Greenbelt
Ceinture de verdure

Old Quarry Trail

The Making of a Landscape

National Capital Commission
Commission de la capitale nationale

Canada

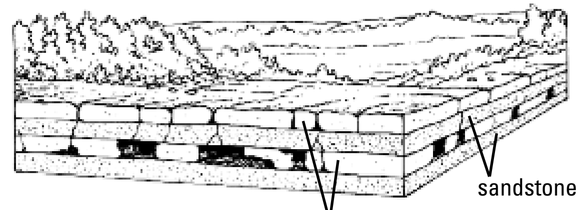
The Making of a Landscape

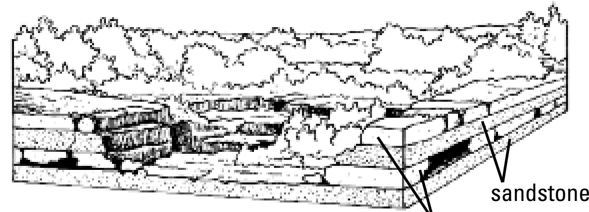
This area was mountainous terrain one billion years ago. Now only the worn-down roots of the ancient peaks remain. In the Gatineaus they are exposed as low, rolling hills. South of the Ottawa River they are mostly covered by younger sedimentary rocks. These were laid down about 450 million years ago, when seawater flooded in to cover the land where you are now standing.

a. At first the sea was shallow, and sand was deposited along its edges as on present-day sea coasts. But the sea was not stationary: it alternately withdrew and returned, becoming shallower and deeper by turns. Whenever the water was deep, fine carbonates were laid down on the ocean floor. As the sea became shallower, sandier layers accumulated on top of the carbonates.

Over time, the sand was compressed into sandstone, and the carbonates were transformed into dolomite rocks. Along the Old Quarry Trail you will see two rock types: sandstone is found in the low areas and sandy dolomite is found in the higher land.

b. If you could have looked into the earth beneath your feet 300 million years ago, you might have seen something like this. Note that the layers of sandstone and dolomite alternate. Deep cracks have developed in the rock layers. Ground water has trickled down through the cracks and squeezed sideways between the layers, slowly eroding portions of the dolomite and creating large caverns.





c. As recently as a million years ago, massive glaciers, two kilometres thick, began to advance over the entire area, continuing the process of erosion. That much ice was heavy enough to collapse the roofs of the underground caverns. Much of the broken rock was carried away by the glaciers, leaving hollows and depressions on the earth's surface. The swampy depression along the Old Quarry Trail occupies one such hollow.

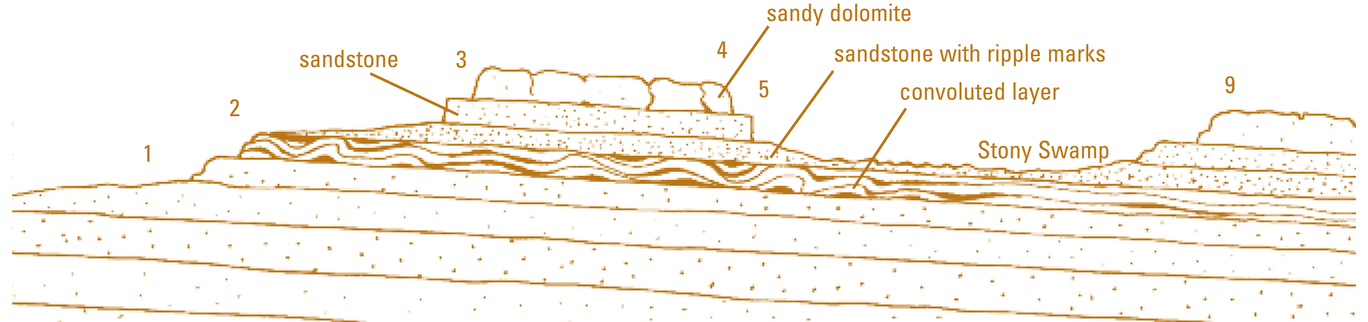
When the glaciers finally melted over 10,000 years ago, they released vast quantities of water, raising the sea level. Also, the land surface was lower than it is now, having been pressed down by the weight of the ice. As a result, seawater flooded up the Ottawa and St. Lawrence river valleys from the Atlantic Ocean: once again this area was at sea! The fine clays laid down on the bottom of this new sea formed most of the flat plains you see around Ottawa today. The remains of its sandy beaches can be found here too.

