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A trip down the Alton Bay flow line

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INTRODUCTION

The purposes of this trip are to obtain an overview of the glacial deposits of southeastern New Hampshire and southwestern Maine and to examine deposits critical to several classical controversies.

The glacial deposits have been described by many authors (Goldthwait et al., 1951; Tuttle, 1952; Bloom, 1960; Bradley, 1964; Smith, 1982; Thompson, 1982). A discontinuous mantle of till a few meters thick overlies bedrock. Characteristically the till is sandy and composed of clasts transported only a few kilometers from their source. Drumlins, often with bedrock cores (Birch and Trask, 1978), may include till over 50 m thick. The internal structure of these drumlins has not been studied nor has the "two till" problem. The till is overlain by stratified sand and gravel including ice-contact deposits and outwash. These form a large variety of landforms including kame terraces, eskers and outwash plains. Younger deposits include dune sands, swamp deposits and alluvium. Below the marine limit of about 70 m (Bradley, 1964) "marine clay" occurs above the till and below or interbedded with the stratified sands and gravels (Bradley, 1964). Subaqueous outwash, as mapped in coastal Maine (Smith, 1982), has not been described from New Hampshire.

Major controversies have concerned the mode of deglaciation (Koteff and Pessl, 1981). Was it normal retreat of active ice? Was it regional stagnation? Was it stagnation-zone retreat? In the coastal zone the controversy has been whether the retreat occurred on land (Goldthwait et al., 1951; Tuttle, 1952) or whether the glaciers calved into the sea (Lougee, 1940; Smith, 1982; Thompson, 1982). At the following sites evidence for these hypotheses can be viewed and discussed.

FARMINGTON, NEW HAMPSHIRE: STOPS 1 and 2.

Detailed study of stratified deposits indicates that here deglaciation was by stagnation-zone retreat (Coupland and Mayewski, 1980). The principal evidence is a branching set of flat-topped eskers and its relationship with kame terraces and the head of a collapsed outwash deposit (figure 1). The eskers were apparently open-ceilinged and recorded pulsating melt-water discharge. Southward narrowing of the Cocheco River valley may have contributed to glacier stagnation.

BERWICK, MAINE: STOP 3.

The Wentworth gravel pit lies along an extension of the "Newington Moraine". This controversial feature was initially interpreted as a marine end moraine (Katz and Kieth, 1917) but later authors disagreed (Tuttle, 1952; Bloom, 1960). Recently the general concept of marine end moraines has been well-accepted by many authors (Bradley, 1964; Smith, 1982; Thompson, 1982)

