CAPE BRETON HIGHLANDS NATIONAL PARK

where the mountains meet the sea

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MISCELLANEOUS REPORT 5

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How to Use This Book

Read it from the beginning. If you haven't the time immediately, then look at the illustrations and turn to the map at the back to find the numbers of the stops along the route you are travelling. Now turn to the roadlogs and follow each stop carefully, for you will find that the beauty of the scene is increased for the traveller who knows something of what he is looking at and how it originated.

The first part of this guidebook outlines in some detail the general geological history of the Cape Breton Highlands National Park area. This is done by describing all the rock units in the sequence of their origin. From these descriptions is drawn something of the succession of events responsible for the rocks and the scenery there today. The second part of the book is a series of notes on what is to be seen at each of the viewpoints and roadside stops along the highway. An index map at the back shows where these points are located.

Many of the words used in a technical sense or which have an unusual meaning are explained where they are first used. If you need to find the meaning of a word look in the index—all unusual ones are listed there, along with localities and subjects.

CAPE BRETON ISLAND *protrudes into the Atlantic Ocean near the northeastern corner of North America and forms part of the eastern boundary of the Gulf of St. Lawrence. Its surface consists of parts of a high upland with, in some places, fringes of a much lower coastal plain. It meets the ocean in cliffs as much as 1,500 feet high and, here and there, in shallowly submerged landscapes which present long curving beaches. Streams have cut deeply into the plateau areas in comparatively recent geological times, so that steep-walled valleys with rounded shoulders are characteristic. Rock exposures in stream valleys and along shores show that the surface of the land is underlain by a complex of ancient rocks, both sedimentary (rocks formed by the accumulation of sediment) and igneous (rocks which have solidified from a molten state), with small patches of younger rocks in some of the lowland places. Some 377 square miles of this lovely land has been set aside as Cape Breton Highlands National Park—a place for us to enjoy the mountains and the sea.*

BOUNDARIES OF THE PARK

Cape Breton Island, on the northeastern end of Nova Scotia, consists of two parts which are separated by the deeply indented salt-water lake called 'Bras d'Or'. The park is near the northern tip of the northwestern part of the island. It extends in a belt, about 14 miles wide, from the Gulf of St. Lawrence on the west, across to the open Atlantic on the east. From the entrance at Ingonish an irregular surveyed line forms the boundary westward to Cheticamp and the western entrance. Northward from Ingonish the boundary skirts Middle Head, the peninsula on which Keltic Lodge is situated, makes a sweep inland to exclude the settled area of Ingonish proper, then follows the coastline from Broad Cove to Neil Harbour.

From here it follows the main highway to the south side of Aspy River valley where it extends along a surveyed line in a more or less easterly direction to the shore of the Gulf of St. Lawrence just west of Pleasant Bay village. At this point the boundary turns southward along the rugged coast to the mouth of Cheticamp River. Cape Breton Highlands is by far the largest National Park in eastern Canada.

GEOLOGICAL HISTORY

As you drive through the park you are presented with views of cliffs and coves, fast-flowing rivers in steep valleys and ponded waters in lakes, flat skylines and rugged mountain-broken horizons, and rocks of great variety. For man it is natural to see beauty in these places, and an understanding of the long history which has led to the formation of the

features in sight can only add to his appreciation. To begin this understanding we must turn first to the history which is shown to us in the solid rocks.

Most of the park area is underlain by a series of ancient sedimentary and igneous rocks that have been folded and faulted and much altered over a very long period of time. These ancient rocks were later invaded by great masses of molten rock, which solidified to form granite. Then, for countless millions of years, the whole complex of older rocks lay open to the agents of erosion. At a much later time in geological history, though still 280 million years ago, various sedimentary rocks were laid down over part or all of the eroded surface developed on the ancient substrate. These younger rocks were folded, faulted and broken at a still later time, during a period of crustal unrest in eastern North America. This chapter in the history of the area was followed in turn by a period of long-continued erosion which cut a flat surface across the ancient rocks and the younger ones that had been folded and faulted into them.

Since that time the erosion surface has been uplifted to form the present highlands area, and erosion has cut deeply into some parts of the land. The coming of the great glacier in very recent geological times has modified the shape of the scenery by scraping up everything loose as it advanced, and by depositing debris over the land as it melted and retreated. The last chapter is the one we are watching now—the streams cutting their valleys deep into the land and the waves eroding and undermining the cliffs.

Small beaches alternate with rocky points along the cliffed shoreline south of Corney Brook. Waves wash in on the beaches, constantly rearranging the sand and gravel, and the process of erosion of the points is never-ending.

The Ancient Rocks

The oldest rocks in the area of the Cape Breton Highlands are 'gneisses' and 'schists'. These are sedimentary and volcanic rocks which have been so changed by high pressure and temperature that they have developed a layering or banding of new minerals made from the reconstitution of the original constituents. To become so much altered the rocks must have gone through extremes of folding, faulting, and probably very high heat. This last might come from either the friction developed during the deformation of the rocks or from the intrusion of large masses of hot molten rock from the depths of the earth.

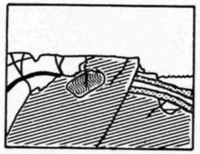
Such schists and gneisses may be seen in many of the roadcuts in Cape Breton Highlands National Park but they are probably best exposed between Presqu'ile and the top of the plateau at the Jumping Brook road-crossing, and along the steepest parts of the climb in the Grande Anse River valley east of Pleasant Bay.

The banding in the schists and gneisses is almost everywhere steeply dipping. The rocks themselves are black, dark green, grey or even silvery-looking, depending on what mineral in them is the most common; chlorite, biotite mica, and hornblende—all complicated combinations of iron, magnesium, aluminum and silica—are the most abundant. In some rocks, small red garnet crystals are visible. Some layers of completely recrystallized limestone are found in the same general sequence of rocks.

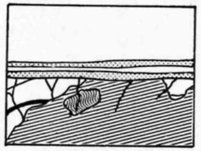
It appears from the form and composition of these rocks that

Principal Chapters in the Geological History of Cape Breton Highlands National Park

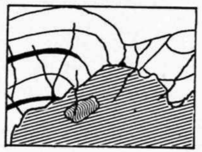
These are arranged by convention in the same way they are found in nature, with the oldest on the bottom and the recent on top.



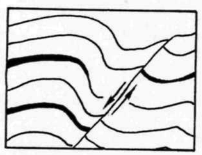
Uplift and erosion followed some faulting. Carboniferous sedimentary rocks were stripped off in some places. Glaciation added a thin veneer of rubble. Erosion is now going on everywhere and may best be seen at the coasts (right edge) and in stream valleys (nick on top).



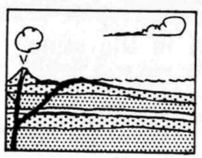
Erosion planed off the whole complex of ancient rocks with the granite intrusions and dykes. Then, about 280 million years ago (Carboniferous), more sedimentary rocks were laid down on top of this surface.



The ancient rocks, already much altered by folding, faulting and mineral changes, were intruded by great masses of granite (line pattern), with numerous offshoots called 'dykes' (solid dark lines cutting across trends). Blocks of the ancient rocks drifted off into the granite and became partly ingested (wavy-line pattern).



The ancient sedimentary and volcanic rocks were folded, broken by faults, and changed in their mineral makeup by the increased pressure and temperature which came as a result of the folding and faulting.



The earliest event of which we have record is a period of deposition of sedimentary (dotted areas) and volcanic (heavy lines) rocks in distant Precambrian time, more than 750 million years ago. The processes of volcanism and sedimentation then were exactly the same as they are now.

they began originally as sedimentary and volcanic rocks and that they lost most of their original properties because of the severe conditions they have experienced in the hundreds of millions of years since they were first laid down.

In an area with a complicated geological history it is natural that the alteration of the rocks would be more severe in some places than in others, so that the ancient gneisses and schists show different degrees of change from place to place. Thus in some outcrops the original sedimentary and volcanic origin of the rocks is fairly evident whereas in others only an expert who has studied carefully the chemical and physical changes to be expected would be able to relate the much-altered or metamorphosed rock to its original beginnings.

Invasion by Igneous Rocks

The second major chapter in the development of the rocky basement of Cape Breton Highlands National Park was the intrusion into the older rocks of great masses of molten igneous rock, which later cooled and solidified to form granite of several kinds and small bodies of slightly different compositions. No one really knows how such masses of igneous material originate. Some say that they are remnants of the original liquid beginnings of the earth, tracing their highly elevated temperature back to the time when the whole earth was a molten mass. Other scientists have suggested that these masses of liquid rock, or 'magma', were produced from the enormous amount of heat generated by friction in the folding, faulting and sliding of one part of the earth's outer framework or crust against another. Still others have suggested that heat from radioactive sources, locally concentrated in the earth's outer layers, gradually builds up enough to melt the rock; thus, over a long period of time, very large bodies of hot liquid rock are produced.

No matter how these masses originated you can see and examine them in many places in the park now. The best places are on the eastern side of the park, from a point several miles south of the Ingonish entrance northward all the way to the valley of Grande Anse River. A spectacular display of various phases of igneous activity may be seen between Black Brook Cove and Green Point. Here, several kinds of granites and various igneous rocks are exposed in the cliffs, in road-cuts, and in excellent exposures at the waveline. Now let's consider what there is to see in this display of igneous rocks.

You would expect, from experience in other things, that a hot molten mass might be cooled in different ways to produce rocks of different appearance. In autumn, when the frost first appears, puddles of water show what happens when cooling is very slow—large crystals of ice, as much as 2 or 3 feet long, make patterns on the top of the water. On the other hand, when freezing takes place rapidly, the crystals do not have time to grow before the whole mass becomes solid. Familiar examples of fast freezing are ice cream and frozen foods.

In igneous rocks, exactly the same process takes place. Nowadays, we can go to volcanoes and actually watch the molten

rock as it pours out on the surface of the land and cools rapidly. The resulting rocks are very fine grained—some of them may even look exactly like dark glass. We know however, from geological investigations, that rocks which cool deep beneath the surface of the earth are coarse grained because the cooling is very slow, perhaps taking thousands of years.

