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Walter A. Anderson, State Geologist

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Title: Bedrock Geology of Portions of the North East Carry and Moosehead Lake Quadrangles, Maine

Author: Ruth H. Simmons

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Contents: 17 page report and map

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PURPOSE

This study was undertaken to provide a more detailed bedrock geologic map of the area and to improve our understanding of the structural geology and the timing of deformation affecting these rocks. Using this information, a more informed interpretation of the tectonic history of the region can be composed. The study area included portions of the North East Carry and Moosehead Lake 15 minute quadrangles (Fig. 1).

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METHODS

Field mapping was done during the summers of 1983, 1984 and 1985 for a total of 16 weeks. Outcrops were found along roads and the shore of Lobster Lake. Traverses were made on Lobster Mountain and across Big Island where outcroppings were judged to be most likely and the terrain most negotiable. Field description of outcrops was augmented by petrographic analyses of thin sections. Structural data were compiled on U.S. Geological Survey topographic base maps (North East Carry and Moosehead Lake 15-minute quadrangles, scale 1:62,500).

PREVIOUS WORK

Mapping of thirteen quadrangles, including the North East Carry and Moosehead Lake quadrangles, was done by A.J. Boucot and others and published in 1969. This study concentrated on areas underlain by Upper Silurian and Lower Devonian rocks in an effort to work out their stratigraphy and structure. He mapped the adjacent pre-Silurian strata in reconnaissance in order to determine the relationship of these strata to those of Upper Silurian and Lower Devonian age.

Unpublisbed mapping in the Lobster Lake area was done by G.M. Boone and C.E. Jarhling during the summer of 1980 and continued during Syracuse University's summer field camps in 1981 and 1982. G.M. Boone also mapped the volcanics on Little Spencer Mountain (unpub.).

BACKGROUND AND REGIONAL GEOLOGY

Many unconformities in New England have been ascribed to the Taconic orogeny. Pavlides and others (1968) suggested that for purposes of regional

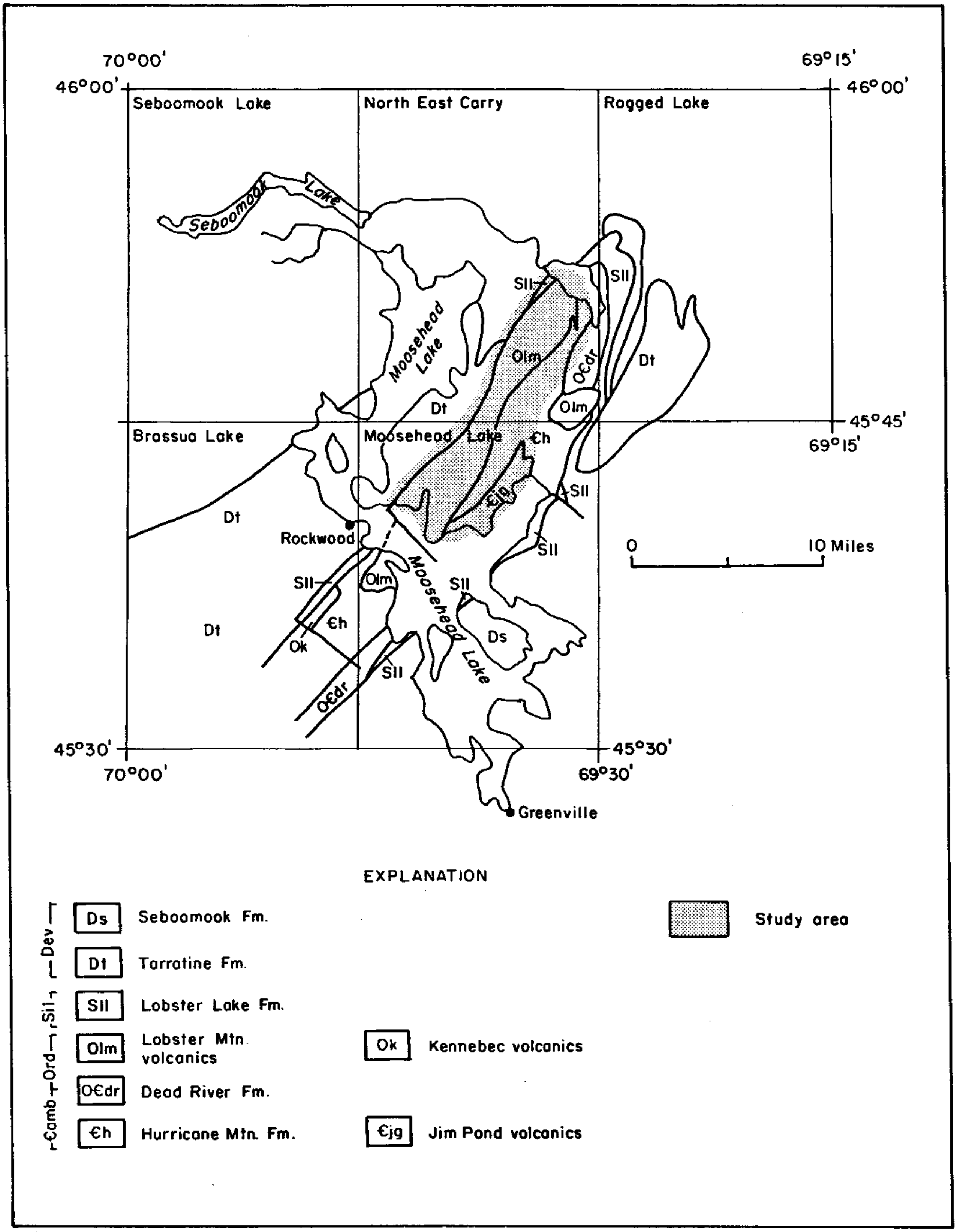

Figure 1. Location of study area (geology modified from Osberg, P.H., Hussey, A.M., II, and Boone, G.M., 1985, Bedrock Geologic Map of Maine, Maine Geological Survey).

evaluation of Taconic unconformities, the term Taconic orogeny should be limited to diastrophic events that took place in the time span from Trenton (Graptolite zones 12-13) in the Ordovician up to Llandovery C(3)-C(5) in the Silurian.

In the Lobster Lake area, Ashgill age fossils have been recovered from the upper part of the Lobster Mountain Volcanics. There is, however, no evidence of a pre-Acadian deformational event affecting these rocks. This strongly supports the contention of G.M. Boone and others (pers. commun., 1983) that the Taconic orogeny did not affect rocks of this region.

The Lobster Mountain anticlinorium is a belt of pre-Silurian rocks that crop out between rocks of the Moose River synclinorium to the northwest and rocks of the Roach River and Kearsarge-Central Maine synclinoria to the southeast (Fig. 2). Along the northeast shore of Lobster Lake an angular unconformity between the older rocks of the anticlinorium and the post-Ordovician rocks of the Moose River synclinorium is exposed (Boucot, 1969).

