

FCOPG Geo-Bike Tour

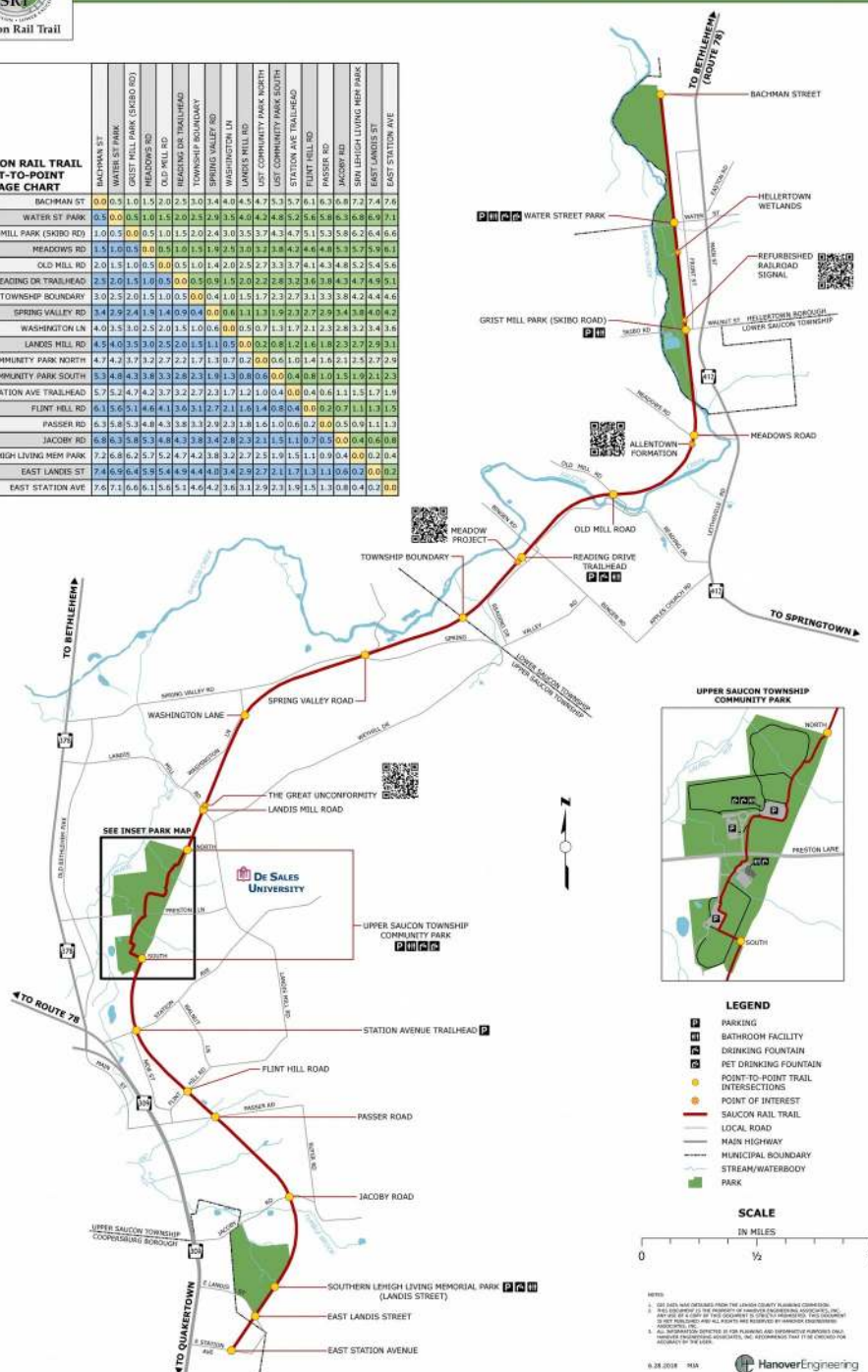
04 October, 2018
Frank J Pazzaglia, Lehigh University



SAUCON RAIL TRAIL

SAUCON RAIL TRAIL POINT-TO-POINT MILEAGE CHART

	BACHMAN ST	WATER ST PARK	GRIST MILL PARK (SKIBO RD)	MEADOWS RD	OLD MILL RD	READING DR TRAILHEAD	TOWNSHIP BOUNDARY	SPRING VALLEY RD	WASHINGTON LN	LANDS MILL RD	USF COMMUNITY PARK NORTH	USF COMMUNITY PARK SOUTH	STATION AVE TRAILHEAD	FLINT HILL RD	PASSER RD	JACOBY RD	SIRN LEHIGH LIVING MEM PARK	EAST LANDIS ST	EAST STATION AVE
BACHMAN ST	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.4	4.0	4.5	4.7	5.3	5.7	6.1	6.3	6.8	7.2	7.4	7.6
WATER ST PARK	0.5	0.0	0.5	1.0	1.5	2.0	2.5	2.9	3.5	4.0	4.2	4.8	5.2	5.6	5.8	6.3	6.8	6.9	7.1
GRIST MILL PARK (SKIBO RD)	1.0	0.5	0.0	0.5	1.0	1.5	2.0	2.4	3.0	3.5	3.7	4.3	4.7	5.1	5.3	5.8	6.2	6.4	6.6
MEADOWS RD	1.5	1.0	0.5	0.0	0.5	1.0	1.5	1.9	2.5	3.0	3.2	3.8	4.2	4.6	4.8	5.3	5.7	5.9	6.1
OLD MILL RD	2.0	1.5	1.0	0.5	0.0	0.5	1.0	1.4	2.0	2.5	2.7	3.3	3.7	4.1	4.3	4.8	5.2	5.4	5.6
READING DR TRAILHEAD	2.5	2.0	1.5	1.0	0.5	0.0	0.5	0.9	1.5	2.0	2.2	2.8	3.2	3.6	3.8	4.3	4.7	4.9	5.1
TOWNSHIP BOUNDARY	3.0	2.5	2.0	1.5	1.0	0.5	0.0	0.4	1.0	1.5	1.7	2.3	2.7	3.1	3.3	3.8	4.2	4.4	4.6
SPRING VALLEY RD	3.4	2.9	2.4	1.9	1.4	0.9	0.4	0.0	0.6	1.1	1.3	1.9	2.3	2.7	2.9	3.4	3.8	4.0	4.2
WASHINGTON LN	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.6	0.0	0.5	0.7	1.3	1.7	2.1	2.3	2.8	3.2	3.4	3.6
LANDS MILL RD	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.5	0.0	0.2	0.8	1.2	1.6	1.8	2.3	2.7	2.9	3.1
USF COMMUNITY PARK NORTH	4.7	4.2	3.7	3.2	2.7	2.2	1.7	1.3	0.7	0.2	0.0	0.6	1.0	1.4	1.6	2.1	2.5	2.7	2.9
USF COMMUNITY PARK SOUTH	5.3	4.8	4.3	3.8	3.3	2.8	2.3	1.9	1.3	0.8	0.0	0.4	0.8	1.2	1.5	1.9	2.3	2.5	2.7
STATION AVE TRAILHEAD	5.7	5.2	4.7	4.2	3.7	3.2	2.7	2.3	1.7	1.2	1.0	0.4	0.6	0.9	1.1	1.5	1.9	2.1	2.3
FLINT HILL RD	6.1	5.6	5.1	4.6	4.1	3.6	3.1	2.7	2.1	1.6	1.4	0.8	0.4	0.6	0.9	1.3	1.7	1.9	2.1
PASSER RD	6.3	5.8	5.3	4.8	4.3	3.8	3.3	2.9	2.3	1.8	1.6	1.0	0.6	0.2	0.5	0.9	1.3	1.5	1.7
JACOBY RD	6.8	6.3	5.8	5.3	4.8	4.3	3.8	3.4	2.8	2.3	2.1	1.5	1.1	0.7	0.5	0.9	1.3	1.5	1.7
SIRN LEHIGH LIVING MEM PARK	7.2	6.8	6.2	5.7	5.2	4.7	4.2	3.8	3.2	2.7	2.5	1.9	1.5	1.1	0.9	1.3	1.7	1.9	2.1
EAST LANDIS ST	7.4	6.9	6.4	5.9	5.4	4.9	4.4	4.0	3.4	2.9	2.7	2.1	1.7	1.3	1.1	1.5	1.9	2.1	2.3
EAST STATION AVE	7.6	7.1	6.6	6.1	5.6	5.1	4.6	4.2	3.6	3.1	2.9	2.3	1.9	1.5	1.3	1.7	2.1	2.3	2.5



