DEPARTMENT OF CONSERVATION
Maine Geological Survey
Robert G. Marvinney, State Geologist

OPEN-FILE NO. 12-21

Title: *Bedrock Geology of the Saddleback Hills, Baldwin, Maine*

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Date: *2012*

Financial Support: Funding for the preparation of this report was provided in part by the U.S. Geological Survey STATEMAP Program, Cooperative Agreement No. 1434-95-A-01363.

Contents: 6 p. report and map

Editor's Note

This map and report were originally submitted to the Maine Geological Survey in 1996 as part of a larger project. The results were incorporated in the bedrock geologic map of the Portland 30' x 60' quadrangle, a regional compilation published by the Maine Geological Survey in 1998 (H.N. Berry IV and A.M. Hussey II, Bedrock geology of the Portland 1:100,000 quadrangle, Maine and New Hampshire, Open-File Map 98-1).

We are glad to finally publish the detailed map and report for the Saddleback Hills, which show the large amount of data collected in this small area, and describe the evidence and reasoning which have led to the current understanding of the bedrock geology. In compiling the regional map, several decisions were made about how to incorporate the rocks of the Saddleback Hills. In particular, the unnamed rock units mapped in the Saddleback Hills were assigned to formations on the regional map in the following way.

Saddleback Hills (this report)	Portland regional map (Berry and Hussey, 1998)
Sgm	Sr
Ss	Srb
Sr	Srlm
Sg	DOsf
Sm	Srm

One of the significant questions raised at the time, and which still remains, concerns the age relationship and stratigraphic sequence of the five units. In the absence of primary topping indicators from the stratified rocks, Schoonmaker describes the rocks from east to west, and is non-committal on the interpretation of stratigraphic sequence. Berry and Hussey, in consideration of the regional stratigraphic sequence and pattern of units, assigned most of the rocks to the Rindgemere Formation (Sr) and adopted Schoonmaker's suggestion (this report, p. 2) of a fault between the eastern unit of migmatite (Sm) and the adjacent granofels (Sg).

In editing the current map and report, it was decided to retain the integrity of Schoonmaker's original 1996 map and report. Even though a somewhat different stratigraphic and structural interpretation was presented in the meantime (Berry and Hussey, 1998), the original work is still valid.

Henry N. Berry IV
Maine Geological Survey
June, 2012

Maine Geological Survey
Open-File 12-21

Bedrock Geology of the Saddleback Hills, Baldwin, Maine

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INTRODUCTION

The area described in this report contains a group of small mountains known as the Saddleback Hills in the townships of Sebago and Baldwin, southwestern Maine. It includes portions of the U.S. Geological Survey North Sebago, Steep Falls, and Cornish 7.5' quadrangles. The field area is bounded approximately by Route 113 on the south and west, Route 107 on the east, and Douglas Hill Road to the north (see accompanying map). The Saddleback Hills rise above the Sebago Lakes region which stretches across a low-lying area several miles to the north and east. The Saddleback Hills rise to a height of 1000'-1300' above sea level and provide an area of good bedrock exposure, especially along the south-facing side of a generally east-northeast-trending ridge which traverses nearly the entire field area. The ridge is divided into separate peaks by saddles, presumably from which the name of the hills is derived.

Field work was conducted during the summer of 1996 at the behest of the Maine Geological Survey as part of a regional project to map the bedrock geology of the Portland 1:100,000-scale map sheet. Additional funding for this project was provided through the STATEMAP program of the U.S. Geological Survey under the National Geologic Mapping Program. Mapping was conducted primarily at 1:24,000 scale. Some detailed work was done at a scale of 1:12,000 to provide a better understanding of the contact relations in the Bald Mountain area. This report concentrates on the rock types, distribution, and structural aspects of the metasedimentary rocks. While intrusive igneous rocks are ubiquitous, they were not studied in detail for the present project.

Previous bedrock mapping in the area includes the Kezar Falls 15-minute quadrangle (Gilman, 1977), that covers the western part of the Saddleback Hills at 1:62,500 scale. Geologic features along a more detailed traverse across the Saddleback Hills are described in an unpublished map and report submitted to the Maine Geological Survey by R.A. Gilman (unpublished data) and summarized in an abstract (Gilman, 1988). These works, particularly the unpublished report, indicated that stratigraphic relationships of regional importance are present in the Saddleback Hills, and provided some useful insights for the present mapping.

The metasedimentary rocks of the Saddleback Hills are assigned to either the lower member of the Rindgemere Formation (DSrb) or to the Vassalboro Formation (SOv) on the Bedrock Geologic Map of Maine at 1:500,000 scale (Osberg and others, 1985). The rocks are inferred to be of Ordovician to Devonian age based on correlations with rocks of other areas by Gilman (1988; 1991), Marvinney (1995), and Hussey (1996). The intrusive rocks are similar to those of the nearby Sebago pluton of Carboniferous age (Osberg and others, 1985; Tomascak and others, 1996). Similar granitic rocks, presumed to be also of Carboniferous age, are described and mapped to the south in the Standish quadrangle (Hussey, 1996) and to the east in the Raymond quadrangle (Creasy, 1996). There have not been any age determinations for rocks of the Saddleback Hills themselves.

