

Relative Ages – Units in Middlesex Fells – listed by relative age (youngest to oldest)

(A hypothetical cross section showing age relationships is on page 2.)

Medford Gabbro (Pm) - crosscuts all other units including all other dikes and faults except one small (~5 cm) dike on Governor's Avenue in Medford outside the Fells. Most updated radiometric age: 304 ± 0.56 Ma ($^{40}\text{Ar}/^{39}\text{Ar}$ biotite).

Unnamed gabbro, dolerite, and basalt dikes and their porphyritic variants (gb, d, dp, ad) – various ages (see below).

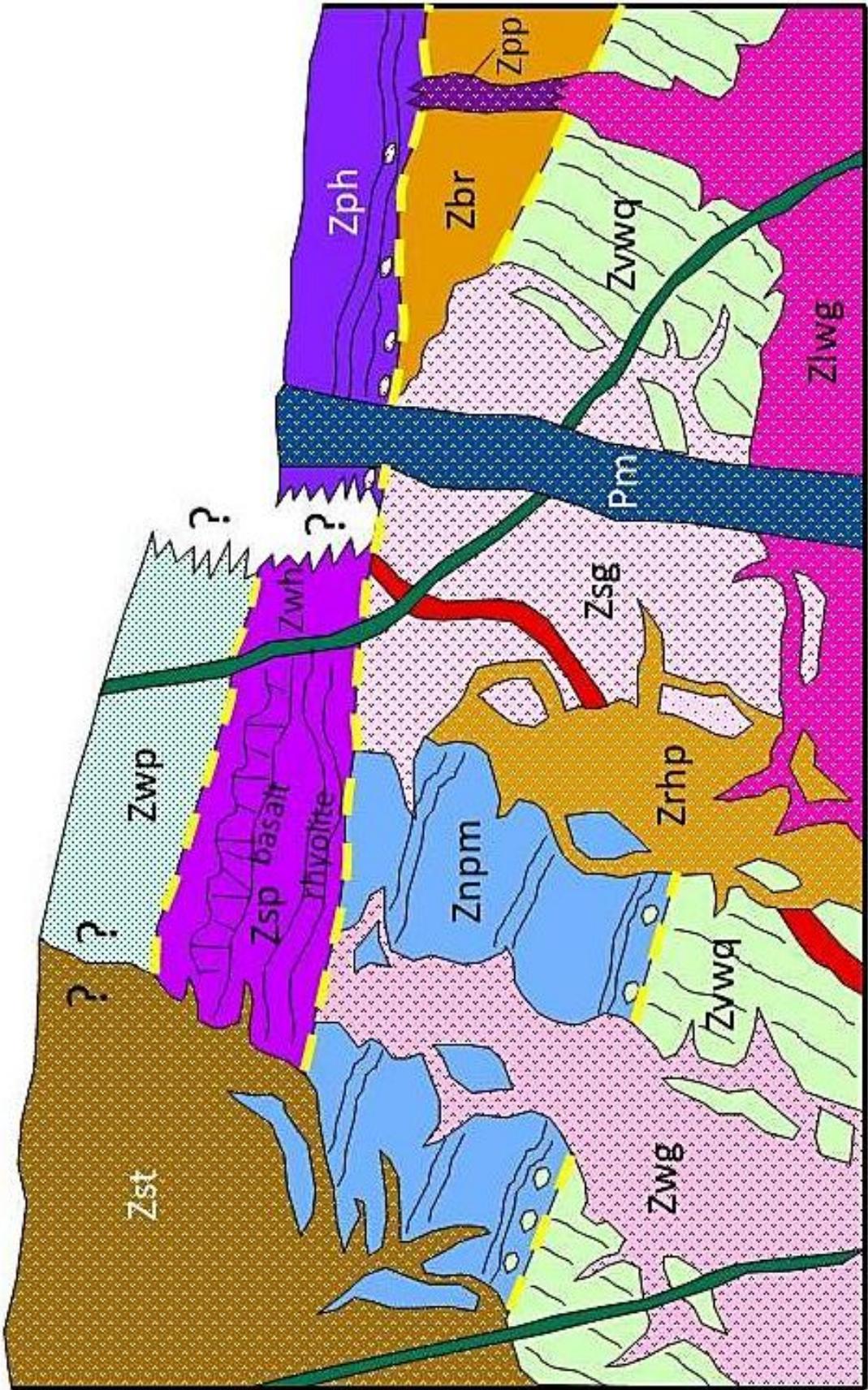
1. Crosscutting relationships between diabase dikes and faults have been determined for several of the dike sets indicating multiple ages. Degree of alteration of different dikes, displacement by faults, well-organized orientation sets (sets of parallel dikes of similar rock type), and crosscutting of different dike sets indicate several ages. Where exposure allows: LaForge's (1932) classification of major E-W dikes crosscutting major N-S dikes is confirmed but there are other directions and not all dikes have crosscutting relationships that can be determined from field exposures.
2. Radiometric ages for basalt, dolerite and gabbro dikes: d (small - 573 ± 5 Ma ($^{40}\text{Ar}/^{39}\text{Ar}$ whole rock), gb - 402.52 ± 3.22 ($^{40}\text{Ar}/^{39}\text{Ar}$ whole rock), d - 353 ± 4 Ma ($^{40}\text{Ar}/^{39}\text{Ar}$ whole rock), d - 290 ± 15 Ma (K/Ar whole rock), d - 226 ± 3 Ma ($^{40}\text{Ar}/^{39}\text{Ar}$ whole rock). The radiometric ages given here are consistent with field relationships and the younger age of E-W trending dikes. They also suggest a wide variety of ages from late Proterozoic to Mesozoic.

