

ABSTRACT

POLYPHASE DEFORMATION AND METAMORPHISM OF THE MIDDLE PROTEROZOIC COAL CREEK SERPENTINITE, GILLESPIE COUNTY, TEXAS

by

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The Middle Proterozoic Coal Creek Serpentinite and adjacent schists and gneisses of the southeastern Llano Uplift, Gillespie County, Texas, have been multiply deformed under amphibolite facies metamorphism during a Grenville-age (1.0-1.3 Ga) orogeny. At least 5 phases of folding, as well as previously undocumented "chocolate tablet" boudinage, affected the southeastern Llano Uplift. The Coal Creek Serpentinite is one of few Grenville-age ultramafic rocks and is a critical part of tectonic models for Texas and North America during the Precambrian. The Coal Creek Serpentinite has been considered to be an altered remnant of an ophiolite.

Detailed mapping of a traverse across the well-exposed Coal Creek Serpentinite body into adjacent Packsaddle Schist and Big Branch Gneiss shows that Coal Creek Serpentinite has been multiply deformed, indicating a complex post-emplacement (and perhaps emplacement) history. Packsaddle Schist shows 2 sets of isoclinal folds (F1 and F2) producing a mushroom-type

fold interference pattern that has been refolded by at least 2 sets of later folds. The predominant regional metamorphic layering (S2) is axial planar to F2 folds. Adjacent to the Coal Creek Serpentinite, extension of S2 in nearly orthogonal directions within a NNW-trending plane produced chocolate tablet boudinage recording high extensional strain, probably by foliation boudinage.

Coal Creek Serpentinite adjacent to Packsaddle Schist shows a similar sequence of deformational features. Serpentinite texture varies from schistose to massive, with 2 orientations of cross-cutting mineralogical layering. Talc-rich Coal Creek Serpentinite at the margins of the body shows 2 crenulation cleavages that correspond in orientation to late-stage folds within Packsaddle Schist.

Serpentinization of the Coal Creek ultramafic body occurred in at least 2 phases, an early phase of serpentinization best preserved in deformed reaction zones around the margins of the body and near amphibolite dikes within the Coal Creek body, and a post-tectonic pervasive serpentinization event probably associated with granite emplacement during the Precambrian.

The polyphase deformation of the Coal Creek area is consistent with the complex deformational history documented elsewhere in the southeastern Llano Uplift and indicates that the serpentinite was emplaced early in the deformational history. If the Coal Creek Serpentinite is indeed a remnant from Grenville-age subduction, its subsequent deformational history requires collision of an island-arc or continental mass with the North American craton prior to 1.0 Ga.