

Structural, textural and petrographic variations in rocks on Bruce Hill, eastern Sebago Migmatite Domain, southern Maine.

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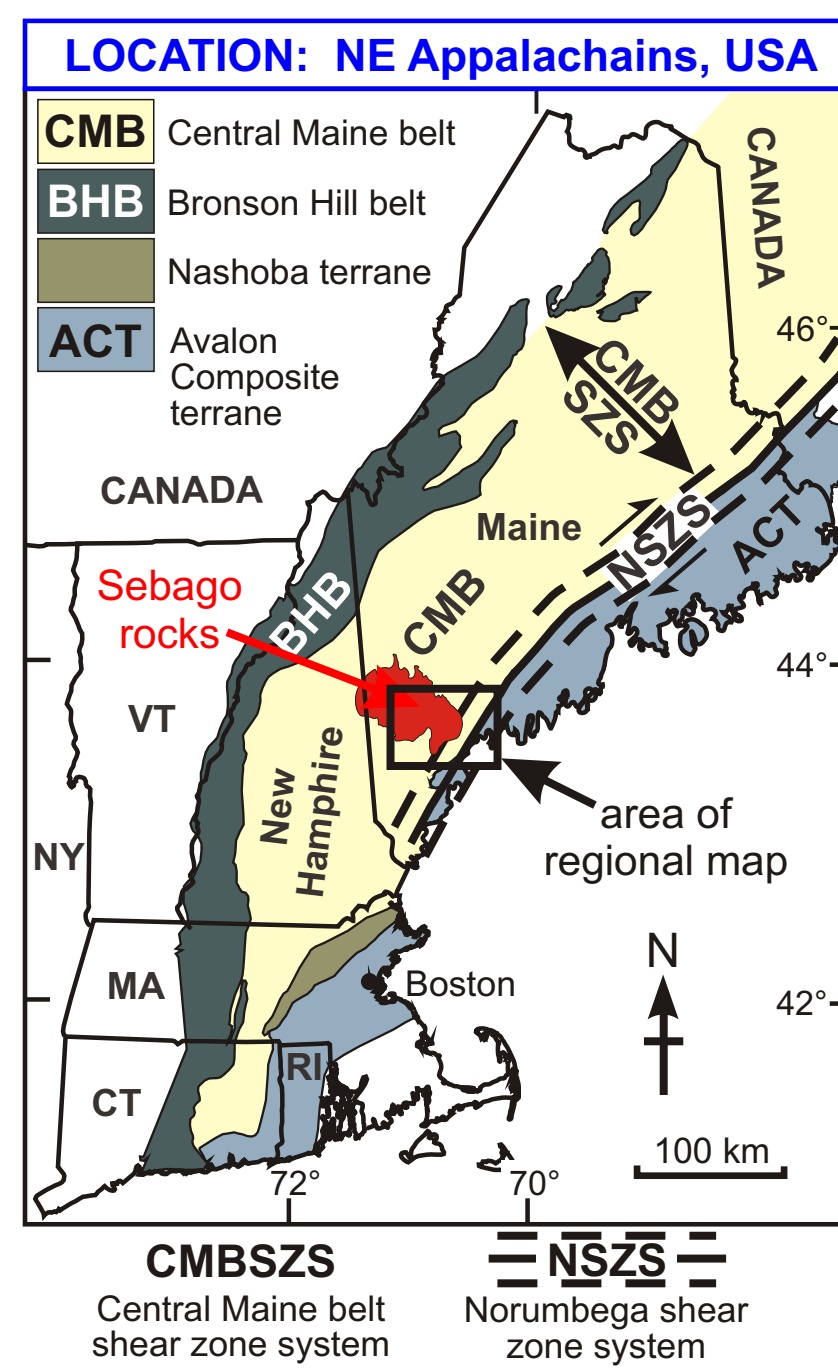


