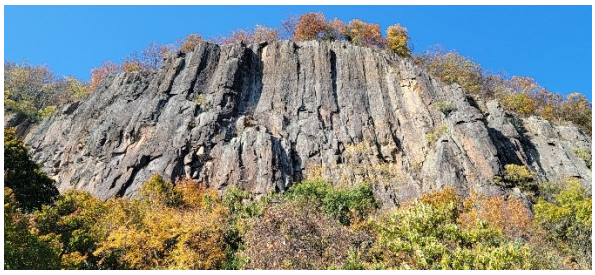
Fieldtrip

Hudson Palisade at Landing Road, Congers, New York

by Bill Menke, November 3, 2023



Hudson Palisade Cliffs

Haverstraw Trail, along the Hudson River

Goal: View the Mesozoic rocks along the Hudson River.

Time and Distance: About two miles roundtrip in two and a half hours.

Starting/Ending Point. Hook Mountain State Park gate on Landing Road, Congers New York. Landing Road is a side street off of Rockland Lake Road, which is road that loops around Rockland Lake, joining Route 9W at both its north and south ends. I urge following the directions of Google Maps or a similar navigation app to find the start point.

Parking. A parking area near the gate is free, but can accommodate only about a dozen cars and not larger vehicles. Much larger Parking Field 2 of Rockland Lake State Park is about 0.1 mile north of the Landing Road – Rockland Lake Road intersection and can accommodate larger vehicles, but a few is sometimes charged. If you park in Field 2, consider dropping off some of your participants at the intersection beforehand so they don't have to walk the extra distance.

Bathrooms. There are no bathrooms along the route of the hike. Parking Field 2 has a bathroom, but it is closed in the winter months. It also has a port-a-potty. A mile north, off of Rockland Lake Road, the main Rockland Lake Park Headquarters building has a four seasons bathroom. If you're with a large group, I urge calling ahead to make sure it's actually open.

Conditions: Hiking along relatively well-maintained trails with significant elevation change. Hiking boots are recommended but not required.

Suggestions: Bring a water bottle and a snack and wear a hat. This area is very photogenic, so consider bringing a camera. A compass and a land lens would be handy, too.

Hazards: Tripping on a rock; falling down a steep hillside, dehydration, Lyme disease, Poison Ivy. I recommend against doing this fieldtrip in winter, but bring micro-spikes or other traction devices if there is any chance of ice.

A plea. Don't damage rock outcrops by hammering on them or marking them. Don't collect rock samples, which is illegal in a public park like this. Stay on the trails so not to trample the fragile cliff-side ecosystem. And don't try to scale the cliffs!

The notation (213/67 yds) means 213 yards from the gate, 67 yards from the last stop.

1. At the Gate. (0/0 yds). Spend a moment orienting yourself. Landing Road heads roughly east, away from Rockland Lake and towards the Hudson River. You are in a valley between two steep hills, one on the north and one on the south. They rise up to the ridge of the Hudson Palisade, which runs roughly north-south.

Ask yourself why there's a valley running through the ridge, and as you walk through it on Landing Road, ask yourself whether the valley is natural or not. As you will see later in the field trip, much of the landscape has been heavily modified by quarrying. A hint is given by a sign that describes the Knickerbocker Ice Company and the Gravity Railway that carted ice from Rockland Lake to waiting barges on the Hudson River. It was built in 1860. In a few minutes you will pass its impressive stone ruins to the right (south) of the road as you descend to river level.

Have a look at the chunk of rock just to the right of the gate. Use your hand lens, if you have one. You have to be careful about chunks of rock near roads, for they could have been brought in from anywhere. But I know from having examined this one that it is local, from the ridge of the Palisade. It is a volcanic rock called diabase. An unweathered surface has a salt-and-pepper texture, with the "salt" being feldspar and the "pepper" being pyroxene, two common igneous minerals. The rock weathers to a brown color in just a few years' exposure to the atmosphere. That's iron oxide from the weathering of magnetite, an iron-bearing mineral that's present in trace quantities. The volcanic rock of the Palisade erupted almost exactly 200 million years ago, during the Jurassic Period.