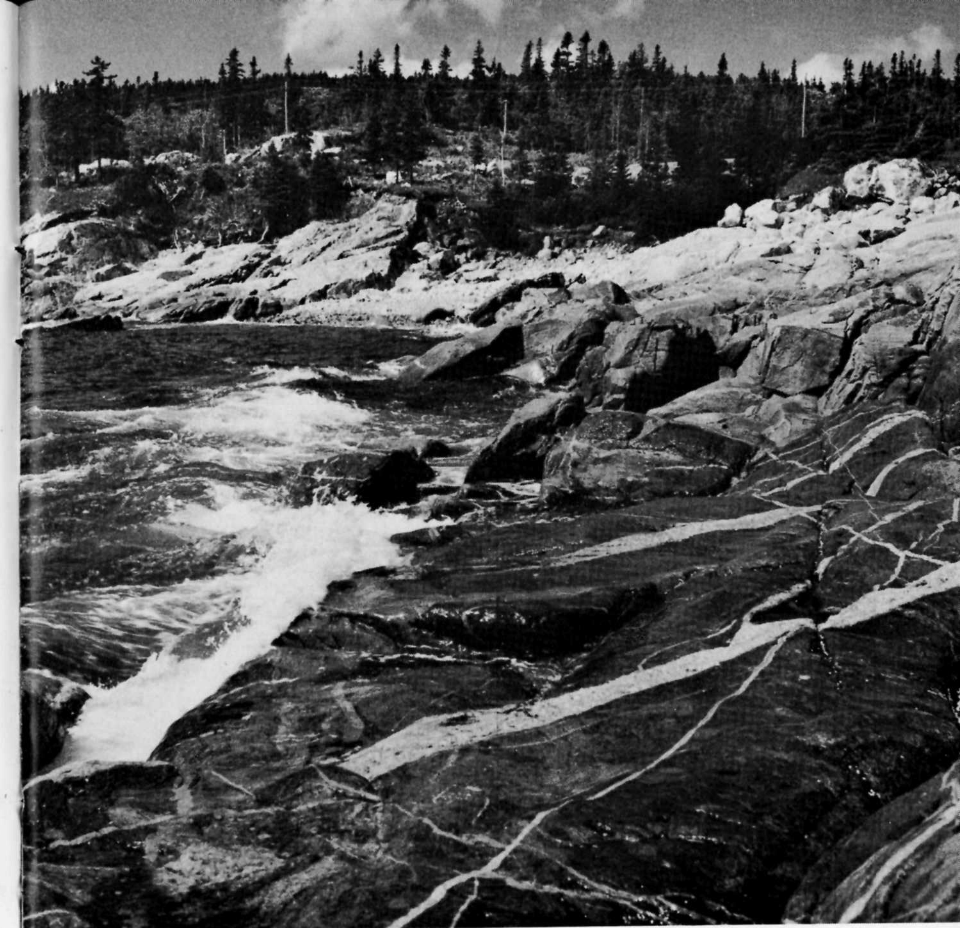
The pink granites and related rocks along the eastern side of Cape Breton Highlands National Park began millions of years ago as masses of molten rock. These pushed their way or were pushed by outside forces into the region where we now find them. The rocks which were already there were partly melted by the hot magma, and were either injected along breaks and cracks or between the layers by liquids from the main mass, or were left more or less unaltered. As the whole mass began to solidify, the edges cooled off more rapidly than the centres. Thin sheets of igneous rock, which squeezed up cracks and small openings in the surrounding wall-rocks to form 'dykes', cooled more quickly than the rest and are therefore much finer grained. The main masses of granite however, cooled slowly over hundreds of thousands of years to form a more or less homogeneous intergrowth of coarse crystals.

If we pick up a specimen of the granite from the roadside or the beach we will be able to see the grains of glassy quartz and crystals of feldspar. The quartz may be transparent or have a milky appearance, and the feldspar may be pink because of traces of iron, or it may be white or pale yellow.

In some pieces there may be flakes and scattered crystals of black minerals, perhaps platy mica or needle-like hornblende. At some localities tiny flakes of white mica may be large enough to be visible.

During the cooling process, most granite masses shrink considerably so that they are broken by systems of fractures called 'joints'. Thus, the granite may break out of outcrops in blocks which may all have the same regular angular shapes or may be highly irregular, depending on the particular kind of fracture systems locally present.

Pieces of the wall-rock, into which the granite was intruded, may drift off into the molten mass and become partly digested in the melt. Other parts of the wall-rock may become intimately injected with 'stringers' and sheets of molten granite to form an obviously banded rock whose composition is halfway between the original rock and the granite itself. Heat from the main granite may alter the rock en masse, so much so, that it begins to resemble the granite itself. These three processes produce banded rocks called 'gneisses', and you can see these gneisses at many places along the roads and shores in the park. Along the shore at Green Cove and Black Point you can walk over blocks of these ingested and altered gneisses and see their edges feathering out into the granite. A great variety of such 'composite gneisses' are visible in the long rock-cuts along the highway as it climbs from the valley of North Aspy River to the plateau in the central part of the northern boundary area of the park. You will probably be impressed by the great variety of rock types formed in this complex manner.



The shore from Green Point to Black Brook presents a wonderful display of banded gneisses, pink and grey granites, and countless dykes which cut across the older rocks and each other. This view near Green Cove shows some of the dark gneisses in the foreground with a variety of granitic dykes. Part of the highway can be seen beyond the small beach of rounded boulders.

Dykes

Dykes are thin masses of igneous rock that cut across the structure of the enclosing rock. They are produced when masses of molten rock are squeezed into cracks or small openings in the surrounding rock along the margins of igneous bodies. They are also formed in the igneous masses themselves during a late stage of their cooling when the outer parts have become solidified and shrink so that fresh magma wells up from below to fill the cracks. Such dykes may be of the same composition as the main granite mass, or they may be of very different compositions.

Thick and thin granite dykes crisscross one another at Green Cove. In some places later dykes cut across earlier dykes very clearly, but here it is difficult to distinguish ages on the basis of cutting relationships.

Light-coloured granitic dykes are cut by very fine grained, brownish dykes in this exposure at Green Cove. Displacement of the white dyke is clearly visible at the head of the hammer. Another brown dyke cuts the same white dyke back and to the left of the hammer. Both kinds of dykes are younger than the darker rock they intrude.

Shore exposures between Black Brook Cove and Green Point show hundreds of dykes that crisscross the granite and the gneisses they form on intrusion, as well as each other (see photos). Dykes are commonly visible also in the long rock-cuts in the MacGregor Brook valley where the main highway climbs from the North Aspy River flat to the plateau above, in road-cuts in the Grande Anse River valley, and along many parts of the sea-coast.

Folding and Faulting

The next chapter in the development of the rocks of the Cape Breton Highlands National Park area was a long-continued period of crustal disturbance—a period in which the rocks were folded, faulted and broken. These movements may have begun even prior to the main part of the igneous intrusion. We do know that the igneous rocks were affected after they solidified for we can actually see the breaks and fractures now. Along some of these breaks, blocks moved upward relative to their surroundings; along others they moved sideways or even downwards. Besides breakage and alteration along major faults, a good deal of minor fracturing took place, so that the rock was no longer a homogeneous mass but instead was broken into millions of individual blocks and pieces.

Erosion

Erosion over a very long period of time, probably measurable in hundreds of millions of years, cut deeply into the rocky framework of the earth where Cape Breton Highlands Park is now situated. Masses of granite and gneisses that had formed deep beneath the surface were gradually exhumed and brought to the surface. A complicated pattern of rocks was produced on the surface of the land because erosion cut into a complicated three-dimensional arrangement of rock types.

We don't know where all the rock waste from this deep erosion went. In some parts of Nova Scotia great thicknesses

of sedimentary rocks were produced at this stage of geological history, and these are known to represent the wastage from adjacent lands. It is not until we come to the rocks of the 'Carboniferous' period, however, that we find some record of where the rock waste went in Cape Breton.

Rocks of Carboniferous Age

Patches of sedimentary rocks lie on top of the ancient rock structures at the four corners of the park: at Ingonish in the southeast, the Aspy River valley in the northeast, Pleasant Bay in the northwest, and Cheticamp in the southwest. These rocks are everywhere divisible into two groups: a lower, older one called 'the Horton Group', made up mostly of sandstone, conglomerate and shale with a few plant remains; and an upper, younger one called 'the Windsor Group', consisting of sandstone, conglomerate, limestone, siltstone, and gypsum. Both these rock units belong to the 'Mississippian' part of the Carboniferous system and are approximately 280 million years old.

The rock record of the time indicates that streams poured off adjacent highlands and brought great quantities of sand and gravel into their deltas. Occasional areas of mud-flats were also formed. Plant debris from the forests of the day came drifting down into the river deltas and became incorporated into the sediments. Now, millions of years later, we find these sediments forming the solid rocks of the Horton Group. At a slightly later time the land was apparently submerged shallowly beneath the sea, but it still received quantities of

The cliffs at Broad Cove on the east side of the park consist of sandstone, siltstone and shale of Carboniferous age. These have been folded and faulted so that in many places they stand on edge. Wave-erosion undercuts the cliffs rapidly; sliding and slumping are common.

sedimentary waste from adjacent highlands. Thus the deltaic and estuarine, sedimentary rocks of the Horton Group are succeeded by shallow-water marine deposits of the Windsor Group—rocks which began as red muds and silts with intercalated sands and gravels.

A very unusual circumstance of Windsor time, however, made the rock record unique in this part of North America. It seems that large parts of the sea became cut off, or partly cut off, so that evaporation from the surface eventually began to precipitate some of the dissolved salts of the sea water. Thus limestone (or calcium carbonate) is commonly found in these rocks of Windsor age, as is gypsum (or calcium sulphate). Gypsum forms the dazzling white cliffs in the Aspy River valley on the north side of the park (see photo on page 39). At this site nearly 10 million tons of gypsum has been mined and shipped to make various plaster products. Gypsum has also been mined at Cheticamp just outside the southwest corner of the park, and other occurrences are found in the Ingonish area.

Calcium sulphate occurs naturally as two different minerals, gypsum and anhydrite. Anhydrite consists entirely of calcium sulphate; gypsum contains water, chemically combined, as 'water of crystallization'. When gypsum is heated, some of the water is driven off and the result is plaster. Anhydrite, on the other hand, cannot be used in the same way for making plaster because there is no water to drive off and replace.

Gypsum and anhydrite occur in nature with limestone and certain kinds of sedimentary rocks which show that they are precipitated directly from sea water by evaporation. We do not know however, whether the first precipitate is gypsum or anhydrite. In fact chemists and geologists have been puzzled for a very long time about the actual mechanics of precipitation of all salts from sea water even though at first glance it seems that it would be a simple experiment to evaporate sea water, observe what is precipitated, and have the answer. Experience however shows that the obvious laboratory evidence does not agree with the story in the rocks. We have not found out whether calcium sulphate is precipitated as calcium sulphate ($CaSO_4$—anhydrite), or as calcium sulphate with two of water ($CaSO_4.2H_2O$—gypsum). Nonetheless, we do know that anhydrite commonly occurs at depth and that near the surface it gradually changes by taking on water to form gypsum. This is why the large quarry operation at Dingwall, in the Aspy River valley, was a stripping off of the surface gypsum with the pale blue anhydrite left behind.

The process of hydration of anhydrite to form gypsum at the surface may be seen at several places in this quarry system. Another place to view the same process is in the Ingonish area, in the small cove on the south side of the narrow isthmus of the peninsula on which Keltic Lodge is located. There, along the shore, very beautiful shapes are sometimes formed by solution of the gypsum and anhydrite in the sea water.

