PETROLOGIC CONSTRAINTS ON THE TECTONIC EVOLUTION OF THE LLANO UPLIFT

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1. Abstract

Tectonic models for the Proterozoic evolution of the Llano Uplift must account for a polymetamorphic history dominated by two kinematically distinct events. Early dynamothermal metamorphism took place at moderate to high pressures and decreased in intensity from southwest to northeast across the uplift. Late largely static metamorphism at lower pressures resulted from a thermal event linked to regionally widespread emplacement of granitic intrusions at relatively shallow levels in the crust.

Relict mineral assemblages that provide thermobarometry for the early event are preserved only in a few localities, but regional patterns of prograde growth zoning in garnet demonstrate that the Uplift as a whole underwent early high-grade metamorphism at elevated pressure. The dominant mineral assemblages in the uplift, characteristic of low-pressure metamorphism in the middle amphibolite facies, commonly overprint deformational fabrics with static recrystallization textures. In key calc-silicate localities, these later assemblages are genetically linked by evidence from phase equilibria and stable-isotope compositions to the widespread intrusion of granitic plutons.

The petrologic evidence is consistent with emerging tectonic models that invoke southwestward subduction of the Proterozoic margin of the continent. Subsequent uplift of deeply buried rocks to shallow crustal levels, where major pulses of granitic intrusion took place as deformation waned, was more pronounced in the southwest than in the northeast.