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Syntectonic microstructures record local strain on the Montana Transverse Zone

In the north Doherty Mountain area a small ~77 Ma igneous stock with associated dikes and sills has been folded along with the country rock into a series of anticlines and synclines. Carbonate rocks adjacent to the intrusions have been variably metamorphosed to marble. Thermally activated crystal-plastic deformation by dislocation creep and recorded by microstructures in the intrusions and metamorphic rocks must have occurred during cooling of the pluton and so provide a "snapshot" of local deformation at ca. 77 Ma. Lower-T deformation is recorded by calcite twins. These local microstructural indicators of strain can be used to ascertain a relationship with the large-scale NW-SE directed strain that produced folds in the area, which lies along the transpressional Southwest Montana Transverse Zone. Twin analysis reveals a preferred orientation of twin planes deformation, which may be used to calculate stress axes. Twin types may be indicative of temperature regimes of deformation. Petrologic analysis of the 8 samples shows that the deformed marbles vary in calcite and quartz content; from 40% calcite and 60% quartz to ~6% quartz to 94% calcite, contain few other accessory minerals, and show highly twinned calcite grains that vary in size from 1 mm to very fine grained.