American Mineralogist, Volume 79, pages 154–160, 1994

Nearly pure iron staurolite in the Llano Uplift and its petrologic significance

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ABSTRACT

Staurolite very close in composition to the Fe end-member is an abundant component of two lithologic layers in an unusual metasedimentary sequence in the Proterozoic Rough Ridge Formation (Packsaddle Group) along White Creek in the southeastern Llano Uplift, central Texas. The exceptional composition of this staurolite makes it an attractive candidate for use in mineralogical, experimental, and thermochemical studies.

The abundance of this nearly pure iron staurolite at White Creek contrasts with nearby evidence for early crystallization and later elimination of staurolite with a typical Fe-Mg ratio. This is consistent with the hypothesis that staurolite spanning a range of Fe-Mg ratios grew during an early moderate-*P* to high-*P* dynamothermal episode, but that only Fe-rich staurolite survived later low-*P* static metamorphism. The White Creek rocks also record incomplete reaction of staurolite + quartz to produce almandine + sillimanite. This reaction might represent the peak of prograde crystallization during early dynamothermal metamorphism near 700 °C and 7 kbar. Alternatively, the reaction might represent partial reequilibration to conditions near 550 °C at ~2.75 kbar during the later static metamorphic event; this alternative presumes that breakdown of unstable H-rich (high-*P*) staurolite yields a metastable almandine + sillimanite assemblage because conversion to a stable low-H staurolite composition is kinetically impeded. Under either interpretation, these observations imply that the southeastern Llano Uplift shared the complex polymetamorphic history documented previously for the northern and northwestern uplift.