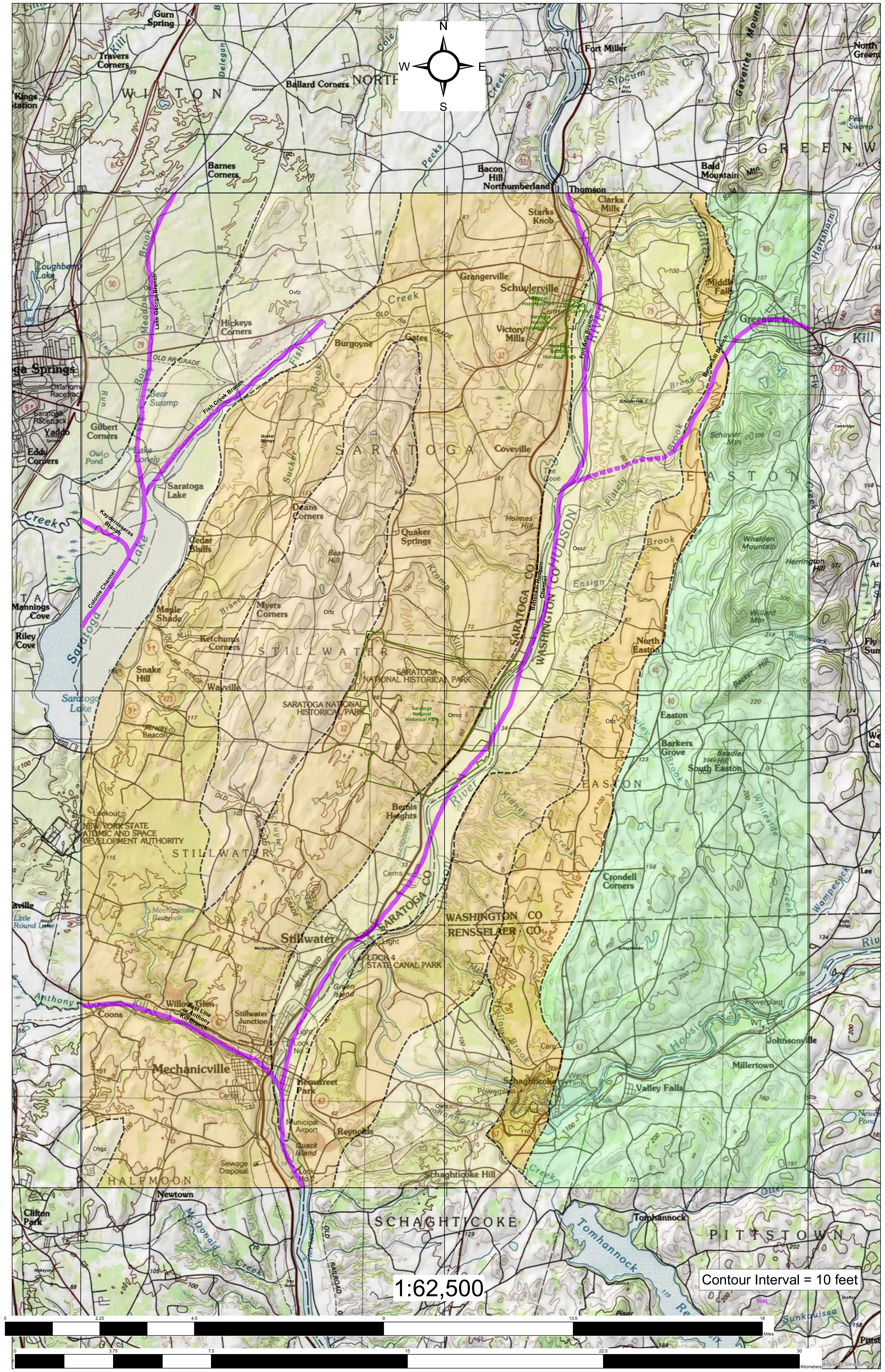
Bedrock Geologic Map of Saratoga National Historical Park and Vicinity, New York



Bedrock Geology Map Unit Descriptions and Geomorphological Implications

NPS boundary

7.5' Quadrangle Boundary

thalweg, approximate

thalweg, approximate and queried

approximate

Os - Schenectady Formation (Middle Orodovician)
The rock in the Northwest portion of the map is shale and siltstone that was not deformed by the Taconic Orogeny. Thus, it is neither flysch nor melange. Rather, it is ordinary sedimentary rock that was never mangled by the mountain building event. The shale formed atop the limestone shelf rock as the shelf was deepened by the ongoing Taconic Orogeny. The rock is not very resistant to erosion but is not as weak as the VFZ and SSZ zones.

