MESOPROTEROZOIC STRUCTURAL EVOLUTION AND LITHOLOGIC INVESTIGATION OF THE WESTERN LLANO UPLIFT, MASON COUNTY, CENTRAL TEXAS

by

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The Llano Uplift of central Texas contains the largest exposure of Mesoproterozoic rocks along southern Laurentia and is thus crucial to the understanding of orogenesis and plate reconstructions along a portion of one of the largest orogens in the world. Most of the current understanding of the Mesoproterozoic tectonic evolution of southern Laurentia comes from the southeastern portion of the Llano Uplift. To fully characterize the tectonic evolution Llano Uplift, detailed mapping is necessary in the less-studied western Llano Uplift.

The Mesoproterozoic Llano Uplift exposes mid-crustal, poly-deformed and metamorphosed schists and gneisses and abundant pre- to post-tectonic granites through an erosional window of Phanerozoic sedimentary rocks. Three lithologic groups were mapped in the western Llano Uplift, from structural highest to lowest these are the Valley Spring Gneiss (VSG), Lost Creek Gneiss (LCG) and Packsaddle Schist (PS). The VSG consists of pelitic schists and pink quartzofeldspathic schists and gneisses. The LCG is a thick, homogeneous package of medium- to coarse-grained augen granite gneiss, interpreted to be a deformed coarse-grained porphyritic pluton. The PS consists of a heterogeneous package of interlayered quartzofeldspathic gneisses and amphibolites and minor marbles. These lithologies are consistent with the PS and VSG domains described in the southeastern Llano Uplift (Mosher, 1998; Reese et al., 2000). The exotic Coal Creek Domain (CCD) of the southeastern Llano Uplift is not observed in the western Llano Uplift.

The western Llano Uplift, including the VSG, LCG and PS, records a deformational history that resulted in multiple fold generations F1-F5 and characterized by a penetrative axial planar foliation S1-S5. F2's are isoclinal folds of S0 (primary layering) and S1 that locally fold F1 axial planes and have steeply plunging and generally easterly trending hinge lines. F3 folds are locally developed, nearly collinear and coplanar with F2's, tight to open, and fold all previous structures (F1/F2) and fabrics (S1/S2). F4's are open folds with northeast-trending axial traces that occur on a regional-scale,. F5's are open to tight folds of all previous structures, with hinge lines that are primarily southeast trending and steeply plunging. S0 to S3 orientations vary from north to east dipping because of reorientation by younger folds. S4 foliations strike to the northeast and S5 foliations are northwest striking and nearly vertically dipping. Late left-lateral shearing (D6) with generally an easterly trend and boudinage affects the VSG, LCG and VSG in this study area and is commonly associated with unfoliated granite material. Four generations of

intrusive granitic sills and dikes are documented and provide relative and absolute age constraints on deformation. The oldest recognized deformation (D1-D3) is constrained between 1253 +5/-3 Ma and 1126 +5/-4 Ma (Roback, et al., 1999). D4 and D5 deformation are constrained between 1126 +5/-4 Ma and 1076 ± 5 Ma (Roback, et al., 1999). Although a change in metamorphic conditions is documented to have occurred between D2 and D3, metamorphic fabrics and assemblages indicate granulite facies conditions during D1, D2 and D3. Amphibolite facies metamorphism occurred during D4 and presumably D5.

Deformation in the Llano Uplift has a similar polyphase deformational history to that recorded here for the western Llano Uplift. Deformation in the eastern Llano Uplift is similarly constrained between ca. 1238 to 1091 Ma. In addition, the youngest deformation generation (F5) can be directly correlated in orientation and timing from the western to the southeastern Llano Uplift, and is constrained between ca. 1119 and 1091 Ma in the southeastern uplift. Both the western and eastern Llano Uplift contain late shear zones and extension structures. Structural differences between the western and southeastern Llano Uplift include differences in style and orientation of all but the latest (D5 and D6) structures. In addition, dip of fabrics and, therefore, structural stacking of lithologic domains is opposite, and no mylonite zones were identified in the west.

In conclusion, the lithologic domains appear to correlated across the Llano Uplift based upon gross lithologic similarities and the tectonic evolution is similar to the well-studied southeastern Llano Uplift, though the kinematics and orientations differ.

These conclusions may require that the kinematics of deformation in the southeastern uplift were controlled by the presence of the exotic island arc terrane (CCD) whereas the kinematics of deformation in the western uplift were controlled by continent-continent collision.