Geology of the Lake Sunapee Area, New Hampshire

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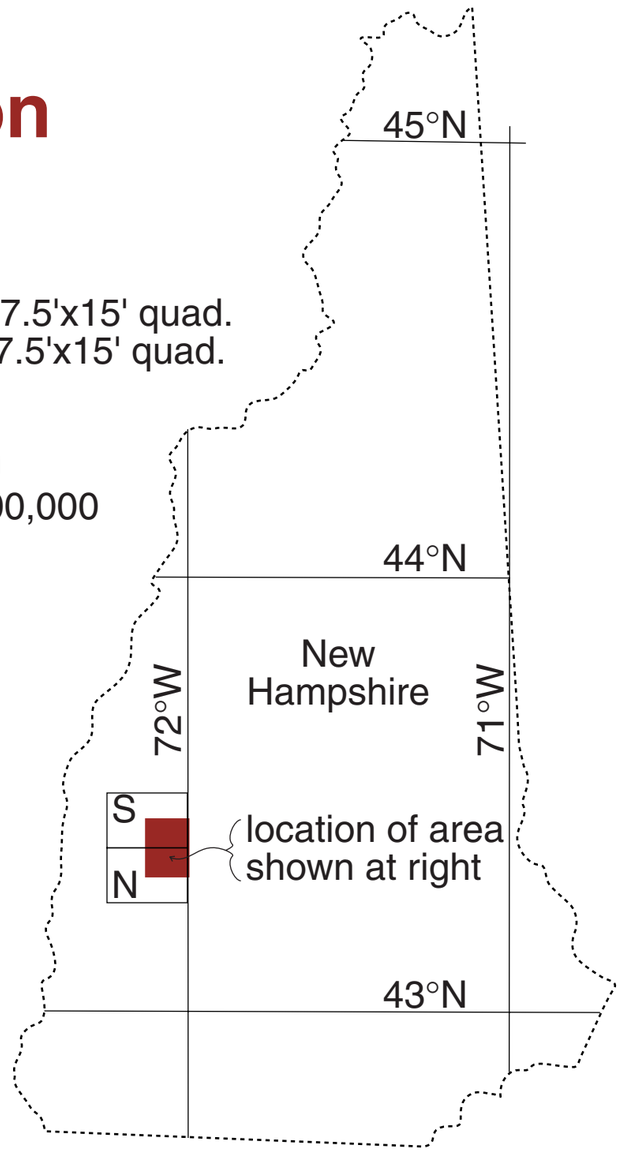
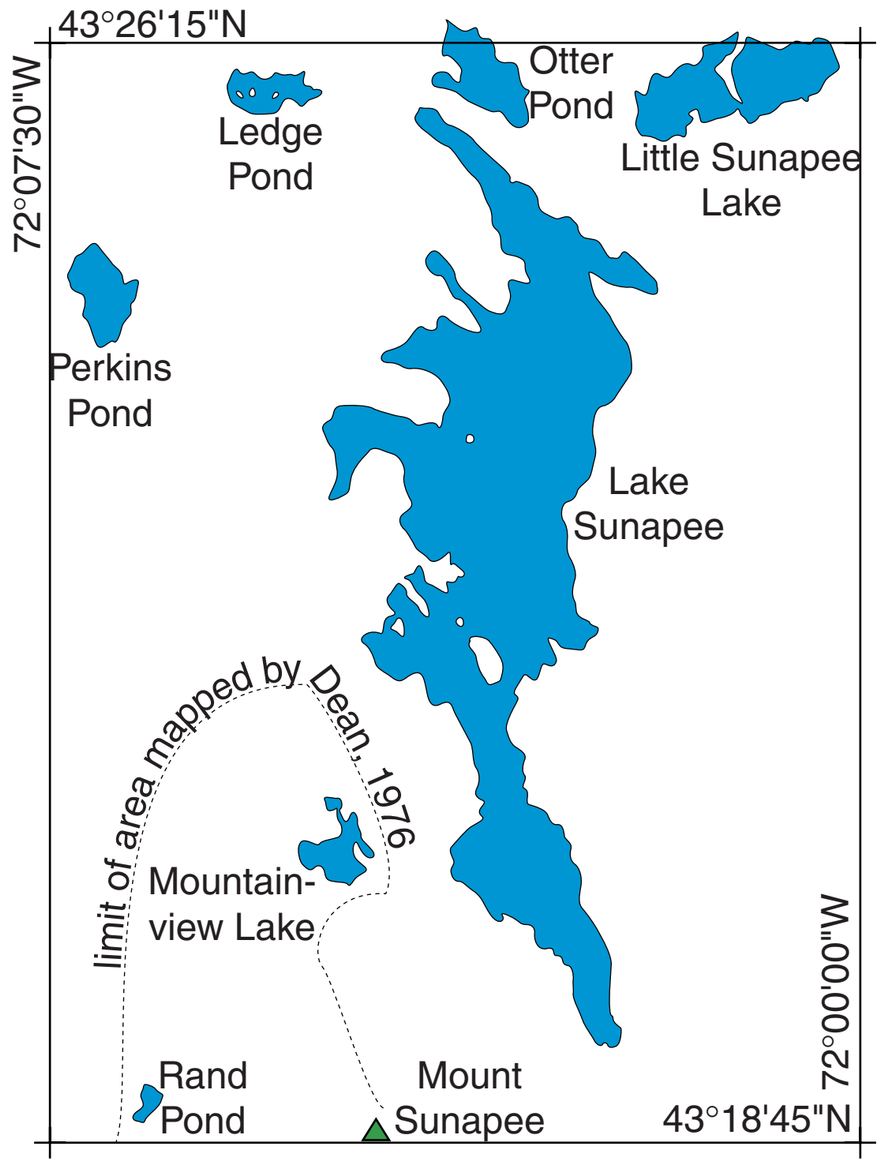
Location

S = Sunapee, NH 7.5'x15' quad.
N = Newport, NH 7.5'x15' quad.

20 km
scale 1:1,500,000





1000 meters
scale 1:150,000

Introduction

The geology surrounding Lake Sunapee, New Hampshire, displays complex relationships formed during the Acadian orogeny. The Mt. Clough and Cardigan plutons (members of the New Hampshire Plutonic Series; Lyons et al., 1997), are separated by a narrow belt of metamorphosed sedimentary rocks known as the Sunapee Septum (Dean, 1976). The Mt. Clough and Cardigan plutons likely formed from the same parent material through anatectic melting of adjacent metasedimentary rocks (Lathrop et al., 1994, 1996). Differing conditions during formation (or subsequent metamorphism) created mineralogical and textural differences between these two plutons (Chamberlain & Lyons, 1983). Post-orogenic intrusion of the Sunapee pluton (Concord Group) cut across the septum, obscuring relationships between and among the metasediments and the Mt. Clough and Cardigan plutons.

Geologic mapping and geochemical analysis of rocks from the Lake Sunapee vicinity are being undertaken to investigate relationships between structural development, magmatism and metamorphism during orogenic events. For the summer of 2000, the mapping effort focussed on the area to the west of Lake Sunapee. Continued mapping of this area, as well as the area to the east of the Lake, is proposed for the summer of 2001.

Geologic Setting
West-Central New Hampshire

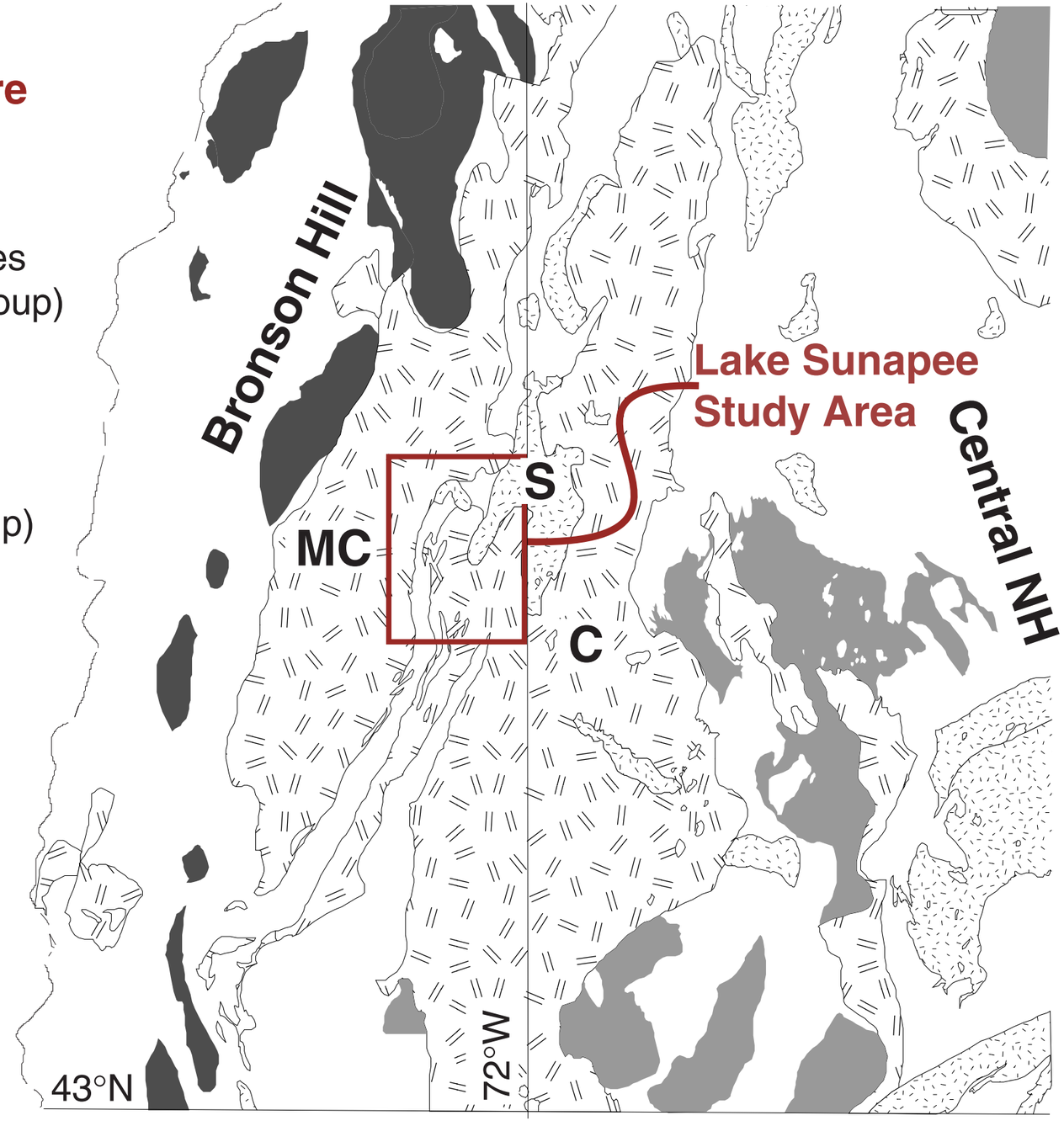
after Lyons and others, 1997

Devonian (410-360)
New Hampshire Plutonic Series
two-mica granite (Concord Group)
S = Sunapee Pluton
granodiorite
MC = Mount Clough Pluton
C = Cardigan Pluton
quartz diorite (Spaulding Group)

Ordovician (500-440)
Highlandcroft and Oliverian
calc-alkaline plutonic series

Undifferentiated Metamorphic
and Igneous Rocks

20 kilometers
scale 1:325,000



Previous Mapping

Chapman (1952) prepared a 1:62,500-scale Geologic Map and Structure Sections of the Sunapee Quadrangle, New Hampshire (15 minute series).

Dean (1976) prepared a 1:24,000-scale Geologic Map of the "Sunapee Septum," a feature that extends across both the Sunapee and Lovewell Mountain, NH quadrangles (15 minute series), however Dean's map overlaps less than 1/4 of the project area.

Thompson and others (1990), who prepared a 1:250,000-scale Simplified Geologic Map of the Glens Falls 1°x2° Quadrangle, New York, Vermont and New Hampshire, cite unpublished manuscript maps by C. P. Chamberlain covering the project area.

Interim Geologic Map of Lake Sunapee and Surrounding Area, New Hampshire, 2000

1:24,000 scale

Igneous Rocks

◯ 2-mica Granite—Concord Granite: light gray, two-mica granite associated with migmatite zones; post-orogenic (Acadian Orogeny); 354 (+/-5) Ma.

◯ Spaulding Group: diorite to granite in composition associated with migmatite zones; synorogenic; 392 Ma.

◯ Bethlehem Gneiss (Mt. Clough Pluton): a foliated homogenous micaceous granodiorite (locally granite to tonalite composition); synorogenic; 407 (+/-5) to 410 (+/-5) Ma.

◯ Kinsman Granodiorite (Cardigan Pluton): a foliated granodiorite with abundant potassium feldspar megacrysts (locally granite to tonalite composition); synorogenic; 413 (+/-5) Ma.

◯ Undifferentiated Igneous Rocks: granitoids

- Pegmatite: granitic; feldspar, quartz, mica

Rock descriptions from field observations, and adapted from Allen, 1997, and Lyons and others, 1997.

Meta-sedimentary Rocks:

◯ Schist—(?) Devonian Littleton Formation: an aluminous marine turbidite with quartzites and minor volcanics; graded bedding; a flysch deposit before the Acadian Orogeny.

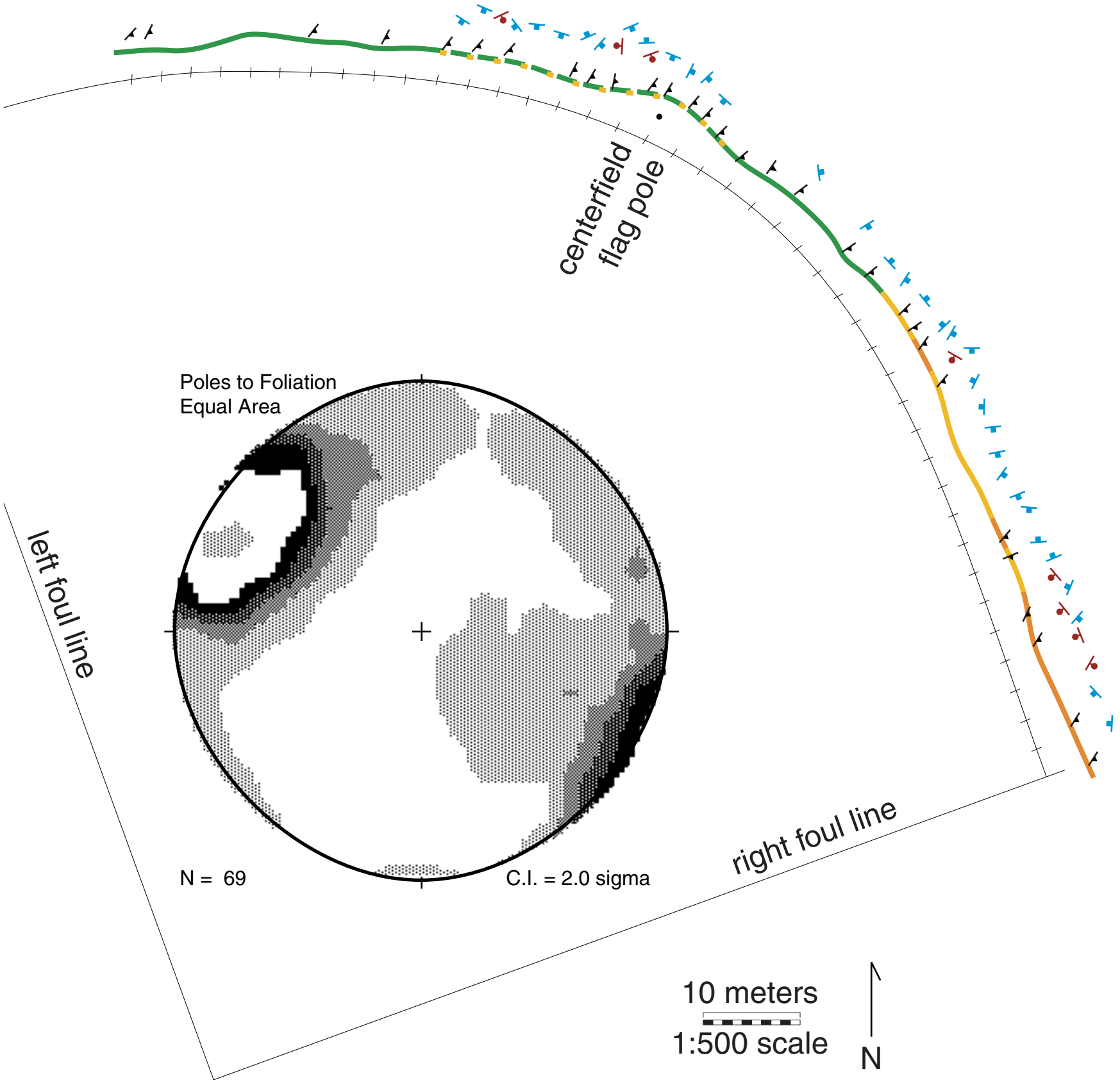
◯ Quartzite—Silurian Clough Formation: a clean quartzite and quartz pebble conglomerate with minor amounts of dirty limestone and greywacke or aluminous shales; locally bearing fossils.

◯ Calc-Silicate—(?) Silurian Madrid Formation: dirty “ribbon” limestone, with occasional black shales, sulfide-rich zones, and arenaceous rocks containing calcareous concretions. Our designation may include calcareous rocks of the Smalls Falls Formation.

◯ Rusty Schist—(?) Silurian Rangeley Formation: graphitic and sulfidic black shales, matrix dominant polymict conglomerates, arenaceous lenses and calcareous concretions; possibly an olistostrome. Our designation may include argillitic rocks of the Smalls Falls Formation.

◯ Undifferentiated Meta-sedimentary Rocks: schists and/or gneisses (Siluro-Devonian)

Sunapee Ballfield Outcrop Detail



Undifferentiated Meta-sedimentary Rock (schists)

Undifferentiated Igneous Rock (granitoids)

Granodiorite Gneiss (sheared Kinsman?)

foliation

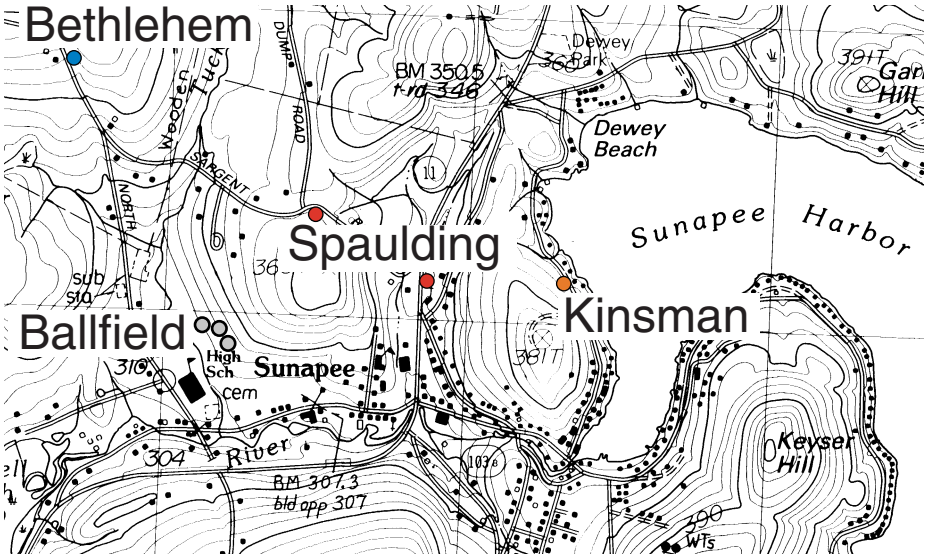
normal fault

joint

fenceposts (position markers)

Locations of Samples Selected for Geochemical Analysis

(results are pending)

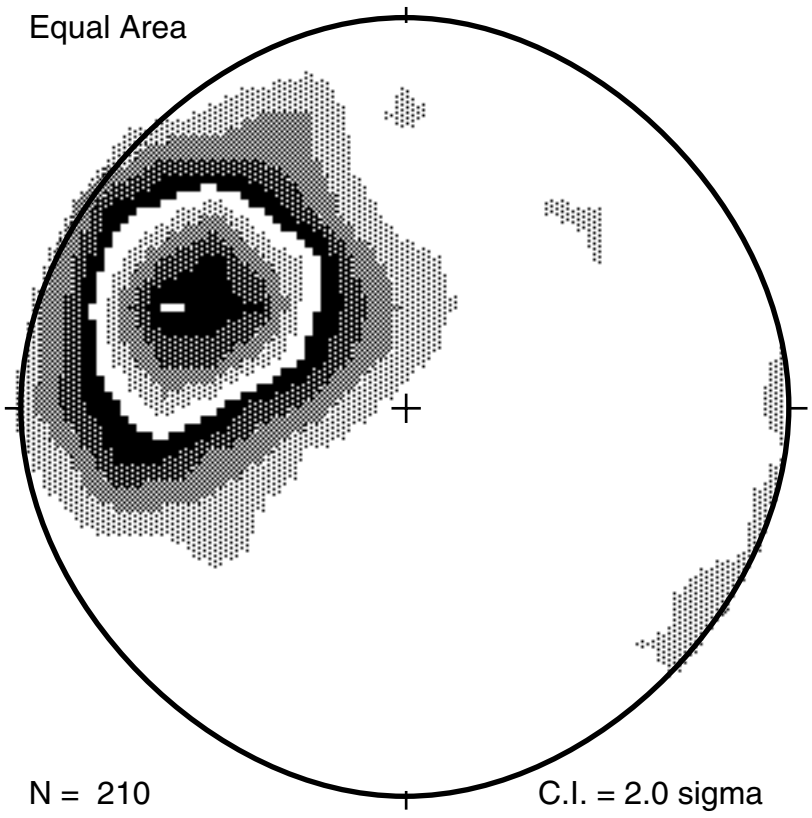


Whole-Rock major- and trace-element analyses are being undertaken to help better constrain the identification of rocks at the Ballfield Outcrop

Stereonets

Poles to Foliation Planes

Equal Area

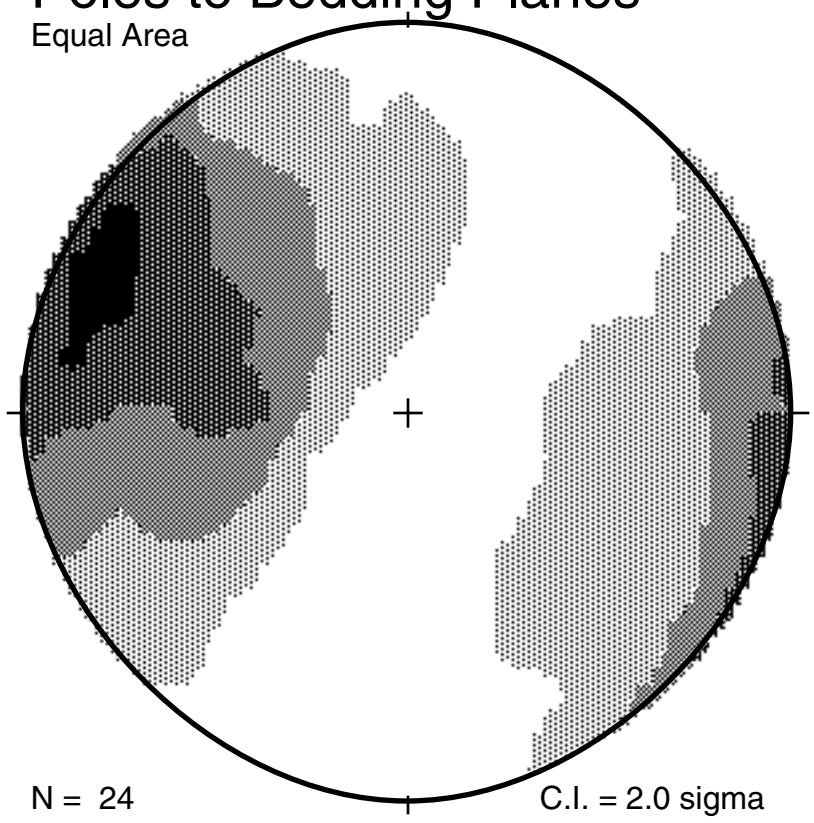


N = 210

C.I. = 2.0 sigma

Poles to Bedding Planes

Equal Area

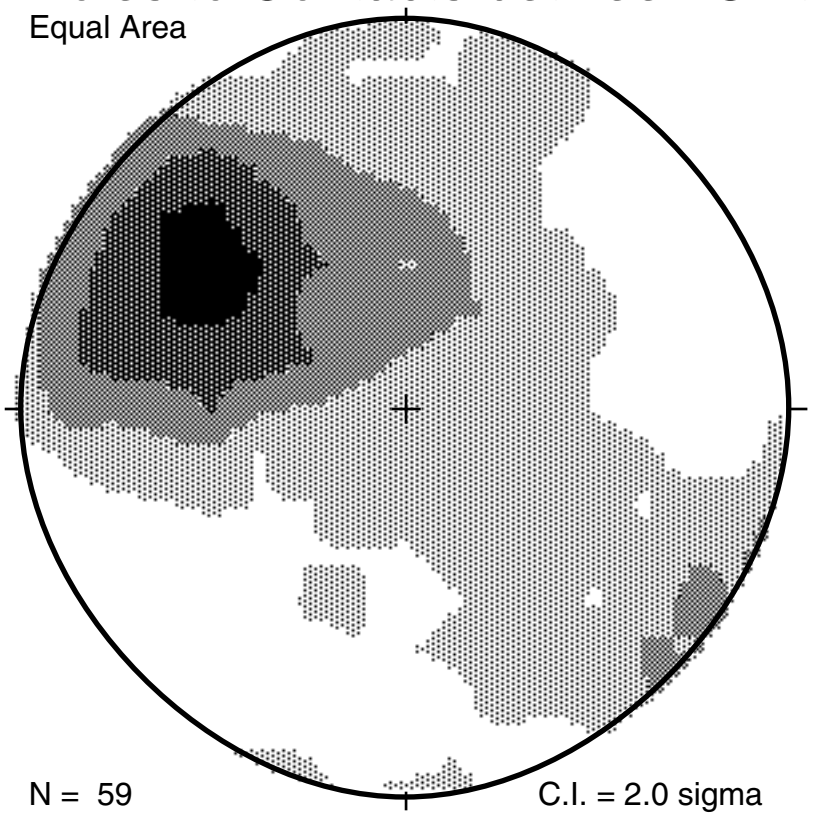


N = 24

C.I. = 2.0 sigma

Poles to Contacts between Units

Equal Area

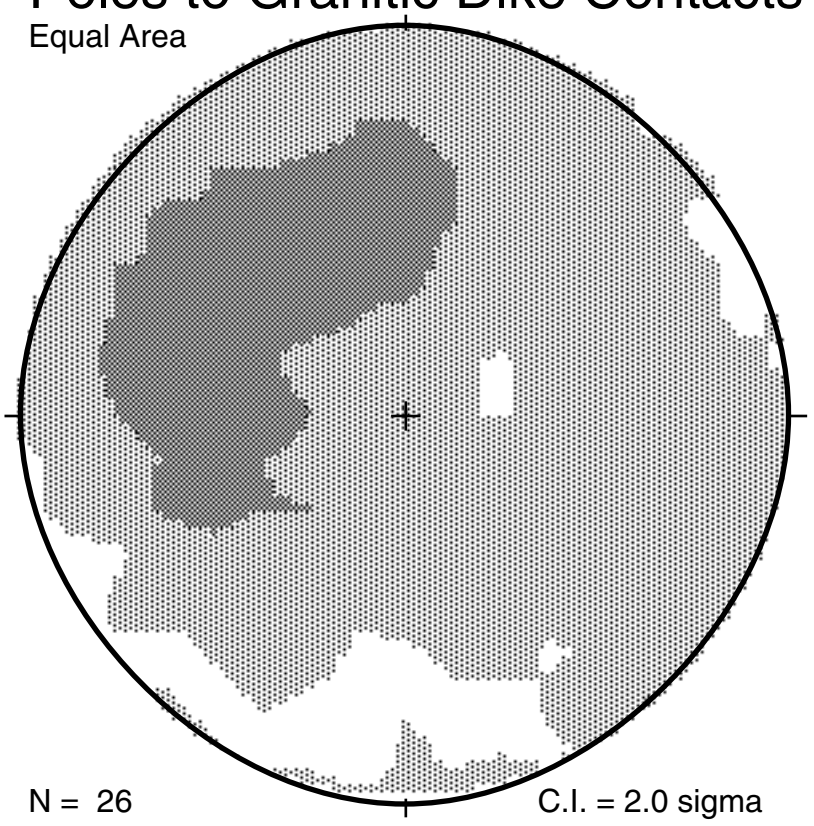


N = 59

C.I. = 2.0 sigma

Poles to Granitic Dike Contacts

Equal Area

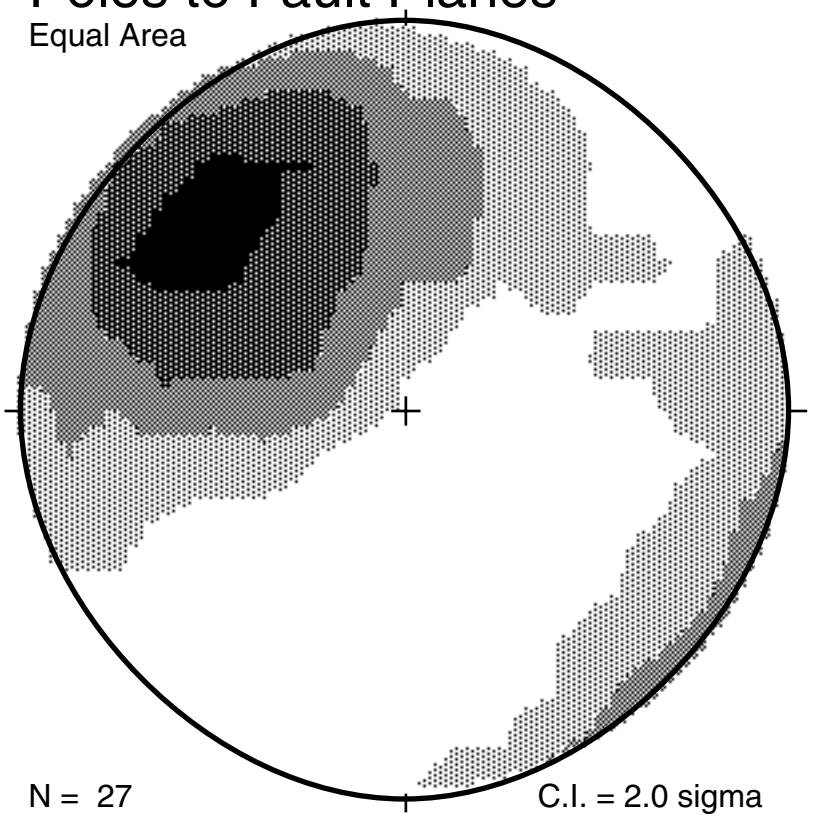


N = 26

C.I. = 2.0 sigma

Poles to Fault Planes

Equal Area

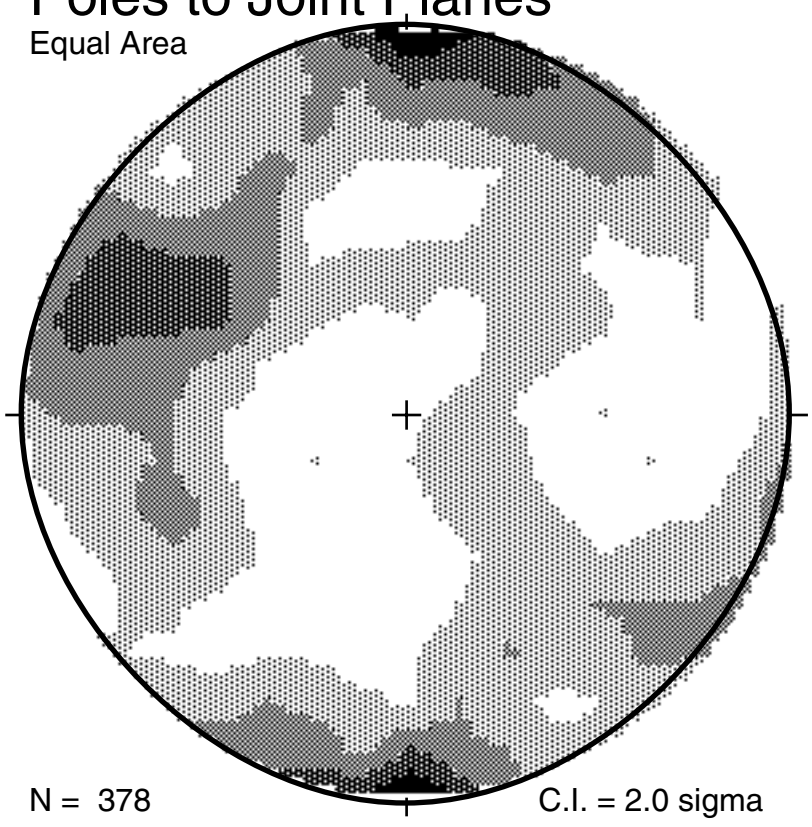


N = 27

C.I. = 2.0 sigma

Poles to Joint Planes

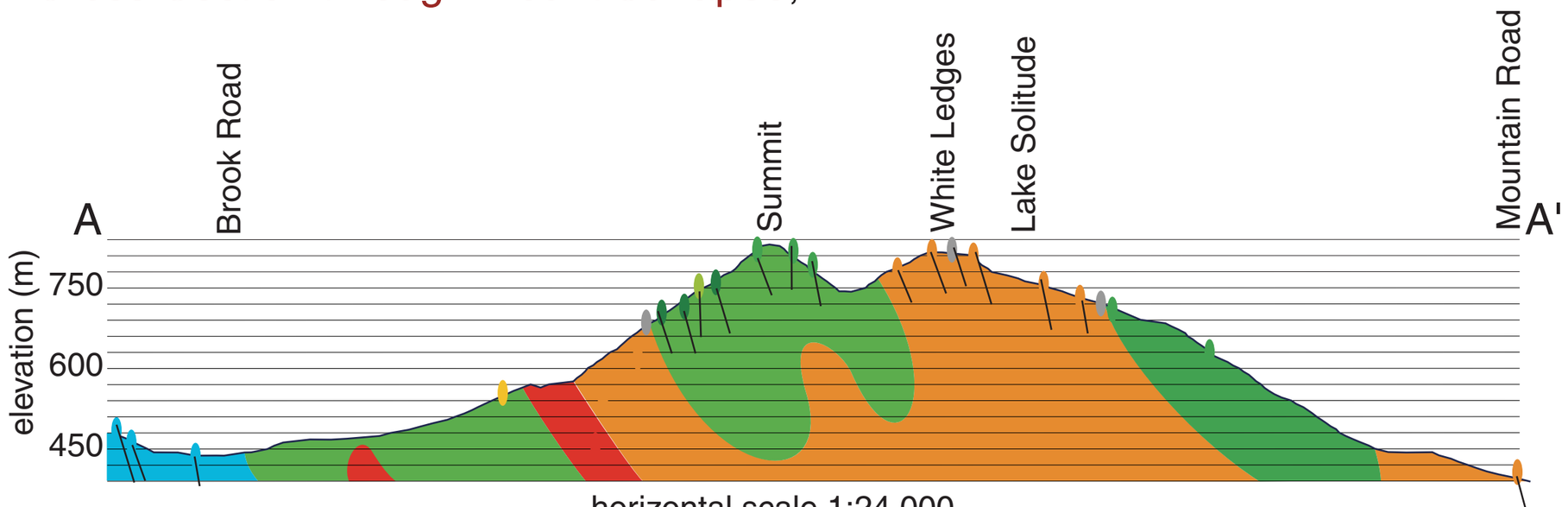
Equal Area



N = 378

C.I. = 2.0 sigma

Cross-Section through Mount Sunapee, A-A'



Location of Sample Selected for U-Pb Isotopic Analysis

(results pending)

Observations

The Cardigan and Mount Clough Plutons may grade into one another in Sunapee;

The Sunapee Septum may include a significant ductile shear zone;

The Septum is also a locus for important late brittle structures; and

Magmas belonging to the Spaulding Group may play an important role in the structure of this area.

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Acknowledgments

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