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Preliminary Bedrock Geologic Map of the Milford Quadrangle, Massachusetts
Sheet 3: Spatial Distribution of Structural Data

by Joseph P. Kopera

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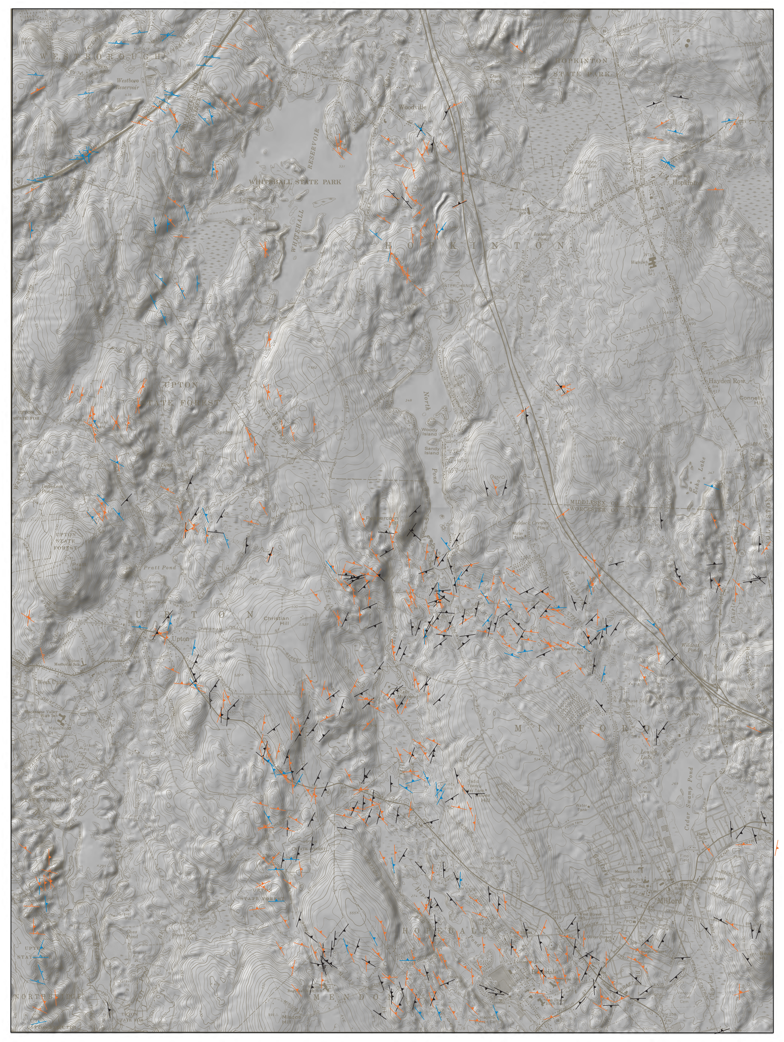
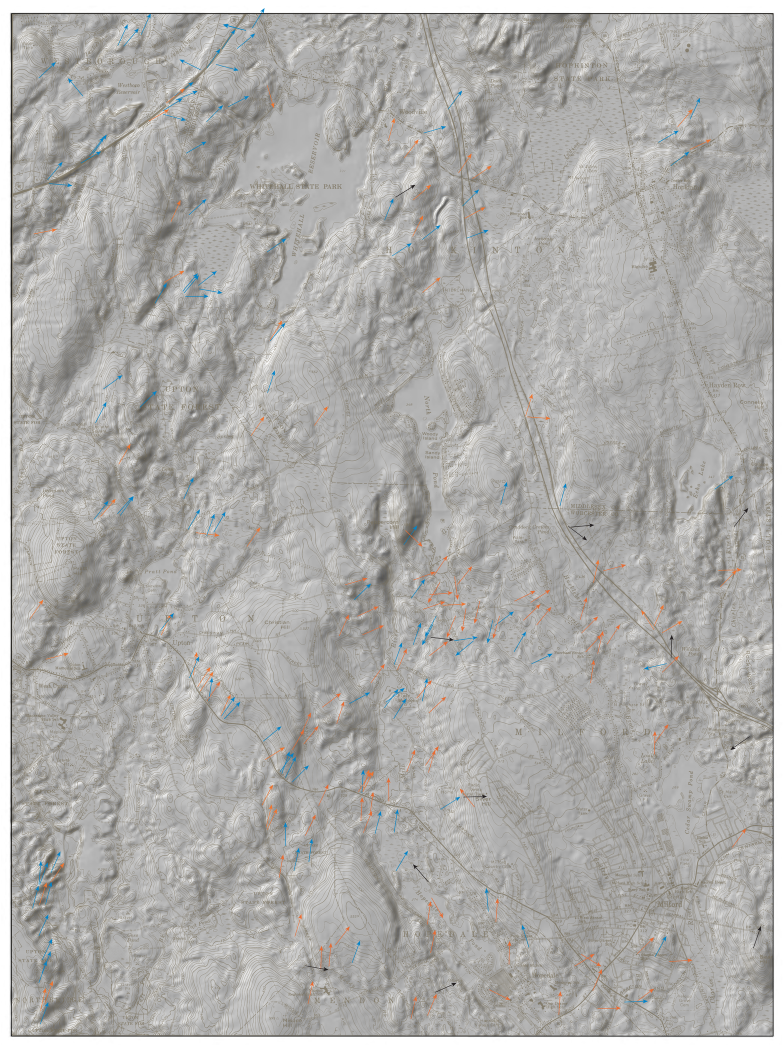
Sheet 3: Spatial Distribution of Structural Data
2007



