

Public Abstract

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Title:Mechanisms for the Formation of Spiraled Inclusion Trails in Garnet Porphyroblasts from the Precambrian Core of the Laramie Mountains, Southeastern Wyoming

Relationships between deformation fabrics and porphyroblasts have been used to evaluate the metamorphic and deformational histories of mountain belts. However, some porphyroblast-fabric relationships, such as those of spiral inclusion trails in garnets, remain controversial. Two end-member models for their formation include: 1) a rotational model that invokes rotation of progressively growing garnet porphyroblasts, and 2) a non-rotational, model that involves multiple periods of garnet growth, resorption, and successive overprinting of near-orthogonal foliations. However, field, petrographic, and microanalytical techniques used to evaluate the origin of spiral inclusion trails from the Laramie Mountains appear consistent with overgrowth of an existing crenulation foliation and only modest rotation. This study used petrographic examination of inclusion trails, Electron Probe Microanalysis (EPMA), and Electron Backscatter Diffraction (EBSD). The EPMA study analyzed low diffusivity elements, such as Mn, Cr, and Y to determine garnet growth patterns relative to inclusion trail geometries. The EBSD analysis evaluated crystallographic structures within garnet grains. Analysis of the growth histories of our spiraled garnets is consistent with ~ 180 degrees of apparent rotation as a result of the overgrowth of an asymmetric crenulation foliation during progressive shortening and continued foliation development. Additional rotation is the product of foliation wrapping that occurs around the hard spot created by the growing garnet and the onset of rotation resulting from partitioned shear strain around garnet porphyroblasts that may occur during folding of interlayered units. An example is presented to explain ~360 degrees of apparent rotation via as little as 58 degrees of real rotation.