

Open File 78-370

Selected Bibliography, Index to Geologic Mapping, and preliminary
Compilation of Bedrock Geology: Boston Two-Degree Sheet

John D. Peper, Compiler

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PRELIMINARY LIST OF REFERENCES

BOSTON 2⁰ SHEET

Abu-moustafa, A.A., and Skehan, J.W., S.J., 1976, Petrology and geochemistry of the Nashoba Formation, east-central Massachusetts, in Lyons, P.C., and Brownlow, Arthur, Editors, Contributions to the geology of New England: Geol. Soc. Am. Memoir 146, p. 31-70.

Source of modes and chemistry of rocks of the Nashoba formation, - samples from the Wachusett-Marlborough Tunnel. Also includes detailed geologic cross-section.

Alvord, D.C., Bell, K.G., Pease, M.H., Jr., and Barosh, P.J., 1976, The aeromagnetic expression of bedrock geology between the Clinton-Newbury and Bloody Bluff fault zones, northeastern Massachusetts: U.S. Geol. Survey Jour. of Research, v. 4, no. 5, p. 601-604, 1:125,000.

Paper shows the close correspondence between aeromagnetic anomalies, on 1/2-mile spacing flight lines, with recently mapped metamorphic rock units in northeastern Massachusetts.

Barosh, P.J., Fahey, R.J., Pease, M.H., Jr., 1977, Preliminary compilation of the bedrock geology of the land area of the Boston 2⁰ sheet, Mass., Conn., R.I., and New Hampshire, U.S. Geol. Survey open-file report 77-285, 1:125,000.

Compilation of mapping to about 1975, no topographic base

Barosh, P.J., Pease, M.H., Jr., Schnabel, R.W., Bell, K.G. and Peper, J.D., 1974, Geologic interpretation of the lineaments on the aeromagnetic map of southern New England: U.S. Geol. Survey, 6p. map scale 1:250,000. Misc. Field Studies Map MF 985

Compiled about 1972, shows mapped and inferred faults and their extensions, major areas of igneous rock, and linaments associated with an aeromagnetic map of southern New England.

Bell, K.G., and Alvord, D.C., 1976, Pre-silurian Stratigraphy of northeastern Massachusetts: Geol. Soc. America Mem. 148, pp. 179-216.

A detailed description of the composition, stratigraphy, probable correlation and origin of metamorphosed stratified rock sequence north and west of the Boston Basin.

Billings, M.P., 1976, Bedrock geology of the Boston Basin, in Cameron, Barry, editor, Geology of southeastern New England: New Eng. Intercollegiate Geol. Conf., 68th Ann. Meeting: Sci. Press, Princeton, New Jersey

Summary of geology of the Boston Basin, Discusses probable Age and stratigraphic relationships of the volcanic and sedimentary rocks and revision of earlier interpretation of geologic structure.

Billings, M.P., and Wolfe, C.W., 1945, Spodumene deposits in the Leominster-Sterling area, Massachusetts: USGS open-file rept., 10 p., 3 maps. (=MDPW-USGS Coop. Proj. Inf. Circ.3)

Detailed maps of granodiorite sills and pegmatite bodies in the area extending southward from Long Hill in Leominster. Description of granodiorite and metasediments.

Billings, M.P., 1956, The geology of New Hampshire; Pt. 2, Bedrock geology: N.H. State Plan. and Devel. Comm., Concord, N.H., 203p.

General summary work on the geology of New Hampshire - description of the stratigraphy, of the metamorphosed sedimentary rock sequence, location of relevant fossil localities. Includes summary discussion of igneous rocks and series. Includes 1:250,000 geologic map on topographic base.

Callaghan, Eugene, 1931, A contribution to the structural geology of central Massachusetts: New York Acad. Sci. Annals, v. 33, p. 27-75.

Detailed description and generalized interpretation of rock units in the Quabbin Tunnel. Includes a section through the Fitchburg Granite.

Castle, R.O., 1964, Geology of the Andover Granite and surrounding rocks, Massachusetts: USGS open-file rept., 550p., 50 pls., 30 figs., 28 tables.

Chemistry, modes, petrographic features of the Andover granite; discussion of origin.

Castle, R.O., Dixon, H.R., Grew, E.S., Griscom, Andrew, and Zietz, Isidore, 1975, Structural dislocations in eastern Massachusetts: U.S. Geological Survey Bull. 1414.

Discussions and synthesis of faulting and fault system on southeast side of Worcester Basin in eastern Massachusetts.

Chute, N.E., 1964, Trip G -Geology of the Norfolk basin Carboniferous sedimentary rocks, and the various igneous rocks of the Norwood and Blue Hills quadrangles: New England Intercollegiate Geol. Conf., 56th Ann. Mtg., Chestnut Hill, Mass., Oct. 2-4, 1964, Guidebook, p. 91-114.

Summary of Chutes mapping and geologic work along and south of the south edge of the Boston Basin.