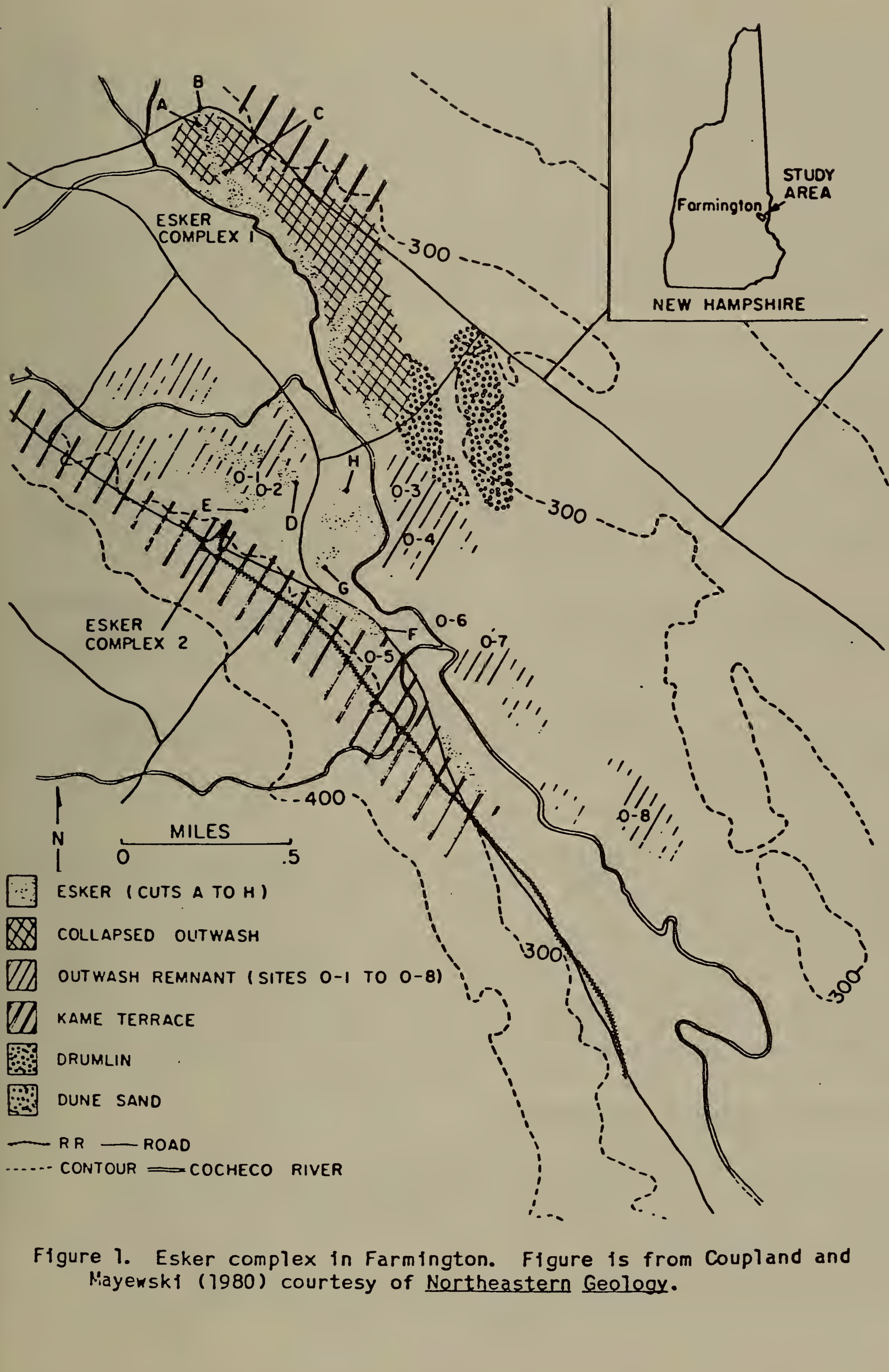

Figure 1. Esker complex in Farmington. Figure is from Coupland and Mayewski (1980) courtesy of Northeastern Geology.

although controversy surrounds individual features. In this pit marine clays are interbedded with stratified sand and gravel. Marine fossils are reputed to have been found here. Folding and thrust faulting of the deposits have been interpreted as signs of active ice during deglaciation.

ELIOT, MAINE: STOP 4.

Great Hill drumlin, as revealed by extensive excavations, is composed of massive till at the northwest end and laminated silt, sand and gravel at the southeast end. Here are an apparent wave-cut terrace and sea-cliff presumably marking the local marine limit at an elevation of about 61 m.

DOVER-MADBURY, NEW HAMPSHIRE: STOP 5.

The Barbadoes Pond deposit is now interpreted as an ice-marginal marine delta (Bradley, 1964; Hensley, 1978; Birch, 1980, Moore, 1982) in contrast to earlier interpretations as a stream or lake deposit (Goldthwait et al., 1951; Tuttle, 1952). Rows of similar deposits lie along bedrock strike ridges roughly parallel to the coast (Figure 2) (Birch, 1980) and mark retreatal positions of the ice sheet (Moore, 1982). The basic deltaic geometry has been confirmed by detailed seismic refraction studies (Birch, 1976; Hensley, 1978; Birch, 1980) and seaward paleocurrents have been mapped (Moore, 1982).

This deposit has been studied in exceptional detail because of hydrologic conflicts between landowners (shores of a small kettle lake), the City of Dover (municipal wells) and the City of Portsmouth (nearby reservoir) (Hall, 1976).

A major unresolved question is the location of the meltwater streams. Were they sub-, en- or supra-glacial? Published evidence is inconclusive (Moore, 1982; Birch, 1980).

EPPING, NEW HAMPSHIRE: STOP 6.