Introduction

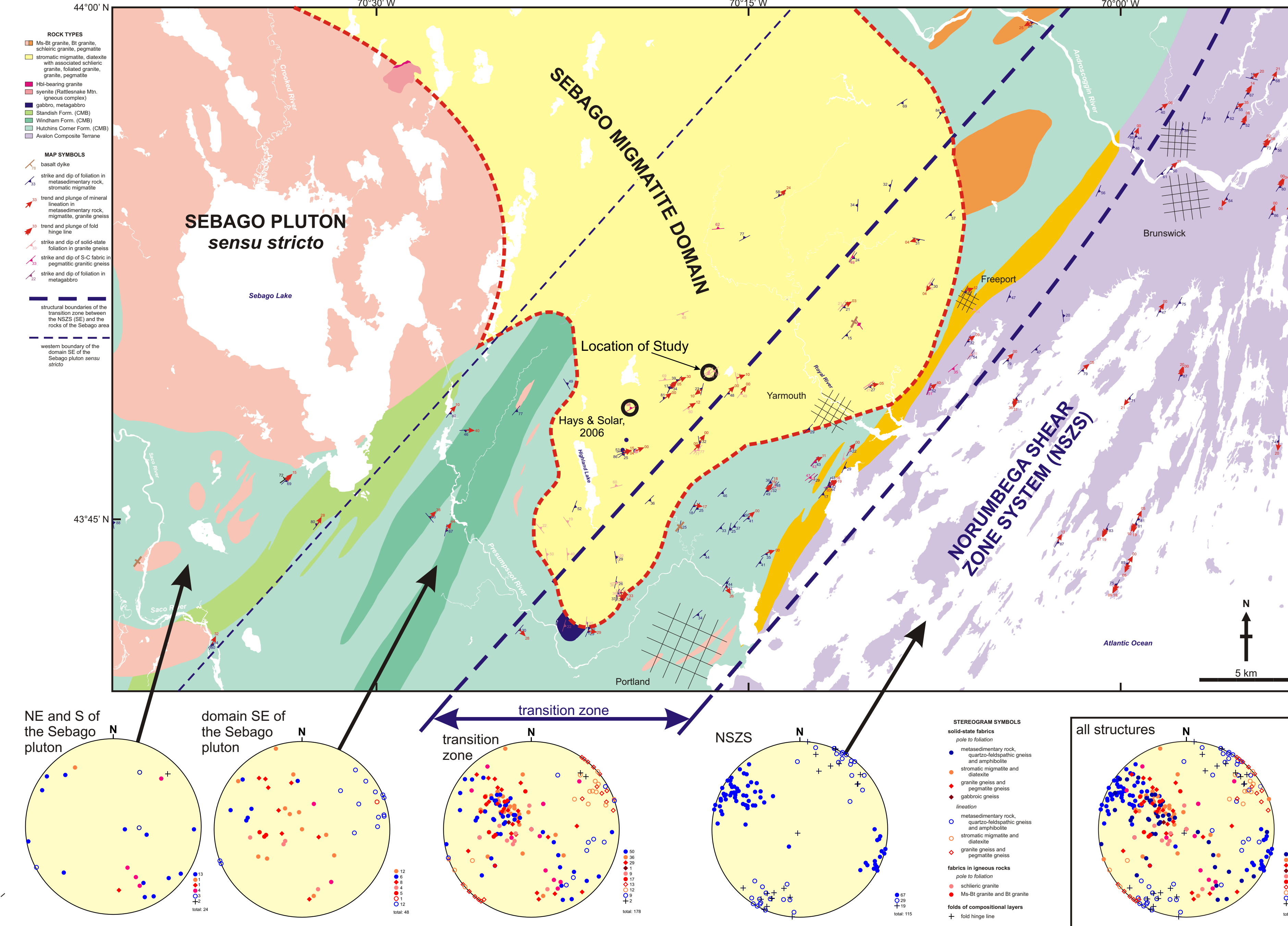
If magma flow through deforming rocks is recorded by structures in migmatites and associated granites, study of such rocks requires multiple scales of observation. As part of a larger multi-disciplinary study of rocks of the northern Appalachian migmatite-granite belt, this study is one of several ongoing concurrent and related projects that together form a database of fine-scale documentation of the Sebago migmatite domain (SMD) and related rocks in S Maine and New Hampshire. For this work, we document variations of mineral content, structures and fabric at the m-mm scale in rocks of Bruce Hill, Cumberland Ctr, ME, located in the E part of the SMD that mantles the 400 km² Permian Sebago granite pluton on its W, N and E. We expect this documentation to be useful in determining the interrelation of the processes of metamorphism, melting, melt segregation, magma flow, magma ascent and emplacement, and plastic deformation.