LEGEND

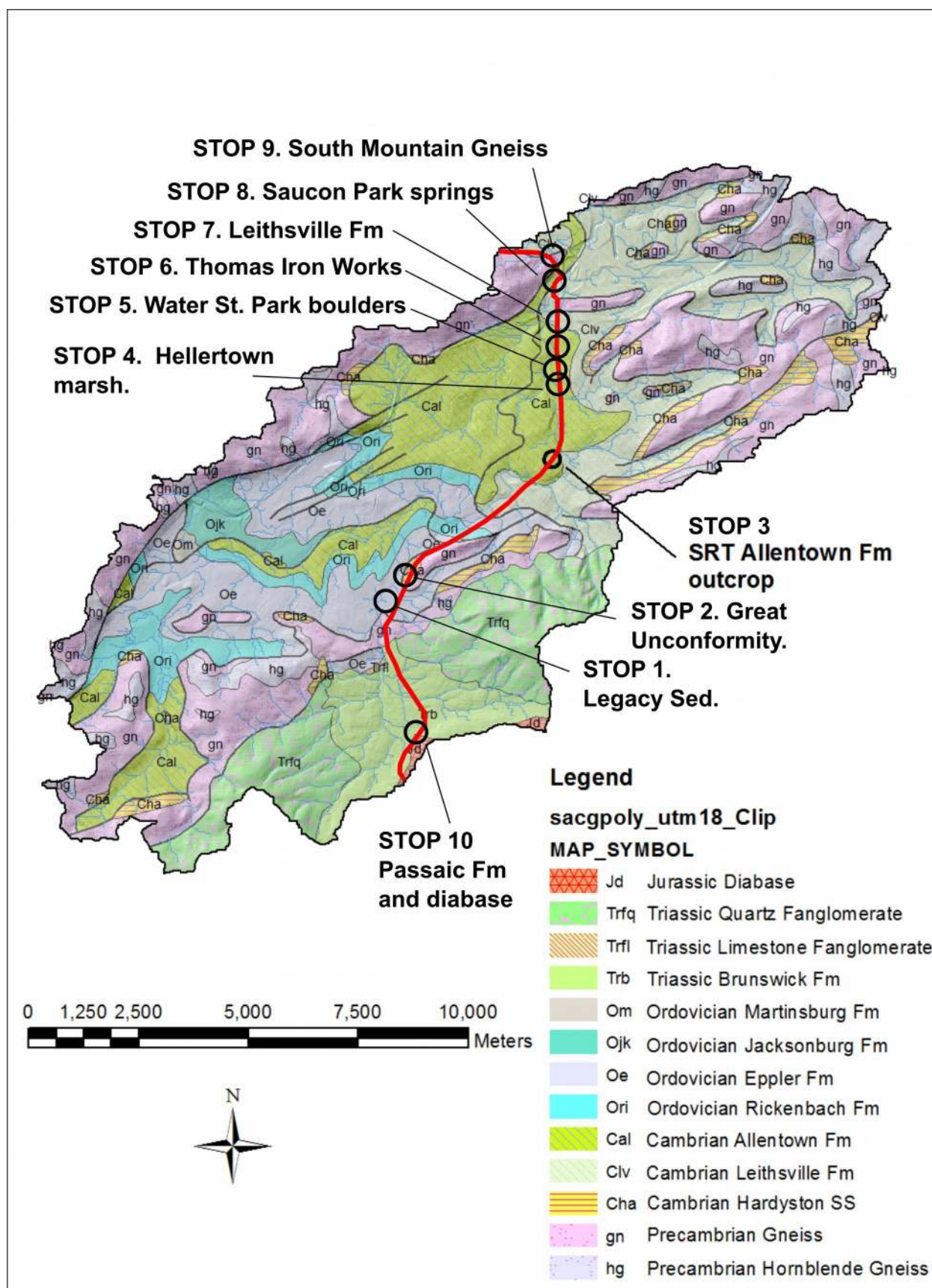
- PARKING
- BATHROOM FACILITY
- DRINKING FOUNTAIN
- PET DRINKING FOUNTAIN
- POINT-TO-POINT TRAIL
- INTERSECTIONS
- POINT OF INTEREST
- SAUCON RAIL TRAIL
- LOCAL ROAD
- MAIN HIGHWAY
- MUNICIPAL BOUNDARY
- STREAM/WATERBODY
- PARK

SCALE
IN MILES
0 1/2 1

NOTES

1. GIST DATA WAS OBTAINED FROM THE LEHIGH COUNTY PLANNING COMMISSION.
2. THE INFORMATION IN THIS DOCUMENT IS BASED ON AVAILABLE INFORMATION. THE PLANNING COMMISSION DOES NOT GUARANTEE THE ACCURACY OF THE INFORMATION. THE PLANNING COMMISSION DOES NOT ASSUME ANY LIABILITY FOR ANY LOSS OR DAMAGE, INCLUDING REASONABLE ATTORNEY'S FEES, ARISING FROM THE USE OF THIS DOCUMENT.
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9.28.2018 HANOVER ENGINEERING

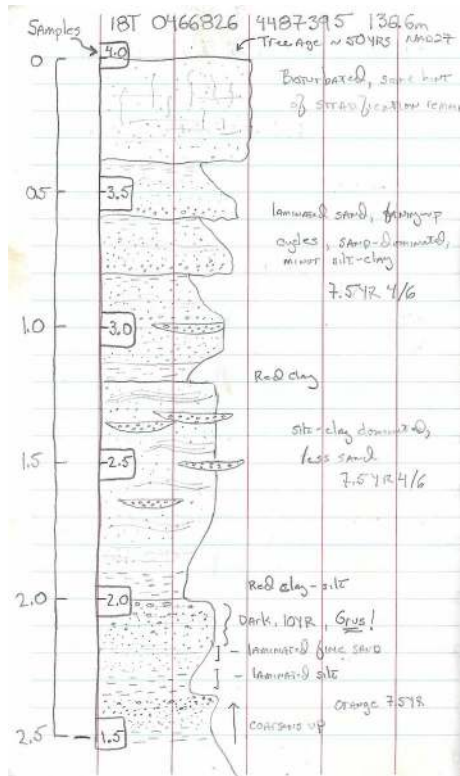


KM MILES

- 0.00 0.00 Start From South Parking lot of Upper Saucon park. Head west to gravel pad behind storage shed at corner of soccer field.
- 0.2 0.12 Leave bike at storage shed, take trail into woods to the high embankment of Laurel Run. **STOP 1.** Legacy sediments along tributary of Saucon Creek. This tributary of Saucon Creek was used, historically, as an impoundments for the Landis Mill site ~ 2 km downstream, as well as a sink for runoff generated by nearby iron mines. The result of these activities was historic aggradation and widening of the floodplain due to the trapping of fine-grained sediment. The Laurel Run channel was raised 2-3 meters by this aggradation in the past 100-200 years, and much more recently has deeply incised back do to near its pre-human impacted elevation. The physical sedimentology of the aggradation and degradation of the channel are well exposed in the embankment at this stop.



STOP 1 as it looked in the summer of 2009. Note the removal of the large tree stump since that time.



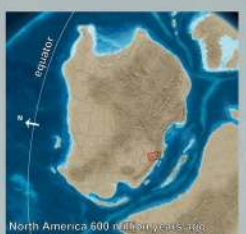
Photos from STOP 1 showing the stratigraphy and characteristics of the base of the deposit where a yellow, leaf-rich horizon buries a black, organic rich, wetland deposit. The wetland deposit in turn lies on top of indurated sand and gravel. Elsewhere in the mid-Atlantic region, the wetland deposit is 14C dated to be mostly ~ 3500-4000 yrs old. That is true too for Saucon Creek and will be displayed at STOP 4. The sand and gravel below the wetland deposit is taken to be LGM or early Holocene in age.

0.2 0.12 Return to bikes, retrace route to parking lot.

0.4 0.25 Depart parking lot through east entrance, cross park entrance road and access paved trail. Follow outline of parking lot to the east, then north.

- 0.88 0.55 Bear right, ascend hill, and pass onto SRT gravel trail heading north.
- 1.35 0.84 Cross Landis Mill Road and park at **STOP 2**. Ancient Oceans, Unconformities, and Building Stones of the Lehigh Valley. The goal of this stop is to touch the Great Unconformity that separates the crystalline, Grenville-age (~1.1 Ga) rocks of the Blue Ridge – Reading Prong, from the Paleozoic sedimentary cover, here represented by the Hardyston Quartzite. The Grenville rocks of the Reading Prong consist mostly of a hornblende-bearing orthogneiss consisting of microperthite, quartz, and oligoclase. There are lesser bodies of a more mafic hornblende-clinopyroxene orthogneiss and alaskite (leucogranites). It is the alaskite that is mapped here at this outcrop. The Hardyston quartzite here and locally contains facies of coarse-grained arkose as well as finer-grained quartz arenites. *Skolithos* may or may not be present in the Hardyston here, but it is present locally. This is an excellent opportunity to discuss the flooding of North America in the early Paleozoic as well as the tectonic and erosional events that have uplifted and exposed this structural level throughout the Lehigh and Saucon Valley. Both the crystalline rocks and Hardyston Quartzite were mined as important local building materials.

Ancient Oceans, Unconformities, and Building Stones



These outcrops along the Saucon Rail Trail expose the basement of North America and record the flooding of ancient seas.

600 million years ago North America, Pennsylvania (outlined in red), and the Saucon Rail Trail (yellow star) were located below the equator. At this time, the Byram Gneiss was exposed at the land surface. These rocks, and others similarly ancient, contain almost no traces of early life.



500 million years ago, sea level rose, flooding most of Pennsylvania, and covering the Byram Gneiss with a layer of quartz sand. Later burial and heating changed the sand to quartzite. These rocks contain fossilized evidence of early life called *Skolithos*.

The contact between the Byram Gneiss and the Hardyston Quartzite lies here along the trail. It represents at least a half-billion years of time. Geologists call this important contact "The Great Unconformity."



Hornblende



Muscovite



Biotite



Feldspar



Quartz

The Byram Gneiss (uphill outcrop labeled G) is composed mostly of these minerals

Uphill Outcrop (Labeled G)

A granite changed by heat and pressure into gneiss, containing the minerals shown above.

The gneiss and quartzite were quarried and used as building stones for many structures in Lehigh, Northampton, and Berks counties

The quartzite, called the Hardyston Formation, was quarried around the Saucon Rail Trail and was considered to be an attractive building stone. It did not require complicated tools to obtain or work, taking advantage of its smooth bedding surfaces and rectangular shapes for foundations and walls. Blue-gray colored material was originally preferred. Later, gray sandstone with brown-red discoloration became more desirable. The gneiss, called the Byram Formation, was also locally quarried, although to a lesser extent because of chemical decomposition near the surface and along fractures. Unlike the quartzite, the gneiss forms irregular blocks more difficult to use for walls or foundations.

Downhill Outcrop (Labeled Q)

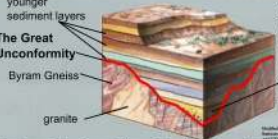
A quartz sandstone changed by heat and pressure into quartzite, containing *Skolithos* fossils (1).



Former Hardyston Quartzite quarry between Bethlehem and Allentown showing the exposed rock on the slope and (left) and the rock after being broken into rectangular blocks (right). (Source: Miller, 1939, 1941, <http://digital.lib.lehigh.edu/lehighgeology/>)

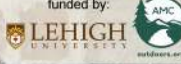


The vertical tubes in this sandstone, exposed at Kalbarri N.P. Australia, are *Skolithos* fossils, thought to have been made by an extinct burrowing worm.



The Great Unconformity, shown in red, separates the fossil-bearing Hardyston Quartzite above, from the Byram Gneiss and granite below.

