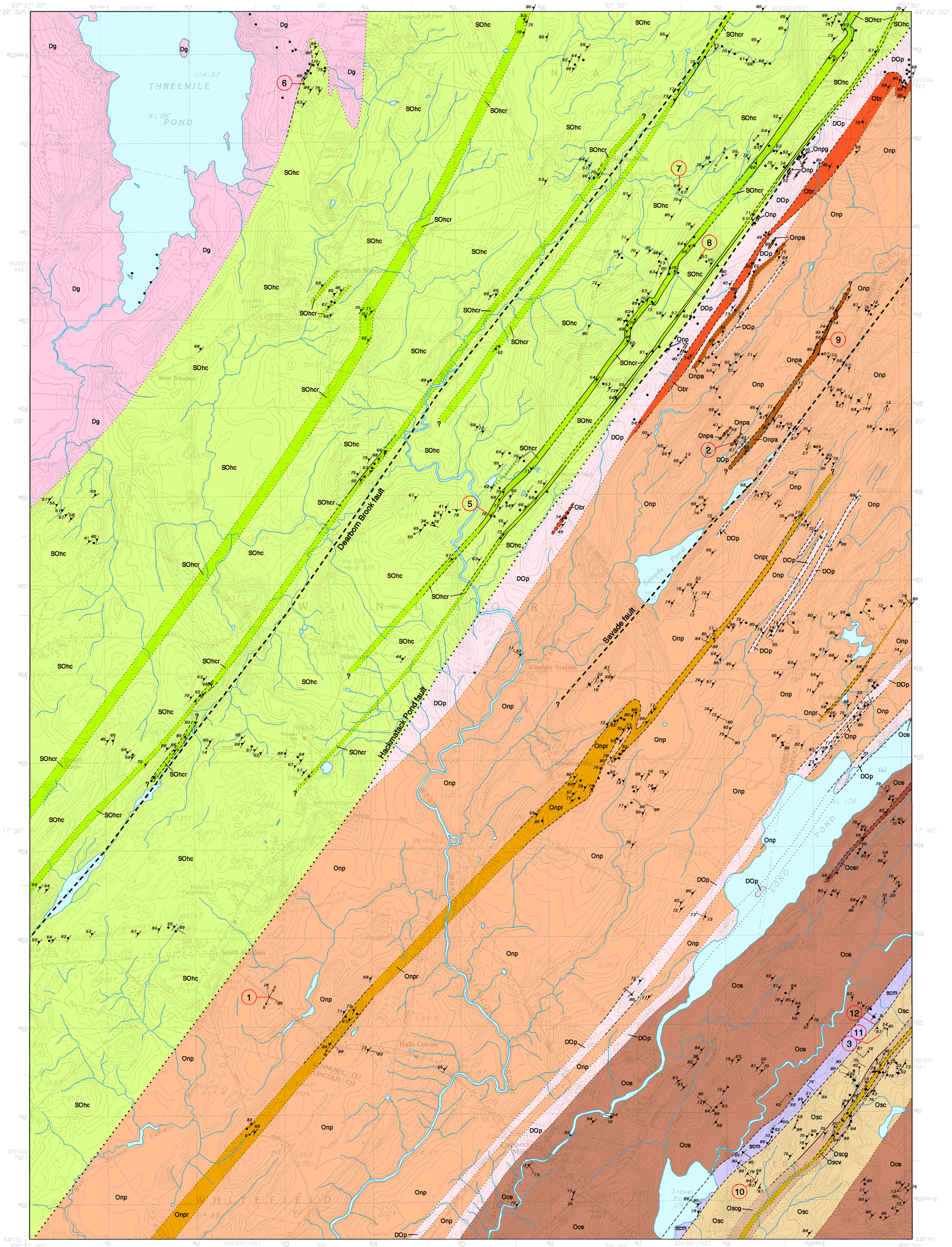
Bedrock Geology



SOURCES OF INFORMATION

Bedrock mapping by Tim Grover and Leslie Fernandes, 2001-2002.

Quadrangle Location

Topographic base from U.S. Geological Survey Weeks Mills quadrangle, scale 1:24,000 using standard U.S. Geological Survey topographic map symbols.

The use of industry, firm, or local government names on this map is for location purposes only and does not imply responsibility for any present or potential effects on the natural resources.

EXPLANATION OF UNITS

INTRUSIVE ROCKS

Devonian

Dg — **Threemile Pond pluton.** Medium-grained to coarse-grained, light gray to light tan weathered, light gray, biotite-bearing granodiorite to granite. Lithologically heterogeneous with biotite content varying from less than 10% to greater than 25%. Locally contains enclaves of granodiorite to diorite or xenoliths of metasedimentary rock. Cut by quartzofeldspathic dikes in some places. High precision U-Pb zircon age of 381 ± 1 Ma reported by Tucker and others (2001).

Devonian(?)-Ordovician(?)

