WHITE SQUALL GEOPADDLE (Aug 2009)

Bring your imagination .....

Mountains ..... Our paddles from our home base will take us into the eroded roots of the Grenville Mountains, possibly the greatest mountain range the Earth has ever seen. Worn away now, but once as high as Everest, mountain peaks rose over Parry Sound and Gravenhurst, stretching in a Himalayan-like range from Texas to Labrador and on to Scandinavia a billion years ago. In fact, some reconstructions of the continents at the time put Australia and southern Africa to the south of Texas and envisage the Grenville Mountains running from there almost to the north pole !

Our paddle will take us into the remains of the western ranges of the Grenville Mountains. If we paddled south, past Parry Sound, we would "tunnel" into the mountains at a depth beneath their peaks of about 20 to 30 km. The twisted pink and black banded rocks in the beautiful new outcrops along Hwy 400 show how the heat and pressure at those depths transformed hard and brittle surface rock into a plasticene-like consistency. This transformation is called "metamorphism" and when the rock cools it looks very different from its original texture.

The most common families of metamorphic rocks in the eroded Grenville Mountains (or, geologically, the Grenville Province) are schist and gneiss. Schist contains a lot of flashy mica flakes and is the result of temperatures of 400 to 500^{o}C and depths of 15 to 20 km. Gneiss has less mica (which contains water and dehydrates at very high rock temperatures) and more feldspar (often pink) and results from temperatures as high as 750^{o}C and depths of 30 or even 35 km. Melting begins at the high end of the temperature "window" in which gneiss is formed and usually results in pink granite that cuts across the surrounding rock, forcing its way into fractures. Granite bands formed in this way are very prominent in the faces of the rock cuts south of Parry Sound.

Just as the Himalayas have risen - and are still rising - because of the collision between India and Asia, so were the Grenville Mountains produced by a great continental collision. North America (or Laurentia, as geologists call its predecessor) may have collided with the Amazonia part of South America between 1090 and 980 million years ago during the building of a

great supercontinent called Rodinia. By 760 million years ago Rodinia was breaking up, leaving part of the Grenville Mountains along the coast of Laurentia and its matching part along the west coast of South America (which has since drifted into the southern hemisphere).

So, although we will explore only a tiny part of the roots of the awesome Grenville Mountains, we will see enough to challenge our imaginations. And, as if thinking about one mountain range were not enough, the La Cloche Range over the northern horizon will remind us that we are in the shadow one of the planet's oldest, most venerable mountain belts. The La Cloche Range is the last high part of the east to west running Penokean Mountains formed between 1.9 and 1.7 billion years ago (over 700 million years before the Grenville Mountains). Because the white, pure quartz sandstones (or quartzites) are so resistant to erosion, they still stand 570 m high. If you multiply the height of Everest (8,800 m) by its age (say 20 million) the result is only about a sixth of the same multiplication for the La Cloche Range - a venerable range indeed !

And if mountains are too overwhelming ..... there are always .....

Ice sheets ..... we will see the evidence for the grinding work of the last 1 - 2 km thick continental ice sheet that melted away from here just 10,000 years ago. Paddling along shores of fresh, clean polished rock make it easy to envisage the land rising after the weight of the ice was removed.

When the Egyptians had already built the first of their pyramids the French River was still flowing north to Lake Nipissing and the Mattawa River. It was not until about 4,000 years ago that the land to the north had risen so much that it tilted the French River toward the south. The land where we will camp has rebounded about 180 m since the weight of the ice was removed and is still rising at about 30 cm a century (or about 0.008 mm per day - which is very fast for a geological process - at that rate it would take less than 3 million years to build Everest from sea level.

Initially the Great Lakes were filled with water from the melting ice sheet but by about 7,900 years ago the ice had melted back so far to the north that meltwater drained straight to the Ottawa River. The Great Lakes then relied only on rain and snow and were much shallower than they were at first. Rebound has tilted the lakes to the south, drowning some of the old beaches

but literally lifting younger ones out of the water forming "raised beaches" that we might see as we look back to the mainland.

Tropical fossils ..... If we were to paddle to Manitoulin Island (we won't !) or to the Limestone Islands to the south we would be able to search for fossils. The rock is about 470 million years old and belongs to the middle of the Ordovician Period. The limestone solidified from the mud on the bottom of a shallow, Florida Bay-like sea that flooded almost all of North America and was home to a wide variety of marine organisms.

If you take away today's vegetation in your mind's eye, you can imagine Lake Huron to be the Ordovician sea as it spread across the landscape - but North America lay across the equator at the time so the water then was not only salty but a good deal warmer too !

Technical stuff .....

Geologists call the piece of the Grenville Mountains we will paddle through a "Domain" or slice of the Grenville Mountains (e.g. Britt, Shawanaga, Go Home Lake). By that we mean a piece of the Earth's crust that has been pushed along with other slices like dominoes on a table because of the pressure of the collision of Laurentia (North America) with its neighbour (probably South America) a billion years ago. Fractures or faults called the Shawanaga and Parry Sound Shear Faults form the upper and lower surfaces of the Shawanaga slab of the Earth's crust.

Anyone who drove to White Squall from the north, down Hwy 69, crossed the front of the Grenville Mountains just south of Sudbury, on the hill above the Richard Lake campground (look for Crown Ridge Road and Good Neighbour Salvage; there are often blueberry sellers at the bottom of the hill !). Approaching the mountains when they existed might have been like reaching the first peaks of the Rockies as you drive west from Calgary.

The collision that produced the Grenville Mountains was driven by very slow convection currents in heat-softened rock, 100 km below the surface. As the continents of Laurentia and Amazonia were driven into one other, their edges were broken and slabs of crust were very slowly pushed up

and over each other, an earthquake at a time, for 100 million years. The effect was like pushing sheets of plywood into a stack several sheets thick along fractures called shear faults.

In the remains of the Grenville Mountains we see today, the equivalents of those sheets are called "domains", like the Shawanaga Domain where we will paddle. There are also Britt and Parry Sound Domains made of rocks that may have been shoved as much as 300 km from their original position at the very edge or beyond the edge of the continental shelf of Laurentia. The Parry Sound Domain includes volcanic rocks probably erupted on the coast of Laurentia as ocean floor was thrust under the edge of the continent, much like volcanoes of the Andes are erupting today.

Other rocks of the Grenville Mountains that we will not see but you might visit another time are those of the Haliburton area which belong to what is called the "Composite Arc Belt". They are volcanic rocks erupted in offshore "island arcs" like today's Indonesian arc and others in the south west Pacific. They are about 1.3 billion years old. There also seem to be fragments of continental rocks and sediments that might have lain offshore from Laurentia like Madagascar lies off the east coast of Africa today.

Finally, the rocks north of Kingston in the Frontenac - Lanark area and the Adirondacks of New York across the St. Lawrence River, seem to have lain even further offshore, perhaps including fragments of continent and volcanic islands, a little like the Japanese Islands today.

Most of the rocks of this part of the Grenville Mountains are now covered by much younger limestone and shale of Manitoulin Island, the Bruce Peninsula and the Niagara Escarpment of southern Ontario. These limestones are the solidified remains of mud and sea floor organisms that lived in warm shallow seas that flooded most of North America about 450 million years ago. Marine life had become quite diverse but plants and terrestrial organisms were sparse and limited to the coast. The Limestone Islands are isolated fragments of a once continuous layer that connected to the Bruce Peninsula in one direction and Manitoulin Island in the other.

Enjoy !

Blame David Pearson for any mistakes !
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