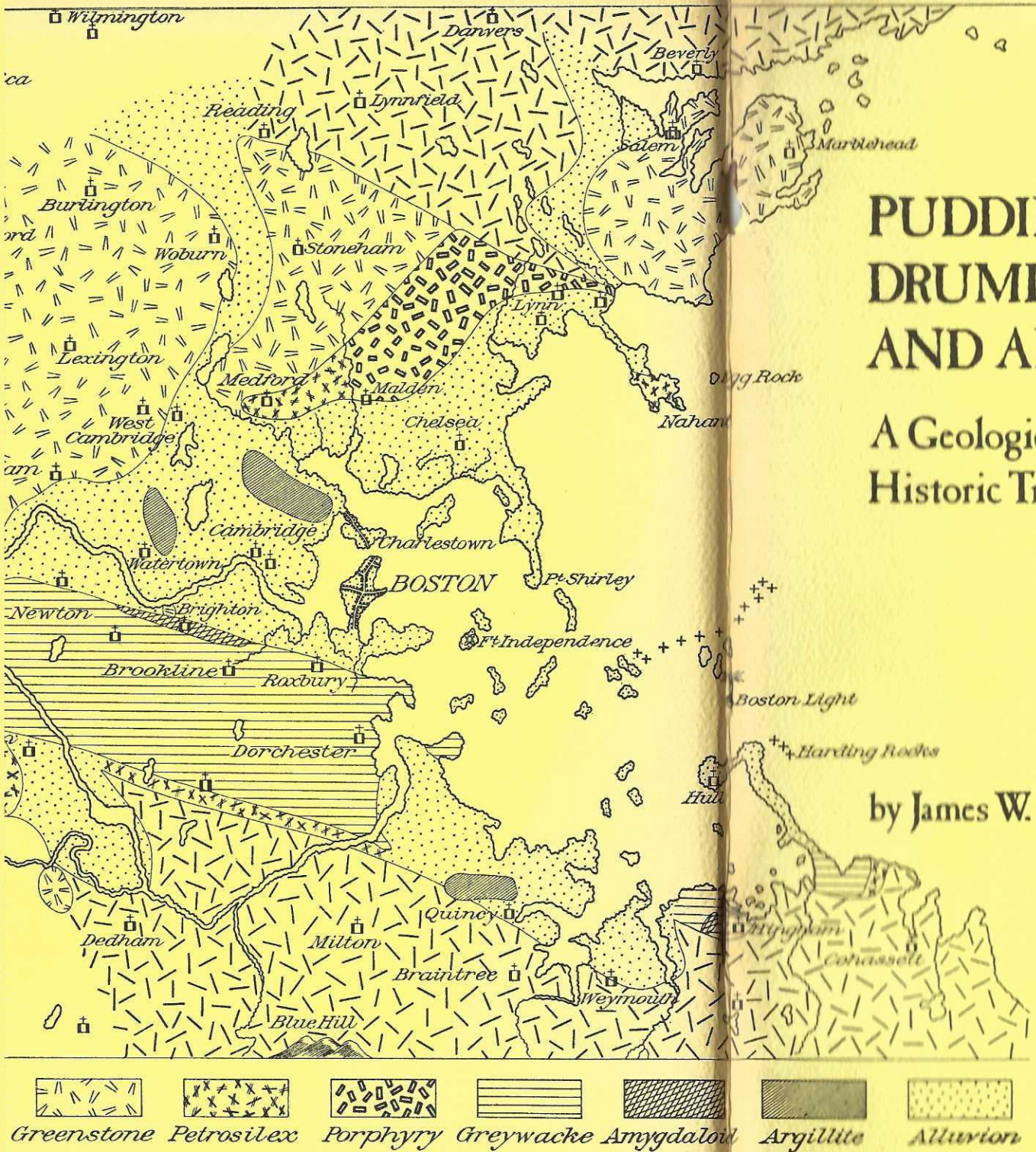

ARLIEST GEOLOGIC MAP OF THE BOSTON DISTRICT

J. F. and S. L. Outlines of the mineralogy and geology of Boston and its vicinity, with a geological map

PUDDINGSTONE, DRUMLINS, AND ANCIENT VOLCANOES

A Geologic Field Guide Along Historic Trails of Greater Boston

by James W. Skehan, S.J.