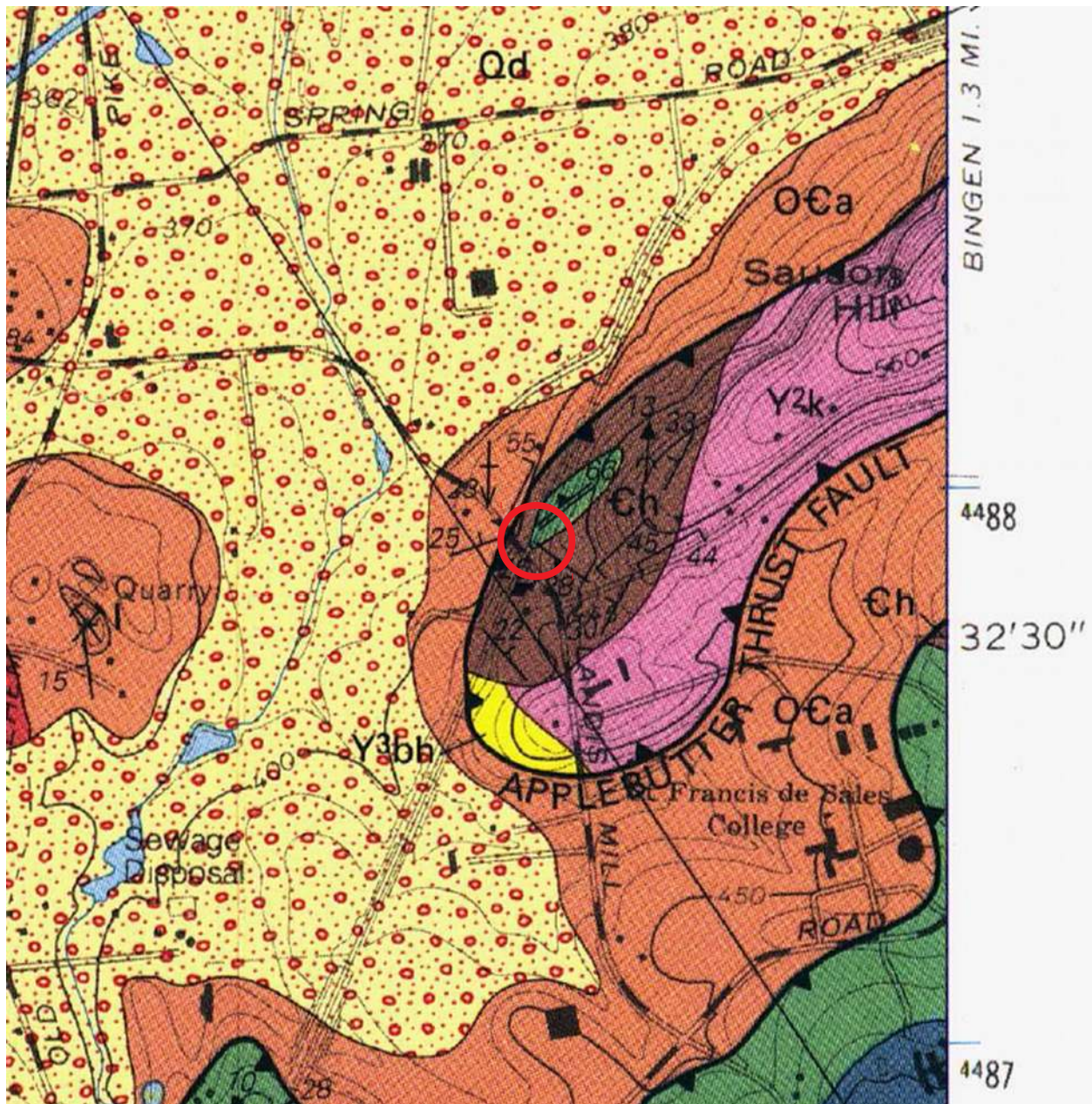
A service learning project funded by:



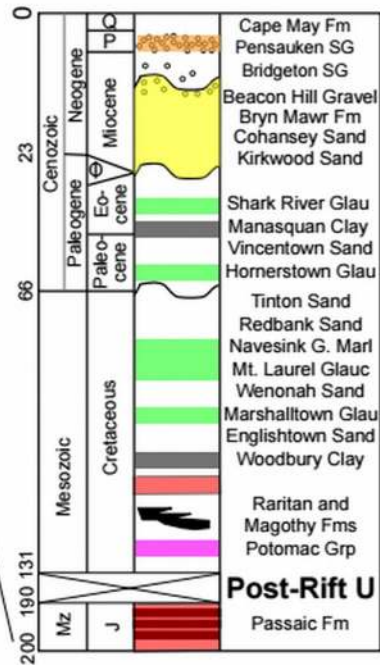
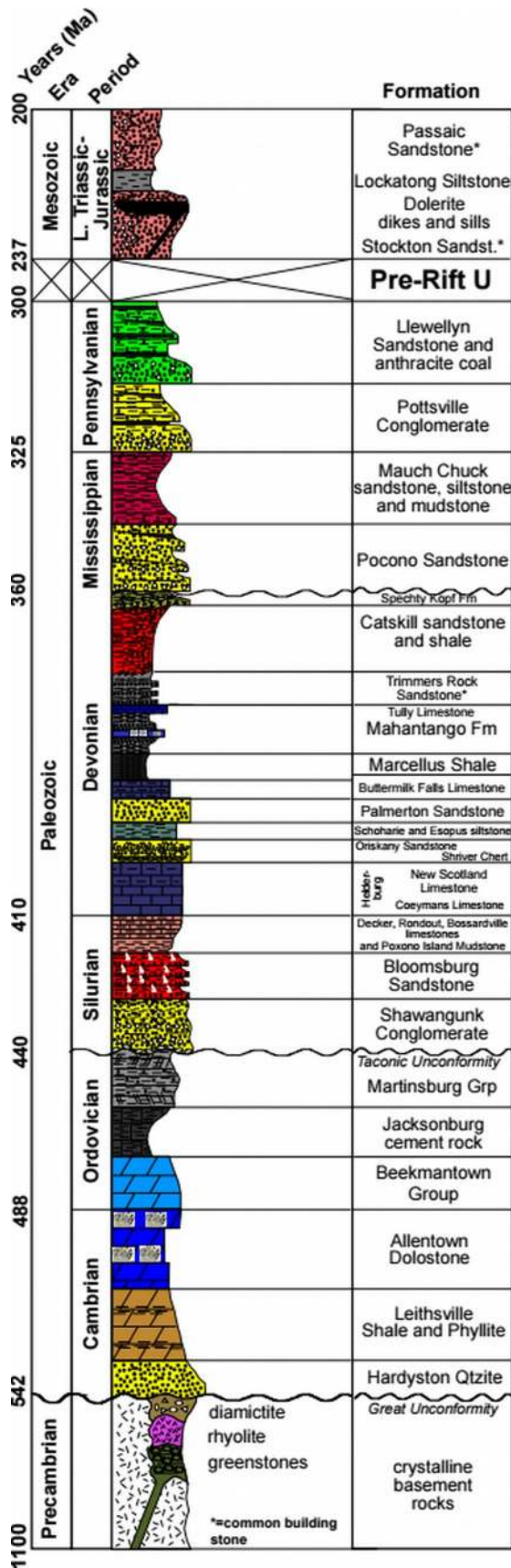
With additional support from these organizations:

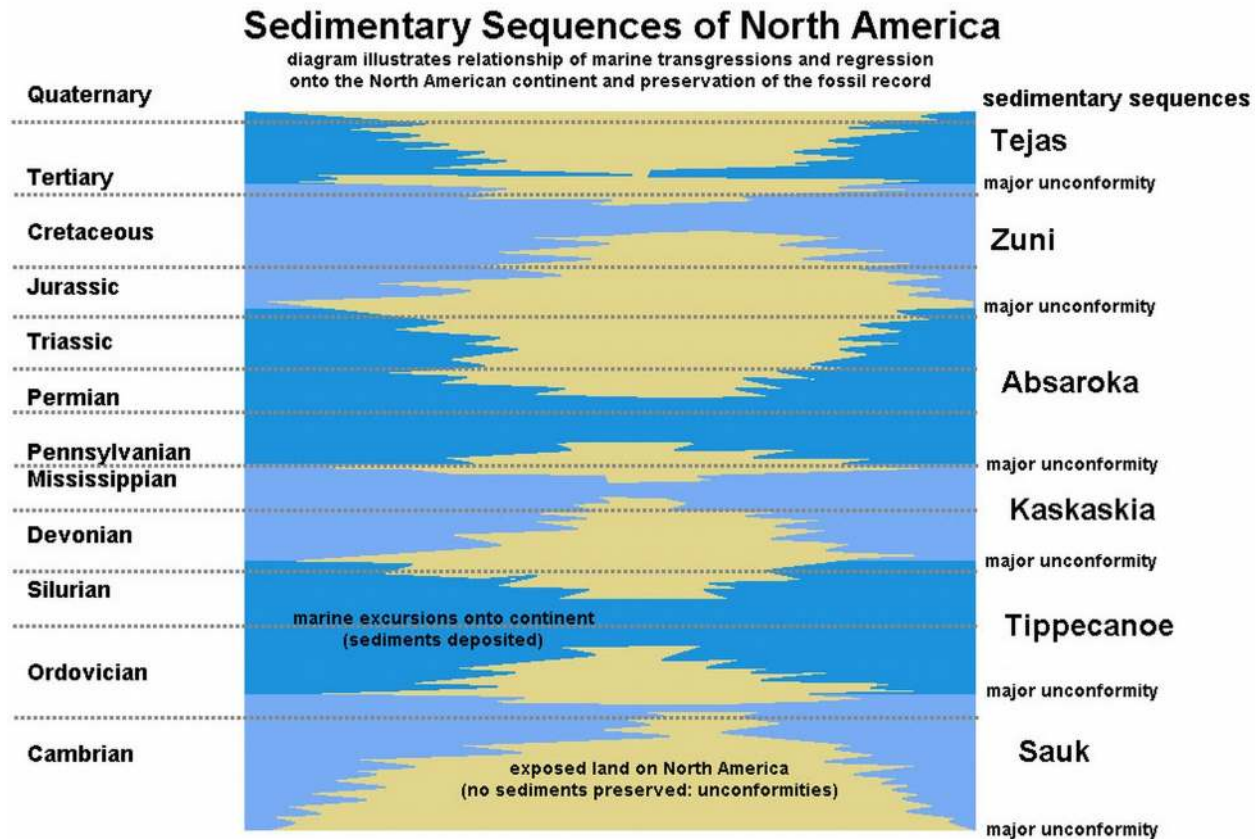


Interpretive sign at STOP 2.



Part of the Allentown East quadrangle, USGS GQ-1804 showing the geology at STOP 2 (red circle). Note that the map interpretation has the crystalline rocks protruding to the surface along the crest of a small anticlinal fold.





