Timing and style of deformation in the Nashoba Formation, eastern MA

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Abstract

The Nashoba terrane (NT) is a moderately north-dipping fault-bounded block within the New England Appalachians and is located on the southwestern end of the Nashoba Formation, resulting in metamorphism. The Nashoba Formation (NF) is the NW portion of the NT and preserves a complex deformational history. The NF is comprised of tonalitic–granodioritic quartz-syenite and amphibolite, with interlayered calc-silicate, impure quartzite, marble, and sillimanite-bearing gneiss. Deformation in the Nashoba Formation is dominated by isoclinal folds, overprinted by top-down-to-the-NW asymmetric folds. These folds and mylonites are the northwestward continuation of the Basement Province cut by subvertical NW-side-down ~0.5 m wide shear zones, and later local subhorizontal NW-dipping top-down-to-the-NW ultra-cataclasites. U-Pb zircon dating indicates that the Basement Province is at least 368 Ma in age, and post-Acadian isoclinal folding of basement rocks is indicated by previously in this portion of the Nashoba Formation. Partial melting may have resulted in the best exposed metasedimentary unit in the NT and preserves a complex deformational history. The NF is comprised of tonalitic–granodioritic quartz-syenite and amphibolite, with interlayered calc-silicate, impure quartzite, marble, and sillimanite-bearing gneiss.

Nashoba Formation Lithologies and Structure

Nashoba Formation Folding

Late Stage Movement

Conclusions

- Structural analysis shows that the Nashoba Formation was first isoclinal folded, and then refolded by top-down-to-the-NW asymmetric folds. Isoclinal and asymmetric folds are cut by top-down-to-the-NW sub-vertical normal shear zones, NW-dipping top-down-to-the-NW ultra-cataclasites, and later normal brittle faults.
- CA-TIMS U/Pb zircon dating indicates that folded dikes are 368 Ma, 365 Ma and 362 Ma and a cross-cutting dike is 364-361 Ma. The timing of folding within the Nashoba Formation is not simple, and may be diachronous across the field area.
- Crystallization ages for migmatic metas in the Nashoba Formation are ~35 Ma younger than previously dated within the terrane (Hepburn et al., 1995). These new ages could possibly be related to either the accretion of the Meguma terrane, or to deformation melting related to the exhumation of the Nashoba terrane from depth.