The pre-Silurian rocks of the Lobster Mountain anticlinorium belong to the Hurricane Mountain Formation, the Dead River Formation, the Lobster Mountain Volcanics, and the Ronco Brook Volcanics (new informal name). Rocks of the Hurricane Mountain and Dead River Formations are polydeformed. However, no evidence of polydeformation has been found in rocks of the Lobster Mountian Volcanics or the Ronco Brook Volcanics.

The age of tha Ronco Brook Volcanics is important in constraining the age of the pre-Acadian deformational event that affected rocks stratigraphically below the volcanics. Isotopic dating of the Ronco Brook Volcanics could give a minimum age for this episode of deformation. Dating of both the Lobster Mountain and Ronco Brook Volcanics will aid in regional correlation.

STRATIGRAPHY

The stratified rocks in the map area belong to nine formations ranging in age from probable Middle-early Late Cambrian to Early Devonian. Each formation will be discussed systematically in the following sections beginning with the youngest. While this study is concerned primarily with the Lobster Mountain Volcanics, surrounding units are included on the map and affect the interpretation of these volcanics. Accordingly, descriptions of the surrounding units are included below.

Descriptions of the Tomhegan, Tarratine and Seboomook Formations have been adapted from Boucot (1969); for more complete information about these units the reader should refer to this work. Descriptions of the Ripogenus and Lobster Lake Formations were compiled from data collected during Syracuse University's summer field camp, 1982 and from Boucot (1969). Descriptions of the Big Island Member of the Lobster Mountain Volcanics was compiled from data collected during Syracuse University's summer field camp, 1982, and from work done by G.M. Boone and C.E. Jarhling. Descriptions of the Little Spencer Mountain Volcanics were provided by G.M. Boone (pers. commun., 1986). The names used for volcanic rock types do not necessarily conform to the total alkali-silica (TAS) classification scheme.

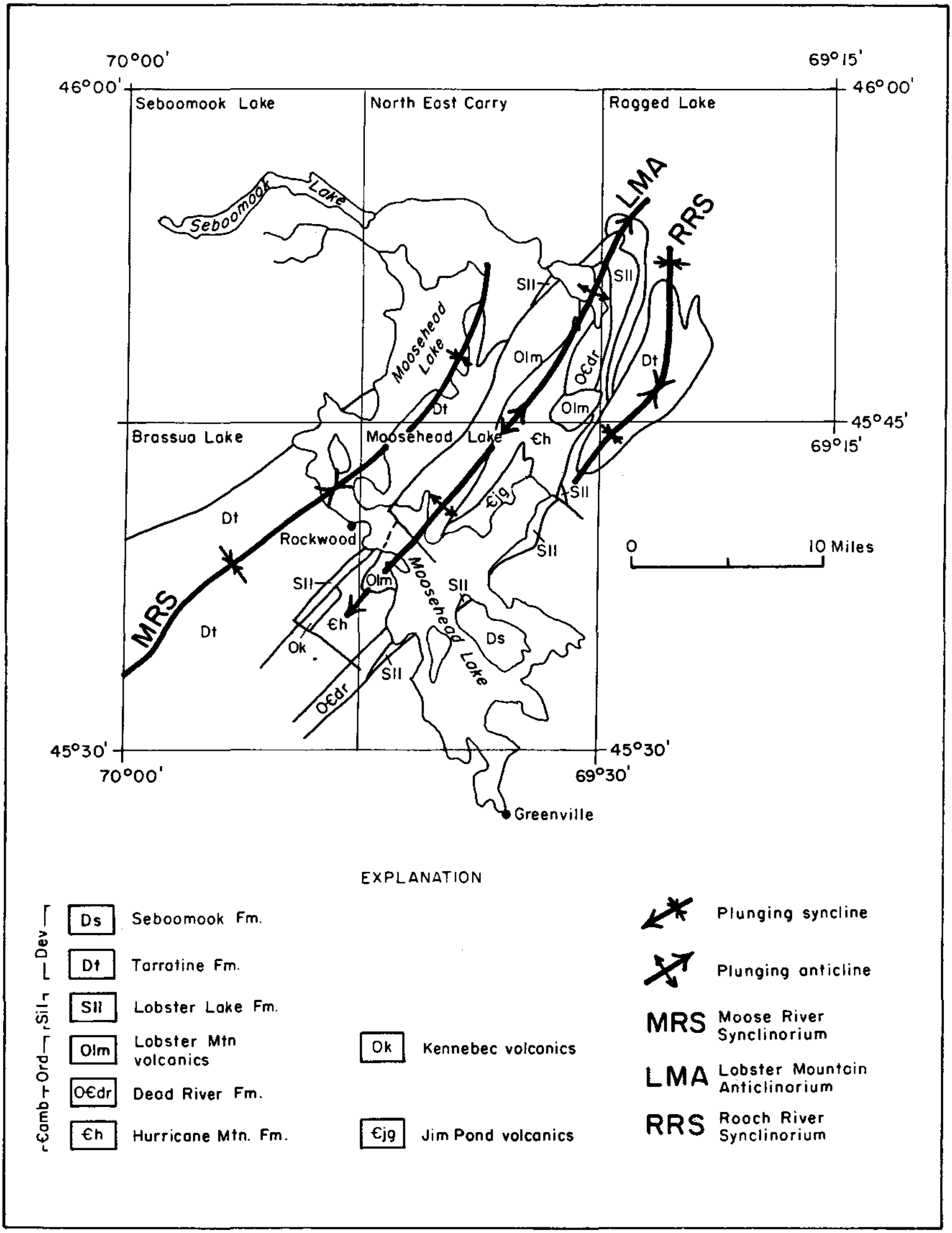

Figure 2. Major structural features, Lobster Mountain or Ronco Brook Volcanics (geology modified from Osberg, P.H., Hussey, A.M., II, and Boone, G.M., 1985, Bedrock Geologic Map of Maine, Maine Geological Survey).

Tomhegan Formation

Dark metasandstone and dark tuffaceous metasandstone of the Tomhegan Formation are massively bedded with beds ranging from 60 cm to 3 m in thickness. These rocks, along with the slate, are blue-gray on fresh surfaces and weather to a gray color. Fine to medium sand-sized quartz, feldspar, and felsite grains occur in a fine-grained dark matrix.

Rusty weathering metasiltstone interlayered with slate and quartzite occurs in beds ranging from 1 to 60 cm in thickness. The cleavage planes are at an angle to bedding so that the rock tends to break into flattish ellipsoidal pieces. The rusty weathering is caused by the oxidation of pyrite which is observable on fresh surfaces.