DESCRIPTION AND STRATIGRAPHY OF THE METASEDIMENTARY ROCKS

Five major lithostratigraphic units have been mapped (Sm, DOg, Sr, Ss, and Sgm). Four thin members within these units were also mapped (Smc, Sms, Srg, and Ssc). The entire sequence is generally west-dipping. The base is inferred to be to the east, although primary topping directions were not recognized in the migmatized rocks in this study. Gilman (unpublished data) reports numerous topping directions which suggest that the sequence is upright. However, the beds in many places are inverted due to folding so the topping direction of the sequence remains uncertain. In the following discussion, the units are described from east to west.

The rocks have been metamorphosed to high grade and migmatized extensively. While small-scale primary features are obliterated by recrystallization, relict bedding is often preserved in the form of compositional layering. A strong foliation is present in most rocks, most often defined by parallel orientation of mica grains. The regional metamorphic grade is in the sillimanite

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zone. Sillimanite clumps are present in most of the lithologic units found in the field area. The sillimanite mineral growth is associated with a strong schistosity-producing metamorphic event. Garnet is present, but it is not associated with cleavage development and appears to post-date the growth of sillimanite, based on cross-cutting relationships between the garnet, sillimanite, and cleavage seen at location 287 (see map).

Banded biotite-quartz-feldspar migmatite (Sm)

This banded migmatite underlies the eastern part of the field area. Despite this unit's wide distribution, it shows little variation with the exception of a sulfidic schist member (Sms) and calc-silicate member (Smc), shown separately on the accompanying map. The unit is distinctively banded (bedded?) with coarse-grained quartz + feldspar-rich layers alternating with coarse-grained biotite-muscovite schist. The psammitic and intervening schist layers are typically 2-5 centimeters (cm) thick. Coarse-grained tourmaline is locally present and medium- to fine-grained garnet is common. Occasionally, coarse-grained muscovite up to several centimeters across decorates the surface of biotite-muscovite schist layers and cross-cuts the strong biotite-controlled foliation. Finer-grained muscovite is present parallel to the foliation.

Along Douglas Hill Road (station # 300 and 301) a sulfidic, graphite-bearing schist (Sms) occurs. This unit is at least 3 meters thick and weathers deeply to a yellow-brown color. This unit is poor in the psammitic component that characterizes the rest of the migmatite unit. Near the western edge (top?) of the unit, near the contact with the biotite-quartz-feldspar granofels unit, a section of massive, fine- to medium-grained, calc-silicate granofels is found (Smc). This unit, containing diopside, epidote, and actinolite, is found at several locations near the contact in the middle and southeastern part of the field area.

Biotite-quartz-feldspar granofels (DOg)

The granofels of this unit is medium-grained and shows various bedding styles. It may be present in outcrop as well-bedded (1 mm - 15 cm thick beds), poorly-bedded, or massive. As the term granofels implies, the rock has a relatively non-foliated and equigranular texture, although bedding is usually planar and laterally continuous. Outcrops weather to a light gray color with a rough sandpaper-like surface. Fresh surfaces display a fine speckled “salt and pepper” appearance; the abundant (~75%) non-foliated white quartz and feldspar is sprinkled with biotite (~25%) that shows a weak foliation. More quartz-rich interbeds (2-10 cm thick) are common, especially in the eastern (lower?) half of the formation. Locally, tourmaline grains 1-5 cm long are present. Some horizons within the granofels may contain up to 50% feldspar. These feldspathic beds are generally massive on the outcrop scale. The biotite-quartz-feldspar granofels unit is easily the most distinctive unit in the field area.

The western boundary (top?) of the granofels is marked by a 5-15 meter thick layer of rusty, brown-weathering pelitic granofels. Outcrops are well-cleaved and crumbly due to the significant amount of muscovite. This horizon grades into the structurally overlying rhythmite (Sr). A 20-50 meter thick layer of granofels (Srg) near the base(?) of the rhythmite unit is nearly identical with rock of the granofels unit. The contact between the two units is marked by the presence of garnet in rocks of the rythmite unit. No lithologic changes were noted near the eastern contact (base?) of the granofels unit, although the contact with the biotite migmatite (Sm) was not observed.

The map width of the granofels unit decreases toward the north. It is thinnest (~100 meters across) on the north flank of Bald Mountain. It may be thinner farther north, but the exposure north of Douglas Hill Road is not sufficient to allow its map width to be measured there. South of Bald Mountain it thickens substantially (to ~1000 meters across). A lobe of the Sebago pluton present in the southeast part of the field area intrudes the granofels. Exposures of granofels are present on both sides of this lobe. The map width across the pluton from the eastern contact with the migmatite to the western contact with the well-bedded rhythmite suggests a dramatic thickening of the granofels unit (~2500 meters). Note that these descriptions refer only to the width of the unit on the map; there has been no attempt to estimate stratigraphic thicknesses due to structural complexity and uncertain volume of intrusive rock.

