# TRIP 8

## GLACIAL GEOLOGY AND SOILS OF THE ST.LAWRENCE-ADIRONDACK LOWLANDS AND THE ADIRONDACK HIGHLANDS

by Michael Kudish

### Introduction

A marked difference between the St.Lawrence-Adirondack Lowlands and the Adirondack Highlands does not only occur in the bedrock, but in the glacial deposits, soils, vegetation, growing season, and land use as well. We begin at Potsdam in the St.Lawrence-Adirondack Lowlands at an elevation of 440 feet (134 m) and climb gradually onto the Adirondack Highlands at Paul Smith's College (elevation 1650 feet or 503 m), some 50 miles (80 km) to the southeast. During this tour we will see great changes:

| | St.Lawrence-Adirondack Lowlands | Adirondack Highlands |
|---|---|---|
| Bedrock | Precambrian, marble-rich, gneisses; Cambrian sandstones; limestones and dolostones of Ordovician age. | Precambrian gneisses, marble-poor, Metanorthosite. |
| Glacial drift | Crushed rocks listed above plus Canadian Precambrian gneisses. | Crushed rocks listed above plus Canadian gneisses and Cambrian sandstone. |
| Soils on well-drained sites | Mostly Inceptisols developed in silty and loamy drift. Locally some Alfisols in high-clay drift. Less leached, not strongly banded, dull-colored, neutral to slightly acid, fertile. | Mostly Spodosols, developed in sandy drift. Highly-leached, strongly-banded, brightly-colored, very acid, infertile. Sandy loams very locally in siltier drift. |
| Growing season | Longer frost-free period due to lower elevation despite more northerly latitude: 140 days at Canton, 150 at Watertown. | Shorter frost-free period due to greater elevation: 103 days at Wanakena, 112 at Tupper Lake, 99 at Lake Placid. |
| Vegetation | Northern hardwoods plus rich-site hardwoods. Also Red and Bur oaks, Red ash, Shagbark and Bitternut hickories, Cottonwood, Cork elm. | Northern hardwoods on tills (STOP 3A & 3B). Spruce-Yellow birch Mixed Woods on outwash (STOP 4). Rare rich-site hardwoods on siltier sites. |
| Land use | Agriculture | Forestry |

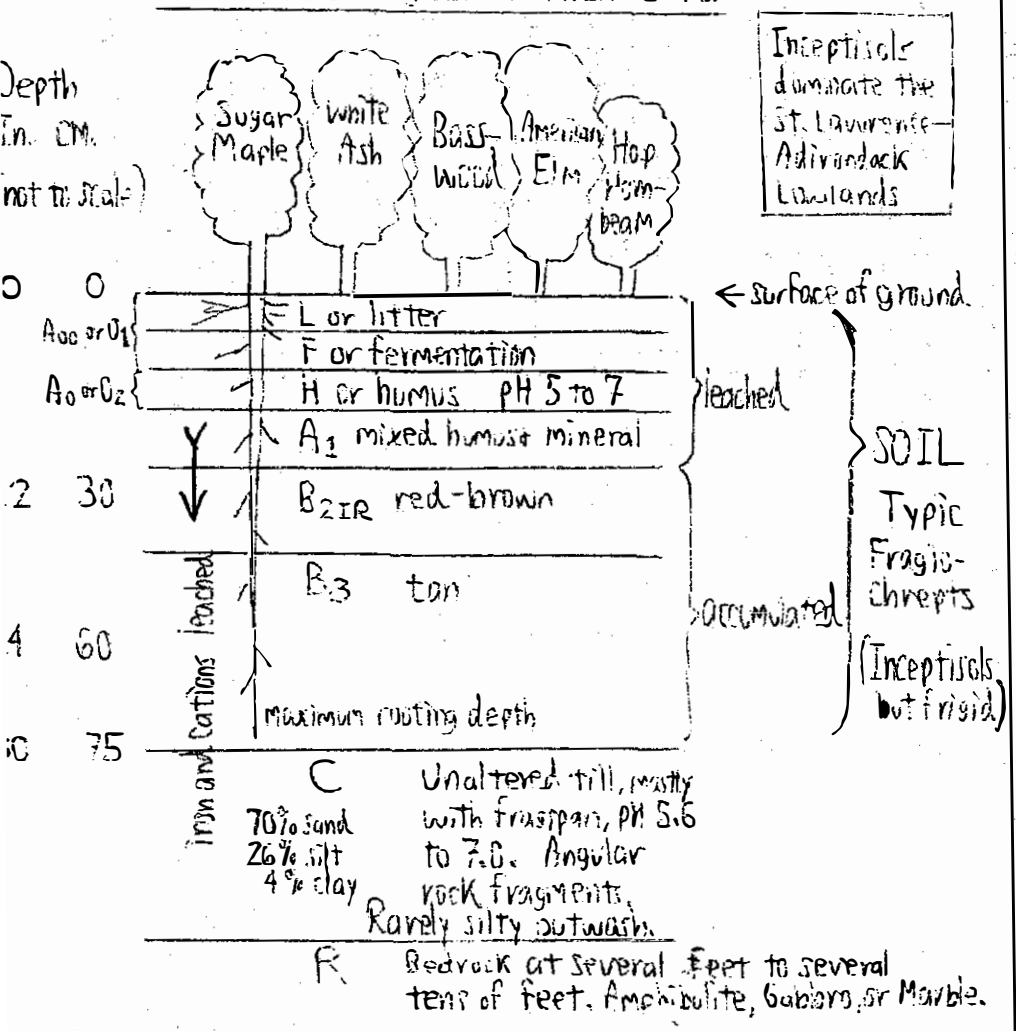
On the Highlands, we will contrast soils and vegetation developed on glacial till and on glacial outwash, both well-drained. We will observe a bog, and, if time permits, an Adirondack Highlands "rich site" on siltier soils.