The "marine clays" of southeastern New Hampshire once formed the basis of an extensive till and brick industry (Chapman, 1950; Goldthwait, 1953). Despite the name, these deposits are primarily rock flour rather than clay minerals and contain large amounts of silt and sand as well as larger dropstones (Chapman, 1950; Bloom, 1960). They are interbedded with the ice-contact marine deltas (Bradley, 1964), evenly drape bedrock (Birch, in press) and correspond to the Presumpscot Formation of coastal Maine (Bloom, 1960). This formation has not been studied in any detail in terms of vertical or horizontal variability, age, fossils or paleomagnetism. A few foraminifera have been collected here (D.W. Collins, personal communication, 1984).

INNER CONTINENTAL SHELF, NEW HAMPSHIRE

Although not on the itinerary for this trip, the deposits offshore merit some description for comparison and contrast. Based on detailed geophysical surveys (Birch, in press) with modest sample control (Flight, 1972; Mills, 1977; Folger et al., 1975; Collins, in prep.; Brooks, in prep.) there are four major sedimentary units. The oldest is presumably till forming scattered patches, drumlins and a large flat-topped bank. This latter feature is unsampled and enigmatic. The next unit is a draped fine-

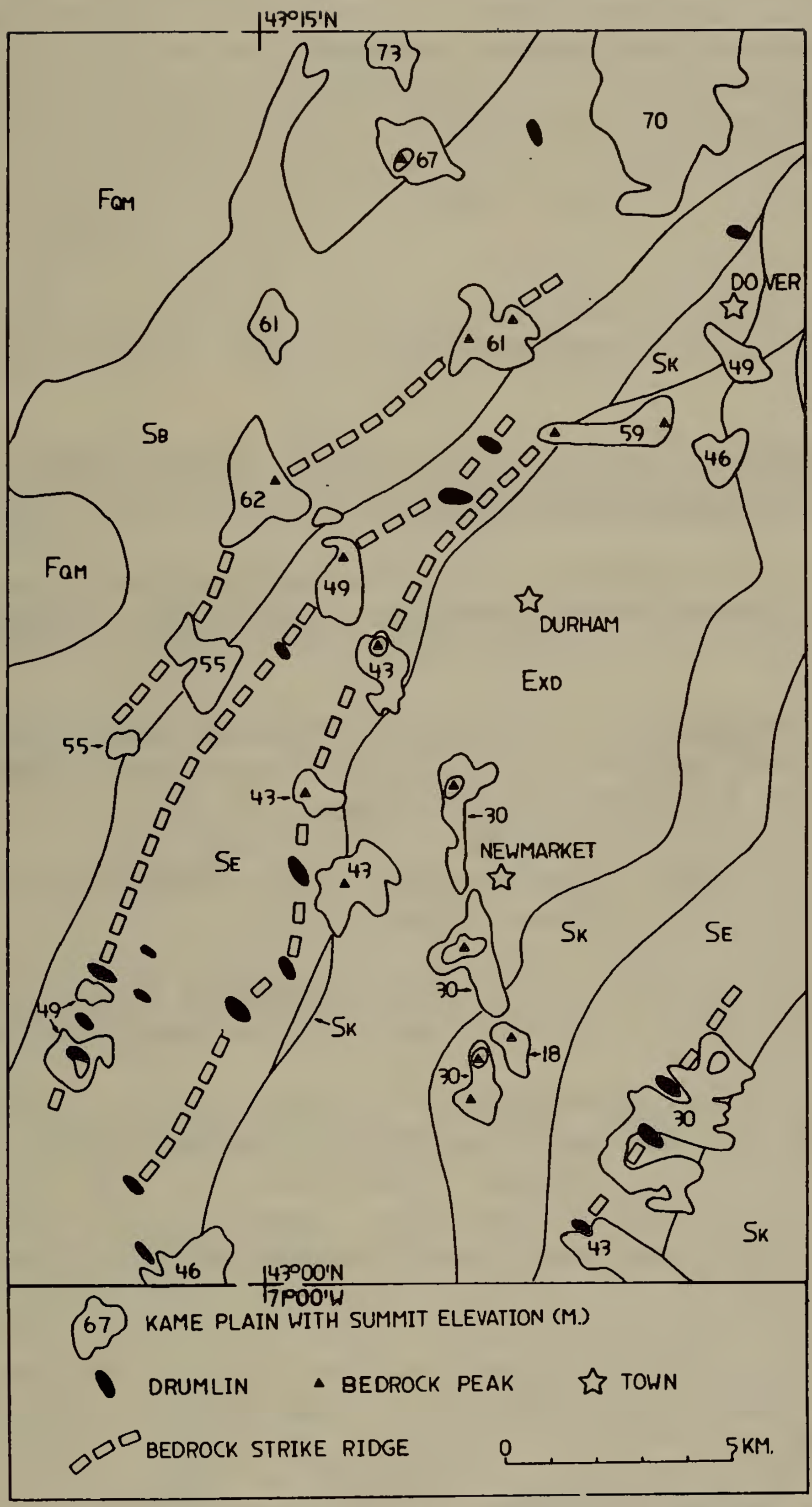

Figure 2. Relationship of kame plains (ice-contact marine deltas) and drumlins to bedrock. Bedrock units include: Fqm, Fitchburg quartz-monzonite; Se, Eliot Formation; Sb, Berwick Formation; Sk, Kittery Formation and Exd, Exeter diorite. Figure is from Birch (1980) courtesy of Northeastern Geology.

grained deposit correlative with the Presumpscot Formation. The central part of this unit contains slumps and debris flows possibly generated by an earthquake. Above the draped unit in deep water is a thin Holocene silt and clay and, at the mouth of the Merrimack River, a drowned sandy delta (Oldale et al., 1983). Finally, Holocene sands lie along the present beaches and also form mobile (?) sheets and mounds at depths of 20 to 30 m.

Conspicuously absent are clear signs of end moraines, ice-contact deposits or outwash.

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ROAD LOG

This road log includes only highway mileage, not any excursions onto side roads at the various stops. At some stops permission of owners may be required. Hard hats may be required also.