In the Standish quadrangle, Hussey (1996) mapped a similar granofels unit as the Hutchins Corner Formation. Its map width there is over 4 miles, with steeply dipping beds. Previous workers have indicated that in the Saddleback Hills area, either the western boundary (Osberg and others, 1985) or the eastern boundary (Gilman, 1988; unpublished data) of the granofels unit has been truncated by faulting. No direct field evidence to support or refute the existence of a fault was observed in the present study. The substantial change in map thickness as the unit is traced south suggests that such a fault may be present. The abrupt change in lithology between the granofels unit and the migmatite unit to the east is also suggestive that the contact is not conformable. The granofels and migmatite units do not contain rock types in common. In contrast, all units west of the granofels unit contain thin interbeds of granofels, and the contact with the adjacent rhythmite unit (Sr) is gradational.

The granofels unit was previously assigned to the Vassalboro Formation of Osberg (1968) by Osberg and others (1985). The name “Vassalboro Formation” was since discontinued by Osberg (1988) in its type area in Vassalboro, Maine. While much of the former Vassalboro Formation has been reassigned to the Hutchins Corner Formation (Osberg, 1988; Hussey, 1996; Marvinney, 1995), some of the former Vassalboro Formation has been reassigned to the Sangerville Formation (Osberg, 1988). If the granofels unit in the Saddleback Hills is correctly inferred to be older than the rocks of the Rindgemere Formation, then a correlation to the Hutchins Corner Formation might be considered.

However, because of the uncertainty in stratigraphic and structural position, possible correlations to younger Silurian-Devonian units cannot be ruled out (see also Hussey, 1996).

Well-bedded rhythmite (Sr)

This unit is best exposed along the ridge west of Bald Mountain and displays the best developed and most consistent bedding of all the units in the area. It is characterized by rhythmically thin-bedded (1-15 cm thick), medium-grained, feldspathic quartzite beds interbedded with biotite schist. The quartzite beds are generally mica-poor although scattered biotite clumps are found within them. The beds of biotite schist are generally a little thicker than the quartzite beds and resemble the biotite schist component of the biotite-quartz-feldspar migmatite unit (Sm). Fine-grained muscovite is commonly parallel to the biotite-defined schistosity. Coarse-grained muscovite books are locally present, cross-cutting the schistosity. Garnet and sillimanite are common in the schist.

Graded beds are occasionally suggested by grain size changes in the quartzite beds, but subsequent migmatization precludes a definite interpretation by the author. Gilman (unpublished report) mentions "numerous topping directions" which is likely in reference to these possible graded beds. Across 3-10 meter sections, the rhythmite grades from a relatively quartzite-rich unit (thicker and more abundant quartzite interbeds) to a more biotite schist-rich unit. This gradation also appears to be repeated numerous times across the strike of the unit.

Approximately 50 meters from the eastern contact (base?) of the rhythmite, is a 10-30 meter thick layer of granofels (Srg), nearly identical to the granofels unit described above (DOg). One important distinction is the presence of garnet in this section and the near absence of garnet in the main granofels unit described above. Discontinuous interbeds (0.5 to 1 meter thick) of a spotted, coarse-grained, biotite-quartz-feldspar schist are locally present. The "spots" consist of lensoid clots 0.5 to 1 cm long of fine-grained quartz and feldspar. The spots are elongate parallel to the dominant foliation.

Poorly-bedded biotite schist, granofels, and quartzite (Ss)

The contact of this schist unit with the underlying(?) rhythmite unit (Sr) occurs over a distance of a few meters. The schist unit contains lithologies similar to those in the rhythmite (Sr) suggesting that the contact is conformable. The schist consists of a massive matrix of dominantly brown-weathering, medium- to coarse-grained, well-foliated biotite schist with muscovite, quartz, feldspar, sillimanite, and locally cross-cutting tourmaline and garnet. Bedding is represented by interlayers of biotite granofels with garnet (similar to the biotite granofels of Srg), medium-grained quartzite, and spotted schists (similar to those found in the rhythmite unit). These interbeds are generally not more than a meter thick and appear to be distributed haphazardly throughout the map unit. The granofels and quartzites are the most commonly occurring lithologies interbedded with the schist while the spotted schist is rare.

Near the western contact (top?) of the unit is a distinctively well-bedded (1-5 cm thick), fine-grained, calc-silicate-bearing quartz-feldspar granofels at least 6 meters thick, shown separately as Ssc on the map. This unit is similar to other calc-silicate units in the area, some mapped within the Rindgemere Formation (Gilman, 1991), and others mapped as "ribbon-bedded meta-limestone" member of the Windham Formation (Marvinney, 1995; Hussey, 1996).

Biotite-garnet migmatite (Sgm)

The biotite-garnet migmatite unit is the westernmost (youngest?) stratified unit mapped in the area. It disappears to the west under the surficial deposits along the Saco River near West Baldwin. The contact between the biotite-garnet migmatite and the biotite schist unit (Ss) is not sharply defined. The biotite-garnet migmatite unit is characterized by a blood-red weathering schist with a migmatitic, medium-grained texture. Bedding or lithologically contrasting layers are generally absent except for rare, thin quartz-feldspar layers, 1-15 mm thick. Quartz veins are common. The rock contains a strong schistosity produced by biotite grains. Garnet is common, often in high concentrations. Sillimanite knots are also present. Coarse-grained muscovite books that cross-cut the dominant biotite foliation are inferred to be late.

