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Stratigraphy, metamorphism and geomorphology in the Greenville-Rockwood Area, Maine

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Trip C-2

STRATIGRAPHY, METAMORPHISM AND GEOMORPHOLOGY OF THE GREENVILLE-ROCKWOOD AREA, MAINE

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INTRODUCTION

In the Greenville-Rockwood area, rocks from Cambrian through Middle Devonian age are exposed within the Moose River Synclinorium, the Lobster Mountain Anticlinorium, and the Roach River Synclinorium. The purpose of this field trip is to show how both original lithology and contact metamorphism influence the topography of this region of Maine.

The Moxie pluton was mapped by Espenshade (1982) and Hon (this volume) has studied its petrology. Boone (this volume) has mapped pre-Silurian rocks in the Lobster Mountain Anticlinorium. The rocks within the Moose River Synclinorium were mapped by Boucot (1961) and Boucot and Heath (1969). We first became aware of the origin of the topography in the Greenville area while mapping the surficial geology for the Maine Geological Survey (Caldwell and Hanson 1975). More recently, students at the Maine Geology Field Camp (Boston University) have mapped these rocks under our direction, furthering our interest in the subject.

STRATIGRAPHY

Detailed descriptions of the rocks within this area are found in the introduction to this volume in Moench and others (1982), and in Boucot and Heath (1969). The rocks within the study area are listed in stratigraphic order and described briefly within Table 1. A simplified geologic map of the area is shown in Figure 1.

Geological Control of Topography within the Structural Belts in the Greenville-Rockwood area

The linear ridges and valleys in the area are the result of differential erosion of Acadian fold belts. Irregularly shaped basins and mountains are associated with plutons and surrounding granofels. The rocks within the cores of synclines are the youngest and least deformed and are also the most resistant (for example, Kineo, Tarratine). The pre-Silurian rocks within the core of the Lobster Mountain anticlinorium are highly deformed, showing more than one cleavage and are relatively non-resistant to erosion.

Moose River Synclinorium

The Kineo member forms a line of steep sided hills and ridges stretching from Brassua Lake to near the northern end of Moosehead Lake. This trend includes the spectacular Kineo Mountain. The toughness and durability of this rock is indicated by the fact that the Kineo (locally called the Kineo flint) was prized by the Indians as a material for arrowheads.

The Tarratine forms a nearly 40-mile-long ridge from Spencer Lake on the southwest, to the northeast end of Moosehead Lake. This ridge includes the redoubtable Misery Ridge between Rockwood and Johnson Mountain.

The Seboomook forms a continuous valley on the southeast side of Misery Ridge, while the valleys of the Moose River and Misery Stream to the northwest of Misery Ridge have both formed within the Tomhegan. The northern end of Moosehead Lake also lies within the area of the Tomhegan and the Seboomook. The topographic expression of the rocks within this portion of the Moose River synclinorium is very reminiscent of the Valley and Ridge in Pennsylvania and Virginia, but on a smaller scale.

Figure 1. Generalized geologic map of the Greenville-Rockwood area. Numbers refer to field trip stops. Geology from mapping and compilation by Gary M. Boone, Syracuse University and Maine Geological Survey.

TABLE 1

DESCRIPTIONS OF ROCKS IN THE GREENVILLE-ROCKWOOD AREAS, MAINE

Map Symbol (Fig. 1)	Formation Name	Brief Description	Topographic Expression
		L A Y E R E D R O C K S	
Dto	Tomhegan	Fossiliferous dark metasandstone quartzite, slate	Low hills and valleys
Dtokm	Kineo member, Tomhegan formation	Rhyolite, tuff, flow breccia	Steep-sided hills, 200-800 ft. relief, (e.g. Mt. Kineo, Big Spencer Mtn).
Dt	Tarratine	Fossiliferous dark metasandstone, metasiltstone, slate	Steep-sided ridges, (e.g. Misery Ridge).
Ds	Seboomook	Metasandstone and slate in thin graded couplets	Low hills except where subjected to contact Metamorphism, where major mountains are formed.
Dc	Carrabassett	Slate, minor metasandstone	Low hills except where contact metamorphosed to hornfels and granofels where high ridges and mountains are formed.
Sc	Capens	Red and green slate	Low hills
Su	Undifferentiated Silurian rocks		Low hills
Ov	Volcanics including Kennebec and Lobster Mtn. volcanics	Felsite, tuff	Low to moderate hills
OCD	Dead River	Greenish metasiltstone and slate	Low hills
Ch	Hurricane Mountain	Rusty metasiltstone with exotic blocks	Low hills, valleys and basins. Exotic blocks form small knobs.
		P L U T O N I C R O C K S	
Dmp	Moxie	Tractolite, norite	Valleys, lake basins