Now walk east along the road, downhill and towards the Hudson River.

2. Gravity Railway (42/42 yds). The stone ramp of the Gravity Railway is on the right. The left (north) side of the road is lines with big rocks. Have a look at them and try to determine which are Palisade diabase and which something else. Not all are diabase. A few are metamorphic rocks – mostly banded gneisses – brought down by Ice Age glaciers to Congers from the Hudson Highlands, 20 miles to the north. They are called erratic boulders, because they don't fit in.

3. Landing Road turns toward the right (84/42 yds). Another ramp of the Gravity Railway is on the right. Can you tell what kind of rock it's made from? You might be able to see the Hudson River to the east, partially obscured by trees. You are still well above river level.

4. More rocks on the left (north) side of Landing Road (21/104 yds). At least one of these rocks is a glacial erratic.

5. Tall outcrop on the right (south) side of Landing Road (142/46 yds). It is composed of diabase. Note the general texture of the material, uniformly brown with prominent fractures, many of which are vertical and which create tall columns of rock. Chunks that break off tend to be rectangular and with sharp edges. This pattern typically develops in cooling volcanic rock and is call columnar jointing. A joint is geology-lingo for a crack. You might be able to find a few places where the brown coating on the rock is chipped off, revealing the salt-and-pepper colored interior.

A few small erratic boulders are beside the road, just uphill of the big outcrop.

If you look towards the top of the outcrop on its downhill (south) side, you will see a white discoloration on a flat surface. It's what's left of a vein, a deposit of the white mineral calcite that was deposited in a joint by hot percolating water when the rock was deeply buried in the Earth.

You will also get your first view of a very tall cliff face.

6. Take the grassy, unpaved road on right (213/67 yds). This road follows the base of a very tall cliff. It's actually a quarry face, dating back to the 1920's when the Palisades were being whittled away for building material, before the conservation movement led by the Rockefellers saved them. (Read Maxwell Anderson's play, *High Tor*, which popularized their plight, if you get a chance).

Note the prominent columnar jointing exposed in the quarry face. Don't try to scale this cliff! Don't even get too close to it, because even a small falling stone could cause serious injury.

Looks at some of the stones that have fallen off the face and verify that they are diabase. Also, ask yourself how safe you feel standing beneath the cliff. Rock faces as steep as this one are not stable and eventually collapse. The last big rockfall, off a natural rock face in the part of the Palisade in Alpine New Jersey, collapsed in 2012. Some picture that I took of it, together with a write-up, are at:

https://www.ldeo.columbia.edu/users/menke/slides/public/12/rockfall12/rockfall12_0.html

As you gaze up at the cliff, note the large, flat and dipping surface on the left (south) end, about halfway up. Is it a just a big joint, or is it a fault (a surface on which movement has occurred)? I'm not sure, but I think in can see faint striations on the surface, which would mean it's a fault.

7. Trail back to a paved pedestrian road (221/8 yds). Leave the grassy road that follows the cliff edge and take either of two trails that lead directly away from the cliff (east) and a short way through the woods to a paved pedestrian path. These trails kind of peter out, but just keep heading east and you'll soon reach the paved path. The flat area that you're walking through is the floor of the quarry. You'll pass numerous big chunks of diabase. I wonder whether they were left behind by the workers when the quarry closed, or whether they subsequently fell off the rock face. Go right (south) when you reach the path, which is edged by diabase stones. Note that you are still well above river level when you encounter views of the Hudson.

8. Pass a road on the left (east) (283/63 yds). You will pass a road on your left (east) that swings north and steeply downhill, with a sign Haverstraw Trail, 3.5 miles. Don't take it; continue south. You are now on the Haverstraw Trail, which runs along the Hudson River from the town of Nyack to the south to Haverstraw to the north.

9. Pass an unpaved road on the right (317/33 yds). Stay on the Haverstraw Trail, which now starts to descend steeply downhill.

10. Ruins of a small building (333/17 yds). What kind of rock is the building made of?

11. Point of land with Picnic Tables (417/83). Leave the Haverstraw Trail when you reach the bottom of the hill and walk out onto a small point of land, with a few trees and picnic tables, that extends into the Hudson River. Take a break for a few minutes and gaze at the river.

