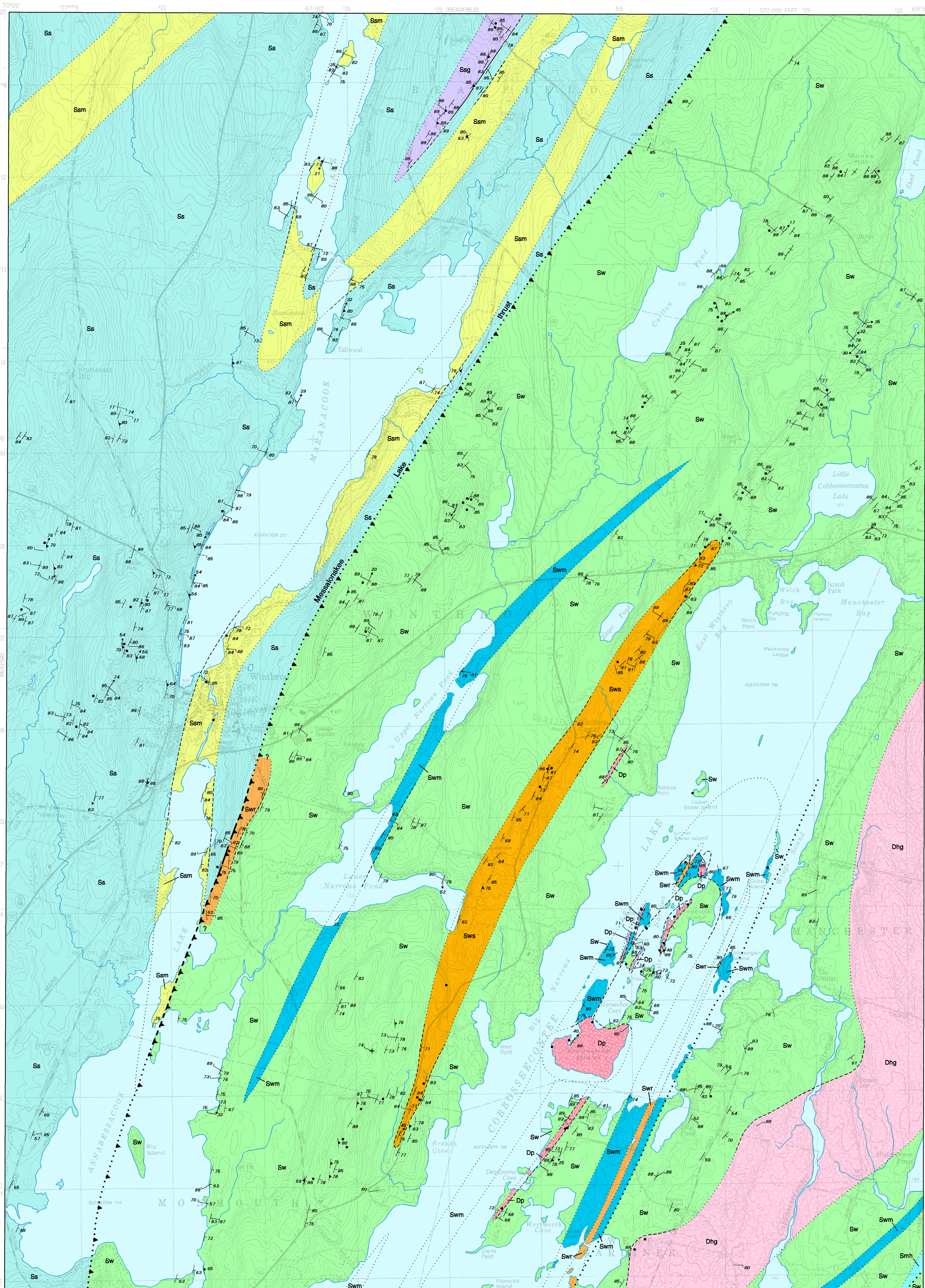

EXPLANATION OF UNITS

INTRUSIVE ROCKS

Devonian

Dhg — **Hallowell Granite**. Felsic intrusive rocks of variable lithology, including medium-grained, biotite-bearing granitoid and muscovite-tourmaline granite. This pluton extends into the Augusta 7½' quadrangle to the east (Barker, 1964; Marvinney and Barker, 2012). Although pegmatite might be related to this unit and is associated with it in the field, it is mapped separately. An Rb-Sr whole-rock age of 387 ± 11 Ma for this pluton was reported by Dallmeyer and Van Breemen (1981).

Devonian(?)

Dp — **Pegmatite**. Many small bodies of uncertain shape and size. Several occurrences on the islands in Cobbosseecontee Lake appear to be dikes. This pegmatite might be related to the Hallowell Granite. May include xenoliths of foliated metamorphic rocks.

STRATIFIED ROCKS

Silurian

West of the Messalonskee Lake Thrust

Ss — **Sangerville Formation**. Medium-grained biotite-muscovite-quartz-feldspar granofels, interlayered on a variable scale with biotite-muscovite-quartz-feldspar schist which commonly contains garnet as 2-3 mm porphyroblasts and staurolite porphyroblasts that exceed 1 cm in length. Beds typically from 2-20 cm, although some beds exceed 1 meter in thickness. Calc-silicate lenses range from a few centimeters to one meter in length and up to 10 cm in width and contain green calc-silicate minerals and often orange grossular garnet. This unit correlates with the Mayflower Hill Formation.

