GEOLOGY SOUNDWALK

SISIMIUT OCEAN ROAD

LEARN ABOUT THE GEOLOGICAL HISTORY OF SISIMIUT

Destination Arctic Circle

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A BILLION YEARS AGO...

Welcome to the Sisimiut geology walk.

This Arctic town may seem quiet today, but the ground under your boots has a dramatic past. You're standing on the exposed roots of an ancient mountain range, rock that was once buried deep underground, later crushed beneath ice, and is now still rising.

Let's go way back.

About 1.9 billion years ago, two ancient landmasses collided. The impact was enormous, crumpling the crust like metal in slow motion. Some rock was pushed upward, forming a massive mountain range. Other rock was shoved deep underground, as much as 20 kilometers down.

Down there, under intense heat and pressure, the rock transformed. Its minerals stretched into dark and light bands, forming **gneiss**. At the same time, molten rock, or magma, pushed up from even deeper levels. It cooled slowly underground, forming large crystals in a coarse, greenish-gray rock called **charnockite**. You'll see plenty of it along this trail—it's one of the most common rocks here in Sisimiut.

Over hundreds of millions of years, wind, rivers, and other forms of weathering slowly wore the mountains down. As the peaks eroded, their weight lifted off the crust. The deep "roots" of the mountains gradually rose, bringing rock that was once buried far below closer to the surface.

Then, across many Ice Ages, glaciers advanced and retreated repeatedly, scraping away loose material and sculpting the landscape, gradually exposing the hard crystalline rock beneath.

During the most recent Ice Age, Greenland was again buried under kilometers of ice. That weight pressed the crust down, and when the ice melted, the land began to rebound. Even today, it continues to rise a few millimeters each year.

Walking this trail, you're not just exploring a beautiful landscape—you're moving across a slice of the Earth's crust, a glimpse into rock that formed deep underground billions of years ago.

Along the way, you'll learn about the minerals, colors, cracks, and folds. Each one a clue to a story that began nearly two billion years ago.

Let's begin.

RUSTY ROCKS

Take a look just ahead to your right. See those bright streaks of orange, yellow, and red? At first, it might look like someone splashed paint on the rock. But it's not. Those colors come from inside the rock itself.

What you're seeing is **chemical weathering**—in simple terms, the rock is rusting. Iron-rich minerals react with moisture and air. Water carries oxygen into cracks and pores, and the oxygen bonds with the iron, forming iron oxides. Rust, but in stone. Over time, those oxides build up just beneath the surface, creating these bold, natural streaks.

Sisimiut's coastal climate gives this process plenty of fuel: salty air, fog, sea spray, sudden rain—all constantly delivering moisture and oxygen to the rock.

Notice how the colors follow cracks and joints. That's because water moves more easily through those weak zones. The streaks act almost like a natural map, showing which parts of the rock are most exposed to change.

Before we move on:
Think of an old bike left outside for years. The metal slowly rusts, forming orange and red streaks. That's similar to what's happening here in the rock.

READING THE ROCK RECIPE

Take a closer look at the rock in front of you to your right, from about chest height down to the ground. Don't just glance at it—really focus.

See those large, chunky mineral grains? They reveal that this rock cooled slowly, far beneath the surface. With plenty of time to crystallize, the minerals grew large. In contrast, lava that cools rapidly at the surface solidifies so quickly that only tiny grains can form.

Remember, this area was once buried beneath mountains. The rock you're looking at sat kilometers below the surface, cooling in the dark, and has only now been exposed here in Sisimiut after millions of years.

Here's a quick guide to what you're seeing.

Quartz is the hard, glassy mineral, often grey-blue or translucent here because of the pressure these rocks experienced. Look near the base of the outcrop for good examples.

Feldspar is usually white or pink, but here it's mostly labradorite—a greenish type that shimmers in the light.

Biotite mica forms dark, flaky patches. Normally black, it fades to a coppery brown after years in the sun. Check the far left and right of this section, around waist height

Hypersthene, an iron-rich mineral, shows up as dull, dark-brown patches that warm the rock's tone.