As you look at the white cliffs of gypsum which are visible here and there in the park or just outside it, you may think of the evaporating seas of millions of years ago and wonder

about the chemistry of precipitation from sea water of the dissolved salts.

Folding and Faulting, a Second Time

After deposition of the rocks of Carboniferous age in this area, a second period of folding and faulting affected both the recently deposited rocks and the ancient rocks on which they lay. This second movement and breakage probably occurred to some extent along the major faults and weak zones that had formed in the ancient rocks during the earlier period of deformation. At any rate, the whole complex of ancient and Carboniferous rocks was broken into faulted blocks that moved up and down and sideways relative to one another.

A Second Chapter of Erosion

In the next period, one of several million years, all the rocks that had been laid down in the various preceding ages were cut into by the slow-working agents of erosion. In this part of Nova Scotia the youngest rocks exposed are those of the Horton and Windsor Groups which we spoke of earlier. This means that there is no rock record of what was happening in the Cape Breton Island area after that time, beyond long-continued erosion.

It seems pretty certain that the whole eastern seaboard of North America was subjected to the same kind of erosion for several tens of millions of years. Large flat areas were developed close to the sea-level of the time, because it controlled the downward limit of erosion.

At a still later time, parts of the old flat surfaces that had developed near sea-level were uplifted, in some places thousands of feet. The huge earth stresses that accomplished these changes are beyond the comprehension of man. They involved the adjustment of vast chunks of the earth's crust over distances of a couple of thousand miles. It is this long history that has accounted for the flat upland of Cape Breton Island at elevations of 1,200 to 1,500 feet above present sea-level (see photo on page 48). The road runs on top of this old uplifted surface between the Aspy River valley and the Grande Anse River and again between Pleasant Bay and the Jumping Brook valley.

Since the uplift of the ancient plain (or 'peneplane'), surface streams have been cutting into the edges of the highland to form steep-walled valleys. The sea has washed against the edges along lines of great cliffs, undermining and eroding them. Areas of soft rock have been rapidly worn down to form new flats (or peneplanes) close to present-day sea-level. All this was in preparation for the last major chapter in the formation of the scenery as it is today.

The Coming of the Glaciers

About a million years ago, which is very recent in terms of geological history, the climate of the world began to cool down. No one knows exactly why this happened but we know for certain that it did take place because the whole of northern North America and many other parts of the world were covered by great ice-caps. These were similar in most respects to those now found in Greenland and Antarctica.

They began to form slowly as the snow came a little earlier each year and stayed a little longer each spring. Eventually it became cold enough for the snow to stay on the ground all year long, so that the whole area was one vast wintery scene. The accumulating snow gradually became so deep that compression changed the layers at the bottom into solid ice. Ultimately the whole mass began to move, and it flowed gently off the highlands toward the margins.

This great moving mass of ice scraped off loose soils and picked up boulders and loose fragments of solid rock and transported them in the direction of movement. The solid rock was scraped and scratched, hollowed out into rounded channels, and polished by the movement of the ice-cap—the same sort of thing that is happening today along the margins of Greenland and Antarctica. When the climate warmed up again, the ice began to melt more quickly than it accumulated until, eventually, the ice-cap disappeared completely. But the land bore evidence of its passing almost everywhere.

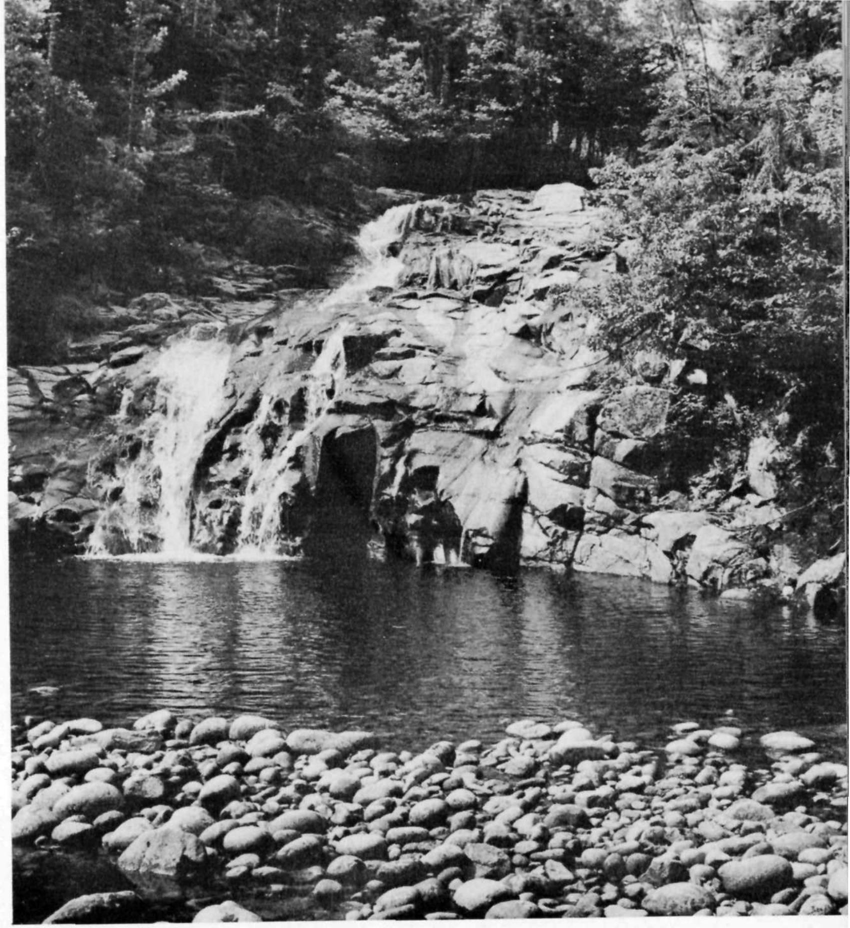
All the old soils and loose rock-debris were removed by the passing ice. Part of the debris was left as an irregular blanket of boulders, cobbles, sand and clay, which covered the country in depths as great as a hundred feet. Large areas of freshly scraped and scoured rock, however, were left bare. The drainage of the area was disrupted by the irregular deposits of glacial debris, so that lakes were formed where valleys were actually dammed, and streams were pushed out of the old valleys and forced to flow around or over masses of bouldery debris. Waterfalls and rapids developed where disrupted streams fell over the walls of old valleys or were first forced to flow over the glacial dams.

Thus, as you travel over the land surface of the park, you will see blankets of glacial rubbish on top of fresh bedrock in rock-cuts; erratic boulders left stranded on the hilltops; boulders of a great variety along the beaches and in the river bottoms; and banks of sand and silt which were washed out of the melting ice. A look at the map will show that the plateau area has many small lakes and large bog areas that were formed by glacial deposits. Warren Lake (picnic grounds) for example, near Ingonish, is clearly the result of partial damming of the valley of Warren Brook.

What is Happening Now?

The processes of erosion have been steadily at work in this area ever since the passing of the glaciers, some 10,000 years ago. Even now, streams are busily cutting their valleys into the upland and constantly carrying to the sea the rock waste derived from glacial debris and the solid rock underneath. Waterfalls and rapids in the streams' courses show where they are being interrupted in their downcutting. Sands and gravels are gradually segregated according to size, shape, or specific gravity, and then mixed again. Thus, on the points of sandbars and at the backs of eddies you may find concentrations of especially heavy or light particles of dark- or light-coloured minerals.

Along the sea-coasts, waves are cutting into the land, undermining cliffs and eroding banks of glacial debris to form new



Mary Ann Falls picnic area is on a small side road leading from the main road at the warden's station north of Ingonish. At low water in summer only a small trickle comes over the granite slope, but in times of high water a roaring falls leaps into the pool below. Note the roundness of the boulders in the foreground. Most of them have been transported by the glaciers and then carried by the stream.

deposits of sand and gravel. Cliffs of many different shapes and sizes, sea caves and marine arches, sand spits and bars of great variety are forming along the margins of the sea. Here and there, material carried by waves and currents is strung out into beautiful beaches—like those across the west side of South Bay Ingonish, the various arms of Aspy Bay on the northeast, Pleasant Bay on the northwest, and at Cheticamp just southwest of the park area. Along the beaches many processes are at work: smoothing them in some places, scalloping them in others, pounding boulders and sand against the shore and against one another, thus rounding the particles, and constantly segregating and mixing mineral and rock fragments.

Where the surface of the rock is exposed to the atmosphere it is continually changing. Fresh rock-surfaces gradually

Beaches are places of endless change with the restless interplay of the sand and gravel and the waves and currents. Here at Broad Cove, wave action has scalloped the shoreline into alternating cusps of gravel and sand. We don't know exactly how this is done but we do know that it is related to the size, shape and frequency of the waves.

weather and change colour, showing that they are being altered chemically. Bits and pieces of the solid rock chip off because of changes in temperature or changes in volume of the minerals on chemical alteration. These grains are washed into the streams or the sea to become part of the sand and mud deposits there.

No matter where you are in Cape Breton Highlands National Park you can see some of these processes at work. What you can see at some of the principal points of interest is described in the roadlog that follows.

ROADLOG AND POINTS OF INTEREST

Ingonish Gate and Park Headquarters (1) *

The southeastern corner of Cape Breton Highlands National Park includes an area of unusual geological interest. This is on the northwestern side of South Bay Ingonish. The official park buildings are made of stone taken from boulders that were transported by the glaciers. These are mostly granites and gneisses common in this section of the park. The park cabins on the east side of the main road and the bathing beach are situated on the shore of Freshwater Lake—a part of South Bay Ingonish that was cut off from the sea by the waves washing debris from the nearby cliffs to form a long bar of sand and gravel. A cliff of white gypsum is visible from the cabin area.

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*Number corresponds to locality number on the map.

Rocks of great variety occur in the glacial boulders in Cape Breton because the glaciers passed over an area of complicated rock history—a history with several chapters of sedimentation, consolidation and igneous intrusion. Here in the wall of the Information Booth at Ingonish, fragments of dozens of different rock types show a cross-section of the geology Cape Breton.

The sand at both beaches here—the salt-water bathing beach on the outside and the one on the inside on Freshwater Lake—is made of fine grains of quartz with smaller amounts of feldspar and a very tiny fraction of black mineral grains, largely magnetite. This is the kind and colour of sand so commonly derived from granite areas, such as the one that occupies a large part of the southeastern section of the park. Along the beach may be seen some evidence of segregation by wave-action; the finer sand is on the lower parts of the beach and the coarse boulders and cobbles have been flung to the back by storm waves.

The north end of the beach leads into a bouldery area which is backed by banks of glacial debris. The boulders themselves are the residue from the washing of the glacial debris; the finer fraction—the sand, the clay and small pebbles—have been separated and removed.

