

AGE AND RELATIONSHIPS OF SHEAR ZONES IN THE HATFIELD PLUTON, WESTERN MASSACHUSETTS

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The Hatfield Pluton, of Devonian age, is located on the western margin of the Connecticut River Valley in western Massachusetts. The pluton is composed of three main rock types (quartz monzodiorite, hornblendite and alkali granite) and is cut by a 2 m thick fault breccia and a myriad of thin, tabular, pistachio green shear zones. Additional crosscutting planar features, including dikes, joints and hydrothermal veins, permeate the pluton.

The purpose of this study was to determine the nature of shear zone formation and evolution. Field, petrographic and SEM/EDS analyses indicate that the shear zones in the Hatfield Pluton are the result of a series of dominantly brittle deformation events. Analysis of the characteristic, pistachio green shear zones reveals high epidote content. This epidote is unrelated to mineral alteration of the host rock as evidenced by lack of Ca-reduction in the surrounding plagioclase. Thus, epidote, though typically found in metamorphic mineral assemblages, is believed to have precipitated from hydrothermal fluids concurrent with shear zone deformation. This study shows that fluids also played a significant role in the formation of the fault breccia and the chloritic microbreccia.

The brittle shear zones are believed to relate to Mesozoic faulting on the western edge of the Deerfield and Hartford basins. The presence of epidote, fault breccia and the chloritic microbreccia add support to evidence of a vertical movement of approximately 1 km on this western boundary fault. It is possible that all shear zones are the result of progressive deformation as the system underwent uplift related to faulting over time.