DESCRIPTION OF THE IGNEOUS ROCKS

Most outcrops are wholly or partly composed of intrusive coarse-grained granite or pegmatite. This abundant intrusive activity is associated with widespread migmatization of the surrounding country rock. By far the most common igneous rock is coarse-grained, muscovite-bearing granite or pegmatite. A finer-grained two-mica granite is less common. The main body of the Sebago pluton lies just beyond the eastern edge of the map area, and only 1-3 kilometers to the north of the area.

Pegmatitic muscovite-bearing granite (Cpg)

This is the most abundant rock type in the field area. Nearly every outcrop bears this intrusive rock. On the accompanying map it is shown as a separate map unit at only one location, although it occurs throughout all other units on the map. It is characterized by its coarse-grained to pegmatitic texture. Feldspar grains are commonly 20-30 cm across, although the bulk of the grains are from 1 to 2 cm across. Muscovite books may be up to 8 cm across. Black tourmaline grains up to 10 cm long are common, locally in clusters of grains. Medium-grained garnet is also widespread, but in small amounts.

Two-mica granite (Cg)

This granite composes the large intrusive lobe in the southeast portion of the field area. Whether the entire lobe is composed of this granite is unclear due to poor exposure, although a stream flowing southeast of Bald Mountain exposes over 50 meters of continuous granite. It is also exposed along its eastern boundary in a swampy lowland directly south of North Baldwin (near station #152). This particular exposure is fairly homogenous. The grain size at other exposures varies from 0.5 to 3 millimeters (mm), but is uniform at each site. The rock has a rather low quartz content for granite, near the 20% minimum required by definition for the name granite. It is generally equigranular, with grain size about 1-2 mm. Both biotite and muscovite are present. The biotite comprises about 10% of the rock, about twice as much as the white mica (~5%). The muscovite is slightly larger in grain size than the biotite. Garnet, which is present in nearly all the lithologies of the field area, is present in this rock. On top of Decker Mountain, in the eastern portion of the field area, a thin intrusion of the pegmatitic, muscovite-bearing granite (Cpg) clearly cross-cuts the finer grained two-mica granite (Cg), demonstrating that the finer grained granite is the older.

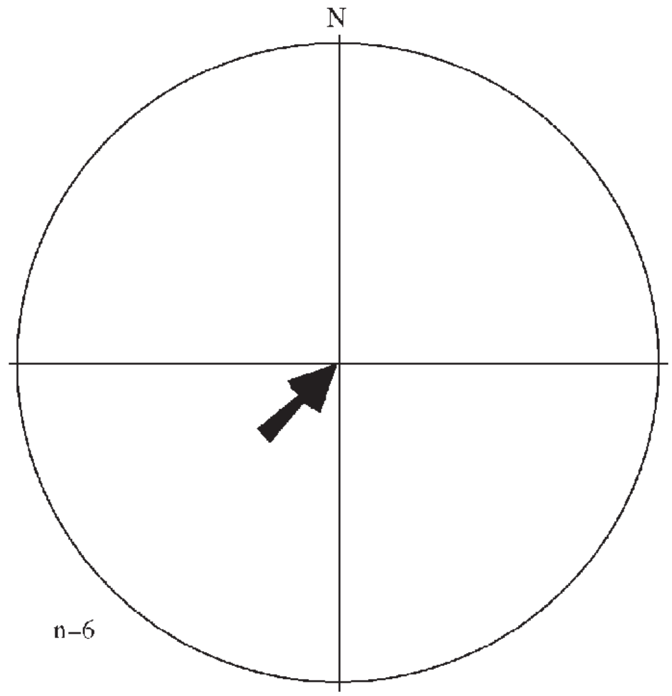

Figure 1. Rose diagram of 6 basaltic dike orientations. Largest petal of diagram lies between 220 and 230 degrees azimuth.

Medium-grained two-mica granite (Cm)

At the trailhead to Douglas Mountain, currently maintained by the Nature Conservancy, a medium-grained (3 mm) two-mica granite (Cm) is in sharp intrusive contact with the muscovite-bearing granite (Cpg), although it is not clear from this exposure which rock is the younger. Muscovite and biotite are present in relatively small amounts compared to the two-mica granite described above (Cg).

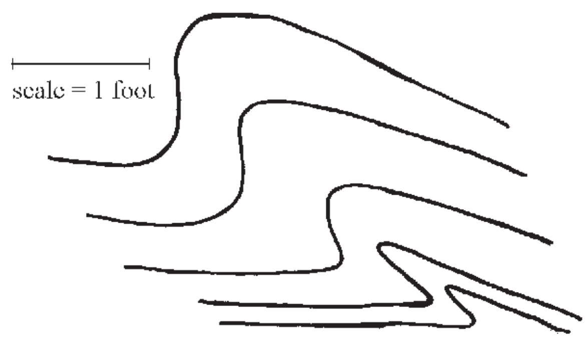

Figure 2. Open fold tightens to a nearly isoclinal geometry in its core (station #217).

Basaltic dikes

Numerous fine-grained basaltic dikes intrude the area and are presumed to be of Mesozoic age. Locally, some dikes contain medium-grained quartz and feldspar phenocrysts or xenocrysts. Most of these dikes are less than a meter thick, but range to over 10 meters thick. The dikes are nearly vertical or dip steeply to the northwest, with northeast - southwest strikes. Contacts are sharp and planar. The dikes weather more readily than the adjacent country rock, probably due to more intense jointing, leaving small, steep-sided notches in the topography. The locations and orientations of some dikes are plotted on the accompanying geologic map. Measured dike orientations are shown on the rose diagram in Figure 1.

