

## **Hollis Rocks! The Tour**

**Introduction:** On this self-guided geology tour around Hollis stopping here and there, you will discover outcrops of the seven types of bedrock underlying Hollis – two kinds of granite, three colors of schist, and a weird old gneiss. You will find several places where you can't take Hollis for granite and then a few where you actually can, and you will learn why geologically, Casablanca, Hollis and Glasgow are sister cities.

The tour consists of nine stops, three short walks and two drive-bys. It covers much of Hollis plus corners of Milford, Amherst, and Merrimack - around twenty seven road miles. It will take two to three hours to complete. One of the stops will be the top of the hill on the north end of Woodmont Orchard. The entry road is rutted gravel and the turnaround on top is meadow grass, so don't bring your Lamborghini. The self-guided tour ends up at Home Depot on 101A in Merrimack so you may want to bring your shopping list.

**Bring:** Tote bag or small backpack, clipboard, pencil, magnifying lens, comfortable walking shoes, insect repellent, a drink bottle and a snack, compass, binoculars and camera are suggested, but are optional.

On this tour we will learn about:

- Three kinds of rock: 1. Old Sediments; 2. Old Lava 3. Too Old and Beat Up to Say.
- How to tell bedrock from imports.
- Locations and examples of the seven different kinds of bedrock under Hollis.
- The three sources of Hollis bedrock.
- Terrain features in Hollis representing geologic faults and lines of bedrock contact.

Before going out on the tour make sure you download the following:

- 1) Bedrock map of Hollis
- 2) Bedrock map of NH
- 3) Geology tour stops - a Hollis street map with the tour route highlighted and numbered locations of our stops.
- 4) Three stories written by Jim Canfield about Hollis Geology that were printed in the Hollis-Brookline Journal during the summer of 2003.
  - Out of Africa: About Woodmont Orchard.
  - Hollis Rocks! Part 1: About the rocks of East Hollis.
  - Hollis Rocks! Part 2: About the rocks of West Hollis

Recommended Reading: The Map That Changed The World by Simon Winchester, ISBN 0-06-093180-9 (paperback) Harper Collins/Perennial, 2002.

## **The Hollis Rocks Tour:**

### Directions to Tour Stop #1

(Take Depot Road south, descend after crossing the east Hollis bedrock wrinkle fault, end at Rt. 111. Note predominant hardwoods and conifers beside the road. Turn left at light, cross over Nashua River on Runnells Bridge, go 2/3 mile, turn left on entry road to Overlook Golf Club. Park on far left corner of lot. 3.8 miles in 9 minutes.)

### Tour Stop #1: Overlook Golf Club

A. Northwest Corner Parking lot: Berwick Formation [Sob], Silurian-Ordovician (405-500 million year old), gray slate-like schist also found in Morocco, North Africa, in the Atlas Mountains.

B. Base of 8<sup>th</sup> hole elevated tee: Exeter Diorite [De9] – a dark gray early Devonian (345-405 million year old) granite with black mica (diorite) crystals.

### Directions to Tour Stop #2

Right (west) on Rt. 111, back over Runnells Bridge, right on Depot Rd. and a quick right again, into the parking area. 0.8 miles in 3 minutes.

### Tour Stop #2

Runnells Bridge pull-off: More Berwick Formation, but now with rusty discoloration and streaks of calc-silicate [Sobc], flakes of yellow mica (muscovite) and bands of quartz. More of North Africa left in New England, from what is called the Appalachian orogeny. Here the river follows a bedrock contact line.

### Directions to Tour Stop #3

Depot Rd. to Rideout Rd. stay left at Parker Road, cross Broad Street to S. Nartoff Rd. to Lone Pine Road. Right then left on to N. Nartoff Rd. and go 1/8 mile to a right turn on to Elnathans Way; circle the cul-e-sac and park on right. Note trees and land uses along the way. Look for white oak, shagbark hickory, white birch, ash trees and healthy lawns. 4.3 miles in 11 minutes.

### Tour Stop #3

Elnathan's Way: A fine exposure of a dark brown variant of Berwick Formation, the Silurian Ordovician rusty schist [Sobc]. This is the "down side" of an up-thrust fault, the same east Hollis wrinkle fault we crossed on Depot road, south of here. This is the same rock encountered in building the new Hollis-Brookline High School outdoor track.

### Directions to Tour Stop #4

(N. Nartoff to Pine Hill Rd. to Broad St. to light. Right on Silver Lake Rd. to pull-off, north border of Silver Lake Park.. Pick up late arrivals, drop off drop-outs in town. En route, note roadside tree species, underbrush and land uses. Seen any hemlock, red oak, spruce, cedar or mountain laurel yet? Turf grass, tree fruits and vegetable crops seem to do well around here. 4.2 miles, 10 minutes)

### Tour Stop #4

Silver Lake Road Pull-off: The Moroccan Hollis-Yankee Hollis line. Where the old rusty schist stops and the Permian (230-280 million year old) granite [P1m] begins. This is both a geologic fault and a bedrock contact line. Look at your maps on edge and see how the west sides of Pennichuck Pond, Dunklee Pond and Silver Lake line up. Fly over Hollis early or late on a clear day and you'll see it like a zipper. The side of that block of rusty schist across the road reveals the line.

### Directions to Tour Stop #5

(North on Silver Lake Road, right on the private dirt orchard road at the top, and slowly drive up into north Woodmont Orchard. Follow the lead vehicle at the top, drive carefully over the grass between the peach trees, and loop around to park in a line, facing south. 1.4 miles, 8 minutes.)