The upper contact of the Tomhegan Formation has been removed by erosion in this area. The maximum preserved thickness is estimated to be about 6000 feet. Field relationships suggest that the contact between the Tomhegan Formation and the Kineo Volcanic Member is gradational. While bedding attitudes suggest that the contact between the Tomhegan and Tarratine Formations is conformable, a faunal break suggests that it may be disconformable. Fossils from the Tomhegan Formation are dominantly of Schoharie age (Early Devonian).

Kineo Volcanic Member

Massive metafelsite (rhyolitic), dark and light metatuff, metaconglomerate, and flow metabreccia make up the Kineo Volcanic Member which crops out as a discontinuous line of hills along the western portion of the mapped area. The maximum thickness of this member is estimated to be about 1200 m. The Kineo Volcanic Member is thought to be at least partially contemporaneous with the basal portion of the Tomhegan Formation. Dark metasandstone pebbles that may have been derived from the underlying Tarratine Formation occur in some of the metaconglomerate beds.

Tarratine Formation

This dark gray metasandstone, slate, and metasiltstone crops out northwest of the Lobster Mountain Volcanics from the north shore of Moosehead Lake east of Mount Kineo (Moosehead Lake quadrangle) to the area east of Norcross Mountain (North East Carry quadrangle). Here it grades into the laterally equivalent Seboomook Formation. The thickness of the Tarratine Formation ranges from a feather edge to about 2400 m in the Big Duck Cove area. The contact between the Tarratine and Seboomook Formations is gradational and is drawn where the cyclically layered slate and metasandstone of the Seboomook Formation form more than 50% of the exposure. The contact between the Tarratine Formation and the underlying Lobster Mountain Volcanics is unconformable.

Seboomook Formation

Cyclically bedded slate, metasiltstone, and metasandstone comprise the Seboomook Formation. The thickness of this unit ranges from a feather edge to 1100 m within the study area. Metasandstone beds grade into overlying slate beds. Generally the beds are about 3-8 cm thick.

The contact of the Seboomook Formation with the overlying Tarratine Formation is gradational as discussed in the previous section. The lower contact of the Seboomook Formation with the Ripogenus Formation and older units is unconformable.

Fossils recovered from the Seboomook Formation suggest that it is of Oriskany or possibly Late Helderberg age (Early Devonian). The lower unfossiliferous part of the formation may be somewhat older, however. Fossils of Ludlow and Pridoli age (Late Silurian) have been recovered from the underlying Ripogenus Formation.

Ripogenus Formation

Named for Ripogenus Lake, this formation consists of metalimestone, calcareous metasiltstone, calcareous metasandstone, and minor meta-conglomerate. This unit is extremely fossiliferous containing mid(?) to upper Silurian bioherms, biostromes, and reefal and off-reef faunas. The metalimestones are typically pitted; the pits are roughly ellipsoidal with their long axes subparrallel to the cleavage. The pits vary in size but roughly average 10 cm long by 5 cm wide and 2 cm or so deep.

The rock is usually dark gray on fresh surfaces weathering to a lighter gray. Weathering rinds are typically 3 to 6 mm thick. Beds are generally 5 to 20 cm thick. The maximum thickness of the formation within the mapped area is about 700 m.

The contact between the Ripogenus and Seboomook Formations is disconformable. The contact between the Ripogenus and Lobster Lake Formations is not well exposed but field evidence suggests that it is gradational.

Lobster Lake Formation

Boucot (1961, p.178-180; 1969, p.47-49) defines the Lobster Lake Formation as consisting of a basal Big Claw Red Bed Member which is overlain by the main part of the formation. Here, the Lobster Lake Formation refers only to rocks of the Big Claw Red Bed Member. These are metaconglomerates, argillaceous and orthoquartzitic metasandstones, metasiltstones, and some slate. One of the most distinctive features of this unit is its maroon color.

A basal metaconglomerate lies with angular unconformity on the Dead River Formation on the point on the northeast shore of Lobster Lake. Pebble-sized semi-angular clasts of quartz, phyllite, and felsite are embedded in a fine grained quartzitic matrix. Clasts and matrix are hematite-stained. Along the shore of Lobster Lake the metaconglomerate is overlain by interbedded metasandstone, metasiltstone, and slate. The beds are generally 30 cm to 1 m thick although they are considerably more massive in the middle part of the section. Quartz veins and quartz filled tension gashes were observed in outcrops on the northeast shore of Lobster Lake and on Ogden Point. Cross bedding and channel fill structures are fairly common.

The contact between the Lobster Mountain Volcanics and Lobster Lake Formation is not exposed, but field relations strongly suggest that it is unconformable. The felsite clasts in the basal metaconglomerate may have been derived from the underlying Lobster Mountain Volcanics. As mentioned in the last section, the contact between the Lobster Lake and Ripogenus Formations is thought to be gradational.

Lobster Mountain Volcanics

These volcanics and associated volcanogenic sediments crop out northwest of the probable continuation of the Squirtgun Fault. Rock types range from basaltic to rhyodacitic and the section includes some reworked volcanogenic sediments and metapelites. The estimated thickness of this formation is approximately 1200 m in the Lobster Mountain area. The formation is divided into three members.

Jackson Cove Member

These interbedded metatuffs, metasiltstones, and metaconglomerates crop out on the south shore of Jackson Cove and on Jackson Point on Lobster Lake. Brachiopods of Ashgill age have been recovered from one of the crystal tuffs exposed just northwest of the benchmark on the west shore of the Little Claw of Lobster Lake (Neuman, 1973, p.165).

Generally, the metatuffaceous beds are 15 to 20 cm thick and are buff colored on the weathered surface. Near the tops of the beds the grain size diminishes rapidly and the steeply dipping cleavage is refracted. The metasiltstone beds are generally thinner (5 to 10 cm thick) and appear darker on the weathered surface. The cleavage is also refracted as it passes from a metasiltstone bed into an overlying metatuffaceous bed. The metaconglomerates are very massive and contain a variety of clast types and sizes. These rocks may represent a volcanic debris flow (lahar).

Lobster Mountain Member

The Lobster Mountain Member has been divided into four submembers. Rhyodacitic porphyry crops out on the northeast end of Lobster Mountain. The contact between the porphyry and interbedded tuffs and metasiltstone of the Jackson Cove Member is probably intrusive altbough it is not exposed. The contact between the porphyritic flows, flow breccias, and bedded tuffs of the felsic submember and the more massive porphyry is interpreted to be intrusive but may be gradational locally.

