A Brief Natural History

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Wild and Beautiful

A Satellite image of southwestern Ontario reveals a sinuous 700 kilometre ribbon of cliffs, hills, and forests winding through Canada's most intensely cultivated and urbanized landscape, from Niagara Falls in the south to Tobermory on the northern tip of the Bruce Peninsula. This is the Niagara Escarpment, the most outstanding geological feature of the region. It rises wild and beautiful above the lakes, farmlands, and urban developments, guarding a treasure of waterfalls, cool glens, and natural ecosystems containing numerous rare plant communities.

In 1990 UNESCO designated the Niagara Escarpment a World Biosphere Reserve, one of six in all of Canada. Each reserve is intended to be a demonstration area for both the biological diversity and the promotion of environmentally appropriate development.

The Blue Mountains

Nowhere does the Niagara Escarpment dominate the landscape and affect the lives of the local people as it does in the Town of the Blue Mountains.

The name Blue Mountains was first used by Charles Rankin when he started surveying the land on the south shore or Nottawasaga Bay in 1833. Today, Blue Mountains is the name given to the section of the Niagara Escarpment running from Osler Bluff which overlooks the Pretty Valley, to Georgian Peaks where the Escarpment is interrupted by the rolling orchard lands of the broad Beaver Valley. The Escarpment reaches its highest elevation here (300 m above Georgian Bay) and thus provides the spectacular views and the best alpine skiing in southern Ontario. Steep sided valleys have been carved into the Blue Mountains by numberous streams such as the Pretty River, Black Ash and Silver Creeks in the Osler Bluff area, and Indian Brook on the Beaver Valley side.

Ancient Seas

Where the Blue Mountains now stand was once the bottom of an ancient sea. During the Paleozoic era, hundreds of millions of years ago, this part of the continent was inundated by warm water seas. For hundreds of millions of years sediments from adjacent mountains were deposited on the floors of these seas. After many millions of years, the sands turned into sandstone and the muds into shales and slates. The seas teamed with invertebrate life, the shells and skeletons of which created limestones and dolostones. In some areas, reefs developed similar to the coral reefs found in the south seas of today.

The rock layers found int he Niagara Escparpment were formed from sediments laid primarily in the Silurian period. The limestones and dolostones of hte Silurian Period are composed primarily of fragmented invertibrate fossils. The dolostone found at the top of the Blue Mountains contains considerable magnesium and is very hard and resistant to erosion. In some places organic silica from sponge-like sea creatures has created minteral deposits. It is a very hard mineral and typically cannot be scratched with a knife. Beacause of its hardness, the paleo-Indians used it for making spear points and other tools. A chert deposit located near Redwing, became the source of this important resource for paleo-Indians throughout southern Ontario, as well as parts of Michigan and New York State.

Underlying the dolostone caprock of the escarpment is a rock formation known as Queenston shale. This red shale can be clearly seen on the Scenic Road in the Loree community just east of Victoria Corners. The red colour of the shale is caused by red iron oxide. The greenish-grey bands which parallel the planes of the shale, or follow plant roots or vertical joints, result from the presence of a green iron oxide. When exposed to atmosphere, the Queenston shale breaks down into a red, slippery clay (hikers beware!). The shale erodes so rapidly that it often supports no vegetation. As a result, miniature badlands are created.

Below the red Queenston shale are numerous thin bedded strata of limestone, sandstone, and grey coloured shales, all laid during the time of the Silurian Seas. The Shales weather quickly into a blueish-grey clay often exposed where ravines have cut back into the Escarpment.

Rocks at the bottom of the Escarpment belong to the Ordovician period. The Ordovician rock which outcrops along the shore of the Nottawasaga Bay in and around Craigleith Provincial Park is often described as shale, but it is actually an impure limestone that can easily be broken into shale-like slabs. Because of the thick beds of this limestone, the was used as a supply of building material by the early settlers.
The Ordovicician rocks which protrude out into the water in the vicinity of Craigleith Provinicial Park contain numerous invertibrate fossils such as Trilobites and Cephalopods, making Craigleith one of the most popular places in Ontario for fossil collectors. The abundant ancient sealife is responsible for the oil embedded in the bedrock along the shore of Nottawasaga Bay. An historic plaque in the Craigleith Provincial Park describes the brief period of oil extraction from these "oil shales" from 1859 to 1861.

Rock Structure
The sediments on the floors of the sea were laid in horizontal strata. In the following hundreds of millions of years these strata were bent and warped by continental mountain building forces. In the Great Lakes region two saucer-like bedrock depressions were created: the Michigan Basin with its centre in the state of Michigan and Allegheny Basins is a rise of bedrock known as the Algonquin Arch. The Niagara Escarpment interescts the Algonquin Arch at its highest point in the Blue Mountains area.
South of Lake Ontario, the Niagara Escarpment is formed along the rim of the Allegheny Basin. North of Lake Ontario, including the Blue Mountains, the Escarpment is formed along the rim of the Michigan Basin and thus the rocks dip gently away from the face of the Escarpment in a southwesterly direction.