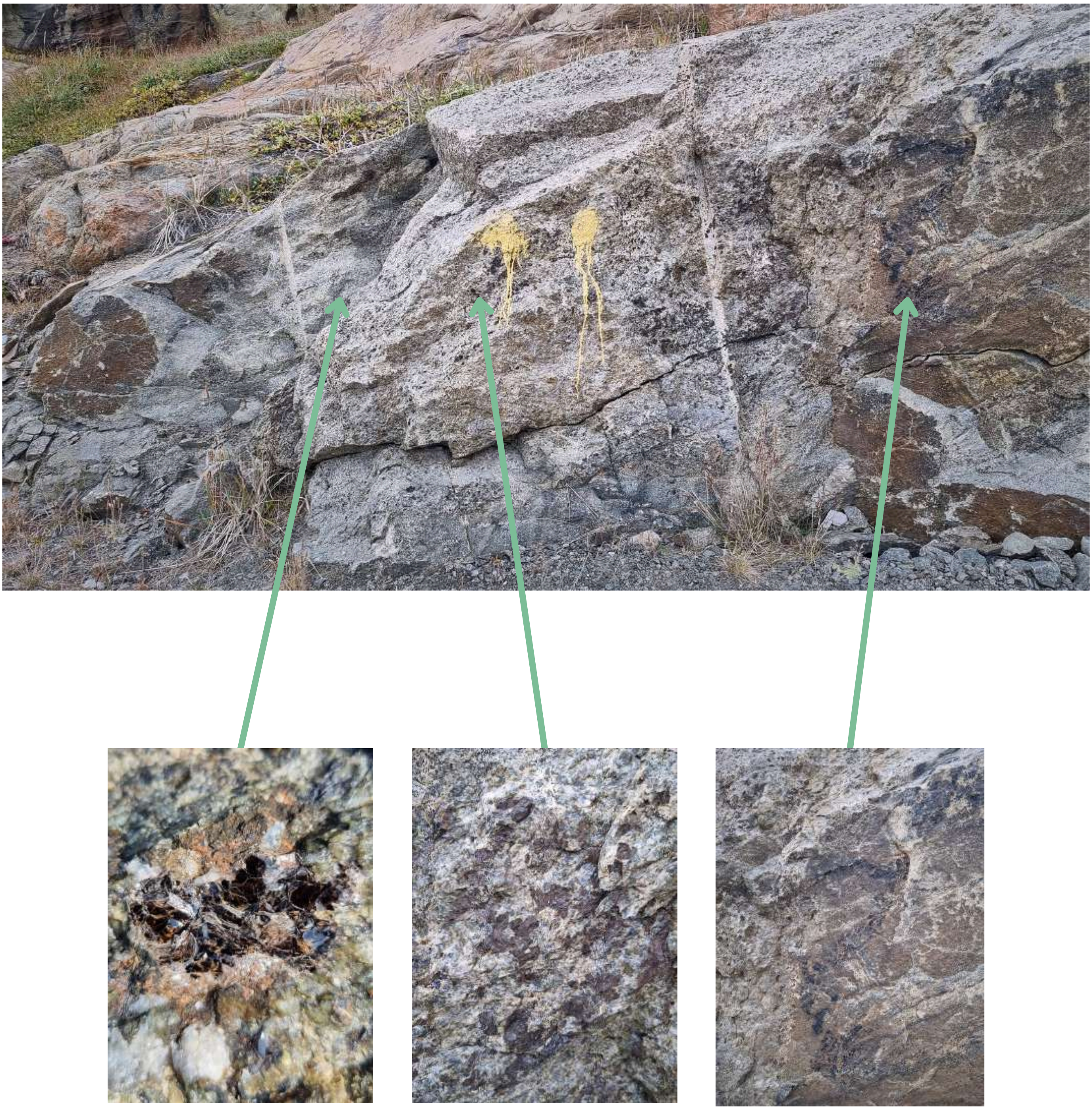
Amphibole, or hornblende, appears as long, black, shiny crystals—often needle-like. Look at the long, almost vertical stripe at the right of the outcrop where the rock is more brown for a great example.