DOp — **Pegmatite.** White, coarse-grained feldspar-quartz-muscovite pegmatite. This rock type intrudes all others in the field area. It is generally parallel or slightly discordant to foliation in the Nehumkeag Pond Formation, but highly discordant to the layering in the Hutchins Corner Formation. The thick pegmatite belt associated with the Hackmatack Pond fault contains abundant, small, foliation-parallel rafts of metasedimentary rock, many of which are not shown on the map. Several ages of pegmatite are probably present.

STRATIFIED ROCKS

Silurian-Ordovician(?)

SOhc — **Hutchins Corner Formation.** Lithologically heterogeneous package of metasedimentary rocks including: gray to tan weathered, dark gray, massive to well-laminated, fine-grained biotite-quartz-feldspar granofels, in some places containing very thin, slightly coarser-grained quartz stringers; gray weathered, dark purplish-gray, fine-grained biotite quartzite; light gray to tan weathered, light gray, schistose granofels with biotite porphyroblasts; light gray to tan weathered, light gray, fine- to medium-grained, feldspathic calc-silicate granofels with chlorite and/or actinolite, commonly calcite-bearing. Rocks in this unit generally exhibit thin to medium scale bedding.

SOhcr — **Rusty weathering schist.** Rusty weathering, highly deformed and crenulated muscovite-bearing schist. It ranges from muscovite-rich to quartz-rich; some contains graphite. Several relatively narrow bands of rusty weathering schist are mapped within the Hutchins Corner Formation. It is not known whether these are separate and distinct units or whether they represent a single unit repeated by folding or faulting. The dominant foliation in the rusty weathering schist is commonly slightly discordant to that in the enveloping rocks.

Ordovician(?)

Obr — **Beaver Ridge Formation.** Deeply rusty weathering, dark gray to black, sulfidic and often graphitic, quartz-muscovite schist to muscovite-quartz-feldspar granofels. It is locally sillimanite bearing.

Onp — **Nehumkeag Pond Formation.** A lithologically heterogeneous unit comprised of metamorphic rocks with both igneous and sedimentary protoliths. The unit is dominated by gray, well foliated, medium-grained, biotite-plagioclase-quartz ± garnet gneiss. Other common rock types include biotite-hornblende-plagioclase gneiss in discontinuous lenses; a salt and pepper, biotite-feldspar-garnet-quartz gneiss with garnets less than 3 mm across; and thin, discontinuous layers of sillimanite-bearing metapelite. Asymmetric "Z" folds are widely present.

Onpg — **Aluminous gneiss.** Light gray, medium- to coarse-grained, biotite-plagioclase-staurolite gneiss with possible garnet and/or kyanite. Also a medium-grained, garnet-biotite schist with possible kyanite. Also biotite-hornblende ± garnet gneiss. All above rock types found in close proximity with pegmatite along the Hackmatack Pond fault. Along strike to the northeast, Pankiwskyj (1996) mapped similar rock as the Sandy Pond Member of the Carrs Corner Formation.

Onpa — **Amphibolite.** Dark gray to black, medium-grained, well-foliated, epidote-plagioclase-amphibolite, locally with garnet. This unit is found as relatively thin, discontinuous, foliation-parallel layers.

Onpr — **Rusty schist.** Rusty weathering, quartz-muscovite-graphite schist, typically crenulated.

-- Relationship uncertain --

Osc — **Scarboro Formation.** Andalusite schist, black to gray to moderately rusty weathering, medium-grained to coarse-grained, graphitic, garnet-staurolite-andalusite schist with discontinuous, intensely folded quartz veins containing coarse, pink andalusite. The schist is interlayered with gray, medium-grained, micaceous quartz-feldspar granofels and lesser amounts of thinly bedded, coarse-grained, diopside calc-silicate rock.

Oscg — **Gray schist.** A gray, medium-grained, highly crenulated schist. A distinctive feature is the presence of thin, discontinuous fold lenses of salmon colored garnet coticule.

Oscv — **Metavolcanic unit.** Greenish gray, medium-grained, garnet-andalusite schist interlayered with boudinaged and folded lenses of medium-grained to coarse-grained calc-silicate granofels. Garnet and andalusite porphyroblasts in this unit are generally idiomorphic and less than 5 mm in size.

Oce — **Cape Elizabeth Formation.** Light to dark gray, medium-grained to coarse-grained muscovite-biotite-quartz-feldspar granofels or gneiss interlayered with coarse-grained feldspathic biotite-muscovite schist. The presence of coarse spangly muscovite is one of the characteristic features of the Cape Elizabeth Formation. Quartz veins of variable thickness down to a few millimeters are common. Calc-silicate layers are also present locally.

Ocer — **Rusty-weathering schist.** One thin but mappable unit of an oxidized, dark gray, medium-grained, quartz-muscovite schist and granofels.

HIGHLY DEFORMED ROCKS

scm — **Sandhill Corner mylonite.** A mappable zone of variably mylonitic rocks. There is a strain gradient, with intensity increasing from west to east across the unit. The western portion of the Sandhill Corner mylonite is a protomylonite with feldspar and muscovite porphyroclasts. The eastern part of the unit is a light gray, highly-jointed, mylonite to ultramylonite with occasional coarsely crystalline muscovite lineations. Cape Elizabeth Formation is the likely protolith.

