

## 2.4 Saint-Pierre-et-Miquelon Islands

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### 1. Introduction

The Saint-Pierre-et-Miquelon archipelago is a small French territory, only 242 sq. km, located 22 km from the southern coast of Newfoundland, between 46° 45' and 47° 10' N and 56° 05' and 56° 25' W. It constitutes an enclave on the Saint-Pierre Bank within Canadian territorial waters. The archipelago is formed by a main island (Saint-Pierre) to the east, where the prefecture and administrative centre are located, by two more important islands (Miquelon and Langlade, joined by a N-S tombolo) as well as six other islands (Le Cap, Grand Colombier, Verte, aux Marins, aux Vainqueurs and aux Pigeons islands) and various islets and reefs (Aubert de la Rue 1970) (Fig. 2.4.1).

The Labrador Current, which flows through the archipelago from east to west, is responsible for cool and foggy summers (85–120 days) and the average annual temperature in this subarctic marine environment is barely 5.5°C. Average annual precipitation is about 1,424 mm – about a third as snow. Winds exceed 60 km/h for almost half the year, and storms are frequent. The storm of January 1987 caused up to 5 m of recession on cliffs cut in glacial drift deposits, the February 1988 storm, with winds of up to 160 km/h cut back cliffs by up to 14 m and the storm of December 1989 caused 7 m of erosion (Rabottin 1990). Much of the archipelago has scrubby vegetation following long-term deforestation, but woodland occupies 20% of Langlade Island. Peatland is extensive, and heathland and grassland are found over coastal sand and pebble areas. The main algae found along the coasts are laminaria, brown algae, red algae and lime-secreting algae.

The geology is varied (Dubois 2006). Le Cap Island is mainly composed of metamorphic crystalline Pre-Cambrian rocks (schists, quartzites, paragneiss and migmatites), with a small intrusive granitic stock. Miquelon Island consists of slightly metamorphosed post-Ordovician volcanic rocks, mainly rhyolites with some basalts, andesites and breccias. Langlade Island has slightly metamorphosed Appalachian Palaeozoic sedimentary rocks (sandstones, schists, phyllites, limestones, quartzites and conglomerates) trending SW-NE with faults. Saint-Pierre and adjacent islands are composed of post-Ordovician intrusive rocks, mainly rhyolites, breccia and tuffs with a few andesites.

The islands are mostly rocky with superficial deposits of glacial till, wind-blown sand, alluvium, weathered rock, landslide debris, colluvium and peat. The islands are the remains of an ancient erosion surface except for Langlade Island, which has a tabular relief. On the main islands there are a number of summits: Morne de la Grande Montagne on Miquelon island (240 m), Le Trépied on Saint-Pierre island (207 m), Tête de Cuquemel on Langlade Island (190 m) and a hill with an altitude of 153 m at the NE end of Le Cap island. The thick superficial deposits are located mainly on Miquelon and Langlade Islands, while silty clay till, superficially reworked by the sea, is present over most of the periphery of Miquelon island and in NW Langlade Island, often affected by landslides. Tombolos of sand and gravel link Langlade and Miquelon Islands, Miquelon and Le Cap Island, and will eventually link aux Vainqueurs and aux Pigeons islands.

The archipelago was covered by ice from Newfoundland during the Middle Wisconsin, as shown by the nature of the erratics, but not during the Late Wisconsin. Glaciation left moraines to the south of Saint-Pierre Island and till over most of the islands. A subsequent marine submergence, around 38,000 years BP left shore deposits and indications of marine erosion up to at least 25 m above sea level. The southern limit of the last glaciation was along the south coast of Newfoundland (Piper and Macdonald 2001), and evidence of periglaciation – including frost wedges – is found on all the islands (Lauriol and Dubois 1981). However, recent shore formations at 10 m on the north of Miquelon Island, 6.4 m in the north of Langlade Island and present sea level on Saint-Pierre Island, could indicate differential Post-glacial emergence. At Quine Point, north of Grand Barachois, the base of a peat bog, 1 m below present sea level, was dated at  $8,460 \pm 150$  years BP, indicating recent submergence (Lauriol and Dubois 1981). The base of another peat bog close to present sea level in the De Savoyard cove, on the south coast of Saint-Pierre Island, had an age of  $2,000 \pm 60$  years BP. Global warming is expected to cause submergence of about 2 mm/year, taking account of continuing glacio-isostatic subsidence (Shaw and Forbes 1990).