Road Log

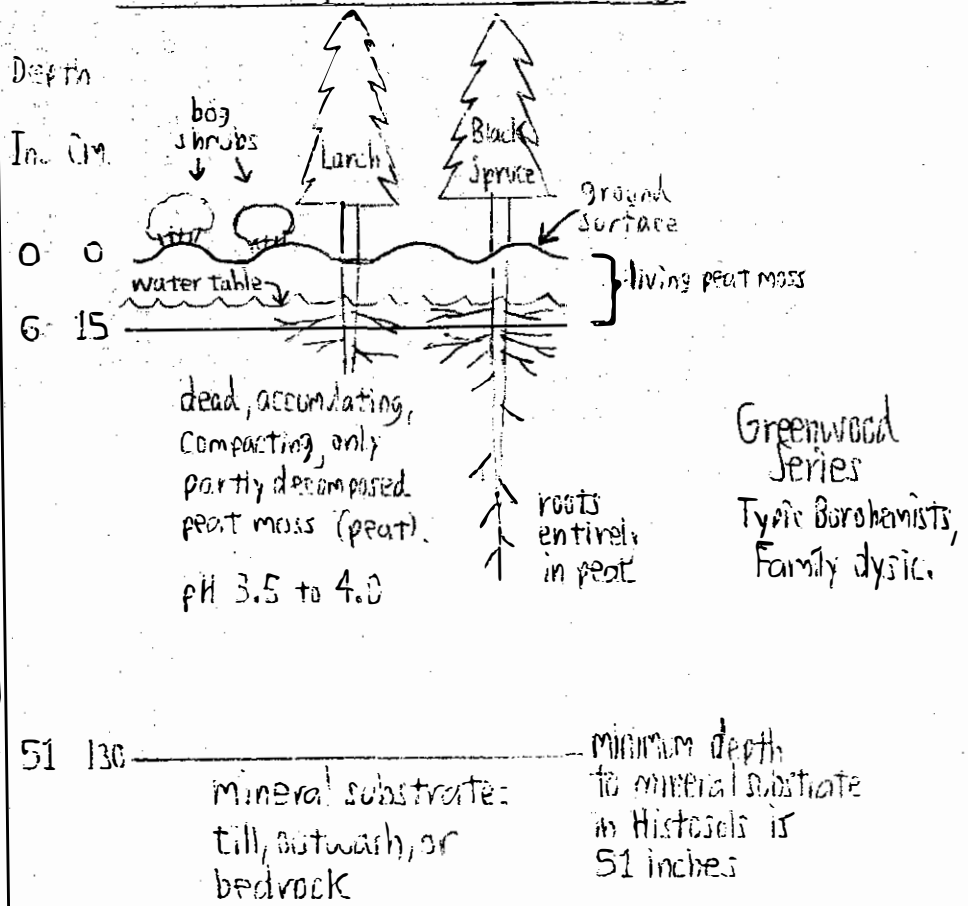
| Total Mileage | Mileage From Last Stop | |
|---|---|---|
| 0.0 | 0.0 | Turn left (south) from Barrington Drive on the S.U.N.Y. Potsdam Campus into N.Y. State Route 56 (Pierrepont Avenue). |
| 1.1 | 1.1 | Turn left (southeast) on N.Y. Route 72. |
| 8.7 | 8.7 | Delta of the West Branch St. Regis River into Lake Iroquois at the 900-foot level. View of Parishville Desert (Stop 1) to the north (left) across the River. |
| 9.1 | 9.1 | Cross West Branch St. Regis River and enter Parishville. |
| 9.3 | 9.3 | Turn left (north) from Route 72 onto School Street in Parishville. |
| 10.3 | 10.3 | STOP 1. PARISHVILLE DESERT. According to Van Diver (1976), this is a delta built into Postglacial Lake Iroquois by the West Branch St. Regis River at the 900-foot level. The delta is now deeply dissected, the Desert only a remnant. Much of the material (mostly fine sand) of the delta was probably carried south of Parishville by the ice sheet and then returned north by the River. Sand-blasted ventifact cobbles and boulders are Potsdam Sandstone, Adirondack Highlands gneisses, Canadian gneisses, and Bucks Bridge limestone (a dirty-brown, strongly-weathered part of the Theresa Formation).<br>Van Diver's hypothesis that upper soil layers have been removed by wind erosion is verified by digging a soil pit; the $B_{2ir}$ horizon is directly under the surface in places, the upper A horizons being absent.<br>A plantation of Scots (and a few Jack) Pines has provided the seed source for naturalized reproduction of these species. Other pioneers on the droughty, infertile soil are Gray and Paper Birches, Trembling aspen, White pine, Red maple, Fire cherry, Bracken fern, and Pilose Hair-cap moss.<br>Return to Route 72 in Parishville. |
| 11.3 | 1.0 | Turn left and continue east on N.Y. 72. |
| 17.7 | 7.4 | End N.Y. 72. Turn right (east) on Route 11B in Hopkinton. |

