A TOUR ACROSS THE MOUNTAIN – A GUIDE TO WAYNESBORO, SOUTH MOUNTAIN AND CARROLL VALLEY, FRANKLIN AND ADAMS COUNTIES, PENNSYLVANIA

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ACKNOWLEDGEMENTS

I want to thank Renfrew Institute for inviting us back for another field trip through the area. All of the stops are on private property and I thank those landowners for granting us permission to utilize their particular feature. Please respect their property and treat it like it was yours. Please keep in mind if you would like to return to revisit these sites, permission must be granted by the landowner. Strawberry Hill is open to public but collecting rocks and minerals on their needs special permission.

INTRODUCTION

Welcome to this specially-designed field trip for Renfrew Institute! Today's trip will take you back into time and see some of the major characteristic rocks in the area. We will let you identify some rocks and minerals and talk about the geologic history of the area.

This cross-sectional tour that you will experience today will visit three distinct geologic areas: the Great Valley (GV), South Mountain (SM) and the Gettysburg-Newark Section (GN). The first two areas belong to the Ridge and Valley physiographic province which also includes the famous Appalachian Mountains. Until 1998, South Mountain was a classified with the Blue Ridge province. Today, the Pennsylvania Geologic Survey considers South Mountain a section of the Ridge and Valley since these two areas were formed during the same geologic processes especially during the Paleozoic Era.

The Gettysburg-Newark Section of the Piedmont contains the youngest rocks on our field trip. These rocks were laid down during the Mesozoic Era, the time of the early dinosaurs and a rather exciting time in southeastern Pennsylvania.

All three sections that we visit today represent not only show characteristic examples of rocks but different stages of how our landscape evolved. Following is a summary of rocks types and ages with each section:

GV	Limestone, dolomite, shale, sandstone (Middle Cambrian)
SM	Metabasalt, metarhyolite, quartzite, phyllite, volcanic slate (Proterozoic – Lower Cambrian)
GN	Sandstone, shale, conglomerate, fanglomerate (Triassic-Jurassic)

Let's summarized the geologic setting of each section:

GV	Rocks formed in a marine setting, i.e. Iapetus Ocean. Later tectonic events folded and faulted the rocks, including large blocks of bedrock being pushed northwestward up and over other blocks.
SM	Volcanic rocks related to the breakup of a supercontinent known as Rodinia. Later tectonic events produced folds, faults and

metamorphism in the rocks. The end result is an overturned anticline (anticlinorium).

GN — Rocks formed as a result of the rifting of the supercontinent Pangaea. No later tectonic events have occurred to further deform these rocks.

Several terms to be defined and used on the field trip include

Anticlinorium — A large arch-shaped fold that consists of smaller-scaled folds within The structure

Dip — The tilt of a rock layer, foliation or geologic structure into the earth.

Foliation — A feature in some metamorphic rocks where minerals are aligned parallel to each other giving the rock a "layered" appearance.

Formation — A body of rock with a measurable thickness consisting of similar rock(s) formed within a certain time span and environment. Formation name usually derived from the location of the best exposure, i.e. Tomstown, Waynesboro, Zullinger.

Orogeny — An episode where deformation (folding, faulting and metamorphism) occurs often pushing up crust into mountains. Most orogenies formed as a result of plate collisions either between two or more continents or a collision with a continent and smaller micro-continents. In our part, the Grenville (Proterozoic), Taconic (Early Paleozoic) and Alleghanian (Late Paleozoic) affected our crust.

Overturned — A fold that has been pushed over a vertical angle. The limbs (sides) of the fold are parallel to each other.