Along strike to the southwest, the felsic submember is interpreted to grade into the intermediate submember comprised of andesitic to dacitic flows, breccias, and pyroclastics. Farther to the southwest, the intermediate submember is thought to grade into the mafic submember which is overlain by the sedimentary submember. The mafic submember is comprised of basaltic flows, tuffs, volcaniclastics, and some metapelite. The sedimentary submember consists of redeposited volcanogenic sediments interbedded with andesitic to dacitic flows and tuffs. The contact between the sedimentary submember and the intermediate submember is most likely gradational.

Big Island Member

This member of the Lobster Mountain Volcanics crops out on the east side of Lobster Mountain south of the Little Claw of Lobster Lake and on the west side of Big Island continuing south of Lobster Lake for two miles where it is inferred to be truncated by the probable continuation of the Squirtgun fault. Along the eastern margin of each outcrop belt, the Big Island Member is in fault contact with rocks of the Hurricane Mountain Formation (Plate 1). The western contact of the eastern belt is also a fault. Southwest of the Little Claw of Lobster Lake, the Big Island Member is intruded by the Lobster Mountain porphyry. The Big Island Member is the lowermost member of the Lobster Mountain Volcanics.

Interbedded blue metasiltstone, tuffaceous metasandstone, and pillowed basalt make up this member (Fig. 3). Bedding is difficult to discern in the well cleaved blue metasiltstone. This rock type is often gun-metal blue on cleavage surfaces and exhibits a chalky white weathering rind up to 6 mm thick. A orangish-red band is sometimes observed in the weathering rind adjacent to the fresh rock. Very fine platy crystals of selenite are occasionally found on joint or cleavage surfaces. Graded beds are common in the tuffaceous sandstone which contains abundant feldspar and very clear quartz grains. Individual grains are somewhat angular. Accessory minerals include magnetite and epidote. Prehnite crystals locally crosscut the sedimentary texture of the tuffaceous sandstone. Pillowed basalts crop out on the west side of Big Island where they are interbedded with blue metasiltstone.

Numerous diabase dikes intrude these rocks. In one location, on the west side of Big Island, soft sediment deformation is apparent adjacent to one of these dikes. Clasts of metasedimentary rock occur within the diabase. Several steeply dipping faults striking generally north further complicate the relationships in this area (Fig. 4).

Ronco Brook Volcanics

Rocks that crop out southeast of the probable continuation of the Squirtgun fault from the north shore of Moosehead Lake in the vicinity of Big Dry Point and Ronco Cove for a few miles along strike to the northeast have been assigned to the Ronco Brook Volcanics (new informal name). This unit is comprised of felsic tuffs, felsic lapilli tuffs, pyroclastics and minor interbedded metapelite. Thickness of this formation is estimated to be around 400 m. Tight folds within the unit complicate the calculation of thickness. The contact of the Ronco Brook Volcanics with the Hurricane Mountain Formation is interpretted to be both an angular unconformity and a detachment zone. Only one cleavage of probable Acadian age is observed in outcrops of the Ronco Brook Volcanics. To the northwest, the Ronco Brook Volcanics is in fault contact with the mafic submember of the Lobster Mountain Volcanics.

Boucot (1969) assigned rhyolitic tuffs and felsite that crop out between Cornish Farm and Long Pond in the Brassua Lake quadrangle (west of the Moosehead Lake quadrangle) to the Kennebec Formation. These rocks contain fossils of Early to Middle Ordovician age and crop out southeast of the Squirtgun fault. Based on their similar structural position, their similar appearance in the field, and petrographic similarities, the Kennebec Formation and Ronco Brook Volcanics may be correlative. However, the Ronco Brook Volcanics are not well dated and fossils have not been recovered from them. Therefore, the Ronco Brook name should be retained until a more positive correlation can be made.

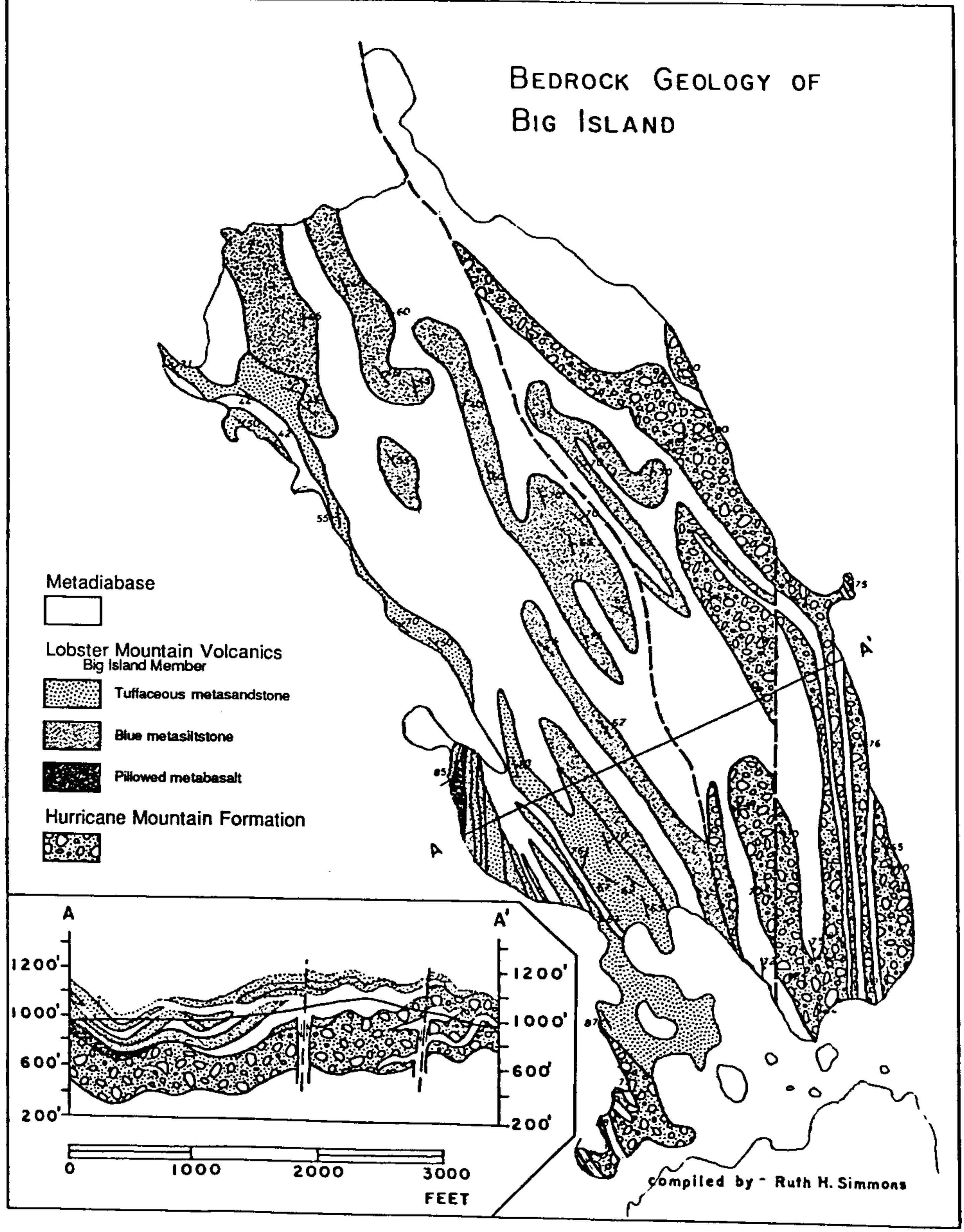

Fig. 3. Distribution of rock types.

