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Cuppels, Norman P., "The Marlboro Formation in the Concord Quadrangle" (1964). *NEIGC Trips*. 65.
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TRIP F

THE MARLBORO FORMATION IN THE CONCORD QUADRANGLE¹

Norman P. Cuppels, U.S. Geological Survey

In describing the great variety of lithologic units which he included in the Marlboro Formation of Precambrian(?) age, Emerson (1917, p. 31) indicated that the "formation may eventually be broken up into several formations". Emerson's observations on the lithologic heterogeneity of the Marlboro are supported by recent mapping in the Concord quadrangle by the writer. Preliminary results of this mapping are shown on the geologic map accompanying this road log. The purpose of this field trip is to examine the variety and complexity of some of the lithologic units mentioned by Emerson and mapped by the writer.

All stops on this field trip are in the 7½ minute Concord quadrangle except Stop 1. Stop 1 is in the Marlboro quadrangle. The trip will be repeated in an abbreviated form on Sunday at which time Stops 1, 4, and 6 will be omitted.

Log starting from campus of Boston College:

Miles

- | | |
|------|--|
| 00.0 | West on Commonwealth Ave. at Main Gate. |
| 5.7 | Charles River. The river is very close to the western boundary of the Boston Basin. The Cambridge Slate (Devonian or Carboniferous) crops out east of the river and the Dedham Granodiorite of Devonian(?) age is exposed west of the river. Cross the river and onto Rte. 128 headed north. |
| 7.9 | Left on Rte. 20 to Marlboro. |
| 24.7 | Stop 1. |

STOP 1 - Outcrops are along right side of Rte. 20 and in cemetery 200 feet up the hill on the north side of the road.

This is the type locality of the Marlboro Formation (Emerson, 1917, p. 25-26). Emerson describes the Marlboro in this area as a well-foliated, dull-black biotite schist intercalated with many beds of dark, well-foliated hornblende schist, and a few beds of conglomerate and quartz-epidote rock. Small, slightly elongate pebbles of aplite in the conglomerate contain much plagioclase and have a micrographic texture. Elsewhere in northeastern Massachusetts, the Marlboro, as mapped by Emerson (1917, p. 31), includes "... a

¹Publication authorized by the Director, U.S. Geological Survey.

variety of rock, although green, gray and black chloritic, hornblendic, epidotic, and biotitic schists predominate. Interbedded with these are many thin layers of quartzite and quartz-muscovite schist, and in places, of rhyolite, and the formation also includes a number of small bodies of limestone and a few lenses of conglomerate". In some places, the quartzite and rhyolite are very abundant and were thought by Emerson to constitute the upper part of the formation or a separate and younger formation.

Emerson mapped two arcuate belts of Marlboro extending 30 miles north-eastward from the Marlboro quadrangle. These belts, each of which is about one mile wide, coalesce in the Concord quadrangle. Within the belts, the formation is exposed in the form of many small outcrops surrounded by and included in igneous rocks of Paleozoic age.

