

I. Introduction

Purpose

To analyze and interpret the rock structures between and within the Nashoba, Putnam, western Avalon and eastern Merrimack terranes.

Background Information

The Nashoba-Putnam terrane (NPT), Avalon terrane (AT) and Merrimack terrane (MT) in southeastern New England are a part of the Appalachian mountain range. The Appalachians formed through multiple orogenic events that occurred during the Ordovician to Permian period (Hatcher, 2010).

Ganderia and Avalonia are two terranes that were derived from supercontinent Gondwana (Hatcher, 2010). The NPT resided along the eastern boundary of Ganderia (Hatcher, 2010). The NPT was created through arc/back-arc volcanic activity and sedimentation (Hepburn et al., 2014). The accretionary event significantly metamorphosed the terrane (Hepburn et al., 1995). The Acadian orogeny (425 - 360 Ma) involved accretion of the AT to Ganderia after subduction of ancient Rheic oceanic crust (Hepburn et al., 1995).

The Merrimack terrane (MT) is located west of the NPT. The Rocky Pond Slice is an enigmatic domain between the Nashoba and Merrimack terranes (Stroud et al., 2009). The Ruebens Hill Complex is a predominantly mafic complex along the Merrimack terranes northern margin and lies just north of the Rocky Pond Slice.

II. Methodology

1

Digitized bedding, schistosity/gneissosity, and cleavage locations within the Nashoba-Putnam, Avalon, and Merrimack terranes from geologic quadrangle maps

2

Compiled strike and dip orientation measurement types (bedding, schistosity/gneissosity, and cleavage), rock types, and terrane classification (Nashoba, Putnam, Merrimack, and Avalon)

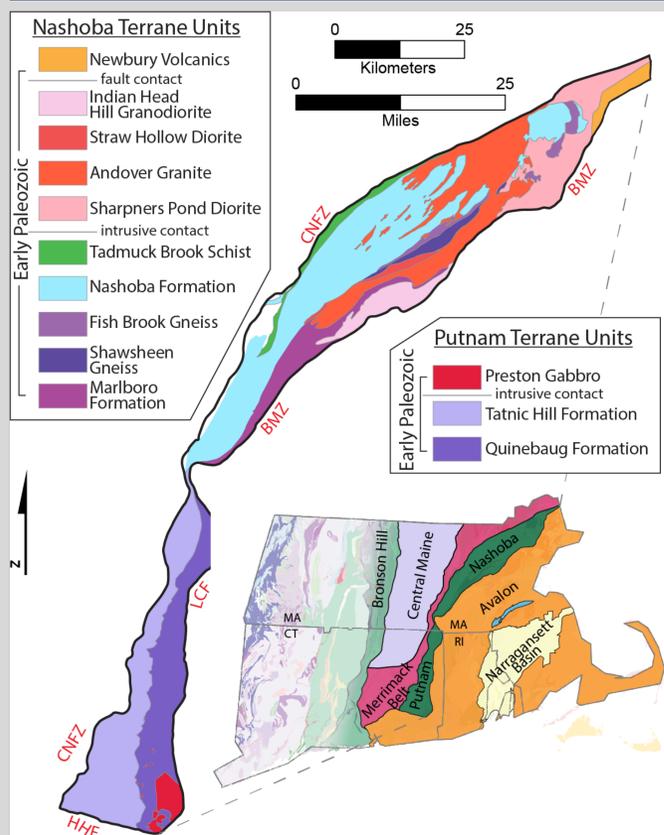
3

Analyzed for observable trends in structural orientations within the NPT, western AT, and eastern MT

4

Used the stereographic projection program, **Orient 3.10.0**, to analyze the structural data from areas within the NPT, western AT, and eastern MT