Clapp, C.H., 1921, Geology of the igneous rocks of Essex County, Massachusetts: U.S. Geol. Survey Bull. 704, 132 p.

Early reference work on igneous rock in the northeastern part of Massachusetts; source of petrochemistry and petrologic description.

Gore, R.Z., 1976, Ayer crystalline complex of Ayer, Harvard, and Clinton, Mass., in Lyons, P.C., and Brownlow, A.H., eds., Studies in New England Geology: Geol. Soc. of America Mem. 146, pp. 103-124.

Detailed petrographic description of the Ayer granite, its contacts, and internal phases, in the eastern part of the Worcester basin in central Massachusetts.

Dennen, W.H., 1976, Plutonic series in the Cape Ann area, in Cameron, Barry, Editor, Geology of southeastern New England: New Eng. Intercollegiate Geol. Conf. 68th Ann. Meeting: Sci. Press, Princeton, New Jersey

Describes distribution, petrochemistry, contacts, relative ages, origin, and emplacement of the igneous rocks of Cape Ann,

Dowse, A.M., 1949, Geology of the Medfield-Holliston area, Massachusetts, Radcliffe College, unpub. Ph.D. thesis. 125 p.

Describes igneous rocks and metasediments; petrography. Separates granitic gneisses.

Emerson, 1917, Geology of Massachusetts and Rhode Island: U.S. Geol. Survey Bull. 597, 289 p.

Basic summary reference on the geology of the map area as known about the turn of the last century. Includes description of fossil localities, occurrences of geologic features, many of which have been lost by later urbanization.

Greene, R.C., 1970, The geology of the Peterborough quadrangle, New Hampshire: New Hampshire Dept. Resources and Econ. Devel., Bull. no. 4, 88 p.

Describes subdivision of the Littleton Formation, problems of stratigraphic synthesis and age. Describes granitic rocks of the Massabesic gneiss, includes modes of metasediments and igneous rocks; discusses metamorphism, includes map 1:62,500

Grew, E.S., 1970, Geology of the Pennsylvanian and pre-Pennsylvanian rocks of the Worcester area, Massachusetts: Unpub. Ph.D. Thesis, Harvard Univ., 263 p.

Describes fossiliferous rocks at Worcester, maps these separately from surrounding older rocks. Describes, probable correlation and stratigraphy and structure of Worcester area. Includes 1:24,000 geologic maps of Worcester region.

Grew, E.S., 1973, Stratigraphy of the Pennsylvanian and pre-Pennsylvanian rocks of the Worcester area, Massachusetts: Am. Jour. Sci., v. 273, no. 2, p. 113-129, illus. (inclu. geol. sketch maps).

More formal presentation of fossil stratigraphy and stratigraphic arguments with regard to the fossiliferous rocks at Worcester, Mass.

Hanson, W.R., 1956, Geology and mineral resources of the Hudson and Maynard quadrangles, Massachusetts: U.S. Geol. Survey Bull. 1038, 104 p.

Detailed geologic map 1:31,680 - description of Nashoba rocks, structure.

Hussey, A.M., II, 1968, Stratigraphy and structure of southwestern Maine, in Zen, E-an, White, H.S., Hadley, J.B., and Thompson, J.B., Jr., Editors, Studies of Appalachian geology, northern and maritime: New York, Interscience Publishers, P. 291-301.

Recent summary of the stratigraphy age correlation of the Kithery, Eliot, and Berwick Formations in southeastern Maine adjoining the Boston two-degree sheet area. Interpretation of structure and structural synthesis.

Kaktins, U. (1976) Stratigraphy and petrography of the volcanic flows of the Blue Hills area, Mass.: In P. Lyons and A. Brownlow, eds. Contributions to the Geology of New England, Geol. Soc. Amer. Mem. 146

Detailed petrography and chemical analyses of rhyolitic flows, stratigraphy of the flows.

LaForge, Laurence, 1932, Geology of the Boston area, Massachusetts: U.S. Geol. Survey Bull. 839, 105 p.

Early summary of the geology of the Boston area.

Lyons, P.C., 1977, Report on the bedrock of the Narragansett basin, Massachusetts and Rhode Island: U.S. Geol. Survey open-file report 77-816, 42 p., 24 pls., scale 1:31,250.

Recent synthesis of the structure, stratigraphy and areal geology of the Narragansett Basin - synthesizes reconnaissance mapping and recent fossil work.

Lyons, P.C., and Krueger, H.W., 1976, Petrology, chemistry and age of the Rattlesnake Pluton and implications for other alkalic granite plutons of southern New England: in Lyons, P.C., and Brownlow, A.H., Studies in New England Geology: Geol. Soc. Am. Memoir 146, p. 71-102

Detailed petrographic, chemical, and radiometric study of an alkalic granite intruding the Dedham granodiorite. Argues for two ages of alkalic granite intrusion in eastern Massachusetts.

Novotny, R.F., 1961, A regional fault in east-central Massachusetts and southern New Hampshire: U. S. Geol. Survey Prof. Paper 424-D, p. D48-D49.