| Total Mileage | Mileage From Last Stop | |
|---|---|---|
| 19.8 | 9.5 | Turn right (south) on N.Y. 458 from Route 11B in Nicholville. Note the change in land use from existing farms to abandoned farms to forest in only several miles as we climb from the St. Lawrence Valley Lowlands to the Adirondack Highlands. The contact between the Potsdam sandstone and the Highlands gneisses is about two miles south of this intersection but concealed by thick glacial drift. Note also the pioneer vegetation on the abandoned farms: Aspens, Balsam Poplar, Paper and Gray birches, Red cherry, Serviceberry, Meadowsweet, and White pine. Elevation 800 ft. |
| 22.2 | 11.9 | Cut in glacial outwash on left (northeast). |
| 23.0 | 12.7 | First cut in Adirondack Highlands rock. The 1970 Geologic Map of New York identifies it as "amg", interlayered amphibolite and granitic, charnockitic, mangeritic or syenitic gneisses. Elevation 1060 feet. |
| 23.3 | 13.0 | Leave St. Lawrence County and enter Franklin County at the bridge over Lake Ozonia Outlet. Elevation 1000 feet. |
| 24.1 | 13.8 | Gravel pit in glacial till on right (north) and another pit 0.3 mile further. |
| 26.0 | 15.7 | Basswood trees in this area. For this Adirondack rarity, see Figure 1. Basswood indicates rich, fertile soil in the Highlands. Elevation 1300 ft. |
| 27.0 | 16.7 | Cross St. Regis River into community of St. Regis Falls. The falls are over "amg" just out of sight to the left (northwest). |
| 27.1 | 16.8 | Route 458 makes a right-angle bend to the south and recrosses the River. Elev. 1250 ft. |
| 29.7 | 19.4 | amg rockcut on south (right). Elev. 1580 ft. |
| 32.0 | 21.7 | Gravel pit in till on left (north). Another pit at 32.8 miles total. |
| 33.4 | 23.1 | Several rock cuts in "phgs" symbol on 1970 Geologic Map of New York. These are charnockitic, granitic, and quartz syenitic gneisses (see also Buddington, 1937). |
| 33.7 | 23.4 | Recross St. Regis River. Elevation 1337 ft. Community of Santa Clara. |