III. Location Map



V. Conclusion

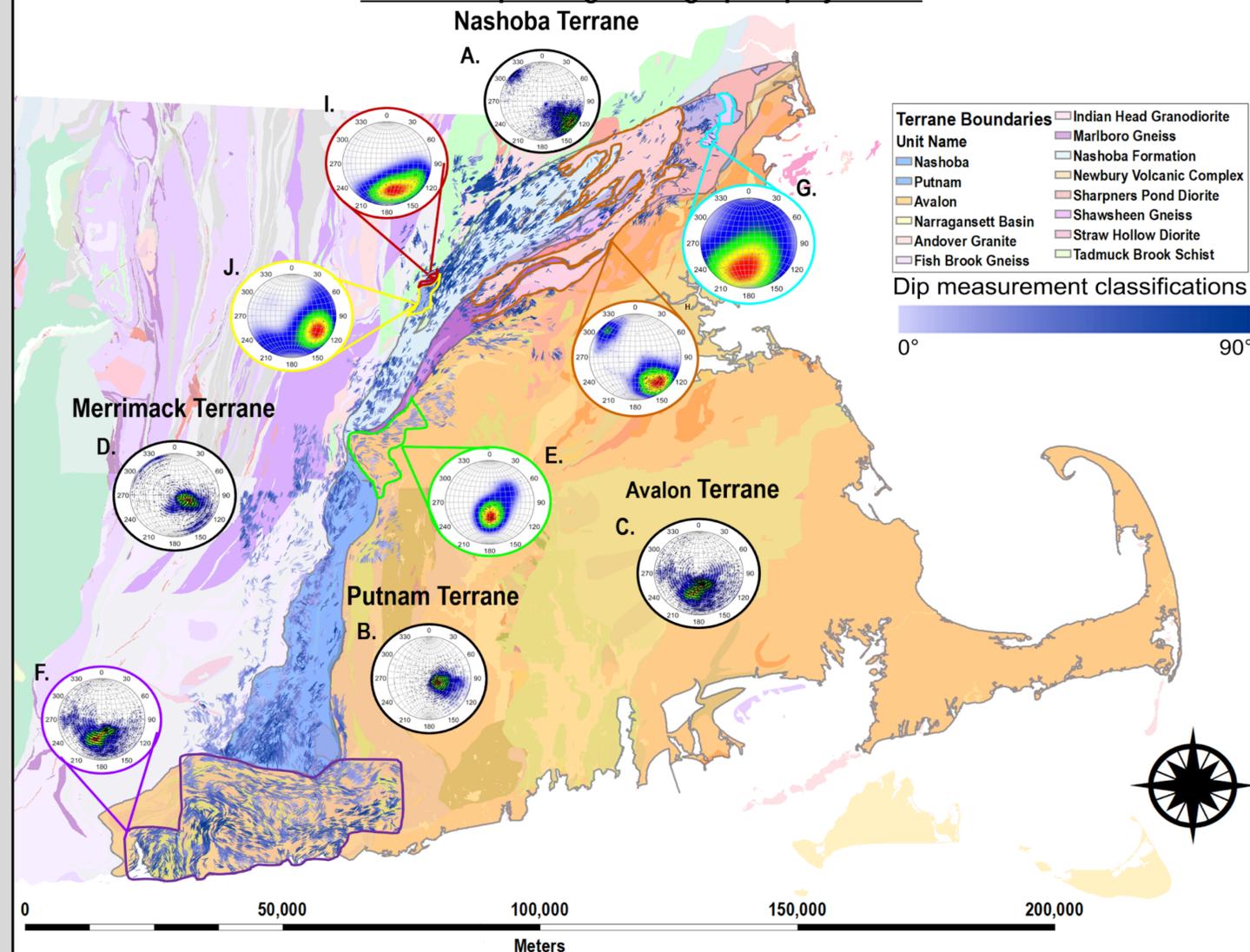
- Orientations of structures within the Nashoba terrane gradually shallow from north to south
- Orientations of structures within the Putnam terrane systematic alternate between shallower and steeper dips across the terrane, possibly suggesting folding.
- In and along the impingement between the Nashoba and Putnam terranes structures strike westerly, possibly because of folding or indentation.
- In the southern Avalon terrane structures strike generally westerly, but have a swirly appearance on the map, that may reflect the generally high metamorphic grade and partial melt in the area.

References: Hatcher, R.D., 2010, The Appalachian orogen: A brief summary: The Geological Society of America, v. 206, p. 1-19, doi:10.1130/2010.1206(01).
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J. Hepburn, G. Dunning, R.H., 1995, Geochronology and Regional Tectonic Implications of Silurian Deformation in the Nashoba Terrane, Southeastern New England, U.S.A: Geological Association of Canada, v. 41, p. 349-365.
Stroud, M.M., Markwort, R.J., and Hepburn, J.C., 2009, Refining temporal constraints on metamorphism in the Nashoba terrane, southeastern New England, through monazite dating: Lithosphere, v. 1, p. 337-342, doi:10.1130/150.1.

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IV. Results

Strike and dip data for the Nashoba-Putnam, western Avalon, and eastern Merrimack Terranes with corresponding stereographic projections



Structural analysis per terrane

- A. Nashoba Terrane:** structures of the Nashoba terrane generally vary from steeply northwest dipping in the north to moderately west-northwest-dipping in the south.
- B. Putnam Terrane:** shallowly northwest dipping with systematic alternation between shallower and steeper dips across the terrane, from west to east, respectively.
- C. Western Avalon Terrane:** structures generally dip northerly, but variation exist within and beyond compiled maps.
- D. Eastern Merrimack Terrane:** structures generally dip moderately to shallowly west-northwest.

Structural analysis per domain within terranes

- E. Central Avalon Terrane:** structures cluster around a moderate northerly dip, but also spread weakly along a great circle.
- F. Southern Avalon Terrane:** map and projection show scattered data suggesting complex map-scale folds, but structures dip generally north.
- G. Fish Brook Gneiss:** structures dip moderately to steeply to the northwest.
- G. Andover Granite:** structures dip steeply to moderately to the northwest.
- H. Ruebens Hill Complex:** dips are moderately to steeply to the north-northwest.
- I. Rocky Pond Slice:** structures dip moderately to steeply to the west-northwest.