Lobster Lake Anticlinorium

This belt forms a generally low area between Misery Ridge and the hornfels mountains and hills to the south. The headwaters of the Kennebec River has formed in the Dead River formation. The Hurricane Mountain formation underlies a broad area of low hills, while some small islands composed largely of exotic blocks occur in the southern terminous of the west outlet in Indian Pond (see Boone, this volume).

Only the Ordovician volcanics (Lobster Mountain volcanics) has extensive positive relief features, particularly toward the northeastern terminous of the structure.

Roach River Synclinorium

The Moxie pluton (see Hon, this volume) has played a major role in shaping the topography within this belt and to the east of Greenville in the mountains commonly called the White Cap Range (Hanson, this volume) in the headwaters of the East Branch and West Branch Pleasant River. The Moxie intruded the Carrabassett and Seboomook at a temperature estimated by Hon (this volume) to be in excess of 1100 C. The resulting thermal metamosphism removed the slately cleavage from the pelitic rocks and produced a resistant granofels. Most of the mountain ranges in Central Maine are granofels, produced by the contact metamorphism of previously low grade, regionally metamorphed, pelitic rocks. In southern Maine and Southern New England such contact metamorphism was less effective because higher grade regional metamorphism was experienced by rock further south, mineral assemblages were produced which were more stable when subsequently subjected to contact metamorphism and hence less altered. Mountains of granofels are practically non-existent in areas subjected to staurolite grade, or higher, regional metamorphism, except where intruded by very hot mafic rocks.

There are few mountains in Maine higher than the mountains surrounding with the Moxie pluton and similar plutons in the Sugarloaf Mountain-Bigelow Mountain area (Boone, 1973). Two prominent exceptions are Mount Katahdin and mountains in the Traveler Range. Katahdin owes its eminence to a resistant summit facies with a granophyric texture which protects the weak core of the pluton from weathering and erosion (Hon, 1980). Where the summit facies has been removed the highest elevations within the pluton are low hills. The Traveler rhyolite is comparable to the Kineo in compostion and resistance to erosion except that at present the Traveler is very much thicker and therefore forms higher mountains (Rankin, 1961).

The Moxie pluton underlies the lowest areas within the region. It forms a long, sinuous valley between the two hornfels mountain ranges. The southern end of the Moosehead Lake is underlain by the Moxie. The border of the Moxie, near its contact with the Carrabassett and Seboomook is fine grained and this rock weathers spheroidally. The coarser interior portion of the pluton undergoes granular disintergration and some areas of saprolite are preserved in this portion of the pluton. The contact phase of the Moxie is found near the summits of some high ridges, near Big Squaw Mountain, for example. The Moxie may have been protected from erosion by the hornfels rock on the northwest flank of the mountain or the finer grained Moxie may itself resist weathering and erosion.

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ROAD LOG

The Greenville, Moosehead Lake, and Brassua Lake quadrangles cover the area of this field trip.

Mileage begins at assembly point, Department of Transportation rest area 2.3 miles south of Greenville on Route 15.

Mileage

0 Rest Area, STOP 1 is about 0.1 miles south of rest area.

Stop 1 - Carrabassett formation. Slatey cleavage dominates the outcrop. Bedding is indistinct, but begins to show upon close inspection. Beds dip steeply northward and young in that direction. The Carrabassett here is typical of that found south of here in the Monson slate belt.

Return to cars.

2.5 Greenville, turn left at Indian Store.

3.7 Greenville Junction bear right on Route 15.

4.7 Stop 2 - Northeast end of granofels ridge of Carrabassett (?) Harfords Point township. Note prominent ridge on Figure 1 or on Greenville quadrangle called Little Squaw Mountain. This is the granofels ridge produced by the Moxie plutic that lies less than one-half mile to the west of here. Note the lack of slatey cleavage and that bedding is more pronounced than at the previous stop. A few small andalucite crystals are present. Walk to next outcrop.

