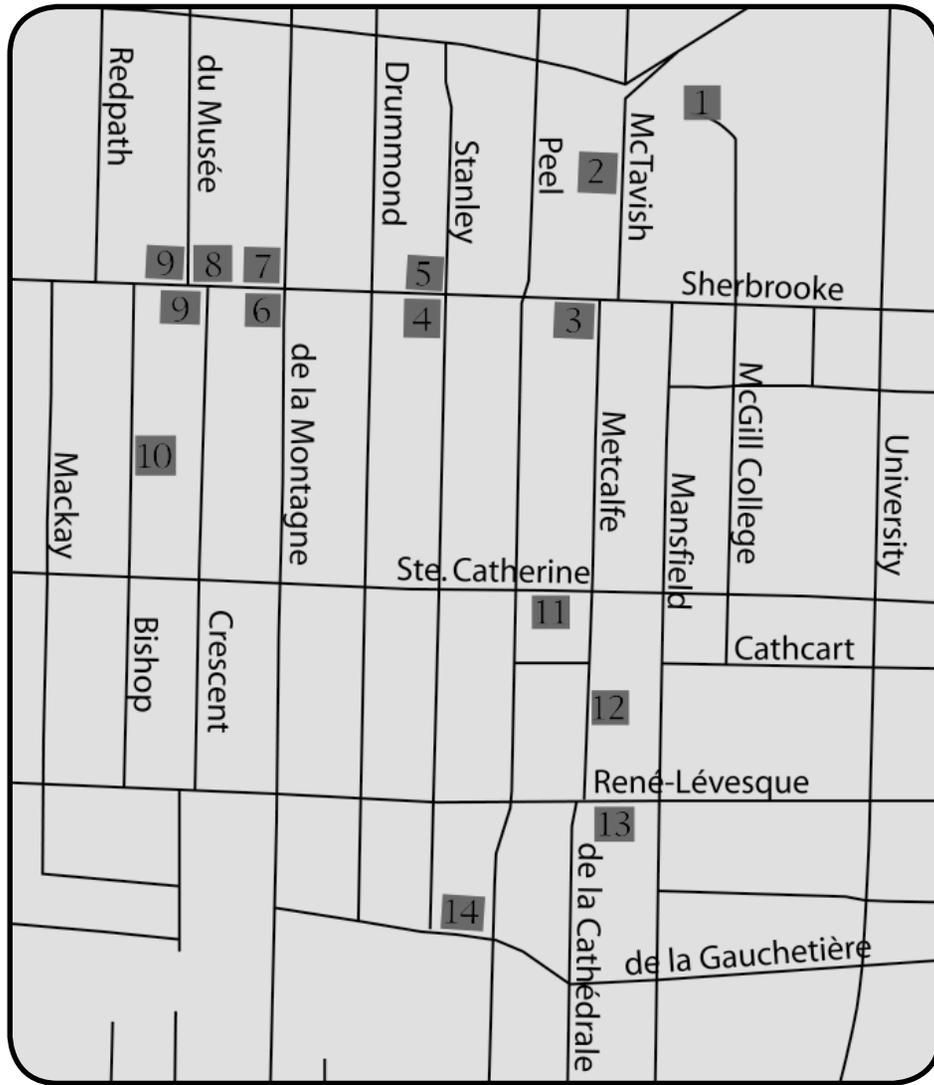


THE SITES



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BUILDING STONES AND FOSSILS



The Tour

This walking tour covers 14 buildings in the downtown core of Montreal. You can start the tour anywhere on the map, you don't have to walk in any order. This is a much shorter version of the publication *What Building Stones Tell*, available in both French and English at the Redpath Museum.

Each building on the tour features different types of rocks and fossils. You will examine some of North America's most attractive and interesting rocks dating from a period in the earth's history more than a billion years ago.

Kinds of Building Stones

Igneous: Rock formed from cooling and solidification of hot molten material (magma) such as granite or syenite. Individual mineral crystals such as quartz, feldspar and mica are easily identified on polished granite surfaces.

