Pennsylvanian-Leonardian Stratigraphic Architecture and Deformation History During and Post Late Paleozoic Orogenesis, East Delaware Basin, West Texas

Amanda Calle[1], Elizabeth Horne[1], Brian Casey[1], David Carr[1], Scott Hamlin[1], John Tackett[2]
[1]University of Texas at Austin; [2]University Lands

9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

The challenging characterization of unconventional reservoirs deposited on the eastern flank of the Delaware Basin during and following Ouachita-Marathon and Ancentral Rocky Mountains orogenies requires an integrated analysis of tectonics, sediment delivery, and base level. This study extracted the Pennsylvanian – Leonardian stratigraphic architecture and deformation history from well-log sequence stratigraphic correlations and 3D seismic reflection interpretation. Mapped thickness distributions reflect a significant change from partitioned, east-tapering clastic wedges that were deposited during Pennsylvanian-Wolfcampian fault-induced subsidence (Atoka - Wolfcamp B), to isopachous and conformable Leonardian post-orogenic infill (Wolfcamp A - Bone Spring). Unconformity-bounded successions across the east Delaware Basin suggest a minimum of four phases of deformation coeval with the deposition of: (1) pre-Pennsylvanian (lower Barnett?), (2) upper Wolfcamp D, (3) upper Wolfcamp C, and (4) lower Wolfcamp A. Pre-Pennsylvanian deformation is characterized by high-amplitude folds that resulted from east- and west-vergent, basement-involved reverse faults, and east-west-trending oblique faults. By contrast, Wolfcampian deformation nucleated preferentially along east-west-trending oblique faults. These oblique faults were reactivated by transpression during the Wolfcampian (with the largest displacement during Wolfcamp C deposition), and may have created local variations of base level that influenced the erosion of deep-marine, synorogenic fill in the hanging-

wall fault blocks. The regional spatial distribution of these faults partitioned the eastern Delaware Basin in roughly west-northwest to east-southeast-oriented sub-basins. Growth strata and apparently, coarser detrital facies within these sub-basins suggest local, east-west transverse, and north-directed axial sediment routing systems. Diagnostic stratigraphic architecture and dispersal patterns of deep marine, syn-, and post-orogenic deposits across compartmentalized sub-basins advances our unconventional reservoir characterization predictive criteria, and highlights the potential for new petroleum play concepts in these fault-bounded sub-basins.

AAPG Datapages/Search and Discovery Article # 91200 © 2020 AAPG Annual Convention & Exhibition Online, Sept. 29- Oct. 1.