Report on the Bedrock Geology of the Narragansett Basin, Massachusetts and Rhode Island

by

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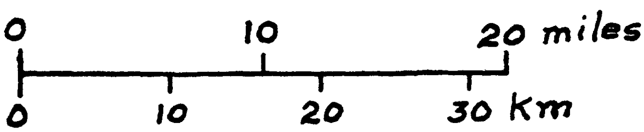

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Introduction

The writer did field work in the Massachusetts section of the Narragansett Basin between May 23, 1977, and September 21, 1977. Bedrock geologic maps were prepared for all the quadrangles in this section of the basin. They include compiled data as well as new data collected during this investigation. What follows is a report of the major findings of this investigation, and is not intended to be a report summarizing what was previously known about the bedrock geology of the Narragansett Basin.

Purpose of Investigation

The general purpose of this investigation was to do reconnaissance and compilation work on the bedrock geology of the Massachusetts section of the Narragansett Basin for the new state bedrock geologic map. Data were to be gathered on lithology, stratigraphy, structure (including strike and dips of beds), and placed on 1:24,000 topographic base maps. Interpretations of structure and stratigraphy were to be made on the basis of the known data. The following quadrangles were involved:

1) Assawompset Pond, Mass.
2) Assonet, Mass.
3) Attleboro, Mass.
4) Bridgewater, Mass.
5) Brockton, Mass.
6) Cohasset, Mass.
7) Duxbury, Mass.
8) E. Providence, Mass.-R.I.
9) Fall River, Mass.-R.I.
10) Fall River East, Mass.
11) Franklin, Mass.-R.I.
12) Hanover, Mass.
13) Mansfield, Mass.
14) Norton, Mass.
15) Plympton, Mass.
16) Scituate, Mass.
17) Snipatuit Pond, Mass.
18) Somerset, Mass.
19) Taunton, Mass.
20) Weymouth, Mass.
21) Whitman, Mass.
22) Wrentham, Mass.

Method of Study

Existing data were gathered from the geologic literature and from water resources publications. The latter were particularly valuable in locating the margins of the Narragansett Basin. Direct observations of bedrock were made in the field and detailed notes were taken at exposures and road cuts. Notes were taken on lithology, stratigraphy, attitude of bedding, folds, faults, joints, veins, cleavage, plant fossils, and glacial striae and grooves. Pace-and-compass methods were used to locate exposures far from road or reference points. In many places, because of the absence of bedrock exposures, boulders were studied and these gave helpful clues about the underlying bedrock. Critical data were placed on 1:24,000 topographic maps and geologic interpretations were made on the basis of known information.

Stratigraphy

The present investigation supports in general the stratigraphic interpretations of Shaler and others (1899). They recognized four formations from top to bottom: (See Table 1)

Dighton Conglomerate (youngest)

Rhode Island Formation

Wamsutta Formation

Pondville Conglomerate (oldest)

However, there are several new stratigraphic conclusions that are based on data collected or compiled during this investigation.

The Dighton Conglomerate is usually easily distinguished in the field by clasts that are commonly over six inches across and by the predominance of conglomerate over other lithologic types. Many exposures are over ninety percent conglomerate. Approaching contacts with the Rhode Island Formation, The amount of sandstone relative to conglomerate increases. The cobble conglomerates are imbricated. The contact with the underlying Rhode Island Formation is gradational.

In the Assonet and adjoining Somerset quadrangle, a new area of probable Dighton Conglomerate has been distinguished. It is not perfectly clear whether it exists in this place due to folding or faulting.

A boulder conglomerate member in the Dighton Conglomerate (Somerset quadrangle, Map B-19, localities 89-96) is characterized by the presence of boulders 30.5 cm to about 61 cm long. It is not clear how this conglomerate relates to the Purgatory Conglomerate but it is not unlikely they are time-equivalent rocks if both are the youngest units in their respective sequence.