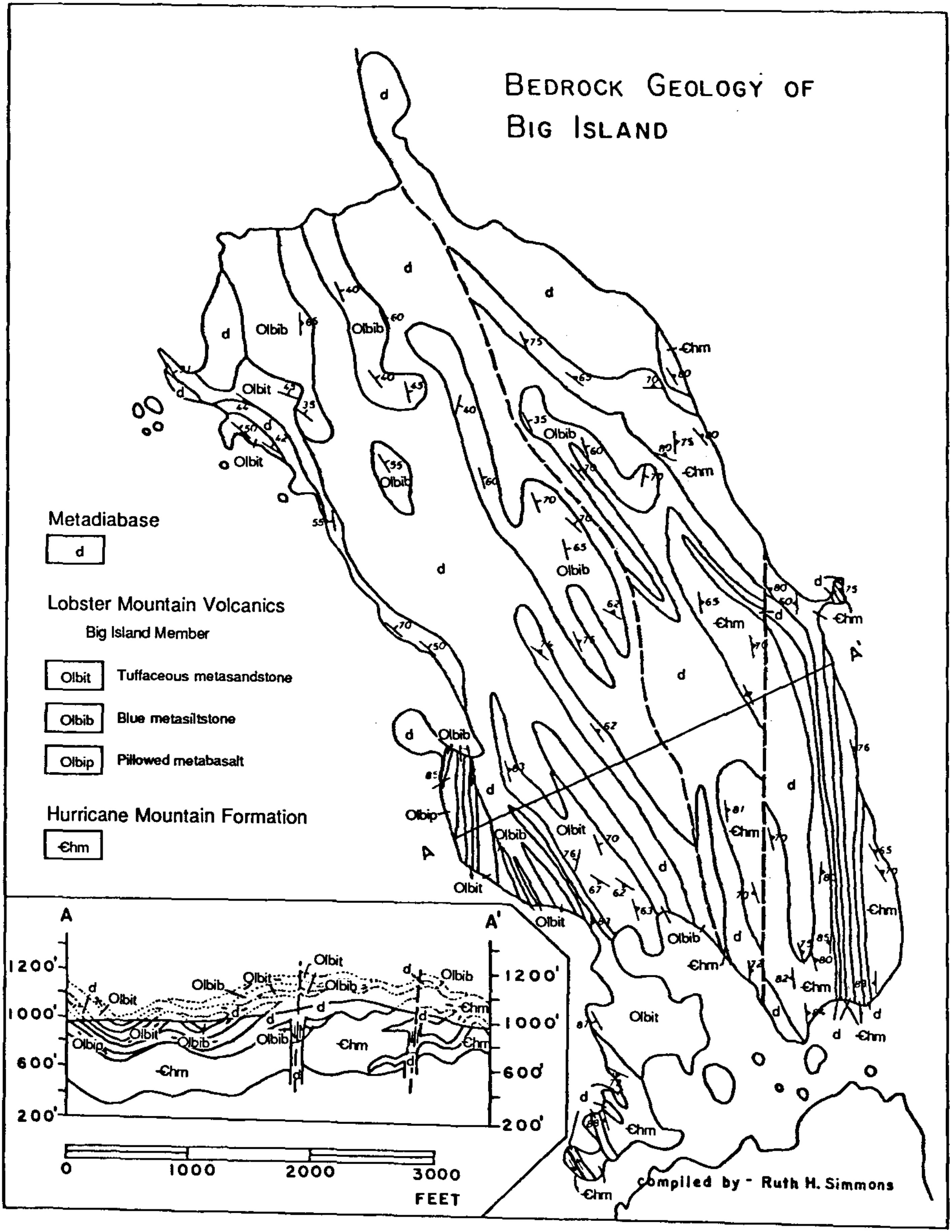

Fig. 4. Structural data.

Dead River Formation

The Dead River Formation consists of metasiltstone, slate, and phyllite with impure metasandstone and is typically a turquoisish-green, fine-grained phyllite in this area although some maroon phyllites crop out near the unconformable upper contact exposed on the northeast shore of Lobster Lake. Abundant micaceous minerals define a dominant cleavage which is crenulated by a spaced cleavage. The high feldspar content accounts for the chalky weathered surfaces in outcrop. Chlorite is ubiquitous although locally cordierite is present giving the phyllite a maculous texture. The maximum thickness of this unit is around 900 m (G.M. Boone, pers. commun., 1983). It is probably of latest Cambrian to early Ordovician age. Numerous diabase dikes and/or sills intrude the Dead River Formation especially in the vicinity of the eastern and southern shores of the Big Claw of Lobster Lake.

Hurricane Mountain Formation

Rocks of the Hurricane Mountain Formation are probably of Middle to Late Cambrian age in the Lobster Lake area (G.M. Boone, pers. commun., 1983). This unit is comprised of dark blue to gray rusty weathering slate, phyllite, metaquartzwacke, subordinate metagraywacke, feldspathic metasandstone, and quartzite (Boone, 1973). Exotic blocks of various lithologies occur within this unit and its matrix commonly exhibits a hackly or scaly cleavage. Many diabase dikes and/or sills intrude the Hurricane Mountain Formation on Big Island and in the area between the Squirtgun fault and the south shore of Lobster Lake. These diabase bodies have chilled margins against the pelitic matrix of the Hurricane Mountain Formation and against other diabase bodies. Their margins are locally faulted.

Layering is often obvious on the weathered surface of outcrops of the Hurricane Mountain Formation but is usually discontinuous. The maximum thickness of this unit is less than 1000 m. The Hurricane Mountain Formation is thought to lie stratigraphically below the Dead River Formation (Boudette and Boone, 1976; Burroughs, 1979; Marvinney, 1982) although the contact was not observed in this area.