Sedimentary: Rock produced when particles such as sand are laid down under water (e.g. sand-

stone) or when fossil corals and shells accumulate to form limestone (e.g. Montreal limestone). If fossil shells are visible in layers in the rocks it indicates that the limestone was deposited in warm, shallow seas.

Metamorphic: Rock that has been changed (metamorphosed) by changes in heat and pressure. Under pressure, original features in these rocks are often deformed or partially destroyed. Examples of metamorphic rocks are marble, ironstone, slate and quartzite.

Choosing Building Stones

Building stone needs to look attractive and last for many decades, if not centuries. The stone must be strong enough to support the building above it and durable enough to withstand attack by rain, sun, organisms, pollution or sea spray. Incompatible stones like sandstone and limestone would not be placed together, as acid solutions that wash carbonates from the limestone can chemically affect the durability of sandstone.

Redpath Museum, McGill University
859 Sherbrooke West, Montreal, Quebec
514.398.4086 www.mcgill.ca/redpath



1 Redpath Museum

859 Sherbrooke West



Built with:

Trenton limestone, a sedimentary rock from the Ordovician of Quebec, about 470 million years old.

What to look for:

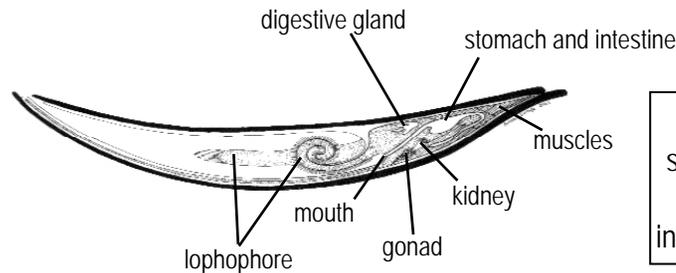
On the west side of building, directly across the road from the glass and metal tower, look at the stones at the base of the building, near the centre. What you see is a white shell with fine ribs or raised stripes. This shell is called *Rafinesquina alternata* and it belongs to a group of animals called brachiopods.



What is a brachiopod?

Brachiopods are a group of animals that form shells, but which are poorly known because there are not very many of them in modern oceans. They were very common in the ancient oceans, especially during the Paleozoic era, about 543-250 million years ago. The soft part of the animal is encased within the shell and divided into two

regions by a membrane or wall. The front part of the cavity contains a coiled and hairy band called the lophophore, which helps in food gathering and breathing. The mouth is in the center of the dividing wall at the base of the lophophore. The gut, stomach, digestive glands, and sex organs are in the cavity behind the wall. Water currents set up by the cilia or hairs on the lophophore carry small food particles toward the mouth.



A brachiopod shell cut in half to show the internal structure

2 McGill Faculty Club

3450 McTavish Street



Built with:

Trenton limestone, a sedimentary rock from Quebec, formed during the Ordovician Period. The red clay bricks on the side wall are made from black shale, another sedimentary rock from the late Ordovician, about 430 million years old.

What to look for:

Walk along the driveway and look at the red bricks on the side wall. Find the cat's paws imprinted in the bricks. Is this a fossil? No. When these bricks were made in the Laprairie Brickyards over 100 years ago, the clay was left to dry in moulds rather than being baked in a kiln or fired. Cats walked over the wet bricks and left their paw prints on them.



3 CIBC Building

1010 Sherbrooke Street West

Built with:

Anorthosite. This stele or monument is from Saint Nazaire, east of Alma in the Eastern Townships region of Quebec. It was formed during the Precambrian, about 1 billion years ago.



What is Anorthosite?

Anorthosite is a very hard, igneous rock formed from molten material that cooled inside the earth. Anorthosite is rare; it is more common on the surface of the moon than the earth. Anorthosite is known as "Black Cambrian granite" and you will find it used for steps, statues and monuments. It is polished to bring out the colours of the different minerals. The pink granite that you are walking on is from Finland and is called Rapakivi granite.