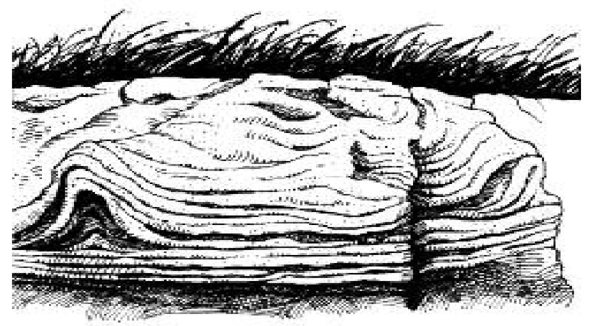
As you follow this trail, see how many clues you can find to the geological processes that have shaped the landscape of Stony Swamp.

1 Steps in Time

Look carefully at the shape of this step-like rise. An enormous flat layer of rock extends ahead of you and to your left and right. Follow it with your eyes as it swings left toward Eagleson Road. The layers (or beds) were formed from sand accumulated at the edge of an ocean that covered this region 450 million years ago.

Walk along the base of the ridge a little way to your right. Can you see individual sand grains in these sandstone layers?

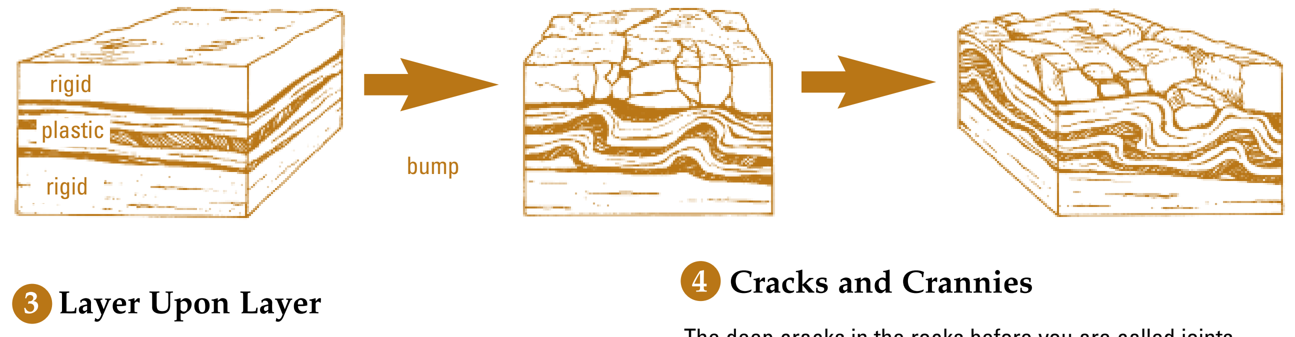




2 Odd Shapes in Stone

Even geologists are puzzled by the unusual layer at the top of this ridge. How was such a strangely convoluted layer formed? You can see that it lies directly on top of a normal, flat sandstone layer.

Perhaps one layer of sand did not lose its moisture as fast as the layers above and below it. Remaining plastic, and on a slight incline, this layer may have buckled up in response to a sudden shock — perhaps a distant earthquake. The layers above and below remained rigid, and blocks from the upper, rigid layer fell into the plastic, convoluted layers.



3 Layer Upon Layer

At least two more layers of rock are easily seen in this second small ridge. Again, the bottom layer is sandstone. You will see this layer again. As you walk along the trail, try to figure out why this layer has so many holes in it.

SANDSTONE OR DOLOMITE? WHICH IS WHICH?

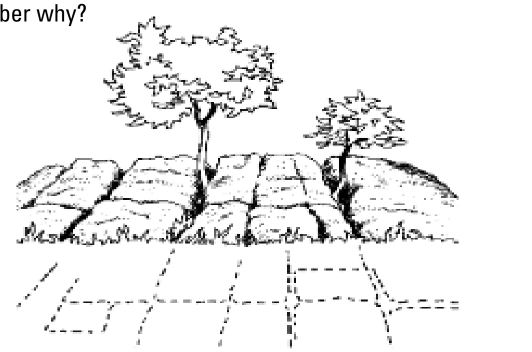
SANDSTONE	DOLOMITE
Made up of tiny quartz sand grains; fresh-cut surfaces glitter white; hard enough to scratch glass.	Was first dissolved in the seawater, then precipitated out; dull finish; softer than sandstone.
Will not dissolve in rainwater.	Dissolves slowly in rainwater.
No reaction to weak acids.	Fizzes slightly in weak acid.