The Study Area and Southern Maine

The exposure is in the central part of the eastern SMD (see **Regional Map** at right) that was previously shown as part of the Sebago batholith (on the state geological map). New mapping and geochemical data (on both the **Maine Map** below and the **Regional Map**, right) show that this area is composed of mostly metapelitic stromatic migmatite and diatexite, with subordinate centimeter- to meter-scale bodies of granite with compositions from medium-grained 2-mica granite to pegmatite, and fabrics from unfoliated to augen gneiss and schlieric granite. This is in distinct contrast with the Sebago pluton (**Regional Map**) composed consistently of fine- to medium-grained 2-mica granite of uniform composition and geochemistry (Tomascak *et al.*, 1996a, 1996b). The SMD granites have fabrics locally, and are cut by centimeter-scale granite dikes. On the NW, the SMD is apparently part of the NE-SW-trending Devonian central Maine-New Hampshire migmatite belt (see **Maine Map** below). Thus the age of the SMD is uncertain, but ongoing work will address this unknown. The eastern SMD is bounded on the SE by the Devonian crustal-scale NE-SW-striking dextral Norumbega shear zone system (e.g., West & Hubbard, 1997). Structure of the eastern SMD is consistent with that zone (see **Regional Map**), so this area may be key to the Sebago pluton history.



REGIONAL GEOLOGICAL MAP OF THE SE SEBAGO PLUTON, E SEBAGO MIGMATITE DOMAIN AND ADJACENT NORUMBEGA SHEAR ZONE SYSTEM, S ME



Results: Rock Types

Rocks at Bruce Hill are of five units that are all typical of the SMD in general, but particularly of the eastern SMD. Stromatic migmatite is the dominant rock unit on the NW and SE flanks of the hill, and is uniformly plastically deformed, including boudinaged leucosomes and granite layers with S-C fabrics. The other units are local semipelitic schist, and granites of three varieties: (1) S-C augen gneiss that composes the SW flank of the hill, (2) pegmatite (locally with solid-state fabrics) that dominates the hill top, and (3) unfoliated to weakly foliated 2-mica granite. Where fabrics exist, they are consistently 048-055-striking and shallowly to moderately SE-dipping. Pegmatite grain size increases with elevation, and is Grt+Tm-bearing where foliated. (See **Detail Map** at right.)

Migmatite, stromatic (layered) from pelitic protolith. The migmatite has biotite foliation and selvage melanosomes, and sub-concordant cm-scale leucosomes that have varied solid-state fabrics. Migmatite outcrops have sub-concordant granitic gneiss layers (cm-scale) and cm- to m-scale cross-cutting unfoliated granites.

