

EVOLUTION OF SPITS AND BARS IN GASPÉ, CANADA

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GEOMORPHOLOGY, SEDIMENTATION AND GEOPHYSICS OF THE HEADLANDS, BAYS AND SAND SPITS ON THE GASPE PENINSULA, QUEBEC, CANADA

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Introduction

The second Keck Geology Consortium research project in Quebec was held on the eastern tip of the Gaspé peninsula in June, 1991. The Faculty on the project included William Fox from Williams College, Richard Stenstrom from Beloit College and Robert Burger from Smith College. Eric Leonard from Colorado College visited Tona Winterbottom in the field. Ten senior Geology majors participated in the program representing 7 colleges in the consortium including Amherst, Colorado, Franklin and Marshall, Smith, Williams, Wooster of Ohio and Washington and Lee University. Karen Boucher of Smith College and Bob Burger Jr. of Yale University assisted with the seismic profiling across the sand spits. Rachel Beane and Rebecca Beavers of Williams College served as research assistants in the field and also prepared our delicious meals.

Geologic setting

The interplay between Paleozoic bedrock geology, Pleistocene glaciation, landslides, and coastal sedimentation provided the framework for the student projects on the development and evolution of the Gaspé bays and spits. The headlands, bays and sand spits are located on the eastern tip of the Gaspé Peninsula where it projects into the Gulf of Saint Lawrence. Cambrian to Carboniferous sandstones, limestones, shales and conglomerates form the basement rocks in the area. The red sandstones, shales and conglomerates in the Devonian Battery Point and Malbaie Formations provide classic examples of braided stream deposits. A sequence of northwest trending anticlines and synclines control the topography in the hills and along the coast. The folds are cut by normal and reverse faults which cause a repetitions and omissions within the stratigraphic sequence.

The peninsula was draped by valley glaciers that radiated out from the Gaspé highlands during the late Pleistocene. The U-shaped valleys, red glacial tills and glacial striations provide the primary evidence for late Wisconsin valley glaciation. Some of the directions of glacial striations indicate that the peninsula may have been overridden by the Laurentide ice sheet, but the complete glacial history is still unresolved.

During the initial post-Pleistocene rise in sea level which was accompanied by isostatic crustal rebound, a series of large sand spits were deposited in the bays and estuaries. With the continued rise in sea level, the sea cliffs were eroded by wave action and landslides, and the sediment was carried along the coast by waves and currents and deposited in large barrier beaches and spits. Rivers clogged with glacial sediments drained the highlands and slowly filled in the bays seaward of the barrier beaches with sand and mud, and formed salt marshes and estuaries behind the spits and bars.

Student Projects

The students focused on several different areas of geology that could help unravel the origin and evolution of the sand spits near the tip of the Gaspé Peninsula. The student projects were concentrated in three distinct areas as shown on the map of project locations (Figure 1). Five students worked with Professors Fox and Burger on the spits and marshes located near the head of Baie Du Gaspé. Two students with Professor Fox studied the pocket beaches located near Pointe Saint Pierre. Three students studied the glacial sediments, offshore deposits and shallow seismic reflections in the area of La Malbaie with Professors Burger and Stenstrom. Two students studied the landslides and sediment deposits at Cannes Du Roches with Professor Stenstrom. **Karen Boucher** (Smith), **Bob Burger** (Yale) and **Lisa Jencka** (Wooster) worked with Professor Burger on the geophysical crew which completed seismic studies from Penouille Spit on the north to Malbaie Spit on the south.

In the northern area at the head of Baie Du Gaspé, the projects were located on Sandy Beach Spit, Haldimand Spit and Douglastown Spit (Figure 1). **Peter Sedgwick** (Williams) studied the grain size distribution and spit development on Sandy Beach Spit. He found a close relationship between a high tide breach in the spit and mean grain size. **Rebecca Beavers** and **Rachel Beane** (Williams) used remote sensing and image processing to map vegetative zones and sedimentary environments in the Marsh on Sandy Beach. **Karen Lenz** (Smith) focused on the tidal currents and sediment patterns on Haldimand and Douglastown Spits. **Ross Hartleb** (Amherst) conducted gravity surveys on Sandy Beach, Haldimand and Douglastown Spits to determine the structures and lithologies beneath the spits.

At Pointe Saint Pierre, the student projects concentrated on the pocket beaches and cliffs which were located in Anse Du Chien Blanc and at Pointe Verte (Figure 1). **Kimberly Allison** (Washington and Lee) studied the sand and pebble populations on a pocket beach and the adjoining cliff exposures of the Devonian Malbaie Formation at Pointe Verte. **Christine Johnson** (Williams) studied the sand and pebbles on Chien Blanc Beach and the sources for the sediments in the glacial till and cliff exposures of the Battery Point and Malbaie Formations.