TABLE 1 General Characteristics of Pennsylvanian Units

Stratigraphic Unit	Color	Lithologic Composition	Fossils
1. Dighton Conglomerate (youngest)	gray	Mainly cobble and pebble conglomerates with generally minor amount of coarse-very coarse pebbly sandstone; clasts commonly over 15 cm long; locally boulders up to 61 cm long; quartzite clasts commonly over 90%; imbricated cobble conglomerates	Stem axes
2. Rhode Island Formation	mainly gray; also green; locally red	Graywacke, pebbly; granule and pebble conglomerate; siltstone, mudstone, shale; coal; underclay; cobble conglomerate minor	Rich megafloral remains; stem axes common in finer conglomerates and coarser sandstones; insect remains rare
3. Wamsutta Formation	red; locally brown and green	Cobble and pebble conglomerates; sandstones, shales; volcanic rocks (porphyritic and banded felsite, amygdaloidal basalt, agglomerate) interbedded with clastic rocks	*Calamites*; megafloral remains locally
4. Pondville Conglomerate (oldest)	gray; also red, green	quartz-pebble conglomerates; pebbly sandstone; arkosic pebble conglomerate	Plant axes

An important finding of the present investigation is the discovery of the location of the uppermost coal bed in the Rhode Island Formation. This is shown near locality 120 in the Norton quadrangle, Map B-16, and is roughly in the general area mentioned by Shaler and others (1899, p. 198). This coal bed is probably a good horizon marker for the top of the Rhode Island Formation in this area.

Red beds at locality 5 in the Attleboro quadrangle are on strike with red beds at Thatcher Street, Attleboro (Lyons and Chase, 1976) and with red beds in the Pawtucket quadrangle (Quinn and others, 1949). An extension of these is shown near South Attleboro on Map B-3. Red beds in the northwestern part of the Norton quadrangle (Map B-16) may also be time-equivalent. All are believed to be part of the Rhode Island Formation and appear to mark the top of the Rhode Island Formation in this area.

A very important finding of this report is that volcanic rocks (porphyritic felsites, amygdaloidal and other basalts, and agglomerate) in the North Attleboro area are part of the Wamsutta Formation. This has been principally learned from the work of Coomeraswamy (1954) and the present field work. These volcanic rocks are definitely interstratified with red shales, sandstones, and conglomerates assigned to the Wamsutta Formation. The felsite at North Plympton is probably pre-Pennsylvanian and this will be discussed later in this report.

The Pondville Conglomerate is not recognized by the writer at most places near the margin of the Narragansett Basin. In many places near the margin of the Narragansett Basin,gray fine sandstone is distinguished. Some of it in the Wrentham and Mansfield quadrangles (Maps B-15, B-24) weathers red and may be assignable to the Wamsutta Formation.

However, Pondville Conglomerate has been distinguished in the Wrentham (Map B-24), Mansfield (Map B-15), Brockton (Map B-6), and Hanover (Map B-14) quadrangles as a discontinuous stratigraphic unit. Faulting or facies changes probably explain its absence in many places.

Pondville Conglomerate is believed to exist stratigraphically beneath the Wamsutta Formation in the North Attleboro Syncline (Map B-3). The contact between the Pondville Conglomerate and the Wamsutta Formation is gradational as indicated at locality 27 on Map B-3. In the Wrentham quadrangle, along Route 495, Pondville Conglomerate appears to grade into the Rhode Island Formation.

Flora

Floral remains of Pennsylvanian age were discovered at thirty-five localities in the Narragansett Basin. The number of new floral localities by quadrangle is given below:

Attleboro (6)

Brockton (1)

Cohasset (1)

E. Providence (5)

Hanover (3)

Mansfield (2)

Norton (3)

Somerset (3)

Taunton (5)

Whitman (1)

Wrentham (5)

The number of new floral localities by formation is: Pondville Conglomerate (1), Wamsutta Formation (2), Rhode Island Formation (30), Dighton Conglomerate (2).

Twenty-seven of these localities yielded only plant axes. Plant axes are characteristic of the coarser sandstones and granule and small pebble conglomerates. They vary from several centimeters in length to "logs" up to 4-1/2 meters in length. All are believed to have been transported by stream action. About seventy-four percent of the azimuths of the sixty-eight plant axes measured have a N00E-N90E trend. The mean azimuth of this set is N.52E. This is probably a good approximation of the paleocurrent source in the Narragansett Basin.

At the other eight localities, *Cordaites*(?), *Cordaites* cf *principalis*, *Calamites*(?), rachises, and fern and arthrophyte fossils were found. An unusual discovery of *Cordaites* was found in well boring fragments in the Cohasset quadrangle (Map B-7) at locality 272. At localities 291 and 292 in the East Providence quadrangle (Map B-10), a local resident (Kevin Rose, 34 Pemrose Drive, Seekonk, MA 02771) found fern and arthrophyte fossils in the overburden.