Sloss sequences showing the flooding and emergence of North America in the Phanerozoic.
https://serc.carleton.edu/integrate/teaching_materials/coastlines/student_materials/889

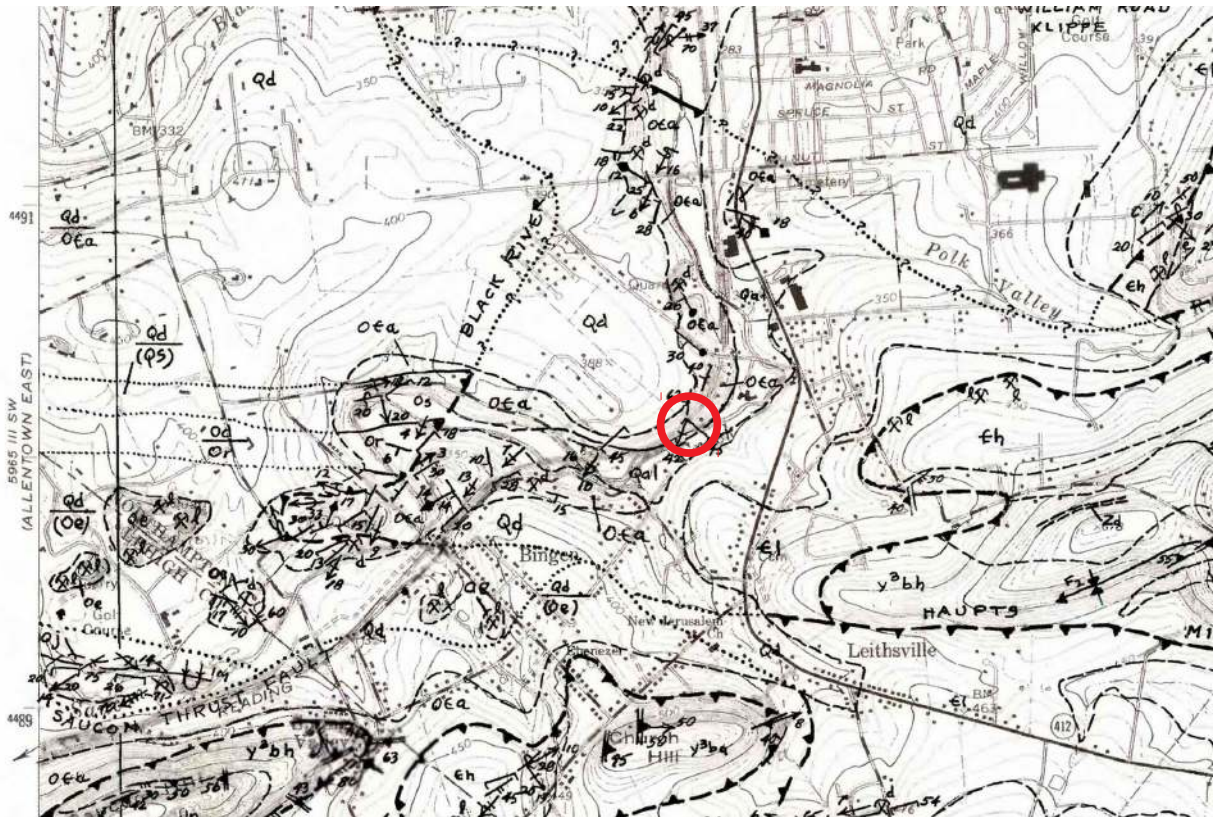
- | | | |
|------|------|---|
| 1.35 | 0.84 | Return to trail, continue north. |
| 3.03 | 1.88 | Cross Spring Valley Road |
| 3.94 | 2.44 | Cross outflow from springs that emerge in the center of the small community of Spring Valley to the east of this location. |
| 4.35 | 2.70 | Reading Road access to SRT. |
| 4.47 | 2.77 | Cross over Bingen Street and traverse cuts of outcrops of Allentown Fm Dolostone that are poorly-exposed and overgrown. |
| 5.0 | 3.10 | Cross Saucon Creek. |
| 5.17 | 3.21 | Old Mill Road and Erhart's Mill Historic District. From Wikipedia, https://en.wikipedia.org/wiki/Ehrhart%27s_Mill_Historic_District , Ehrhart's Mill Historic District is a national historic district located along Saucon Creek at Lower Saucon Township, Northampton County, Pennsylvania. The district includes 9 contributing buildings, 2 contributing sites, and 4 contributing |

structures associated with a 19th and early 20th century grist mill. The buildings include a small barn, the stone grist mill (destroyed), and three stone or brick vernacular houses. The mill is a three-story, five level stone building with a slate covered gambrel roof. The most prominent structure is an iron Pratt truss bridge built in 1867, and known as County Bridge #16. The mill was destroyed by fire. For more information, see also: <https://www.nps.gov/nr/travel/delaware/ehr.htm>.



Photos of Erharts Mill (destroyed) and the Old Mill Bridge (still standing).

- 5.76 3.57 Allentown Fm and **STOP 3**. The purpose of this stop is to observe the stratigraphy, texture, and fossils of the Allentown Dolostone on an outcrop that has been cleaned for public display along the SRT. Excellent examples of several different types of stromatolites as well as oolites are visible in these beds. The overall stratigraphy is consistent with stacked shallowing upward cycles, interpreted as deposition on a production-dominated, slowly-subsiding carbonate shelf, also influenced by eustatic change.



Part of the Hellertown quadrangle, USGS OFR 96-546 showing the geology at STOP 3 (red).



Lehigh student power washing the outcrop in 2014.

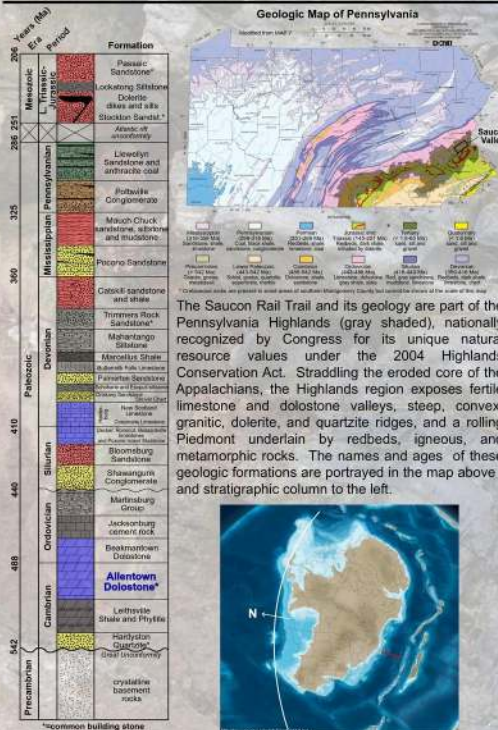
Allentown Formation Dolostone

Cambrian Period (515-500 million years old)

A student service learning project mentored and funded by



with additional support from these community partners



The Allentown Formation is a dolostone [$\text{CaMg}(\text{CO}_3)_2$] originally deposited as a carbonate (limy) mud and sand in warm, shallow seas that once covered most of the eastern United States during the Late Cambrian (515-500 Ma). Underlying much of the southern Lehigh Valley and Saucon Valley, the Allentown Formation beds here dip to the southwest and exhibit features, such as the fossilized stromatolites, consistent with deposition in an ancient, shallow, tropical sea. Among the most ancient organisms preserved in the fossil record, stromatolites are ecosystems of cyanobacteria bio-film mats (similar to algal mats) that trap carbonate mud as they grow. The stromatolites are numerous in the outcrop and range in size from < 1 cm to ~ 50 cm in diameter. They are found today mostly in sheltered, saline environments but were much more common in the Cambrian oceans. Use the photos to the right to help find stromatolites in the outcrop.

How do we know?

Geologists understand the history of Planet Earth through observation, comparison of past processes to those operating in the present, and by the rigorous, repeatable testing of hypotheses following the scientific method.

How do we know that the Allentown Formation dolostone was originally deposited in an ancient shallow ocean?

Ooids, wave ripples (right, and visible on the blocks used to make the steps), and the stromatolites are all common features in modern limy mud-bottom shallow seas in warm, tropical areas. The stromatolites here are of the type that form in Shark Bay, Australia, where they are regularly exposed during low tide. The ooids are virtually identical to those found on beaches in the Bahamas. Most modern limestone and dolostone deposition occurs in the oceans.

How do we know that the rocks exposed at the SRT outcrop are really between 500 to 515 million years old?

Geologists use two key tools to document deep geologic time (1) direct radiometric dating of minerals using the fixed decay rates of radioactive elements and (2) biostratigraphy, the study of the history of life, including extinctions. Radiometric ages using minerals found in the crystalline rocks, the Jacksonburg Formation, and the Marcellus Shale (left) provide constraining numeric ages. Biostratigraphic correlation using conodont microfossils (right), not visible in the outcrop here, firmly establish the great antiquity of these rocks.

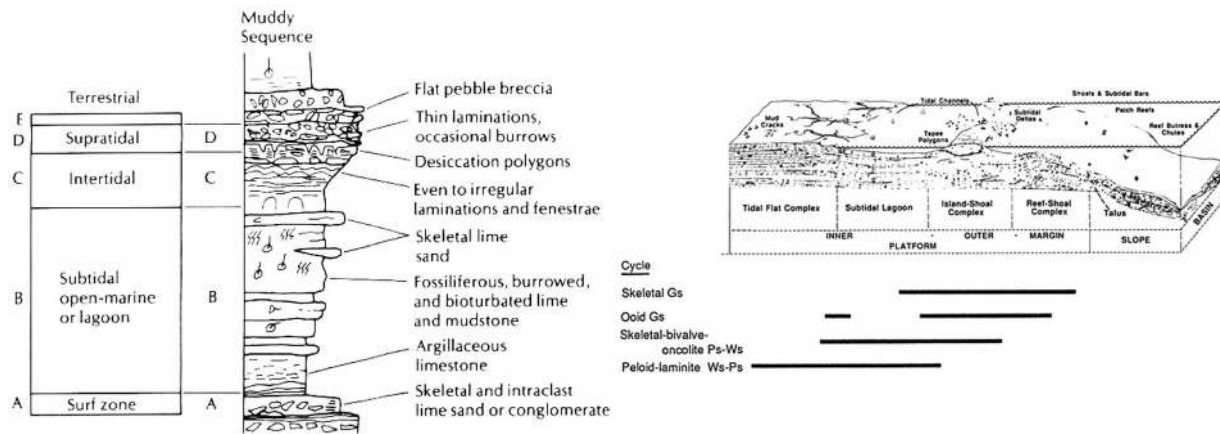


1 mm

Interpretive sign at STOP 3.



