graben’s structural development. New ⁴⁰Ar/³⁹Ar ages bracket basin subsidence and sedimentation between ~16.4 and ~1.9 Ma (Whitman et al., this meeting). Cross-cutting relationships among kinematic indicators along the main boundary fault system suggest highly oblique dextral-normal slip followed by mainly normal dip-slip, consistent with a regional mid-Miocene change in extension direction. Early dextral kinematics suggest SW-directed Basin and Range extension continued past ~16 Ma. Apparent dextral offset of newly-dated intrusive units along the master fault system (Ratté, 1989) suggests that this change postdated ~14.7 Ma, and that SW-directed extension between the Plains and Mogollon Plateau was greater than that between the Plains and the SE Colorado Plateau. Future ⁴⁰Ar/³⁹Ar dating will test and refine these results.

References:


Keywords: