

# Aerogeological Tour of East Central New York

By

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Have you ever wondered as you fly what the often intricate patterns etched on the landscape below you mean and how the land came to look the way it does? New York State has had an extremely interesting geological history that has left its mark on its diverse set of landscapes. Each of these has a history whose dynamics can often be read from the air simply by observing the patterns of features like streams, lakes, and ridges. This flight will look at three very different kinds of mountains and their intervening lowlands, all of which can be seen on an approximately 185 mile loop-flight around Albany that starts at Glen Falls. The trip will be preceded by a briefing on reading the landscape that will be given on Tuesday June 25, 2007, so these notes are intended to give only a brief outline of the salient features together with the legs of the flight plan.

**Leg 1: Glens Falls to Hoosick:** Leaving the airport at Glens Falls to pass over Hudson Falls with the cave made famous in James Fennimore Cooper's tales. The cave is in limestone that accumulated in a tropical sea on the edge on Proto-North America nearly half a billion years ago. On the horizon to the southeast is the crest of the Taconic Mountains, a range that was pushed westwards several hundred miles on to North America by the collision of an arc of volcanic islands about 480 million years ago. The country below has a pronounced north-south grain caused by overlapping, westward thrust sheets of slaty and volcanic rock and the sliding of great island-sized blocks down the face of the collision zone into the Hudson trough.

The Hudson Valley is an old suture zone between two tectonic plates - North America on the west and the leading edge of Baltica to the east. To the west near the south end of this leg all of the land between the Hudson and Saratoga Lake is a great landslide block dating back to this collision event. To the east, in western Massachusetts is the Hoosac Tunnel, which cuts 4.75 miles through the range of that name. This tunnel was completed in 1875, after 24 years and many casualties, and is still the longest transportation tunnel in the Eastern US. It is a prime example of the difficulty of east-west land-transport across the grain of the country New

England and eastern New York that was inherited from the Taconic collision-event.

**Leg 2: Hoosick to Stephentown:** Much of this leg flies along a deep north-south valley formed by the glacial scouring of a major thrust-fault. The passage of great ice sheets over this area from 14,000 to 2,000,000 years ago accentuated the grain of the bedrock. To the west lies the surprisingly wild Rennselaer Plateau, with its westward-thrust ridges and boggy lakes. To the east another trust-ridge of the highest Taconics lies on the Massachusetts border.

**Leg 3: Stephentown to Athos:** The flight-line now turns southwest cutting diagonally across the old western slope of the thrust-pile. The north-south grain of the country is still strong and the long hill at the eastern approach to the Rip van Winkle Bridge across the Hudson is another gigantic slump-block. The Hudson River itself is at sea-level here, as it is to Albany. It is essentially a fiord, scoured out of the soft sedimentary rock of the suture-zone during the Ice Ages.

**Leg 4: Athos to Palenville:** Shortly west of the river the country still has its north-south grain but the rocks here are younger (about 400 million years ago) than those east of the river. They are limestones and shales, called the Helderberg Range that were gently folded and pushed slightly to the west by a second episode of mountain building that resulted from the collision of another continental fragment, called Avalonia, which now forms eastern and central New England. Some geologists think that this range may have been as high as the present-day Himalayas. To the west is the impressive face of the Catskill Mountains, here forming the nearly 2,000 foot-high escarpment called the Mural Wall. Its remarkably straight north-south trend is the result of glacial scouring by a mile-thick ice sheet that removed all of the rock that lay above the present level of the Hudson Valley. (Note: In the event of excessive air-turbulence on the front of the range, a route from Athos to East Wyndham, to Prattville is preferable.)

**Leg 5: Palenville to Maben Airport:** Unlike the Taconic Mountains, the Catskills consist of sediments that dip westward at about a degree and were brought down rivers that flowed out of the Avalonian Mountains of eastern New England. So the Catskills are essentially a huge delta, the size of the Mississippi delta, which has been eroded into high relief by the forces of glacial and modern erosion. Note that the westward dip of the sediments

makes their eastern sides steeper than the others, so that these have been called one-sided mountains. Note that as soon as we crossed the Mural Wall (or reach East Wyndham) we are in a broad north-west trending valley that seems too large for the relatively small stream that occupies it today. This is actually a glacial spillway that was eroded by ice that flowed over the top of the range from the Hudson Valley. Several such northwest trending valleys can be seen atop the Catskills and were last occupied by ice about 14,000 years ago. Other signs of ice action are the rounded bowl-shaped hollows, called cirques, on the upper slopes of the mountains, as well as U-shaped gorges cutting across east-west mountain ridges. Just west of the Mural Wall we enter the drainage of Schoharie Creek, the only northwestward flowing major stream in the region.