Outcroppings of white gypsum may be seen farther along the beach to the north. You may note that the gypsum is made up mostly of an aggregate of tiny white crystals, but crystals of gypsum as much as an inch long are scattered through it and may appear as dark patches against the lighter groundmass. Occurring with the gypsum in some places are thin, pale grey or blue-grey bands of the much harder anhydrite. Very unusual shapes are produced where the sea water has dissolved the gypsum and anhydrite along joints, fissures, and minor cracks. Veins of a beautiful, white, satiny variety of gypsum cut the ordinary white gypsum and the grey clay that is sometimes found with it.

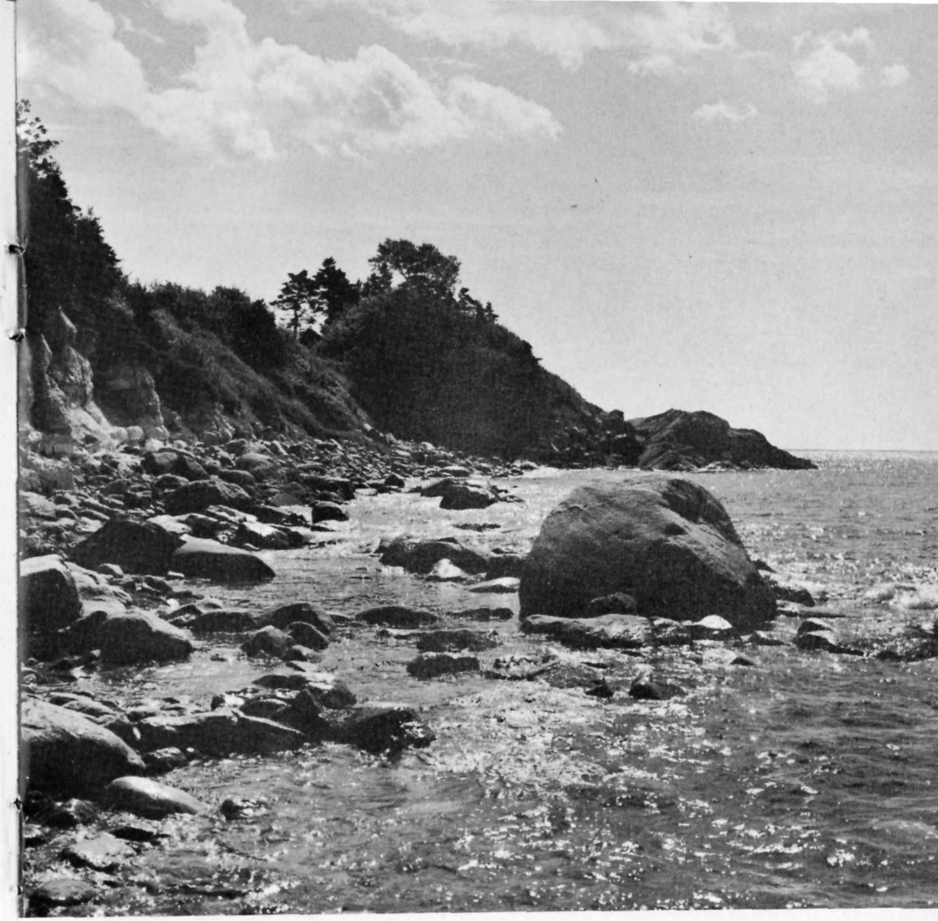
Middle Head Peninsula and Keltic Lodge (2)

Keltic Lodge is a little less than halfway out on a long rocky peninsula, known as 'Middle Head', which separates North Bay Ingonish from South Bay Ingonish. Interesting rocks line the shores of this peninsula, particularly on the south side. From the top of Middle Head a magnificent view southward leads from Cape Smoky on the seaward side, along the cliffs to the sandbars and beaches on the west side of the bay.

Cape Smoky may be seen, even from here, to be a jointed and faulted mass of granite. Along the shore to the right, or west, bright-red cliffs of Windsor sedimentary rocks show gentle dips. Because they are very quickly eroded by the waves they are more noticeably undercut at the waterline than the mass of granite farther out to sea.

Still farther to the right or west a superb beachbar cuts off Freshwater Lake from the sea completely and forms a bar across Ingonish Harbour, which is pierced only in a small gut near the lighthouse. The differences in colour in the bar are due to the segregation of fine sand in the lower half and small pebbles and boulders at the back or upper half. From the Keltic Lodge area the rolling hills marking the edge of the plateau of the highlands of Cape Breton form a beautiful backdrop to the marine scenery in the foreground.

Rock exposures all along the south side of Middle Head peninsula are of dark, altered intrusive and volcanic rocks cut by masses of pink granite. At the narrowest part of the isthmus, shore exposures show masses of gypsum, anhydrite,



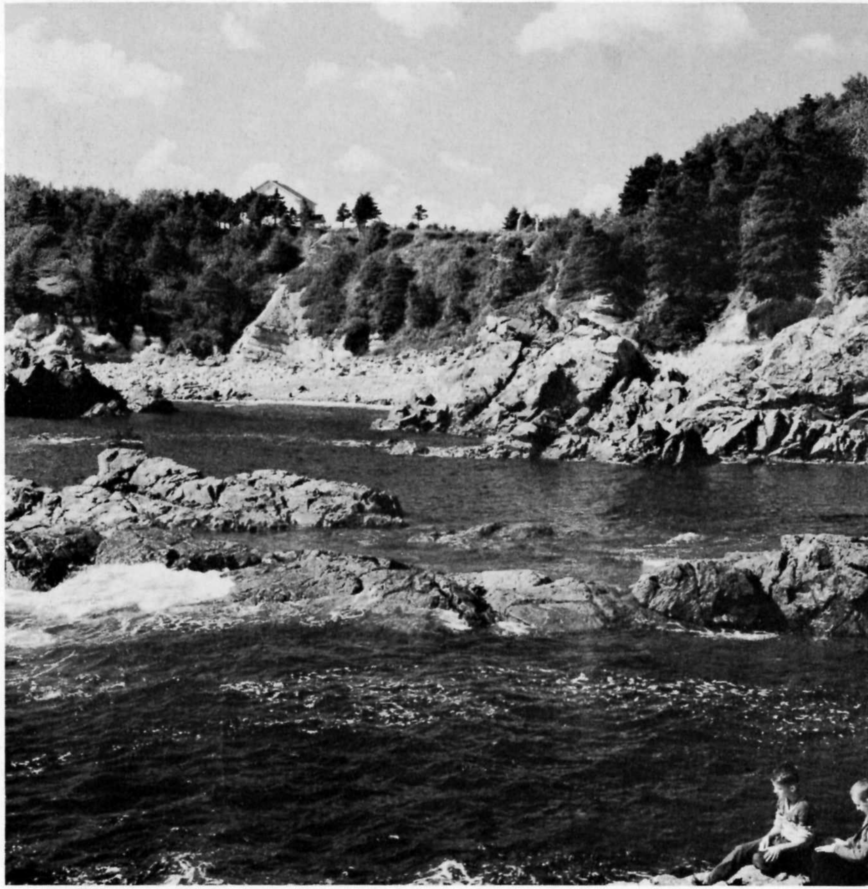
This boulder-strewn beach on the south side of the isthmus on which Keltic Lodge is situated has many stories to tell. The large boulder to the right of centre bears scratches made by ancient glaciers. The reddish point tells of granitic intrusions. The light cliff of gypsum, to the left of centre, tells of ancient seas evaporating. Amid all of this geological history the modern scene is one of great beauty.

and accompanying clayey sedimentary rocks which lie flat on an ancient eroded surface of the granite and darker rocks. At several places along the isthmus area, banks of glacial debris, made up of a mixture of boulders, cobbles, pebbles, sand and clay, are seen to lie on top of all the solid rocks.

A climb down to the beach just below the east end of the golf course is well worth while, both for the beautiful scenery and the interesting geology to be seen there. The dark rocks are cut by the granite in large masses and by dykes at several places. The gypsum is of several varieties, and in one place very beautiful specimens of fibrous 'satinspar', a variety of gypsum, strew the beach line. On the east side of the cove a granite dyke cuts the older dark rocks; at one time it must have protruded as a pinnacle above an old erosion surface, for bits and pieces of it are found in the overlying gypsum-bearing sedimentary rocks.

The boulders here, on the beaches in the small coves, are unusual because of their very high degree of roundness. How they got this way is not too apparent in calm weather, but on days when the waves roll in from the open Atlantic it is readily understandable how the corners are very soon knocked off in the turmoil of breaking water and back currents.

The wall in front of the parking area at Keltic Lodge is made of a variety of local stones. Pink granite, black and white granite, 'salt and pepper' mica-hornblende granite, dark green altered volcanic rocks or impure sedimentary rocks—all are displayed here. Some of the stones are freshly broken and



Points and ledges of granite in the foreground contrast with low cliffs of white and grey gypsum back of the beach, and these in turn are quite different from the glacial clays, sands and gravels forming the top of the bank where Keltic Lodge and other buildings are situated.

Ocean waves pound beach boulders back and forth against one another and against the solid rocks, gradually wearing away sharp edges and corners to produce beautifully rounded boulders. These are on a small beach below Keltic Lodge.

angular but others are well rounded. The rounded ones must come directly from beach or river deposits, or from glacial deposits, for it is only in these places that such rounding is produced.

The view to the north over North Bay Ingonish shows the sweeping curve of the beach on the west side of the bay. It is backed by a lowland area developed on a patch of younger Carboniferous rocks. Ingonish Island to the right or east is partly made of the same Carboniferous rocks. The highland still farther away is part of the Cape Breton Highlands and is composed of gneisses and granite.

Roadside Stop, Near Edge of Low Cliffs and Beach (3)

The southward view over North Bay Ingonish extends past the irregular shape of Middle Head peninsula and the white buildings of Keltic Lodge, to the high mass of Cape Smoky beyond. To the right or east, the long sweep of the bay with its beaches and banks of glacial debris extends to the mouth of Clyburn Brook and the butt of Middle Head peninsula. In the foreground you can see that the beach is sandy at the shore but is backed by round boulders and low banks of glacial debris. The beach extends to a series of rounded glaciated knobs of rock—a feature that is termed a 'tied island'; in other words it is not really an island but it would be if it were not tied to the mainland by this spit of sand.

The sweep of the cusped beach at Broad Cove just north of Ingonish leads from the younger sedimentary rocks along the left margin to the granites and metamorphic rocks in the line of cliffs beyond. Erosion of the sedimentary rocks is comparatively rapid, so slumping and sliding are common; in the more distant rocks the cliffs are little affected.