STRUCTURE OF THE METASEDIMENTARY ROCKS

Clear evidence for two deformational events is present in the field. The first event produced a strong, ubiquitous schistosity and the second produced a well developed open fold set with a weak axial planar cleavage. A strong schistosity, usually defined by biotite and muscovite, is present in rocks throughout the field area and is generally parallel to bedding. Rare isoclinal folds were observed in bedded rocks which have axial surfaces parallel to this schistosity. However, it is not clear whether these folds are the same age as the schistosity or younger than the schistosity. The latter alternative is suggested by non-cylindrical open folds that deform the schistosity, but which gradually tighten toward their core to where the axial surface becomes sub-parallel to the older schistosity on the fold limbs (Figure 2). At one location (station #164), later crenulation folds are observed on the limbs of an earlier tight, parallel fold (Figure 3), in-

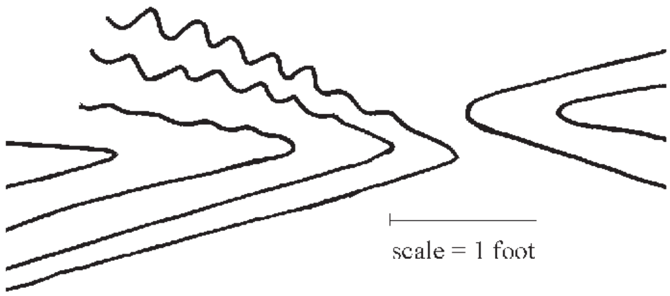

Figure 3. Small, late, open folds superimposed on earlier closed fold (shown folding bedding). Early schistosity is parallel to axial surface of closed fold.

dicating that at least some folds are older than the open, crenulation-related set. Bedding is often parallel to the dominant schistosity, particularly in the central portion of the field area. In the western portion of the field area, bedding and schistosity are often at a significant angle to one another. In the eastern portion of the field area, the bedding-schistosity relationship is not known because bedding was not recognized east of Bald Mountain.

A set of open, chevron folds clearly deforms the schistosity. These open folds are readily observable in outcrop. A fine crenulation cleavage is parallel to the axial plane of these folds. The cleavage surface is defined by oriented, fine-grained biotite flakes. Occasional mineral lineations are parallel to the fold hinge orientation of these late folds. Some of the folds have non-similar shapes suggesting a flexural-slip mechanism, but associated mineral lineations perpendicular to the hinge line on folded surfaces were not observed. Measured fold orientations are shown in Figure 4. Detailed mapping on Bald Mtn. at 1:12,000 scale, shown as an inset on the accompanying map, demonstrates that the contacts between units have fold shapes and orientations like the open folds measured in outcrop. Therefore, this episode of deformation is thought to strongly control the distribution of map units.

Stereographic analysis of the bedding, dominant schistosity, open fold hinge, and axial surface orientations shows structural complexity. Poles to bedding (Figure 4a) vaguely define a great circle with an inferred fold hinge orientation of N 68 W, 24. This coincides in a general way with the average observed open fold hinge orientation (Figure 4d) of S 77 W, 22. The schistosity, which formed prior to the open folds, has too scattered a range of orientations to make a simple inference (Figure 4b). This range

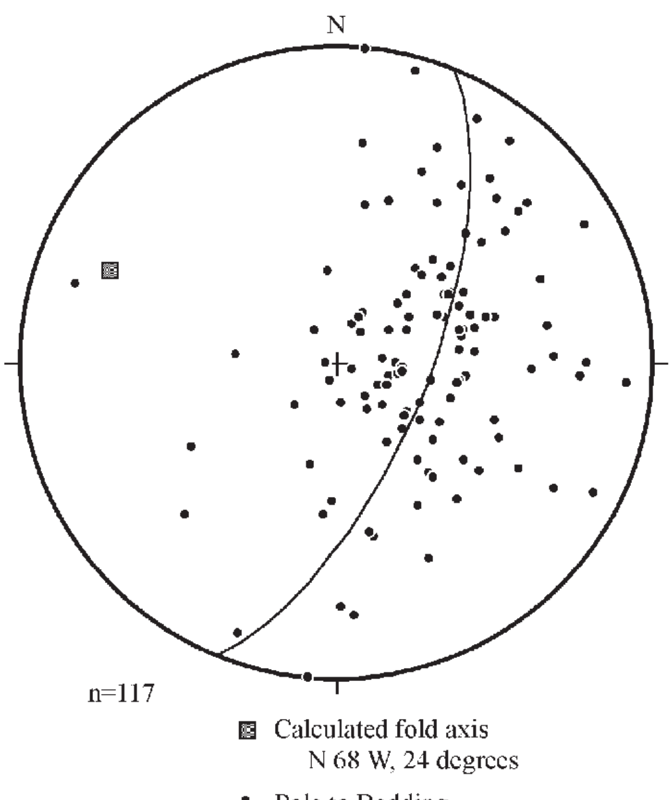

Figure 4a. Equal area stereonet of bedding poles. Best fit great circle produces a calculated fold axis orientation of N 68 W, 24.

