STRATIGRAPHY, TECTONICS, AND BASIN EVOLUTION IN THE ANZA-BORREGO DESERT STATE PARK REGION

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This chapter in the new book provides an overview of the geologic, stratigraphic and tectonic evolution of the Anza-Borrego Desert State Park region during the past ~10 million years. Plate tectonic forces determine where sedimentary basins form, how long and how fast sediments accumulate, and why they are later faulted, uplifted, and eroded at the Earth's surface. In the Salton Trough of southern California, late Miocene to present-day subsidence, filling, and final destruction of sedimentary basins has resulted primarily from the evolution of the greater San Andreas Fault system, which makes up the active plate boundary between the Pacific and North American plates. This complex fault network includes the dextral San Andreas Fault, various normal faults and the younger San Jacinto, Elsinore, and San Felipe strike-slip faults. My talk will present a brief overview of existing knowledge about the regional stratigraphy and tectonic evolution of sedimentary basins in the western Salton Trough since late Miocene time.

Although significant questions remain, the Neogene tectonic evolution of the western Salton Trough can be generally divided into three stages: (1) late Miocene extension and formation of nonmarine rift basins; (2) Pliocene to early Pleistocene normal and oblique slip on the west Salton detachment fault and formation of a large supradetachment basin (Axen and Fletcher, 1998); and (3) Pleistocene to modern strike-slip faulting and compressional folding.

Stage 1 is recorded in conglomerates and megabreccias of the Split Mountain Group, which is best exposed in and around Split Mountain Gorge.

Stage 2 was initiated with rapid incursion of marine waters in latest Miocene time, at ~6.5-6.0 Ma, apparently in response to localization of the Pacific-North American plate boundary along the San Andreas Fault and Gulf of California (Oskin and Stock, 2003). Marine incursion is recorded in the Fish Creek Gypsum and oldest turbidites of the Imperial Group. Tectonic subsidence early in stage 2 (earliest Pliocene) produced offshore marine conditions throughout the Salton Trough and northern Gulf of California that led to deposition of fossiliferous marine mudstone and sandstone of the Imperial Group. Voluminous input of Colorado River-derived sediment caused gradual filling of the basin and transition to terrestrial sedimentation in a large fluvial-deltaic system that was flanked by local rivers and alluvial fans (Palm Spring Group) (Winker, 1987; Winker and Kidwell, 1996). The detachment fault and upper-plate basin were deactivated by initiation of the San Jacinto, San Felipe and Elsinore strike-slip faults starting in late Pliocene or early Pleistocene time.

Geomorphic evidence for stage 3 is ubiquitous in the landscape and is reflected in present-day mountain ranges and ridges, active fault scarps, alluvial fans, eroding badlands, and playa lakes. Ongoing uplift and erosion has exposed the deposits of the older sedimentary basins in modern dry washes and canyons, making them available for the study of ancient depositional environments and the diverse life forms that inhabited them.