Ovfz - Vischer Ferry Zone (Middle to Upper Orodovician)
The rock is a very shale-rich flysch with only minor greywacke. It is quite similar to the SSZ and is just as easily eroded. A major pre-glacial bedrock valley largely follows this weak zone of rock and is called the Colonie Channel. Both Saratoga Lake and Round Lake are found in this channel. The Fish Creek Branch of the Colonie Channel extends Northeast from Saratoga Lake. Another pre-glacial branch, the Lake George Branch, joins the Colonie Channel at the North end of Saratoga Lake. The Colonie Channel and Battenkill-Hudson Channel represent 2 parallel pre-glacial bedrock channels in this part of the Hudson Lowland.

Ohgz - Halfmoon Greywacke Zone (Middle to Upper Orodovician)
These are two elongate narrow oval bands of greywacke-rich flysch with much less shale than the adjacent MRZ & SSZ. Thus, the rocks of these greywacke-rich zones are much more resistant to erosion than the surrounding rocks. Most of the HGZ is off the map to the South. The RTZ is named for the small hilltop Northwest of the Park's Visitor's Center. The contact between the RTZ and the MRZ largely follows Rte 32 just West of most of the Park and just West of the Visitor's Center. The RTZ and HGZ form prominent uplands on the Hudson Lowland floor. They mostly have a thin cover of glacial deposits and have much exposed bedrock. Ridges very plainly trend to the North-Northeast following the prevailing structural grain in the rock from the Taconic Orogeny.

Ortz - Rocky Tucks Zone (Middle to Upper Orodovician)
These are two elongate narrow oval bands of greywacke-rich flysch with much less shale than the adjacent MRZ & SSZ. Thus, the rocks of these greywacke-rich zones are much more resistant to erosion than the surrounding rocks. Most of the HGZ is off the map to the South. The RTZ is named for the small hilltop Northwest of the Park's Visitor's Center. The contact between the RTZ and the MRZ largely follows Rte 32 just West of most of the Park and just West of the Visitor's Center. The RTZ and HGZ form prominent uplands on the Hudson Lowland floor. They mostly have a thin cover of glacial deposits and have much exposed bedrock. Ridges very plainly trend to the North-Northeast following the prevailing structural grain in the rock from the Taconic Orogeny.

Ossz - Stillwater Shale Zone (Middle to Upper Orodovician)
The rock is a very shale-rich flysch that only has very minor greywacke. It forms a fairly narrow band that starts North of Mechanicville. It is the rock that is easiest to erode of all the flysch and melange on the floor of the Hudson Lowland. Thus, the deeper part of the Hudson River pre-glacial valley follows the trend of this zone. We call this pre-glacial valley the Battenkill-Hudson Channel as the pre-glacial Batten Kill exits the Taconic Mountains and follows this zone. North of the Batten Kill, a branch of the pre-glacial valley extends to the North through Fort Ann and is called the Fort Ann Branch. The SSZ extends East from Rte 4 below the bluffs of the Park.

Omrz - Mohawk River Zone (Middle to Upper Orodovician)
The rock is melange that is mostly shale with some greywacke. It's of intermediate resistance to erosion and forms several bands on the Hudson Lowland floor. But, it does not form the deeper parts of any pre-glacial bedrock valleys. Some greywacke-rich ridges stand up above the glacial deposits. The MRZ is also notable because an isolated block of pillow basalt, a volcanic rock that formed under the ocean, was incorporated into the melange. This pillow basal is much more resistant to erosion than the surrounding rocks and stands as a prominent hill, Stark's Knob. Stark's Knob played a significant role as an observation point because it is near the Hudson River and overlooks the river with excellent views to the North and South. See Stark's Knob marked on the map in Schuylerville. Visit the site and you can see the pillow structure of the basalt that formed when lava oozed onto the ocean floor and cooled into rock. The MRZ underlies most of the Saratoga Battlefield and the low hills that stand about the flat lands in between are cored with somewhat more resistant rock than surrounding areas. The hills were less worn down by glacial erosion.

