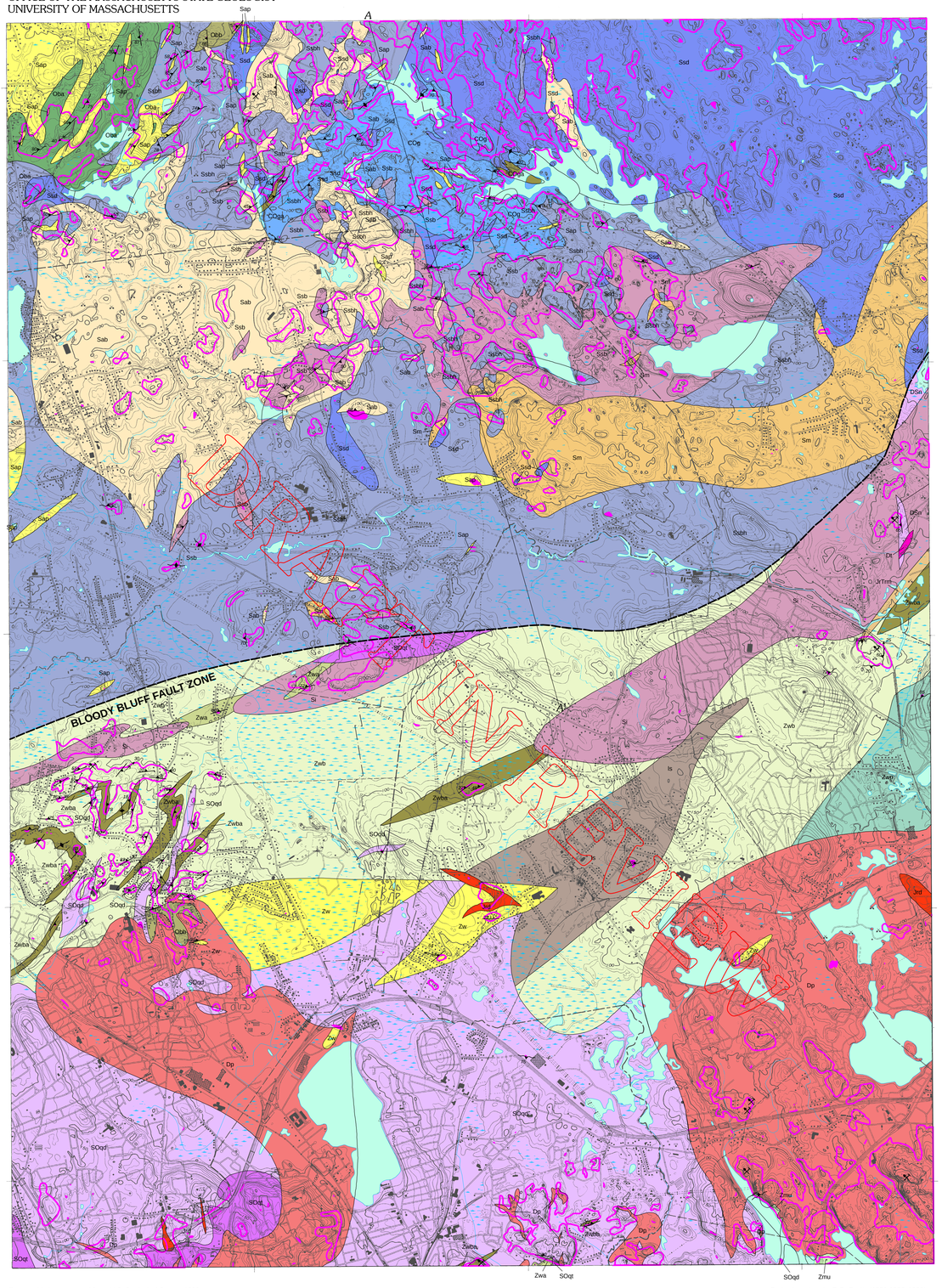
OFFICE OF THE MASSACHUSETTS STATE GEOLOGIST
UNIVERSITY OF MASSACHUSETTS

Prepared in cooperation with the
COMMONWEALTH OF MASSACHUSETTS
STATE GEOLOGIST

BEDROCK GEOLOGIC MAP
READING QUADRANGLE, MASSACHUSETTS
v. 1.0

Stratigraphic correlation chart accompanies map



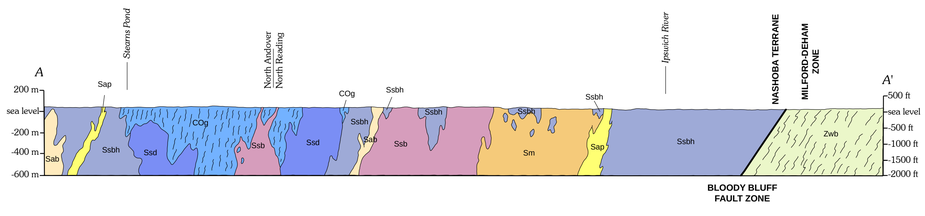
Topographic base scanned from U.S. Geological Survey, 1966
Polyconic projection. 1927 North American Datum
Digitally reprojected to 1983 North American Datum, 1:24,000 scale
10,000 foot grid ticks based on Massachusetts state plane coordinate system, mainland zone
1000-meter Universal Transverse Mercator grid ticks, zone19

APPROXIMATE MEAN DECLINATION, 1999

SCALE 1:24 000
1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

Bedrock geology by R.O. Castle (1951-1952, 1992). Updated and revised by J.C. Hepburn and J.P. Kopera (2004).
Digitized by J.P. Kopera (2005).