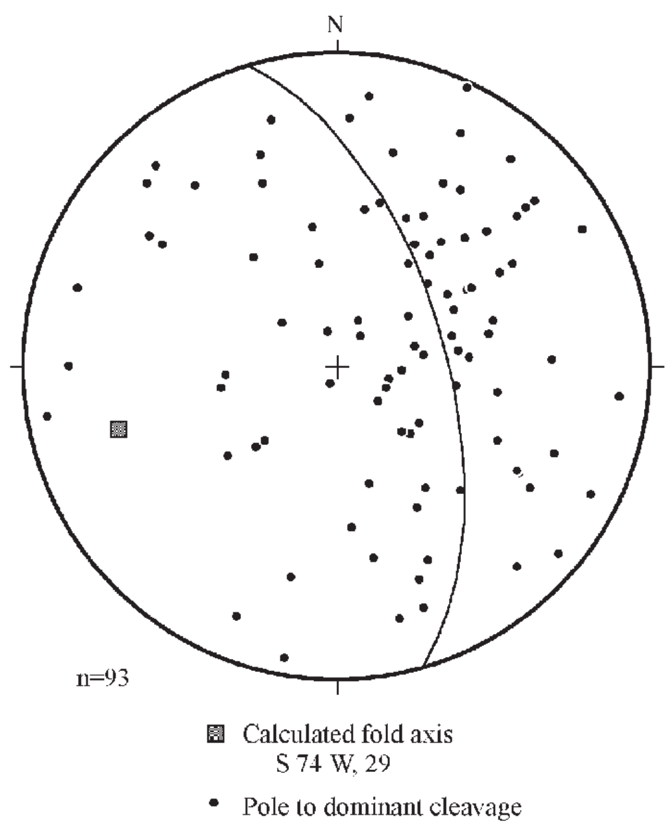

Figure 4b. Equal area stereonet of dominant cleavage poles. Best fit great circle produces a calculated fold axis orientation of S 74 W, 29.

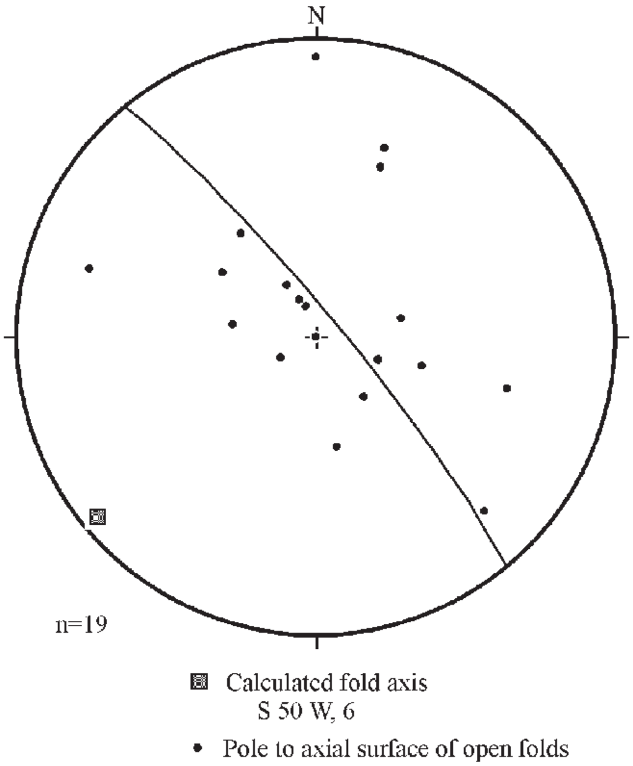

Figure 4c. Equal area stereonet of axial planes to late open folds. Best fit great circle produces a calculated fold axis orientation of S 50 W, 6.

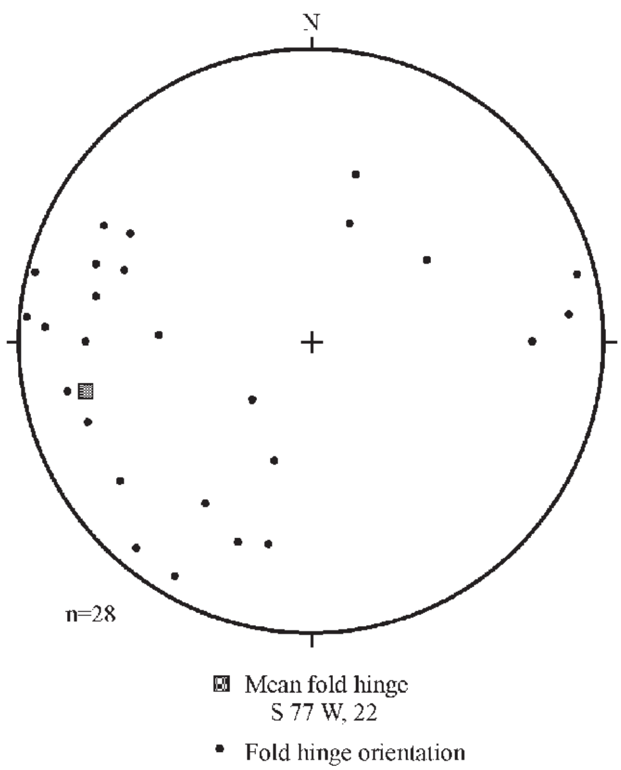

Figure 4d. Equal area stereonet of late open-fold hinge orientations. Best fit great circle produces a calculated fold axis orientation of S 74 W, 29.

of schistosity orientations cannot be explained by a single set of cylindrical folds. There may be an additional, unrecognized folding event that occurred following the development of the schistosity and possibly after the open folding event as well. The variation in orientations of axial surfaces (Figure 4c) and hinge lines (Figure 4d) of the open folds is consistent with a subsequent, although rather mild, deformation. Part of the scatter in structural orientation is likely related to subsequent intrusive activity associated with the Sebago batholith.