Describes distribution of silicified rocks along northeast trending zone through the Worcester Basin east of the Fitchburg granite; Argues that zone is a fault zone on the basis of displacement of strata.

Novotny, R.F., 1968, Geology of the Sea Coast Region, New Hampshire: Concord, New Hampshire Division of Economic Devel. Quadrangle Report. 46 p.

Detailed map (1:62,500) of the seacoast region. Bulletin describing separation of Rye, Kittery and Elliot for motions in eastern New Hampshire; Petrology of exeter quartz diorite.

Page, L.R., 1968, Devonian plutonic rocks in New England, in Zen, E-an, White, W.S., Hadley, J.B., and Thompson, J.B., Jr., eds., Studies of Appalachian geology--Northern and maritime: New York, Interscience Pubs., p. 371-383.

Summary work on Devonian plutonic rocks. Describes similiar groups of salient petrographic features that distinguish the igneous rocks in relation to time of metamorphism, and style of emplacement.

Peck, J.H., 1975, Preliminary bedrock geologic map of the Clinton quadrangle, Worcester County, Massachusetts: U.S. Geol. Survey open-file report 75-658

Map showing rock sequence northwestward from edge of Nashoba Formation to central part of Worcester Basin.

Peper, John D., and Wilson, Frederick A., 1978, Reconnaissance bedrock geologic map of the Fitchburg quadrangle and part of the Ashby quadrangle, North-central Massachusetts: U.S. Geol. Survey Misc. Field Studies Map MF 959 (in press)

Map and text subdivides Emerson's Fitchburg granite into younger (weakly-foliated) and older (strongly-foliated) granites. Discusses stratigraphic relationships and sequence of deformation.

Perry, J. H., and Emerson, B.K., 1903, Geology of Worcester, Massachusetts: Worcester Nat. Hist. Soc., 166p.

Early work of the geology of Worcester area, describes many locals since lost to urbanization.

Quinn, A.W., 1971, Bedrock geology of Rhode Island, U.S. Geol. Survey Bull. 1295, 68 p.

Summary work on the bedrock geology of Rhode Island -- correlation of igneous rocks and metasediments

Robinson, G.R., Jr., 197_, Bedrock geologic map of the Pepperell, Shirley, Townsend quadrangles and part of the Ayer quadrangle, Mass. and N.H.: U.S. Geol. Survey Misc. Field Studies Map MF-957 (In press).

Four 7 1/2 minute quadrangle maps (1:48,000) showing distribution of rock units, metamorphism, and structural elements of the Worcester Basin. Includes eastern lobe of Fitchburg granite, and new mapping of Chelmsford and Ayer granites.

Shaler, N.S., 1889, Geology of Cape Ann, Massachusetts: U.S. Geol. Survey Ninth Ann. Rept., p. 529-611.

Classic early observations and description of the Cape Ann granites.

Shaler, N.W., Woodworth, J.B., and Foerste, A.G., 1899, Geology of the Narragansett Basin, Monograph, U.S. Geol. Survey, v. 33, 402p.

Early description and synthesis of observations on the rocks of the Narragansett Basin.

Shride, A.F., 1971, Igneous rocks of the Seabrook, New Hampshire-Newbury, Massachusetts, area, Trip B-5, in Guidebook for field trips in central New Hampshire and contiguous areas: New England Intercollegiate Geol. Conf., 63rd Ann. Mts., Concord, N.H., 1971, Guidebook, p. 105-117.

Describes and synthesizes separation of igneous rocks in northeastern part of the Boston two degree sheet - includes discussion of subdivision of the Newburyport quartz diorite, separations of mafic igneous rocks from older mafic volcanic rocks

Shride, A.F., 1976, Stratigraphy and correlation of the Newbury Volcanic Complex, northeastern Massachusetts, in Page, L.R., Editor, Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148. (In press)

Detailed work on the Newbury Volcanics and their relationships to surrounding rocks.

Skehan, J.W., 1964, Folio of maps and cross sections of Wachusett-Marlborough tunnel, Clinton to Marlborough, Massachusetts; Unpub. Rept. for Metropolitan District Commission, 42 maps and sections, scale 1:24,000

Detailed summary of lithologic description of rocks exposed in the tunnel. Also map of faults, folds, orientation, joints.

Skehan, J.W., and Abu-moustafa, A.A., 1976, Stratigraphic Analysis of rocks exposed in the Wachusett-Marlborough Tunnel, East-central Massachusetts, in Page, L.R., Editor, Contributions to the Stratigraphy of New England: Geol. Soc. Am. Memoir 148.

Discussion of stratigraphic relations of metamorphic rock units based on evidence from the Tunnel.

Skehan, J.W., 1968, Fracture tectonics of southeastern New England as illustrated by the Wachusett-Marlborough, Tunnel, east-central Massachusetts, Chap. 21 in Studies of Appalachian geology, northern and maritime (Zen, E-an, and others, editors): New York and London, Interscience Publishers, P. 281-290, illus., table.