4 Atholston House 1172 Sherbrooke Street West

Built with:
Trenton limestone, 470 million years old.

What to look for:
In the stone right under the bay window and on the stairway are broken pieces of fossils laid down in layers; this is called bedding or stratification.

What is bedding?

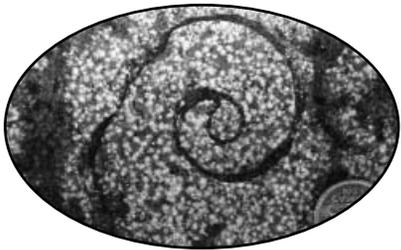
Most sedimentary rocks show distinct layers or strata, which is the Latin word for 'layers'. After animals in the water died they fell to the bottom of the sea, slowly building up thick layers or strata. This accumulation of shells and body coverings compressed into a solid mass and formed limestone.

5 Mount Royal Club 1175 Sherbrooke Street West

Built with:
Trenton limestone, a sedimentary rock from Quebec, formed during the Ordovician Period, about 470 million

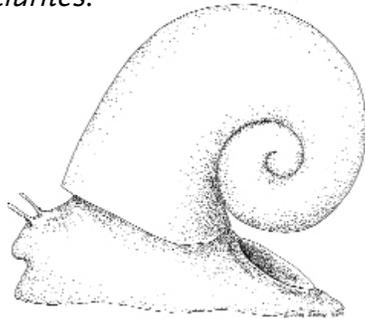


years ago
What to look for:
On the stone wall by the sidewalk are gastropod molds from the sea snail called *Maclurites*.



What is a gastropod?

Gastropods are snails and slugs. Their coiled shell protects the snails from predators and desiccation (drying out). This snail lived about 470 million years ago, when this area was a tropical sea.



6 Holt Renfrew 1300 Sherbrooke Street West

Built from:
Stanstead granite on the base. The walls are made of Indiana limestone from the Bloomington-Bedford area of Indiana. The limestone was formed about 360 million years ago during the Carboniferous Period.

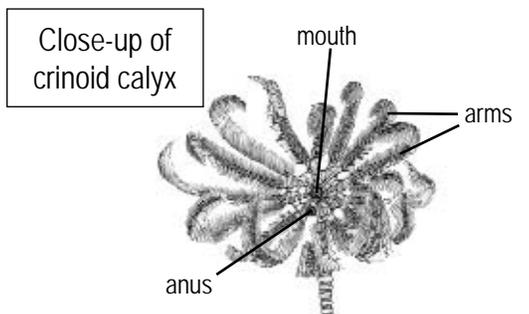
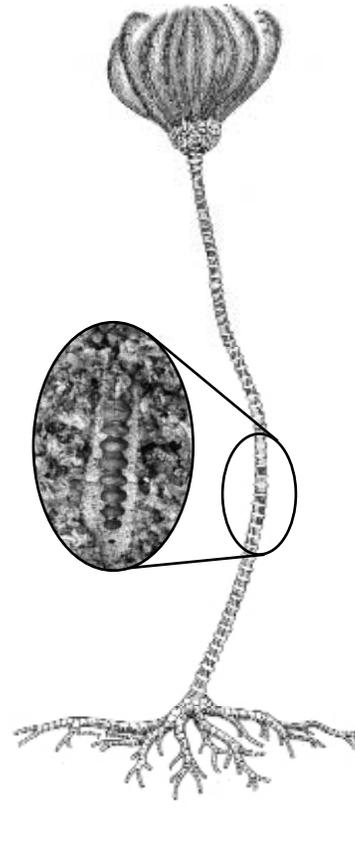


What to look for:

If you look closely at the walls on the east side of the building going down rue de la Montagne you will see that it is made of many broken pieces of calcite and small disks. These disks are the fossils of ancient crinoids, or "sea lilies", and the building stone is called encrinal or crinoidal limestone.

What is a crinoid?

