Monday, March 27, 2006

HGS North American Explorationists Dinner Meeting

Westchase Hilton • 9999 Westheimer
Social 5:30 p.m., Dinner 6:30 p.m.

Cost: $25 Preregistered members; $30 non-members & walk-ups

The HGS prefers that you make your reservations on-line through the HGS website at www.hgs.org. If you have no Internet access, you can e-mail reservations@hgs.org, or call the office at 713-463-9476. (include your name, e-mail address, meeting you are attending, phone number and membership ID#).

by ***Steven L. Dorobek***
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Late Paleozoic Deformation in the Permian Basin Region: Styles, Patterns, Kinematics and Effects on Petroleum Reservoirs

The Permian Basin of West Texas and southeastern New Mexico is located in the foreland of the Ouachita-Marathon orogenic belt. The basin was segmented into several sub-basins by fault-bounded basement uplifts during late Paleozoic deformation that coincided with shortening in the Ouachita-Marathon orogen. The north-south trending Central Basin Platform (CBP) is one of these uplifts. It strikes at a high angle to the front of the orogenic belt. The CBP separates the Delaware Basin to the west from the Midland Basin to the east and is bounded by complex fault systems that vary from steep reverse faults to transpressional/transtensional deformation zones. The Ozona Arch is an eastern extension of the southern CBP and separates the Midland Basin from the Val Verde Basin. The Ozona Arch likely represents a broken forebulge that is bounded by steeply dipping, east-west-trending fault

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zones that accommodated oblique-slip displacement during late Paleozoic time. The Val Verde Basin was the narrow foredeep in front of the Marathon orogenic belt during Mississippian to early Permian time.

Three main stages of late Paleozoic deformation can be recognized across most of the Permian Basin, based on significant changes in lithofacies distributions, various styles of deformation across the basin, and where active deformation occurred over time. Before late Mississippian time, the Permian Basin was a relatively stable tectonic region that was characterized by extensive shallow-water carbonate sedimentation. Minor *en echelon* folding reflected the initial regionally distributed right-lateral transpressional deformation that developed during late Mississippian–middle Pennsylvanian time. These folds probably record the earliest phase of reactivation of deep, late Precambrian–early Cambrian extensional fault systems that predated formation of the Tobosa Basin, an ancestral sag basin that existed prior to late Paleozoic foreland deformation and development of the Permian Basin. Soon after deposition of the Strawn carbonate ramp facies during a middle Pennsylvanian phase of relative tectonic quiescence, renewed and amplified right-lateral convergence (i.e., dextral transpression) enhanced structural relief along the flanks of the asymmetrically faulted anticlines that are widely distributed across the Permian Basin region. Variable erosion across the crests of these asymmetric anticlines created tectonically enhanced unconformities that may have influenced porosity and permeability distributions within sub-unconformity lower and middle Paleozoic strata. 3D seismic volumes from the southwest Midland Basin show that some of these faulted anticlines also have resolvable fault and fracture systems that might have influenced production from Strawn and older strata. During late Pennsylvanian through Permian Wolfcampian time, widespread *en echelon* folding and faulting across the basin diminished, although right-lateral convergence continued and was mostly accommodated along the boundaries of the CBP as oblique-slip deformation and contraction. This last phase of deformation is dominantly expressed as steeply dipping reverse faults and asymmetrical flower structures along the boundary fault zones of the CBP. Major uplift of the CBP also occurred during this last phase of intraforeland deformation and the CBP served as the source for wedge-shaped, upper Pennsylvanian through Permian Wolfcampian synorogenic periplatform deposits. The entire area returned to tectonically stable conditions during Leonardian time, which allowed development of extensive carbonate platforms that built away from the structural margins of the CBP. ■

Biographical Sketch

Steve Dorobek received his BS in geology from Ohio University and his PhD from Virginia Tech. He has been a faculty member in the Department of Geology & Geophysics at Texas A&M University since 1987 and is currently Professor and holder of the M.T. Halbouty Chair in Geology. He has worked in many sedimentary basins worldwide, and his current research focuses on the role of tectonic deformation in carbonate-platform evolution and reservoir distribution.