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Geology of the Standish 7 1/2' Quadrangle, Southwestern Maine

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INTRODUCTION

Rocks of the Standish 7 1/2' quadrangle include a small variety of igneous rocks ranging in age from Devonian to Mesozoic, and metamorphosed sedimentary rocks of the lower part of the Central Maine Sequence of Silurian age. Outcrops are generally rather sparse because of extensive cover of diverse glacial sediments.

STRATIGRAPHY

Windham Formation

The name "Windham" was proposed by Hussey (1971) for pelitic, psammitic, and calcareous metasedimentary rocks exposed in the general Windham area, southwest of the Sebago batholith. The Windham Formation occupies two synformal belts trending north-northeast through the Standish quadrangle. A third belt, extending north-northeastward from Bonny Eagle in the northwestern edge of Hollis Township and originally included with the Windham Formation (Hussey, 1971, 1985), is separated in this report and tentatively correlated with the Rindgemere Formation.

The principal lithology of the Windham Formation is nonmigmatized generally brownish gray fine-grained non- to slightly rusty-weathering massive to thin bedded biotite-muscovite-garnet schist, locally with staurolite, kyanite, and/or fibrolitic sillimanite. Kyanite has only been seen in outcrop and in thin sections of the metapelites north of the Standish map area in the North Gorham area. Kyanite does occur within the Standish quadrangle in rocks tentatively correlated with the Rindgemere Formation (see discussion below). Thin interbeds of quartz-biotite-muscovite garnet granofels and granulose schist and rarely calc-silicate granofels occur throughout the formation. Near the middle of the formation in exposures to the north of the Standish map sheet is a 60-100 meter thick ribbony-bedded brownish gray weathering metalimestone and calc-silicate marble. A single outcrop of calc-silicate granofels in the southeastern belt of the Windham Formation may repre-

sent the only exposure of this ribbon limestone member of the formation.

Hutchins Corner Formation

The most extensive unit of the Standish quadrangle consists of rocks of the Hutchins Corner Formation which was originally mapped in the Waterville area as the Vassalboro Formation (Osberg, 1968). Osberg (1988) demonstrated that rocks of the Vassalboro type area include stratigraphic intervals above, as well as below, the Waterville Formation, hence he recommended against use of the name "Vassalboro." In the Palermo area of central Maine, he proposed the name "Hutchins Corner" for rocks stratigraphically beneath the Waterville Formation (Osberg, 1988).

The principal lithology is medium brownish to purplish gray quartz-plagioclase-biotite-hornblende granofels with thin interbeds of buff-weathering medium greenish gray calc-silicate granofels. One to five-meter thick zones of rusty-weathering pyrrhotitic quartz-muscovite-biotite schist are common throughout the formation. The best exposure of this formation is the kilometer-long dry channel of the Saco River at Bonny Eagle where there is a nearly continuous outcrop that includes all the lithologies of the formation. The Hutchins Corner Formation is not migmatized within the Standish quadrangle.

Unnamed Schist (Rindgemere Formation?)

Rusty and non-rusty-weathering pelitic rocks occupy an antiformal belt extending north-northeast from the Saco River near Bonny Eagle to and beyond the Standish area. These rocks were originally included with the Windham Formation, but are separated from that formation in this report on structural and lithologic grounds. Rocks of this belt include slightly to very rusty-weathering muscovite-quartz-biotite-staurolite schist, locally with sillimanite and kyanite; muscovite-biotite quartz schist; and quartzite. In general these rocks are richer in musco-

vite, and rustier weathering than pelitic rocks of the two belts that are mapped as Windham Formation. The position of these rocks stratigraphically below the Hutchins Corner Formation is suggested by the consistent northeasterly plunge of parasitic folds in the Hutchins Corner Formation exposed in the dry channel of the Saco River. The tentative correlation of these pelitic rocks with the Rindgemere Formation is suggested by the widening of the antiformal belt to the southwest and off the western edge of the map into the main outcrop belt of the Rindgemere Formation in the Limington 7 1/2' quadrangle to the west. Alternatively, these pelitic rocks may be interpreted as a lens within the Hutchins Corner Formation, thus eliminating the antiform.