Crinoids are animals that look like flowers on jointed stalks. The flower part, or calyx, has both a mouth and an anus and is surrounded by many feathery arms that gather food into the mouth. Species that live attached to the sea floor have a stalk which is actually a column made of many segmented pieces. Most beds of crinoidal limestone consist mainly of broken columns, with few calyxes. Relatives in today's oceans include starfish, sand dollars, sea urchins and sea cucumbers.



7 Le Château Apartments 1321 Sherbrooke Street West

Built from:

This building is made of very distinctive Tyndall limestone from the Garson Quarry about 40 km northeast of Winnipeg.

What to look for:

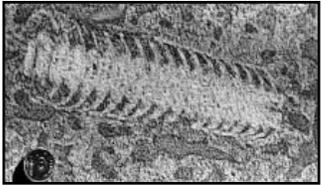
All the most exciting fossils can be found on the eastern wall of the building on rue de la Montagne. You will find gastropods (see Building 5), cephalopods and corals.



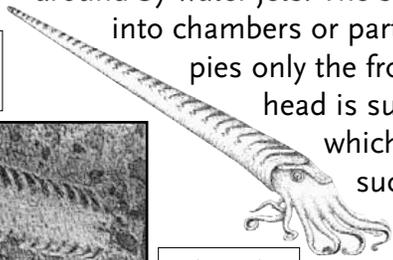
What is a cephalopod?

Cephalopods are the brainiest of marine mollusks. They are predators that move around by water jets. The shell is divided internally into chambers or partitions; the animal occupies only the front opening of the shell. Its head is surrounded by tentacles which usually have hooks or suckers. The most common living forms are the squid, octopus, cuttlefish and nautilus.

(below) fossil cephalopod



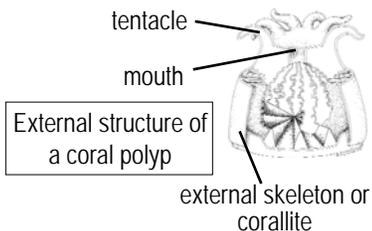
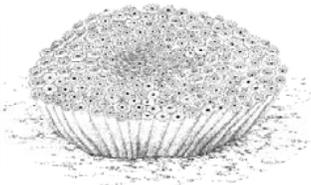
(above) prehistoric cephalopod



What is coral?

The round structure, composed of many small tubes or chambers, is a colonial coral. The animal or polyp that lives inside each chamber is a simple bag-shaped creature with no specialized organs. A ring of tentacles at the top of the bag allows the polyp to collect food and push it through the central mouth. In colonial corals, the corallites of the adjoining polyps join to form a continuous structure which may build up a coral reef.

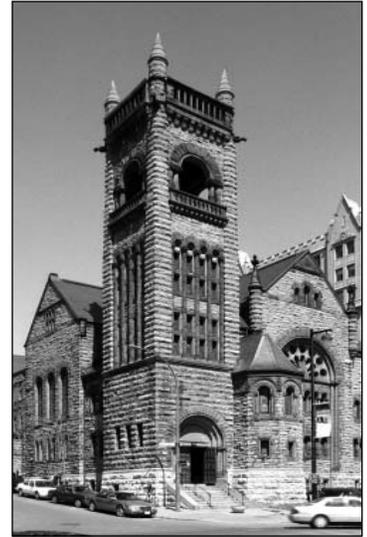
A colonial coral, many corallites joined to form one structure



8 Erskine & American Church 1339 Sherbrooke Street West

Built from:

Three different types of rock: The grey sedimentary stone on the walls is limestone. The olive brown bands are sandstone. The steps and walkways are made of grey granite. Look at the base of the tower and notice how the sandstone is wearing away more quickly than the other rocks.



Why is the sandstone wearing down?

Sandstone is porous and takes more punishment than the limestone when it rains in the summer or freezes in the winter. Although limestone is a very strong rock, it reacts to acids. Acid rain eats into the limestone and dissolves minerals within it. These are then absorbed by the porous sandstone beneath as the water washes over it.