0 miles:	Start at parking lot for "Mt. Washington" cruises on Route 11 on the west side of the lake at Alton Bay. Proceed south on route 11 through Alton Bay towards Farmington.
14.4 miles:	Stop where railroad crosses Route 11. STOP 1. Turn around and proceed north on Route 11.
16.2 miles:	Stop at intersection of Routes 11 and 153. STOP 2. Turn around and proceed south on Route 11 into Rochester.
21.8 miles:	Bear left on Route 11 (Walnut Street) just after shopping mall. Continue into the center of Rochester: here Route 11 becomes Route 16. Continue on Route 16 to south.
23.1 miles:	Pass Frisbie Memorial Hospital.
25.3 miles:	Pass Skyhaven airport.
26.9 miles:	Turn left onto Route 16A. Continue into Somersworth.
29.0 miles:	Turn left onto High Street, Somersworth (Routes 9 and 16A south turn off to right here).
29.5 miles:	Cross Salmon Falls River, bear right and then left onto Routes 9 and 236. Continue east on Route 9 (School Street).
33.9 miles:	Turn right onto Wentworth Road.
34.8 miles:	Stop by white house (Mr. Wentworth) on left with barn across on right. STOP 3. Continue south on Wentworth Road.
35.4 miles:	Turn right on country road at intersection.
35.9 miles:	Cross railroad tracks and turn right onto Route 4. Proceed towards South Berwick.
38.2 miles:	In center of South Berwick turn left at intersection to continue on Route 4.
38.2 miles:	Turn left onto Route 236 towards Eliot and Kittery.
42.9 miles:	Turn left onto Route 101 and proceed south.
44.7 miles:	Stop with Great Hill on left. STOP 4 Turn around and proceed north on Route 101.

46.5 miles: Cross route 236. Continue on Route 101 into center of Dover.

50.1 miles: At intersection turn left into Dover.

50.4 miles: Bear right on South Portland Street.

50.6 miles: Turn right on Saint John's Street.

50.65 miles: Turn left onto Route 9 (Winter Street).

50.7 miles: Turn left on Route 9 (Central Avenue).

51.3 miles: Turn right on Route 9 (Silver Street).

52.1 miles: Bear left following Route 9. Crossover Spaulding Turnpike.

52.6 miles: Turn right following Route 9.

55.0 miles: Stop at Iafolla gravel pit. STOP 5. Continue west on Route 9.

55.8 miles: Cross Bellamy River reservoir.

58.6 miles: Turn left onto Route 125. Proceed south towards Epping.

63.1 miles: Go half-way around traffic circle and continue south on Route 125 towards Epping.

72.4 miles: Stop at abandoned Sunoco gas station in Epping. Clay pits are behind W.S. Goodrich store on east side of Route 125. STOP 6.