Cuestaform Erosion
The Niagara Escarpment is not the result of faulting as some escarpments are, but instead is a cuesta which was formed by the differential erosion of rock strata. Simply stated, this means that underlying soft rocks eroded away relatively quickly and the more resistant caprock was undermined and broke off, creating a cliff-like slope. The erosion process was quite complicated and took place over hundreds of millions of years.
The Silurian rocks exposed along the Niagara Escarpment were not the last sediments laid down in Ontario. There were seas covering most of Southern Ontario for another hundred plus million years.
Deposition in these seas buried the presently exposed bedrock with a great thickness of sediments which turned into various kinds of rocks. By the end of hte Palezoic era the seas receded and southern Ontario rose above the waters.
As soon as the land emerged from beneath the sea, drainage networks developed on the newly exposed sea floor, and began dissecting its surface. Rivulets, streams and major rivers began removing unimaginable amounts of rock material from the land. The rate of denudation has been estimated on one metre every 1000 years which would result in the removal of 2km in 200 million years. The rock layers that had accumulated above the presently exposed bedrock were all carried away.
After the rock over the currently exposed rocks were eroded away, and the rock strata had warped into the basin and arch structure described above, differential erosion began to etch out the cuesta now known as the Niagara Escarpment. The orginal Niagara Escarpment existed well beyond the present scarp face, somewhere out in what is now Nottawasaga Bay. As more and more of the underlying rocks were eroded and the caprick fell away, the Escarpment migrated away from the scarp face, southwestward in the Blue Mountains area. Because of the dip in the rock strata, and the increasing depth of sedimentary rocks in the southwestern direction, the escarpment became higher as it migrated.
Where streams flow over erosion-resistant layers of bedrock, pictureesque waterfalls develop. There are numerous examples in the Blue Mountains area. The most spectacular in the immediate environs is Eugenia Falls near the head of the Beaver Valley. Hydroelectric power was developed at this falls as early as 1895. Waterfalls like Eugenia maintain a vertical face as a result of a process called sapping. As this sapping erosion continues, the waterfall migrates upstream. At Eugenia, it has migrated back from where it first plunged down into the deep valley of the Boyne. The walkway provided by the Grey-Sauble Conservation Authority provides an excellent opportunity to view Eugenia Falls and gorge. Another scenic gorge can be seen on the upper Beaver River where it crosses Grey Rd 2 at Feversham.
Streams that flow down the scarp slope erode very rapidly. In some places their tributaries cut back behind the scarp face, ultimately creating upland "islands" separated from the main body of the Escarpment. These are called outliers. The Georgian Peaks area is an example which geomorphologists have named the Camperdown

Outlier; it's island like nature can be seen from the Scenic Road east of Victoria Corners. Osler Bluff is an example of an outlier in the making. Some day in the distant future it will become an "island" separated from the main body of the Escarpment.
Solution is another active process in the erosion of the Niagara Escarpment. Dolostone and limestone are carbonate rocks which are dissolved by the natural acidity of rainwater. Landscape created by a large amount of solution is called Karst topography. Karst features include pitting of rock surfances, crevices, and sink holes which drain surface waters down through the rocks, subterranean channels, and caves. The water that drains down through the rocks emerges at a lower level as seeps or springs which feed coldwater streams. A hike along the Bruce Trail in the Blue Mountains area gives one an opportunity to see a number of these Karst features.
Water in the cracks and joints of the dolostone caprock freezes in winter and wedges blocks rocks apart. The roots of trees also pry blocks of rock apart. Eventually, rocks from fist-size to house-size break away and fall to the base of the cliff, where they accumulate to form the break-of-slope called a talus slope that is so charactoristic of the profile of the Niagara Escarpment. The talus slope is quite pronounced at Georgian Peaks, Osler Bluff, and Old Baldy in the Beaver Valley.
In some areas, huge dolostone blocks that have been wedged away from the cliff by the ice are underlain by wet slippery shale, and have tilted and slowly slipped away from the cliff. In some places smaller blocks of rock have become wedged between the large block and the cliff. The openings between huge blocks of rock that have separated from the cliff are called crevice caves. The Scenic Caves Nature Preserve above the Blue Mountain Ski Resort provides and excellent example of crevace caves. The largest is over 15m deep and 30 m long. It is so cool on the floors of some of these vaces that ice and snow remains in them during the summer months. One free standing rock at the Scenic Caves was considered sacred by the Petun Indians and has been given the name Ekarenniondi.