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by James W. Skehan, S.J.
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Second, revised edition — 1979.

Figure 39

ramp to the inner circular ramp. Follow this ramp counterclockwise along the roadcut to its southern end where the Pondville Conglomerate is well exposed.

Stop 19. Routes 128 and 28 Intersection: The Pondville Conglomerate and Blue Hills Granite Porphyry.

Giant Pondville conglomerate is made up of pebbles, cobbles, and large rounded boulders ranging in size from less than an inch to four feet across in some places (Fig. 39). The large boulders are chiefly pink to purple fine-grained riebeckite granite which are probably related to the Quincy Granite. The pebbles and cobbles are mostly quartzite, dark shale, and felsite porphyry, which is related to the Blue Hills Granite Porphyry. The matrix is sand- to clay-sized grains of quartz and feldspar. The Pondville Conglomerate is Pennsylvanian in age, based on structural relationships and the identification of the plant fossil *Calamites* found north of Canton Junction.

Retrace your steps along the outcrop to the "ghost" boulder zone or "spheroidal" zone which separates the Pondville Conglomerate and the Blue Hills Granite Porphyry. This zone is named for the spherical bodies of various sizes which superficially resemble the boulders in the Pondville Conglomerate. The contact between the conglomerate and this zone is abrupt and is defined as the place where the *aphanitic* matrix of the spheroidal zone gives way to the sand and the *lithic fragment* matrix of the Pondville (Sayer, 1974). Boulders in the Pondville protrude from the surface while the ghost boulders in the spheroidal zone exhibit continuity with the outcrop surface (Fig. 39).

Two theories are presently held as to the nature and origin of this zone. The first holds that the zone represents a *fossil soil* that formed from erosion of Blue Hills Granite Porphyry and was trapped by deposition of the Pondville (Chute, 1969). More recently, workers such as Sayer (1974) have theorized that this zone is the surface of a variably oxidized lava flow. The lack of sufficient conclusive evidence leaves the exact nature of this zone uncertain.

Finally, the Blue Hills Granite Porphyry grades from the "ghost" boulder zone. It is bluish-red to green fine-grained porphyritic granite. Typically it displays *euhedral* to *subhedral* crystals of perthite, quartz and riebeckite in a fine-grained matrix of similar composition. It is of questionable age and origin, but generally is considered to be related to the Quincy Granite.

South from here on Route 28, the Pondville Conglomerate *conformably* overlies and grades into the Pennsylvanian Wamsutta Formation. This gradational contact is well-displayed in alternating beds of the Pondville Conglomerate and the red Wamsutta Sandstone. The contact is placed by Chute (1964, p. 107) ". . . where the amount of red sandstone and the slate first exceeds the gray Pondville type coarse sandstone and conglomerate."

The two formations are generally thought to be of roughly the same age and correlative with basal coarse-grained conglomerates, sandstones (including arkose) and shale in the Narragansett Basin. The northern edge of the Norfolk Basin syncline is delineated in this area by the exposure of the Pondville Conglomerate and the Wamsutta Formation.

142.2 Continue north on Route 28.

144.7 Follow Route 28 left toward Mattapan Square.

145.5 Follow Route 28 left.

146.2 Follow signs for Mattapan Square (right) and get into the left lane, preparing for a left turn just beyond the bridge.

146.4 Turn left onto Cummins Highway.

147.6 Turn left into the parking lot at Bradlee's Department Store (Fig. 40).

147.9 Drive all the way to the far end of the parking lot and park.

Stop 20. Sally Rock Quarry: Mattapan Volcanics.