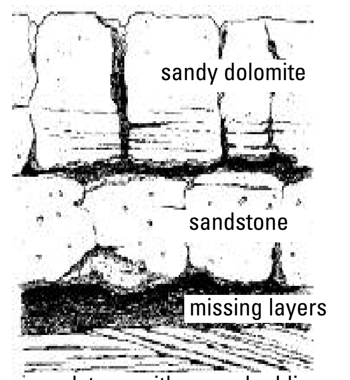
Also examine the uppermost layer of sandy dolomite, which was laid down in slightly deeper water than the sandstone. It is smoother and greyer and contains large crystals of the mineral calcite. Tiny sand grains are visible surrounded by the mineral dolomite. Dolomite is much softer than sandstone and it dissolves slowly in rainwater.

Notice that the broken edges of the dolomite tend to be rounded, whereas those of the harder sandstone are squared off.

4 Cracks and Crannies

The deep cracks in the rocks before you are called joints. They are very common in bedrock and have developed here in response to some shock. Notice that the joints run in more than one direction. The sandstone seen earlier also had joints but they were not weathered in the same way. Do you remember why?



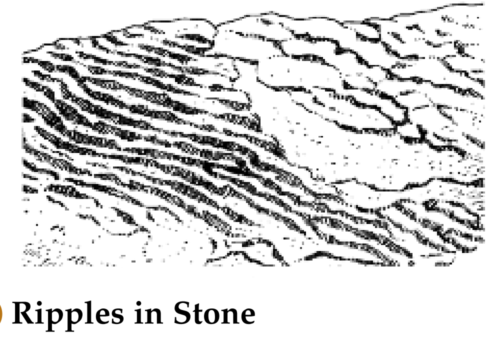


5 The Inside Story

Stop 4 is on the ledge above you.

Over time, rain, frost and trees have widened the joints, leaving behind large well-separated blocks. Notice that most of these blocks have not moved relative to each other. (Can you find any that have toppled out of position?) You can still trace the beds from one to the next. Wavy horizontal lines indicate places where slimy algae mats may have grown. Again, note the numerous holes in the sandstone layer. Can you find cross-bedding? (See sketch.) These slanted layers were laid down where a sand beach sloped toward the ocean.

Some layers seem to be missing! The sandstone layers were so poorly cemented that the rock has fallen apart and can only be found deep in the cliff where it is protected from the elements.



6 Ripples in Stone

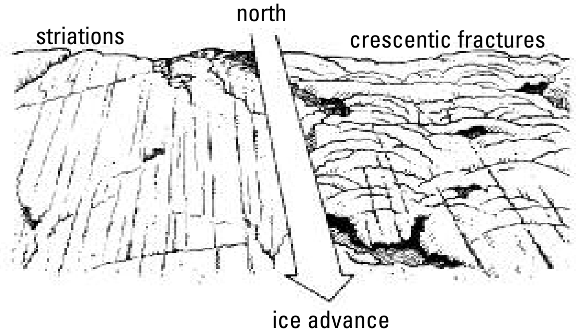
Do you remember having seen ripples on a wet sand beach at the ocean's edge — or felt them underfoot as you waded in? The ripples on this sandstone were formed near a seashore 450 million years ago.

Can you find two different shapes of ripples near here?

7 Glacial Etchings

Fifteen thousand years ago, this region was glaciated for the last time. As the massive ice sheet advanced, sand embedded in the base of the moving glacier "sandpapered" the exposed rock. Look for places where rocks carried by the moving ice scratched the smoothly polished surfaces. These scratches in the glacial polish are called *striations*. A huge boulder carried by the ice has gouged out a broad trough in the sandstone.

Also present are crescentic fractures formed when a boulder carried by the moving ice rammed into the bedrock, cracking it in this unusual way.



8 The Old Quarry

It's not hard to guess why this small quarry was once a popular source of flagstones. Its sandstone is thin-bedded, square-jointed, of uniform colour and very resistant to weathering — in other words, made-to-order for paths and patios.

Explore the quarry, keeping a lookout for "fossil" worm burrows in some of the layers. Do you think the worm burrows could explain the holes in the sandstone?

On the way to the next stop, the trail rises from the level of the sandstone, with its many glacial markings, to the level of the sandy dolomite seen at Stop 4.