Earlier paper establishing a picture of systematic faulting in eastern Massachusetts, with general west over east movement sense.

Sriramadas, Aluru, 1966, Geology of the Manchester quadrangle, New Hampshire: Concord, New Hampshire Dept. Resources and Econ. Devel., Bull. 2, 92p.

Detailed map 1:62,500 and discussion of rocks in the Manchester quadrangle. Includes description of massabessic gneiss; early subdivision of Merrimack group metasediments, metamorphism.

Sundeen, D.A., 1971, The bedrock geology of the Haverhill 15' quadrangle, New Hampshire: Concord, New Hampshire Dept. Resources and Econ. Devel. Bull. 5, 125 p.

Detailed map 1:62,500, and discussion of igneous rocks in Haverhill quadrangle. Possible subdivision of Merrimack Group, structure.

Thompson, J.B., Jr., and Norton, S.A., 1968, Paleozoic regional metamorphism in New England and adjacent areas, in Zen, E-an, White, W.S., Hadley, J.B., and Thompson, J.B., Jr., Editors, Studies of Appalachian geology, northern and maritime: New York, Interscience Publishers, P. 319-327.

General source discussing distribution, overprinting, and contrasts in regional metamorphism and isograds. Inferences as to timing and significance of isograd distribution. Based on data available about 1967.

Toulmin, P., III, 1960, Composition of feldspars and crystallization history of the granite - syenite complex near Salem, Essex County, Massachusetts: Internat. Geol. Cong., 21st, Copenhagen, 1960, Rept., pt. 13, p. 275-286

Detailed discussion of crystallization sequence and history of igneous rocks near Salem

Toulmin, Priestly, 3rd, 1964, Igneous rocks of the Salem area, Massachusetts, Trip E, in Guidebook for field trips in the Boston area and vicinity: New England Intercollegiate Geol. Conf., 56th, Ann. Mtg., Chestnut Hill, Mass., 1964, Guidebook, p. 67-79.

Field guide emphasizes rock sequence and field relations of igneous rocks.

Toulmin, Priestly, III, 1964, Bedrock geology of the Salem quadrangle and vicinity, Mass.: U.S. Geol. Survey Bull. 1163-A, 79p.

Detailed map, 1:24,000, of the granites and volcanics in the Salem-Peabody Massachusetts area; chemistry and modes of the igneous rocks

Warren, C.H., and McKinstry, H.E., 1924, The Granites and pegmatites of Cape Ann, Massachusetts: AAAS Proc. V. 59, no. 14, p. 315-357.

Early discussion of the igneous rocks of Cape Ann - source of petrography and modes, some petrochemistry.

Washington, H.S., 1898, 1899, The petrographical province of Essex County, Massachusetts: Jour. Geology, v. 6, p. 787-808, v. 7, p. 53-64, 105-121, 284-294, 463-480.

Classic study on northeastern Massachusetts igneous rocks - source of petrography and petrochemistry of the rocks.

Weed, E.G.A., Minard, J.P., Perry, W.J., Jr., Rhodehamel, E.C., and Robbins, E.I., 1974, Generalized Pre-Pleistocene geologic map of the Northern U.S. Atlantic Continental Margin, U.S. Geol. Survey Misc. Inv. Series Map 1-861, 1:1,000,000.

Small-scale map showing distribution of off-shore units, as inferred from cores, seismic profiling.

Zartman, R.E., and Marvin, R.F., 1971, Radiometric age (Late Ordovician) of the Quincy, Cape Ann, and Peabody Granites from Eastern Massachusetts: Geol. Soc. America Bull., v. 82, p. 937-958.

Establishes a Paleozoic age for these alkalic granites.

Index to Geologic mapping
Boston 2° sheet

1. Alvord, D. C., 1975, Preliminary bedrock geologic maps fo the Westford and Billerica quadrangles, Middlesex County, Massachusetts: U.S. Geol. Survey open-file report 75-387.
2. Alvord, D. C., Bell, K. G., Pease, M. H., Jr., and Barosh, P. J., 1976 The aeromagnetic expression of bedrock geoloy between the Clinton-Newbury and Bloody Bluff fault zones, northeastern Massachusetts: U.S. Geol. Survey Jour. of Research, v. 4, no. 5, p. 601-604, 1:125,000.
3. Barosh, P. J., 1974, Preliminary bedrock geologic map of the Webster quadrangle, Massachusetts and Connecticut: U.S. Geol. Survey open-file report 74-192.
4. _____ 1976, Preliminary bedrock geologic map of the Oxford quadrangle, Massachusetts-Connecticut-Rhode Island: U.S. Geol. Survey open-file report 76-622.
5. _____ 1977, Preliminary map showing bedrock geology superposed on an aeromagentic base map of the Worcester Region, Massachusetts, Connecticut, Rhode Island: U.S. Geol. Survey open-file Report 77-131.
6. Barosh, P. J., and Johnson, C. K., 1976, Reconnaissance bedrock geologic map of the Leicester quadrangle, Massachusetts: U. S. Geol. Survey open-file report 76-814.
7. Barosh, P. J., 1978, Reconnaissance bedrock geologic map of the Marlborough quadrangle, Massachusetts: U. S. Geol. Survey open-file report 78____, scale 1:24,000.