Miles

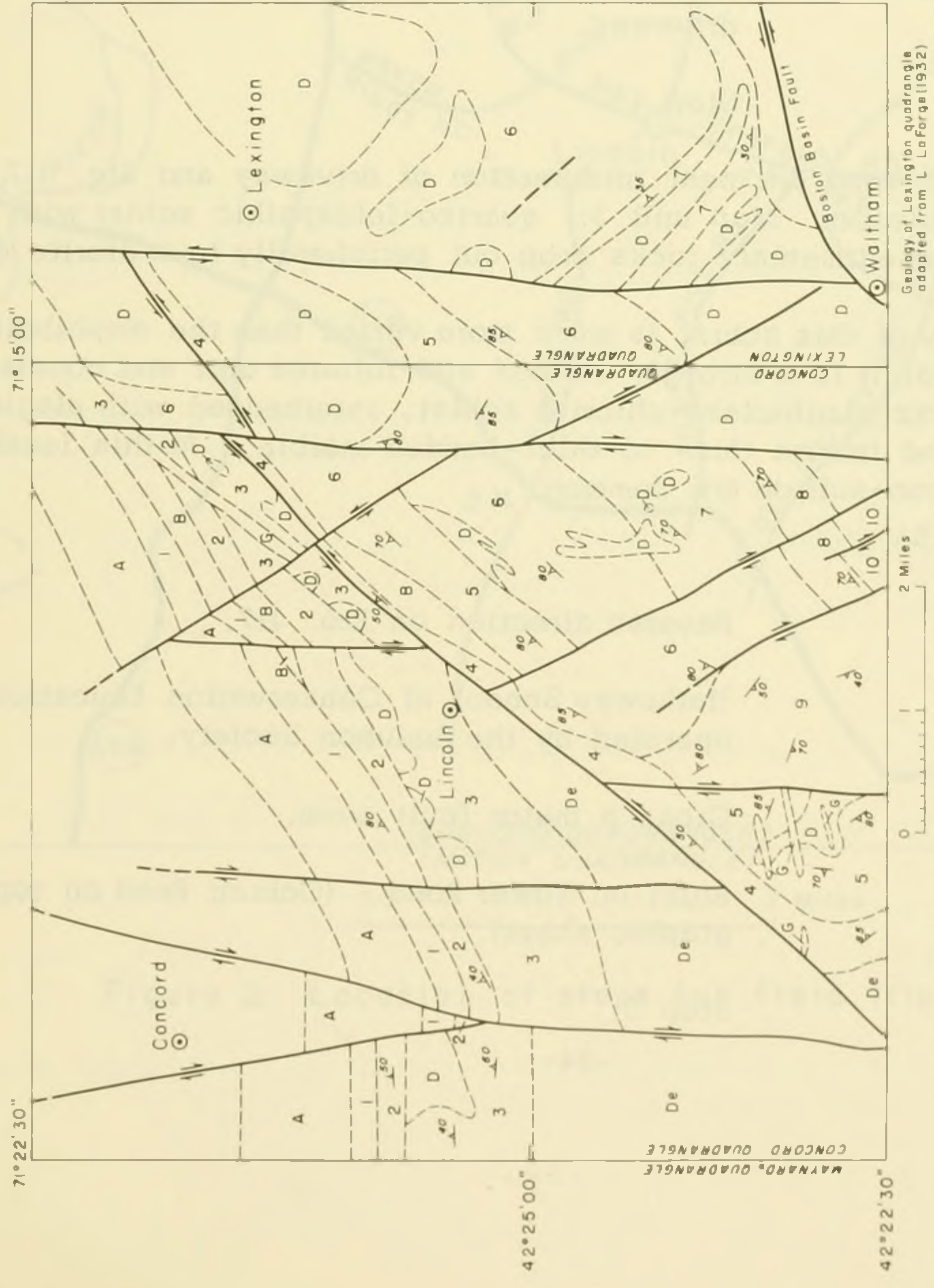
	Reverse direction on Rte. 20.
35.7	Left on Rte. 126.
36.7	Cross southern boundary of Concord quadrangle.
41.4	Right on Baker Bridge Road.
44.3	Right on Sandy Pond Road.
44.4	Left at entrance to DeCordova Museum.
44.8	Stop 2.

STOP 2 - Outcrop is along road west of museum. Bus will use museum parking lot east of museum. Map unit 2: thin-bedded amphibolite.

The amphibolite exposed here is considered to be correlative with the amphibolite at the type area of the Marlboro Formation. The rock is chiefly actinolitic hornblende and plagioclase with varied amounts of quartz, epidote, and biotite. The conglomerate seen at the type locality occurs in places along the strike of this unit. The lithologic units shown on the geologic map are numbered in the order of increasing age and will be visited in that order as nearly as possible. Possible discrepancies in the age sequence will be discussed during the trip.

Miles

	Leave museum grounds and turn right on Sandy Pond Road.
45.5	Stop 3.