Photos of different types of stromatolites exposed at STOP 3.



<https://www.geol.umd.edu/~jmerck/geol342/lectures/15.html>

<http://www.kgs.ku.edu/Publications/Bulletins/233/Crevello/>

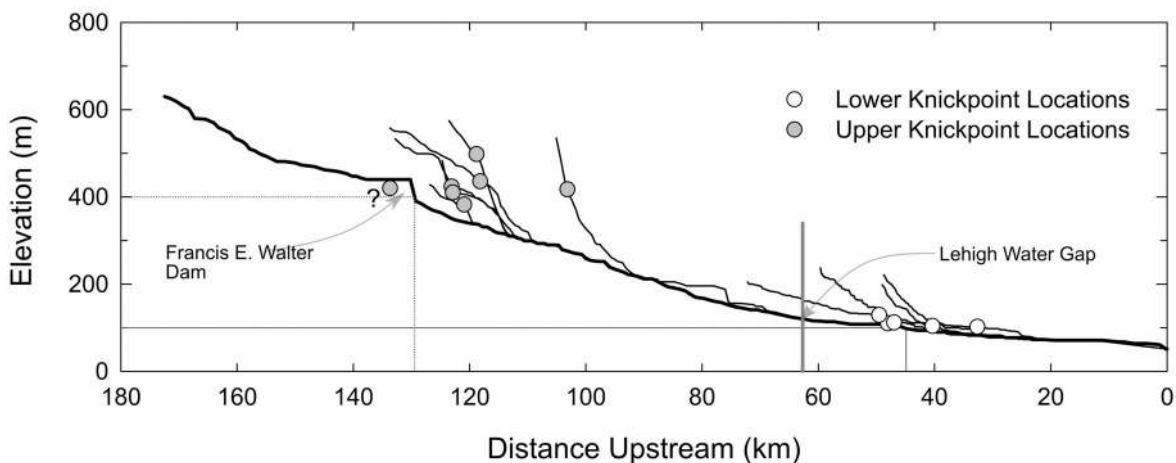
(Left) Schematic of shallowing up carbonate facies model and (right) spatial distribution of facies on a carbonate shelf.

5.76 3.57 Return to trail, continue north.

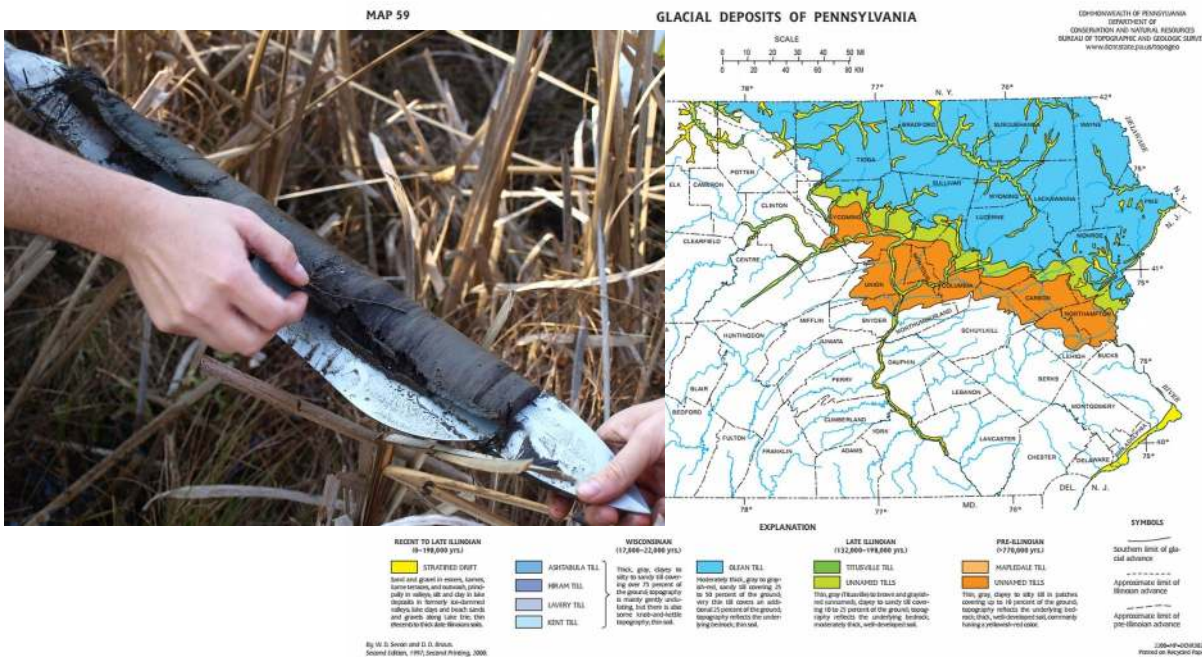
5.94 3.68 Cross Meadows Road.

6.17 3.83 Cross Saucon Creek, note low diversion dam in channel to right. This dam diverts flow into a mill race that feeds the Hellertown Grist Mill ~ 1 km to the north. The fact that such short distances translate into head drops of ~ 2 m speaks to the steepness of mid-Atlantic streams. The elevation of Saucon Creek at this location is about 290 ft (83.4 m), which places it well within a knickzone that extends up to ~ 100 m on all tributaries of the Lehigh and Delaware Rivers. Preliminary analysis of the celerity of this knickpoint migration upstream suggests that it is early Pleistocene in age, responding to a major epeirogenic base level fall before or coincident with the first major glacio-eustatic drawdowns associated with northern hemisphere glaciation.

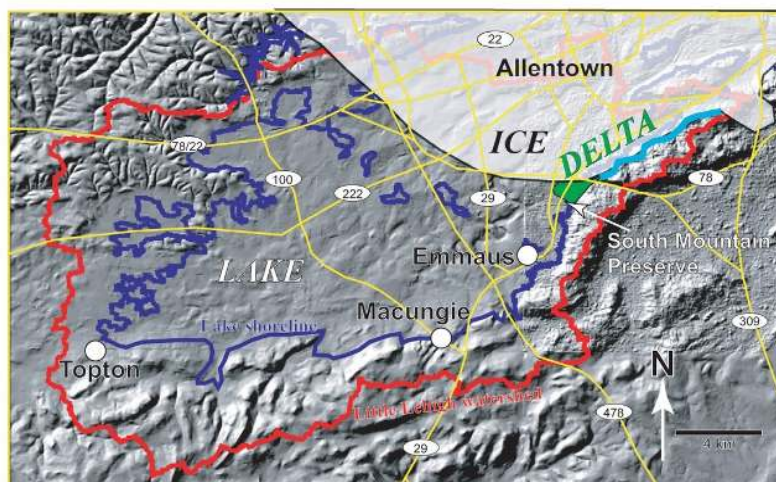
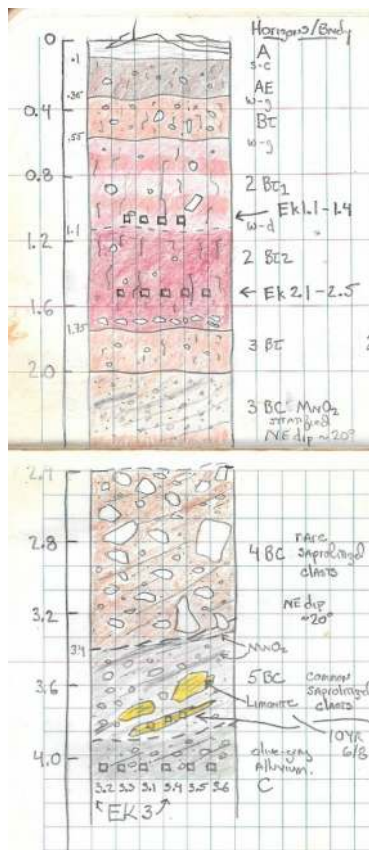
Lehigh River System Knickpoint Locations



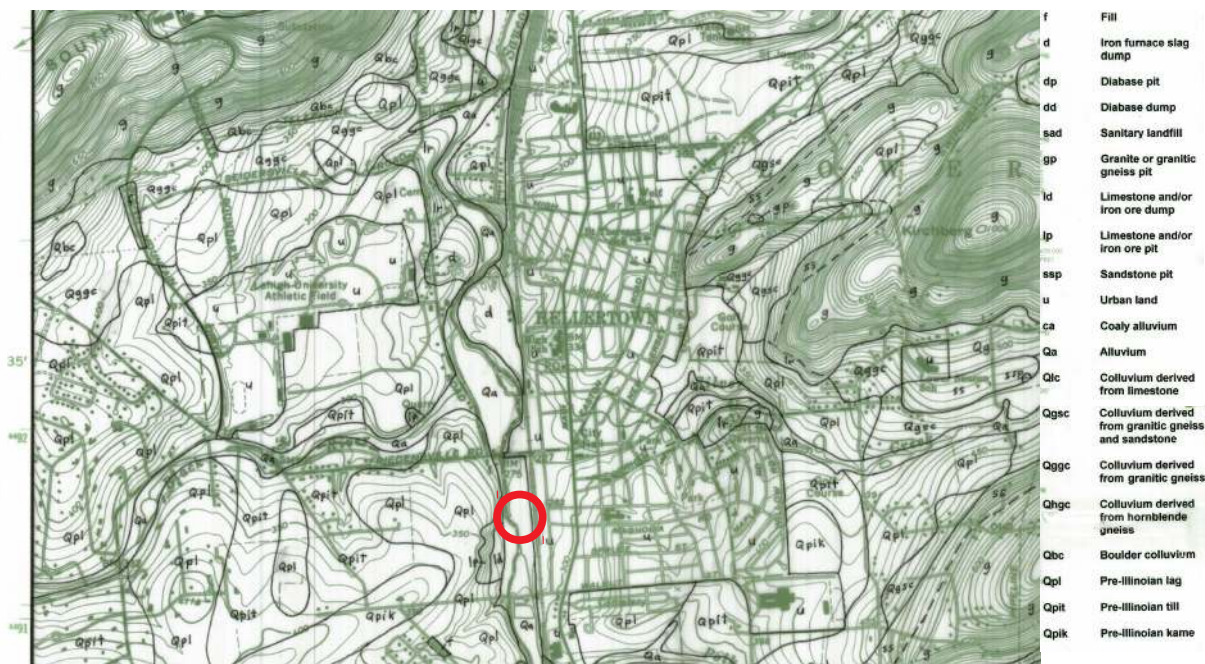
- 6.3 3.91 Cross the mill race
- 6.69 4.15 Cross Walnut Street, Historic Grist Mill to the left.
- 7.23 4.48 Hellertown Marsh and **STOP 4**. The Hellertown marsh is a remnant of a much larger wetland that once filled the valley bottom of Saucon Creek, and probably representative of similar wetlands that filled the valley bottoms of most mid-Atlantic streams prior to colonization, farming, and damming of the rivers for water power. The marsh sits atop ~ 1m of legacy sediments like those viewed at STOP 1. A core that has been pushed through these sediments pushed down through the former pre-colonial wetland, that black layer visible at STOP 1. The base of the core has been radiocarbon dated to 3540+/-30 ybp (UGAMS# 6125; Nov, 2009). The interpretive sign at this stop speaks of the marsh sitting on top of glacial deposits ~850 ka. That is generally true, although those deposits are unevenly distributed and because of poor exposures in the Saucon Valley, we are inferring an age from regional stratigraphic relationships. We do know that a pre-Illinoian ice sheet advanced from the NE to SE passing over this part of the Saucon Valley, building a terminus at what is now Emmaus, PA. At that location on the other side of South Mountain, a kame delta is exposed in a former gravel pit. That delta fed a proglacial lake that resulted from the damming of the Little Lehigh River and Saucon Creek. Silty sediments exposed in that kame ~ 4 m below the surface are paleomagnetically reversed, meaning that the pre-Illinoian ice must be older than 780 ka.