BIG Q: Is there a systematic composition, age or paleomagnetic variation with dike set orientation?

Porphyritic andesitic (ap) and red to tan dacitic to rhyolitic dikes (fp, fq) – mixture of at least 3 ages intruding Stoneham Tonalite (Zst), Whip Hill Formation (Zwp), Spot Pond Granodiorite (Zsg), Black Rock Volcanics (Zbrc), Winchester Granite (Zwg), Nanepashemet Formation (Znpm), and Virginia Wood Quartzite (Zvw). These dikes have not yet been found in the Lawrence Woods Granophyre (Zlwg) or cutting across basalt/dolerite dikes. These dikes all have conspicuous chill zones. There are three main compositions: 1) gray porphyritic andesite/dacite, 2) tan to red porphyritic dacite/rhyolite, and 3) rhyolite containing many coarse embayed and rounded xenocrysts and multi-grain xenoliths from coarse plutonic rocks.

1. Gray porphyritic andesite/dacite dikes in the northeast Fells along Spot Pond shore and in Pond Street area to Whip Hill may be associated with the Stoneham Tonalite (Zst) and are at least as young as the Whip Hill Formation (Zwp), which is intruded by the gray dikes.
2. At Wenepoykin Hill, reddish porphyritic rhyolitic dikes cut through the Spot Pond Granodiorite (Zsg) but are crosscut by the Rams Head Porphyry (Zrhp). Irregular reddish rhyolite dikes cut through the Winchester Granite (Zwg). These dikes are not aplite dikes.
3. Several rhyolitic dikes with abundant coarse embayed and rounded quartz, plagioclase and alkali feldspar xenocrysts post-date a coarse plutonic body in the northeast Fells (Stoneham Tonalite, Doleful Pond Granite, or Spot Pond Granodiorite).
4. All felsic dikes are cut by the basalt, dolerite and gabbro dikes in the Fells suggesting an association with Ediacaran magmatism.

BIG Qs: How many ages and what are the ages relative to sialic plutons?



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Wanapanaquin Porphyry (Zwap): Red/orange color due to hematite in matrix, only on Wanapanaquin Hill.

- 1) Same composition, but with reddish-orange color (due to hematite staining), as Stoneham Tonalite (Zst). Probably a porphyritic branch of the tonalite, similar to tonalite contact areas east side of the large fault on west side of Bear Hill. This would be the only area of Stoneham Tonalite west of the fault.
- 2) Cuts across Nanepashemet Formation.
- 3) Cut by dolerite dikes (d) and altered dolerite dikes (ad).

Stoneham Tonalite (Zst): Mostly equigranular but porphyritic in chill zones. Contains altered plagioclase with clean rims. Higher mafic content than most other large sialic intrusive bodies in area. Red color in places is due to hematite stain/oxidation in matrix.