Broad Cove (4)

You can see Broad Cove either from the highway, which comes very close to the edge of the cliffs along its shore, or from the shore itself by taking a short side road just south of the Warren Brook crossing. Warren Brook drains into Broad Cove but is largely cut off at the beach by a bar that

is constantly being built up by the waves. To the south of the mouth of the brook, rocky cliffs of mashed and broken schist, gneiss, and granite extend for half a mile to Archibald Point. Northward, a sandy beach is backed by cliffs of grey sedimentary rocks that are evenly bedded in some sections but mangled in others. These Carboniferous rocks continue for half a mile to the north and provide a continuously changing structural scene. Small pockets of coaly material occur in them.

An irregular thickness of glacial drift overlies the sedimentary rocks and in some places has slumped down onto the beach, carrying with it some of the forest cover. To the north the grey rocks end abruptly against high cliffs of jointed pink granite which extend off into the distance.

From the cliffs at the back of Broad Cove you can look out over the broad bosom of the open Atlantic, and as you watch the waves breaking on the shore below you may wonder about the distant storm, perhaps thousands of miles away, that produced them.

Green Cove Area (5)

Between Broad Cove and Green Cove the highway skirts the top edge of the cliffs that face the open sea. Expanses of wave-washed rocks, steep cliffs of granite extending into the sea, and short stretches of boulder-strewn beach feature the scene. Between Green Point and Black Point, several easily accessible shore exposures provide an unusual array of rocks on clean wave-washed outcrops.

Banded gneisses at Green Cove are cut by light-coloured granitic dykes. They range in thickness from 18 inches to less than ¼ inch. The second one up from the lower left corner feathers out into several tiny offshoots. Just below it are some wave-rounded boulders, including one of granite with a thin dyke cutting it.

The oldest rocks seem to be large masses of dark gneiss. These have become engulfed and intruded by pink and white granites. In these granites you can see grains of clear quartz, pink or white feldspar, and small masses or clots of other minerals, perhaps identifiable as white mica, black mica, or hornblende. Many thin offshoots from the granite cut the gneisses and even the granite itself. These are dykes, and they are composed mostly of fine-grained granitic rock. You may find it interesting to trace the way in which these dykes crisscross one another. In so doing, you are looking at some evidence of their relative ages, for if one dyke cuts squarely across another and interrupts it, the through-going dyke must be the younger.

It is worth while to look at the boulders in the small coves and at the backs of the gulches in the cliffs here. Not only do they show an interesting assortment of rock types—for they come from the erosion of the cliffs and from the droppings of the glaciers—but in addition they show how the violent motion of the water along the shoreline produces rounding, and to great perfection.

Black Brook Cove (6)

Black Brook Cove presents a beautiful white sandy beach to interrupt the line of rocky cliffs along the eastern shore of the park. The sand is made almost entirely of grains of the mineral quartz. The very round boulders on some parts of the beach are almost all made of granite from nearby points. The process of rounding of angular fragments can be watched in action on this beach in almost any weather, for there are nearly always some waves to keep the boulders at the line of breakers in motion. At most times you can actually hear the boulders being bashed against one another in the backwash of the waves. The rocks on either end of the beach comprise pink and grey granite, broken and jointed and cut by numerous pink dykes.

Black Brook enters the southwest corner of Black Brook Cove. In the summertime it supplies water to this corner of the beach which is slightly warmer than the open sea water. It is interesting to note here the different patterns of light produced where the fresh and salt waters mix, because of their different densities. Tides along the beach are very slight, as they are on all open ocean fronts.

Neil Brook (7)

A small picnic ground is situated at the mouth of Neil Brook. The solid rock that crops out all around it is made entirely of pink jointed granite with small gneissic inclusions, and is cut by small dykes. The mass of sand visible to the southeast, farther out Neil Harbour, is actually a bar that almost cuts off the inland end of the harbour. This lovely beach is not accessible from here because of a narrow gut on the near end. In bars such as this, the 'gut' or narrow channel often changes position over the years. They are kept open by the action of tides and the small amount of fresh water coming in from the brooks. During great storms, however, the waves may completely seal off the opening; and it may take some time for a new one to form, this time perhaps in a different place.

The line of hills along the northwestern side of the Aspy River valley marks a great fault or break in the earth's outer layers. This view from the White Point road shows the Aspy lowland in the foreground and centre, and the high plateau of Cape Breton rising sharply in the background.

It is interesting to note that the walls around the picnic site are made of angular stone and must therefore have been broken by the masons. By contrast the fireplaces are made of rounded stones that must have come directly from the beach or one of the nearby brooks.

If you take a small side trip into Neil Harbour itself you will find several outcrops of granite with many inclusions of dark rocks. Some of these make quite spectacular 'intrusion breccias' with numerous angular dark fragments of ancient gneisses engulfed in light granite.

Roadside Stop, Top of Hill (8)

From the top of the hill, an elevation of about 700 feet above sea-level, a view to the northwest shows the broad lowland of the Aspy River valley which is underlain by Carboniferous rocks. Away to the northwest, some 5 or 6 miles across the valley from here, the Aspy River lowland ends abruptly against the great wall of the Aspy escarpment, formed along the Aspy fault. From the valley flat the country rises steeply. A thousand feet higher, the gently rolling surface of the Cape Breton Highland itself forms the skyline.

Large glacial boulders occur all along this section of the highway and may be seen in the ditches and scattered over the surface of the land.

This hill of gypsum near the Aspy River crossing at Cape North village shows the characteristic pillar and solution-cavity surface that is common in most outcroppings of this soluble rock in the Maritimes.

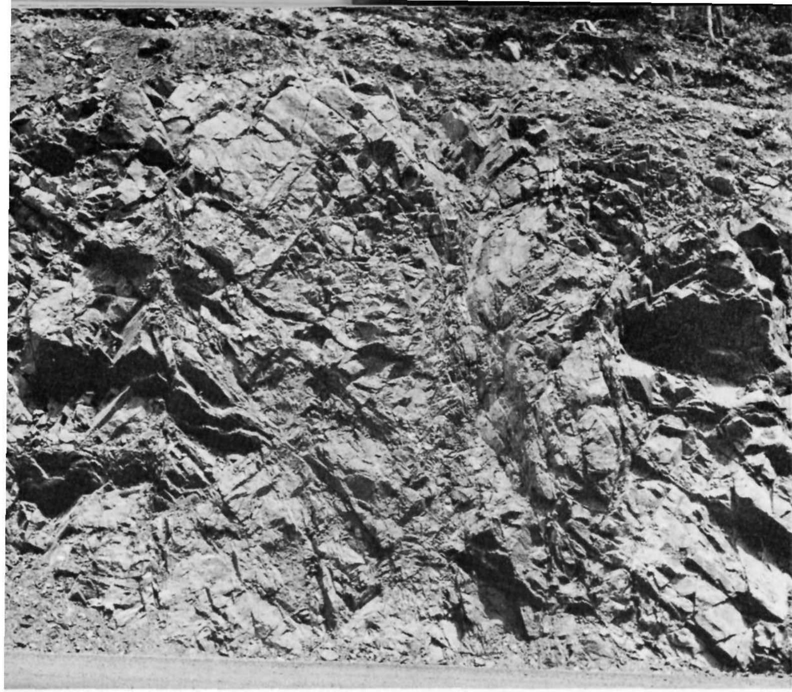
Dingwall Gypsum Quarries (9)

From the highway you can see irregular hills and lumps of dazzling white gypsum sticking up through the forests and fields. Some 10 million tons of high-grade gypsum has been shipped from stripping operations in this immediate neighbourhood, for use in making plaster, plaster board and other products. A drive of a few hundred feet northward along the side road here will show road-cuts of white gypsum and pale blue anhydrite.

Roadside Stop, Outside of Highway Curve (10)

This point provides an excellent view of the valley of Aspy River with the great scarp along the Aspy fault to the northwest. The Cape Breton Highlands, lying beyond the fault scarp to the northwest at an elevation of about 1,500 feet above sea-level, are broken along this great fault system which has been traced for more than 20 miles. A great block of the earth's crust must have moved downward relative to the highland block to the northwest. In addition to being lower than the highland area, this block—and our viewpoint here is part of it—was covered by a considerable thickness of younger Carboniferous rocks.

In the view to the northeast look for the occasional patches of gypsum showing white in the darkly forested surface; the various ponds cut off by the sandy beach bars; and the northeast extension of the Aspy escarpment, terminated eventually by the sea itself.



At this rock-cut on the roadside along the valley of MacGregor Brook the rocks are thoroughly broken and sheared. It would be difficult to obtain a solid piece more than 6 inches long from this locality. This kind of breakage indicates a long history of folding and faulting.

Rock-cuts along MacGregor Brook Valley (11)

The undulating surface of the Cape Breton Highlands is about 1,500 feet above sea-level whereas the bottom of the nearby valley of North Aspy River, where the road crosses it, is only about 100 feet above sea-level. To negotiate this steep incline the highway travels along the side of Aspy River and then its tributary, MacGregor Brook, and is lined by almost

Thousands of feet of rock-cuts mark the road as it climbs from the Aspy River valley to the plateau along the steep wall of MacGregor Brook. The several kinds of rocks exposed are all shattered and much altered chemically and mineralogically. In this view we see ancient sedimentary rocks cut by a variety of lighter-coloured dykes.

continuous rock-cuts. These show smashed and broken sedimentary and volcanic rocks that have been very highly altered by heat and pressure. A great many narrow dykes of pink granite cut the older rocks and, in some places, are so inextricably intermingled with the older rocks that a composite rock results. Here and there, dykes of a dark fine-grained rock are seen cutting the older rock. At many places in the road-cuts you may even see the actual surfaces of movement—the places where one part of the rock moved past another. Some of these are vertical and some are more or less diagonal. Visible at the tops of the cliffs is a thin blanket of glacial debris and rock rubble which has recently come down the hillside.

The view to the southeast from part way along MacGregor Brook valley shows the upland surface of the Cape Breton Highlands making a flat skyline at an elevation of about 1,500 feet on the other side of the North Aspy River valley. Valleys of tributary brooks make deep gashes with rounded shoulders in the edge of the plateau.

Top of Plateau (12)

After the long steep climb, from either east or west, the road travels along the flat, gently undulating surface of the Cape Breton Highland at an elevation of approximately 1,350 feet above sea-level. You certainly do not get any idea of being on a narrow tableland from this section of the road. A thin mantle of glacial debris with scattered boulders here and there reminds us that even the tops of the Cape Breton Highlands were once covered by glaciers.

Upper Grande Anse River Valley (13)

Long rock-cuts are prominent at the roadside along the upper end of Grande Anse River. Sheared and broken, dark altered volcanic and sedimentary rocks are shot through with intrusions of pink granite. The proportion of granite seems to decrease to the westward or lower part of the hills in the highway cuts. In most of these outcrops the rock is so very much broken that it is indeed difficult to get out a solid piece more than a few inches long. In some sections of this part of the highway, masses of water-saturated clays have flowed off the steep banks and present a hazard to highway maintenance.

