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BEDROCK GEOLOGIC MAP OF THE NEWTON 7.5′ QUADRANGLE, MIDDLESEX, NORFOLK AND SUFFOLK COUNTIES, MASSACHUSETTS

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MASSACHUSETTS GEOLOGICAL SURVEY GEOLOGIC MAP GM-17-01
BEDROCK GEOLOGIC MAP OF THE NEWTON 7.5′ QUADRANGLE, MASSACHUSETTS
2017
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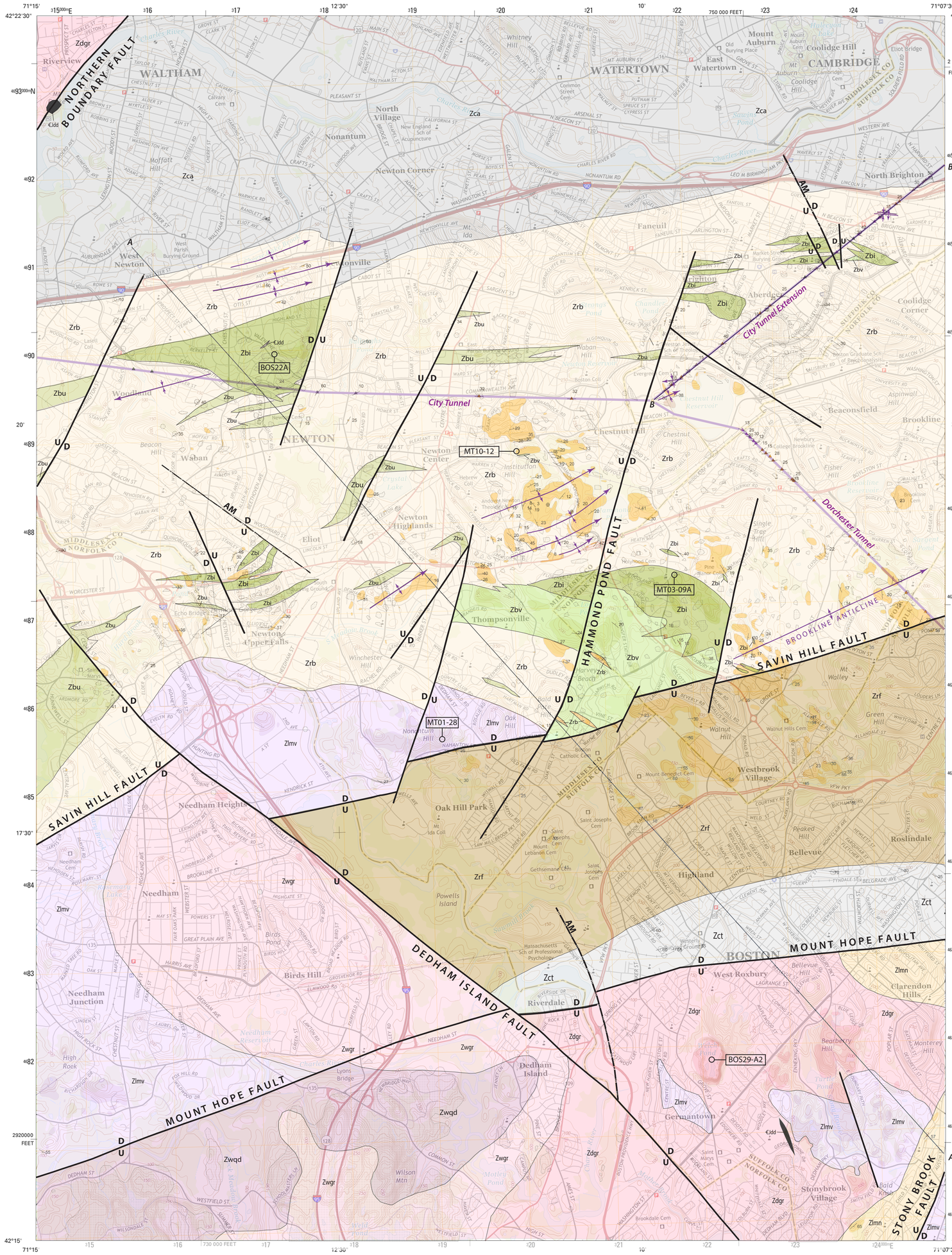
The National Map US Topo