### Tour Stop #5

The top of north Woodmont Orchard: Elevation 500 feet above sea level. Glacially polished exposures of Permian two mica granite/Rusty schist contact. Granite dike shows flow lines or “schlieren”, and flakes of black and yellow mica, glacial scouring and metamorphism. Hollis topography in tectonic context. If it’s clear, from here we can see Mt. Watatic, Mt. Wachusett, Birch Hill, Temple Mountain, Pack Monadnock, Federal Hill, Fort Mountain, The Atlantic Ocean, the top of the Prudential Tower and the top of the bell tower on the Hollis Town Hall. This is a pretty special place in Hollis.

### Directions to Tour Stop #6

(Return to Silver Lake Road, turn right then left after the ice pond, on to Plain Rd. to its non-surfaced end. Turn right on Federal Hill Rd., cross Hayden Road, continue up to Milford line. Note some trees and ground cover you haven’t seen earlier. You’re over granite now, and have entered Yankee Hollis, where spruce, hemlock, red oak, yellow birch and mountain laurel thrive. Watch for transitions back and forth between granite bedrock acid soil native flora and then mixed rock glacial overlay and agriculturally amended neutral pH soil environments. After the road becomes surfaced at the Milford town line, pull in to the trail access parking on the right. 2.8 miles, 10 minutes.)

### Tour Stop(s) #6

Permian granite/Massabesec gneiss contact; the Yankee Hollis/Celtic Hollis line. Look for exposures of gray granite Permian biotite granite [P1m] and exposures and erratics of the Precambrian (over 425 million year old) Massabesic Gneiss [Zmz]. This is the oldest rock in Hollis. Look for blueberries, mountain laurel, spruce and hemlock and other acid soil flora. Continue on another half mile and pull over on the right side of the road to study glacially scoured exposures of – surprise – Permian gray biotite granite. (Per the geologic map, this stuff isn’t supposed to be here.)

### Directions to Tour Stop #7

(Watch carefully for traffic while pulling out. Continue north down Federal Hill Rd. 1 mile to right turn on Mountain View Rd. Take first right on Stone Court. Circle the cul-de-sac, and park. 1.5 miles, 5 minutes.)

### Tour Stop #7

Stone Court. Freshly excavated boulders of Massabesic Gneiss, an ancient sea floor sedimentary rock. You’ll find outcrops of this rock if you climb up to the top of Birch Hill from Rocky Pond. It displays striking gray and black and occasionally white laminations. Here it shows severe deformation and much metamorphism. This is a remnant of old Avalon, a rock also found in the north and west of Scotland and Ireland, left here during the Acadian orogeny, which preceded the Appalachian orogeny. This distinctive, ancient rock may make a tectonic movement believer of you. Hold a piece up to your ear and listen for bagpipes.

### Directions to Driveby

(Return to Federal Hill Rd. north to end, on Emerson Rd. Turn left, take Emerson Rd. to light on Rt. 13 and turn right. Take next right on to 101 East, until next exit, to Rt.101A . Look at the patterns in

the rock as you pass, especially on left (west) side Take a right at end of exit ramp, to Rt. 101A east and proceed about 1 mile. Just before the traffic light at Rt. 122, turn right up Overlook Park access road and an immediate left on the road to The Shoe Box. Park in parking lot. 4.1 miles, 13 minutes.)

### Driveby (DB)

Rt. 101 to 101A Exit drive-by, left (west) side. Permian gray diorite granite intrusions into fractured, deformed Massabesic Gneiss [Zmz]. Vertical walls of cut rock show contorted and disrupted layers of Massabesic gneiss. Fractures in the gneiss are injected by columns of gray Permian biotite granite. This is what the rock under the top of Federal Hill Road in Hollis would look like cut in deep cross section, too. It also resembles what you would see in a vertical slice of the rock under where we stood at the top of Woodmont Orchard, but with brown Rusty schist rather than gray Massabesic gneiss being intruded by the granite. The patterns in the rock here should help you to appreciate that under great heat and pressure, over time, rock is a plastic medium.

### Tour Stop #8

Parking Lot, The Shoe Box: Hands-on close-up of Permian Granite intrusions into Massabesic Gneiss. Good example of deformations and metamorphosis of the Massabesic gneiss as well as granite schlieren. The variation in composition and metamorphosis of the granite caused by flow structuring and contact rock admixture show how making granite is like making ice cream.

### Directions to Tour Stop #9

(Take 101A east 2 miles, past Wal-Mart, South Merrimack Road and PC Connection, to left into entry road, Home Depot. Go up entry road as drive-by #2 to top, then take right to go behind Home Depot; follow service road to left turn at end of building and park. 4.1 miles, 13 minutes )

### Home Depot Driveby

Home Depot entry and exit roads: Rusty Schist [SObc] contact with Silurian Ordovician (405-500 million year old) White Muscovite Schist [Sobg], the third distinct variant of the Berwick Formation to be found in Hollis. Why can't Home Depot display outdoor building materials neatly? You'll see more rusty schist displayed down the exit road by Dunkin' Donuts, just as badly arranged.

### Home Depot Tour Stop #9

Northeast corner, service road behind Home Depot. "The Magnificent 7" What rocks make up the "7" ? Can Home Depot install one of these in my back yard? Was the "7" made like the granite "flames" in the gneiss behind the Shoe Box? Is this "7" older or younger than the "flames"?

Post-tour bonus: return to the center of Hollis where this tour started by taking Rt. 101A west to the light at South Merrimack Rd., turn left and go ¼ mile to a right turn on Witches Spring Road. This takes you through what I call the "Savannah of North Hollis", the portion over white schist bedrock and its sweet sandy soils, supporting acres of meadow grass and the Pennichuck aquifer. I can't find a bedrock exposure of white schist in Hollis like Home Depot's. Please let me know if you can! You will recognize where Witches Spring Road enters granite country before it ends at Silver Lake Road. By the time you're done today, you will have become a bedrock savvy citizen of Hollis.

