

A STRUCTURAL, PETROLOGIC, AND GEOCHEMICAL INVESTIGATION OF THE VALLEY SPRING GNEISS OF THE SOUTHEASTERN LLANO UPLIFT, CENTRAL TEXAS

by

Justin Andrews Zumbro, M.S.

THE UNIVERSITY OF TEXAS AT AUSTIN

December, 1999

Supervisor: Sharon Mosher

Recent studies of the Valley Spring Gneiss (VSG) of the southeastern Llano Uplift of central Texas indicate that these gneissic rocks are dominantly of igneous origin and share a common deformational history with the supracrustal rocks of the overlying Packsaddle Schist. The results of this study further constrain the tectonic evolution of the Grenville orogenic belt along the southern margin of Laurentia. Deformation affecting the VSG is similar in style, orientation, and tectonic transport to that of the Packsaddle Schist. The dominant fabric is S_2 , which is axial planar to tight to isoclinal folds of S_0/S_1 .

Asymmetric augen in mylonites reveal tectonic transport to the NE. The ubiquitous, SE-trending lineation is an intersection lineation parallel to major fold axes. S_3 is a well-developed metamorphic fabric that cuts S_2 at a low angle. Both S_2 and S_3 are traceable across the contact between the VSG and the Packsaddle Schist. In the area mapped, S_4 is only locally expressed in the VSG as ESE – plunging crenulations. Broad, open, NE-verging F_5 folds reorient all previous structures. The only type of structure commonly observed in the VSG that is rare in the Packsaddle Schist is a late extension in two directions producing large-scale, pervasive boudinage. The effects of boudinage are most pronounced adjacent to garnet clinopyroxenite layers.

Field mapping of a 4.5 km x 11.5 km area ~8km SE of Llano and NW of the contact with the Packsaddle Schist in Honey Creek as well as thin section analysis has distinguished five laterally extensive, mappable units of primarily intrusive (?) igneous origin in the uppermost VSG. Compositions are dominantly microcline – rich granitic gneisses with lesser amphibole, biotite, and biotite – amphibole gneisses. These gneisses are in thrust contact with the overlying Packsaddle Schist and are ~20 m.y older. At structurally deeper levels, the VSG becomes a more diverse lithologic unit dominated by metasedimentary rocks with lesser interlayered metaigneous rocks. The oldest dated unit in the uplift that records an older deformational and metamorphic history (Reese, 1995; Reese et al., in review) is laterally extensive and intruded by amphibole and felsic gneisses. Abundant late, syntectonic aplites and pegmatites cut the pervasive schistosity, but are also foliated, at least at the margins of larger bodies. Garnet clinopyroxenites, apparently representing retrogressed eclogitic rocks, are also preserved with observable contacts. These layers parallel the gneissic layering and major compositional contacts and are extensively boudinaged. The margins of the boudins are foliated parallel to the surrounding gneissic

foliation, particularly where severely retrogressed, and in some boudins, contain an older, highly oblique foliation. The nesting of these boudins with those of weakly foliated pegmatites indicates that boudinage was late syntectonic.