- 1) Unit has abundant inclusions of Virginia Wood Quartzite both as white quartzite and argillite hornfels (especially on Deer Hill) and basalt hornfels of Nanepashemet Formation (Znpm) and Straw Point Volcanics (Zspb).
- 2) Appears to have a roof pendant of hornfels from the Virginia Woods Quartzite (Zvw) on Deer Hill and at Sheepfold and from the Nanepashemet Formation at Sheepfold and further north on Winthrop and Bear Hills and Taylor Mountain.
- 3) Chill zone contact where it intrudes Straw Point Volcanics at north end of Spot Pond.
- 4) Probably feeds Wanapanaquin Porphyry (Zwap).
- 5) Separated from Winchester Granite (Zwg) by a major fault west of Bear Hill and has less alkali feldspar than the Winchester.
- 6) No contact with other plutonic bodies or Whip Hill Formation have been found. Intrusion of the Whip Hill Formation seems likely near Whip Hill. Gray dacitic to andesitic dikes on Whip Hill and along Pond Street may be related to this unit.

BIG Q: How young is this unit – is it Ediacaran or younger?

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Whip Hill Formation (Zwp) - gray laminated to massive rusty-weathering mudstone and siltstone, with light gray sandstone olistoliths that are all highly deformed in mass flow units. Unit is not foliated by regional metamorphism and has well preserved laminated bedding and ripple crossbeds that appear to strike ~E-W and dip steeply ($+75^\circ$ in most places with some slightly overturned) with up to north. Laminated mudstone and siltstone with preserved bedding has a strong anisotropy of magnetic susceptibility (AMS) foliation at a low angle to the plane of bedding but a weak lineation, suggestive of a sedimentary fabric. Could be a candidate for a paleomagnetic pole position if not overprinted by local intrusive and volcanic rocks and not rotated.

- 1) Includes a small enigmatic exposure of volcanic rock, similar to Wamose Hill Volcanics, along a fault at north end of Whip Hill.
- 2) Unconformably overlies Wamose Hill Volcanics southwest of DCR maintenance yard, at southern end of Whip Hill and in Whip Hill Park. Also has fault contacts with Wamose Hill Volcanics.

BIG Q: Could this be a Cambridge Argillite or distal Roxbury equivalent?

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Volcanics in Northern Fells

Straw Point Volcanic Complex (Zspr, Zspc, Zspb) – units form a gently dipping bimodal volcanic sequence at northwest corner of Spot Pond (Straw Point) including sialic (Zspr, Zspc) and basaltic (Zspb) units interbedded with contorted greenish gray laminated argillite. Also occurs as banded rhyolite flow at north end of Middle Reservoir.

- 1) At north end of Middle Reservoir low angle banded sialic lava and layered pyroclastic units sit on an angular unconformity with foliation/bedding in hornfels and conglomerate of the Nanepashemet Formation (Znpm).
- 2) Intruded by Stoneham Tonalite (Zst) at Straw Point.
- 3) Contains embayed and rounded quartz xenocrysts from coarse granodiorite or granite (Zwg, Zsg or Zdpg)
- 4) Unlike the Wamose Hill Volcanics it has a basaltic component at Straw Point.
- 5) Radiometric age: Zspr @ Middle Reservoir – 594.7 ± 0.3 Ma (zircon, ID-TIMS) at Middle Reservoir. This is similar to age for the Wamose Hill Volcanic Complex.

Wamose Hill Felsite (Zwh): welded and non-welded crystal and lithic tuffs and rhyolitic lavas that form lithic pyroclastic, fine porphyritic, and banded rhyolites and volcanoclastic rocks with coarse embayed quartz xenocrysts.

- 1) Unconformably overlain by Whip Hill Formation (see above).
- 2) Contains quartzite and argillite lithic fragments from Virginia Wood Quartzite (Zvwq).
- 3) Contains embayed and rounded quartz xenocrysts from coarse granodiorite or granite (Zwg, Zsg or Zdpg).
- 4) Overlies Virginia Wood Quartzite (Zvwq) along an unconformity east of Spot Pond. Quartzite lithic fragments, irregular trace of contact with lack of fracturing and truncation of metamorphic foliation in quartzite below argue against a fault.
- 5) Unit does not have the metamorphic grade or fabric of the Virginia Wood Quartzite below.
- 6) It has strictly sialic (rhyolitic) components unlike the Straw Point Volcanics.
- 7) Radiometric age: Zwh @ Wamose Hill – 595 ± 0.22 Ma (zircon, ID-TIMS). This age is younger than the Spot Pond Granodiorite and Winchester Granite but similar to Straw Point Volcanics at Middle Reservoir (see above).