CORRELATION OF ROCK UNITS

[Dates in bold type from samples in Newton quadrangle (details in U-Pb Summary Table below). Zrf date from Thompson et al., 2014, Zca date from Thompson and Bowring, 2000; Zwgr and Zwqd dates from Thompson et al.,1996]

PALEOZOIC AND MESOZOIC IGNEOUS ROCKS

€Jdd diabase dike — JURASSIC (?) TO CAMBRIAN

NEOPROTEROZOIC SEDIMENTARY ROCKS

Boston Bay Group
Zct
Zca
≤ 570 Ma
Unconformity
< 598.87 ± 0.71 Ma
Zrb
< 595.14 ± 0.90 Ma
Zrf

NEOPROTEROZOIC IGNEOUS ROCKS

Brighton Igneous Suite
Zbu
Zbv
Zbi
584.19 ± 0.70 Ma
585.37 ± 0.72 Ma

Wilson Mountain quartz diorite
Zwqd 589 ± 2 Ma

Lynn-Mattapan Volcanic Complex
Zlmn
Zlmv
597.4 ±1.5 Ma

Westwood Granite
Zwgr 599 ± 2 Ma

Unconformity

Dedham Granite
Zdgr 609.1 ± 1.1 Ma

— NEOPROTEROZOIC

DESCRIPTION OF MAP UNITS

[Units listed below as Neoproterozoic fall within the 635 –541 Ma Ediacaran Period in the geologic time scale of Gradstein et al., 2012]

SEDIMENTARY ROCKS

Boston Bay Group (Neoproterozoic)
Cambridge Formation

Zct — Transition member—Siltstone to fine sandstone in shades of olive, dark gray, dark greenish- or bluish-gray and grayish- or greenish-black. Beds up to 30 cm thick are internally laminated on a scale of mm. Some horizons are graded, rippled or slumped, and hummocky cross stratification is also present. Composed mainly of lithic fragments altered to felty masses of chlorite and white mica, along with minor interspersed quartz and feldspar grains. Accessory minerals include apatite, chalcopyrite, monazite and zircon. Sparse flakes of detrital muscovite measuring up to 0.15 mm distinguish this group from the Argillite member. A maximum depositional age of ≤ 570 Ma was obtained from an ash bed in this unit in the Old Mystic Quarry in the Boston North Quadrangle (Thompson and Bowring, 2000).

Zca — Argillite member—Mudstone and siltstone in colors varying from light, medium or dark gray to light olive or olive gray to light or dark greenish gray. Principal minerals are Fe-rich chlorite and K-deficient white mica (illite), along with < 10% modal albite and quartz. Planar bedding ranging from a few cm to tens of cm and mm-scale internal lamination reflect variations in disseminated pyrite and lenses of opaque organic material more than grain size variations. Apatite, monazite, and zircon are other typical accessories. Slump structures are common. Rare surface exposures are indurated but uncleaved, though cleaved zones are reported in subsurface sections (City Tunnel Extension). Minor interbedded sandstone in shades of greenish gray or chocolate brown.

Roxbury Conglomerate

Zrb — Brookline member (including units previously assigned to Dorchester and Squantum members)—Conglomerate, sandstone and siltstone in relative proportions varying across the map area. Conglomerate consists of rounded pebbles, cobbles and rarely boulders, with clast assemblages dominated by volcanic rocks, chiefly felsites but also including minor mafic or intermediate varieties. Other clast lithotypes, in decreasing abundance, are quartz arenite and granite. Conglomerate can be clast or matrix supported. Matrix composed of lithic-rich granules and coarse sand grains that are commonly flattened and show tails of white mica. Associated sandstones in shades of light brownish and brownish to olive gray or pale yellowish brown are medium- to coarse-grained lithic or feldspathic arenite, locally hosting pebbles measuring up to a few cm. Siltstone horizons range in color from olive to greenish- or brownish-gray to grayish red. Trough cross bedding, hummocky cross bedding and current ripples can be found in some sandstones, and some siltstones show slump structures. Interstratified with and intruding this sedimentary sequence are members of the Brighton Igneous Suite. A maximum depositional age of ca. 599 Ma has been obtained from the Brookline member in the Newton quadrangle (details in U-Pb Summary Table).