EXPLANATION OF SYMBOLS

- Bedrock outcrop.
- Strike and dip of main foliation. (Inclined, Vertical)
- Trend and plunge of fold hinge. (Dextral, Rotation sense unspecified)
- Trend and plunge of lineation. (Horizontal, Plunging)
- Strike and dip of joint. (Inclined, Vertical)
- Lithologic contact. (Known, Approximate, Inferred)
- Fault. (Known, Approximate, Inferred)
- ④ Location of photograph shown in sidebar

Weeks Mills Quadrangle, Maine

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Most of the bedrock that underlies the Weeks Mills quadrangle is stratified, or layered, rock of Ordovician to Silurian age (Photos 1-5), that was subsequently changed into metamorphic rock by heat and pressure, probably in the Devonian Period (see Geologic Time Scale below). A lesser amount of intrusive igneous rock, solidified from molten rock, is also present, as a large mass in the northwest corner of the map area (Photo 6), and as thin sheets injected into the metamorphic rocks (Photos 2, 6-8). Features attributed to the metamorphic process include stretching and folding of layers (Photos 8-11), as well as the presence of minerals such as garnet and andalusite that form at high temperatures (Photos 2, 11). The bedrock has been broken by several faults, shown on the map by the offseting of units, and by the presence of a rock called mylonite that consists of highly sheared rock typically found in fault zones (Photo 12).

Photo 1. This photograph shows some of the variation in rock types of the Nehumkeag Pond Formation (**Onp**). The gneisses of the Nehumkeag Pond Formation, at least in part, are metamorphosed volcanic rocks. *(Roadcut along Route 17 east of South Windsor.)*

Photo 2. This garnet-bearing amphibolite of the Nehumkeag Pond Formation (**Onpa**) formed as result of the metamorphism of an iron-rich igneous rock during the Devonian Acadian orogeny. The white vein cutting across the rock is an igneous rock that intruded after the amphibolite was metamorphosed. *(0.7 miles northeast of Savade Pond.)*

Photo 3. Outcrop of schists of the Scarboro Formation (**Osc**) in a blueberry field in the southeastern corner of the map area. The northeast-trending ridge is controlled by the bedrock structure. *(East of Black Brook.)*

Photo 4. Woozel has a nose for sniffing out the outcrop! Here she is sitting on an outcrop of the Hutchins Corner Formation (**SOhc**), with thin greenish and purplish gray layers steeply inclined.

Photo 5. This rusty weathering rock is one of several thin bands of iron sulfide-bearing schist (**SOhcr**) that occur in the Hutchins Corner Formation. *(1.2 miles north of Windsor Station.)*

Photo 6. A boulder of Threemile Pond plutonic rock (**Dg**) which was intruded by white pegmatite dikes. *(East of Threemile Pond.)*

Photo 7. A white pegmatite dike cuts across the layering in the metasedimentary rocks of the Hutchins Corner Formation. Dikes of this sort are common. *(0.5 miles east of Weeks Mills.)*

Photo 8. A stretched pegmatite dike in gneisses of the Hutchins Corner Formation. At one time the white pegmatite dike, which is an igneous rock, was a layer of constant thickness. After it was emplaced it was deformed during the Acadian orogeny. *(0.8 miles southeast of Weeks Mills.)*

Photo 9. The tight, small scale folds in this amphibolite of the Nehumkeag Pond Formation suggest deformation during the Acadian orogeny was intense. *(1.6 miles northeast of Savade Pond.)*

Photo 10. The prominent Z-shaped folds in this exposure of the Scarboro Formation are common throughout the Weeks Mills quadrangle. They are thought to be associated with right lateral shear along the Norumbega fault system. *(Power line east of Travel Pond.)*

Photo 11. Asymmetric folds in the Scarboro Formation. There is a large pink andalsite crystal on the right side of the Brunton compass. The presence of andalusite indicates that these rocks were metamorphosed at relatively high temperature at shallow levels in the Earth's crust. *(Same blueberry field as Photo 3.)*

Photo 12. Folded mylonitic foliation in the Sandhill Corner mylonite (**scm**). A mylonite forms when the crystal size of a rock is reduced through shearing of the rock. The shearing results when blocks of rock slide past one another. *(About 400 feet west of Photo 3.)*

GEOLOGIC TIME SCALE

Geologic Age		Absolute Age*
Cenozoic Era		0-65
Mesozoic Era	Cretaceous Period	65-145
	Jurassic Period	145-200
	Triassic Period	200-253
Paleozoic Era	Permian Period	253-300
	Carboniferous Period	300-360
	Devonian Period	360-418
	Silurian Period	418-443
	Ordovician Period	443-489
	Cambrian Period	489-544
Precambrian time		Older than 544

* In millions of years before present. (Okulitch, 2002)

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