- *. Barosh, P. J., Fahey, R. J., Pease, M. H., Jr., 1977, Preliminary compilation of the bedrock geology of the land area of the Boston 2° sheet, Mass., Conn., R. I., and New Hampshire, U. S. Geol. Survey open-file report 77-285, 1:125,000.
- 8. Bell, K. G., 1948, Geology of the Boston Basin, Mass., M.I.T. Ph.D. Thesis: U.S. Geol. Survey open-file report, 421 p.
- 9. Bell, K. G., U.S. Geol. Survey unpub. data, 1976.
- 10. Bell, K. G., 1976, Bedrock geologic map of the Lynn and Marblehead South quadrangles, Mass.: U. S. Geol. Survey open-file report 77-180.
- 11. Bell, K. G., Cupples, N. P., Nelson, A. E., and Alvord, D. C., U.S.G.S. unpub. data, 1974.
- 12. Bell, K. G., Shride, A. F., Cupples, N. P., 1976, Preliminary bedrock geologic map of the Georgetown quadrangle, Essex County, Mass.: U.S. Geol. Survey open-file report 77-179.
- 13. Bell, K. G., and Alvord, D. C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts: Geol. Soc. America Mem. 148, pp. 179-216.
- 14. Billings, M. P. Harvard Univ., unpub. data, 1977.
- 15. Billings, M.P., 1956, Bedrock geology, part 2 of the geology of New Hampshire: Concord, New Hampshire State Plan. Devel. Comm., 203 p.
- 16. _____ 1976, Bedrock geology of the Boston Basin, in Cameron, Barry, editor, Geology of southeastern New England: New Eng. Intercollegiate Geol. Conf., 68th Ann. Meeting: Sci. Press, Princeton, N. J.
- 17. Callaghan, Eugene, 1931, A contribution to the structural geology of central Massachusetts: New York Acad. Sci. Annals, v. 33, p. 27-75.

18. Castle, R. O., 1964, Geology of the Andover Granite and surrounding rocks, Mass.: U.S. Geol. Survey open-file report no. 744.
19. Chute, N. E., 1950, Bedrock geology of the Brockton quadrangle, Massachusetts: U.S. Geol. Survey Geol. Quad. Map GQ-5, scale 1:31, 680.
20. Chute, N. E., 1965, Geologic map of the Scituate quadrangle, Plymouth County, Mass.: U.S. Geol. Survey Quad. Map GQ-467.
21. Chute, Newton E., 1965, Geologic map of the Duxbury quadrangle, Plymouth County, Mass.: U.S. Geol. Survey Quad. Map GQ-466.
22. _____ 1966, Geology of the Norwood quadrangle, Massachusetts: U.S. Geol. Survey Bull. 1163-B.
23. _____ 1969, Bedrock geologic map of the Blue Hills quadrangle, Massachusetts: U.S. Geol. Survey Quad. Map GQ-796.
24. Dennen, W. H., 1975, Bedrock geologic of the Rockport quadrangle, Mass.: U.S. Geol. Survey open-file report no. 75-545.
25. Dennen, W. H., 1975, Preliminary bedrock geologic map of the Gloucester quadrangle, Massachusetts: U. S. Geol. Survey open-file report 75-546.
26. _____ 1975, Preliminary bedrock geologic map of the Ipswich quadrangle, Massachusetts: U.S. Geol. Survey, open-file report 75-544.
27. Dennen, W. H., 1975, Preliminary bedrock geologic map of the Marblehead North quadrangle, Massachusetts: U. S. Geol. Survey, open-file report 75-453.

28. Dennen, W. H., 1976, Plutonic series in the Cape Ann area, in Cameron, Barry, Editor, Geology of southeastern New Eng. Intercollegiate Geol. Conf. 68th Ann. Meeting: Sci. Press, Princeton, N. J.
29. Dixon, H. R., U.S. Geological Survey, unpub. data, 1977.
30. Dixon, H. R., U.S. Geol. Survey, unpub. data, 1978.
31. Dowse, A. M., 1949, Geology of the Medfield-Holliston area, Massachusetts, Radcliffe College, unpub. Ph.D. Thesis. 125 p.
32. Emerson, B. K., 1917, Geology of Massachusetts and Rhode Island: U.S. Geol. Survey Bull. 597, 289 p.
33. Fowler-Billings, Katherine, 1959, Geology of the Isle of Shoals, New Hampshire and Maine: New Hampshire State Planning Development Commission, viii, 51 p.
34. Goldsmith, R., U.S. Geol. Survey, unpub. data, 1977.
35. Gore, R., U.S. Geol. Survey, unpub. data, 1976
36. Gore, R. Z., 1976, Ayer crystalline complex of Ayer, Harvard, and Clinton, Mass., in Lyons, P. C., and Brownlow, A. H., eds., pp. 103-124.
37. Greene, R. C., 1970, The geology of the Peterborough quadrangle, New Hampshire: New Hampshire Dept. Resources and Econ. Devel., Bull. no. 4, 88 p.
38. Grew, E. S., 1970, Geology of the Pennsylvanian and pre-Pennsylvanian rocks of the Worcester area, Massachusetts: Unpub. Ph.D. Thesis, Harvard Univ., 263 p.