Zrf — Franklin Park member—Conglomerate containing more abundant boulder-size clasts and clast assemblages with fewer quartz arenite and granite components than the Brookline Member to which it has previously been assigned. Associated rocks include only minor, discontinuous sandstone lenses in shades of gray or dusky red Volcanic interbeds absent. A maximum depositional age of 595.14 ± 0.90 Ma has been obtained from a sample of this unit in the Boston South quadrangle (Thompson et al., 2014).

IGNEOUS ROCKS

€Jdd — **Diabase dike (Cambrian to Jurassic?)**—Medium-grained olive- to dark greenish-gray or greenish-black diabase weathering to dusky brown. Relict ophitic to sub-ophitic texture in which thoroughly sausseritized plagioclase encloses or is enclosed by masses of intergrown chlorite, epidote, titanite and fibrous actinolite ("uralite") replacing original pyroxene. Accessory apatite and opaque minerals. No U-Pb dates are available to constrain the ages of these dikes.

Brighton Igneous Suite (Neoproterozoic)

Zbv — Volcanic member—Non-porphyritic basaltic flows in shades of medium-dark, dark and greenish gray, commonly with < 1 to 5 mm rounded vesicles variously filled with epidote, chlorite, quartz and calcite. Groundmass dominated by plagioclase laths ubiquitously altered to sericite and epidote (saussserite). Interstitial minerals include epidote, chlorite, titanite, and in some samples calcite and/or actinolite. Accessory apatite, sulfides, magnetite and zircon. Interstratified with flows are lapilli tuffs and tuff breccias containing mafic volcanic fragments from a few cm to 30 cm in a matrix of mm-size lithic grains. Breccias containing larger clasts are mottled in shades of grayish orange pink, dusky red and greenish gray, while finer units are more uniformly grayish- to dusky red because of finely disseminated hematite. Conglomerate horizons are also present locally. None of these flows yielded zircon for U-Pb dating.

Zbi — Intrusive member—Porphyry of andesitic to dacitic composition, everywhere considerably altered. Rocks are gray to (dark) green ish-gray and contain single or clustered phenocrysts of sericitized plagioclase and subordinate quartz measuring < 1 to 3 mm. Ground mass consists of plagioclase laths with interstitial chlorite, epidote, quartz, titanite and iron oxides. Recurrent accessory minerals are apatite and zircon, accompanied locally by barite, chromite and sulfides. Vesicles may also be present and are filled with various combinations of chlorite, titanite, epidote, quartz, calcite and iron oxides. Includes distinctive intrusion breccia in which porphyry described above is chilled against irregular, internally laminated reddish stringers composed of fine-grained quartz, albite and Fe-bear ing white mica (phengite?), along with epidote and titanite. In several locations, the intrusion breccia additionally incorporates coarse-grained rocks along irregular or mutually interpenetrating contacts. Coarse-grained rocks include breccia consisting of angular felsic volcanic clasts in a reddish matrix, as well as conglomerate dominated by granule- or pebble-sized clasts. Two samples from the Newton Quadrangle yielded closely comparable dates of ca. 585 and 584 Ma (details in U-Pb Summary Table).