In addition to wave action there are longshore currents which have contributed to the shaping of the tombolos on Langlade, Miquelon and Le Cap Islands (Dubois 1980).

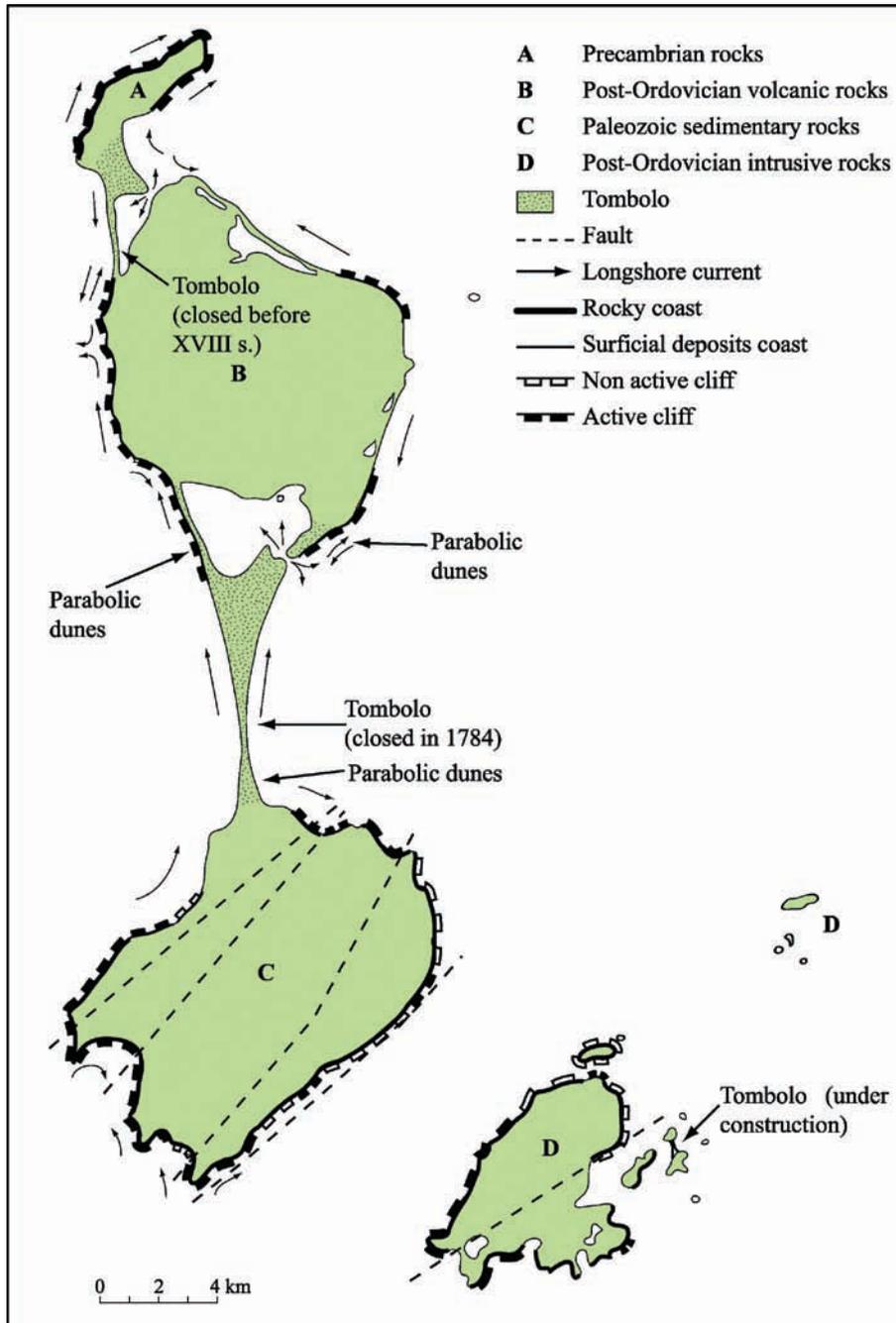


Fig. 2.4.1  
The Saint-Pierre-et-Miquelon archipelago.