The student projects at La Malbaie focused on the origin of the Malbaie Spit from several different perspectives (Figure 1). **Greg Balco** (Williams) studied the Pleistocene glacial history of the spit and the area around Malbaie making a gravity survey and studying evidence for glaciers in tills and striations. **Lisa Jencka** (Wooster) conducted a seismic survey across Malbaie Spit to determine the depth to bedrock and thicknesses of glacial till and unconsolidated sediments beneath the spit. **Joseph Klinger** (Franklin and Marshall) made a bathymetric map of Malbaie and studied the offshore sediments in the bay. He used a wave refraction program to plot the wave distribution in the bay.

The Cambrian and Ordovician conglomerates, limestones, sandstones and shales exposed in the cliffs and landslides at Cannes Du Roches provided a possible sediment source for Malbaie Spit. **Darren Braccia** (Washington and Lee) measured a stratigraphic section of the cliff exposures and studied the succession of landslides along the coast. **Tona Winterbottom** (Colorado) followed the sediments from the landslides along the coast to the landward end of Malbaie Spit.

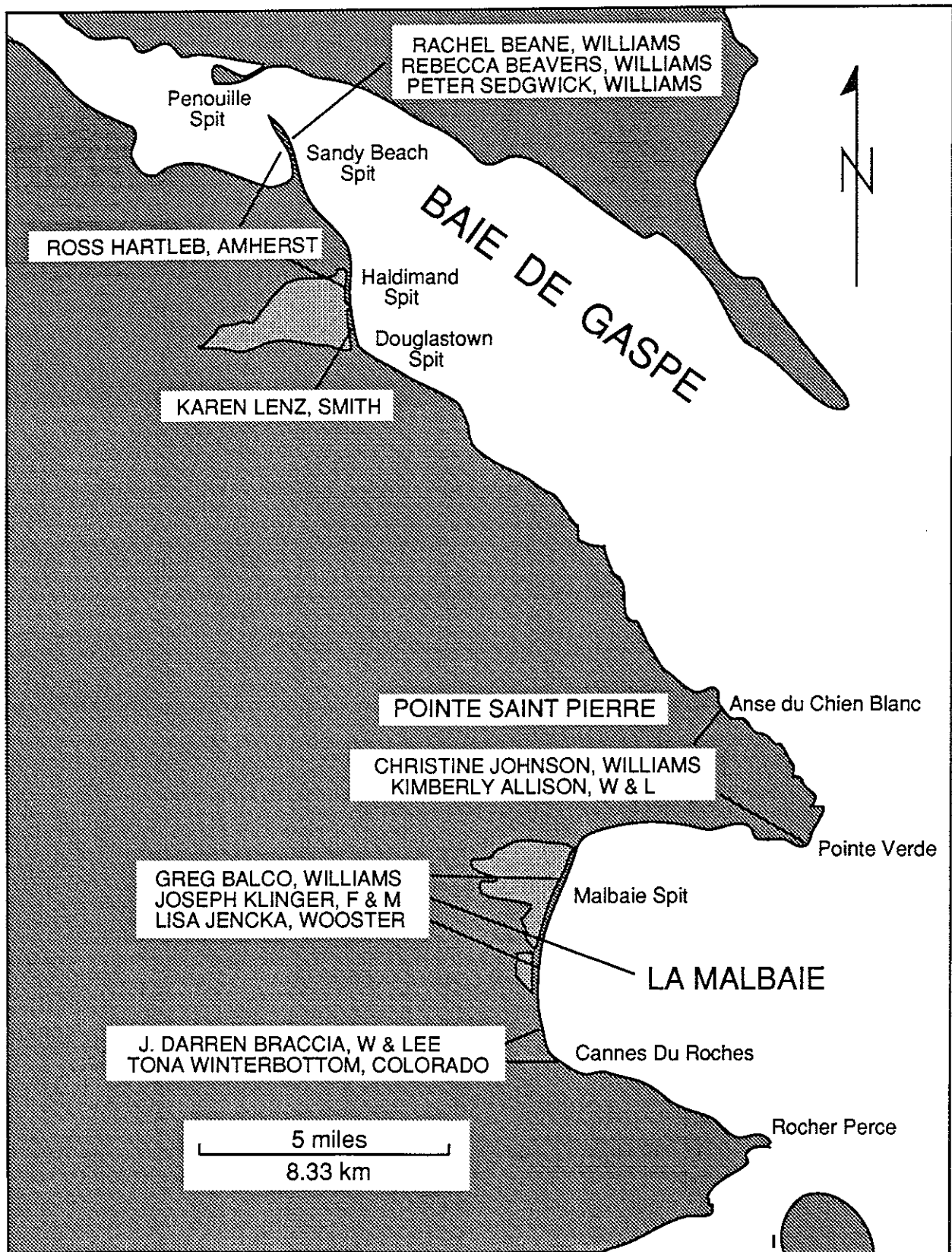


Figure 1. Map of locations for student projects in Gaspe, Quebec, 1991.