The dominant schistosity clearly formed during a discrete event that was earlier than the open folds, their axial planar crenulation cleavage, igneous intrusion and garnet/tourmaline growth. Whether some of the tight to isoclinal folds that predate the open folds may be related to the schistosity is unclear. The open folds and the associated crenulation cleavage may be related to granitic intrusion (the Sebago batholith?). But some evidence suggests that the timing of intrusion and garnet and tourmaline growth postdates the open fold development. The nature of any late deformation is not clear except that axial surfaces to the open folds are not tightly clustered (Figure 4c).

Large garnet and tourmaline growths cross-cut the dominant schistosity at many locations but are not associated with any preferred orientation. Given the abundant intrusive activity in the area it is suggested that this mineral growth is associated with thermal metamorphism related to intrusion.

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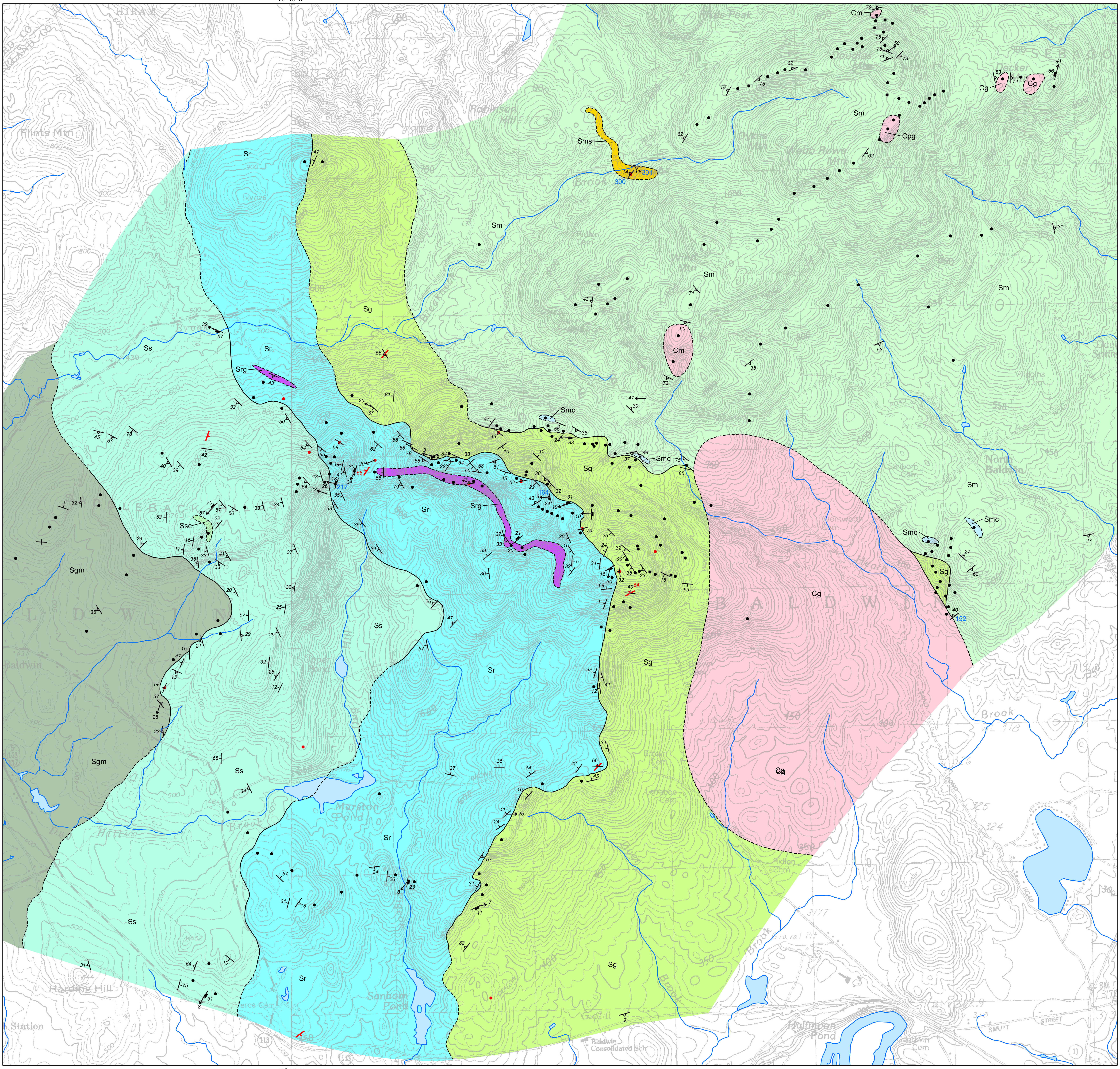
43° 52' 30" 70° 45' W 43° 52' 30" N



