

The Oldest Rock Formations on Earth

The Nuvvuagittuq (NOO-voo-AG-it-tuck) Greenstone Belt is a large group of rock formations located in Quebec, Canada. The Greenstone Belt is special—it's one of the oldest groups of rock formations on Earth. In fact, measurements show that the Nuvvuagittuq Greenstone Belt is between 3.8 billion and 4.3 billion years old. That's almost as old as Earth itself!

When the Nuvvuagittuq Greenstone Belt formed at Earth's surface, it was made of sedimentary and igneous rock. Now it is made of metamorphic rock. However, all the rock formations that make up the belt have stayed together ever since they formed billions of years ago. To understand how the rock in the Greenstone Belt could have transformed—and how it could have stayed together as one group of rock formations—it's important to understand how rock material transforms and moves on Earth.

How Rock Can Change

It may seem like rocks never change, but the opposite is actually true. Over millions or billions of years, rocks are always in the process of being changed from one type of rock to another. Geologists classify rocks into three main types, based on how they are formed. Rock that has formed from the cooling and hardening of liquid magma is called igneous rock. Rock that has formed through the compaction and cementation of sediment is called sedimentary rock. When a rock formation is exposed to heat or pressure deep underground, it becomes a third type of rock: metamorphic rock. Metamorphic processes transform rock without melting it.



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The Nuvvuagittuq Greenstone Belt is located in northern Quebec, Canada.

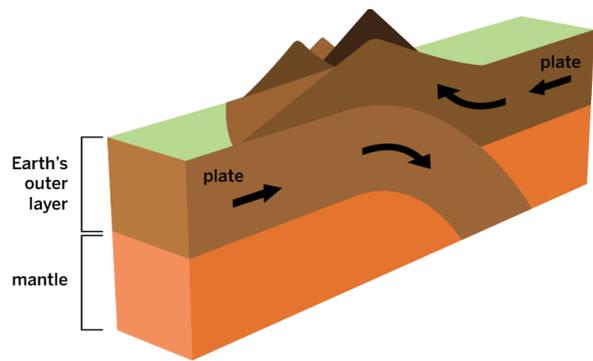
Plate Movement and Rock Transformations

The Nuvvuagittuq Greenstone Belt is made up of metamorphic rock, so it must have been buried deep underground in the past. How can a giant rock formation like the Nuvvuagittuq Greenstone Belt move deep underground... and then move back up to the surface? It's possible thanks to the processes of subduction and uplift. Earth's rocky outer layer is divided into plates. During subduction, one plate, along with all of its rock formations, moves under another plate and farther inside Earth. When one plate moves under another plate, the rock formations move under Earth's outer layer, to where energy inside Earth can transform the rock. In contrast, uplift is the process that pushes rock formations from down below up to Earth's surface. When one plate moves under another, the plate on top is pushed upward, which exposes it to weathering and erosion at the surface.

The plate motion that causes both uplift and subduction is driven by energy inside Earth. Because these processes are caused by enormous moving plates, entire regions of Earth's surface slowly subduct or are uplifted to form mountains. When this happens, the high pressure and heat caused by plate motion can change rock formations into metamorphic rock. These processes are usually very, very slow, but they never stop.

Explaining the Nuvvuagittuq Greenstone Belt

Billions of years ago, the Nuvvuagittuq Greenstone Belt was made of sedimentary and igneous rock formations that were probably located near a plate boundary. The Greenstone Belt experienced its last rock transformation 2.7 billion years ago, when it was subducted and changed into metamorphic rock. Those metamorphic rock formations were buried so deep inside Earth that they



Subduction takes place when one plate moves under another plate. Subduction causes some rock from the surface to move deep into the Earth. It can also cause mountains to form as they are uplifted.

were covered by many more layers of other rock. It took billions of years for the rock layers above the Greenstone Belt to be slowly weathered and eroded away by wind, ice, and water. Once the rocks on top were gone, the rocks of the Greenstone Belt were finally exposed. They had been transformed into metamorphic rock. Today, the Nuvvuagittuq Greenstone Belt has been weathered nearly flat, but is still made of the same rock formations that were formed so long ago.