And tucked in between all this are tiny black spheres of **magnetite**, an iron oxide that can make the rock slightly magnetic. You're going to have to look *very* carefully to see them!

Each of these minerals crystallized at a different stage as the magma cooled. Their size, shape, and arrangement preserve a record of the conditions deep underground, giving us a glimpse into how this rock formed over a billion years ago.

Before we move on:
Find a part of the outcrop where you can spot at least three different minerals. Try to tell them apart — by colour, by shine, or by shape.

READING THE ROCK RECIPE



BIOTITE MICA HYPERSTHENE AMPHIBOLE

ANCIENT ROCKS

Take a look at the rock face in front of you, just to your right, about waist height.

Notice those subtle light and dark bands? They're not surface markings—they're part of the rock itself. This is **banded gneiss,** older than the charnockite you've seen so far.

Gneiss forms when rock is buried deep underground and squeezed under intense heat and pressure. The minerals reorganize without melting. Light minerals like quartz and feldspar separate from darker iron- and magnesium-rich ones, creating those striped layers geologists call **foliation**.

This gneiss is part of the ancient foundation of West Greenland—over 1.9 billion years old. Much of the crust here once looked like this.

Later, during a major mountain-building event, magma pushed upward in the Sisimiut area, forming charnockite and other intrusions that overprinted or erased gneiss in many places. But this patch survived.

You can still find broad exposures of banded gneiss in places like Kangerlussuaq and Maniitsoq—reminders of an even older landscape.

Take a closer look at the bands. The crystals inside are stretched and aligned, all pointing the same way. That shows the rock was squeezed while still solid. It didn't melt—it flowed slowly under pressure, like stiff putty deep underground.

This outcrop gives us a rare glimpse into an earlier chapter of the region's geologic story—a piece of what came before the charnockite.

CAUGHT IN THE FLOW

Look ahead of you, around shoulder height, and you'll see a dark, speckled shape embedded in the lighter rock face.

That darker patch is probably a **mafic** rock, like diorite or amphibolite. "Mafic" means it's rich in iron and magnesium, which gives it a darker color and a slightly rougher texture. It also has less quartz than the surrounding charnockite, so it's softer and weathers more quickly—you can see it's set back a bit, eroded more than the pale rock around it.

Here's the interesting part: this mafic rock didn't form here. It's a blob of older magma that got carried along as the lighter charnockite rose. Geologists call these trapped fragments **enclaves** or **xenoliths**.

Picture dropping a dark chocolate chunk into a bowl of lighter cookie dough. The chunk doesn't melt—it stays intact while the surrounding dough flows around it. That's essentially what happened here, just less tasty.

Notice that the blob isn't round—it's stretched into a sausage-like shape. That shows the surrounding magma was slowly flowing and deforming, pulling the enclave with it.

What you're seeing is a solidified record of deep underground motion—a snapshot of molten rock over a billion years old.

Before we move on:
See those small holes inside the dark patch? They're early weathering pits, where wind, moisture, and salt have started to break down the softer mafic rock. We'll see more of this process later in the tour.

BEFORE AND AFTER

Look at the rock wall in front of you, just to your right, between the ground and your knees. Notice the colour shift?

Near the base is a dark grey triangular patch. That's fresh charnockite—recently exposed, still tight-grained and solid. Above it, the rock turns brownish yellow. It's the same material, but weathered. Years of exposure to air and moisture have transformed it.

Here's what's happening. Once rock reaches the surface, weathering begins. Air and water slip into tiny pores, and iron-bearing minerals react and break down, forming iron oxides—essentially rust. The earthy browns and yellows you see are the result, just like the chemical weathering we looked at earlier.

So what you're seeing here is a kind of before-and-after snapshot.

The grey area shows the rock as it looks when newly exposed. The lighter zone shows what time and chemistry have done since.

And it's not just the colour that changes. The fresh grey rock is solid and crisp, with angular mineral edges that catch the light. The weathered section above is more matte, with edges slightly rounded and tiny pits where iron-bearing minerals have slowly oxidized over time.