Pleasant Bay Viewpoint (14)

This viewpoint is on the outside bend of the third loop of the highway above the Pleasant Bay level. On clear days it provides a magnificent view out over the village and small farms of Pleasant Bay to the great line of cliffs, along which the Cape Breton Highlands meet the Gulf of St. Lawrence. Except for the lowland in and around Pleasant Bay, the apparently rolling hilly country is really the edge of the flat tableland which has been cut into by stream valleys. Far below, close to sea-level, you may be able to distinguish the flat or terrace along the shores of Pleasant Bay.

The distant cliffs are of two kinds. The cliffs extend more or less continuously down to water level from the highland where only ancient gneisses and schists or the intruded granites meet the sea. Where there is a strip of Carboniferous rock along the shore, however, you may see that the profile of the cliffs flattens into a terrace-like interruption just back of the much lower cliffs which face the sea.

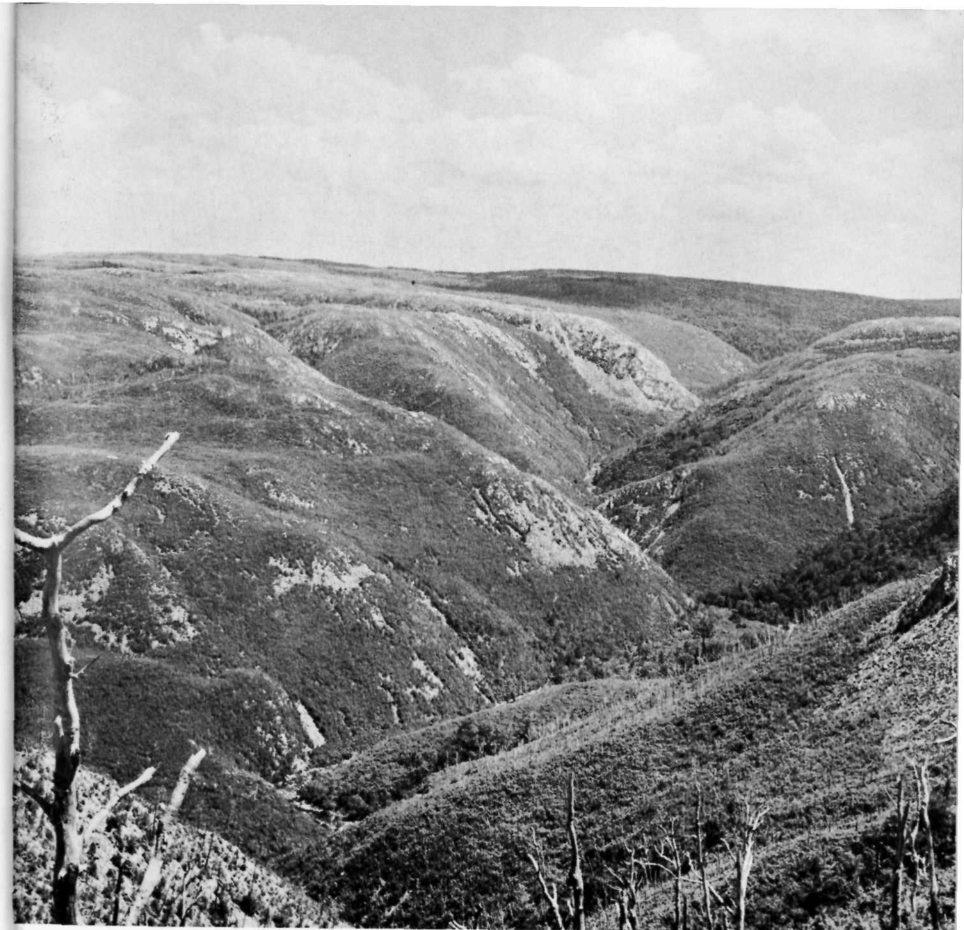
Here and there along the line of cliffs the rock gives way to banks of glacial debris which are visible even from this distance. The rocks into which the hairpin turns are cut, in the steep hills from the top of the plateau down to the Pleasant Bay level, are various mixtures of gneisses and the granite that has intruded them.

Viewpoint over Mackenzie River (15)

This stop provides a view to the east that shows beautifully the flat skyline of the upland surface of Cape Breton Island and the effect of the cutting of valleys by rivers on its margins. The great gash of the Mackenzie River valley with its branches and spurs is about 500 feet deep directly opposite us. The rounded granite hills up the river valley are scarred here and there by recent landslides. 'Scree slopes' are common below some of the steep parts of the valley walls. Weathering of the surface of the granite has bleached the rocks somewhat, making fresh exposures, such as the landslide areas on the valley sides and rock-cuts along the highway, appear to be darker. The path of a forest fire is clearly visible in the hills across the valley and may account in some part for the bleaching of the rock in this area.

Viewpoint over Fishing Cove Brook (16)

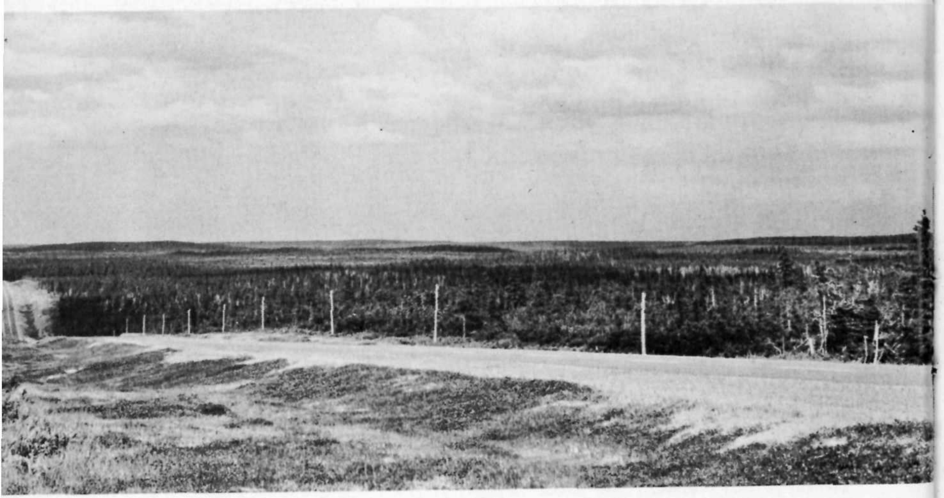
This parking area and viewpoint is unusual in that it lies on the crest of a very narrow ridge that separates the steep



The valley of Mackenzie River cuts deeply into the high plateau of Cape Breton in the Pleasant Bay area. Occasional scree slopes scar the steep valley walls. Note the bare hills of granite and the even skyline.

valley of Fishing Cove Brook on the west from the equally deep valley of a tributary of Mackenzie River on the east. This means that the road is squarely perched on a 'divide'—the line that separates the drainage of one river from the drainage of another. At this place you can easily see that the water falling on one side of the road would drain into one river system whereas the water on the other side would drain out to the sea in a different river system.

The view northwest down the narrow steep valley of Fishing Cove Brook shows perfectly the kind of narrow slits that the



The top of the Cape Breton Highland is a gently rolling plain, about 1,500 feet above sea-level. This view is between Jumping Brook and Fishing Cove Brook on the western side of the park.

streams have cut into the highland surface along its edges. The small bar thrown up by the waves partly crosses Fishing Cove itself.

Top of Plateau (17)

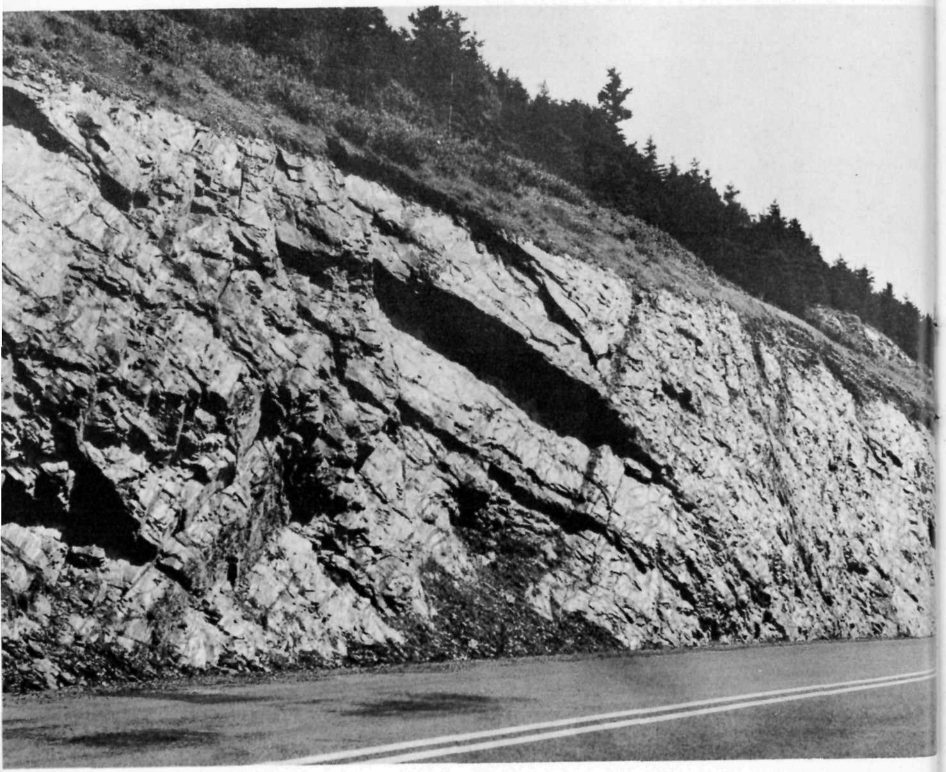
The highway, after climbing to the top of the Cape Breton Highlands plateau level, from near sea-level either at Pleasant Bay on the north or up Jumping Brook valley from the west, passes over gently undulating country that gives no hint of its position near the edge of the upland. A thin veneer of glacial debris may be seen almost everywhere. Bogs and small ponds further tell of the passing of the glaciers and the disruption of the drainage system by the irregular deposition of glacial debris. You may notice the considerable difference in the vegetation at this height, for here the trees are stunted and many show the obvious effects of being wind blown.

Roadside, Jumping Brook Valley (18)

The main road is cut into the solid rock on the steep south side of the valley of Jumping Brook. A variety of altered sedimentary rocks, now largely mica schists, dip generally westward out to sea. Faults and breaks are common. Across the valley, slides have made gashes in the forest on the opposite wall. Some of these seem to have been rockslides whereas others were probably made during the winter by snow. The snow forms great cornices on the edge of the plateau and then breaks off to cascade down the valley, tearing out all trees and bushes in front of it.

The angle of repose—the angle at which materials of a given size, weight, shape, and surface characteristics will stop slumping and sliding—controls several features in this brook valley. The steepness of the 'scree slopes', the steepness of the ballast and fill used to make the road, the steepness of the snowbanks that will hold without sliding—these are all functions of the angle of repose.