INTRUSIVE ROCKS

Foliated Granodiorite at Bonny Eagle

This rock unit is exposed in the southern quarter of the dry channel of the Saco River at Bonny Eagle. No other exposures are known. This is a medium gray, fine to medium grained moderately foliated biotite-hornblende granodiorite. Near the contact with the host Hutchins Corner Formation, it is finer grained and more strongly foliated.

Two-Mica Granite

Parts of two small plutons of medium grained slightly foliated to massive light gray biotite-muscovite-garnet granite crop out in the northwestern part of the Standish quadrangle. The southern pluton is located just west of the Saco River at Bonny Eagle, and the northern pluton is located just east of Watchic Pond in the northwestern corner of the map. Both plutons are mostly exposed in adjacent quadrangles.

Basalt and Diabase

Basalt and diabase sills and dikes ranging from 1/4 to 3 meters in width intrude all other rock units of the Standish quadrangle. These are particularly common in the exposures of the Hutchins Corner Formation in the Bonny Eagle dry channel of the Saco River, and in the area just west of Standish village. A 1/2 to 1 meter-wide dike at the northern-most exposure in the dry channel, just below the dam, has large ultramafic mantle xenoliths.

AGE AND CORRELATION OF UNITS.

The Windham Formation was first mapped by Pendexter (1949) who referred to it as the Little River formation, but the name was never formalized, nor used in a published journal or guidebook. Gates (1961), unaware of this informal usage, adopted it and formalized the name Little River Formation for rocks in the Eastport-Cutler area. Because of this formal pre-emption, the writer proposed the name Windham Formation for

the rocks in the greater Windham area. The type locality for this formation is the exposure at the base of the dam at the south end of Dundee Pond near North Gorham. This exposure continues about 200 m south of the dam, and includes the ribbon limestone member of the formation. The Windham Formation is correlated with the Waterville Formation of the Augusta-Waterville area (Osberg, 1968) on the basis of lithic similarity. It is now regarded to be stratigraphically above the Hutchins Corner Formation, but when first mapped by the writer, the stratigraphic order was just the opposite on the basis of correlation with the Waterville section. Osberg (1968) originally regarded the Waterville Formation to be the highest unit of that section, with the Mayflower Hill Formation at the base, but now regards the Hutchins Corner Formation to be the basal unit (Berry and Osberg, 1988). The Windham Formation is inferred to be Early to Middle Silurian in age on the basis of the correlation with the Waterville Formation which has been dated as Early to Middle Silurian on the basis of graptolite fossils at a few central Maine localities.

The Hutchins Corner Formation is traceable directly to the Augusta-Waterville area around the east margin of the Sebago batholith, into rocks that are inferred to be the base of the Central Maine Sequence, and hence beneath the Waterville Formation. The Hutchins Corner Formation is regarded to be Late Ordovician to Early Silurian in age by its conformable stratigraphic position beneath the fossiliferous Waterville Formation.

Pelitic rocks here included tentatively with the Rindgemere Formation were originally mapped with the Windham Formation. The outcrop belt of these rocks is inferred to be an antiformal fold with the Hutchins Corner Formation on either limb. The plunge of this fold is inferred to be to the north on the basis of (1) the plunges of minor folds of the Hutchins Corner Formation in the dry channel of the Saco River at Bonny Eagle just to the southeast, and (2) the widening of the outcrop belt of these pelitic rocks to the southwest toward the general outcrop area of the Rindgemere Formation in the Limington quadrangle. The position of these pelites, conformably beneath the Hutchins Corner Formation raises the problem of what they may correlate with in the Central Maine Sequence of the Rangeley area (Osberg and others, 1985). A more tenable correlation of the Rindgemere Formation is with rocks of the Rangeley-Seboomook sequence to the north (Hussey, 1989). A better understanding of the relations of these pelitic rocks with the pelitic rocks of the Rindgemere Formation to the west is needed before any correlation and age can be stated with reasonable certainty.