Glaciation
Duing the Ice Age, which geologists call the Pleistocene Epoch, continental glaciers covered Southern Ontario on numerous occasions. Over a period of about a million years, major advances of glaciers alternated with long periods of mild climate during which the glaciers completely disappeared. When at it's minimum, the glacial ice was about two km deep in the Blue Mountains area. The last glacier retreated from this area some 10,000 years ago.
As an erosional agent, glaciation is insignificant compared to kstream erosion as far as the origin of hte Niagara Escarpment is concerned. Many Millions of years before glaciation, the Blue Mountains had taken the basic form we recognize today. When glaciers advanced over the land, the great pressure caused rock materials, ranging in size particals from clay to boulders, to freeze into the bottom of the ice. These acted as scraping and gouging tools which left scratches, gouges, and grooves which can be seen on exposed bedrock on top of the Escarpment. As more rock was picked up and became frozen into the bottom of the ice. In time, theere was as much rocky material in the glacier as there was ice. Thus the glacier acted more like a conveyer belt carrying rocks than like a bulldozer pushing them.
When the ice had picked up a bigger load that it could carry, it plastered the clay and rock mixture off the bottom to create an undulating surface called a till plain. In some parts of southern Ontario till is hundreds of metres deep, and in some cases it has completely bured the Niagara Escarpment. The till deposited on the bedrock above the brow of the Blue Mountains was only a few metres deep, and much of it has eroded away. Below the Escarpment, till has been plastered over the talus slope. The till was composed of primarily sedimentary rock material, most of which was scooped out of Georgian Bay. However, there are some large crystalline rocks (e.g., granite, basalt) which were carried here from the Canadian Sheild. These rocks are called erratics because they are of different composition than the bedrock on which they are located.
When the leading edge of the glacier was stationary for a period of time, it deposited ridges of rock material called merginal moraines. There are two prominent marginal moraines just south of the Blue Mountains. The Banks Moraine just north of the hamlet of Gibraltar. Both the Banks and Gibraltar Moraines extend southwestward almost to Lake Huron.
The last glacier began retreating from this area about 10,000 years ago. As soon as the ice left, streams began their erosional work. Dendritic patterns of valleys were carved into the glacial till. In some cases small "misfit" streams are found in large valleys that were previously carved out by the glacial meltwaters.

After the glacier disappeared, the land which had been depressed by the heavy load of ice, began to rebound. The Blue Mountains area has risen over 15m and is still continuing to rise at a rate of 15cm per hundred years. At one time, the drainage basin we now know as the Great Lakes had its outlet through the St. Lawrence blocked by continental glaciation. This fact, and the huge amount of meltwater created by the retreating glacier, greatly increased the size of the lakes. One of these large lakes, Lake Algonquin, occupied the Michigan, Huron, and Geogian Bay lake basins. The water was, of course, much higher than present. The shoreline of historic Lake Algonquin is a prominent bluff that can be observed along the base of the Blue Mountains (775 ft. or 230 m contour). It continues across the Beaver Valley south of Thornbury. Just a short distance north of the old Algonquin bluff is a shoreline created by a later historic lake called Nipissing (635 ft. or 190 m contour). It is not as prominent as the Algonquin bluff, but is still clearly observable on any north-south road that traverses it.

Plant Communities

The Niagara Escarpment is more htan just a pre-glacial geological holdover; it is the home of numerous plant communities, some of them very rare.

Only recently, scientists have discovered that the Eastern White Cedar trees growing on the Escarpment comprise Ontario's oldest old-growth forest, in fact, it's the only virgin forest. The most ancient living Cedar found on the Escarpment is over 1000 years old, but there may be older trees yet undiscovered. Scientists have not yet determined just how these trees take root and survive on the barren dolostone. Sometimes growing on a bare cliff, the trees are exposed to severe wind and cold. There is no soil to protect their roots so they must survive temperatures that reach -40 degrees celcius. Because of the harsh environment, the trees grow very slowly. A magnifying glass is required to see the annual growth rings. The trunk diameter of a 400 year old Cedar found in the Feversham Gorge was only 25 cm. That tree had relatively good growing conditions. One 400 year old Cedar was found with a trunk diameter of less than 10 cm.

Because of major forest fires along the Blue Mountains in the 1880's, and again in 1906, in only a few places can you find the old growth forest that is associated with much of the rest of the Niagara Escarpment.

Some parts of the Niagara Escarpment have been designated by the Province as Areas of Natural and Scientific Interest (ANSIs). The scarp slope and Georgian Peaks and the plateau above (the Camperdown Outlier) have been designated as an ANSI. It contains patches of mature deciduous and coniferous foreest as well as open areas of grass, wild flowers, shrubs and young trees. In this area, naturalists have identified 260 vascular plant species, including the provincially rare Chilean Sweet Cicely and Drooping Sedge, and 31 species of birds nesting in the area. Some of these birds are species which usually nest only in the interior of large forests.

Beacuse much of the Niagara Escarpment is forested, it has an abundance of spring flowers and other plants usually found in southern Ontario deciduous and mixed woods. The northern portion of the Niagara Escarpment (Grey and Bruce Counties) is particularly known for its profusion of ferns. They are found on top of the Escarpment, in the crevice caves, among the talus boulders at the foot of the cliff, and sometimes even clinging to the cliff face. There are some forty species of ferns found along the Escarpment in Grey and Bruce counties, most of which can be found in the Blue Mountains Areas. The Scenic Caves, Loree Forest, Feversham Gorge, and Old Baldy (above Kimberly) are all excellent places to look for a wide variety of ferns.

In addition to trees, shrubs, flowers and ferns, the Niagara Escarpment is home to a wide range of mosses, lichens, algae, and fungi. Fore example, scientists have recently inventoried more than 50 species of algae and fungi on the dolostone cliffs.

In short, the Blue Mountains area is a naturalist's paradise.

References

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