Owfz - Waterford Flysch Zone (Middle to Upper Orodovician)
The rock is flysch that is very shale-rich with less greywacke and limestone than the TFZ to the East. Thus, the rock is very non-resistant to erosion and forms the deeper floor of the Hudson River pre-glacial valley South from Waterford. From the best we can tell, the Hoosic River pre-glacial bedrock valley follows this rock zone when it exits the Taconics and turns to the South. The WFZ pinches out just North of the Hoosic Valley. The type section for this rock is in the lower part of the Mohawk River's Cohoes Gorge.

Otfz - Troy Frontal Zone (Middle to Upper Orodovician)
The rock is a melange that is very shale-rich but with some greywacke. This narrow band of rock is immediately adjacent to the Taconic Allochthon. Thus, it contains numerous slivers and pieces of both Laurentian limestone shelf rock and Taconian deep water rock. Among the latter, there may be Mt. Merino shale that contains green chert, a Native American source material for tools. The limestone slivers and pieces may contain grey or black chert. The TFZ rock is of intermediate resistance to erosion and forms the eastern edge of the Hudson Lowland up against the lower flank of the Taconic Mountains. More resistant areas may stand up as low ridges or small hills above the fill of glacial deposits.

OCta - Taconic Allochthon (Upper Cambrian to Lower Ordovician)
The rocks consist of phyllite, slate and shale with some interbeds of greywacke. They are stacked up with numerous thrust faults, not unlike thin sheets of rock or a deck of cards. The metamorphosed rocks, having been altered by heat and pressure, are the strongest rocks of the region. They are most resistant to erosion and stand tall as the eroded remnants of the ancient Taconic Mountains.
- Phyllite - a metamorphic rock from moderate heating of shale.
- Slate - a metamorphic rock from slight heating of shale.
- Limestone - a sedimentary rock that forms from the remains of tropical and subtropical life that accumulates on the ocean floor of the shelf.

TACONIC OROGENY & THE ORIGIN OF REGIONAL ROCKS AND STRUCTURES
What was the Taconic Orogeny?
This mountain-building event occurred when 2 crustal plates collided over approximately 20 million years from 460-440 million years ago. "Our" crustal plate was Laurentia, the name given to the ancient North American plate. Prior to the mountain-building event, the eastern margin of Laurentia was not unlike the tropical to subtropical coast off Florida with calcium carbonate sediments from warm oceanic life accumulating to form limestone on a shallow continental shelf. Farther to the East, the shelf dropped off to the deep ocean basin comparable to the deep Atlantic today.
What was quite different from today was what was happening still farther to the East. There, the deep ocean floor was subducting under a developing volcanic island arc. The subduction zone dipped to the East. The slab of oceanic crust, the western part of an ancient Iapetus Ocean, was disappearing into a trench. The environment was somewhat comparable to the Caribbean Sea today. Like the Caribbean Islands, a line of volcanic islands named Taconia formed as the orogeny ensued and continued for 20 million years. The volcanic islands eroded sediments into the deep ocean basin associated with the trench and subduction zone.

THE TACONIC MOUNTAINS, TACONIC ALLOCHTHON & EMMONS LINE;
Over this 20 million years, the slab of oceanic crust was subducted and the edge of the volcanic island arc collided with the edge of the Laurentian shelf. The deep oceanic sediments derived from the eroding volcanic islands were compressed, heated, folded and tortured. They were uplifted along low angle thrust faults from the deeps and onto the shelf of Laurentia. Thus, the deep oceanic rocks of Taconia were thrust up and on top of the shallower water rocks of Laurentia. This represents the Taconic Allochthon or overthrust belt. The westernmost limit of these overthrust rocks is called Emmons Line. It marks the trace on the ground of the Taconic Frontal Thrust, the westernmost-extending and basal thrust of the Taconic Mountains. As these faults shoved Taconian rock up and over the continental shelf of Laurentia, slabs of our shelf rock were sliced off and carried along with the faults. Our shelf rock, limestone, can be found in places along the basal fault - see near Middle Falls and Bald Mountain along Rte 40. This limestone is a valuable rock to quarry. Emmons Line is shown on the map by the long, line with triangles pointing to the East indicating that's the overlying slab of rocks.

