



Thermochronology of the Grenville Orogeny in west Texas

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Abstract

The Carrizo Mountain Group (CMG) comprises the westernmost exposures of the metamorphic core of the Grenville Orogen in Texas. Unlike the correlative Llano uplift, 500 km to the east, the CMG underwent one phase of medium P/T metamorphism; peak T was attained during D_2 in all CMG exposures. The peak metamorphic paleotemperatures decrease to the northwest, in the overall direction of tectonic transport, from staurolite to biotite grade. Garnet in the southeast Carrizo Mountains grew isothermally and probably during decompression (i.e. part of a clockwise $P-T$ loop) at ca. 520 °C, in between biotite-grade D_1 and D_3 events. Hornblende in this region cooled below closure T , during D_2 , at 1057 ± 6 Ma, within error of muscovite closure in the northwest Carrizo Mountains at 1059 ± 2 Ma. Hornblende in higher grade exposures to the southeast cooled through closure T as late as 1002 ± 7 Ma. Muscovite in the garnet-grade and higher exposures closed to Ar diffusion at 992 ± 4 Ma to 981 ± 3 Ma. Biotite and (partially recrystallized) hornblende from the northwest Carrizo Mountains cooled through closure in this same time period. We interpret these data as signifying: (1) Ar loss due to peak metamorphism in hornblende (southeast Carrizo Mountains) and muscovite (northwest Carrizo Mountains) at ca. 1059 Ma; (2) post- T_{max} cooling through 500 °C in the higher grade outcrops until ca. 1000 Ma; and (3) cooling of all CMG exposures through 300 °C, due to uplift along the Streeruwitz thrust and erosion, from 1000 to 980 Ma. These ages significantly post-date known tectonism in the Llano uplift and extend the duration of Grenville orogenesis in Texas by ca. 115 million years. The 1000–980 Ma time period is a time of thrusting in frontal regions of the Grenville Province of Canada and the northeastern US, and shearing in the Natal Province, South Africa, suggesting ultimate closure of the Grenville Orogen and supporting recent Rodinia reconstructions.

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