Geology of Lexington quadrangle
adapted from L. LaForge (1932)

Figure 1. Simplified geologic map of the Marlboro Formation in parts of the Concord and Lexington quadrangles

EXPLANATION

- | | |
|-----------------------|--|
| Metasedimentary Rocks | |
| 1 | Nashoba Formation |
| Marlboro Formation | |
| 2 | Amphibolite, thin-bedded |
| 3 | Quartz-feldspathic schist, with lenses of marble |
| 4 | Felsite, laminated |
| 5 | Paragneiss, thin-bedded |
| 6 | Amphibolite, thick-bedded |
| 7 | Quartz-feldspar granulite |
| 8 | Quartz-hornblende-plagioclase schist |
| 9 | Amphibolite, lineated |
| 10 | Westboro Quartzite |
| Intrusive Rocks | |
| A | Andover Granite |
| G | Granite |
| B | Diabase |
| De | Dedham Granodiorite |
| D | Diorite |
| Carboniferous | |
| Precambrian(?) | |
| Precambrian(?) | |
| Intrusive Rocks | |
| Carboniferous | |
| Carboniferous(?) | |
| Upper Paleozoic(?) | |
| Devonian(?) | |
| Lower Paleozoic(?) | |
| Symbols | |
| | Strike and dip of foliation |
| | Strike and dip of foliation and parallel bedding |
| | Fault, showing relative movement |
| | Lithologic boundary |

STOP 3 - Outcrops are in a field on right side of road. Poison ivy is abundant near these outcrops. Map unit 1: Nashoba Formation.

The quartz-mica schist exposed here is not typical of the Nashoba Formation as described by Hansen (1956, p. 31-39). Because of its mineralogy and texture however, it more properly belongs with the high-alumina Nashoba Formation than with the finer grained, low-alumina Marlboro Formation. It may correlate with the Brimfield Schist. This is the closest outcrop to the contact between the two formations.

Miles

Reverse direction on Sandy Pond Road.

45.0 Right on Baker Bridge Road.

47.2 Left on Concord Road (Rte. 126).

48.6 Right on Rte. 117.

50.0 Cross Sudbury River and turn right into private driveway.

Stop 4.

STOP 4 - Outcrops are near intersection of driveway and Rte. 117, and in back yard of residence. Map unit 3: quartzo-feldspathic schist with lenses of marble. The metasedimentary rocks crop out peripherally to a diorite dike.

The lithology of this schist is much more varied than the amphibolite of Stop 2. In general it is a strongly bedded and foliated unit and consists of thin beds of quartz-plagioclase-chlorite schist, interbedded with plagioclase amphibolite and impure thin- to thick-bedded marble. At this locality, nodules of copper-iron-sulfide are common.

Miles

Reverse direction on Rte. 117.

