Structural Inheritance for the Laramide of Wyoming and Montana Implications for Basement Architecture of the Trans-Hudson Orogen and Development of Foreland Basins

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Abstract

The Laramide belt of the North American Cordillera is a thick-skinned orogen that continues to garner attention. Recent seismic studies provide a better understanding of Laramide tectonism at deep crustal levels. However, mechanisms for deformation accommodation in the upper crust remain unclear. A structural/tectonic analysis of basement-cored Laramide arches and uplifts in Wyoming and Montana, along with a hypothesis on the potential role of these features in Laramide orogenesis, is presented. This work provides evidence for the presence of Neoarchean convergence zones directed from SW-NE towards the Wyoming Province forming NNW anisotropies in north-central Wyoming. Regional compressional forces from convergence formed WNW- and NE-striking conjugate shears. Precambrian basement fabrics characterize all three directions of anisotropy in Wyoming. The Central Montana uplift lies just north of the Laramide belt in eastern Montana. It is characterized by six well-defined fault zones with trends to the WNW and NE; however, NNW trends seen in Wyoming are not present in Montana. Previous work attributes development of these Montana fault zones to transcurrent motion on basement-rooted faults that were reactivated during the Laramide. A Paleoproterozoic origin for the fault zones is proposed, with faults initially forming in cratonic basement as pure-shear conjugates during SW--NE convergence at the northeastern margin of the Wyoming Province. It is further proposed that the

conjugate shears were reactivated as simple shears during the Laramide under similar SW--NE stress conditions as those in the Precambrian. During the Laramide, reactivation of anisotropies occurred throughout Laramide contraction in both Wyoming and Montana. Reverse-left oblique-slip faults developed from reactivation of WNW fabrics and, where connected, acted as relay zones facilitating major arch development along NNW-striking faults in Wyoming. In contrast, WNW and NE anisotropies in central Montana were also reactivated, but because NNW zones of weakness are not observed in eastern Montana, NNW-trending Laramide arches did not form. Like Wyoming and Montana, western North Dakota and southern Saskatchewan may have developed similar basement anisotropies as a result of docking of the Superior/Wyoming cratons and the final assembly of Laurentia towards the latter stages of Trans-Hudson orogenesis. This has implications for the structural and tectonic evolution of the Williston Basin.

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