Looking left (north, upstream) you will see the ridge of the Palisade on the river's near (west) bank and the hills of Westchester County on the far (east) bank. You ought to be able to make out Croton Point, a large peninsula that extends into the river from its west bank.

Looking right (south, downstream). you will see the Mario M Cuomo Bridge spanning the wide section of the river that's called the Tappan Zee (Dutch for sea). The Ridge of the Palisade is on the river's near (west) bank and the hills of Westchester County on the far (east) bank.

Looking down, you will see a lot of diabase on the ground near the water's edge. But not all the rock is diabase. Examine some of the flatter slabs. What kind of rocks are they? Do you think this little point of land is natural or landfill? One hint is that you will find a few bricks mixed in with the rocks.

Return to the Haverstraw trail and head south.

12. Rock outcrop by Cable Crossing sign (425/8 yds). You will soon come to a rock outcrop on the left (west) side of the Haverstraw Trail, near a cable crossing sign. Is this diabase? Consider that the color is more grey than brown, and that the rock as faint horizontal lines. It's a layered sedimentary rock.

13. Rock outcrop by Cable Crossing sign (437/12 yds). You will soon pass more outcrops of sedimentary rock. The rock types range from shales (solidified mud) to siltstone to sandstone (solidified sand). They were deposited about 220 million years ago, during the Triassic Period.

14. A low rock outcrop with an overhang (445/8 yds). Look for a low outcrop with an overhang, and carefully examine the rock that makes the "cave" and the "roof". Are they the same type? If different, then how did that difference contribute to the formation of the overhang?

15. Reddish outcrop (470/25 yds). You will pass an outcrop of reddish siltstone crossed by several bands of coarser grey sandstone. Look carefully at layering of the sands. Is it uniform? Also, why are the rocks different colors?

16. Tall overhanging outcrop (495/25 yds). Another much taller (and longer) outcrop is just a short distance away. Be careful around this outcrop and don't tempt fate by trying to pry slabs off the overhanging roof! Also beware of the occasional Poison Ivy vine, clinging to the rock or growing between the Trail and the rock. Despite these issues, it is a great outcrop and worth studying in detail.

Are the rock types in the "cave" and the "roof" the same as in the previous outcrop? A few big roof slabs have fallen and are laying beside the trail, which makes examining them easy.

As you inspect that rock face, you will see that many of the rock layers are cross-bedded. The layers are not tabular, but rather wedge shaped, and pinch out in just a few feet. This pattern is typical of sediments laid down in meandering streams. Can you figure out which way the water was running?

Although the cross-bedding makes discerning an overall dip of the rock strata difficult, try to figure it out. Remember that it could be dipping in or out of the cliff face, as contrasted to the right or left.

There is at least one and possibly several "fossilized stream channels" in the outcrop. Can you find one?

Some of the rock is reddish in color. Why?

You will be able to find small shards of shale in the sandstones, and small pebbles, too. Can you find some? Where did they come from.

An important issue is whether the sediments are younger or older than the Palisade diabase. If younger, you might expect to see pebbles of diabase in it. Do ay occur?

17. Cross-beds (514/19 yds). At the south end of the big overhanging outcrop, near where trees are growing at Trail level, is a reddish section of outcrop with alternating shale and sand layers. Try to work out the current direction from the cross-bedding. Speculate on the time period between the repeating layers. Is it just weeks or months? Or millions of years?

18. Coarse sediment with pebbles (552/38 yds). The grain size of the sediments in this area is very variable. You can find beds with fairly large pebbles. What does this say about the velocity of the water that transported them?

19. Erratic Boulder (570/18 yds). An erratic boulder composed of a metamorphic rock is by the right (west) side of the Trail.