Formation Names and Thickness Encountered On This Trip

Waynesboro Formation	Limestone/sandy dolomite	±1,000 feet
Antietam Formation	Sandstone/phyllite	500-900 feet
Harpers Formation	Phyllite	300-1,000 feet
Weverton Formation	Quartzite	500-1,400 feet
Catoctin Formation	Metarhyolite/metabasalt/schist	3,000-3,200 feet
Gettysburg Formation	Sandstone/shale/conglomerate/ Fanglomerate	15,500 feet
Diabase	Diabase	10-1,500 feet

Schedule:

9:15 – 9:20	Travel
9:20 – 9:45	STOP 1. Fitz Lane Quarry – Limestone and the Great Valley
9:45 – 10:00	Travel
10:00 – 11:15	STOP 2. Jacks Mountain Tunnel – Metabasalt and faulting
11:15 – 11:35	Travel
11:35 – 12:05	Lunch at Strawberry Hill Nature Center
12:05 – 12:50	STOP 3. Strawberry Hill Quarry
12:50 – 1:10	Travel
1:10 – 1:35	STOP 4. Liberty Hall Road Diabase Quarry
1:35 – 1:40	Travel
1:40 – 2:05	STOP 5. Iron Spring
2:05 – 2:20	Travel
2:20 – 2:40	STOP 6. Rte. 16 Rhyolite/Basalt Exposure - volcanic
2:40 – 3:00	Return to Renfrew Institute

An itinerary and location map is included here. To assure that we arrive back to Refrew on time, we hope to stay on the schedule.

Feel free to collect rock samples at the stops. Although not many pretty crystals will be seen today, members of the Franklin County Rock and Mineral Club will be on hand to show you the exciting hobby of "rockhounding."

Of course, cameras and hammers are welcomed at all of the stops for you to collect both your memories and specimens to take home. Thank you for attending this special tour and hop you enjoy the adventure!

STOP 1

What:	Abandoned limestone quarry known as the Daniel and Floyd Hess quarry, dba Hess Stone & Supply Company
Location:	Off of Fritz Road, south of Amsterdam Road in small wooded area
Coordinates:	39° 43' 58.98" N. 77° 33' 4.97" W.
Rock Type(s):	Waynesboro Formation limestone
What To See Here:	Attempt to find the layering in the rock. The limestone is rather massive in thick layers. At the north end of the exposure are thinner layers visible. The dip of the rock is to the east at about 83-88°. Being limestone, the rock will react with hydrochloric acid. The ridge to the south contains sandstone of the same formation.
Geologic History:	The Waynesboro Formation is Middle Cambrian in age. The sediment was deposited in the Iapetus Ocean.

STOP 2

What:	Jack's Mountain CSX Railroad Tunnel
Location:	0.5 mile east of Iron Springs Road along the CSX Railroad
Coordinates:	39° 44' 40.2" N. 77° 26' 37.8" W.
Rock Type(s):	Catoctin metabasalt and Weverton quartzite
What To See Here:	Two type of rocks are easily noticed here. Participants will decide which rock type is encountered first along the railroad. Notice the fracture in the rock crossing inside the entrance of the west portal. This is a fault contact between the metabasalt and quartzite. Quartzite makes up the majority of the interior of the tunnel. On the east side of the tunnel, notice the rock cut on the north side of the tracks. Intense folding is seen here – probably one of the next such examples in this part of SM. Try to follow individual layers in the quartzite – it is hard, right?
Geologic History:	The metabasalt found here represents a rime when the supercontinent Rodinia was rifting apart. Rodinia was located near the South Pole during the Proterozoic. Rodinia began to split into at least three fragments (Balticia, Laurentia and Gondwanaland). This basalt is believed to be a inter-plate initial rifting continental theoleiite The quartzite originally formed as sand and sandstone along the coastline of a rift sedimentary basin such as an early Iapetus Ocean where sediment was overlapping onto the older Catoctin Formation rocks. These rocks were deformed during the Taconic Orogeny and probably reactivated during the Alleghanian Oogeny.