THE HUDSON LOWLAND, MELANGE & FLYSCH
The onslaught of the Taconic Orogeny closed up the western portion of the Iapetus Ocean, eventually resulting in the collision of the Taconia volcanic island arc with the edge of the Laurentian shelf.
This slow process was accompanied by the depression of the shallow shelf as Taconia approached. The deeper water and influx of eroded sediments prevented limestone from accumulating on the shelf as time went on. Instead, shale and greywacke formed in the now deeper waters where the shallow shelf once stood.
The crunch of the collision with the thrusting of the Taconic Allochthon compressed and folded and tortured the rocks in what would become the Hudson Lowland. All of this was happening under deep water. Slumps and slides from the rising Taconic Mountains of the overthrust belt brought sediments and rocks to the west of Emmons Line. Indeed, some of these slabs and slumped pieces of crust came from Taconia. The rocks that resulted from this severe torturing can be generically called melange and flysch. Structural geologists have distinguished the rocks of the Hudson Lowland based upon the predominant rock types present & mapped structural details.
Melange is rock that resulted from the gravity slumping, sliding and shearing in the zone in front of the thrusted Taconic Mountains. It's a mixed rock and the name is derived from the French for mixed. Flysch is rock that was deposited from eroded sediments into the deep waters of the submerged shelf and crust between Laurentia and Taconia. It typically consists of layers of shale alternating with layers of greywacke. The word flysch is derived from the German for flow.
On the bedrock map, these zones are marked according to how shale-rich or greywacke-rich they are. These distinctions help determine the erosional resistance of the rock zones. The zones form distinct bands oriented generally North-South.
Shale - a rock that was formerly mud on an ancient sea floor. It forms off the shore on a shelf and in very deep water.
Greywacke - a very specific type of sandstone that forms from submarine avalanches - scubalanches - of sand and mud into very deep water. Technically, we refer to these underwater avalanches as turbidity currents.
Melange - rock that resulted from the gravity slumping, sliding and shearing in a mountain building zone where the water was a deep basin between the colliding crustal plates. Rock layers may be so broken up that they cannot be traced very far.
Flysch - rock that was deposited from eroded sediments into the deep waters of the submerged shelf and crust between two colliding plates. It typically consists of layers of shale alternating with layers of greywacke.

IMPACT OF THESE LANDSCAPE ELEMENTS ON THE LATER GLACIERS
A long period of the land's evolution through time is missing between the Taconic Orogeny of 460-440 million years ago and the multiple advances and retreats of huge ice sheets over the last 2 million years. The ice sheets flowed across the landscape and ground down the hills and valleys again and again, enhancing the pre-glacial landscape by deepening the pre-glacial valleys beneath the thicker ice. The structural geology from the Taconic Orogeny and the varying rock types discussed above helped to steer the ice as it flowed across the hills, ridges and pre-glacial valleys. The ridges and hills were smoothed and shaped by the overriding ice sheet into tear-dropped shaped forms. Eventually, the melting ice of the last glacial retreat deposited sediment over the bedrock, powerful winds blew sediment into dunes, rivers emptied into glacial lakes and formed deltas, the lake bottoms were covered with mud, and lastly, major floods from outside the Hudson Lowland deeply carved the newly deglaciated lands into what we see today. Refer to the Surficial Geology map for more details.

Original Source: De Simone, David, 2015, Bedrock Geologic Map of Saratoga National Historical Park and Vicinity, New York: De Simone Geological Investigations, 1:62,500 scale bedrock map

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The digital files for this map can be obtained from the following URL:https://irma.nps.gov/DataStore/Reference/Profile/2223978

This map presents land cover imagery for the world and detailed topographic maps for the United States. The map includes the National Park Service (NPS) Natural Earth physical map at 1.24km per pixel for the world at small scales, i-cube eTOPO 1:250,000-scale maps for the contiguous United States at medium scales, and National Geographic TOPO! 1:100,000 and 1:24,000-scale maps (1:250,000 and 1:63,000 in Alaska) for the United States at large scales. The TOPO! maps are seamless, scanned images of United States Geological Survey (USGS) paper topographic maps. For more information on this map, including our terms of use, visit us online at http://goto.arcgisonline.com/maps/USA_Topo_Maps