Syn-orogenic Slope and Basin Depositional Systems, Ozona Sandstone, Val Verde Basin, Southwest Texas

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The Ozona sandstone is the stratigraphic record of Permian syn-orogenic deep-marine sedimentation in the Val Verde foreland basin. I used subsurface data (well logs and cores) to map Ozona genetic stratigraphy at multiple scales and to reconstruct depositional and tectonic history during the late Ouachita orogeny. Depositional controls on gas productivity in Ozona field were also investigated.

Shelf, slope, and basin-floor geomorphic elements were well developed in the northern Val Verde Basin. Each geomorphic element had characteristic bathymetry, gradient, and position in the basin, and each element can be recognized by distinctive stratigraphic architecture and depositional systems. Gravitational potential energy dominated sediment transport and deposition, resulting in concentration of sandy turbidite systems on the basin floor in aggradational strata. On the lower slope fine-grained turbidites and mass-transport complexes formed gently dipping, onlapping strata. The more steeply inclined upper slope was characterized by excavation and bypass on a relict Strawn carbonate surface. The shelf was also an area of bypass and erosion. Most syn-orogenic sediments were deposited beyond the shelf margin.

The principal Ozona depositional systems are line-sourced, delta-fed aprons, which are composed of sandy turbidite channels and lobes enclosed in muddy turbidite sheets. Turbidite channels are composed of thick-bedded, channel-fill sandstone facies that grade laterally into thin-bedded sandstones and mudstones of the channel-levee facies. Many channel-fill sandstones terminate downdip in mudstone, whereas others are attached to sandy lobes. Turbidite lobe sandstone facies display greater lateral continuity and greater variability in vertical bed-thickness trends than do channel-fill sandstone facies.

Depositional systems display systematic stacking patterns within Ozona stratigraphic sequences. Across sequence boundaries, however, depositional systems are abruptly rearranged, the main changes being in location and style of sandstone deposition and in sediment source areas and dispersal patterns.

Stratigraphic architecture, sequence development, and sandstone distribution are linked to tectonic events. Contemporaneous offlap in the south and onlap in the north record asymmetrical infilling and a northward-increasing lag time between subsidence and deposition. This overall northward migration of deposition coincides with foredeep migration as plate convergence progressed from south to north. Episodic thrusting events caused pulses of subsidence, which are recorded stratigraphically first by hemipelagic drape facies and then by shifting sandstone depocenters, features that mark the beginning of each Ozona sequence. Uplift on the Central Basin Platform created new sediment source areas and transport directions on the northern basin margin, which also resulted in rearrangement of turbidite systems on the basin floor.