The last assemblage mentioned strongly indicates a Westphalian D age and correlates with material dredged out of the Barrington River in Barrington, R. I. (Lyons, Weston Observatory, unpublished), and with the Easton flora (Lyons and Darrah, in press). No other precise age determinations are warranted by the data collected, although the presence of *Cordaites* is most indicative of Westphalian C.

Reference to two floral localities not included on the unpublished list of Lyons and Jones were found in Doll (1931) and Warren and Powers (1914).

Major Folds

The five major synclines in the Massachusetts section of the Narragansett Basin with the strikes of their axial traces are given below from north to south:

1.	Mansfield Syncline	N82E	Maps B-15, B-24
2.	North Attleboro Syncline	N00E-N40E	Map B-3
3.	Attleboro Syncline	N75E	Map B-3
4.	Great Meadow Hill Syncline	N50E-N80E	Maps B-3, B-9, B-10, B-16, B-20
5.	Dighton Syncline	N45E-N90E	Maps B-2, B-11, B-19

With the exception of the North Attleboro Syncline, all the axial traces strike northeast to east-northeast. A discussion of the significance of this fact is given in the section of thrust faults.

The North Attleboro Syncline, in contrast to the other synclines, has only the two lower formations represented, the Pondville Conglomerate and the Wamsutta Formation. All the other synclines (except the Mansfield Syncline) have the Rhode Island Formation and Dighton Formations, the two highest formations in the northern section of the Narragansett Basin.

The Mansfield Syncline in the Wrentham and Mansfield quadrangles appears to be cut off to the west either by a cross fault or a thrust. To the east in the Brockton quadrangle it cannot be traced due to lack of exposures. It is significant that the Dighton Conglomerate is not known in the Mansfield Syncline and this may mean that it was eroded or, perhaps, is represented by a time-equivalent coal sequence.

The North Attleboro Syncline is well defined in its southern part but its northern part can not be traced due to lack of exposure. It is not clear whether a bedrock well near its northernmost end (Map B-3) is in Cambrian or Pennsylvanian red beds; the former appears to be most likely. On the north end, this syncline is cut off by the Plainville thrust and on the south end by the North Attleboro thrust. A Cambrian sequence and Precambrian granite (Goldsmith, pers. commun.) is exposed to the west of the North Attleboro Syncline.

The approximate maximum thickness of the Pondville Conglomerate and Wamsutta Formation in the North Attleboro Syncline is given below and compared with their maximum thickness in the Norfolk Basin (Chute, 1966):

	Narragansett Basin	Norfolk Basin
Wamsutta Formation	1525 m (5,000 ft.)	915 m (3,000 ft.)
Pondville Conglomerate	458 m (1,500 ft.)	976 m. (3,200 ft.)

The Attleboro Syncline is a well defined fold as shown on Map B-3. This fold is cut off to the west by the North Attleboro thrust and to the east by an inferred fault. The maximum thickness of the Dighton Conglomerate in this syncline is 427 m (1,400 ft).

The Great Meadow Hill Syncline (Map B-16) is also a well defined syncline. Its axis is more northeasterly in the East Providence quadrangle (Map B-9). It may also be cut off by a fault to the west, but this is not shown. The maximum thickness of the Dighton Conglomerate in this syncline is also 427 m (1,400 ft).

The Dighton Syncline is not well defined in the Somerset quadrangle. Attitude of beds is nonsystematic and it is possible that faulting has broken up the syncline. This syncline is probably cut off to the southwest by a NNW-striking fault along the Kickamuit River. On its east end it is probably cut off by a fault in the Assonet quadrangle (Map B-2). In the Fall River quadrangle (Map B-11) the maximum thickness of the Dighton Conglomerate is 915 m (3,000 ft). The thickness of the Rhode Island Formation in this quadrangle, assuming an average dip of 45 degrees, is 3,660 m (12,000 ft).

Minor Folds

Minor folds were found in both the Pennsylvanian and Pre-Pennsylvanian rocks. The axial traces strike N25E to N60E in conformity with the general NE-trending folds in the basin. In the Bridgewater quadrangle (Map B-5, locality 224), a minor fold plunges 35 degrees to the southwest. This is fairly consistent with the plunge of an anticline in the Wrentham quadrangle (Lyons and Chase, 1976). The Dighton Syncline in the Fall River quadrangle (Map B-11) plunges about 30 degrees to the northeast. The North Attleboro Syncline plunges about 40 degrees to the north.