Radiometric dates are not available for the two small granitic plutons, the granodiorite, or any of the mafic dikes. The granite plutons are lithologically similar to the nearby Sebago granite and Lyman granite which have ages of 280 and 325 MA respectively (Aleinikoff and others, 1985), but they are also similar to many two-mica granites of central Maine that give Devonian ages. Consequently the ages of these two minor plutons are indicated as Devonian to Late Carboniferous. The foliated granodiorite is not constrained by any radiometric ages or criti-

cal field data, but is probably older than the two-mica granites on the basis of the foliation. Basaltic and diabasic dikes cut and hence are younger than the granodiorite and two-mica granites. The younger limit of their age is unknown, but they are similar to mafic dikes elsewhere in New England that are probably Late Triassic to Early Cretaceous in age.

STRUCTURE

The structure of the Standish quadrangle is dominated by two major synclines in which the Windham Formation is exposed, the intervening anticlines which expose the Hutchins Corner Formation, and a third anticline on the northwest that preserves the Rindgemere(?) Formation. Designation of these structures as anticlines and synclines is tenuously based on the geometry of parasitic folds of the Hutchins Corner Formation exposed in the dry channel of the Saco River at Bonny Eagle. The attitude of axial planes of these folds averages N 24° E, 32° SE, and axes average N 47° E, 30°. They are slightly overturned to the northwest. Figure 1 is a plot of poles to bedding showing fairly consistent steep dips to the southeast throughout the quadrangle.

Schistosity (Figure 2) although generally parallel to bedding shows more variability, probably reflecting two distinct schistosity-producing events. The later schistosity is generally much gentler, with variable strikes, and is not reflected in parallelism or subparallelism to bedding. Similar structural relations in the area just east and northeast of the Lyman pluton are apparently related to the intrusion of the Lyman pluton (Hussey, 1985; Marvinney and others, 1995). The later gentler schistosity in the Standish quadrangle may similarly be related to intrusion of mi-

nor granite plutons, some of which may not be exposed at the present erosion level. Figures 3 and 4 are plots of a limited number of mineral and crenulation lineations. The crenulation lineation is quite consistent with an average trend of N 50° E, 28. Mineral lineation is more variable, but the number of data points is too small to be statistically significant.

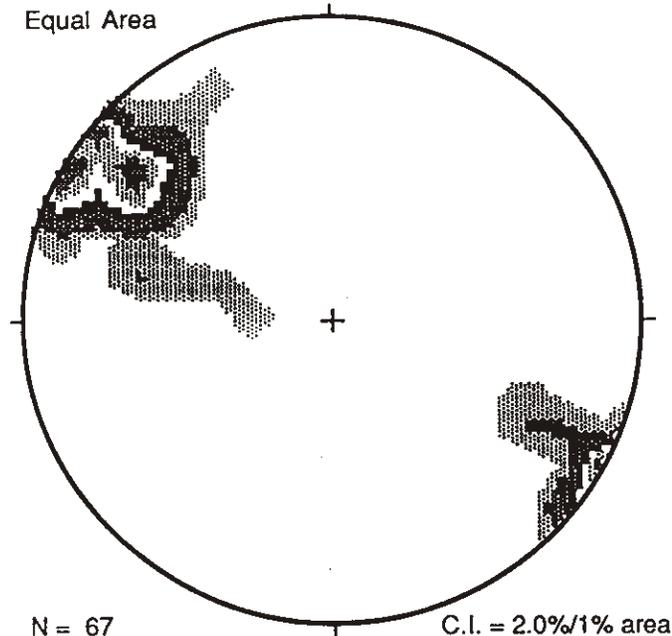


Figure 1. Lower hemisphere equal area plot of poles to bedding, Standish 7 1/2' quadrangle, southwestern Maine.