Ssm — **Marble and calc-silicate rock**. Medium-grained, dark gray to black marble with variable amounts of calc-silicate minerals, interlayered on a scale of 2-10 cm with medium-grained, green and white calc-silicate layers that commonly contain calcite, and medium-grained biotite-quartz-feldspar granofels.

Ssg — **Gray slate**. Medium gray, thinly bedded slate. Some thin granofels beds. Some layers contain abundant biotite, staurolite, and small garnets.

East of the Messalonskee Lake Thrust

Vassalboro Group (Marvinney and others, 2010)

Smh — **Mayflower Hill Formation**. Purplish-gray, medium-grained quartz-feldspar-biotite granofels, in medium to thick beds (5-25 cm), although there are some sections of thinly bedded granofels. Bedding thickness can be quite variable within and among outcrops. Some sections contain abundant green-gray fine-grained calc-silicate layers and lenses. The granofels is interbedded with thin biotite-muscovite schist. Graded beds are common, particularly at lower metamorphic grades. This unit correlates with the Sangerville Formation. Based on regional geology, this unit is inferred to underlie a small area in the southeast corner of the map.

Sw — **Waterville Formation**. Thinly bedded, medium-grained biotite-quartz-feldspar granofels, commonly interlayered on a scale of 2-10 cm with medium-grained, green and white calc-silicate rock. Muscovite-biotite schists and alumino-silicate-bearing schists are common, although these rock types are subordinate to the granofels and calc-silicate rock. Quartz laminae of 1-2 mm thickness are common.

Note: The ordering of the following subunits within **Sw** does not represent a stratigraphic order.

Swm — **Marble and calc-silicate rock**. Medium-grained, dark gray to black marble with variable amounts of calc-silicate minerals, interlayered on a scale of 2-10 cm with medium-grained, green and white calc-silicate layers that commonly contain calcite, and medium-grained, biotite-quartz-feldspar granofels.

Swr — **Rusty weathering schist**. Medium-grained, muscovite-rich or quartz-rich, rusty-weathering schist. Pyrite is present locally. Translucent brown (root-beer colored) biotite is preserved in some places, but often is weathered to a golden brown color. This unit occurs at different stratigraphic positions within **Sw** south of downtown Winthrop, and also as thin units within **Swm** in Cobbosseecontee Lake.

Sws — **Thinly layered, rusty-weathering granofels and schist**. Rusty-weathering unit that shares many lithologic characteristics with the main part of the Waterville Formation. Medium-grained, rusty-weathering biotite-quartz-feldspar granofels interlayered with medium-grained, rusty-weathering muscovite-rich or quartz-rich schist. The relationship of this unit to belts of **Swr** on the map is unknown.

EXPLANATION OF SYMBOLS

Note: Structural symbols are drawn parallel to strike or trend of measured structural feature. Barb or tick indicates direction of dip, if known. Annotation gives dip or plunge angle. For most planar features, symbol is centered at observation point; for joints, observation point is at end of strike line opposite dip tick. For linear features, tail of symbol is at observation point. Multiple measurements at a site are represented by combined symbols.

- • Outcrop of mapped unit.
- + Outcrop of pegmatite within another unit.
- 20 Bedding (inclined, vertical).
- 20 Metamorphic foliation (inclined).
- 20 Lineation.
- 20 Fold axis.
- 20 Joint (inclined, vertical).

EXPLANATION OF LINES

Contact between mapped units (well located, approximately located, poorly located).

Fault (poorly located).

Interpreted thrust fault, teeth on upper plate (well located, approximately located, poorly located). The Messalonskee Lake thrust is inferred from regional geology as presented by Osberg (1968), Osberg (1988), and Tucker and others (2001).

Bedrock Geology of the Winthrop Quadrangle, Maine

Bedrock geologic mapping by
Timothy W. Grover

Digital cartography by
Susan S. Tolman

Geologic editing by
Henry N. Berry IV
Robert G. Marvinney

Cartographic design by
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State Geologist

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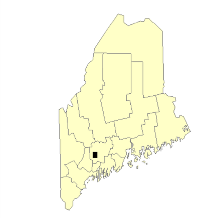
Open-File Map 14-3
2014



Quadrangle Location

TRUE NORTH

SCALE 1 : 24,000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET

SOURCE OF INFORMATION

Field work by T. W. Grover, 2005-2006.

Topographic base from U.S. Geological Survey Winthrop quadrangle, scale 1:24,000 using standard U.S. Geological Survey topographic map symbols. Magnetic declination 17° west of North.

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

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GEOLOGIC TIME SCALE

Geologic Age		Absolute Age*
Cenozoic Era		0-66
Mesozoic Era	Cretaceous Period	66-145
	Jurassic Period	145-201
	Triassic Period	201-252
Paleozoic Era	Permian Period	252-299
	Carboniferous Period	299-359
	Devonian Period	359-419
	Silurian Period	419-444
	Ordovician Period	4443-485
	Cambrian Period	485-541
Precambrian time		Older than 541

* In millions of years before present. (Walker, J.D., Geissman, J.W., Bowring, S.A., and Babcock, L.E., compilers, 2012, Geologic Time Scale v. 4.0: Geological Society of America, doi: 10.1130/2012.CTS004R3C.)