20. Side trail heading uphill and northwest (593/23 yds). Walk up this trail just far enough to examine the big rock outcrop on its left (south). Is it sediment or diabase? Sometimes they are hard to distinguish, for some of the grey sandstone can look a lot like diabase. If you find a freshly broken surface, you will be able to see that its diabase. Now return to the Haverstraw trail and look carefully at the rocks just a little north and south of the side trail. Although their color is similar to diabase, I think you will be able to see that they are layered. This is about as close to finding the contact (geology-lingo for boundary) between the diabase and sandstone as I have been able to come in this area. It's buried under the side trail somewhere in the ten yards or so between the outcrops of the two rock types. I know of other parts of the Palisades, down in Alpine, New Jersey, where you can see the two rock types touching – but not here. When you're ready, continue south on the Haverstraw Trail.

21. Picnic table by the side of the Trail (696/13 yds). What kind of rock is exposed on the hill behind the picnic table? Note that we always try to find rock outcrops that are "attached" to the ground and not float (in geology-lingo). Most of the loose rocks in this area are top of the cliff, and they tell you about what is at the top of the cliff (all diabase!) and not about what's at the bottom.

22. Talus from rock fall (639/33 yds). You will pass several large piles of loose rock (talus in geology-lingo) that are from rock falls off the face of the cliff. Some of these (like this one) seem to be in natural areas, unmodified by quarrying. This one happened in 2011, during Tropical Storm Lee. Initially it was bare rock, but quite a lot of vegetation has grown up in the subsequent 12 years.

23. An older, but bigger rock fall (710/71 yds). As you round a bend in the Trail, you will come to a pile of very large boulders that are the remains of a very large rock fall (I don't know when it happened). If you gaze south down the Hudson River, you will see a nice profile of the Hudson Palisade cliffs in Alpine, New Jersey (an area unmodified by quarrying).

24. Alcove with picnic table (799/88 yds). You will pass an alcove with a picnic table. Take note that the rock behind it is sediment.

25. An older, but bigger rock fall (799/88 yds). up and try to discern where the lowest outcrop of diabase is. The contact is between that point and the sediment, somewhere.

26. More sediment by 3/4mi marking (838/18 yds). Is i5 a shale, siltstone or sandstone?

27. More big boulders with a view of a big rock face (967/129 yds). Do you think this is a natural cliff face or another quarry. Why?

Another alcove with a picnic table is just around the corner. As this is the last stop, it might be a good place to sit down, rest and mull over what you've seen. Still unanswered is the question of what's under the river. Do you think its more likely to be diabase or sediment? And why? Also unanswered is the type of rock that composes the hills of Westchester County, on the east bank of the Hudson River. Next time you're in Westchester, you should take note of them. Or maybe if you've already been there, you can remember.

It's time to head back. As you pass the overhanging cliff, think about the shape of the Palisade ridge. The cliff is on the east side, facing the river. But the west side has a gentler slope and no cliff, a configuration called a hogback in geology-lingo. What does that shape have to do with the dip of the sediments?

An important geological question is how the Palisade diabase related to the sediments. Possibilities include:

(A) The diabase erupted first, and the sediments were deposited on top of it;

(B) The diabase is younger than the sediments and was erupted on top of them;

(C) The diabase is younger than the sediments and was intruded into them;

(D) Irrespective of the ages, the two were formed separately and much later brought into juxtaposition by faulting.

On the basis of what you've see, you can rule out at least one possibility.

When you get back to the quarry, don't try to find the trail that you took through the woods. Stay on the paved pedestrian path. It will pass a house on the right and then connect with Landing Road, which you can take back past the Gravity Railway to the park gate. As you pass the quarry, ask yourself why the quarry floor is where it is. Why didn't the workers quarry all the way down to river level?

28. Erratic boulders (1000/33 yds). If you have a spare moment when you're at the gate, walk west towards Rockland Lake along Landing Road until you're even with the start of a grassy field on the right (the one with the flagpole). In the woods at the edge of the field are three large dark-colored erratic boulders. Although metamorphic, they are not the typical banded gneisses that the glaciers brought from the northwest from Harriman State Park. To me, the look more like the rock found in the general area of Croton Point. But if so, then the glaciers were coming out of the northeast, as contrasted to the northwest, at least for a while.

Of course, its possible that they are stones brought in by people, and not glacial erratic boulders at all.