Major Faults

Border Faults

Evidence is poor for a series of border faults around the Narragansett Basin, but these are assumed to exist when the Basin is viewed in light of a tectonic model. Doll (1931) previously distinguished a border fault in the Franklin quadrangle, Map B-13.

Near the border of the Narragansett Basin in the Mansfield and Hanover quadrangles bedding in places dips away from the Basin probably indicating a border fault. In the Assonet quadrangle, the Assonet River Fault, proposed in this report, is indicated by a strong topographic lineament, the Assonet River and the highlands to the southeast. A magnificent view of the Basin can be seen from Profile Rock in the highlands. The border of the Basin the Fall River quadrangle may also be a fault but the evidence is less compelling. However, probable faults to the north in the Assonet quadrangle are roughly on line with this border and this might indicate faulting to the south as well. In the Weymouth quadrangle (Map B-22), there is also a probable border fault indicated by a nearby observed vertical fault.

It is not clear whether there are border faults extending into the Atlantic Ocean in the Duxbury and Scituate quadrangles, Maps B-8 and B-18. There are probably a mixture of boulders from the Narragansett and Boston basins in this area. If these faults do exist, they are assumed to vertical or subvertical like the other faults associated with downfaulting of the Narragansett Basin.

N-S Cross Faults

A series of roughly north-striking cross faults along the northern margin of the Narragansett Basin were originally recognized by Shaler and others (1899). More recently they have been recognized by Weston Observatory (Interim Report, 1976). They are probably best displayed in the Wrentham and Mansfield quadrangles where the horizontal offsets are generally of the order of 610 to 915 m. However, the Red Brush Hill Fault (Doll, 1931) extends from the Wrentham quadrangle into the Franklin quadrangle and shows almost 2,440 m of offset. The Beaver Brook Fault (name proposed in this report) in the Hanover quadrangle shows about 1,983 m of offset. The most spectacular cross faults occur in the Assawompset Pond quadrangle and have been distinguished by Koteff (1964). Here the offsets are of the order of 7,625 m.

A few new cross faults have been distinguished during the course of the present investigation. Two of these are in the Wrentham quadrangle and another, named the Old Pond Fault, is in the Mansfield quadrangle, Map B-15.

The cross faults are principally indicated by offsets in the pre-Pennsylvanian border rocks, mainly the Dedham Quartz Monzonite and related granitic rocks. To a lesser extent, they are indicated by brooks and streams which appear to follow the trace of the faults. Thus, many of the faults are named after brooks and streams. It is not clear in some places because of the lack of structural data whether the cross faults along the northern margin of the Basin offset the Mansfield Syncline.

The Mansfield Syncline is shown to be offset in the Mansfield quadrangle, Map B-15. However, in the Wrentham quadrangle, there is no compelling evidence to indicate offset of this syncline. However, it seems reasonable to assume that the cross faults extend for over 1,660 m into the Narragansett Basin. The northern extension of a few of the cross faults in the Wrentham quadrangle probably continues into the Norfolk Basin as indicated by offsets in the granitic rocks along the southern margin of the Norfolk Basin as shown on Map B-24.

Other evidence indicating the presence of cross faults is shown by minor structures observed during this investigation. Joints, fault breccia, and quartz veins near the margin of the Basin tend to strike north-south. This is best shown in the Wrentham quadrangle, Map B-24. Here, west of the Mirimichi Fault, a cross fault is indicated by vein breccia dipping $40\text{-}47^{\circ}$ east. Joints and quartz veins indicate steeper dips. In the Mansfield quadrangle, the Belcher Road cross fault (name proposed here) probably is a subvertical fault as indicated by a fault discovered on Belcher Road. In the Assawompset Pond quadrangle (Map B -1), minor faulting near the northeastern corner of the quadrangle is nearly vertical and with left-lateral sense.

The best clue to the type of faulting represented by the north-south cross faults is found in the Assawompset Pond quadrangle. Here the offsets of the margin of the basin are of the order of several kilometers as previously indicated by Koteff (1964). Here the Pennsylvanian rocks have apparently been downfaulted in a large graben now occupied by large bodies of water (Koteff, 1964). Therefore, it is assumed that all the N-S cross faults are associated with high-angle faulting associated with the formation of horsts and grabens.