## Figure 1: Optional Stop
## Adirondack Highlands Rich Site




## Figure 2: Stop 2
## Soil Developed in Peat - a Bog

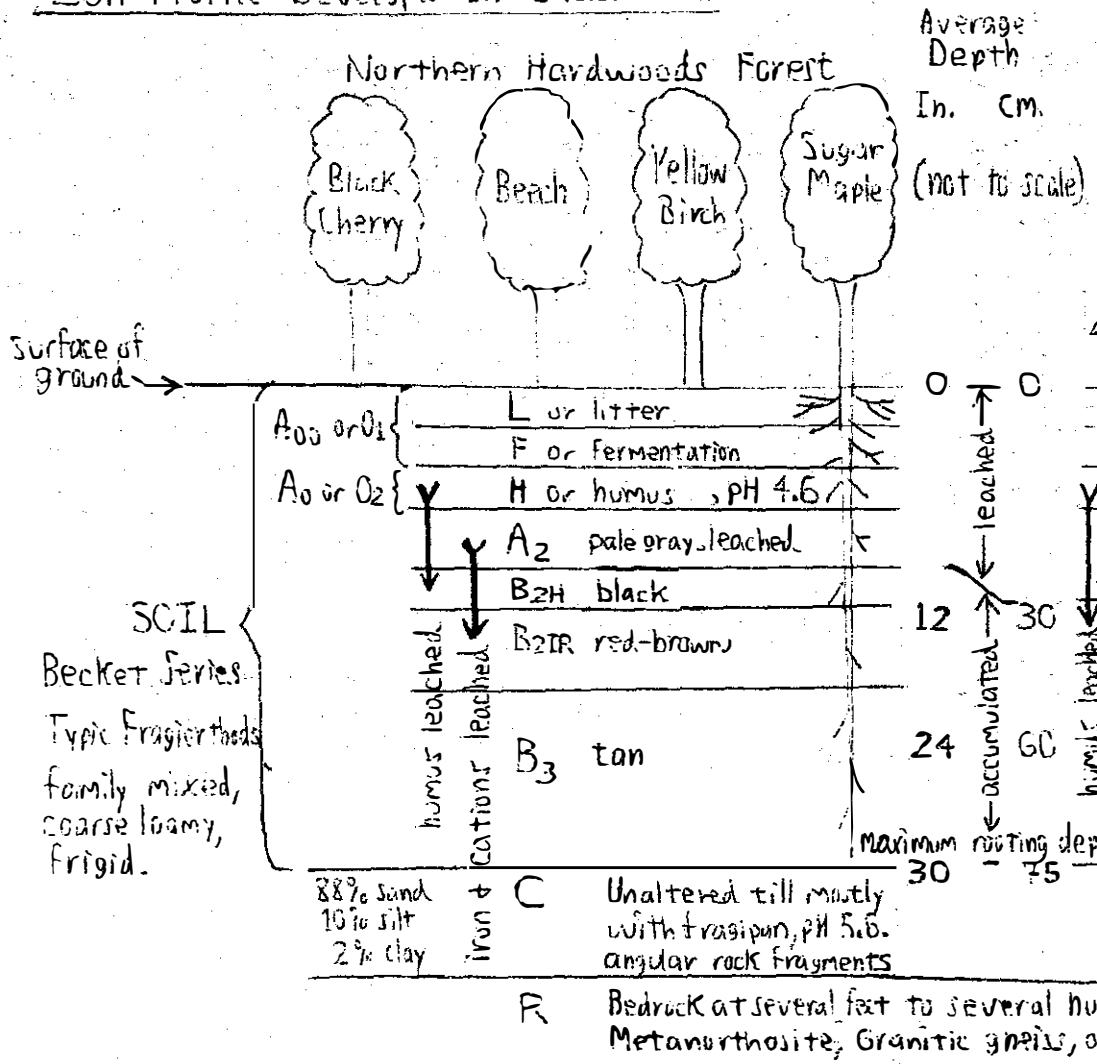


| Total Mileage | Mileage From Last Stop | |
|---|---|---|
| 34.0 | 23.7 | Rock cut in phgs. Shallow soils surround outcrops in the Highlands and often Red spruce and Hemlock predominate. On the deeper, well-drained till soils we have Northern Hardwoods (Beech, Yellow birch, Sugar maple). |
| 34.4 | 24.1 | A Balsam swamp. Poorly-drained areas lacking Peat moss are dominated often by Fir. |
| 35.2 | 24.9 | Rock cut in phgs and a till cut at Mileage 36.0. Elevation 1650 feet. |
| 37.7 | 27.4 | Parking area. Note Northern Hardwoods. |
| 39.4 | 29.1 | Deep cut in glacial outwash. At Total Mileage 39.9, the Town of Santa Clara is using another outwash mass for sanding roads in winter. |
| 40.4 | 30.1 | STOP 2. BLACK SPRUCE BOG. Elevation 1450ft. This extensive bog extends to Total Mileage 40.9; stop anywhere along its half-mile length. Note the resemblance to northern Canadian or Alaskan muskeg. Poorly-drained soils are classified by the U.S. Soil Conservation Service as Histosols where at least 51 inches (1.3 m) of organic matter overliesthe glacial drift or bedrock. All living plants and trees are fully rooted in the organic matter;no roots penetrate the mineral substrate. The dominant ground cover plants are the Peat mosses (Sphagnum spp.); when these mosses die, they accumulate, decay only partially, become compressed, and create extremely acid (pH 3 to 4) peaty soils. Most mineral nutrients are in limited supply so that the plants which grow here must survive on very low concentrations. A few of the plants have adapted to this environment by capturing insects as a nitrogen supplement (Sundews and Pitcher plants), while most others use mycorrhizal fungi to greatly extend the root absorption surface. Among the spruces in more open areas are Cranberries, Labrador Tea, Bog Laurel, Bog Rosemary, Leatherleaf, and Cottongrass sedge. See Figure 2 . |
| 41.1 | 0.7 | First of a series of rock cuts extending for 0.6 mile. A parking area is at Total Mileage 41.5. The westerly cuts are in phgs but the easterly are in "hbg", biotite and/or hornblende granitic gneiss (Buddington, 1937). |