The floor of the former Sally Rock Quarry to the east (left) is now covered with brush, rubble and solid waste. You will proceed to some outcrops on the small hill to the south (Fig. 40), and then follow back north along the base of the large quarry itself, behind Bradlee's. The rocks throughout the quarry are Mattapan Volcanics of probable Precambrian age.

Walk along the abandoned dirt road south from the parking lot. Bear right on a road branching toward some oak trees standing out against the skyline, until you reach the crest of the hill overlooking some streets and houses (Fig. 40). Follow the crest to the left until you come to the first set of outcrops of gray- to pink-weathered red rhyolitic rock. There is quartz visible in the fine-grained groundmass, indicating rhyolitic composition. The rock has the appearance of welded tuff or a nuée ardente type deposit, since there are fragments of different composition incorporated into the flow. To the west is the cut-away bank of Monterey Hill, a drumlin which overlies the tunnel drilled beneath the George Wright Golf Course.

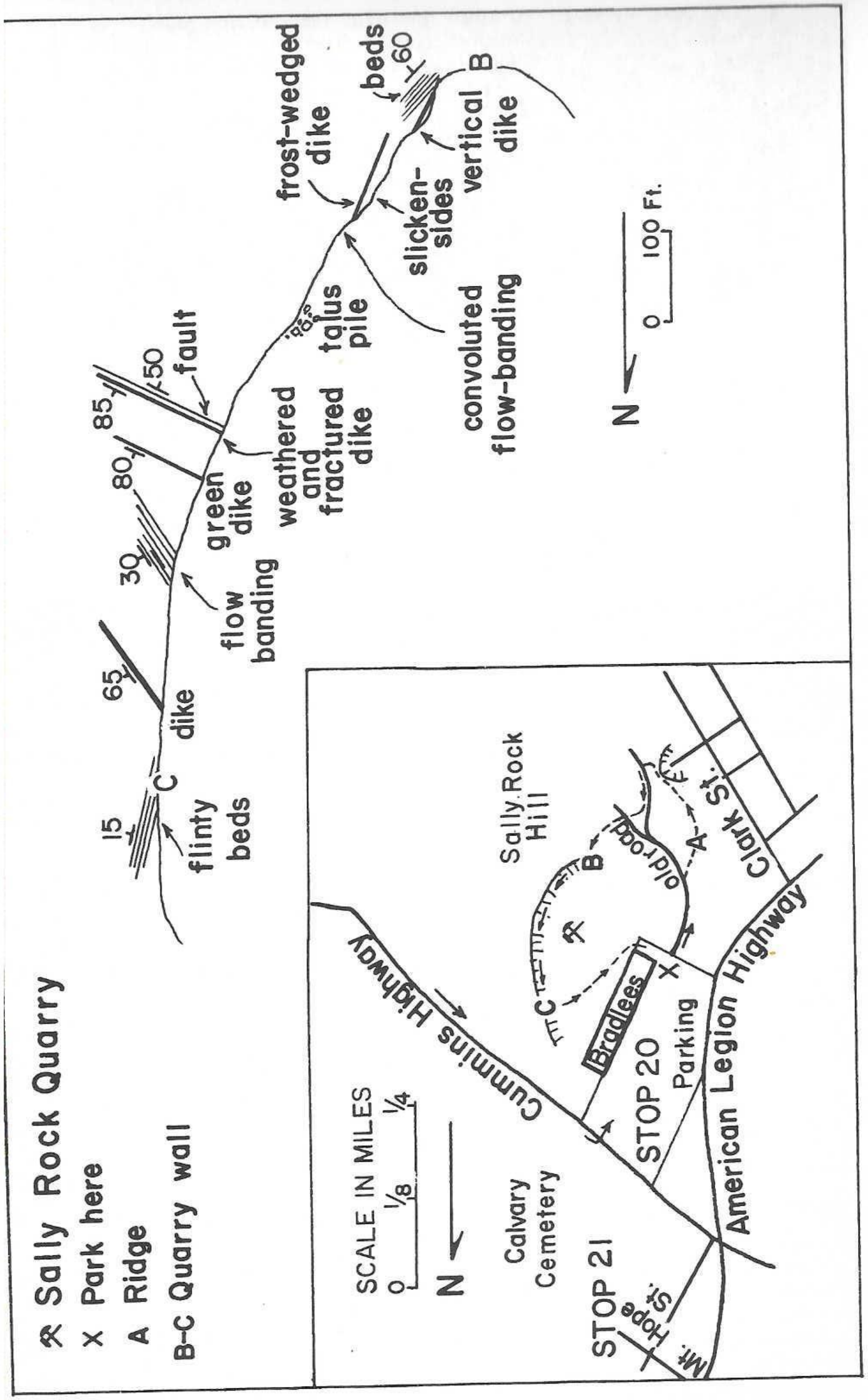
Proceed from this outcrop south-southeast about 200 ft to the higher part of the hill where you can see a large outcrop looming in the distance. Walking along the hillside, note several erratics of Roxbury Conglomerate. The rock at the crest of the hill is dominantly gray, fine-grained felsite and red rhyolite.