DESCRIPTION OF LITHOLOGIC UNITS

NASHOBA TERRANE

Metasedimentary and Metavolcanic Rocks

Boxford Formation (Ordovician)–Reduced in rank and included as Boxford "Member" of Nashoba Formation by Bell and Alvord (1976)

Obb — **B member**–Chiefly fine-grained, distinctly foliated, very thinly layered, light-gray to black schist and gneiss. Composed of rocks of widely differing mineralogical composition, including amphibolite, calc-silicate rock, andalusite-sillimanite-sericite schist, quartz-feldspar gneiss, and others transitional between these extremes. Contains a few thin beds of white quartzite along flanks of formation

Oba — **A member**–Chiefly fine- to medium-grained schist, gneiss and amphibolite. Schist commonly bluish-gray and composed mainly of muscovite, biotite and quartz with minor amounts of andalusite and fibrolitic sillimanite. Gneissic rocks composed of quartz and plagioclase with varietal amounts of actinolite. Amphibolites in part coarser-grained than those of B member of Boxford Formation. Poorly exposed

Gneiss (Cambrian to Ordovician)–Confined to northern part of Reading quadrangle. Chiefly medium-grained, contorted, light-gray gneiss. Composed mainly of quartz, plagioclase and biotite with accessory amounts of apatite, magnetite and zircon

COga — **Amphibolite facies**–Chiefly fine-grained, foliated and locally layered dark-gray amphibolite. Composed mainly of hornblende, plagioclase, quartz and biotite

Intrusive Rocks

Sm — **Monzogranite at Middleton Pond (Probably Silurian)**–Medium- to fine grained, massive, pink to red monzogranite. Composed chiefly of microcline, plagioclase and quartz with varietal amounts of biotite almost completely altered to chlorite. Contains abundant xenoliths

Andover Granite (Silurian)–*Age about 450 ± 25 (Rb-Sr) to 412 ± 2 (U-Pb)*

Sap — **Pegmatitic granite facies**–Chiefly medium- to extremely coarse-grained, massive, pearly-white to light-bluish-gray monzogranite and pegmatite. Composed mainly of microcline, plagioclase, quartz and muscovite. Biotite occurs locally and garnet is a common accessory. Broad areas underlain entirely by pegmatite

Sab — **Binary granite facies**–Chiefly medium-grained, massive to faintly foliated, pearly-white to light-gray monzogranite. Composed mainly of microcline, plagioclase, quartz, muscovite and biotite with accessory garnet. Pegmatite prominent locally

Sharpners Pond Diorite (Silurian)–*Age about 430 ± 5 (U-Pb)*

Ssb — **Biotite tonalite facies**–Chiefly medium- to fine-grained, massive to distinctly foliated, light- to medium-gray tonalite. Granodiorite and monzogranite occur locally. Composed mainly of plagioclase, quartz and biotite, together with lesser amounts of microcline and hornblende. Contains accessory amounts of magnetite, apatite and sphene

Ssbh — **Biotite-hornblende tonalite facies**–Chiefly medium-grained, massive to vaguely foliated, medium to dark-gray tonalite. Composed mainly of plagioclase, hornblende, quartz and biotite, together with accessory amounts of sphene, apatite and magnetite

Ssd — **Hornblende diorite facies**–Chiefly medium- to coarse-grained, massive, medium-gray to black diorite and tonalite. Composed mainly of plagioclase and hornblende, together with variable but generally small amounts of quartz. Biotite locally composes as much as 10 percent of the rock. Main accessories include magnetite, sphene and apatite

MILFORD-DEDHAM (AVALONIAN) ZONE

Metasedimentary and Metavolcanic Rocks

JrTrm — **Middleton basin red beds (Late Triassic to Early Jurassic)–**Conglomerate, arkose and sandy shale, light to dark red. Confined to Middleton basin of Kaye (1983)

DSn — **Newbury Volcanic Complex (Early Devonian and Late Silurian)**–Fine grained to aphanitic, locally porphyritic, massive to thinly layered metavolcanic rocks. Dark greenish gray and flesh-colored to white varieties predominate. Dark rocks composed chiefly of plagioclase, quartz and epidote; lighter colored rocks composed chiefly of feldspar and quartz. (Interbedded sediments unexposed in this area)

Waltham Tectonic Melange (Late Proterozoic to Silurian(?))–Modified from LaForge (1932)