70° 45' W

EXPLANATION OF UNITS

INTRUSIVE ROCKS

Mesozoic

20 • **Basalt dike.** Reddish-brown weathering, dark gray, basaltic dike. Less than a meter to several meters thick. Line symbol is parallel to strike of dike with known orientation. (inclined, orientation unknown)

Carboniferous

Cpg **Pegmatitic muscovite-bearing granite.** Coarse-grained to pegmatitic muscovite-tourmaline +/- garnet granite. Quartz and feldspar grains commonly up to 30 cm, muscovite books up to 8 cm across. Locally contains coarse-grained masses of black tourmaline or medium-grained garnet. One large body is mapped separately. Also occurs as widespread small intrusions mixed with country rock throughout map area. Most abundant rock type in area.

Cg **Two-mica granite.** White to gray, medium-grained biotite-muscovite granite. Contains fine-grained biotite and muscovite, and coarse-grained muscovite. A massive intrusive unit not associated with country rock.

Cm **Medium-grained two-mica granite.** Gray, massive, medium-grained biotite-muscovite granite with substantially less muscovite and biotite than Cg.

STRATIFIED ROCKS

Silurian

Sgm **Biotite-garnet migmatite.** Massive to poorly-bedded, red-stained to rusty-weathering, medium-grained biotite migmatite. Generally lacks interbeds of contrasting rock types except for rare, thin layers of feldspar-quartz granofels 1 to 15 mm thick. Highly garnetiferous and sillimanite-bearing.

Ss **Poorly-bedded biotite schist.** Rusty-weathering biotite schist with randomly interbedded layers of medium-grained quartzite, biotite-quartz-feldspar granofels, and rare beds of spotted schist.

Ssc **Calc-silicate member.** Light greenish-gray, thinly-bedded, medium-grained, diopside calc-silicate granofels unit. Minimum 6 meters thick.

Sr **Well-bedded rhythmite.** Rhythmically bedded quartzite alternating with biotite-muscovite-quartz-garnet +/- sillimanite schist, biotite-quartz granofels, or spotted biotite-muscovite-feldspar-quartz schist. Beds are from 1 to 15 cm thick, commonly with sharp contacts.

Srg **Granofels member.** Garnet-bearing biotite-quartz-feldspar granofels unit 10 to 30 meters thick.

Sg **Biotite-quartz-feldspar granofels.** Massive to well-bedded granofels. Quartz-rich in most places, but locally containing up to 50% feldspar. Distinctive texture of medium-grained, equigranular quartz and feldspar grains with scattered biotite flakes gives "salt and pepper" appearance. Near western contact (with Sr), granofels becomes muscovite-bearing, brown-weathering, and crumbly.

Sm **Banded biotite-quartz-feldspar migmatite.** Monotonous, migmatitic biotite-muscovite schist with quartz-feldspar bands (beds?). Muscovite generally subordinate to biotite. Coarse-grained black tourmaline and medium-grained garnet present locally. Muscovite occurs also as coarse-grained books.

Smc **Calc-silicate member.** Massive, fine-grained to medium-grained diopside-epidote-actinolite calc-silicate granofels.

Sms **Rusty schist member.** Deeply yellow-brown to rusty weathering sulfidic, graphitic biotite-sillimanite-quartz schist.

EXPLANATION OF SYMBOLS

20 Bedding (inclined, vertical)

20 Dominant schistosity or metamorphic foliation (inclined)

20 Hinge line of minor fold

20 Axial surface of minor fold (inclined)

152 Numbered location of feature described in accompanying report

• Outcrop with no structural data

EXPLANATION OF LINES

Stratigraphic or intrusive contact (well located, approximately located)

GEOLOGIC TIME SCALE

Geologic Age		Absolute Age*
Cenozoic Era		0-65
Mesozoic Era	Cretaceous Period	65-142
	Jurassic Period	142-200
	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	489-542
Precambrian time		Older than 542

* In millions of years before present. (Okulitch, A. V., 2004, Geological time chart, 2004: Geological Survey of Canada, Open File 3040 (National Earth Science Series, Geological Atlas) - REVISION.)

Bedrock Geology of the Saddleback Hills, Baldwin, Maine

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Funding for the preparation of this map was provided in part by the U.S. Geological Survey STATEMAP Program, Cooperative Agreement No. 1434-95-A-01363.

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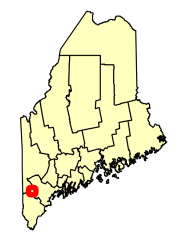
Open-File No. 12-21
2012

For additional information, see accompanying 6 p. report.



Map Location

N

SCALE 1:15,000

0 1 Miles

0 500 1,000 2,000 3,000 4,000 5,000 Feet

0 1 Kilometers

SOURCES OF INFORMATION

Field work by Adam Schoonmaker during the summer of 1996.

Topographic base from U.S. Geological Survey Cornish and Steep Falls 7.5' quadrangles, 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 impute responsibility for any present or potential effects on the natural resources.