All foliations and partings parallel to foliation (PPF)

PPF Fol
Dip of 0°-29°
Dip of 30°-59°
Dip of 60°-89°

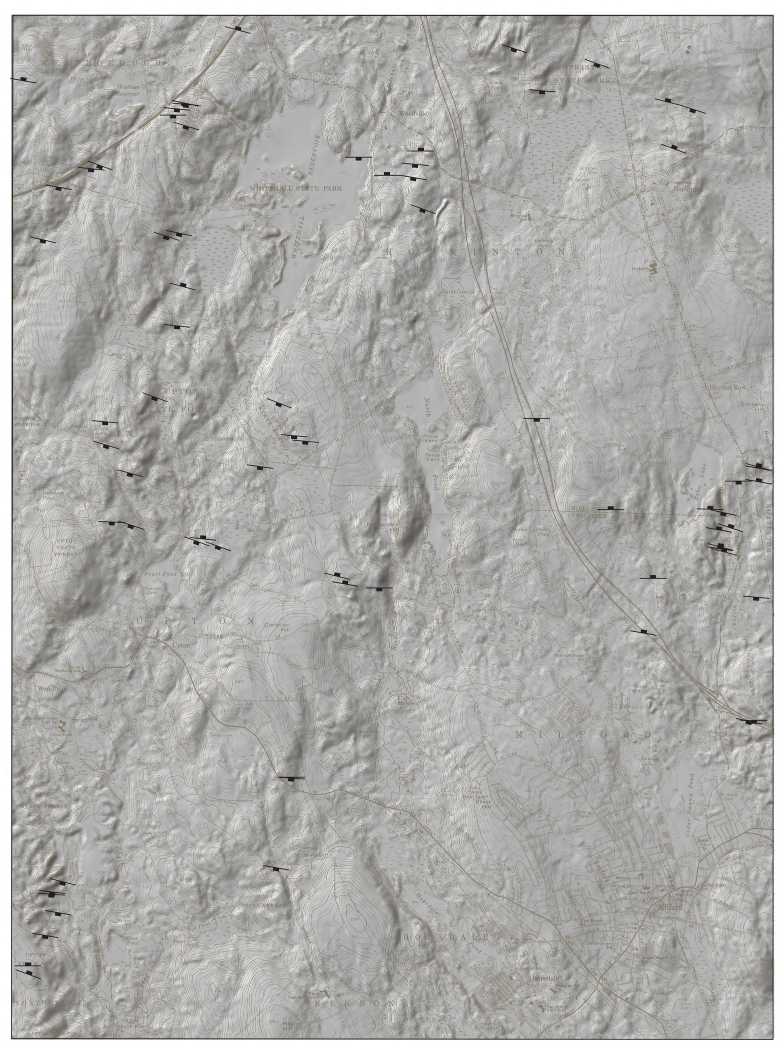


All Lineations

Dip of 0°-29°
Dip of 30°-59°
Dip of 60°-89°

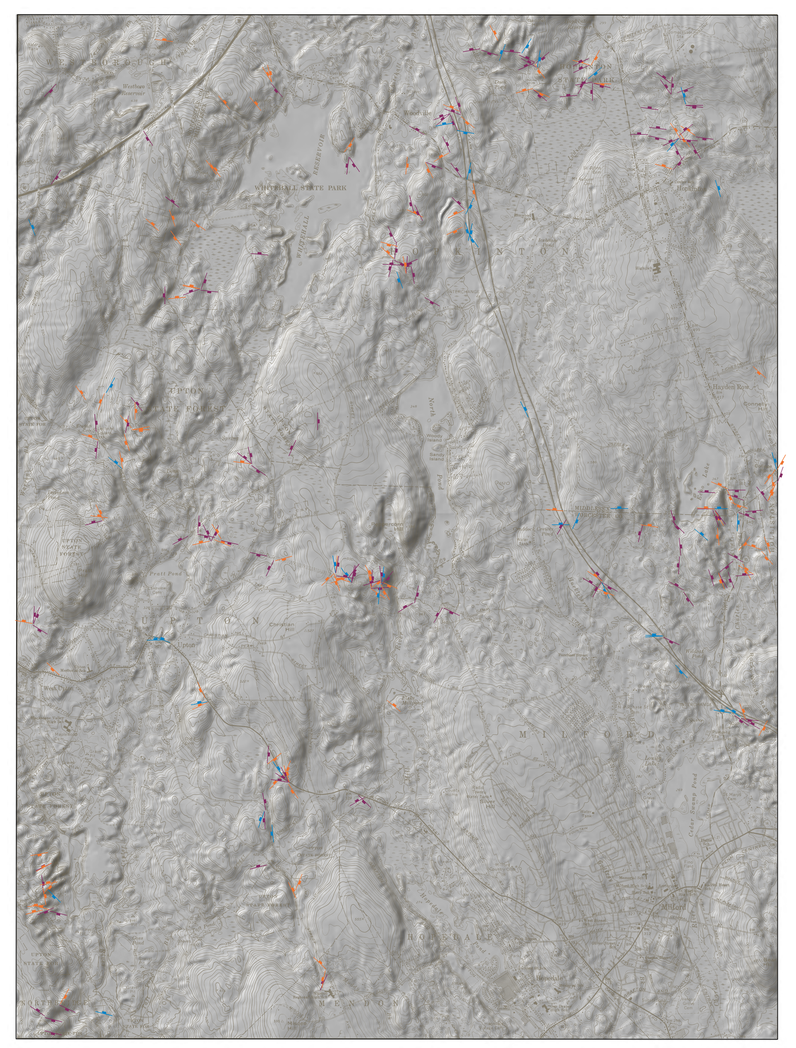
Northwest striking, moderately southwest-dipping fractures
(orthogonal to regional lineation)
131°/311° > 50° dip

North- to northeast-striking, steeply dipping fractures
022°/ 202° > 60° dip



East-west to northwest striking steeply dipping fractures
101°-281° > 60° dip

North-south to northwest striking steeply dipping fractures
351°-171° > 60 dip



All other fractures with < 60° dip
(does not include fractures orthogonal to lineation displayed above)

Dip of 0°-19°
Dip of 20°-39°
Dip of 40°-59°

Fracture Zones (discrete zones of closely spaced fractures)
(steeply dipping fracture zones are included in major sets displayed above)