52.5 Hatheway School of Conservation Education operated by the Audubon Society.

53.2 Cross a major fault zone.

53.4 Right on Tower Road. (Coburn Road on topographic sheet).

53.5 Stop 5.

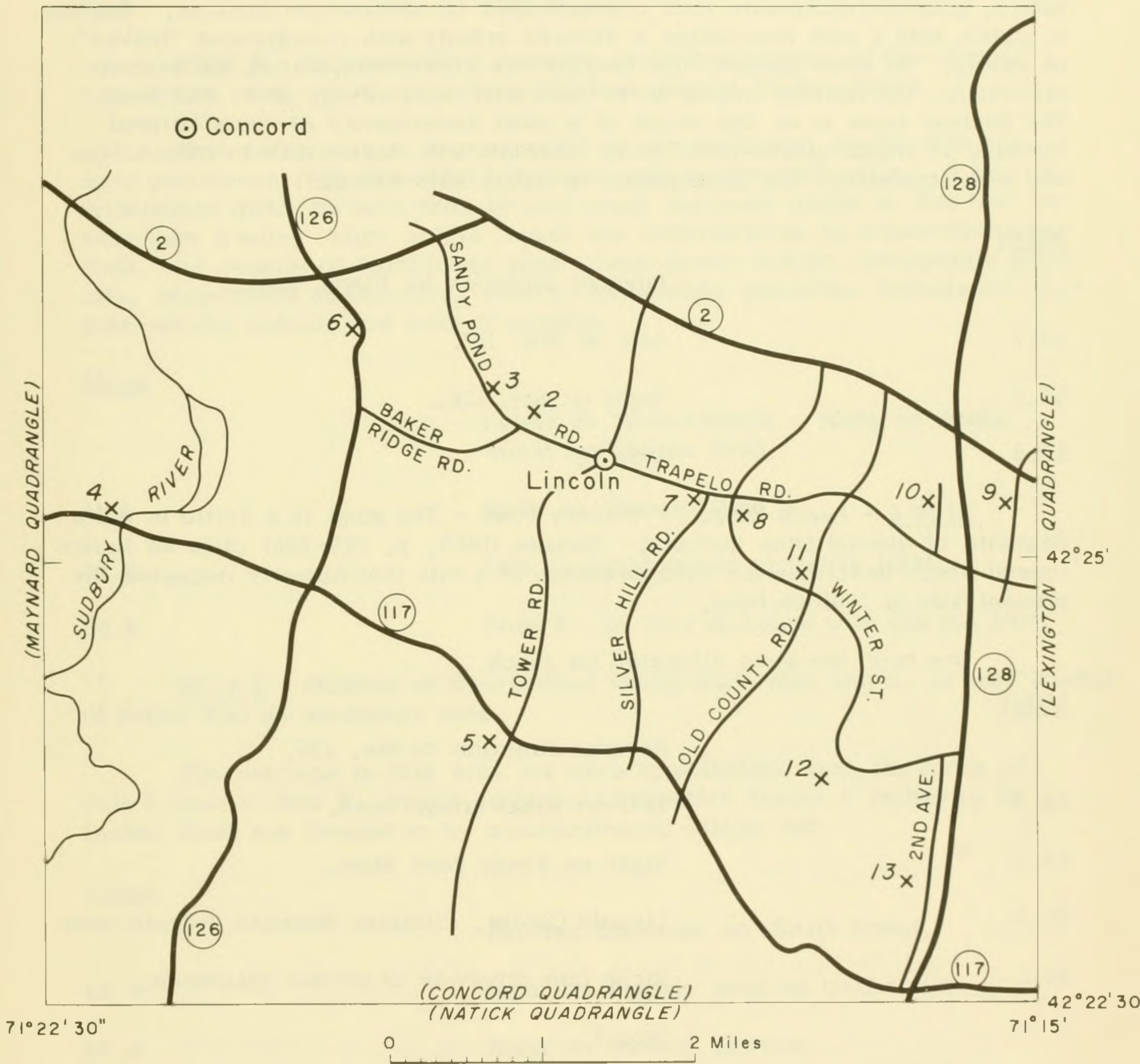


Figure 2. Location of stops for field trip No. 6

STOP 5 - Outcrop is along railroad tracks west of Tower Road. Map unit 4: Laminated felsite.

This felsite is a very fine-grained, light-gray to light-green to light-brown, quartzo-feldspathic rock characterized by pronounced laminae. Locally it grades into a rock resembling a sheared granite with conspicuous "leaves" of quartz. At some places, the laminae are continuous across the outcrop; elsewhere, the laminae appear to be fractured and rotated, as at this stop. The laminae seem to be the result of a weak development of compositional layering in which quartz-rich layers alternate with layers rich in plagioclase and some chlorite. The plagioclase is partly sericitized.

Miles

Reverse direction on Tower Road.
53.7 Left on Rte. 117.
55.8 Right on Rte. 126.
57.8 Stop 6.

STOP 6 - Lunch Stop. - Walden Pond - The pond is a kettle in delta deposits of glacial Lake Sudbury. Thoreau (1893, p. 285-286) cites an Indian legend which describes the disappearance of a hill that formerly occupied the present site of Walden Pond.

One hour has been allocated for lunch.

Miles

Reverse direction on Rte. 126.
58.5 Left on Baker Bridge Road.
59.8 Right on Sandy Pond Road.
60.4 Lincoln Center. Straight ahead to Trapelo Road.
61.1 Right into driveway of private residence.
Stop 7.