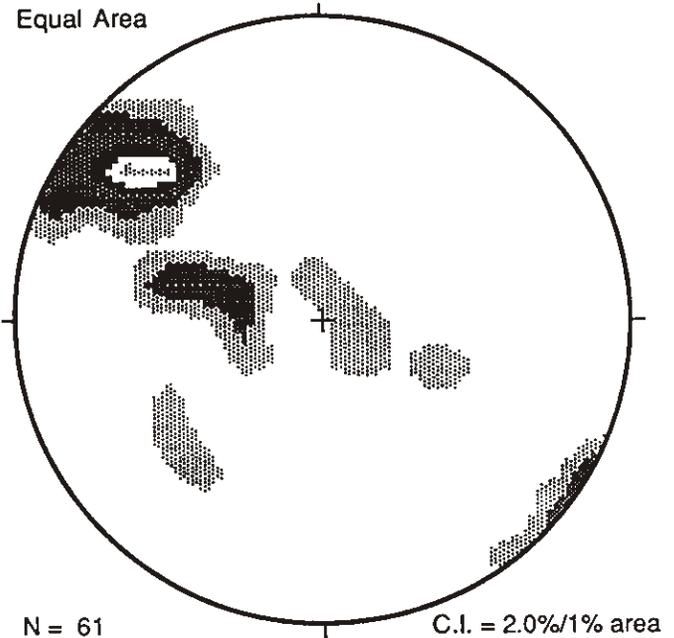


Figure 2. Lower hemisphere plot of poles to schistosity, Standish 7 1/2' quadrangle, southwestern Maine.

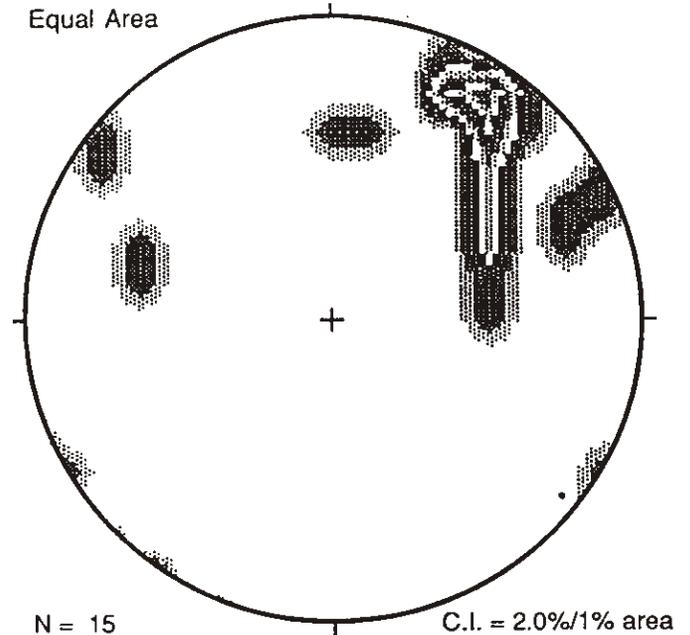


Figure 3. Lower hemisphere plot of mineral lineation, Standish 7 1/2' quadrangle, southwestern Maine.