Zwb — **B member**–Chiefly fine-grained, foliated and locally layered, greenish-gray to black biotite-quartz-hornblende-plagioclase schists locally interlayered with ultra-fine-grained siliceous schists. The siliceous schists commonly are chloritic and epidotitic and crop out most conspicuously along the flanks of the Waltham Melange. Commonly mylonitic or sheared. Interlayered quartzite and quartz-feldspar gneiss occur locally. Transitional with A member

Zwba — **Amphibolite facies of B member**–Chiefly fine-grained, distinctly foliated and locally thinly layered, gray to black amphibolite and plagioclase amphibolite. Composed mainly of hornblende and plagioclase with lesser amounts of magnetite, chlorite and calcite. Epidote conspicuous locally. Mapped separately where amphibolite or plagioclase amphibolite is the predominant rock type

Zwp — **Porphyroblastic gneiss member**–Chiefly interlayered plagioclase amphibolite and porphyroblastic biotite-feldspar-quartz gneiss. Porphyroblasts are chiefly microcline and range from 3 to 10 mm in diameter. Poorly exposed in this area

Zwa — **A member**–Chiefly medium- to coarse-grained foliated and layered, very light- to dark-gray gneiss. Commonly possesses an augen- or flaser-like texture. Composed mainly of varying amounts of quartz, plagioclase, microcline and biotite. Hornblende, muscovite, epidote and chlorite commonly present in small amounts. Contains some amphibolite and thin quartzite layers. Transitional with B member

Zmu — **Metamorphic rocks, undifferentiated (Late Proterozoic?)**–Fine-grained and locally porphyroblastic, foliated and locally layered, dark- to light-gray metamorphic rocks. Lithologic varieties include hornfels, calc-silicate rock and quartzitic gneiss. Confined to area adjacent to Hawkes Pond

Zw — **Westboro Formation (Late Proterozoic)**–Chiefly fine-grained, massive to faintly foliated, light-greenish-gray to white quartzite. Composed mainly of quartz with minor amounts of feldspar, chlorite and amphibole. Poorly exposed

Is — **Serpentinite at Lynnfield (age uncertain)**–Chiefly ultra-fine-grained, massive and slickensided, very dark bluish- to greenish-gray serpentinite. Composed chiefly of antigorite. Colorless amphibole, olivine, magnetite and chlorite present locally. Poorly exposed

Intrusive Rocks

Jrd — **Diabase (Early Jurassic)**–Fine- to medium-grained, massive, dark-gray to black. Commonly porphyritic with tabular plagioclase phenocrysts up to 3 cm in diameter. Composed chiefly of plagioclase and pyroxene. Confined to Wilmington, Woburn, Reading, Lynnfield and Peabody areas

Dt — **Trachyte at Middleton (Devonian?)**–Fine-grained, generally massive, light-gray trachyte or keratophyre. Composed chiefly of sodic plagioclase, potassium feldspar and pyroxene. Highly altered. Localized within small area about 2.2 km south of Middleton center

Dp — **Peabody Granite (Late and Middle Devonian)**–Age about 360 ± 24 (Rb-Sr) to 395 ± 20 (U-Pb). Coarse-grained, massive, light-gray granite. Composed chiefly of microperthite, quartz, hornblende and plagioclase. Biotite occurs mainly in peripheral rocks. Included with "alkalic" intrusive series of Toulmin (1964)

Si — **Tonalite athwart Ipswich River at Middleton-Peabody town boundary (Silurian?)**–Chiefly medium-grained, massive and locally foliated medium- to dark-greenish-gray tonalite. Composed mainly of plagioclase and quartz together with minor amounts of microcline. Abundant secondary chlorite and epidote. Intensely sheared and brecciated locally. Continuous with Newburyport (?) Quartz Diorite of Toulmin (1964)

Diorite at Lake Quannapowitt and vicinity (Silurian or Ordovician)–*Age about 444 ± 3 (U-Pb)*

SOqt — Biotite-hornblende tonalite facies–Chiefly massive, medium-grained dark-gray, alkali-rich tonalite. Composed largely of plagioclase, hornblende, quartz and biotite

SOqd — Hornblende diorite facies–Chiefly massive, medium grained, gray to black, alkali-rich diorite. Composed mainly of plagioclase and hornblende, together with variable but generally small amounts of quartz and biotite. Accessories chiefly magnetite and sphene

EXPLANATION OF MAP SYMBOLS

Lithologic Contacts

Contact, location generally approximate

Faults

Only faults traceable at map-scale and on surface are shown

Location approximate

Structural Symbols

Planar Features

Strike and dip of bedding

Strike and dip of dominant foliation / vertical foliation (includes mylonitic foliation). Compositional layering generally parallels foliation in stratified rocks

Approximate strike and dip of heavily deformed foliation / vertical deformed foliation

Linear Features

Trend and plunge of mineral lineation

Trend and plunge of minor fold axis

Mine or bedrock quarry

Bedrock Exposure

Individual Outcrop

Areas of abundant outcrops or shallow bedrock (within 10 ft (3 m) of surface)

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BEDROCK GEOLOGIC MAP OF THE READING QUADRANGLE, MASSACHUSETTS

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2005 (in review)

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Note: This manuscript is currently undergoing peer review, and is not a final