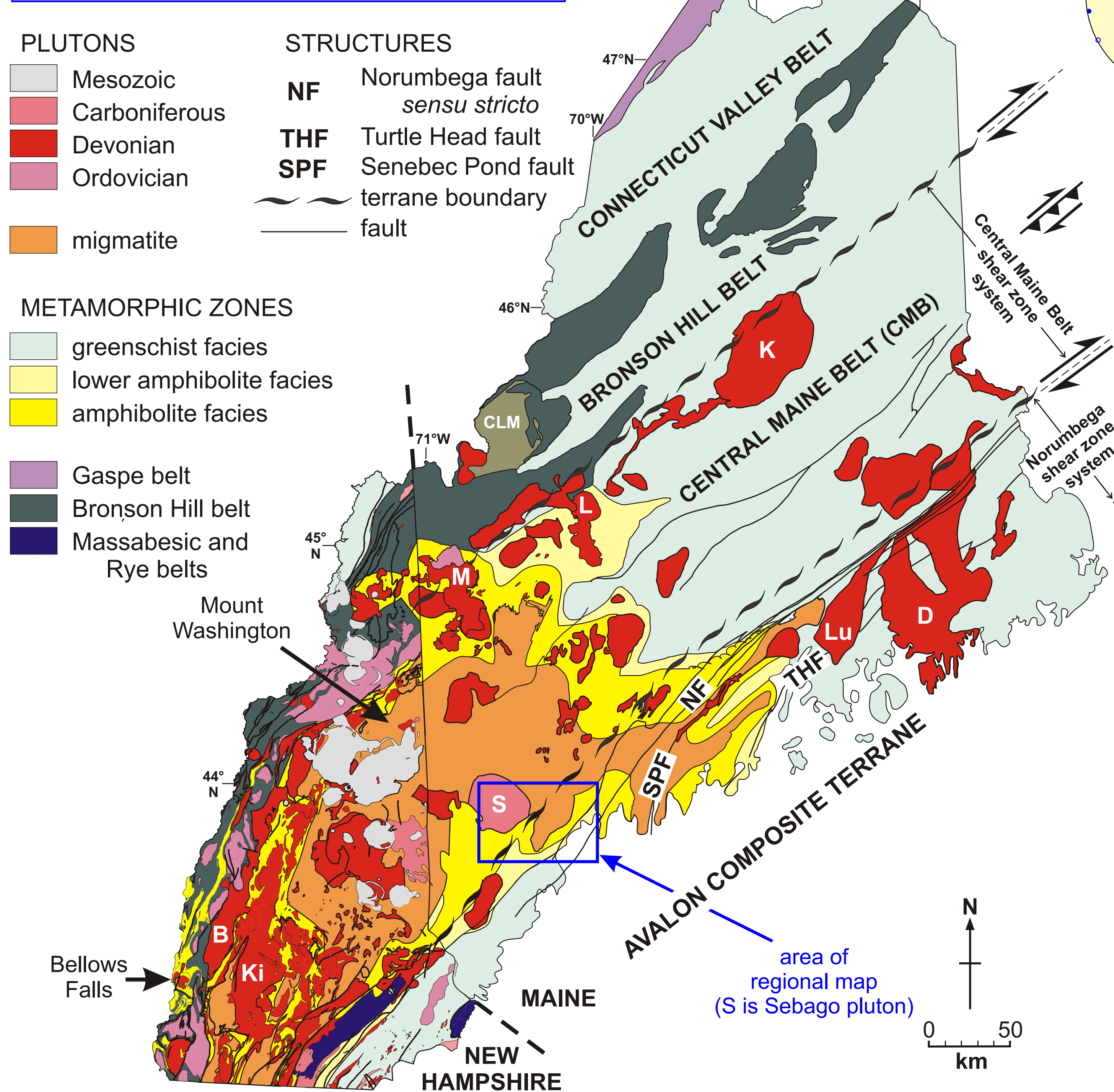
Granitic augen gneiss has a strong S-C fabric and biotite foliation.

Pegmatitic granitic gneiss has variable solid-state fabric defined by quartz and feldspar ribbons. Grain size varies with elevation where coarser grains are found at the top of the hill. Pegmatitic rocks have variable mineral content including Grt+Tm where fabrics are strongest.

The **two-mica granite** is relatively homogenous with weak or no visible fabric. Where fabric exists it is defined by somewhat planar-aligned micas. This rock is typically strongly discordant to fabrics in country rocks.