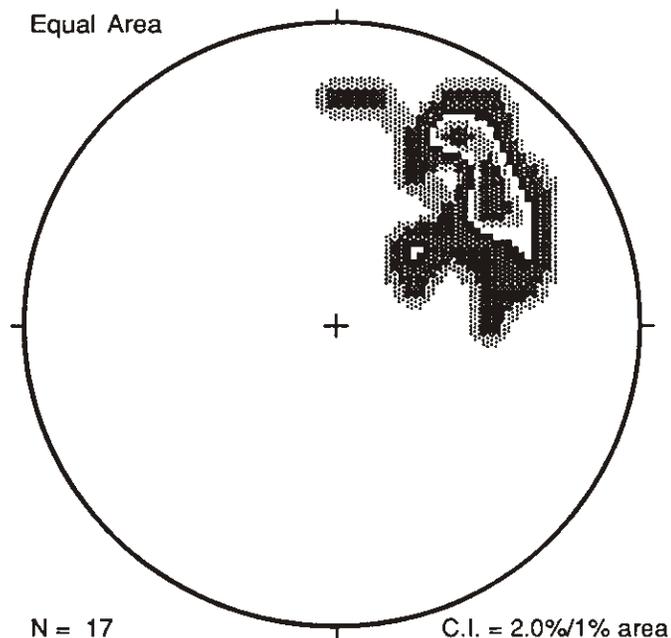
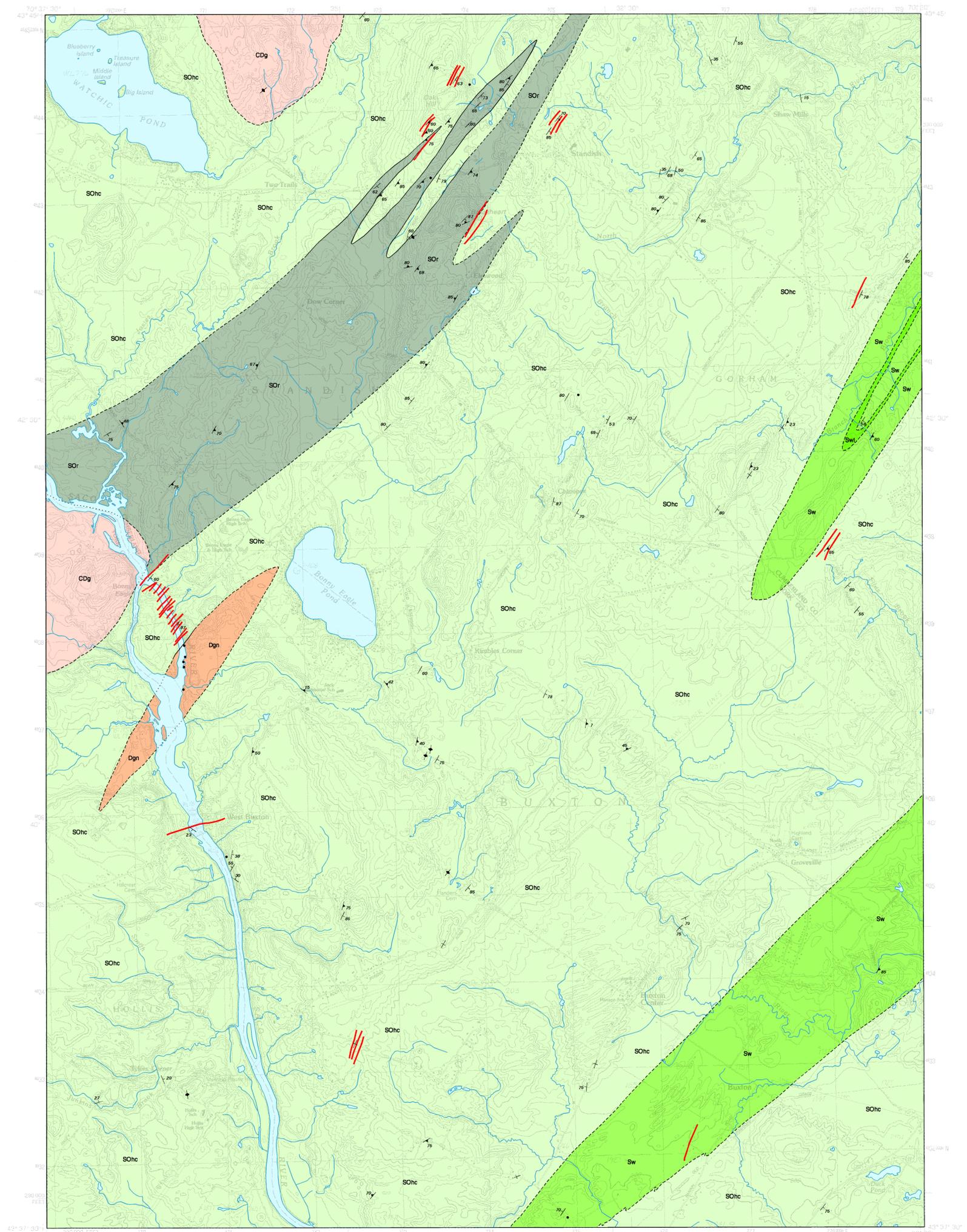