Billions of tiny flakes of mica in the schists that line the highway from Jumping Brook south to Presqu'ile make the road-cuts shine in the sun. Joints, faults and occasional thin zones of other rocks are visible here.



Viewpoint North of Corney Brook (19)

This stopping place, partly up the cliffs north of Corney Brook, provides a view along the cliffed shoreline for many miles. The horizon is rimmed with the lowland developed on Carboniferous rocks in the neighbourhood of Cheticamp and Cheticamp Island. At Presqu'ile a wharf sticks out into the Gulf of St. Lawrence but is protected by offshore reefs. Still closer, a marine stack or remnant, made of dipping red layers, lies offshore from a flat terraced area and marks a small patch of Carboniferous rocks.

Shining cliffs of mica schist can be seen on the coast between the mouth of Trout Brook and the clearly visible Corney Brook campground area. The low part of the coastline immediately below this viewpoint faces the sea in cliffs of red sandstone and siltstone of Carboniferous age. These rocks may be seen in outcrops along the road immediately across from the viewpoint area. Their seaward dip is clearly shown in the flat bedding-slopes. The hill above them is made of granite, so the red beds really form a thin sliver along this part of the seaward edge of the Cape Breton Highlands. The contact between the Carboniferous rocks and the older ones below them may be seen in the rock wall along the road just above this viewpoint. The contact itself, and the rocks on each side of it for several tens of feet, are marked by breakage and shearing—indicators of considerable fault movement between the two rock groups.

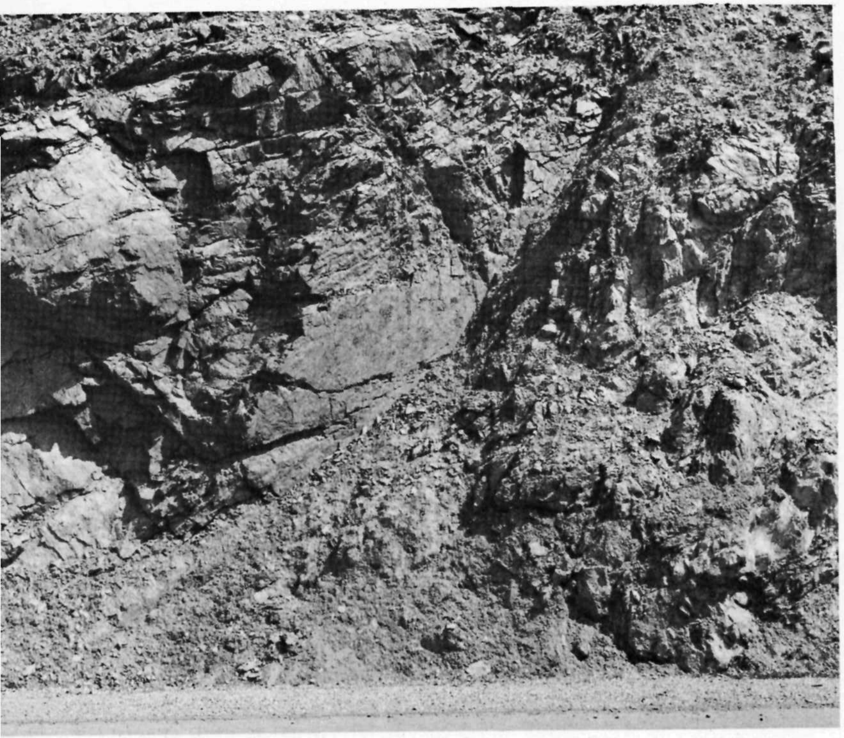
Corney Brook Area (20)

The mouth of Corney Brook and the surrounding area are of great interest geologically, for meeting here are the three major elements of Cape Breton geology—the ancient gneisses and schists, the granites, and the younger Carboniferous rocks. To the north of the actual mouth of Corney Brook the obviously bedded rocks of the Horton Group (Carboniferous) dip at approximately 50 degrees out underneath the Gulf of St. Lawrence. They form a thin sliver or wedge plastered against the edge of the Highland plateau. The same rocks occur farther south along the shore and form the erosional remnant or 'stack' off the mouth of Trout Brook.

The rocky point on the south side of the Corney Brook beach area is made of granite. A walk to the top of the cliffs at that point gives a superb view to the south; wave washed cliffs of granite in the foreground give way, past the curving beach, to a rocky point of the older schists and gneisses and, still farther, to shining flat cliffs of mica schist. In rock-cuts on the main highway just opposite this point the faulted contact between the pink granite and the schists is very well exposed. From the same general area the view to the northeast is also one of the very beautiful ones in Cape Breton Highlands National Park, with the great cliffs below the rounded shoulders of the highland and the highway winding diagonally up the slope.

Corney Brook valley is typical of those intersecting the seaward edges of the Cape Breton Highlands plateau, for it is

Headlands and points, bays and coves—features typical of any shoreline being cut into rocks that differ in kind and structure from place to place—mark the eroding shores of western Cape Breton. In this view, northward from just south of Corney Brook, the rugged shoreline developed on old rocks in the foreground gives way, beyond Corney Brook beach, to a steep even shoreline developed on steeply dipping sandstones and siltstones of Carboniferous age.



Broken and altered granite and micaceous schists form the shoreline and the rock-cuts to the south of Corney Brook. In this photo a fault dips downward to the left and separates the granite on the left from the schist on the right. The same fault-contact can be seen in the shore just to the west.

steep in profile, has rounded shoulders and spurs, and its bottom is a mass of boulders derived from recent erosion and glacial debris.

Mouth of Trout Brook (21)

The shore at the mouth of Trout Brook may be reached from the main highway by walking across the open fields or by driving down the remnant of the old road. The rocks here are of Carboniferous age and they show many typical features of sedimentary rocks. White and grey-green quartz sandstone filled with specks of flesh-coloured or pink feldspar, and red sandstone with siltstone are common on the north side of the mouth of the brook. A black shale containing fossils crops out in the bank south of the brook. The sandstone point still farther south is made of crossbedded grey-brown sandstone.

The chief item of interest at this stop is the marine stack offshore. It is made of reddish sandstones that dip seaward and at one time were continuous with the line of cliffs along the shore. Wave-erosion has cut in behind the stack and isolated it, and, in the normal course of events, will remove it altogether.

Banks of glacial debris lie on top of the sedimentary rocks all along the shore here. The boulders and pebbles on the beaches along this part of the coast show many different kinds of rocks because they are derived largely from the glacial debris, which in turn came from the passage of the glaciers over many different rock types.

Irregular remnants of rock are often left behind as ocean waves erode the land. This unusual sloping rock with the hole cut through it is on the western shore near the mouth of Trout Brook.

Wharf Area on Shoreline Below Road (22)

A short side road leads down to the shore and a wharf used by local fishermen. A reef which lies a few yards off the beach has interfered with waves and currents along the beach and as a result a deposit of sand and gravel has been built out from the shore. It is from the point of this spit that a wharf has been constructed. The reef is elongated parallel to the shore because that is the trend of the rocks here, and it forms a natural barrier or breakwater. Carboniferous rocks form a very thin selvedge along the seaward margin of the hills, which are made of schists and gneisses. The reddish Carboniferous sandstones can be seen dipping seaward off the older grey schists at several places along the shore nearby.

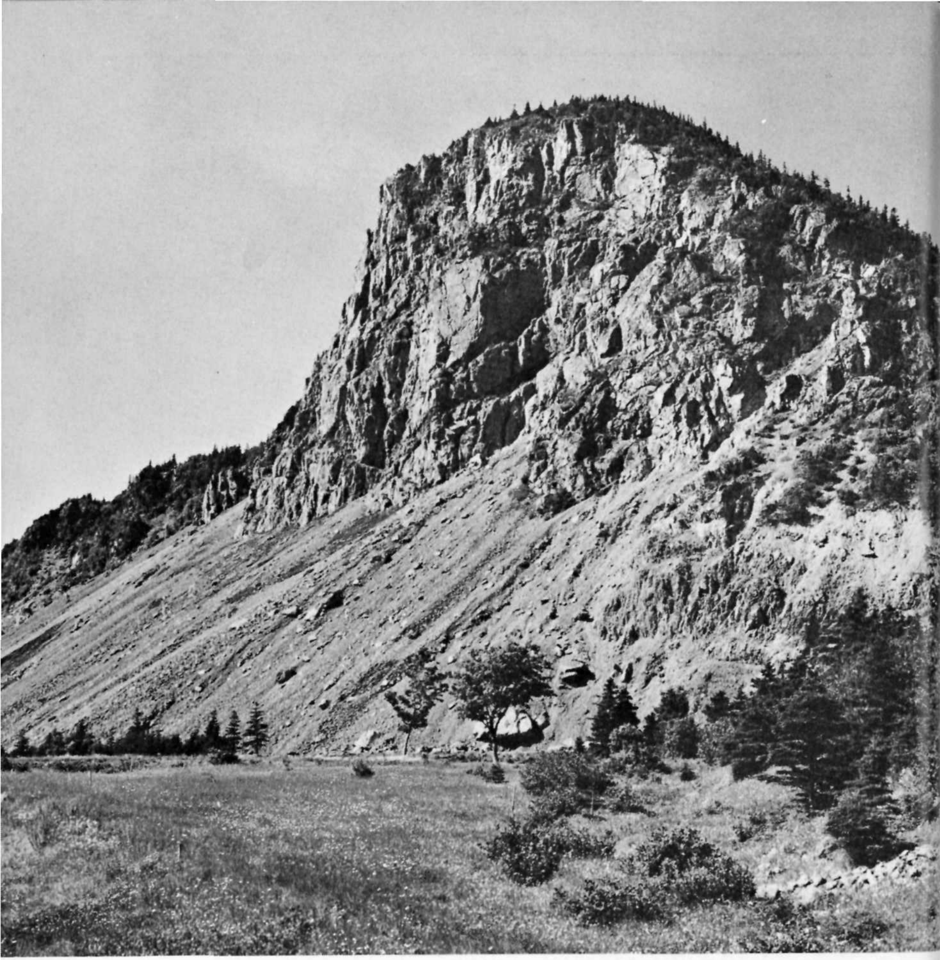
Presqu'ile (23)

A small hill of Carboniferous sedimentary rocks is connected to the mainland by low areas of sand and gravel at each end. The high hill to the east is made of schists of the old rock complex. You can drive down to the beach at the southwest end of Presqu'ile and see the upturned edges of the Carboniferous sandstones dipping seaward at about 35 degrees.

Farther along the beach to the southeast, two small erosional remnants stand in the sea just offshore. From this point southward for a short distance the rocks are of volcanic origin and, although generally grouped with the older rock complex, they seem to lie on top of an erosion surface that crosses the schists and granites. Thus they must be younger.