Generally, the longshore currents flow in a clockwise direction, but there are local reversals in the vicinity of large capes on the eastern shore of the Langlade isthmus and the tombolo between Miquelon and Le Cap Islands. Sediment are certainly carried offshore by convergent longshore currents to the west of Miquelon Island.

There is historical evidence of coastal erosion in the archipelago since the eighteenth century, but there have

also been local phases of accretion, as on the Langlade isthmus. Using landmarks established between 1984 and 1989 and comparisons of the 1952 and 1985 aerial photographs, Rabottin (1990) concluded that 88% of the coasts in superficial deposits on Langlade and Miquelon Islands had receded at an average annual rate of slightly more than 1 m, and that this rate was increasing. On lagoon barriers, erosion sometimes reached 2–3 m/year. On the morainic

shores of Miquelon Island the annual recession rate is smaller, between 0.1 and 0.4 m. Furthermore, according to fishermen, it seems that during the last 80 years winters have been less rigorous and the winter ice-foot offers less littoral protection than before (Lauriol et Dubois 1981). There are only nine areas of accretion, all on the Langlade isthmus and the tombolo between Miquelon and Le Cap Islands. Rabottin (1990) found that the average rate of accretion was slightly more than 1 m/year. Accretion occurs near sediment sources such as eroding cliffs and around lagoon outlets. The rocks of the cliffs are relatively friable and are disintegrated by cycles of freeze-and-thaw, after which waves remove the fallen material.

## 2. Island Coastlines

Le Cap Island is linked to Miquelon Island by a sand and pebble tombolo more than 3 km long, and in places, less than 100 m wide. This double tombolo, which was built before the sixteenth century, contains a lagoon with an outlet on the eastern side. Since its altitude is only 1–4 m, the tombolo is often inundated during storms coinciding with high tides. During the winter of 1947–1948 a 2.5 m rampart of ice and pebbles was pushed up by storm waves, and this was still visible at the end of May. Le Cap Island has an indented coast with high rocky cliffs which are eroding.

Miquelon Island has low morainic and slightly indented coasts with numerous eroding peat bogs at times. On the west coast cliffs cut into till have a height of 5–10 m, and are receding (Lauriol et Dubois 1981), but a few rocky points and reefs protrude. On the lower east coast some cliffs are rocky, but numerous beach barriers of sand and pebbles enclose lagoons of varying size.

The Langlade isthmus is a 12 km long and 100 m to 6 km wide tombolo composed of sand and pebbles with an altitude varying from 1–4 m, and dunes west of Grand Barchois reaching an altitude of 26 m. Captain James Cook mapped an opening about 1.8 km wide in the isthmus in 1763, but this has been closed since 1784. There are parabolic dunes 10–20 m high (locally named *buttereaux*) at both ends, where spits shelter two large lagoons with outlets towards the east. The west coast is strewn with shipwrecks. It is estimated that there have been more than 650 shipwrecks around the archipelago since 1816 and this coast has become known as the ship necropolis (Sanguin 1983). About 20% of these wrecks occurred between the end of August and the beginning of October, close to the Fall Equinox (Dubois 1980).

Langlade Island has a high plateau with an altitude of 130–140 m, incised by many valleys with permanent water

courses, notably the Belle Rivière – the only real river in the archipelago. The island is surrounded by high receding rocky cliffs up to 25 m high, except in the north where the coastline is lower. This low coastline, cut mainly in till and glacio-fluvial deposits, with recent shore deposits to the NW, is mostly receding (Dubois 1980).

In the north and west of Saint-Pierre Island, the coasts are rocky and rectilinear, with cliffs up to 75 m high, sometimes receding. In the south the coast is low, rocky and indented, with reefs and numerous coves containing pebble and boulder beaches (Mailhot et Dubois 1983). There are only a few sandy beaches, notably at De Savoyard and Alumette, where unfortunately sand extraction occurred in the past. Fortunately this practice has been prohibited since 1984 (Rabottin 1990). A fault zone 50–100 m wide may separate the two types of coast. Saint-Pierre Island is separated from Langlade Island by a strait often referred to as La Gueule de l'Enfer (the Mouth of Hell) because of its violent currents. Breakwaters have been built to shelter the harbour at Saint Pierre. Since 1974 breakwaters have also been built to counter erosion in the inner parts of the coves, but erosion is widespread on the coasts of the smaller islands (Dubois 1980).

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