Figure 4. Lower hemisphere plot of crenulation lineation, Standish 7 1/2' quadrangle, southwestern Maine.

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EXPLANATION OF UNITS

Intrusive Rocks

Mesozoic

Mafic dikes. Dark gray, unaltered basaltic and diabasic dikes of presumed Mesozoic age ranging from a few cm to several meters in thickness; plagioclase phenocrysts common; planar contacts with narrow chill zones; columnar jointing common perpendicular to dike walls. One dike at Bonny Eagle contains abundant lherzolite nodules.

Carboniferous

Granite. Fine- to medium-grained, light gray, locally foliated biotite-muscovite granite. Pegmatite dikes abound within and in the vicinity of the pluton. These are very thin to meters-thick dikes, very coarse-grained quartz, perthite microcline, muscovite, biotite, garnet, and schorlite.

Devonian

Granodiorite gneiss. Medium gray, foliated and lineated biotite-hornblende granodiorite gneiss.

Stratified Rocks

Silurian

Windham Formation. Thin bedded to massive muscovite-biotite-garnet-quartz-staurolite or sillimanite schist with variable rusty weathering. Thin interbeds of quartz-biotite-muscovite granofels, and local calc-silicate gneiss.

Metalmestone member. Gray, thin ribbon-bedded metalmestone and calc-silicate marble with thin interbeds of brownish gray quartz-plagioclase-biotite-calcite granofels.

Ordovician or Silurian

Hutchins Corner Formation. Light tan-weathering, medium-grained quartz-plagioclase-biotite granofels in beds of 5-10 cm thickness with some thinner packets, some beds to several meters thick. Graded bedding common; bed bases are sharp and distinct. Minor thin quartzose biotite schist. Small greenish gray calc-silicate-rich lenses and thin beds occur infrequently in the granofels. Massive, rusty-weathering quartzose biotite schist comprises 10% of unit.

Unnamed schist. Rusty to non-rusty muscovite-biotite-garnet schist with thin quartzite interbeds. Stratigraphic assignment uncertain.

EXPLANATION OF SYMBOLS

Bedding - inclined, vertical. Note: S1 foliation is always parallel to bedding and is not shown by separate symbol.

Bedding with known topping direction - inclined, vertical.

Foliation - inclined, vertical.

• Outcrops without structural data.

Symbols representing inclined fabrics are annotated with dip angles.

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All linear features are solid where approximately placed, dashed where inferred, dotted where concealed, and queried where uncertain.

Bedrock Geology of the Standish Quadrangle, Maine

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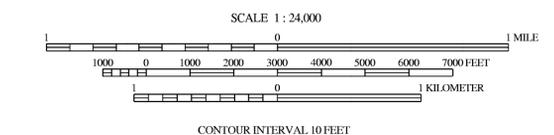
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Quadrangle Location



SOURCES OF INFORMATION

Bedrock mapping by Arthur M. Hussey completed during the 1995 field season.

Topographic base from U.S. Geological Survey Standish 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.