Zbu — Undifferentiated intrusive and volcanic rocks

Lynn-Mattapan Volcanic Complex (Neoproterozoic)

Zlmn — Neponset Gorge member—Volcaniclastic or epiclastic sequence of conglomerate and sandstone. Conglomerate contains some boulder horizons, but mostly consists of pebbles and cobbles up to 10 cm composed of volcanic rocks including basalts and rhyolites (porphy ries, flow banded and pyroclastic varieties) and granite, but not quartz arenite. Matrix and interbedded fine- to coarse-grained sandstone horizons, both varying in color from brownish gray, olive or mediu dark gray, and brownish black, are volcanic-rich lithic arenite. Sandstones contain current ripples and slump folds and, in places, conglomerate has foundered into underlying sand.

Zlmv — Volcanic member—Mainly rhyolitic or dacitic ash-flow tuff containing 25-30% commonly fragmented crystals measuring up to 5 mm. In order of decreasing abundance, these include plagioclase, quartz and K-feldspar, along with trace amounts of chloritized biotite. Ground mass in shades varying from medium dark to brownish- or olive gray groundmass is typically devitrified and recrystallized to cryptocrystal line intergrowths of quartz and feldspar with some secondary musco vite and titanite. Relict pumice clasts and glass shards can be identi fied in some thin sections. Accessory minerals include apatite, ilmenite, magnetite and zircon. Some of these units also contain lithic components ranging from lapilli-size clasts to blocks measuring tens or hundreds of m (megabreccia). Flow-banded rhyolite and sub-vol canic porphyries are minor members of the siliceous assemblage. Subordinate dark gray, greenish-gray and greenish-black units are highly altered tuffs and flows ranging geochemically from andesite to basalt. Aligned laths of albitized plagtioclase reflect the igneous ori-gin of some of these rocks, but remaining components are altered beyond recognition to masses of chlorite, epidote, hematite, muscovite and titanite. The 597.4 ± 1.5 Ma weighted mean $^{207}Pb/^{206}Pb$ date listed in the U-Pb Summary Table for the Mattapan Volcanic member is the oldest reported date for this unit. Samples collected outside the Newton Quadrangle range up to 593.19 ± 0.73 Ma (weighted mean $^{206}Pb/^{238}U$ date of Thompson et al., 2014).

Zwqd — **Wilson Mountain Quartz Diorite (Neoproterozoic)(new name)**—Gray to pink medium-grained quartz diorite containing plagioclase, elongate or poikilitic hornblende, biotite with interstitial quartz and minor K-feldspar, along with accessory apatite, ilmenite, magnetite and zircon. Secondary minerals include chlorite, epidote, sericite and titanite. The quartz diorite grades into pegmatitic diorite and darker-colored gabbro. In a few places the diorite is co-mingled with a lighter-colored hornblende-bearing granitic component. The dated sample of this unit was collected from the road-cut on Rt. 109W exit from Rt. 128 south in the Norwood quadrangle (unnamed quartz dio-rite in Thompson et al., 1996).

Zwgr — **Westwood Granite (Neoproterozoic)**—Pinkish- to light brownish gray, fine- to medium-grained massive granite composed of quartz, perthitic K-feldpar and sausseritized plagioclase with minor chloritized biotite. Accessory minerals include apatite, magnetite, and zircon. Color reflects hematite finely disseminated throughout the sample, and hematite alteration around magnetite gives rise to splotchy patches on weathered surfaces. Titanite and calcite are other secondary minerals. In places, granite is porphyritic with K-feldspar and subordinate plagioclase phenocrysts in a micrographic groundmass. The dated sample of this unit (Thompson et al., 1996) came from same road-cut as the dated quartz diorite in the Norwood quadrangle .

Zdgr — **Dedham Granite (Neoproterozoic)**— Gray to pink, massive, medium- to coarse-grained granite composed of quartz, plagioclase, perthitic K-feldspar, biotite and locally hornblende. Accessory minerals include allanite, apatite, rutile and zircon. Plagioclase is variably altered to epidote and sericite; biotite and hornblende commonly replaced by chlorite and Fe-oxides (± titanite). K-feldspar commonly salmon-colored on weathered surfaces. The granite is cut by fine-grained, pinkish gray aplite dikes and grades upward into brownish- to pinkish-gray or pale red porphyry containing quartz and subordi nate feldspar phenocrysts in a micrographic matrix. Dedham Granite from localities outside the Newton quadrangle has yielded two other dates that overlap within error the 609.1 ± 1.1 Ma listed in the U-Pb Summary Table below (weighted mean 206Pb/238U dates of Thomp son et al., 2014). The 630 ± 15 Ma upper intercept date of Zartman and Naylor (1984) can no longer be considered meaningful.