Dip of 0°-29°
Dip of 30°-59°
Dip of 60°-89°

Ductile and Brittle Faults

Ductile Brittle
Dip of 0°-29°
Dip of 30°-59°
Dip of 60°-89°

Veins and Dikes

Dip of 0°-29°
Dip of 30°-59°
Dip of 60°-89°

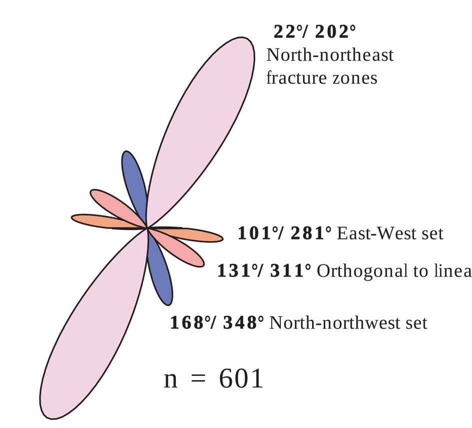


Figure 1 - Major families of steeply dipping fractures
Rose diagram of gaussian distribution of major families of fractures with dips > 60°. Length of petal of rose denotes relative abundance of fracture set relative to the total population. Width of petal roughly denotes one standard deviation of the mean from that set.

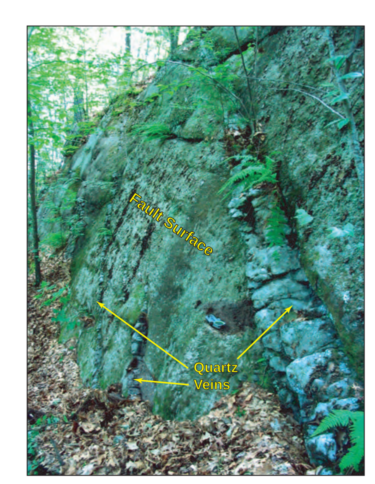


Photo 3 - Quartz veins associated with a semi-ductile fault. The veins are oriented approximately 30° to the fault plane.

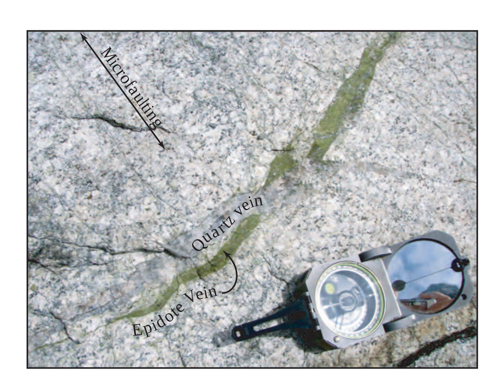


Photo 4 - Quartz vein cross-cutting an epidote vein. Both are oriented perpendicular to micro-faults, which are related to a larger northwest-striking ductile fault. The fault is located approximately 15 meters to east (compass is pointing north). Veins in coarse-grained granite gneiss (Zcg; see Sheet 1).

INTRODUCTION

The maps to the left show the geographic distribution of the major fracture sets described on Sheet 2 (Figure 1), in addition to foliation measurements, lineation measurements, fracture zones, faults (Photos 1 and 2), and veins (Photos 3 and 4) and dikes. Each symbol represents the strike and dip, or, in the case of lineation, bearing and plunge, of the respective fracture set measured at that station. Symbols are color-coded as to steepness of dip (see respective legends under each map).

Observations regarding the major fracture sets and faults are summarized on sheet 2. The significance of the foliation and lineation trends at map scale is largely due to folding and is discussed on Sheet 1 and in Shaw (1966; citation on Sheet 1). Observations on the geographic distribution of faults, veins, and dikes are listed below.

Observations regarding the geographic distribution of outcrop-scale faults:

Ductile faults (Photo 1):

- Many ductile faults (i.e., shear zones) can be traced between outcrops at map scale and are shown on Sheet 1
- In the southeatern corner of the quadrangle, a set of north- to northeast-trending, steep east-dipping semi-ductile, healed (quartz-filled) faults exist.
- A series of north- to northeast- trending semi-ductile faults exist in the southwestern portion of the quadrangle. These faults are roughly parallel to a large northeast trending topographic depression and area of deep glacial fill that passes through Whitehall Resevoir.
- In the eastern portion of the quadrangle, near Echo Lake, there are several east-west trending, north dipping ductile faults within the Milford granite (Zmgr; see Sheet 1).