(Above) Photo of the Russian core sample through the Hellertown marsh, dated at ~3500 ybp.
 (Right) The extent of glaciation in eastern Pennsylvania. The Saucon Valley is located in the orange, pre-Illinoian deposits.



(Left) Stratigraphic section through the Emmaus kame delta showing the location of paleomagnetic samples. Samples EK-3 have predominantly reversed polarity. (Top) Map showing the extent of the lake that resulted from the damming of the Little Lehigh drainage. The Saucon Valley lies beneath the words "South Mountain Preserve" and would have also presumably been dammed by the lob of ice that is protruding through the Saucon water gap.



Part of the Surficial Geologic Map of the Hellertown Quadrangle, PA Geologic Survey OF 96-44. STOP 4 is located with the red circle.

- 7.23 4.48 Continue north on the SRT.
- 7.46 4.63 Cross Water Street.
- 7.51 4.66 Water Street Park Boulders and **STOP 5**. The purpose of this stop is to observe the sedimentary structures, namely mudcracks and wave ripples, that are well-preserved on boulders of Allentown Dolostone. Not all boulders are dolostone and here and throughout Water Street Park, there are examples of many of the rocks exposed from South Mountain to the Newark Basin. A paleocurrent analysis of the wave ripples shows that they were created at ~0.5 m water depths, by waves that were ~ 2 to 10 cm high.

Natural History of Water Street Park Boulders

Mudcracks



Mudcracks are formed when sea level falls and exposes muddy sediment. The mud dries and contracts to form polygonal shapes. When sea level rises, the mudcracks are buried by new sediment and preserved.

Rock 8 contains mudcracks.

A warm shallow sea once covered Hellertown where you are now standing. Evidence of that sea and dramatic environmental change can be observed in the mudcracks, wave ripples, and fossilized stromatolites preserved in and on the boulders arranged here. These boulders were locally quarried and moved to the park. They are made of a Late Cambrian Period (515-500 million years ago) dolostone that was deposited on the floor of a shallow, warm ocean dotted by islands, resembling the setting of the modern-day Bahamas. This ocean flooded North America during a time of high atmospheric CO₂, warm climate, and high sea level. The background image of this sign by artist C. P. B. van Kempen depicts some of the fantastic creatures that lived in that ocean, including stromatolites. See if you can find the wave ripples, mudcracks, and stromatolites on the numbered boulders. Use the weblink to learn more.

Fossils



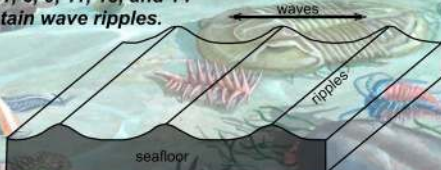
Fossils are the remains of ancient organisms preserved in sedimentary rocks. The fossils here are cyano-bacteria ecosystems called stromatolites. They trap sediment and grow upwards from the seafloor.

Rocks 4, 7, and 11 contain stromatolites

Ripples

Ripple are sedimentary structures formed by water or wind currents. Symmetric ripples, like those preserved on the boulders here, are formed by the back and forth motion of waves. Geologists can use ripple height, ripple spacing, and limestone grain size to tell us that the water depth of the ancient shallow sea here was between 1 and 3 meters.

Rocks 1, 6, 9, 11, 13, and 14 contain wave ripples.



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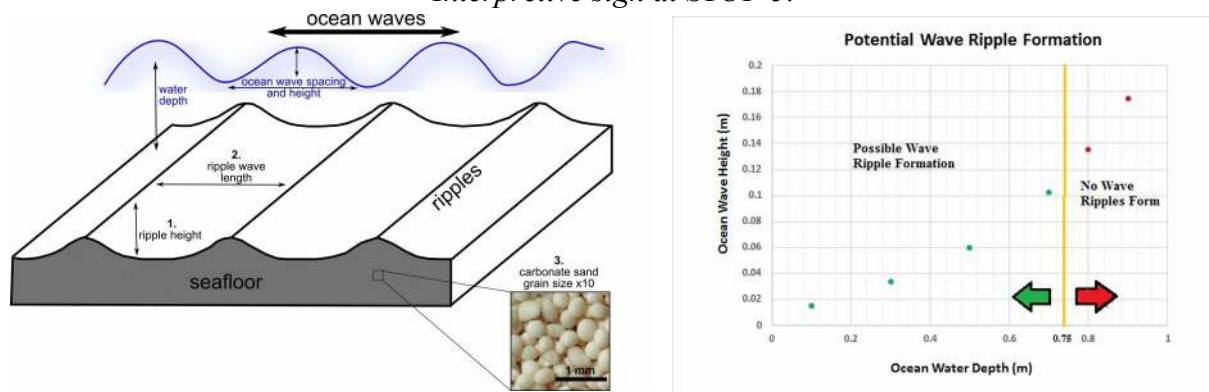




scan this to learn more

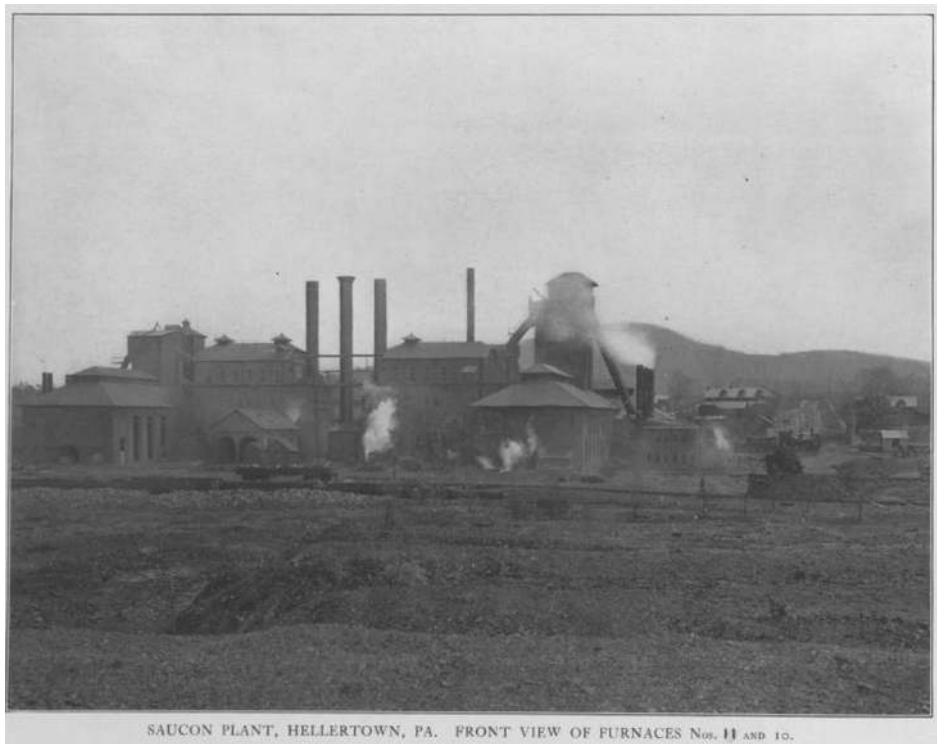


Interpretive sign at STOP 5.



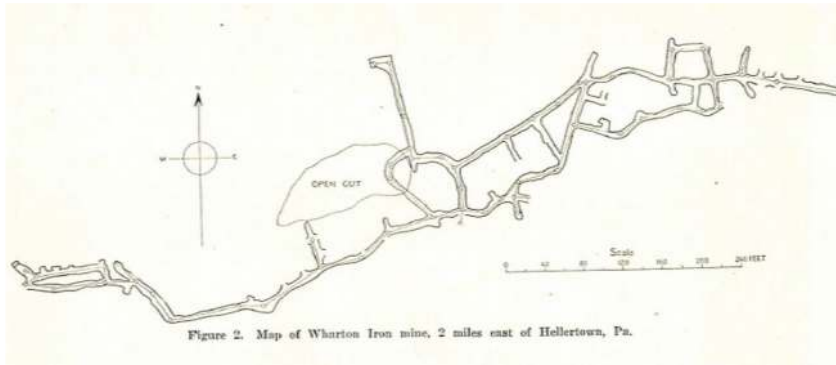
(Left) Description of oscillation ripples and (Right) phase space of allowable wave heights and water depths given the wave ripple spacing and grain size of the dolostone.