39. Grew, E. S., 1973, Stratigraphy of the Pennsylvanian and pre-Pennsylvanian rocks of the Worcester area, Massachusetts: *Am. Jour. Sci.*, v. 273, no. 2, p. 113-129, illus. (inclu. geol. sketch maps).
40. Hansen, W. R., 1956, Geology and mineral resources of the Hudson and Maynard quadrangles, Massachusetts: *U.S. Geol. Survey Bull.* 1038, 104 p.
41. Hepburn, J. C., U.S. Geol. Survey, unpub. data, 1976.
42. Hepburn, J. C., 1978, Preliminary bedrock geologic map of the Shrewsbury quadrangle, Worcester County, Mass.: *U.S. Geol. Survey open-file report 78__* .
43. Hepburn, J. C., and DiNitto, R. G., 1978, Preliminary bedrock geologic map of the Marlborough quadrangle, Middlesex and Worcester Counties, Mass.: *U.S. Geol. Survey open-file report 78_____*.
44. Jahns, R. H., Willard, M. E., and White, W. S., 1959, Preliminary bedrock geologic map of the Lowell-Westford area, Mass.: *U.S. Geol. Survey open-file report no. 21*.
45. Kaye, C. A., 1974, Unpublished sketch map of the Boston Basin.
46. Kaye, C. A., U.S. Geol. Survey unpub. data, 1977.
47. Lyons, P. C., 1969, Bedrock geology of the Mansfield quadrangle, Massachusetts: Boston, Mass., Boston University, 282 p.
48. Lyons, P. C., and Krueger, H. W., 1976, Petrology, chemistry and age of the Rattlesnake Pluton and implications for other alkalic granite plutons of southern New England: in Lyons, P. C., and Brownlow, A. H., *Studies in New England Geology: Geol. Soc. Am. Memoir 146*, p. 71-102.

49. Lyons, P. C., 1977, Report on the bedrock of the Narragansett basin, Massachusetts and Rhode Island: U.S. Geol. Survey open-file report 77-816, 42 p., 24 pls., scale 1:31,250.
50. McKniff, J. M., 1962, The petrology of the south half of the Blackstone quadrangle, Massachusetts and Rhode Island, Brown Univ. Masters Thesis.
51. Nelson, A. E., 1975a, Bedrock geologic map of the Framingham quadrangle, Middlesex and Worcester Counties, Massachusetts: U.S. Geol. Survey Quad. Map GQ-1274.
52. _____ 1975b, Bedrock geologic map of the Natick quadrangle, Middlesex and Norfolk Counties, Mass.: U.S. Geol. Survey Quad. Map GQ-1208.
53. Novotny, R. G., 1968, Geology of the Sea Coast Region, New Hampshire: Concord, New Hampshire Division of Economic Devel. Quadrangle Report, 46 p.
54. Peck, J. H., 1975, Preliminary bedrock geologic map of the Clinton quadrangle, Worcester County, Massachusetts: U.S. Geol. Survey open-file report 75-658.
55. Peper, John D., and Wilson, Frederick A., 1978, Reconnaissance bedrock geologic map of the Fitchburg quadrangle and part of the Ashby quadrangle, North-central Massachusetts: U.S. Geol. Survey Misc. Field Studies Map MF _____ (in press).
56. Perry, J. H., and Emerson, B.K., 1903, Geology of Worcester, Massachusetts: Worcester Nat. Hist. Soc., 166 p.
57. Peterson, R. G., and Shaw, C. E., Jr., 1967, Surficial geologic map of the Whitman quadrangle, Plymouth County, Massachusetts, U.S. Geol. Survey Map GQ-632.