9 Musée des Beaux-Arts 1379 & 1380 Sherbrooke Street West

Built from:

Both buildings are made with Vermont marble, a metamorphic stone. Layers and folds of grey and black minerals run through this fine-grained marble.



What is metamorphism?

Metamorphism means change. The rock used in this building is marble that has metamorphosed from limestone. When limestone undergoes changes in temperature and pressure, the bonds between the elements melt and reform. These changes at the atomic level alter the look, character and strength of the resulting marble.

10 Maison Peter Lyall

1445 Bishop Street



Built from:

'Old Red Sandstone' from Scotland. Scottish sandstone or brownstone is uncommon in Montreal. The base of the building is made of Chazy Formation limestone from Quebec, formed about 450 million years ago.

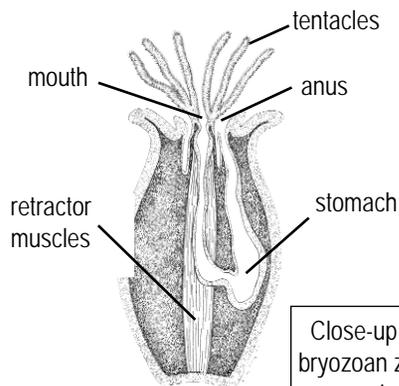
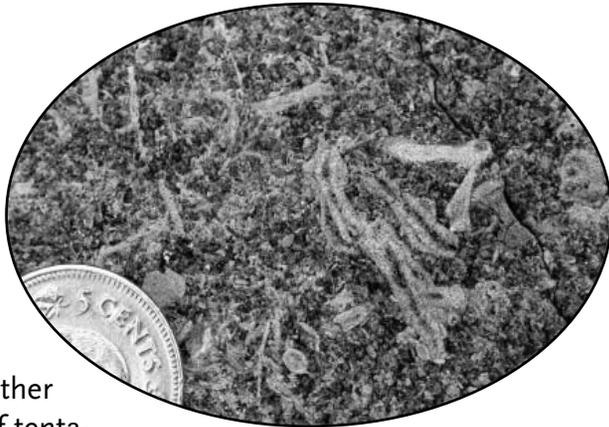
What to look for:

In the limestone on the wall to the left of the front steps are little marks that look like broken branches of wood. These are the fossil remains of bryozoans

(“moss animals”).

What are bryozoans?

These animals look a bit like corals or sponges but they are more complex. The small living section or zooid has a saclike body that contains three cell layers. The bottom end of the body is closed, the other end has a ring or loop of tentacles called the lophophore around the mouth. These tentacles capture food and push it into the u-shaped digestive tract or stomach. They cover themselves with a jelly coating under tough membranes or walls that form colonies. Today there are approximately 5 000 different kinds of living bryozoans. From the fossil record we have indentified about 3 000 species.



Close-up of a bryozoan zooid, or animal

11 Dominion Square Building

1010 Sainte Catherine West

Built from:

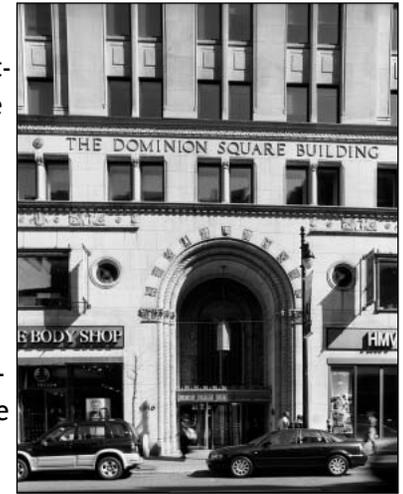
Limestone from Rockwood, in northwestern Alabama. It is more durable than the Indiana limestone found on the walls of the Holt Renfrew building. The base is grey granite from Stanstead, Quebec.

What to look for:

The walls just inside the door, on the west side, show dark streaks or lines dispersed through the limestone. These are called fracture lines.

What are fracture lines?

Fracture lines are breaks or cracks that occurred when the limestone was stretched or squeezed by movements of the earth's crust. There are no fossils in this limestone.



