ABSTRACT

STRUCTURAL EVOLUTION OF THE VAL VERDE BASIN

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The nature and origin of the Val Verde Basin has frequently been misinterpreted by plate tectonicists. It has most commonly been called a foredeep basin associated with the Wolfcampian Marathon overthrust belt.

The Val Verde Basin began as a Pennsylvanian (Strawn) graben and is one arm of a rift-rift-rift triple junction formed over a thermal dome. The Val Verde, Delaware and Marfa Basins did not develop any new oceanic crust during this dilation or extension phase, and are properly called aulacogens. The principal difference is that the Val Verde graben is elongate parallel to the principal fracture system on the craton, and its configuration is simpler than the other two oblique rifts.

The thermal event that caused the lithosphere to dilate and break up also caused partial melting within the crust. Individual producing anticlinoria were developed over local batholiths, stocks and dikes. Many anticlinoria predate the formation of the aulacogens and lie partly in the basin and partly on the platform.

The brittle crust pulled apart along pre-existing vertical fracture systems during dilation and the overlying sediments were stretched and thinned. During the cooling period, the crust settled downwards from the arc towards the chord, and internally developed compressional structures were formed.

While the Val Verde Basin subsidence was initiated in Strawn time, the time of maximum uplift was at the close of the Pennsylvanian, and the maximum subsidence was during the ebbing or cooling phase in Wolfcampian time. As the crust cooled and contracted, it adjusted downwards by gravity, assisted by loading of sediments derived from the growing Marathon mountains.

There is little or no evidence for external compression or wrenching. By the time the Marathons had been obducted onto the craton, the cooled blocks had become recoupled and less responsive to external stresses. The main structural effect of the Marathons was loading, which has left its record.

This basin is a classic area for study of thermally induced deformation because there is no overprint of subsequent stresses. It should assist in understanding the structural evolution of areas with more complex histories, such as the Rocky Mountain foreland, the Anadarko aulacogen and the Rhine graben. Thermal deformation, long recognized, has not occupied its proper structural niche because it has never been applied to a simple type area.