**Leg 6: Maben Airport to Blenheim:** Flying north down the deeply cut valley of Schoharie Creek, look westward to see Grand Gorge which lies at the north end of a gorge that cuts through the ridge to the head of the Delaware River to the south. During the Ice Age the glacier and, later, meltwater flowed southward through this divide. As the ice melted back to the north, numerous lakes formed in the blocked drainage way of the Schoharie. A very large human-built dam impounds the creek at Gilboa. The 380 million year-old rocks found here once lay on the western shore of the Catskill delta and supported stands of the earliest known trees.

**Leg 7: Blenheim to Esperance:** North of Blenheim, the floor of the valley becomes broad and flat and Schoharie Creek begins to swing in lazy meanders. This means that the slope of the stream bed (its gradient) has decreased. These are signs that the creek is flowing across a valley that was filled with sediments from a glacial lake. Up ahead, at Esperance, there is a great pile of sediments, called a moraine, that were pushed southwestward out in front of the glacier, damming the Schoharie, and creating a lake that filled the valley and ran for miles up the main stream and its tributaries. The lake drained after the ice retreated northeastward and the soft sediments of and the moraine were breached by the running water. Just before reaching Esperance, the Schoharie cuts through the Helderberg ridge, a land of many caves. The country between streams has the gently rounded contours of glacially scoured rock and here and there can be seen some streamlined glacial hills called drumlins.

**Leg 8: Esperance to Fort Hunter:** North of Esperance, another set of meanders show that the Schoharie is flowing over another former lake bed.

This one was caused by a glacier that came around the southern margins of the Adirondack Mountains and blocked the Mohawk valley from the northeast. At the confluence of the Schoharie with the Mohawk is the ruined aqueduct that carried the Erie Canal across the creek. This aqueduct was completed in 1825 and the path of the canal here is the last segment of the original 1821 canal still visible anywhere along its route. The structure was still intact as late as the early Twentieth Century but its eastern end has now been breached. With some 14 arches to support the weight of the water in the channel, this structure formed a semi-permeable obstacle across the creek. The New York Thruway up stream did not fare much better even though it had only two piers in the creek. A torrent swept away it away in the 1980's with the loss of ten lives.

Seen from the air the Mohawk River looks much too small to have excavated the very broad valley that it occupies. Valleys with such undersized streams are called "underfit" by geologists and they are a sure sign that there a much higher flow at some time in the past. In this case it seems that as the front of the ice sheet withdrew northward about 13,000 years ago, the Mohawk carried all of the meltwater from the ancestral eastern Great Lakes and continued to do so until the Saint Lawrence opened at about 10,000 years ago. This was to have considerable importance for the development of our nation because the oversized course of the ancestral Mohawk provided an easy water-level route to the West and made New York City the primary port of the Eastern Seaboard.

**Leg 9: Fort Hunter to Day Corner:** Northeastward from the banks of the Mohawk, the route traverses a huge glacial moraine that blocks what was once a south-flowing tributary of the Mohawk. The result was a glacial lake that occupied the same basin as the present Great Sacandaga Lake and reversed the flow of the original river northeastward into the upper Hudson River drainage. Eventually the outlet of the lake eroded downward enough to drain the original lake, but an artificial dam west of Glens Falls restored it some 5,000 years after the original disappeared. One sign that something is "wrong" with the direction that the Sacandaga flows is that its two tributary arms point "downstream" to the Mohawk. Note that the lake sits in a deep trough with very steep sides.

This part of our route crosses the Adirondack Mountains and this part of them is marked by deep fault-basins known as grabens. The Adirondacks are the third kind of mountains encountered on this trip. Their core consists of billion year-old rocks that are highly folded and partially melted to form the very hard, erosionally resistant basement for the continent in this region.

This basement was overlain by eroded layers of softer sedimentary rock whose eroded edges turn upward around the up pushed central dome of the range. In fact the dome may still be rising. One source gives the rate at an amazing 3 mm per year but a large part of this is probably caused because the bedrock is still rebounding from the weight of weight of the now melted ice sheet.

**Leg 10: Day Corner to Glens Falls:** The route turns eastward to cross the Conklinville Dam and the block-faulted southeastern corner of the Adirondacks. The “new” course of the Hudson flows south at Lake Luzerne, still within the range. The pre-glacial “Colonie” channel lies buried at the front of the Adirondacks as our route crosses a fault at the margin of the Hudson Basin, just before reaching Glens Falls and the terminus of the trip.

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