E-W Cross Faults

East-west cross faults have not been previously reported in the Northern part of the Narragansett Basin. However, they are assumed to exist in the Plympton and Bridgewater quadrangles (Maps B-17, B-5) as indicated by offsets in the pre-Pennsylvanian crystalline rocks. They are believed to be due to vertical faulting associated with horst formation that has brought up the basement rocks.

These faults are best observed in the Assawompset Pond quadrangle, Map B-1. Here east-west-striking faults occur in a fault zone over 200 m wide along Route 140. The E-W faults dip between 80° to vertical. Slickenside lineations generally indicate a plunge of 23-30 degrees to the west. The faults are apparently subvertical normal or vertical faults. Reconnaissance work by Goldsmith, (pers. commun., 1977) indicates a dominant east-west joint set to the south of this area.

E-W faults pose some problems in explaining the distribution of the Pennsylvanian rocks in Southeastern part of the Bridgewater quadrangle. However, N-S-striking faults cannot explain the existing data shown on Map B-5. An outlier of Pennsylvanian rocks is assumed to exist in this area and was probably caused by erosion. However, other interpretations of the margin of the basin in this area are possible, but are less probable according to my interpretation of the structure.

It is not improbable that a series of such E-W faults, analagous to the N-S faults occurring along the northern border of the Narragansett Basin, exist along its eastern margin. They, like the north-south cross faults, are indicated by drainage as shown in Figure 1 (Weston Observatory, Interim Report, 1976).

Minor Faults

About ninety minor faults were noted in the field. These were mainly indicated by slickensides and to a lesser extent by vein breccia, fault gouge, offset veins or clasts, mylonite, cleavage or heavily oxidized zones. A summary is given in Table 2.

According to fault type, the N00E-N45E set tends to be reverse or strike-slip faults, the N46E-N90E and N00W-N45W sets tend to be normal faults, and the N46W-N90W set tends to be normal, vertical, or strike-slip faults. About eighty percent of the faults indicated by evidence other than slickensides strike N00-N90E.

Little evidence was gathered on the relative age of the minor faults. In the Assawompset Pond quadrangle (Map B-1), a N20E fault cuts off a probable W-E fault and in the Weymouth quadrangle (Map B-22) a mylonite zone striking N45E cuts off a N45W-striking fault. Thus, in these two places the NE-striking faults are the youngest. A Late Pennsylvanian (Conemaughian) or younger age of these faults is indicated by the flora of the Basin.

TABLE 2 Summary of Minor Structures in or near the Narragansett Basin

Type of Structure	No. Measurements	STRIKE SETS							
		Mean N00-N45E	%	Mean N45-N90E	%	Mean N00-N45W	%	Mean N45W-N90W	%
1. Joint	157	N19E	33	N70E	22	N20W	28	N70W	17
2. Quartz Vein	173	N21E	24	N69E	39	N23W	14	N72E	23
3. Slickensides	69	N28E	26	N64E	32	N23W	24	N77W	18
4. Vein breccia, gouge, mylonite	21	N13E	33	N62E	43	N21W	10	N67W	14
5. Axes of minor folds	06	N32E	67	N55E	33	----	--	----	--
6. Trap dike in Rhode Island Formation	01	N15E	100	----	--	----	--	----	--
7. Trap dike cutting Dedham Quartz Monzonite	01	----	---	----	--	----	--	N75W	100
8. Granite aplite and pegmatite dikes in surrounding rocks	07	N33E	43	N80E	14	N10W	28	N75W	14

Other Minor Structures

A summary of minor structures recorded during my field investigations is given in Table 2. In general, N00E-N90E features are more frequent that N00W-N90W features. This is a general reflection of NE-striking structures in the Narragansett Basin.

About thirty-nine percent of the joints in or near the Narragansett Basin fall into a N19E-N20W set. This is probably an indication of the tendence of the joints to parallel or subparallel the cross faults in the northern part of the basin. This is clearly shown on the geologic map of the Wrentham quadrangle, Map B-24.

Quartz veins are commonly associated with minor faults observed in the field. They also tend to be parallel or subparallel to cross faults.

