

The tectonic source of the Pennsylvanian Orogeny in the Midcontinent, Permian, and beyond

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The Pennsylvanian Orogeny is a “catchall” term for the tectonics and mountain building events that shaped the eastern, southern, and western margins of North America during the Late Mississippian through Middle Permian. When it comes to deformation in the Midcontinent and Permian Basins, the Ouachita-Marathon fold and thrust belt is often invoked as the driving force for intracratonic basement-involved uplifts including the Wichita-Arbuckle System, the Central Basin Platform, Permian Basin structures, and even the Ancestral Rocky Mountains. However, the Ouachita-Marathon system is primarily thin-skinned deformation that does not involve basement rock. It is conceptually analogous to a rug (the thin-skin sedimentary section) sliding over a wood floor (the basement). Furthermore, the Ouachita-Marathon system verges to the north and northwest which suggests paleo-maximum horizontal stress was also directed north and/or northwest during this time. However, many of the intracratonic basement involved structures indicate an east or northeast vergent stress direction suggesting deformation was largely derived elsewhere.

This talk will discuss the structural styles and kinematics of Pennsylvanian-age deformation from the Anadarko Basin towards the southwest into the Permian Basin. Several structures will be presented that validate a northeast directed maximum horizontal stress during the Pennsylvanian that support more recent literature models inferring tectonics along the western and southwestern margins of North America were the culprit for intracratonic basement deformation. This includes two structures from the southern and northern Anadarko Basin, a structure along the Red River-Matador Arch, structures north of the Delaware Basin, and east of the Midland Basin. This presentation will also include a quick recap of larger Permian Basin and Ft. Worth Basin tectonics supporting the idea that deformation was driven by forces along the western and southwestern margins of North America during the Pennsylvanian.

By looking at the structural styles with regards to Andersonian Faulting Theory we can imply a paleo stress field, and by analyzing the syn-tectonic stratigraphy we can identify the timing of the paleo stresses. This information allows us to build a discussion invoking that deformation was driven by tectonics along the southern and southwestern margins of North America. Although Pennsylvanian-age tectonics along the southwestern margin of North America remains poorly understood, the resounding evidence support this region as the driving force for the Pennsylvanian Orogeny which begs for geoscientists to take a deep dive and decipher these illusive tectonics.