Before we move on:
Think about a brand-new brick from the store—sharp edges, solid and hard. Now imagine leaving it outside for years, exposed to rain, sun, and wind. Its edges soften, tiny pits form, and the surface becomes rougher. That's essentially what's happening here.

SLICING THROUGH THE PAST

Take a close look at the rock wall to your right and ahead of you.

Do you see the coarse bands cutting through the finer-grained background rock? You'll notice several between waist and head height. These are called **cross-cutting intrusions**—formed when new magma forced its way into cracks in solid rock.

Here's a simple rule in geology: the rock doing the cutting is always younger than the rock it slices through. By observing how rocks intersect, you can read the order of events.

n this case, deep underground, after the surrounding rock had cooled, fresh magma rose through the crust.

IIt squeezed into the cracks, cutting through the older rock, and cooled into the seams you see now.

Take a closer look at the textures. The surrounding rock is fine-grained, while the intrusive seam is coarse, with large crystals of quartz and labradorite feldspar. Remember, those big grains tell us the magma cooled slowly—the minerals had time to grow.

Before we move on

Think about squeezing glue into a crack in a piece of wood. The wood was already there, and the glue fills the gap and hardens. That's very similar what happened here: newer magma pushed into cracks in older rock, cooled, and solidified.

WHERE THE SEA USED TO BE

Take a moment to look around—both sides of the road.

Not too long ago in geologic time, this spot was underwater. You're standing on what used to be the floor of a shallow bay.

So how did it become dry land? The answer is **post-glacial rebound**—the slow rise of the ground after the weight of ancient ice is gone.

During the last Ice Age, this region lay buried under kilometres of glacier and all that ice pressed the crust down under its heavy load. Then, when the ice melted around 10,000 years ago, that weight lifted, and the land began to rise.

Old shorelines turned into meadows, and former bays lifted out of the sea.

You're standing right in the middle of that change.

Geologists track this slow rebound by studying raised beaches, wave-worn rocks far above today's waterline, and shells found well inland. These clues tell the story of land that has been rising ever since the glaciers melted— and still moving today by a few millimetres each year around Sisimiut. It may seem small, but over thousands of years, that gradual rise adds up to a dramatic change.

Before we move on:
Imagine a thick mattress pressed down by a heavy load. When the weight is removed, the mattress slowly springs back. That's what happened here: after thousands of years buried under ice, the land had gradually lifted.

THE RELEASE OF PRESSURE

Take a look at the rock wall in front of you and to the right, just below shoulder height.

See that long, horizontal crack running into the distance? Follow it with your eyes. Notice how the rock on both sides still lines up, like a puzzle that was never pulled apart.

That's a big clue this isn't the result of violent motion, like an earthquake fault. It's something much gentler: it's a **pressure-release fracture**.

Here's what happened. This rock spent most of its life buried deep underground—first under ancient mountains, then beneath kilometres of glacial ice. All that weight kept it compressed and locked in place.

But when the mountains eroded and the ice melted, the pressure lifted. The rock relaxed and cracked—not from sudden movement, but from relief.

As you follow the crack forward, notice subtle changes in colour or texture. These show where fluids have passed through the fracture, leaving minerals behind or slightly altering the rock. You've seen examples of intrusions and chemical weathering earlier on the tour, and here the same processes have been enabled by this release of pressure.

The rock finally relaxed after millennia underground, and this crack is the record of that slow adjustment.

Before we move on:
Imagine bending a thick piece of chocolate very slowly—it eventually cracks from the steady pressure. That's similar to how this rock formed its fracture.

JEWELS FROM THE UNDERWORLD

Take a look at the rock outcrop just ahead, around chin height.

See those reddish-pink circles scattered across the surface? They're not stains or paint—this rock is full of **garnet**.

Garnet is a mineral that forms deep underground under intense heat and pressure. Remember, this land was once buried 15 to 20 kilometres below the surface, where temperatures exceeded 650°C and the pressure was crushing.

Each reddish spot is a cluster of tiny garnet crystals, sometimes with a few larger ones mixed in. Geologists call these **porphyroblasts**.