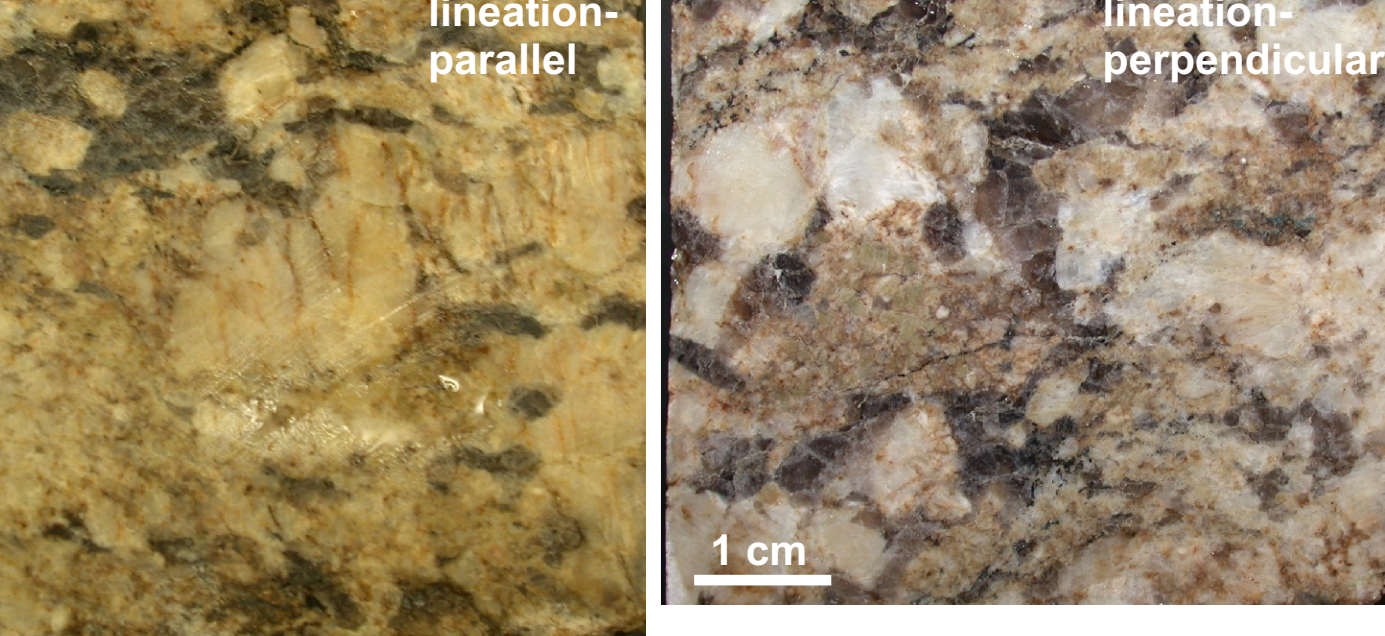
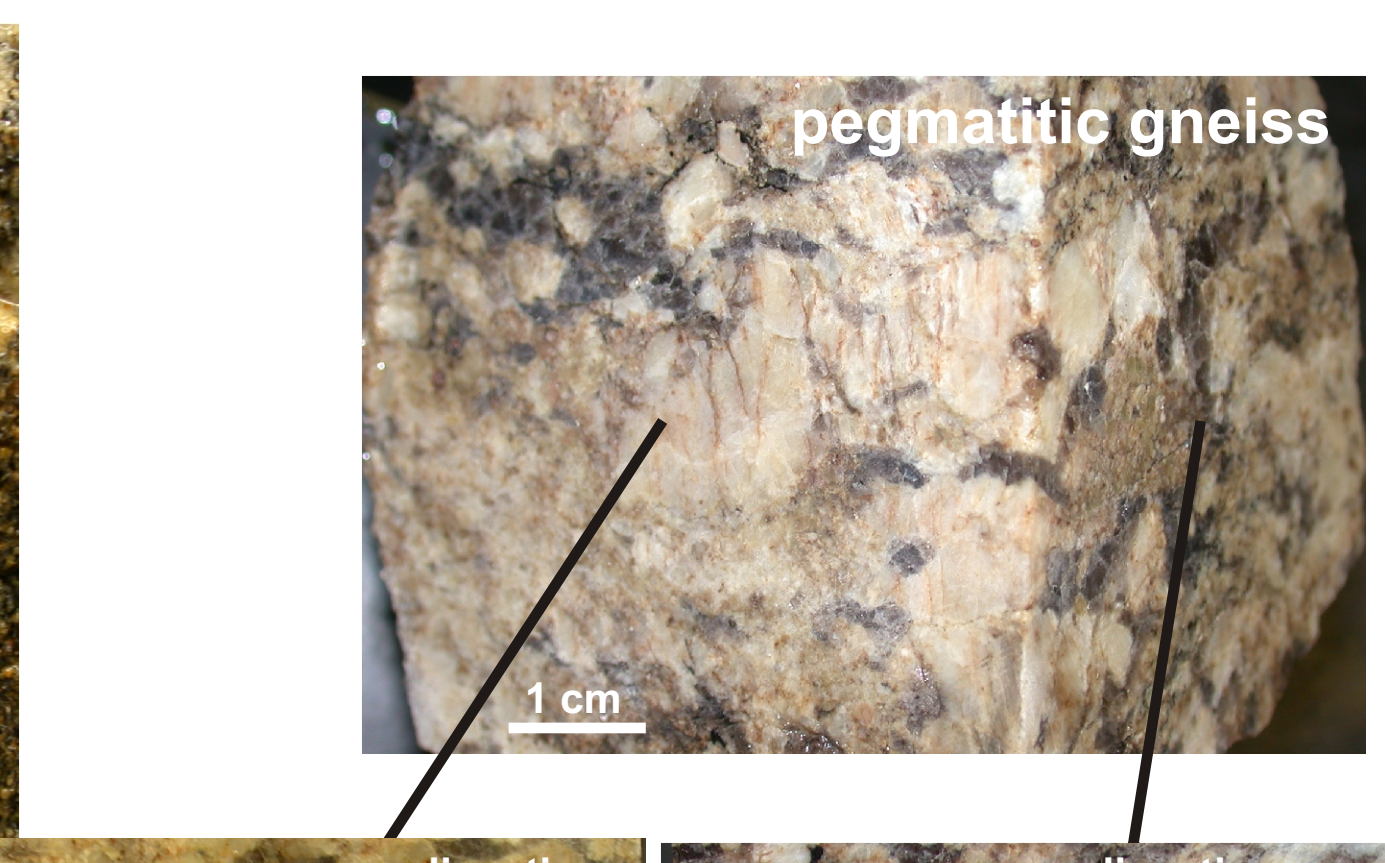
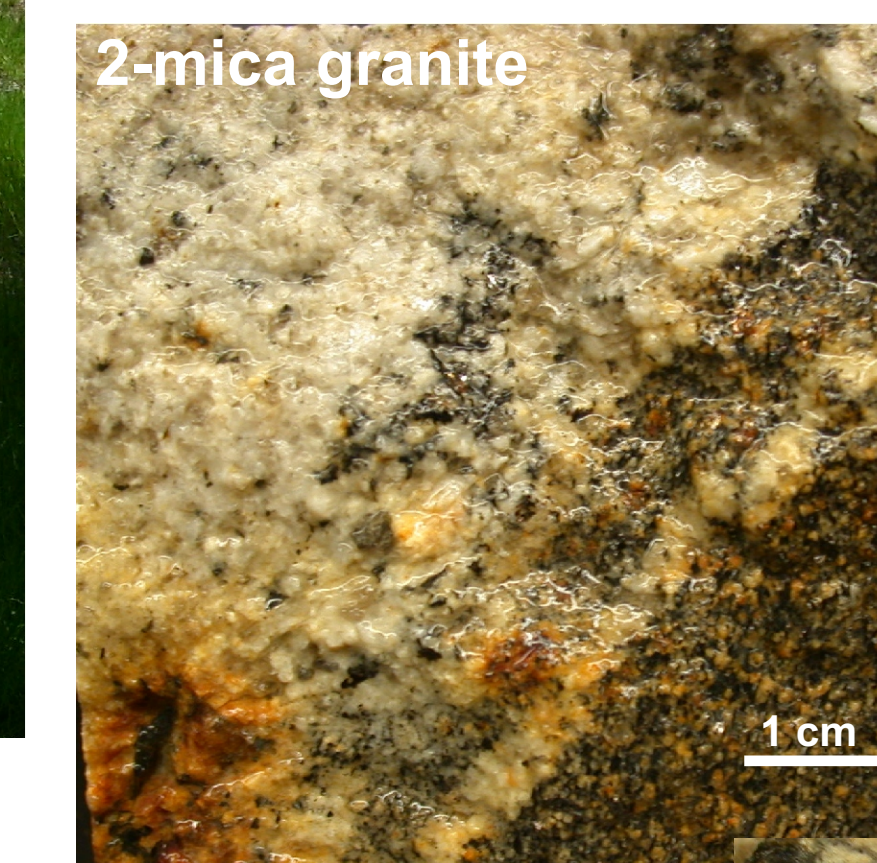
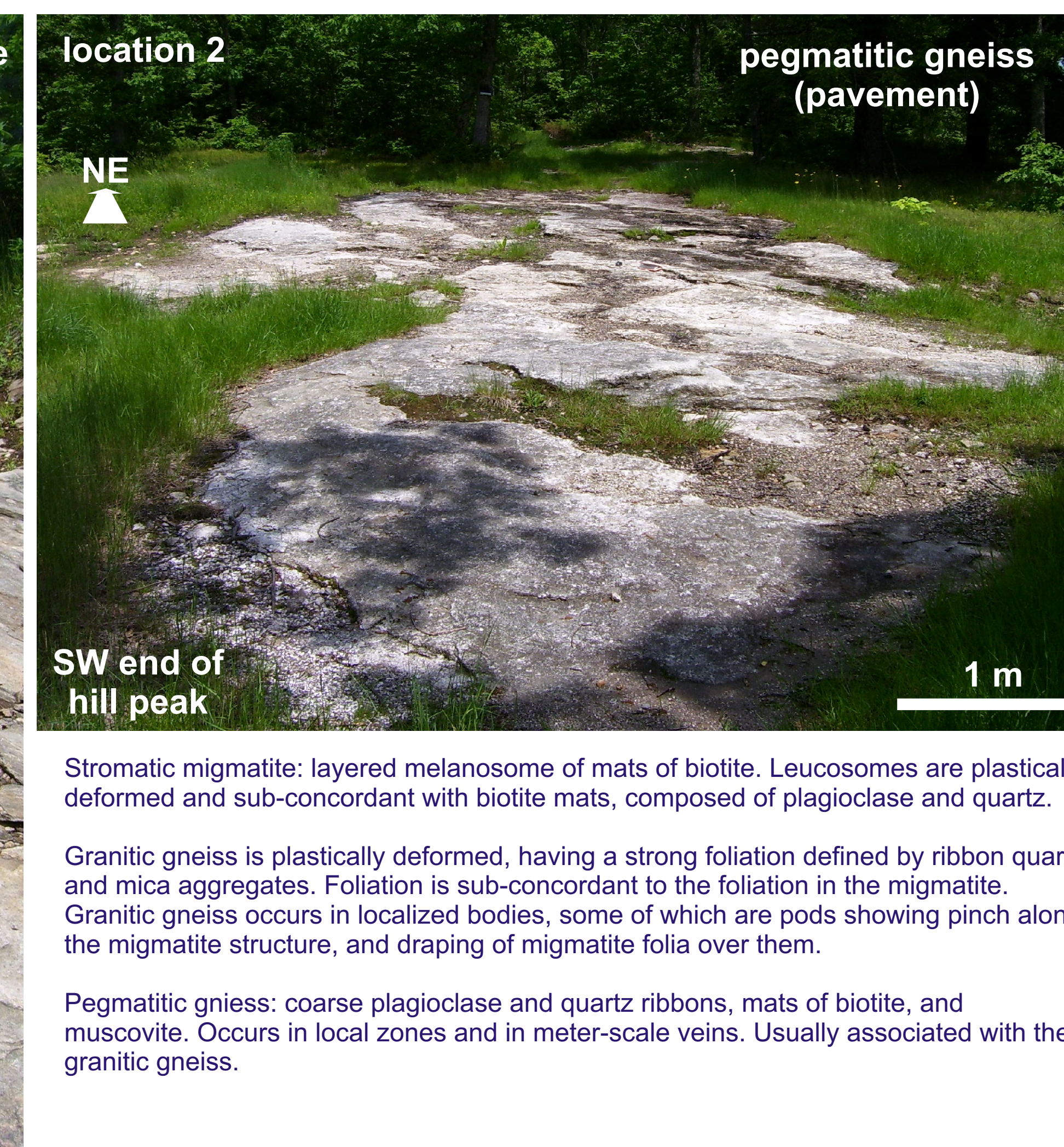


SIMPLIFIED GEOLOGIC MAP: Maine and New Hampshire



Methods

This work involved both field work and supporting hand-specimen and thin-section petrography of rocks collected at Bruce Hill outcrops. Field work involved detailed mapping and documentation of rock types present, mineral compositions, mineral textures, shapes and their variations including orientation (in 2-D, or 3-D if possible), their size, and their distribution. Study of hand-specimens included documentation of textures on cut surfaces, cut according to the mineral fabrics, typically parallel and perpendicular to the mineral lineation (if any; see **Rock Type photographs**), and perpendicular to the mineral foliation. Thin sections were made along those surfaces for textural study.



Simplified metamorphic, structural and pluton map of Maine and New Hampshire, USA. Plutons are ornamented by age. B is the Bethlehem pluton, D is the Deblois pluton, L is the Lexington pluton, Lu is the Lucerne pluton, K is the Katahdin pluton, Ki is the Kinsman quartz monzonite body, M is the Mooselookmeguntic igneous complex, and S is the Sebago pluton. The CMB shear zone system is after Solar & Brown (1999, 2001) and West & Hubbard (1997).