Please use caution, especially if there are children in the group! Proceed south about 150 ft to a cliff which overlooks houses built in a former quarry. Big Blue Hill, with the Harvard Meteorological Observatory on the top, can be seen in the distance to the left.

At the north end of this outcrop, note the distinct red and gray banding as well as angular to semi-rounded fragments of red lava incorporated in the gray rock.

Along the edge of the cliff are joint surfaces with several different orientations, showing the highly fractured nature of the volcanics. The highest pinnacle here has on its back slope, layers of rounded pellets, some of which have concentric structure which may indicate origin as *spherulites* in lava.

Approximately 75 ft to the east of the cliff, near the dirt road, there is a



large outcrop that shows brecciated fragments clearly consisting of gray and red volcanic rocks intermixed. Note that some blocks in the breccia have flow banding which indicates a derivation from layered rock of the same type. Blocks are 2 to 4 ft in length.

Follow the dirt road roughly due north, generally in the direction from which you came, through some small gravel pits. Leave the road and approach the southeastern end of the main face of Sally Rock Quarry ("B", Fig. 40). Note glacially scoured surfaces under the till at the top of the cliff. The flow-banded volcanics, gray to pale green in color, can be observed in this corner of the quarry. Follow north along the base of the cliff.

Throughout this traverse, one should be very careful, particularly after heavy rains when the blocks within the cliff tend to be unstable and there is a danger of falling rocks. Also watch out for boards with nails, etc. underfoot.

At the southeasternmost edge of the quarry face a dark, altered basalt dike can be seen in contact with country rock, striking approximately N.25°E. along the cliff face. This dike and others further along the cliff, probably served as feeders to volcanoes which poured out Brighton Volcanics of Dane Park (Stop 10) and, as such, give evidence of intrusive volcanism of basaltic type which is younger than the felsic volcanic rocks of the Sally Rock Quarry. However, the altered nature of the dikes here, suggests they are older than the basalt volcanism represented by the fresh basalt dikes at Beach Bluff (Stop 3).

About 100 ft from the southeast corner, the wall of rhyolite is marked by nearly horizontal *slickensides,* resulting from faulting (see Fig. 40). A second basalt dike, approximately 3 ft thick, can be observed from the side and in cross-section, striking N 25°E. It is nearly vertical. The dike has been pushed away from the wall rock about 1-1/2 ft, and there are blocks of rock wedged between the dike and country rock. This is an excellent example of the process of weathering by frost wedging. Water seeping into the crack freezes and pushes the dike outward from the face of the rock. Blocks of rhyolite have fallen into the crevice and are assisting in the process.

About 10 ft further north along the cliff, there is distinct, convoluted flow-banding in shades of purple and gray.