EXPLANATION OF MAP SYMBOLS

Contact–Approximately located

Outcrops–Areas of exposed bedrock or closely spaced contiguous bedrock exposures examined in this study. Rendered in slightly darker shades than shown for map unis themselves.

Legacy bedrock outcrops–Taken from maps of Burr (1901) and Kaye (1980). Many of these exposures no longer exist. Circles mark archival exposures of LaForge (1903) shown in 1980 map of Kaye.

Boreholes–Locations of drill core archived by Massachusetts Water Resources Authority from water supply tunnel alignements. Color code same as for surface outcrops.

Approximate location of tunnels for which subsurface maps available–City Tunnel Extension (Billings and Tierney, 1964), City Tunnel (Tierney et al., 1968), Dorchester Tunnel (Richardson, 1977). References in text.

U / D / AM — **Brittle Fault**–Denoted AM where location inferred from aeromagnetic lineament. **U**, upthrown side; **D**, downthrown side.

Anticline

Syncline

BOS29-A2 — **Geochronology sample location**–Dates and details on samples in table below.

Summary of U-Pb zircon dates from the Newton quadrangle

Sample #	Map unit and rock type	Current constraint (Ma)		
		$^{207}Pb/^{206}Pb$ date	$^{206}Pb/^{238}U$ date§	Ref
BOS22A	Brighton Igneous Suite— andesite porphyry (Zbi)		584.19 ± 0.70	1
MT03-09A	Brighton Igneous Suite — dacite porphyry (Zbi)		585.37 ± 0.72	1
MT10-12	Roxbury Conglomerate —lithic wacke (Zrb)		<598.87 ±0.71	1
MT01-28	Lynn-Mattapan Volcanic Complex —rhyolite porphyry (Zlmv)	597.4 ± 1.5*		2
BOS29-A2	Dedham Granite—coarse-grained granite (Zdgr)		609.1 ± 1.1	3

* Date via Thermal Ionization Mass Spectrometry (TIMS) on air-abraded single zircons. All others are CA-TIMS dates from single zircons pre-treated by chemical abrasion. Methods and details of error reported can be found in indicated sources: 1—Thompson et al., 2014; 2— Thompson et al., 2007; 3—Thompson et al., 2010.

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 19T
10 000-foot ticks: Massachusetts Coordinate System of 1983 (mainland zone)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, July 2014
Roads.....HERE, ©2013 - 2014
Names.....GNIS, 2015
Hydrography.....National Hydrography Dataset, 2014
Contours.....National Elevation Dataset, 2008
Boundaries.....Multiple sources; see metadata file 1972 - 2015

UTM GRID AND 2015 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
MN 14° 46 262 MILS
GN 1° 28 26 MILS
U.S. National Grid
100,000-m Square ID
CG
Grid Zone Designation
19T

SCALE 1:24 000
1 0,5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0,5 0 1 MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011. A metadata file associated with this product is draft version 0.6.18

MASSACHUSETTS
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

1 Concord
2 Lexington
3 Boston North
4 Natick
5 Boston South
6 Medfield
7 Norwood
8 Blue Hills
ADJOINING QUADRANGLES

Geology mapped in 1981-84 and 2014-2015 by Thompson.
Other data sources used in compilation listed in explanatory text.
Digital compilation by Thompson.

NEWTON, MA
2015

Notes on subsurface data: Units 1, 4, 8, 11 and 27 of those numbered in strip maps of Billings and Tierney (1964) are ornamented and labelled in cross section; strata below Unit 1 not encountered in tunnel; most of the dikes transected by the tunnel cannot be shown at the scale of this cross section and only a few of the faults can be demonstrated at the surface.

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