STOP 3

What:	Strawberry Hill Nature Preserve Quarry
Location:	On the west side of Starr Lane about 0.5 mile north of Mt. Hope Road
Coordinates	39° 48' 25.03" N. 77° 25' 6.48" W.
Rock Type(s):	Catoctin phyllite
What To See Here:	Phyllite is a metamorphic rock. This rock probably originated as volcanic shale and later metamorphosed. Characteristic of some metamorphic rocks is foliation. Can you detect which way the foliation is dipping into the earth? Quartz veins cut through the phyllite, usual marking older an older foliation.
Geologic History:	This rock is related to the metabasalt and metarhyolite with the continental rifting of Rodinia during the Late Proterozoic.

STOP 4

What:	Liberty Hall Road Diabase Quarry
Location:	Just west of the intersection of Liberty Hall Road and Water Street
Coordinates:	39° 46’ 1.5” N. 77° 20’ 3.5” W.
Rock Types:	Diabase and Gettysburg Formation hornfels
What To See Here:	The western exposure is diabase. Notice how massive the rock is and is tuff to break with a hammer. The fractures running through the diabase are joints. When diabase is allowed to weather for a long period of time, the rock takes on a spheroid shape. At the eastern end of the quarry are hornfels. This rock was a sandstone which was changed during the intrusion of the diabase. The hornfels is not as massive as the diabase and evidence of layering can still be detected. Bedding is dipping toward the northwest.
Geologic History:	These rocks reflect the split-up of Pangaea. The sandstone was laid down in a rift valley during the Late Triassic Period. This would generally correspond with the Weverton Formation as seen as Stop 2 with the rifting of Rodinia. Magma intruded through the sedimentary rocks during the Jurassic Period as a result of the rifting. The hot temperature of the magma baked the sandstone and caused the rock to chemically change into a new distinct rock type. This process is known as contact metamorphism or thermal metamorphism.

STOP 5

What:	Iron Spring
Location:	On the north side of Iron Spring Road and just east of the CSX Railroad.
Coordinates:	39° 46’ 34.68” N. 77° 23’ 53.77” W.
Rock Type(s):	Catoctin metarhyolite, Antietam Formation and Gettysburg Formation
What To See Here:	One of many springs in the Carroll Valley area along the eastern slope of South Mountain. A fault present here acts as a natural channel for groundwater to migrate to the surface. Because the water is running down slope off of South Mountain, even underground, the water has a velocity high enough to come to the surface. There is no pumping involved in this man-made fountain, only a pipe to gather the water at a central location.
Geology:	Springs are commonly found along the slopes of South Mountain. Water percolates down through the overlying soil and into bedrock to join the groundwater system. In this case, hard, fairly resistant rocks underlie South Mountain. Less resistant, softer rock underlies the valley. Add to this the fact that many of the South Mountain

rocks are poor transmitters of groundwater, while the valley rocks are good transmitters. And finally, at this location, faulting plays a role in the development of Iron Spring. Faults are natural channels for groundwater to follow.

STOP 6.

What:	Outcrop of rhyolite containing several basalt intrusions
Location:	On the north side of Pa. Rte. 16, 0.4 mile west of the intersection with Pa. Rte. 116 at the PennDot maintenance complex
Coordinates:	39°44' 12.81" N. 77° 22' 46.49" W.
Rock Types:	Catoctin metarhyloite with basaltic intrusions
What To See Where:	This exposure shows several different types of metarhyolite (reddish) and several small metabasalt intrusions (greenish). This exposure is near the east side of South Mountain, meaning that the rocks are dipping toward the east. Notice joints in the rock. How does the directions of these joints compare to the joints seen at Jacks Mountain Tunnel (Stop 2)? Also notice behind the PennDot office sheared (broken) rock termed mylonite is found. This marks the location of a fault.
Geologic History:	These two volcanic rocks reflect the continental rifting of Rodinia during the Late Proterozoic. This site suggests a age relationship between the metabasalt and metarhyolite. Based on the discussion above, what is the conclusion? Metamorphism of these rocks took place during the Taconic Orogeny and some change during the Alleghanian Orogeny.

NOTES

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