DISCUSSION OF STRUCTURAL RELATIONSHIPS

While several cleavages are found in rocks of the Hurricane Mountain Formation and two steeply dipping cleavages are found in rocks of the Dead River Formation, only one cleavage is observed in rocks stratigraphically above the Dead River Formation. This later cleavage is of Acadian age. It is steeply dipping and generally axial planar to the upright, somewhat asymmetric, fairly tight folds of Acadian age that affect this region and are responsible for the prominent northeast-southwest structural grain. The axial planes of these regional folds dip steeply to the southeast in the mapped area. Many minor folds occur on the limbs of the major structures. These minor folds are asymmetric with the steeply dipping limb occasionally being slightly overturned.

Two major northeasterly-striking faults occur within the study area. Gently plunging lineation formed by elongate feldspar grains in a mylonitized volcaniclastic rock that crops out near Cowan Brook suggests that some of the motion on the northwestern fault may have been strike-slip. A similar lineation occurs near sample location ML 35 (Plate 1). The major folds of this region are doubly plunging.

Several faults striking almost north-south are mapped on Big Island and south of Big Island for a couple of miles where they are inferred to be cut by a major northeast-striking fault. Slickensides on one of these faults exposed on the north end of Big Island indicate normal faulting. Numerous diabase dikes also crop out in this area. These faults may have formed during a period of extension related to the emplacement of the diabase dikes. The age of these dikes is not known but they are probably pre-Late Silurian since none is found cutting rocks of the Lobster Lake or Ripogenus Formations. Soft sediment deformation adjacent to one of the diabase dikes on Big Island suggests that the intrusion of these dikes may have taken place before some of the sediments of the Big Island Member of the Lobster Mountain Volcanics were completely lithified. No diabase dikes were observed to crosscut other members of the Lobster Mountain Volcanics. A few diabase dikes do crosscut rocks of the Ronco Brook Volcanics. If the Ronco Brook Volcanics are correlative with the Kennebec Formation, then this suggests that the dikes may have been emplaced in late mid-Ordovician or early late Ordovician time.

As can be seen from the cross sections (Plate 1), the Lobster Mountain Volcanics appear to be the remnants of a fairly typical stratovolcanic complex. The rocks cropping out on Lobster Mountain represent a more proximal facies than those cropping out to the southwest because the percentage of reworked material increases to the southwest. This interpretation suggests a period of felsic volcanism, perhaps of Middle Ordovician(?) age, represented by rocks of the Ronco Brook Volcanics. This was succeeded by more mafic volcanism yielding pillowed basalts of the Big Island Member and basalts of the mafic submember of the Lobster Mountain Volcanics. The upper part of the volcanic pile is again more felsic; rhyodacites of the Lobster Mountain Porphyry are interpreted to intrude the Jackson Cove Member of the Lobster Mountain Volcanics from which Ashgill age brachiopods have been recovered (Neuman, 1973, p.165).

Volcanic rocks of probable Ordovician age also crop out on Little Spencer Mountain. The lowermost unit is composed of basaltic andesite. The contact between this basaltic andesite and the Hurricane Mountain Formation is unconformable. The lowermost unit is overlain by porphyritic dacite which is overlain by another basaltic andesite. Feeder dikes for the porphyritic dacite were observed to crosscut the Hurricane Mountain Formation and continue through the lower basaltic andesite. This suggests that the contact between the lower basaltic andesite and the Hurricane Mountain Formation is stratigraphic rather than tectonic. These rocks on Little Spencer Mountain may be correlative with some of the rocks of the Lobster Mountain Volcanics, especially those belonging to the mafic and intermediate submembers (Plate 1. Section B - B'). Radiometric dating would aid in correlation of these volcanics.

A petrographic study of selected samples of the Lobster Mountain volcanic suite was done at Syracuse University during the Spring of 1986 (Helsel, 1986). Based on a limited number of samples from the mafic and intermediate submembers of the Lobster Mountain Volcanics, it was concluded that these rocks may have crystallized from a subalkaline magma. If these samples were comagmatic, then the magma followed a calc-alkalic differentiation trend. The results of this study are not definitive due to the small number of analyses used, however, they are not inconsistent with an island arc setting for the development of this stratovolcanic complex.

Relict skeletal oxides comprised of titanite or magnetite with ilmenite lamellae on relict (111) planes occur in rocks of the mafic submember of the Lobster Mountain Volcanics and also in rocks from Little Spencer Mountain. Based on a limited number of chemical analyses, the Lobster Mountain Volcanics and Little Spencer Mountain volcanics both show a calc-alkaline differentiation trend (Helsel, 1986). These results are consistent with the correlation of the Lobster Mountain Volcanics with those of Little Spencer Mountain as mentioned above.

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APPENDIX 1

PETROGRAPHY

Thin sections were made of twenty samples collected from the locations shown on Plate 1. Following are brief descriptions of those thin sections.

Sample 712 SW - Rhyodacite
- porphyritic seriate texture; locally glomeroporphyritic.
- phenocrysts 20% of volume (visual estimate).
- phenocrysts: plagioclase and quartz; subhedral to anhedral.
- plagioclase phenocrysts show various stages of sausseritization.
- quartz phenocrysts have inclusions and embayments of fine grained matrix.
- flow defined by long axes of phenocrysts or clumps of crystals.
- subhedral to euhedral Fe/Ti oxides are a minor constituent; some crosscut plagioclase phenocrysts.
- matrix fine grained quartz, plagioclase, and mica, locally spherulitic.

Sample NC 10 - Rhyodacite
- porphyritic seriate texture.
- phenocrysts: quartz and plagioclase; subhedral to anhedral. plagioclase phenocrysts show various stages of alteration. phenocrysts of quartz have embayments and inclusions of matrix. matrix hypocrystalline with spherules; quartz, plagioclase and mica with minor Fe/Ti oxide and a few carbonate grains.

Sample NC 14 - Rhyodacite
- porphyritic hiatal texture.
- phenocrysts: quartz and plagioclase; subhedral to anhedral.
- plagioclase partially altered; quartz phenocrysts have embayments and inclusions of matrix.
- matrix composed of crystallites and microlites of quartz, plagioclase, and mica; minor Fe/Ti oxide usually as rims around phenocrysts or replacing phenocrysts.

Sample NC 17 - Rhyodacitic welded tuff
angular broken plagioclase and quartz crystals in a matrix of crystallites.
microfractures filled with mica.
some groups of Fe/Ti oxides that may represent altered phenocrysts are locally crosscut by plagioclase crystals, a few patches of small carbonate crystals.

Sample NC 18 - Rhyodacitic welded tuff
angular broken crystals of plagioclase, quartz, and relict glass shards.
matrix hyalopilitic; locally spherulitic.
many microfractures filled with fine grained mica and Fe/Ti oxide.
small epidote crystals associated with Fe/Ti oxides occur as rims around relict fragments.