STOP 7 - Outcrop is in the back yard of the property owner. Rock here is map unit 4, laminated felsite.

The felsite at this stop appears to be gradational between the felsite seen at Stop 5 and a rock resembling a sheared granite.

Miles

- Return to Trapelo Road and turn right.
- 61.4 Right on Winter Street. First house on left.
- 61.8 Stop 8.

STOP 8 - Exposure is a recently dynamited outcrop of thin-bedded paragneiss, map unit 5, in a field 200 feet east of Winter Street,

This paragneiss is characterized by compositional layers that are more continuous than any other lithologic unit in the quadrangle. A bed of feldspathic quartzite less than 10 feet thick has been traced in this unit for more than a mile. Most of the layers are considered to be metasedimentary beds, and consist of hornblende-plagioclase-quartz schist, feldspathic quartzite, plagioclase amphibolite, quartzo-feldspathic granulite, hornblende-epidote-zoisite schist, and sills of granite.

Miles

- Return to Winter Street. Right on Winter Street to Trapelo Road.
- 61.5 Right on Trapelo Road.
- 64.2 Left on Smith Street at traffic light.
- 64.8 Stop 9. In yard of house with big red barn.

STOP 9 - Outcrop of thin-bedded paragneiss, map unit 5, is near summit of Fuller Hill on southeast side.

The outcrops in this area are more amphibolitic than the rocks of unit 5 seen at Stop 8. White, quartzo-feldspathic layers 4 inches to 18 inches thick are thought to be metamorphosed silicic tuff.

Miles

- Reverse direction on Smith Street.
- 65.4 Right on Trapelo Road at traffic light.
- 65.9 Right on Brennan Avenue.
- 66.3 Stop 10.

STOP 10 - Outcrops are in a recent excavation along east side of hill. Fault zone.

Rocks exposed at this stop are in one of the major north-trending fault zones of the Concord quadrangle. The rocks are thoroughly shattered, and highly polished slickensides of epidote are abundant in the thick-bedded amphibolite (Unit 6), gabbro, diabase, and granite. Evidence can be seen for the following sequence of events from oldest to youngest:

1. Faulting of the thick-bedded amphibolite.
2. Intrusion of the gabbro and diabase.
3. Faulting of the amphibolite, gabbro, and diabase.
4. Intrusion of the granite.
5. Faulting of the entire complex.

Miles

Reverse direction on Brennan Avenue.

66.7 Right on Trapelo Road.

67.4 Left on Old County Road.

68.4 Right on Winter Street.

68.7 Stop 11.

STOP 11 - Thick-bedded amphibolite, map unit 6, exposed in a road cut along right side of Winter Street.

This is a good exposure of the thick-bedded amphibolite. It is composed chiefly of actinolitic hornblende and heavily saussuritized plagioclase. Light-colored megacrysts, which occur in some zones, are composed of sericitized plagioclase and quartz.

Miles

Reverse direction on Winter Street.

70.5 Right on private road to Casala's piggery.

71.3 Stop 12.

STOP 12 - Outcrops are in an abandoned pig sty. Map unit 7, quartz-feldspar granulite.

Map unit 7 is a white, to light brown, aphanitic to fine-grained weakly foliated, quartzo-feldspathic rock. Varietal minerals include diopside, garnet, hornblende, biotite, epidote, and zoisite. Much of the unit appears to have a clastic texture. Emerson excluded this unit from the Marlboro Formation, mapping it as a "gneiss and schist of unknown age".

Miles

	Return to Winter Street.
72.1	Right on Winter Street
73.0	Right on Second Avenue. This road not shown on topographic sheets.
74.1	Stop 13.

STOP 13 - Outcrops are on right side of road in excavation, exposing unit 8, quartz-hornblende-plagioclase schist.

This unit is a thin-bedded to laminated, light-green to gray schist that commonly weathers white. At some places, much of the hornblende is altered to epidote and zoisite.

TRIP F

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