About 150 ft north of the basalt dike along the cliff base is a big pile of talus blocks of flow-banded rhyolite and pyroclastic material which have toppled from the overhanging cliff. This is a good place to collect easy-to-get specimens showing various features previously described. You may wish to retrace your steps to the road from here and return to your car.

Several other dikes, a fault, and good exposures of layered volcanics can be seen further along the quarry wall. Refer to Fig. 40 for approximate locations. At the north end of the quarry the strike of the beds is essentially parallel to the cliff face, and the dip is 15°SE. The strike and dip undulate in the section slightly, and the rocks are flinty as contrasted with those half-way along the cliff. These rocks appear to be silicified volcanics and probably should be called felsite since they are so flinty. Approximately 150 ft further north is the northernmost end of the quarry and a path which leads out to Bradlee's.

147.9 Return to your car.

148.2 Leave Bradlee's the way you drove in, turning left onto Cummins Highway.

148.4 Turn right onto American Legion Highway.

148.6 Turn right onto Mt. Hope Street, follow it to a dead end at the gate of Calvary Cemetery.

Stop 21. Cambridge Argillite, Calvary Cemetery.

Just inside the cemetery gate (pillars of Quincy Granite), there are some outcrops of Cambridge Argillite. It crops out on both the northern and southern limbs of the Central Anticline, a structure which probably formed

in Permian time (Table 1), approximately 290-225 m.y. ago. The *argillite* is a light to dark gray, slightly *calcareous*, fine-grained rock. Individual layers range in thickness from 1 mm to 8 cm. In many places, lighter rock composed of particles of silt or fine sand, alternates with darker rock containing clay or fine silt, to produce conspicuous banding. At Calvary Cemetery the beds strike N.60°W.

The fine particles which make up the argillite are believed to have been deposited during the Cambrian period, some 500-600 m.y. ago. Like other sedimentary rocks in the Boston Basin, the sands and clays accumulated in extensive lakes or marine embayments. The argillite underwent slight deformation during the Permian folding event. This resulted in the systematic joint pattern found within the argillite. The joints intersect the bedding at a high angle and, where fractures have developed along bedding planes, the rock breaks into parallelopiped-shaped fragments.

Notice the glacial striations and grooves which trend S.10°E., at an angle to the bedding. The outcrops are in the form of roches moutonnées, although not as nicely developed as those at Harris Park (Stop 12).

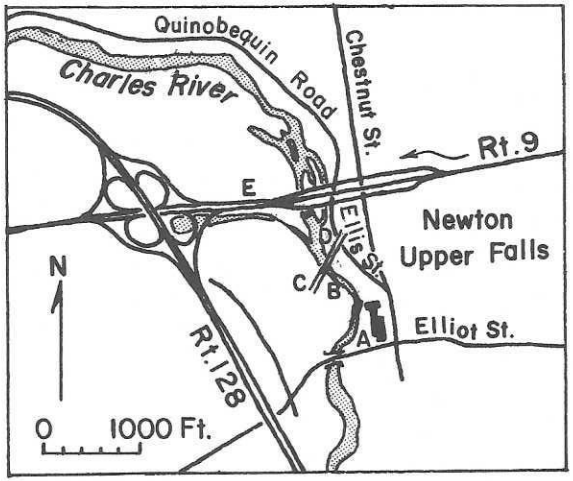


Figure 41

8.7 Return to Canterbury Street and proceed west.

8.9 Turn right onto Cummins Highway.

9.1 Turn right onto Hyde Park Avenue, which leads into Washington Street.

0.5 Traffic Circle under the bridge just past the end of the elevated MBTA: go three-quarters way around onto Rt. 203 (the Arborway) towards Boston.