Sample SP 6 - Pyroclastic flow
- larger broken plagioclase crystals (2mm) and crystals of devitrified glass in a fine grained pilotaxitic matrix.
- secondary carbonate in small veins and replacing phenocrysts.
- anastomosing veinlets of chlorite and very fine Ti- oxides (anatase or brookite?).

Sample SP 38 - Porphyritic flow
- subhedral to anhedral plagioclase phenocrysts occur in a fine grained hyalopilitic matrix.
- a few anhedral quartz phenocrysts.
- many small epidote crystals are peppered through the matrix.
- minor hematite and carbonate.

Sample ML 7 -
- hypocrystalline texture with a few spherulites.
- quartzofeldspathic veinlets crosscut one another.
- one edge of the section contains anastomosing veinlets of chlorite and hematite around elongate fragments of quartz and plagioclase; crosscutting quartzofeldspathic veinlets appear offset locally in this part of the section.

Sample ML 8 - Siltstone
- well sorted subrounded quartz grains generally less than 0.1 mm with a few plagioclase grains, accessory muscovite and hematite, silica cement.
- secondary chlorite and epidote.

Sample ML 17 - Rhyodacitic flow breccia
- glomeroporphyritic texture; clasts of quartz and plagioclase crystals and fine grained rounded clasts with spherulites and feldspar inclusions in a matrix of crystallites and small quartz crystals with accessory hematite.
- crosscut by microfratures filled with calcite and mica.

Sample ML 19 - Rhyodacitic lapilli tuff
- lapilli size porphyritic to hyalopilitic clasts occur in a porphyritic matrix.
- phenocrysts within the lapilli: subhedral to anhedral quartz, anhedral plagioclase.
- phenocryst within the matrix: quartz and plagioclase.
- matrix: quartz, plagioclase, carbonate, hematite, chlorite, epidote, and crystallites.
- some carbonate crystals have quartz rims.

Sample ML 20 - Altered vesicular flow
- vitrophyric; flow indicated by long axes of relict plagioclase crystals; spherules often elongate parallel to relict plagioclase laths.
- opaque mineral (unidentified) associated with anomalous blue mineral (polarized light) and minor hematite.

Sample ML 22 - Lapilli tuff
- vitroclastic fabric; lapilli size clasts and relict glass shards.
- clasts contain quartz phenocrysts with perlitic texture and relict plagioclase phenocrysts (antiperthitic?).
- matrix contains carbonate, sericite, epidote; hematite and magnetite occur along microfractures.
- one of the lapilli appears to be accretionary.
- slide contains one unidentified azure blue grain.

Sample ML 35 - Sheared felsic volcanic
- strongly tectonized fabric, dark anastamosing fine grained felted chloritic matrix surrounds elongate crystals of strained quartz, plagioclase, and microcline.
- various stages of replacement by muscovite are observed.
- some crystals are broken and pulled apart.
- some crystals have "S" shapes and well developed "tails" of mica.

Sample ML 37 - Diabase
- relict plagioclase phenocrysts in a matrix of relict plagioclase (sausseritized).
- flow indicated by alignment of long axes of relict plagioclase crystals.
- some small patches of carbonate.
- matrix chloritic with minor quartz and magnetite.

Sample ML 39 - Andesite porphyry
- relict plagioclase and pyroxene phenocrysts in a very fine grained groundmass.
- plagioclase phenocrysts altered to sausserite, sericite, and carbonate.
- pyroxene phenocrysts altered to chlorite and carbonate.
- hematite associated with relict pyroxene.
- groundmass hypocrystalline with carbonate, sericite, sausserite, and hematite microlites.
- hematite and quartz along fractures.

Sample ML 44 - Metasomatized porphyry
- relict plagioclase phenocrysts(?) are all that remains of the original texture.
- carbonate 60% (visual estimate), hematite, pyrite, goethite, brookite(?), minor quartz, epidote.

Sample ML 45 - Metasomatized porphyry
- relict plagioclase phenocrysts(?) are all that remains of the original texture.
- similar to ML 44 except contains more pyrite.

Sample LM 6 - Felsic tuff
- a few lapilli in matrix of ash.
- phenocrysts: plagioclase rimmed by sericite and quartz.
- matrix: chlorite, hematite and goethite.

Sample LM 7 - Metasomatized porphyry
- relict plagioclase phenocrysts(?) are all that remains of the original texture.
- very similar to ML 44.