Imagine baking a muffin and dropping a blueberry into the batter. The muffin rises and shifts, but the blueberry holds its shape. That's what happened here: the garnets formed early and stayed solid while the surrounding rock stretched and folded around them. Over millions of years, as mountains eroded, these deep rocks rose to the surface, carrying the garnets with them.

You can think of the garnets not only as minerals, but as miniature time capsules. They preserve evidence of the intense heat and pressure that shaped this landscape, offering clues to how the rock formed under some of the planet's most extreme conditions.

Before we move on:
Step up close to one of the reddish-pink circles. Can you also spot some of the larger individual crystals?

COLD POWER

Take a look at the rock in front of you to your right – just past the waterfall.

See how it's cracked into sharp, blocky chunks? That's **frost fracturing**—water freezing and slowly prying the rock apart.

Here's how it works. Water from rain or melting snow slips into tiny cracks. When the temperature drops, especially during cold Arctic nights, that water freezes and expands by nearly ten percent.

Now imagine that force acting inside solid rock. Each time the water freezes, it widens the crack a little more, like tapping a chisel again and again.

Eventually, the rock splits.

It's the patient work of countless freeze-thaw cycles. In places like Sisimiut, where temperatures often swing above and below freezing in a single day, this process is very common.

And once the cracks open up, life moves in. Dust, seeds, and tiny plants settle into the gaps. Mosses and even small flowers can take hold—you can already see patches of green growing right out of the rock. This simple fracture becomes a foothold for new life.

Before we move on:
We're all familiar with how water expands when it freezes. Picture a Coke bottle filled almost to the top with water. As it freezes, the water expands, pressing hard against the sides.

HOLES IN THE STONE

Take a look at the rock surface in the mid-distance, just above the cave.

Notice the tiny holes and shallow pockets? It might look like the rock's been melted or chewed, but it hasn't. These are called **weathering pits**, and they've been forming for thousands of years

Here's how it happens.

Sea spray carries salty moisture inland, and the mist seeps into tiny cracks and pores. When it dries, salt crystals are left behind. As the crystals grow, they push mineral grains apart from the inside. Add in wind-blown sand, rain, freeze-thaw cycles, and lots of time, and the grains gradually loosen and fall away, leaving rounded pits and shallow hollows.

Some pits deepen, some connect, and over time they form a honeycomb pattern called **tafoni**. These features form best in rocks with uniform minerals, like this patch of diorite. And being close to the ocean ensures plenty of moisture, salt, and wind to drive the process.

Remember the mafic enclave we saw earlier? You saw the early stages of this process getting started there. Here, you're seeing the long-term result.

Before we move on:
Think of an old brick wall by the sea. Over the years, rain, wind, and salt slowly wear away the surface, leaving tiny pits and hollows. That's what's happening here—salt, water, and wind are gradually prying grains from the rock, creating the holes and hollows you see.

A WALL THAT REMEMBERS

You've reached the final stop on the Sisimiut Geology Walk.

Take a look at the rock wall ahead and to the right—the one just before the path turns and heads up the hill.

Although this isn't really a dramatic cliff, it *is* a kind of geologic archive – showcasing several of the forces that shaped this landscape over billions of years.

See if you can spot the signs.

Start with the dark patches—those are **mafic enclaves**, blobs of older magma caught and stretched as lighter charnockite flowed around them.

Notice the pitted, sponge-like textures on the surface? Those are **weathering pits**, carved slowly by salt, wind, and sea spray.

Trace the pale veins slicing across the rock at odd angles—classic **cross-cutting intrusions**, showing where younger molten rock forced its way through older layers.

And those streaks of orange? That's **chemical weathering** at work, iron reacting with air and moisture, tinting the stone from the inside out.

This one stone face tells a story of fire, pressure, ice, and erosion. A natural archive, a billion-year-old journal written in minerals, textures, and fractures.

You've now walked through nearly two billion years of geologic history. You've seen how rocks stretch, crack, freeze, rust, and recover. From the roots of ancient mountains to the slow rebound of a post-glacial coastline, you've followed a story most people walk right past—written into the very stone beneath your feet.

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SPECIAL THANKS TO GEOLOGY CONSULTANT:
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