Much of the so-called cleavage observed in the Pennsylvanian rocks is probably bedding fissility. It is difficult in the absence of bedding data to determine if the splitting behavior of the rocks is cleavage or bedding fissility so a statistical analysis was not attempted. However, in the Attleboro quadrangle, the cleavage is subparallel to the axis of the North Attleboro Syncline and has a mean strike of N35E and a mean dip of 58° NW. Cleavage in the felsite at North Plympton has a similar strike but a dip of only 15° NW. A second cleavage strikes roughly east-west and has a mean dip of 42° north. This cleavage is parallel to east-west fold axes in the Narragansett Basin and is a pervasive cleavage in the Bristol, R.I. quadrangle (Lyons, unpub. data, Weston Observatory).

This NE-striking cleavage is also parallel to the axes of minor folds as shown in Table 2.

The orientation of the trap dike cutting the Rhode Island Formation and indicated in Table 2 hints at a genetic relationship with the N-S cross faults and related features.

Foliation in the phyllite shown on the map of the Plympton quadrangle (Map B-17) is conformable with that in the Metacom Granite Gneiss. This indicates a pre-Pennsylvanian age for the phyllite which may be correlative with the Plympton felsite. Both are metafelsites according to R. Goldsmith (pers. commun., 1977). Foliation in the Barefoot Hill Quartz Monzonite and Dedham Quartz Monzonite in the Assawompset Pond quadrangle strikes N80E-N90E and dips at steep angles.

The orientation of another trap dike and the orientation of aplite and pegmatite dikes are also shown in Table 2.

Glacial Striae and Grooves

Thirty-two measurements of glacial striae and grooves were made at thirty-one localities in or near the Narragansett Basin. These are indicated on the geologic maps indicated in Appendix I. All except one trend S.05E. to S.35E. The mean trend is S.17E.

CRYSTALLINE ROCKS

Introduction

No attempt was made to carefully study the crystalline rocks bordering the Narragansett BAsin. However, some observations and conclusions are given below. Table 3 gives information in rock samples collected.

Plympton felsite

The Plympton felsite of Shaler and others (1899) is interpreted to be a pre-Pennsylvanian metavolcanic rock. Two exposures of this rock are indicated on Map B-17, one is referred to as a phyllite because it is outside of the area of Plympton felsite given in Shaler and others (1899). The latter has a foliation consistent with that of the Metacom Granite Gneiss (Lyons, Weston Observatory, unpub. data). The rock is characterized by a fine-grained matrix and megacrysts of feldspar, quartz, biotite, and hornblende, all rarely over 2 mm long. In thin section the rock contains clinozoisite, chlorite, actinolite, sphene, sericite, and quartz(?); it is a greenstone with a metamorphic fabric overprinted on a felty texture (R. Goldsmith, pers. commun., 1977).

TABLE 3 Rock Samples Collected

Sample No.	Rock Type	Quadrangle
29	trap	Attleboro
81	DQM	Assonet
131	sandstone	Taunton
149	sandstone	Brockton
177	plant fossil	Wrentham
185	DQM	Whitman
197A	congl.	Hanover
197B	congl.	Hanover
198A	sandstone	Hanover
198B	plant axis	Hanover
201	quartz diorite(?)	Hanover
204	DQM	Hanover
208*	? Plympton felsite	Plympton
209	Plympton felsite	Plympton
223	trap dike rock	Bridgewater
224A	laminated siltstone	Bridgewater
224B	cross-laminated sandstone	Bridgewater
228	DQM	Assawompset Pond
242*	porphyritic felsite	Attleboro
248**	red pebble congl.	Attleboro
270	Westwood Granite	Weymouth
272A	plant fossil	Cohasset
272B	trap rock in well fragments	Cohasset

* sample collected and sent to R. Goldsmith for radiometric dating

** collected by E-an Zen

DQM Dedham Quartz Monzonite

Westwood Granite

A small body of Westwood Granite (Chute, 1966) has been distinguished in the Weymouth and Whitman quadrangles, Maps B-22 and B-23. The rock is a fine-grained porphyritic granitic rock with phenocrysts of feldspar, quartz, and chlorite. The minerals in the groundmass have an approximate size of 0.5 mm; feldspar and quartz phenocrysts are as long as 12-14 mm.

Dedham Quartz Monzonite

This is the most common rock bordering the Narragansett Basin in Massachusetts. This granite is well described in Lyons (1969) and no further comment will be made here except to note that to the south (e.g., in the Assawompset Pond quadrangle) it is foliated in places.