BIG Q: Is this a Pine Hill Volcanics equivalent – similar lithology? This is the working hypothesis.

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Pine Hill Felsite in Pine Hill area, 2 distinct members (Zpt, Zpmh):

Zpmh (lower member – Middle Hill Member) – basal volcanoclastic rocks with quartz and alkali feldspar crystals (xenocrysts), and granite lithic debris derived from Spot Pond Granodiorite (Zsg), and volcanic and quartzite/argillite hornfels lithic debris; May be equivalent of Zbjc facies of Boojum Rock area.

Zpt (upper member – Wrights Tower Tuff Member) - welded to non-welded crystal and lithic tuffs of Pine and Middle Hills and at Wrights Pond.

- 1) Zpt inclusion in Zlwg at west side of Middle Hill.
- 2) Zpt intruded by Zlwg on southern Pine Hill, to west on Little Pine Hill, and at Wrights Pond with chill zone in Zlwg.
- 3) Zpmh has brecciated granophyre lithic clasts at one place west of Bellevue Pond just above contact with Zlwg while east of Bellevue Pond the granophyre intrudes Zpt – The Lawrence Wood Granophyre and Zpmh appear to be partly coeval.
- 4) Zpmh has granite debris from Spot Pond Granodiorite (Zsg) in volcanoclastic conglomerates on Little Pine, Middle, and Pine Hills and west of Middle Hill.
- 5) Quartzite lithics in Zpt and Zpmh (some mylonitic and some with intact round grains) and abundant volcanic lithic fragments of a variety of types.
- 6) Intruded by dolerite dike dated at 573 Ma as well as many younger dolerite and gabbro dikes.

BIG Q1: How does this unit relate to Wamoset Hill and Straw Point Volcanics in northern Fells?

BIG Q2: What are its equivalent units further east (see Smith and Hon, 1984)?

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Facies of Pine Hill Volcanics in Boojum Rock area (Zbjv, Zbjb, Zbjc, Zbjp): occurs east of the Flynn Ice Rink on Boojum Rock as far east as the MIT Observatory and at northeast corner of Wrights Pond. The unit is not divided into members due to complex shearing along Woodland Road associated with Quarter Mile Pond Fault.

Zbjv - ultra fine-grained chert-like vitric tuff with only very small crystals that are hard to detect in outcrops.

Zbjb - mixture of pyroclastic banded and welded crystal to lithic tuffs with a dark purplish gray color and in some places very well preserved primary volcanic structures such as banding and fiammé. Includes areas that look like coarse dark gray porphyry but are a highly welded large crystal tuff. Also has patches of reddish volcanic breccia like in unit below. At northeast Wrights Pond includes dark reddish black welded and pyroclastic banded tuff with varying crystal and lithic fragment concentrations.

Zbjc - basal breccia and volcanoclastic conglomerate and sandstone unit that contains volcanic, quartzite, alkali granite (possibly Ball Quarry Granite of Smith and Hon, 1984), and well-bedded argillite clasts. Unit seems to grade upward from an unconformity first as volcanic breccia with highly angular red volcanic clasts and then into much better sorted rounded-pebble, polymictic conglomerate with occasional red sandstone clasts. The unit unconformably overlies the Spot Pond Granodiorite (Zsg) northeast of the ice rink across Woodland Ave. In some places the base has an intensely reddish-brown color suggestive of oxidation by weathering or oxidation related to contact metamorphism near the contact with the Lawrence Woods Granophyre (Zlwg). This unit appears to be an equivalent of Zpmh in the Pine Hill area.

Zbjp –traceable zone of reddish to pinkish gray porphyritic rhyolite with non-broken euhedral plagioclase crystals and very few lithics. Has flow banded zones and thinner volcanoclastic zones with rounded volcanic clasts along its contacts. Interpreted to be a volcanic fissure cutting across older Black Rock Volcanics in the southeastern Fells as an offshoot of the Lawrence Woods Granophyre.