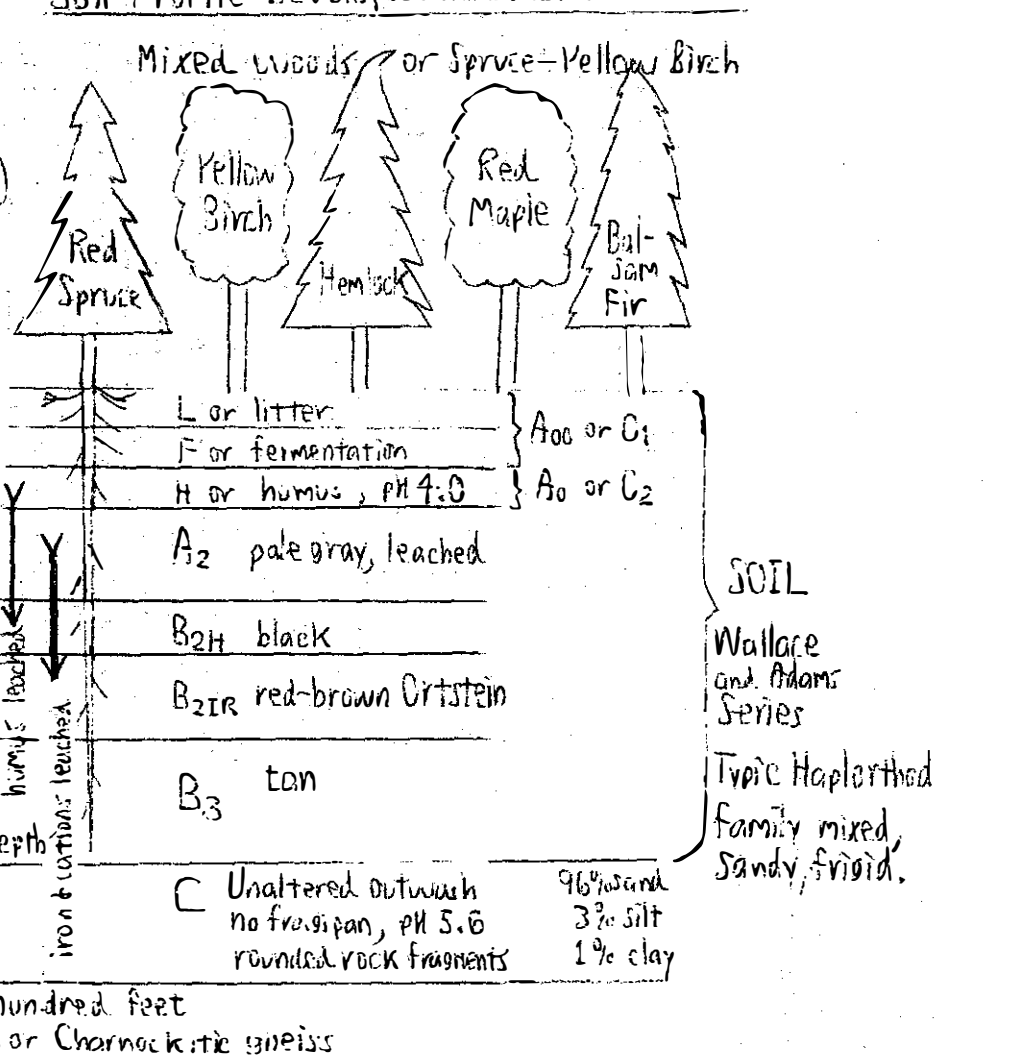
| Total Mileage | Mileage From Last Stop | |
|---|---|---|
| 43.5 | 3.1 | End Route 458. Turn right (south) on N.Y. Route 30. Elevation 1600 feet. |
| 44.7 | 4.3 | Rock cut in phgs. Elevation 1645 feet. From here for the next 4.7 miles, N.Y. 30 crosses a large, rolling outwash plain with numerous cuts and fills across kames, kettles, and crevasse fillings. Much of this area, called McColloms, was burned over in 1903 and earlier, and has been covered with pine plantations. |
| 49.4 | 9.0 | Rock cut in "a", Marcy Metanorthosite (Buddington, 1953; Davis, 1971). Mountain Pond on the left (northeast) is bounded on the west by an esker and on the east by bedrock. Mountain Pond elevation 1634 ft. |
| 50.4 | 10.0 | Barnum Pond on the right (west). View of Jenkins and St. Regis Mountains beyond, the northwesternmost outposts of the Metanorthosite in the Adirondacks. |
| 50.8 | 10.4 | STOP 3A. GLACIAL TILL. This cut is in glacial till with a loamy sand texture (average 88% sand, 10% silt, 2% clay), consisting mostly of crushed Metanorthosite, gneisses, and Potsdam Sandstone. It is often quite hard and dense, with silt grains cementing the sand and angular gravel fragments into a fragipan. The vegetation above this cut had been cleared for farmland and then was reforested both naturally and by people. The trees and plants you see here are pioneers; we must go to STOP 3B to see natural vegetation on a well-drained till site. |
| 51.1 | 0.3 | Turn left (east) up hill into Beech Hill Road (unmarked), a single-lane paved road. |
| 51.4 | 0.6 | STOP 3B. NORTHERN HARDWOODS ON TILL. Park on left (northeast) side of road opposite first house. This road cut shows a typical soil profile developed in the upper 30 or so inches (0.75m) of well-drained glacial till. Soil can be defined as the zone of interaction between parent material (here till) and forest; it is only about 30 in. thick in most places as few roots penetrate deeper. Because of the sandy nature of the till, the soil which develops in it is characterized by rapid leaching (removal of organic matter and minerl material) from the upper or A horizons and deposition in the lower or B horizons. Such soil profiles developed in sands are very colorfully |