- 7.51 4.66 Continue north on the SRT.
- 7.84 4.86 Entrance at left to optional mountain bike path to Thomas Iron Works
- 8.25 5.12 Park bench, Thomas Iron works off to left. This is **STOP 6**. The concrete foundations of the Thomas Iron works preserved here, are a testament to the long and early history of iron mining and steel production in the Saucon and Lehigh Valleys. These iron works were established in 1866 by Jacob Riegel of the Saucon Iron Company, and purchased by the Thomas Iron Company in 1884. Over 350 people were employed when the furnaces were in full blast. The iron ore came from many local, low grade, residual and bog iron sources, the most important of which were located in the Polk Valley watershed SE of Hellertown. The iron ore here is residual in nature, part of a deep saprolite that formed at the structural contact between Precambrian crystalline rocks and the Leithsville Fm. Acidic ground water carrying dissolved iron from the crystalline rocks is buffered by the dolostone in the Leithsville Fm, changes pH, and precipitates the dissolved iron into masses of goetite and hematite. The saprolite hosting these ironstone ores is surprisingly deep, exceeding 200 m in the axis of Polk Valley (known from water wells), and speaks to the degree of chemical weathering in the pre-Quaternary Pennsylvania landscape. The Wharton mine was the major producer in the Saucon valley, opening in 1872 and worked until 1910. Over its life, it produced about 200,000 tons of ore that was on average, 43% iron, 19% silica, 4.2% alumina, 2% manganese, 0.4% phosphorus, and 7% moisture. Pig iron was produced from this ore at this site until 1920, and the buildings were demolished in 1924. Slag piles remain on the site as hills dumped on the Saucon floodplain.



SAUCON PLANT, HELLERTOWN, PA. FRONT VIEW OF FURNACES NOS. 11 AND 10.

http://digital.lib.lehigh.edu/cdm4beyond_viewer.phpCISOPTR=5668&ptr=5685&searchworks=cat10



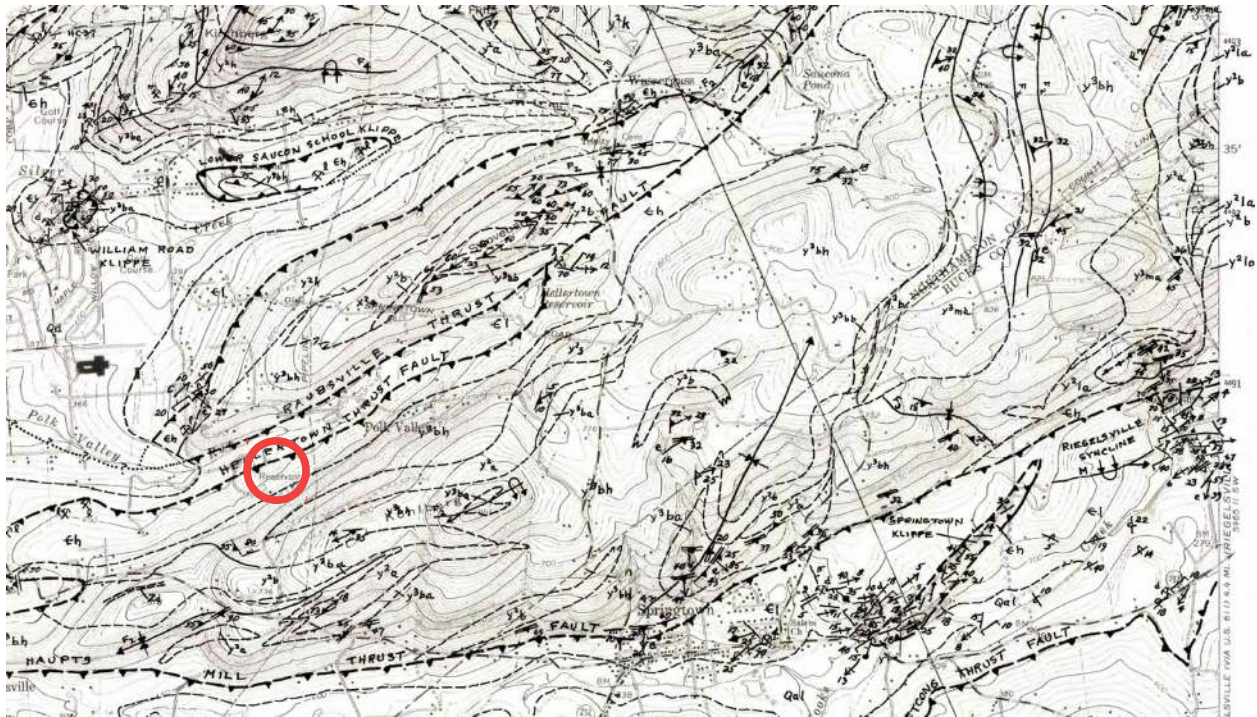
(Left) From the PA Geologic Survey Atlas of the Allentown Quadrangle, Atlas 206, Miller, 1925.

(Right) Photo of a goetite (?) dendrite from the Wharton mine.

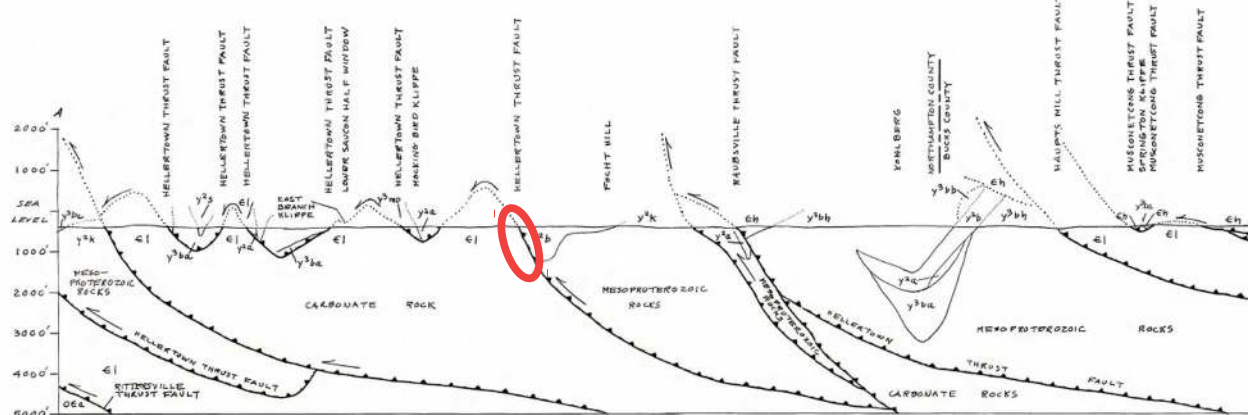
http://digital.lib.lehigh.edu/cdm4/beyond_viewer.php?CISOPTR=5624&ptr=5685&searchworks=cat10



Scanned photo of the Wharton mine during operation. (from the Hellertown Borough Authority photo archives).



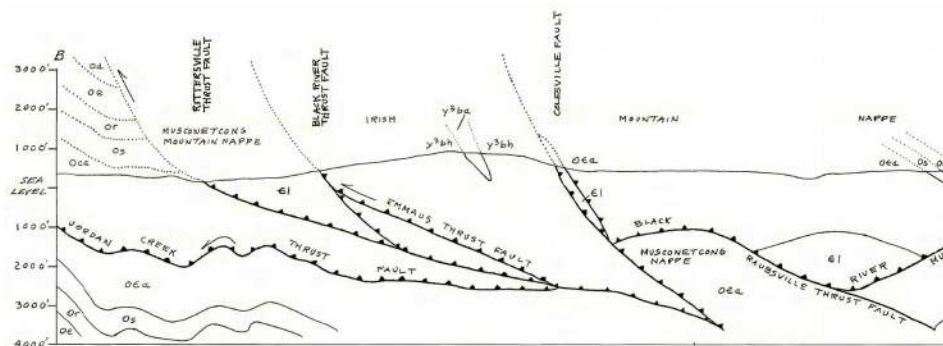
Part of the Hellertown quadrangle, USGS OFR 96-546 showing the geology for the Polk Valley and surrounding region. The red circle is the former location of the Wharton Iron Mine.



Cross-section line from NW to SE across the Polk Valley showing the inferred structural interpretation of Drake, 1996 (USGS OFR 96-546). The Wharton Mine residual iron ore would have been located in the area of the red ellipse.

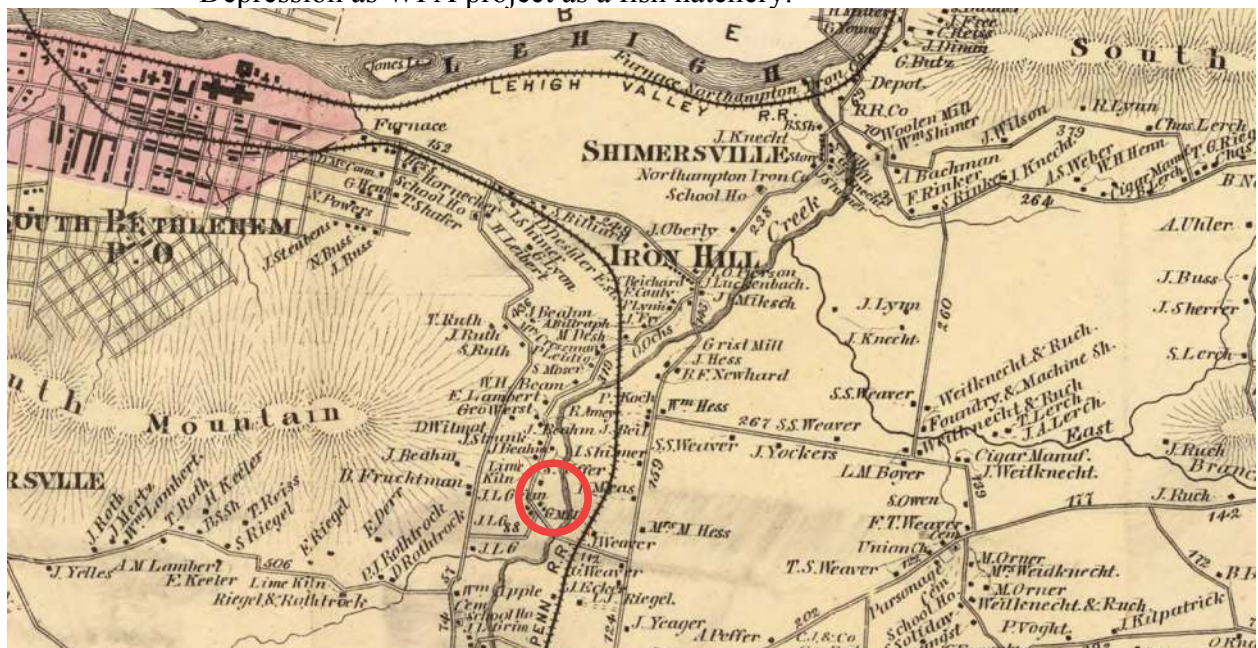
- 8.25 5.12 Continue north on the SRT.
- 8.38 5.20 Turn right, off trail, then left onto Whitaker Street.
- 8.5 5.27 Turn left on Clark Street
- 8.54 5.29 Turn right onto rail trail behind Blindermans Recylcing. Follow overgrown trail to the bridge overpass.