Contacts and continuity of the Boojum Rock units are hard to trace because of intense shearing and dismemberment of rocks east of the Quarter Mile Pond Fault along Woodland Road.

- 1) Breccia and conglomerate of Zbjc rest on an unconformity on the Black Rock Volcanics (Zbrc) and the Spot Pond Granodiorite (Zsg).
- 2) Basal unit contains granite pebbles and boulders including red alkali granite possibly from Ball Quarry Granite and abundant quartz grains, which are rare in the underlying Black Rock Volcanic Complex.
- 3) Intruded by Lawrence Woods Granophyre along Woodland and East Border Roads. But unit above this contact may also have granophyre lithic fragments suggesting a coeval relationship between Pine Hill and Lawrence Woods units.
- 4) Well preserved volcanic structures: units with banding and flattened pumice with rapid facies changes.
- 5) Many dark reddish to purplish gray to reddish brown banded tuff and crystal tuff lithic fragments.
- 6) Red porphyritic rhyolite unit (Zbjp) seems to form a fissure cutting across the Black Rock Volcanics and appears to be associated with the Lawrence Woods Granophyre (Zlwg).

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Lawrence Woods Granophyre (Zlwg – pinkish gray granophyric porphyry): euhedral phenocrysts of plagioclase, embayed quartz, and granophyric and micrographic matrix of fine alkali feldspar and quartz. Needle-like amphibole phenocrysts. Subvolcanic intrusive unit that appears to be associated with Pine Hill Volcanics.

- 1) Chill zone against Zpt and Zpmh of Pine Hill Volcanic Complex, Pine Hill Volcanics at Boojum Rock and at Middle Hill and Pine Hill areas. Intrudes Spot Pond Granodiorite (Zsg) in Lawrence Woods, near Pine and Middle Hill areas, and near Boojum Rock. Also occurs as lithic fragments in base of Pine Hill Volcanics (Zpmh) west of Bellevue Pond and above Woodland Avenue suggesting a coeval relationship.
- 2) Contains xenolith of Zpt in valley on west side of fault along west side of Middle Hill.
- 3) Has a peculiar contact zone with Zlwg that makes Zpt look porphyritic at Pine Hill.
- 4) Has chill zones against Rams Head Porphyry at Medford High School entrance and nearby in Lawrence Woods with Spot Pond Granodiorite (Zsg).
- 5) Has an inclusion of Rams Head Porphyry (Zrhp) south of South Border Road near Lawrence Memorial Hospital in Lawrence Woods.
- 6) U-Pb zircon (ID-TIMS) ages (2 populations, both possibly inherited): 598.13 ± 0.27 Ma; 596.77 ± 0.25 Ma

BIG Q: Can Zpmh form on an unconformity over Zlwg in some places while being intruded in others – does Zpmh contain brecciated granophyric clasts? Yes, west of Bellevue Pond and possibly above Woodland Avenue. Zpmh seems to be baked and intruded by Zlwg in other places.

Rams Head Porphyry (Zrhp): Porphyritic, highly plagioclase-dominated quartz diorite porphyry with very low alkali feldspar abundance.

- 1) Unit has a chill zone in contact with the Spot Pond Granodiorite just west of Rt. 93 on the west side of Wenepoykin Hill and at the southern end of South Reservoir where the Spot Pond Granodiorite may form a roof pendant.
- 2) Unit has inclusions of Spot Pond Granodiorite (Zsg) in the areas mentioned above and they are partly assimilated, especially at point on west side of eastern embayment at south end of South Reservoir.
- 3) Occurs as inclusions in the Lawrence Woods Granophyre (Zlwg) in Lawrence Woods.
- 4) Cuts across reddish-colored rhyolite dikes that cut through Spot Pond Granodiorite on Wenepoykin Hill.
- 5) Small area of mafic-rich diorite (dr) along fault west of southern end of South Reservoir is probably this unit.
- 6) U-Pb zircon (ID-TIMS) age: 596.24 ± 0.16 Ma

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Black Rock Tuff (Zbrc, Zbrl, Zbrv): dacitic crystal and lithic tuff that is dark greenish gray on fresh faces with rare quartz crystals (or xenocrysts from quartzite) and a dominance (up to 50% and possibly more) of plagioclase crystals with scattered hornblende crystals in various states of alteration.