Roadside Stop Under Great Cliff With Scree Slope (24)

The main highway in this section of the park passes along a valley that separates a mass of granite on the east from a block of Carboniferous sandstone and other sedimentary rocks on the west. The position of the valley, which at present is not drained by any major stream, suggests that it must be a remnant of an earlier drainage system. In some places the steep cliffs of granite on the east side have great scree slopes at their feet. The white gashes in the granite are veins of quartz.



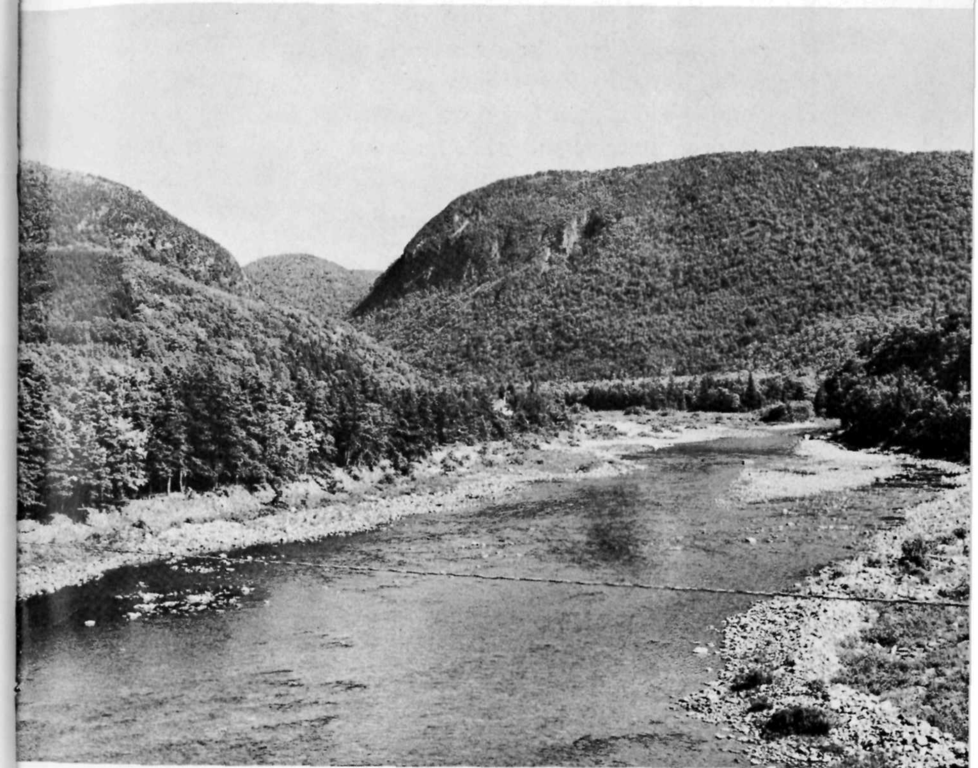
This great mass of rock with talus slopes below it occurs east of the highway about 2 miles from the Cheticamp entrance. Some of the talus has been used in road construction.

In this view from the cliffs just south of Presqu'ile the lowland of Carboniferous rocks is abruptly terminated by the scarp that marks the edge of the Cape Breton Highland. Bars cut off lagoon areas and give way to rocky cliffs capped by glacial debris near the left margin of the picture.

Bridge over Cheticamp River, and Western Entrance Area (25)

Cheticamp River, which, through most of its length flows close to the southern border of the park, has cut a spectacular canyon nearly 1,000 feet deep into the surface of the Cape Breton Highlands. From the bridge over the river the valley can be seen leading back into the mountainous mass. The strew of debris in the stream bottom shows the kinds of rock exposed in the course of the river itself and also shows the nature of the glacial debris farther upstream.

Downstream from here and only partly within the park is a lagoonal area where the mouth of Cheticamp River has been dammed by a beachbar built up by waves and currents. The flat area to the southeast of the river-crossing is underlain by Carboniferous Horton and Windsor sedimentary rocks that dip gently seaward. White cliffs of gypsum are visible from the highway about half a mile south of the gate, marking the site of a once active quarry.



Cheticamp River emerges from the highlands through this valley near the southwest entrance. A few miles inland the valley narrows and becomes a spectacular canyon, cut more than 1,200 feet into the surface of Cape Breton Highlands.

EPILOGUE

As you travel through Cape Breton Highlands National Park—it may be on a day when the swirling mists hide all but the first few feet above sea-level, or a crystal clear day when you can see forty miles along the coast from the Highlands—you cannot but be impressed by the magnificent scenery of mountains and sea. The beauty of these surroundings becomes more deeply appreciated with a knowledge of the long geological history behind each part of the landscape.

The high flat upland surface, with its wind-blown and stunted trees alternating with open bogs and small lakes, was carved on a complex of ancient rocks at a time when the present surface stood near sea-level. The valleys of the steep brooks that cut the edges of the plateau are now filled by beautiful forests and rushing streams. At one time this country was blanketed by a great ice-cap, and it was part of a vast desolate wintery scene that extended over millions of square miles of northern North America.

Along the coastline the ceaseless surge of the open ocean brings souvenirs to Cape Breton from storms as far away as Greenland and the South Atlantic. Waves and currents are undermining cliffs of glacial debris and solid rock, and strewing sand and gravel along beaches and bars. Whether you come to these shores during the calm of summer or during the fury of winter storms you can see many processes of erosion at work as Nature seeks to restore the balance by carving away the land and filling the sea.

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For further information the following publications are available from the Queen's Printer, Ottawa, Canada.

Guide to Geology for Visitors in Canada's National Parks, by D. M. Baird. Ottawa, 1960. National Parks Branch, Department of Northern Affairs and National Resources. This is a pocket-size booklet containing 144 pages and 37 illustrations, which outlines in layman's language the general principles of geology with special reference to Canada's National Parks.

Geology and Economic Minerals of Canada, by officers of the Geological Survey of Canada. Economic Geology Series No. 1, Fourth Edition, Ottawa, 1957. A wonderful source of material on the geology and mineral deposits of Canada.

Particular information concerning the geology of Cape Breton Highlands National Park may be obtained by writing to the Director, Geological Survey of Canada, Ottawa, Canada.

The following reports, also available from the Queen's Printer, Ottawa, pertain to the geology of areas in and around Cape Breton Highlands National Park. They contain geological maps and information of a more technical nature about these areas.

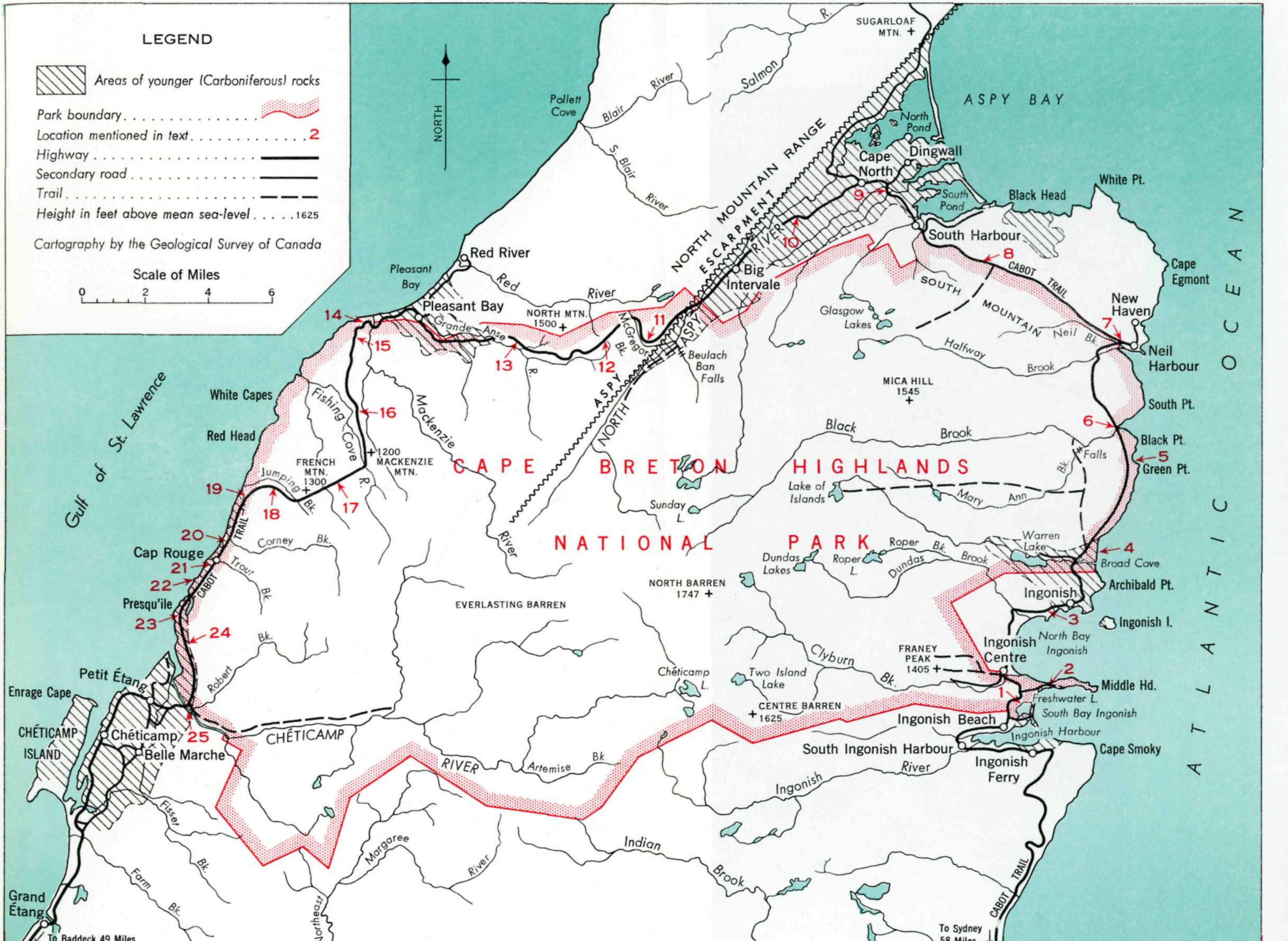
Cheticamp River, Inverness and Victoria Counties, Nova Scotia, by A. S. MacLaren. Ottawa, 1956. Geological Survey of Canada, Paper 55-36.

Ingonish, Victoria County, Nova Scotia, by A. S. MacLaren. Ottawa, 1956. Geological Survey of Canada, Paper 55-35.

Dingwall, Victoria County, Cape Breton Island, Nova Scotia, by E. R. W. Neale. Ottawa, 1955. Geological Survey of Canada, Paper 55-13.

Pleasant Bay, Inverness and Victoria Counties, Nova Scotia, by E. R. W. Neale. Ottawa, 1956. Geological Survey of Canada, Paper 55-24.

For other information about Canada's National Parks write to the superintendent of the park concerned or to the Director, National Parks Branch, Department of Northern Affairs and National Resources, Ottawa, Canada.



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