- 8.9 5.52 Bridge under High Street, Allentown to Leithsville Fm transition, park bikes, this is **STOP 7**. The purpose of this stop is to see the contact between the Allentown Dolostone and the underlying Leithsville Fm, typically thought of as a shale, but here shown to be an interbedded sandy dolostone and phyllite. The beds dip south, away from South Mountain and consistent with their position in the hanging wall syncline of a north-vergent thrust thought to underlie all of the Saucon Valley.



(Previous page) Part of the Hellertown quadrangle, USGS OFR 96-546 map and cross-section showing the location of STOP 7 (red circle) and Drake's (1996) interpretation for thrust faulting in the Reading Prong part of the Saucon Valley. An unresolved feature of Drake's maps are thrust faults that place younger rocks over older rocks. Curiously, this arrangement of rocks does not require a thrust fault. It can be explained more parsimoniously by the normal stratigraphic order of units as well as by normal faults, which do place younger rocks over older rocks.

- 8.9 5.52 Return to bikes and head south, retracing route back to Clark Street.
- 9.28 5.75 Intersection of Clark and Whitaker, turn left and ascend hill
- 9.58 5.94 Turn left onto High Street.
- 9.81 6.08 Turn right on Ravenna Street.
- 10.42 6.46 Left on Silvēx, watch for traffic.
- 10.53 6.53 Stay right into Saucon Park.
- 10.76 6.67 Turn right into parking lot, this is **STOP 8**. The purpose of this stop is to observe a series of wetlands and springs that emerge from the floodplain of Saucon Creek, as the carbonate aquifer of the Allentown Dolostone and Leithsville Fm narrows in the watēgap between, and probably floored by crystalline rocks of the Reading Prong. This site also offers an opportunity to explore the remnants of the mill race of the former Gran grist mill that was re-purposed during the Great Depression as WPA project as a fish hatchery.



Part of the Northampton County Lower Saucon Township Atlas of 1974 showing the location of STOP 8, including the grist mill.



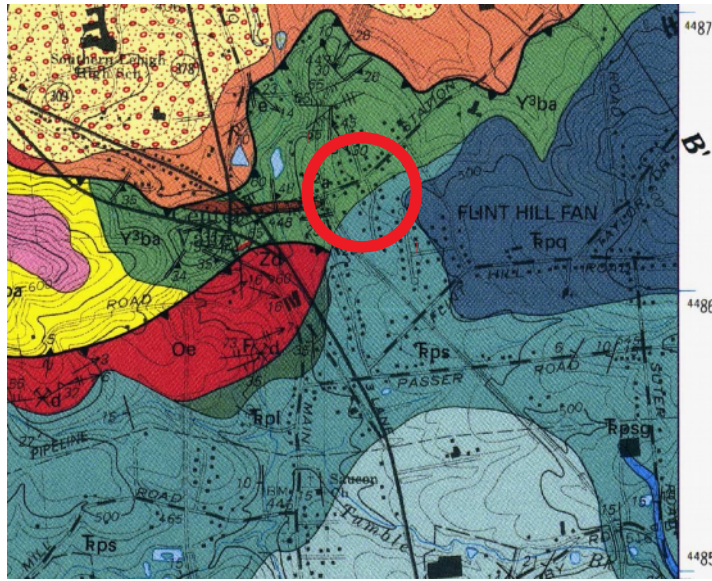
Oblique north-oriented aerial view of the Saucon water gap showing Saucon park in the foreground, including the former mill race that now directs the flow from the springs to Saucon Creek. STOP 8 is shown by the red circle. Image from GoogleEarth. Scale changes across this view.

- 10.76 6.67 Use a break in the parking bumpers at the eastern edge of the parking lot to descend into the park, and then turn left to follow the paved, but bumpy sidewalk that parallels the mill race.
- 10.84 6.72 Site of old mill, old mill race, springs, and re-purposed fish hatchery. Note that the walls are constructed of Hardystone Quartzite.
- 11.06 6.86 Cross Saucon Creek. Note the water level as you cross in comparison to the water level of a bankfull event, captured in the photo below taken on 28 Sept, 2018.



View (left) upstream and (right) downstream of Saucon Creek during a bankfull discharge.

- 11.2 6.94 Bear right off of sidewalk into parking lot, right turn onto Dearborn Ave.
- 11.51 7.14 Left turn onto Auburn Street and proceed to coarse gravel at end of road.
- 11.73 7.27 Ascend onto the Bethlehem Greenway, the extension of the SRT. Note former railroad tower, now the home of a nesting pair of Bald Eagles.
- 12.4 7.69 Small outcrops of Precambrian Reading Prong rocks on the left side of the trail. This is **STOP 9**. The outcrops here show how shallow the crystalline rocks are to the surface here, supporting the interpretation of them riding in the footwall of a north-vergent thrust sheet. You can compare the mineralogy of this outcrop to other crystalline rocks seen along the SRT. You can also compare and contrast different models for the structural geology of the Reading Prong. The prevailing model presented during this tour follows that of the USGS mapper Avery Drake who favored a thin, folded crystalline thrust sheet over the earlier ideas of Benjamin Miller and others who favored a basement rooted structure bound by high-angle reverse faults.
- 12.4 7.69 After visiting the outcrop, return to bikes, turn around, and head south on the SRT, retracing steps back to Water Street Park in Hellertown.
- 16.71 10.36 Water Street Park Pavilion and **LUNCH**.
- 24.22 15.02 Upper Saucon Park parking lot. Turn right on paved trail. Proceed under Preston Lane, pass Upper Saucon Library and stay straight on gravel, then paved trail. Ascend hill to panel at entrance back to the SRT.
- 25.27 15.67 Access gravel rail trail after library
- 25.34 15.71 Overgrown stone quarries in Precambrian rocks on the left.
- 25.82 16.01 Cross Station Ave. In ~200 m the SRT passes from Precambrian crystalline rocks to the Passaic Formation of the Newark Basin (called Brunswick Fm on the Allentown East geologic map). There is no border fault at this location and the contact, presumably an onlap of the basin sediments over the crystalline rocks, is not exposed.



Part of the Allentown East quadrangle, USGS GQ-1804 showing the geology where the trail crosses into the Newark Basin (red circle). Note the paleo-alluvial Flint Hill fan that must have been sourced in a much higher footwall of the border fault, which is now buried by the fan and inter-fan Passaic Fm.

26.38 16.36 Cross Flint Hill Road.

26.65 16.52 Cross Passer Road

27.21 16.87 Cross Lutron.

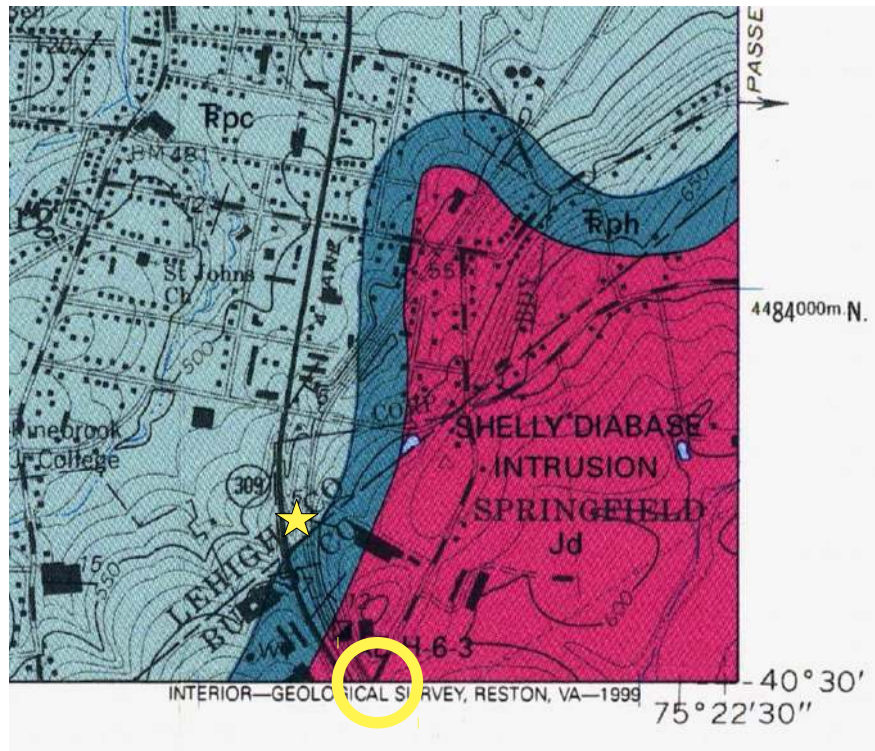
27.52 17.06 Cross over Tumble Brook, a tributary to Saucon Creek. The hills in background (to the SE) are underlain by a diabase intrusion onto the Newark Basin sediments.

28.1 17.42 Entrance to Living Memorial Park on the right.

28.34 17.57 Cross Landis Street.

28.64 17.76 Arrive at Station Ave. Turn left, then make a quick right onto Springfield. Follow Springfield Street to the final stop.

29.75 18.45 Bridge over Newark Basin outcrops including diabase, hornfels, and interbedded Passaic Formation red and green sandstone, shale, and paleosols. STOP 10 is in the railroad cut below and north of the bridge. NOTE: There is no easy access to this site and it is frequently flooded. There are plans in the near future to rehabilitate and open this part of the SRT. To the NW of this bridge, and sandwiched between the RR cut and Rt 309 is the former location of a dinosaur trackway. No prints remain after having been illegally removed by fossil hunters.



Part of the Allentown East quadrangle, USGS GQ-1804 showing the geology at STOP 10. The yellow circle is the stop and star marks the location of the former trackway.

29.75 18.45 Return to bikes and retrace route back to Upper Saucon Park.

34.79 21.57 Arrive at Upper Saucon Park. End of Geo-Bike Tour.

THANKS FOR COMING. ENJOY THE REST OF THE FIELD CONFERENCE!!