Zbrc is crystal tuff occurring over a wide area in the southeastern Fells.

Zbrv is an area of vitric and faintly banded tuff on the southeastern side of the Fells that has very small crystals that are difficult to detect in outcrops.

Zbrl is a traceable zone of lithic tuff within Zbrc that has volcanic and quartzite lithic fragments.

All units show evidence of a steeply eastward-dipping features.

- 1) Entire unit is pyroclastic with no intrusive component.
- 2) Volcanic (sialic) and quartzite/argillite lithic fragments but no granitic fragments or debris.
- 3) Unlike other volcanic units it has only rare angular and broken fine quartz fragments that are likely xenocrysts from the Virginia Wood Quartzite, i.e. no coarse embayed or resorbed quartz from plutonic bodies.
- 4) Subtle cleavage-like fractures that are not found in the Pine Hill Volcanics suggest a period of light deformation not experienced by the younger units, likely while still hot. This deformation is associated with slickensided surfaces that have hematite mineralization, especially near the MIT Observatory on Boojum Rock.
- 5) Pine Hill Volcanics at Boojum Rock lie unconformably on Black Rock with basal breccias and conglomerates.
- 6) Radiometric age: Zbrc @ Hemlock Pool – 602.1 ± 3.9 Ma (LA-ICPMS, 42 zircons). This age is similar, given uncertainties, to the Spot Pond Granodiorite and Winchester Granite.
- 7) Black Rock Volcanics are thought to unconformably overlie the Virginia Wood Quartzite south of Virginia Wood but this contact is concealed by glacial sediment.
- 8) Contact with Spot Pond Granodiorite is exposed east of Woodland Avenue but its interpretation remains uncertain. These units may be coeval. No granite debris occurs in the base of the Black Rock and the Spot Pond has no xenolithic material from the volcanics.

BIG Q1: Could this unit be coeval with Rams Head Porphyry or Spot Pond Granodiorite?

BIG Q2: Is this unit intruded by the Spot Pond Granodiorite east of Woodland Road or does it form a volcanic pile over it?

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Spot Pond Granodiorite (Zsg) and Doleful Pond Granodiorite (Zdpg): coarse granodiorite to granite with perthitic alkali feldspar and high quartz content. Plagioclase dominates feldspar. Was lumped with other units into Dedham Granodiorite. This is the rock type considered the ideal Dedham.

- 1) Pieces of Zsg in Zpmh of Pine Hill Volcanics.
- 2) Rare inclusions of sialic volcanic rock (Zfi) of uncertain origin in Zsg.
- 3) Intermingling contact (?) with Black Rock Volcanics (Zbrc) northwest of Fells Reservoir suggests coeval volcanics, no crystal tuff inclusions from Black Rock have been found in granodiorite and no evidence of granodiorite inclusions have been found in Black Rock.
- 4) Abundant large inclusions of Virginia Wood Quartzite (Zvwq) at south end of Spot Pond, along Rt. 28, and west of Rt. 93 over to Winchester Reservoirs. These inclusions and Zsg get truncated along contacts with Zlwg and Zrhp.
- 5) Contact area with Virginia Wood Quartzite west of Rt. 93 has a well defined mylonitic fabric paralleling contact and large E-W fault. Interpreted to be the result of shearing of weak granodiorite along fault. Magnetic susceptibility indicates shear in mylonite is east-west (i.e. horizontal). Fault is very steep – close to vertical.
- 6) Contains areas of leucocratic alkali granite (Zsgk). Are these xenoliths?
- 7) Radiometric age: Zsg @ Red Cross Path – 609.5 ± 0.2 Ma (zircon, ID-TIMS); $602.2 + 4.4$ Ma (LA-ICPMS, 38 zircons). This age is virtually identical to the Black Rock Volcanics and Winchester Granite.

BIG Q: What unit are the sialic volcanic inclusions from (pre-Zsg) and are the alkali blocks xenoliths?

Winchester Granite (Zwg - dark red to orange pink medium-grained granite): distinctly alkaline appearing equigranular granite to granodiorite with red-colored K-spar and medium grain size in northwest Fells. Contains elongate lenticular rhyolite dikes. Unit is never porphyritic (even in contact areas) and has larger quartz grains. Unit is much more alkaline than the Stoneham Tonalite (Zst). Unit also has more alkali feldspar than and is finer than the Spot Pond Granodiorite (Zsg).