12 Sunlife Building

1155 Metcalfe Street

Built from:

The entire building is made of grey granite from Stanstead, Quebec. The interior foyer or entrance is made of marble: the pink variety on the walls and floors is from Tennessee and Italy; the black marble pilasters, or interior columns, are from Belgium.



What makes marble different colours?

This is caused by tiny amounts of trace elements that are dispersed among the normal rock-forming elements. For instance, if a trace element such as iron is present it may cause the resulting marble to be pink, yellow, red or brown. It doesn't take a lot of trace element to work its magic—perhaps only a few parts per million.

13 Cathédrale Marie-Reine-du-Monde

1085 Rue de la Cathédrale

Built from:

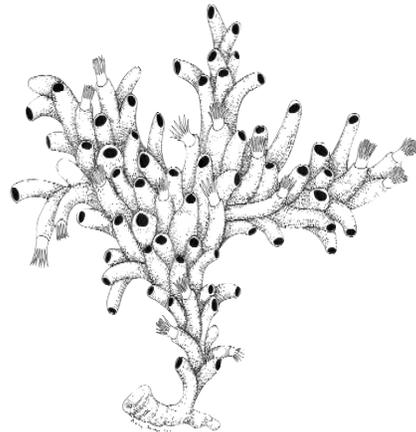
Limestone formed in Quebec during the Ordovician Period, about 470 million years ago. The capitals at the top of the columns on the west side (closest to rue de la Cathédrale) have been restored with Chazy Limestone.



What to look for:

Three very clear pockets of bryozoan colonies can be found weathered out of one block on the right hand side of the main door. Bryozoans lived on or near coral reefs and were very common in the Ordovician sea. The fossil form preserved in this building is a branched trepostome. The

massive colony or zoarium is composed of many branching tubes or body cases (zooeciae). Inside each body case is a zooid or animal. The colonies consist of many individual animals and measure up to 70 cm across.



Drawing of a modern bryozoan colony or zoarium very similar to the one preserved in the cathedral's walls.

14 St. George's Anglican Church

1101 Stanley Street

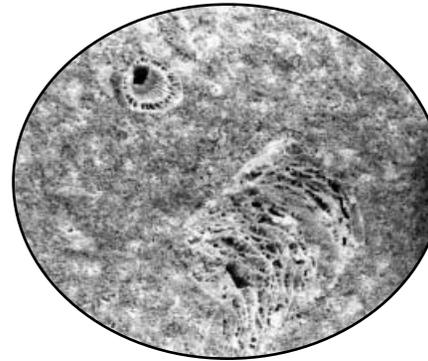
Built from:

Limestone on the walls, sandstone on the gables and colonnets. The roof is made of purple slate.



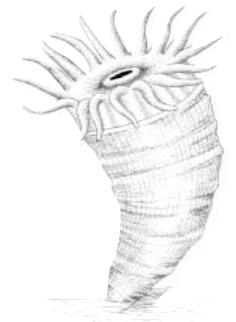
What to look for:

Most of the slate produced in North America comes from clay minerals in Ordovician rocks. The slate began as mud sediment. The sediments were re-worked by ocean currents to produce a fine-grained mud which was then compacted over millions of years to produce shale. The shale was metamorphosed into slate by heat and pressure. Slate is used on walkways and the thicker beds are split into shingles for roofing. Also, note small pockets of solitary (rugose) corals in sandstone on the window casing on Stanley Street.



What is solitary (rugose) coral?

In solitary corals, the external appearance of the fossil is a horn-shaped corallite. The shape of the fossil shows that as the animal or polyp grew, its corallite expanded and started to curve. This group has a very special way of building septa



or dividing walls, and you can see them in the fossil. Major septa are inserted two or four at a time. These complex septal structures (or walls) relate to a general trend toward building bigger and better coral reefs. Stronger corallite walls and septa permitted stronger attachment to the substrate and other corals.

Coral polyp inside the horn-shaped corallite that it built