1.3 Traffic Circle: go three-quarters way around, take Rt. 1, VFW Parkway west.

2.2 Keep right on Route 1.

2.8 Traffic Circle: turn right onto West Roxbury Parkway.

3.3 Go straight through the circle on West Roxbury Parkway.

3.7 Continue straight onto Newton Street.

4.1 Traffic Circle: turn right onto Hammond Street.

4.9 Turn left onto Route 9 west.

7.7 Exit toward Chestnut Street (Waban).

7.9 Turn left at Quinobequin Road intersection.

8.0 Park on the right of Ellis Street in a dirt driveway, below the Echo Bridge abutments of the Sudbury Aqueduct ("D" on Fig. 41). Approach the gorge under the bridge.

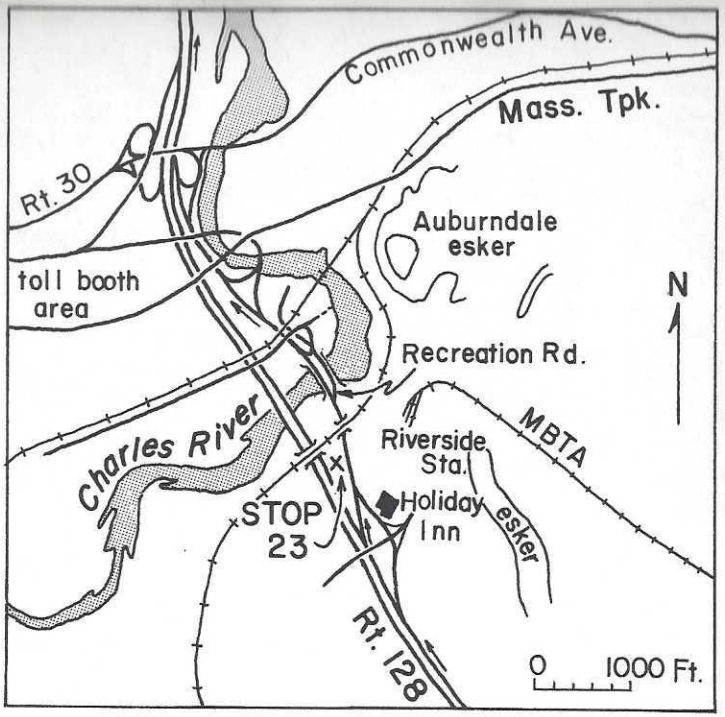


Figure 42

Stop 22. Hemlock Gorge MDC Reservation at Newton Upper Falls.

The Roxbury Conglomerate crops out in much of the reservation, including the familiar boulder conglomerate and some layers of volcanic rocks. It is suggested that some of these volcanics were intruded into the sedimentary rocks (Gielisse, 1959). The pebbles in the conglomerate are noticeably elongate, possibly stretched during metamorphism.

Hemlock Gorge was formed by the erosive action of the once more vigorous Charles River during melting of the Pleistocene ice sheet retreating from this region. Near the level of the river on the west side is a small cave.

The development of close-spaced mineralized fault fractures in pebbles and boulders of the conglomerate suggests that a fault zone is nearby. This is especially apparent on the Ellis Street side of the Charles River.

Follow the path downstream toward the ramp leading from Route 9. Cross a small dam, look for the circular dam just below the ramp. Beware of poison ivy! A basalt flow containing microscopic *vugs* can be seen on the water's edge, above the dam. This dike is also visible on the north side of Route 9.

Walk north along Ellis Street, under Route 9, and walk west (left) up the approach to Route 9 ("E" in Fig. 41). Further west the contact between the conglomerate and the volcanics is very well-exposed in the road cut. Inspect the contact closely for evidence that the volcanic rocks intruded the conglomerate. The contact is offset to the left by a fault above the roadcut, an area which can be approached through the woods around the right end of the roadcut.

158.0 Return to your car on Ellis Street, and turn around.

158.1 Turn left from Ellis Street onto Route 9 past the roadcut just described.

158.3 Turn right onto Route 128 north.

160.0 Take Exit 51-52 (Mass Pike, Route 30, Recreation Road), and turn onto Recreation Road.