58. Pomeroy, J. S., 1975, Preliminary bedrock geologic map of the East Brookfield quadrangle, Worcester County, Massachusetts: U.S. Geol. Survey open-file report 75-530.
59. Quinn, A. W., 1971, Bedrock geology of Rhode Island, U.S. Geol. Survey Bull. 1295, 68 p.
60. Robinson, G. R., Jr., 197____, Bedrock geologic map of the Pepperell, Shirley, Townsend quadrangles and part of the Ayer quadrangle, Mass. and N. H.: U.S. Geol. Survey Misc. Field Studies Map MF-957 (in press).
61. Robinson, Peter, and Tucker, R. D., 1977, unpub. compilation map: University of Massachusetts, Dept. Geol., U.S.G.S. grant no. 14-03-0001-G-134.
62. Shaler, N. W., Woodworth, J. B., and Foerste, A. G., 1899, Geology of the Narragansett Basin, Monograph, U.S. Geol. Survey, v. 33, 402 p.
63. Shaw, C. E., Jr., 1967, Geology and petrochemistry of the Milford area, Mass.: Brown Univ. Ph.D. Thesis, 141 p.
64. Shaw, C.E., Jr., and Peterson, R. G., 1967, Surficial geological map of the Hanover quadrangle Plymouth County, Massachusetts, U.S. Geol. Survey Map GQ-633.
65. Shride, A. F., 1976, Preliminary map of bedrock geology of the Newburyport West and Newburyport East quadrangles, Mass. and N. H.: U.S. Geol. Survey open-file report no. 76-488.
66. Shride, A. F., U.S. Geol. Survey unpub. data, 1977.

67. Skehan, J. W., 1964, Folio of maps and cross sections of the Wachusett-Marlborough tunnel, Clinton to Marlborough, Massachusetts: Unpub. Rept. for Metropolitan District Commission, 42 maps and sections, scale 1:24,000
68. Skehan, J. W., 1968, Fracture tectonics of southeastern New England as illustrated by the Wachusett-Marlborough, Tunnel, East-central Massachusetts, Chap. 21 in Studies of Appalachian geology, northern and maritime (Zen, E-an, and others, editors): New York and London, Interscience Publishers, p. 281-290, illus., table.
69. Sriramadus, Aluru, 1966, Geology of the Manchester quadrangle, New Hampshire: Concord, New Hampshire Dept. Resources and Econ. Devel., Bull. 2, 92 p.
70. Sundeen, D. A., 1971, The bedrock geology of the Haverhill 15' quadrangle, New Hampshire: Concord, New Hampshire Dept. Resources and Econ. Devel. Bull. 5, 125 p.
71. Toulmin, Priestly, III, 1964, Bedrock geology of the Salem quadrangle and vicinity, Mass.: U.S. Geol. Survey Bull. 1163-A, 79 p.
72. Volckmann, R.P., 1973, Preliminary bedrock geologic map of the Holliston quadrangle, Mass.: U.S. Geol. Survey open-file report no. 1926.
73. Volckmann, R. P., 1973, Preliminary bedrock geologic map of the Medfield quadrangle, Mass.: U.S. Geol. Survey open-file report no. .927

74. Weed, E.G.A., Minard, J. P., Perry, W. J., Jr., Rhodehamel, E. C.,
and Robbins, E. I., 1974, Generalized Pre-Pleistocene geologic
map of the Northern U.S. Atlantic Continental margin, U.S. Geol.
Survey Misc. Inv. Series Map I-861.

* Barosh, Faye, and Pease were used as a general reference base for
the Boston 2° sheet.

Explanation to accompany a preliminary Compilation of
the Bedrock Geology of the Boston Two-Degree sheet

John D. Peper Compiler

JTrd	Diabase dikes and sills
Dp	Pegmatite and quartz monzonite
Pz-p&m	Massabesic Gneiss
Dgr	Granite
Dbqm	Binary quartz monzonite
Dpqm	Porphyritic quartz monzonite
Dsqd	Spalding Quartz Diorite
Dc	Chelmsford Granite
Dkqm	Kinsman Quartz Monzonite
Dfbg	Foliated binary granite
Dgg	Aluminous, granitic gneiss
DSac	Ayer Granite, Clinton facies
S0ad	Ayer Granite, Devens-Long Pond facies
D0a	Ayer Granite, undivided
DSf	Fitchburg Granite
DSff	Fitchburg Granite, gneissic facies
DSfg	Fitchburg Granite, granodiorite facies
DScE	Canterbury and Eastford Gneisses
DSd	Diorite and tonalite, includes Dracut Diorite, Exeter Diorite in New Hampshire
S0nq	Newburyport Quartz Diorite
S0nqp	Newburyport Quartz Diorite porphyritic facies
S0an	Andover Granite, includes Acton Granite

sp Sharpners Pond Diorite
 sh Straw Hollow Diorite and Assabet Quartz Diorite
 rd Rowley Diorite
 qm Quartz monzonite in the Newbury area
 gp Fine grained granite and porphyry

 ca Cape Ann Granite
 cas Cape Ann Granite, quartz-poor facies; includes Beverly
 Syenite and Wenham Monzonite
 cam Squam Granite
 pg Peabody Granite
 qg Quincy Granite
 rt Rattlesnake Hill Granite
 ag Alkalic granite at Franklin
 ng Nahant Gabbro
 sd Salem Gabbro-diorite
 ss Sharon Syenite
 ih Indian Head Granodiorite
 c Cumberlandite
 gb Gabbro, Undiff
 s Serpentine

 pEs Scituate Granite Gneiss
 pCh Hope Valley Alaskite Gneiss
 pEpo Ponagansett Gneiss
 pCe Esmond Granite
 pEm Milford Granite