Barefoot Hill Quartz Monzonite

This rock is named after Barefoot Hill in the Mansfield quadrangle (Lyons, 1969). It is the porphyritic variety of the Dedham Granodiorite of Emerson (1917). It is characterized by megacrysts of feldspar usually 1 to 2.5 cm long, but up to 7.5 cm long in places; less quartz and more dark minerals (including hornblende) than the Dedham Quartz Monzonite, and more Or-rich alkali feldspars (Lyons, 1969). It is the second most common rock bordering the Basin in Massachusetts. It also is foliated to the south in the Assawompset Pond quadrangle. The feldspar megacrysts are aligned as well as the dark minerals, chloritized biotite and hornblende.

Quartz Diorite

This rock has been distinguished in the Hanover quadrangle (Map B-14) and in the Duxbury quadrangle (Map B-8). It is usually a leucocratic light gray fine-medium grained (2-3 mm) granitic rock with about twenty percent quartz, notable less than generally found in the Dedham Quartz Monzonite. It is also known from boulders bordering the basin.

Schist

Schist has been mapped by Koteff (1964) in the Assawompset Pond quadrangle at locality 230. It is gray very-fine grained quartzite interlayered with very-fine grained mica-quartz schist. It is folded and plunges 10 degrees to the northeast. Foliation strikes in the same direction and dips to the southwest. Quartz veins parallel and cut across the foliation.

Other Crystalline Rocks

Diorite and monzonite(?) have been distinguished in the Weymouth quadrangle, Map B-22. Boulders of different granitic types have been distinguished in the Mansfield quadrangle. Quincy Granite is commonly observed as boulders in the Cohasset, Duxbury, Whitman and Weymouth quadrangles. Several other crystalline rock types have been distinguished in these same quadrangles. In northwestern part of the Attleboro quadrangle (Map B-3), boulders of gneiss, diorite, and Quincy Granite from Rhode Island have been distinguished.

SUMMARY AND MAJOR CONCLUSIONS

The total stratigraphic thickness of beds in the Massachusetts section of the Narragansett Basin is about 6,070 m (19,900 ft.) According to formation, the thicknesses are as follows:

Dighton Conglomerate	427 m (1,400 ft)
Rhode Island Formation	3,660 m (12,000 ft)
Wamsutta Formation	1,525 m (5,000 ft)
Pondville Conglomerate	458 m (1,500 ft)
Total	6,070 m (19,900 ft)

A boulder conglomerate member is recognized in the Dighton Conglomerate. It may be the time-equivalent of the Purgatory Conglomerate. A new area of probable Dighton Conglomerate is recognized in the Assonet and Somerset quadrangles. It is not completely clear if it is a small syncline or a faulted part of the Great Meadow Hill Syncline. The location of the uppermost coal in the Rhode Island Formation was discovered.

Red beds south of the North Attleboro Syncline in the Attleboro quadrangle appear to be a distinct stratigraphic unit in the Rhode Island Formation that can be traced into the Pawtucket quadrangle. They are considered to be in the uppermost part of the Rhode Island Formation.

The volcanic rocks in the North Attleboro area are definitely interstratified with sedimentary rocks in the North Attleboro Syncline which has been clearly distinguished by Coomeraswamy (1954) as a major syncline plunging to the north. This syncline is part of what is believed by him to be a thrust sheet that has thrusted Pondville Conglomerate and Wamsutta Formation southward from the Norfolk Basin.

The felsite at North Plympton is considered to be pre-Pennsylvanian and is not a part of the Narragansett Basin sequence.

Thirty-five new floral localities have been discovered in a total of eleven quadrangles. All but five were in the Rhode Island Formation; one in Pondville Conglomerate, two in Wamsutta Formation, and two in Pondville Conglomerate.

The major faults bordering the Basin are considered to be horsts and grabens bounded by vertical faults or subvertical normal faults. East-west faults are newly recognized along the eastern border of the Narragansett Basin.

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APPENDIX A

A-1 Field notebook I, localities 1 - 60.

A-2 Field notebook II, localities 61 - 177.

A-3 Field notebook III, localities 178 - 236.

A-4 Field notebook IV, localities 237 - 308.

APPENDIX B

APPENDIX B (cont'd.)

B-21 Bedrock Geologic Map of the Snipatuit Pond quadrangle

B-22 Bedrock Geologic Map of the Weymouth quadrangle

B-23 Bedrock Geologic Map of the Whitman quadrangle

B-24 Bedrock Geologic Map of the Wrentham quadrangle