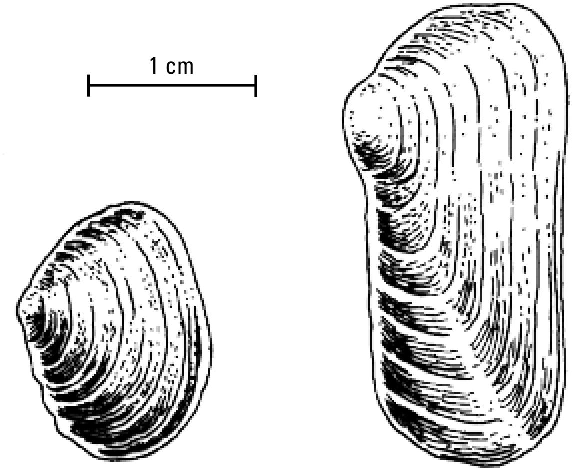
9 Erratic Rocks

The huge boulders gathered here were once scattered randomly over the entire area. Unlike the younger, layered sandstone and dolomite, these rocks are over one billion years old — examples of Canadian Shield rocks that were plucked from their native Gatineau Hills by the glaciers, only to be strewn across the countryside to the south, wherever the melting ice happened to drop them.

10 Solving the Puzzle

You have seen layers of dolomite alternating with layers of sandstone, and know that one dissolves slowly in rainwater, while the other does not. Imagine water trickling down the joints into rock layers buried well below the surface, then travelling horizontally and eroding large caverns in dolomite layers deep underground.

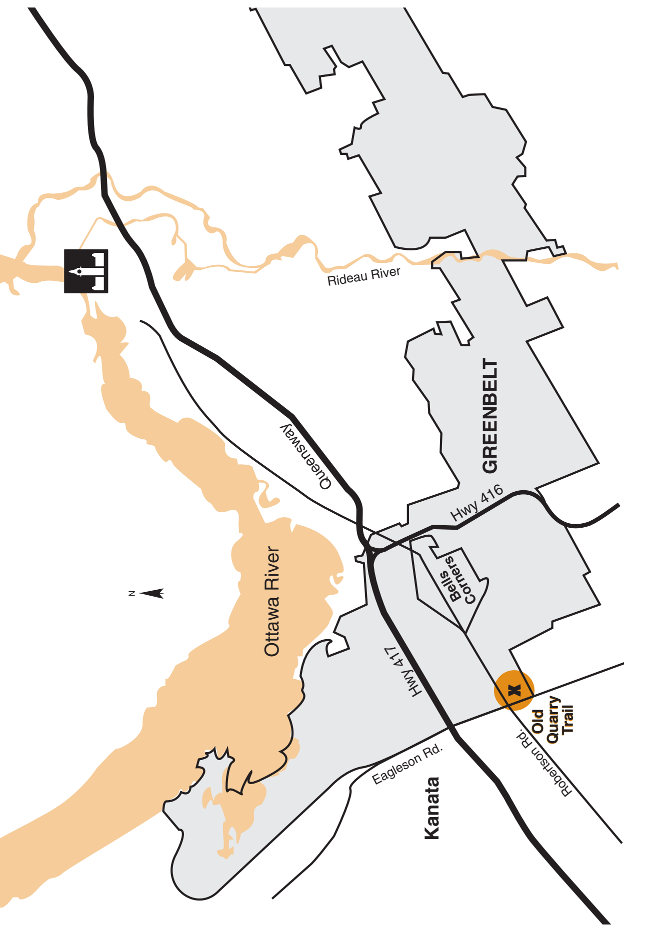
Now think of the glaciers, over two kilometres thick, that covered the region with ice 15,000 years ago. The tremendous weight of this ice could have been enough to collapse the rock layers forming the cavern roofs. The ice could then have carried away the rock rubble, leaving the bowl-shaped hollows that we find throughout Stony Swamp today. The rock ledge that forms the edge of the hollow you have been circling remains intact because the underlying layers were not eroded away.



11 Fossils from the Sea

About 12,000 years ago, the Old Quarry Trail was again inundated by the sea. The glaciers were releasing huge quantities of meltwater, and the land surface was lower than at present since it had been weighed down by the ice. The Champlain Sea, an arm of the Atlantic Ocean, flooded up the Ottawa-St. Lawrence Valley and remained here for 2,000 years or more. This period ended when the water supply diminished and the land began to rebound.

For a time though, the seashore did extend right across the Ottawa region. Again beaches were formed: our evidence this time is not ripple marks in stone, but fossil seashells in sand. Examine the loose sediment at your feet. The tiny shells you see are the remains of a type of clam that still lives in Arctic waters today. Sedimentary rock is in the making yet again.



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