4.9 Stop 3 - Little Squaw Mountain (T3 R5), Seboomook formation with prominent bedding, cross stratification and minor folds. On the southwest side of road toward Greenwood Motel is a greenish quartzite that may be the Madrid formation.

Return to cars.

5.3 Cross contact into the Moxie pluton.

5.4 Stop 4 - Fine grained troctolite (plagioclase, olivine). Well developed spherioridal weathering and development of iron-stained soil.

6.4 Stop 5 - Big Squaw Mountain Township (T2 R6). Coarse grained interior phase of Moxie. Note knots of mafic minerals which may result from crystal settling. Thi rock undergoes granular disintergration, with the development of grus. Above th jointed fresh rock is a zone of particularly decomposed rock that resemble pebbles, but consist of the knots of dark colored minerals surrounded by decomposed or disintergrated feldspar. Above this is a thick mantle of rusty soil composed of partially decomposed feldsfar crystals and clay. Although not typical of the clay-rich saprolites of the south, this material may in fact be a saprolite. We believe that the weathering represented here is probably pre-Wisconsin and may be partly pre-Pleislocene in development. The fact that any of this loose material escaped erosion by the ice sheets that passed this way may mean that it was originally much thicker and also may have been frozen during glaciation.

7.4 Last outcrop of Moxie on north west side of pluton. This rock resembles that seen at Stop 4. Total width of pluton here is about 2 miles.

7.8 STOP 6 - Spectacular outcrops of Seboomook. Thin (2-5 cm) graded beds with large andalucite crystals in the upper pelitic layer. This gives the impression that the pelitic layers are coarser and that the beds fine downward into the sandy layer. The beds in fact fine upward. These effects are best seen in the weathered upper surface of the outcrop where there are also small folds interpreted as slump phenomena. The rocks here are granofels, with a sparkling luster from the coarse grained biotite, andalusite and possibly cordierite. The outcrop is the northern end of the large ridge that ends on the sumit of Big Squaw Mountain. Before leaving, look back along the road to Greenville. Visible in the background is the hornfels ridge of Little Squaw Mountain and in between is the valley formed in weathered Moxie pluton.

8.0 Turn left into entrance of Squaw Mountain lodge for lunch and for Stop 7 at the summit of Big Squaw Mountain after lunch. The mileage for the remaining afternoon portion of this field trip will pick up at the entrance road as we will continue north on Route 15 into the Lobster Mountain and Moose River structural belts.

STOP 7 - Summit of Big Squaw Mountain beds of Seboomook hornfels rock. Fine-grained border rocks of Moxie lie a few hundred feet to the southwest. From this vantage point, the broad lowland of the Lobster Mountain anticlinorium is visible with Misery Ridge beyond and the Kineo trend beyond that. Slightly to the northeast are two long mountains. The easterly mountain is Big Spencer composed of Kineo volcanics. Far to the northeast is Katahdin.

Return to bottom of mountain and assemble in caravan at end of entrance road to Squaw Mountain.

8.0 Turn left on Route 15 toward Rockwood.

10.8 Undifferentiated Silurian rocks.

12.8 Capens formation

13.8 West outlet, headwaters of Kennebec. Optional Stop 8. Green phylitic slate of Dead River formation.

14.6 Hurricane Mountain formation.

20.6 STOP 9 - Tarratine formation at northeast end of Misery Ridge. Fossiliferous metasandstone, metasiltstone and metapelite with well developed slatey cleavage.

21.4 Look to right across narrows to Kineo Mountain. Kineo rocks are exposed in bushes on left.

22.6 Moose River and exposures of Tarratine are visible on far shore.

26.6 STOP 10 - Southwest termination of Kineo member occurs a few 10's feet beyond right side of road. Rhyolite displays prominent layering with slump features displayed.

END OF TRIP.

Proceed around sharp bend to wide gravel shoulder. Brassua Lake is visible. Turn around and return to Squaw Mountain for Annual Supper.

- THANK YOU -