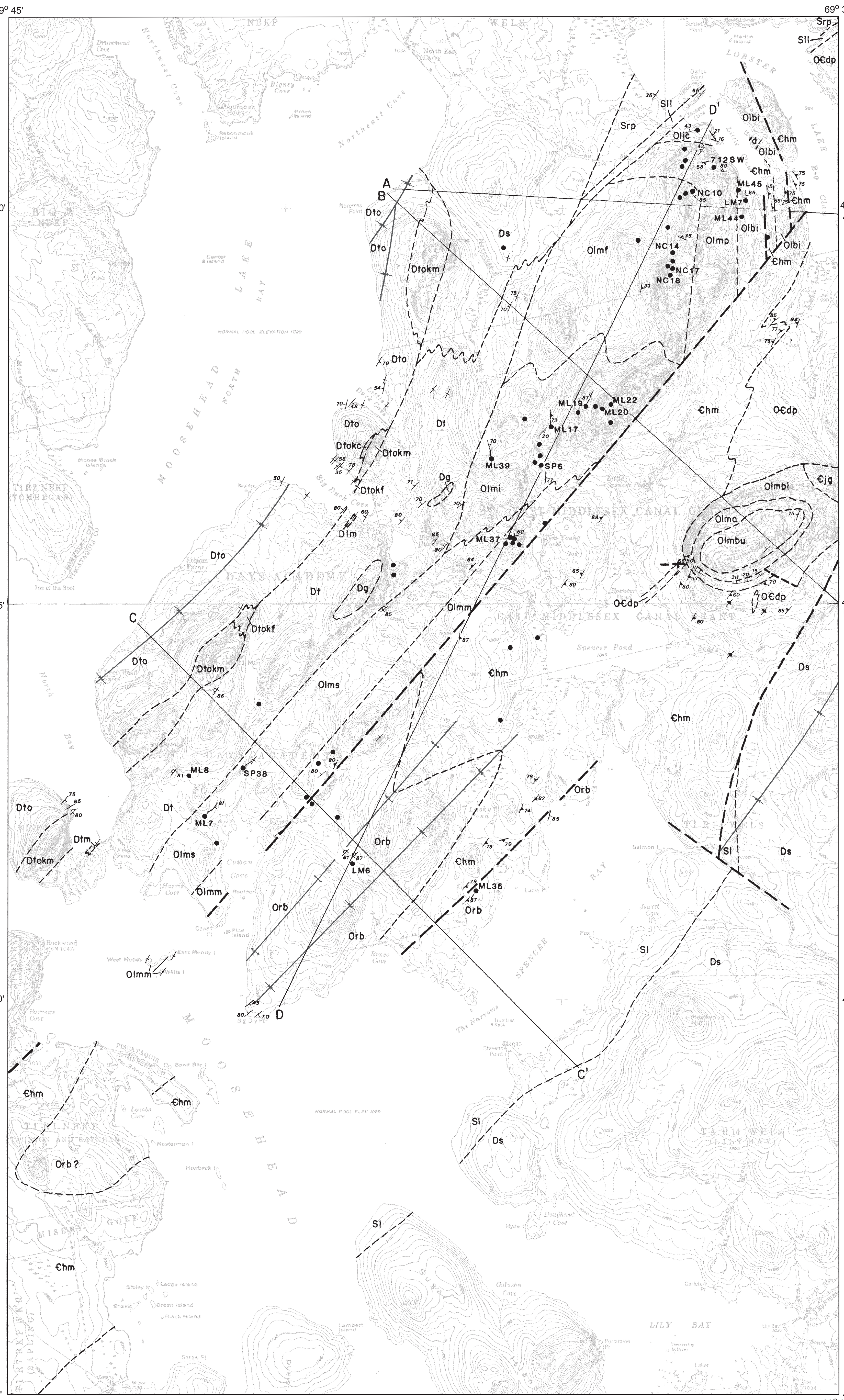


PLATE 1

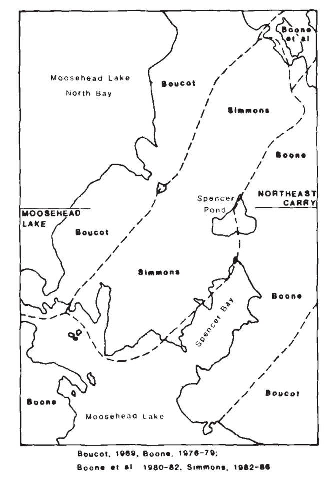
BEDROCK GEOLOGY OF PORTIONS OF THE NORTH EAST CARRY AND MOOSEHEAD LAKE QUADRANGLES , MAINE

BY RUTH SIMMONS

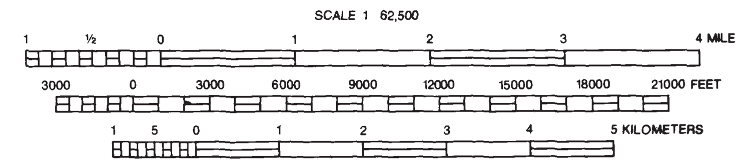
1987

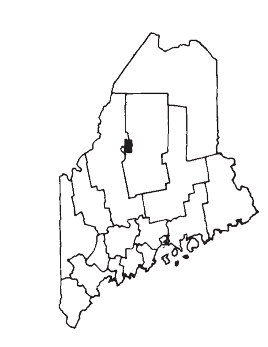
Maine Geological Survey
DEPARTMENT OF CONSERVATION
Walter A. Anderson, State Geologist

Open-File No. 87-22



Source Map





Quadrangle Location

EXPLANATION

STRATIFIED ROCKS

Dto — TOMHEGAN FORMATION - dark blue-gray metasandstone, dark blue-gray tuffaceous metasandstone, slate, rusty weathering metasiltstone, and quartzite

Dtokm / Dtokc / Dtokf — KINEO VOLCANIC MEMBER - massive metafelsite (Dtokm), metaconglomerate (Dtokc), and meta-flow breccia (Dtokf)

Dt — TARRATINE FORMATION - dark gray metasandstone, slate, and metasiltstone

Dtm — MISERY QUARTZITE MEMBER - fine to medium grained light gray quartzite cut by veinlets of milky quartz with minor slate and feldspar grains

Ds — SEBOOMOOK FORMATION - cyclically bedded dark blue-gray slate, metasiltstone, and blue-gray metasandstone

Srp — RIPOGENUS FORMATION - pitted light gray to blue-gray metalimestone, light gray to buff calcareous metasiltstone, gray calcareous metasandstone and minor blue-gray calcareous metaconglomerate

Sll — LOBSTER LAKE FORMATION - red orthoquartzite, slate, and metaconglomerate

Sl — undifferentiated metasedimentary rocks

--- unconformity ---

LOBSTER MOUNTAIN VOLCANICS

Oljc — JACKSON COVE MEMBER - light blue-gray metatuff, dark blue-gray metasiltstone, and blue-gray metaconglomerate

Olmf / Olmi / Olms / Olmm — LOBSTER MOUNTAIN MEMBER
felsic submember (Olmf): light and dark gray massive meta-porphyritic flow-rock, meta-breccia and metatuff

intermediate submember (Olmi): metaandesitic to metadacitic flow-rock, metabreccia and metapyroclastic rock

mafic submember (Olmm): dark green-gray metabasaltic flow-rock and metatuff with minor rusty weathering metasiltstone and gray metavolcaniclastic rock

sedimentary submember (Olms): gray redeposited metavolcaniclastic rock and interbedded rusty weathering metapelite with minor metaandesitic to metadacitic flow-rock and metatuff

Olbi — BIG ISLAND MEMBER - blue rusty weathering metasiltstone, blue tuffaceous metasandstone, and dark green metabasalt

VOLCANICS OF LITTLE SPENCER MOUNTAIN

Olmbu — UPPER MEMBER - metabasaltic andesite

Olma — MIDDLE MEMBER - metaporphyritic dacite

Olmbi — LOWER MEMBER - metabasaltic andesite

Orb — RONCO BROOK VOLCANICS - (Orb) felsic metatuff, lapilli metatuff, metapyroclastic rock, and minor rusty weathering metapelite and laminated metasiltstone

--- unconformity ---

O€dp — DEAD RIVER FORMATION - green phyllite with interbedded metasiltstone and slate

--- unconformity or fault ---

€hm — HURRICANE MOUNTAIN FORMATION - rusty weathering blue to gray metapelite and metasiltstone with hackly cleavage; contains exotic blocks of various lithologies

€jg — JIM POND VOLCANICS - greenstone; locally poorly pillowed

INTRUSIVE ROCKS

Dg — UNNAMED - rhyolite; garnet bearing

Olmp — LOBSTER MOUNTAIN PORPHYRY - rhyodacitic; light gray to dark gray aphanitic groundmass with plagioclase and quartz phenocrysts

d — DIABASE - dark green sills and/or dikes commonly with fine grained chilled margins

SYMBOLS

contacts; inferred or approximately located

fault; inferred or approximately located

anticlinal axis

synclinal axis

bedding (inclined, overturned)

cleavage

flow banding

location of outcrop; structural data unavailable

ML8 — location of sampled outcrop

INTERPRETIVE CROSS SECTIONS