p&mm Milford Granite, mafic facies

p&gr Granite, transitional in texture and composition between Milford
and Dedham Granites

p&d Dedham Granite

p&an Dedham Granite, Saugus and Lynnfield areas

p&gp Porphyritic granite and gneissic inequigranular granite
near Westport

p&t Topsfield Granodiorite

p&gm Grant Mills Granodiorite

p&wg Westwood Granite

p&ag Muscovite-garnet bearing gneissic Alaskite

p&di Diorite metamorphosed in part to amphibolite and hornblende gneiss

p&gb Gabbro - metamorphosed in part to amphibolite and hornblende gneiss

p&gu Granite, gneiss, and schist undivided. May include granite of
Paleozoic age.

EXPLANATION

Stratified rocks

¶Pd	Dighton Conglomerate
¶Pfw	Fossiliferous strata at Worcester
¶Pr	Rhode Island Formation
¶Prc	Conglomerate in the Rhode Island Formation
¶Pw	Wamsutta Formation
¶Pwv	Volcanic rocks in the Wamsutta
¶Pb	Bellingham Conglomerate
DSn	Newbury volcanic complex undivided
DSnr	Micrographic rhyolite, intrusive
DSnu	Upper members - calcareous mudstone, red mudstone, and silicious siltstone
DSna	Porphyritic andesite member
DSnl	Lower members - volcanic rocks
Pzc	Cambridge Argillite and Dorchester Members of the Roxbury Conglomerate
Pzcc	Conglomerate and sandstone in the Cambridge Argillite
Pzr	Roxbury Conglomerate, Brookline and Squantum Members
¶Pzrv	Melaphyre in the Roxbury Conglomerate
Pzv	Felsic and intermediate volcanic rocks
Pzv1	Lynn Volcanic Complex
Pzvm	Mattapan Volcanic Complex

Pzvmi Mattapan Volcanic Complex, intrusive rhyolite
 Pzvb Blue Hills Porphyry
 DSl Littleton Formation, undivided
 DSlc Crotched mountain member of the Littleton Formation of Greene, 1970
 DSlp Peterborough member of the Littleton Formation
 DSlpv Volcanics in the Peterborough Member
 DSlpt Thin-bedded mica schist in the Peterborough Member
 DSlf Francestown Member of the Littleton Formation
 DSlS Souhegan Member of the Littleton Formation
 DSh Holden Formation of Grew, includes Bee Hill Formation of Hepburn.
 Where complexly infolded with rocks of Paxton Group, mapped as
 DSh + Spqr
 DShm Marble in Holden Formation of Grew
 Sp paxton Group, undivided
 Sph Lower Formation of Paxton Group
 Sps Schist in Paxton Group
 Spss Sulfidic mica schist in Paxton Group, includes some gray schist.
 Spqr Quartzite and rusty schist in Paxton Group
 Spg Gray mica schist and calc-silicate gneiss in Paxton Group
 So Oakdale Formation
 Sb Berwick Formation
 Sbs Schist in the Berwick Formation
 Se Eliot Formation
 Sk Kittery Formation
 Sw Worcester Formation
 St Tower Hill Quartzite of Grew

Sts Phyllite in the Tower Hill Quartzite of Grew
 Svh Vaughn Hills Quartzite of Hansen, phyllite, quartzite
 conglomerate, and chlorite schist. Includes Harvard
 conglomerate of possible Pennsylvanian age
 S0b Boylston Schist of Grew, restricted to Boylston area
 S0tb Tadmuck Brook Schist, schist and phyllite
 S0m Merrimack Group, undivided
 S0mp Phyllite and schist in the Merrimack Group

0-p&t Tatnic Hill Formation
 0-p&n Nashoba Formation
 0-p&rv Metavolcanic gneiss of the Rye Formation
 0-p&rm Metasediments of the Rye Formation
 0-p&nb Boxford Member of the Nashoba Formation
 0-p&f Fish Brook Gneiss
 0-p&sh Shawsheen Gneiss
 0-p&q Quinebaug Formation
 0-p&m Marlboro Formation
 0-p&mg Grafton Gneiss Member of the Marlboro Formation

E_g Greenlodge Formation, upper Cambrian
 E_{bw} Braintree and Weymouth Formations, middle and lower Cambrian
 E_h Hoppin Formation, middle and lower Cambrian

- pEp Plainfield Formation
- pEw Westboro Quartzite, includes quartzite in the Saugus and
Lynnfield areas
- pEb Blackstone Series
- pEbq Quartzite
- pEbs Schist and phyllite, includes some metavolcanic and meta-
volcaniclastic rocks
- pEv Metavolcanic rocks, includes Kendall Green Formation, Middlesex
Fells volcanic rocks, Cherry Brook Formation, Rice Gneiss,
and meta-felsite near Plympton
- pEvf Felsic metavolcanic rocks
- pEgn Layered feldspathic gneiss in the New Bedford area