- 1) Intrudes Nanepashemet Formation in northwest Fells creating metabasalt hornfels in Nanepashemet. Along the contact the Nanepashemet may recrystallize to amphibolite with large hornblende crystals.
- 2) Intrudes Virginia Wood Quartzite (Zvw) with relatively smooth intrusive contact over long distances with rare quartzite xenoliths.
- 3) Has many light-colored rhyolite dikes that do not occur in the Stoneham Tonalite (Zst).
- 4) Separated from Stoneham Tonalite by a major fault and does not share a contact with the Stoneham.
- 5) Contains xenoliths (?) of alkali granite (Zsgk) and quartz diorite (Zwgd) on Money Hill in Winchester. Radiometric ages: Zwg @ east Long Pond – 609.72 ± 0.24 Ma (zircon, ID-TIMS); $605.7 + 3.3$ Ma (LA-ICPMS, 40 zircons). These ages are older than the Straw Point and Wamoset Hill Volcanics and indistinguishable from the Spot Pond Granodiorite.

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Nanepashemet Formation (Znpm): Dark (almost black) to medium gray to greenish gray metabasalt and dark greenish black mudstone and volcanic pebble conglomerates. Unit appears massive in outcrop and is usually hornfels because of alteration near Stoneham Tonalite, Winchester Granite, and mafic dikes. Has a quartzite-bearing red conglomerate/breccia and laminated sandstone/mudstone at base on Molly's Spring Road and dark volcanic pebble conglomerates (with a few sialic pebbles) and a marble (skarn) unit at the north end of Middle Reservoir.

- 1) Unit overlies Virginia Woods Quartzite along Molly's Spring Road. This contact is rarely exposed due to faulting and intrusions. There is a change in metamorphic grade across the contact and truncation of foliation below in the Virginia Wood. Base of unit contains conglomerate, breccia, and mudstone with clasts from Virginia Wood and occasionally well-preserved sedimentary layering that has not been altered by metamorphism.
- 2) Unconformably overlies the Virginia Wood Quartzite (Zvwq) at south end of Sheepfold.
- 3) Top of unit at north end of Middle Reservoir has steep bedding truncated by gently dipping layering in pyroclastic and flow units of rhyolite in Straw Point Volcanics indicating an unconformity.
- 4) Structures in this unit are recrystallized and obscured by contact metamorphism across most of the Fells.

Mapping has reinterpreted areas of hornfels that were previously mapped as quartz vitrophyre and vitrophyre (basalt) by Kaye (1980). No basaltic flow or pillow structures or vesicular units have been found in the Fells but may occur at the Stoneham High School tennis courts (see Smith and Hon, 1984).

BIG Q: How did this unit form?

Westboro Formation(Zvwq): interlayered white to dark gray quartzite and sheared siliceous argillite with a large band of calcium/magnesium silicate rocks containing tremolite, diopside, calcite, and zoisite. Unit has mylonitic and necked quartzite layers and units with highly stretched, sutured and polycrystalline quartz grains with muscovite tails and shadows in some places. Has preserved bedding in isolated places with a bedding parallel metamorphic foliation and a well developed AMS (magnetic susceptibility) foliation with a distinct lineation indicating stretching in addition to flattening. Small scale folds are developed through relict bedding, especially in calcium/magnesium-silicate units, that give a sense of shear.

- 1) Unit is deformed and metamorphosed with a distinct metamorphic fabric as compared to all other units.
- 2) On Wamoset Hill foliation is truncated by unconformity at contact with Wamoset Felsite.
- 3) Occurs as large xenoliths in the Spot Pond Granodiorite and lithic fragments in the Black Rock Volcanics (Zbrc) and all younger volcanic units.
- 4) Has the same zircon age population as quartzites further east at Breakheart Reservation in the Westboro Formation (see Thompson et al., 2012). Detrital zircon crystals yielded a youngest U-Pb age of 909 +/-24 Ma (LA-ICPMS; F. MacDonald, pers. com.) Limits age to less than ~900 Ma.
- 5) Occurs as pebbles in the base of the Nanepashemet Formation west of South Reservoir and along Molly's Spring Road.