| Total Mileage | Mileage From Last Stop | |
|---|---|---|
| | | banded although infertile and are called Spodosols (formerly Podzols). The soil series here is Becket, a Typic Fragiorthod, family coarse-loamy, mixed, frigid. The C horizon is unaltered till in its original state, underlies the soil rather than is a part of it, and is not visible here without further excavation.<br>The forest which develops on well-drained tills such as Becket soils is a Northern Hardwoods Forest with Beech, Yellow Birch, and Sugar maple dominant. Walk up the old log road to the left (north) of the cut for a quarter of a mile or so to see this forest. Other trees are Striped maple, Hemlock, Red spruce, and perhaps Black cherry. See Figure 3.<br>The elevation at the road cut is 1680 feet. Marcy Metanorthosite outcrops on the summit of 1863-foot nearby Beech Hill.<br>Common ground cover plants are Spinulose woodfern, Wood sorrel, Clinton's lily, Canada mayflower, Starflower, Wild sarsaparilla, and Purple trillium. Humus pH averages 4.5 to 4.7 under Sugar maple.<br>Return to Route 30. |
| 51.7 | 0.3 | Turn left and continue south on Route 30. |
| 52.7 | 1.3 | STOP 4. GLACIAL OUTWASH. Park on the shoulder at the intersection of Route 30 and the Keese Mills Road which diverges to the right (west). Paul Smith's College Campus and Route 30's junction with Route 192 are adjacent. More extensive cuts in glacial outwash are present on Campus and we can observe them if time permits. Elevation of junction of Routes 30 and 192 is 1658 feet. See Figure 4.<br>This cut is in glacial outwash with a sand texture averaging 96% sand, 3% silt and 1% clay. The deposit, made by a meltwater stream flowing to the southwest, consists of the same kinds of crushed rock as are found in the area tills, but with most of the silt and clay carried away in suspension. Due to the inadequate quantity of silt, sand and rounded gravel particles are not cemented together into a fragipan. Our Campus is built upon a series of kames as part of a valley train. Numerous dry kettles and kettle ponds are found locally. The thickness of the outwash valley train, as determined by water well data, ranges from zero at out- |

## Figure 3 : Stop 3
## Soil Profile Developed In Glacial Till




## Figure 4 : Stop 4
## Soil Profile Developed in Glacial Outwash



| Total Mileage | Mileage From Last Stop | |
|---|---|---|

crops to over 165 feet (50.3 m); the average thickness on Campus is 60 to 100 feet (18.3 to 30.5 m). The valley train extends for 23½ miles (38 km) southwest from Loon Lake to Fish Creek Ponds, with Paul Smiths about midway. The highest elevation of these sands at the College is between 1680 and 1700 feet so that any higher hills project above this sea of outwash as rock islands mantled with till. Taking isostatic rebound into effect, the original southwest slope of the train seems to have averaged about 5.8 feet per mile (Kudish, 1975,1981).

The soil profile which develops on well-drained outwash sands is also a Spodosol. Because of the still coarser texture, the rate of leaching from the A horizons and the rate of accumulation in the B horizons are greater than in the tills. These outwash soils, with less silt and clay, are even more infertile than their till counterparts. Drainage on the kames and other valley train features can be excessive and plants can wilt during long summer droughts. The sand grains of the $B_{21r}$ horizon are often cemented by iron and aluminum sesquioxides ($Fe_2O_3$ and $Al_2O_3$), leached down from the gray $A_2$ horizon above, creating a dense red-brown hard layer called an Ortstein. Just as fragipans occur locally only in tills, Ortsteins occur only locally on outwash. The critical concentration of silt appears to be about 6%.

The soil series here areWallace (with Ortstein) and Adams (without); they are Typic Haplorthods, family sandy, mixed, frigid.

Climax vegetation on outwash consists of trees which can survive on nutrient-poor, drought-prone sands; the forest type is a mixed woods (mixed broadleaf and evergreen species) dominated by Red spruce, Yellow birch, Balsam fir, Red maple, and Hemlock. White pine follows disturbances and Red pine occurs on sites where wind exposure prevents other trees from surviving. Ground cover is very much like that on till soils, but humus pH is even more acid-- pH 4.0 commonly. Under the more open Red pine stands, commonly on the east shores of lakes, less shade-tolerant species occur: Blueberries, Huckleberry, Wintergreen, Trailing arbutus, Serviceberry, Sheep laurel and Bracken fern.

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