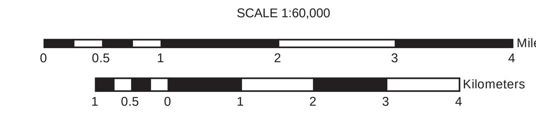
Brittle Faults (Photo 2):

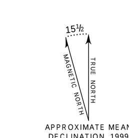
- A north- to northwest-trending set of brittle faults exists in the northwestern portion of the quadrangle where the rock is commonly strongly foliated. The strikes of these faults are roughly perpendicular to the strike of foliation and the trend of lineation.
- In outcrops along I-495, many brittle faults are associated with north- to northeast-trending diabase dikes and ductile shear zones.
- In the southeatern corner of the quadrangle, a north- to northwest-trending, steep east-dipping set of brittle faults exists parallel to local ductile faults. This set is roughly parallel to geologic contacts in the area and the axial trace of the Hopewell Antiform (see Sheet 1), and, as of this writing, appears to be associated with an abundance of outcrop-scale xenoliths and mafic pillows in the Milford granite. Mapping presently underway hopes to provide further insight into faulting in this portion of the quadrangle.

Observations regarding the geographic distribution of veins and dikes:

- Several north-south to northeast trending Triassic diabase dikes exist in the quadrangle, and are best exposed along I-495 and quarries in the southeastern portion of the quadrangle. These dikes are also delineated on Sheet 1.
- Within ducitle shear zones throughout the quadrangle, but especially in the northwestern and northeastern portion, vein sets commonly exist roughly perpendicular, or at 30° or 60° angles to lineation and or the direction of motion along a nearby ductile or semi-ductile fault (Photos 3 and 4).
- In massive rocks, such as the Milford granite in the eastern portion of the quadrangle, subvertical, north-south striking veins are common.
- An east-to northeast-striking set of veins is common across the quadrangle.

SCALE 1:60,000





QUADRANGLE LOCATION

Photo 1 - Example of ductile shear zone.
Shear zone within coarse-grained gneiss (Zcg; see Sheet 1).

Photo 2 - Example of brittle fault surface.
Fault within coarse-grained gneiss (Zcg; see Sheet 1).
Fault surface is mineralized with quartz.

Topographic Base Information:
Topographic base scanned and georeferenced from paper base U.S. Geological Survey, 1969
Polyconic projection. 1983 North American Datum

Shaded relief from MassGIS (http://www.mass.gov/mgis/img_shdrel5k.htm), produced with an illumination azimuth of 315° with an altitude of 45° and a vertical exaggeration of 1.5, without the effects of local shadows.

Data Sources:

Map produced from digital structural database of the Milford quadrangle.

-Structural data collected by Joseph P. Kopera with assitance from Stephen B. Mabee and Rick Ponti (2006-2007)

-Additional foliation and lineation measurements for southern portion of quadrangle from Shaw (1966).

NOTE: This Open-File map is a progress report of ongoing mapping in this area, and is preliminary in nature. It has not been peer reviewed or edited to conform with editorial standards of the Massachusetts State Geologist or with the North American Stratigraphic Code. A final, edited, reviewed version of the map will be published at a later date.

This research was supported by U.S. Geological Survey, National Cooperative Geologic Mapping Program, under assistance Award No. 06HQAG0012. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government, the Commonwealth of Massachusetts, or the University of Massachusetts.

Citation:

Kopera J.P., Shaw C.E. Jr.,,and Fernandez, M., 2007, Preliminary bedrock geologic map of the Milford quadrangle, Massachusetts: Office of the Massachusetts State Geologist Open File Report 07-01. Scale 1:24,000. 4 sheets and digital product: Adobe PDF and ESRI ArcGIS database.

A digital copy of this map, including GIS datalayers, is available at **http://www.geo.umass.edu/stategeologist**. Additional paper copies can also be obtained from the Office of the State Geologist