

Salish Sea Touring Map

THE 'SALISH SEA' INCLUDES THE INLAND COASTAL WATERWAYS OF SOUTHERN BRITISH COLUMBIA AND WASHINGTON STATE, INCLUDING THE STRAIT OF GEORGIA, JUAN DE FUCA STRAIT AND PUGET SOUND. THE NAME HONOURS THE COAST SALISH PEOPLES WHO HAVE LIVED IN THE PACIFIC NORTHWEST FOR MANY THOUSANDS OF YEARS, AND RECOGNIZES THAT FLORA, FAUNA, CLIMATE AND GEOLOGY AREN'T BOUND BY THE BORDERS THAT EXIST BETWEEN COUNTRIES TODAY.



This large ecosystem covers 18,000 square kilometers of water, and is home to 7 million more, more than 200 species of fish, 20 different marine mammals, 100 types of birds, and over 3,000 invertebrate species. It's an area of great natural beauty, an important trade route, and a source of many natural resources. But it's also an area influenced by massive and ongoing geological forces.



Understanding the remarkable geology of the region, through ongoing exploration and research, is vital to the sustainability of the humans, plants and animals that call the Salish Sea their home.

For more information on the science and marine geology of the features in this map, purchase a copy of the Salish Sea GeoTour Guide, or visit bcgeotours.nrcan.gc.ca for free information on the Salish Sea area and other regions in British Columbia. Natural Resources Canada nrcan.nrcan.gc.ca Geological Survey of Canada gsc.nrcan.gc.ca

Thanks to PHILIP HILL, P. Jane Wynne, Audrey Dutton and Robert King. Written by Kati Westridge. Designed by Anni Goodall. Cover: Royalties explore the sandstone cliffs of Gabriola Island. Photo courtesy of Pacific Northwest Expeditions Ltd., www.pnwexp.com. For information regarding reproduction rights, contact Public Works and Government Services Canada at 1-877-982-6868 or information@pwgsc.gc.ca. © Her Majesty the Queen in Right of Canada 2010. MA-951-2010 ISBN 978-0-662-66109-4



Seeing the Seafloor

Scientists use multi-beam sonar to get a "picture" of what the seafloor looks like, what it's made of, and to study things like marine habitats and faults in the seafloor. Multi-beam echosounders send thousands or even millions of "pings" across a wide swath of the seafloor as the research ship travels over an area. The return times and returned energy of the "pings" provide detailed information on what the seafloor looks like, and allow scientists to produce maps of the seafloor. Multi-beam sonar was used to find things like the sponge reefs in Active Pass, the sill in Burrard Inlet, and giant underwater dunes off Victoria.

In this multi-beam image of the southern Salish Sea, the deepest parts of the seafloor are dark blue. The increasingly shallow parts of the seafloor are orange and yellow. Note the shallow areas off Vancouver where the Fraser River is creating river seafloor. The deepest area in the Salish Sea is off Nanaimo, with depths up to 400 metres.

Vancouver

1 BURRARD INLET SILL

During the last Ice Age, glaciers flowing from the Coast Mountains filled the Salish Sea with almost two kilometres of ice. As the glaciers travelled down British Columbia's inlets, they scoured out deep fjords, and brought huge amounts of rock and silt to the mouth of the inlets. Left behind when the glaciers retreated, the piles of rubble formed giant ridges or sills. In Vancouver's harbour, the sill is 15 kilometres long and only 15 metres deep at low tide – a large headache for the captains of cargo and cruise ships.



Multibeam image showing the Ice Age sill at the entrance to Burrard Inlet.



Because the dispersion of river water depends on tidal water-driven currents, the shape of the Fraser Plume is constantly changing.

Strait of Georgia

3 SPONGE REEFS

Active Pass Sponge Reefs – Sponges are found worldwide, but the only place they're known to form reefs is on the continental shelf of British Columbia. Scientists think the sponge reef at the eastern entrance to Active Pass is several centuries old. It's as big as several football fields, has individual sponges as tall as four metres high, and is important habitat for juvenile rockfish.



4 VENUS PROJECT

Victoria Experimental Network Under the Sea (VENUS) – VENUS is a seafloor network of cables that provides real time images and information to anyone with an internet connection. Scientists use some of the VENUS data to track the 18 million cubic metres of sand, mud, rock and clay deposited by the Fraser River each year. That's enough to bury downtown Vancouver under six metres of sediment! Most of the sediment accumulates at the mouth of the river, building a steep slope. If the slope fails, it could trigger an underwater landslide and a tsunami. By tracking the deposits, scientists can help port authorities to plan for, and implement measures to reduce the risk of a natural hazard.



VENUS instruments sit on the seafloor in the Fraser Delta, the Strait of Georgia and the Saanich Inlet, and send data to the VENUS facilities via fibre optic cables.

2 FRASER PLUME

The Fraser River carries a large load of sediment out to the Strait of Georgia, particularly in the spring when the flow of the river is strongest. The sediment is propelled out into the ocean, forming a noticeable plume of light brown coloured water (right). The large area covered by the plume gives us a good idea of the enormous amount of sediment and fresh water that enters the Strait from the river every day.



Image courtesy of the British Columbia Department of Transportation.

All the geophysical data above and below are listed in the Salish Sea region. All data was collected from the Canadian Digital Elevation Data website www.geobase.ca/geobase/geobase/iceberg.html. Seafloor data was collected and compiled with the Land Info, by the Geological Survey of Canada.

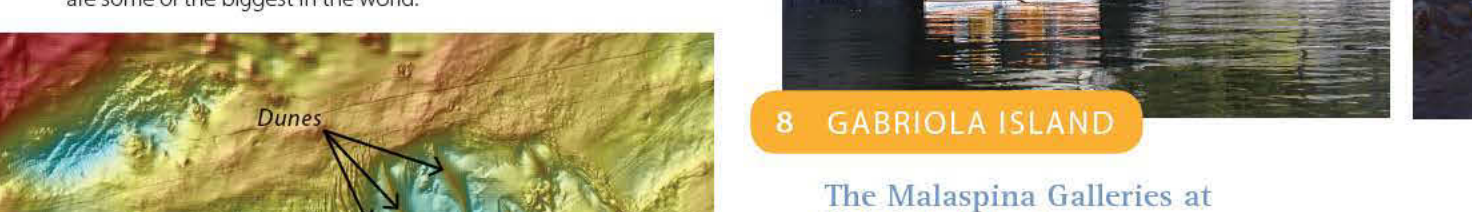
5 THE EMPRESS HOTEL

Victoria is made up of a number of bays. When glaciers from the last Ice Age retreated, mud and clay were washed down to the centre, creating a soft basin floor. The north wing of the Empress was built on gravel and bedrock, but the south wing was built on softer mud and clay. During construction of the south wing between 1912 and 1915, engineers had to re-level the wing every month. By 1973, the wing had sunk a total of 73 centimetres, although much of the sinking occurred within the first five years.

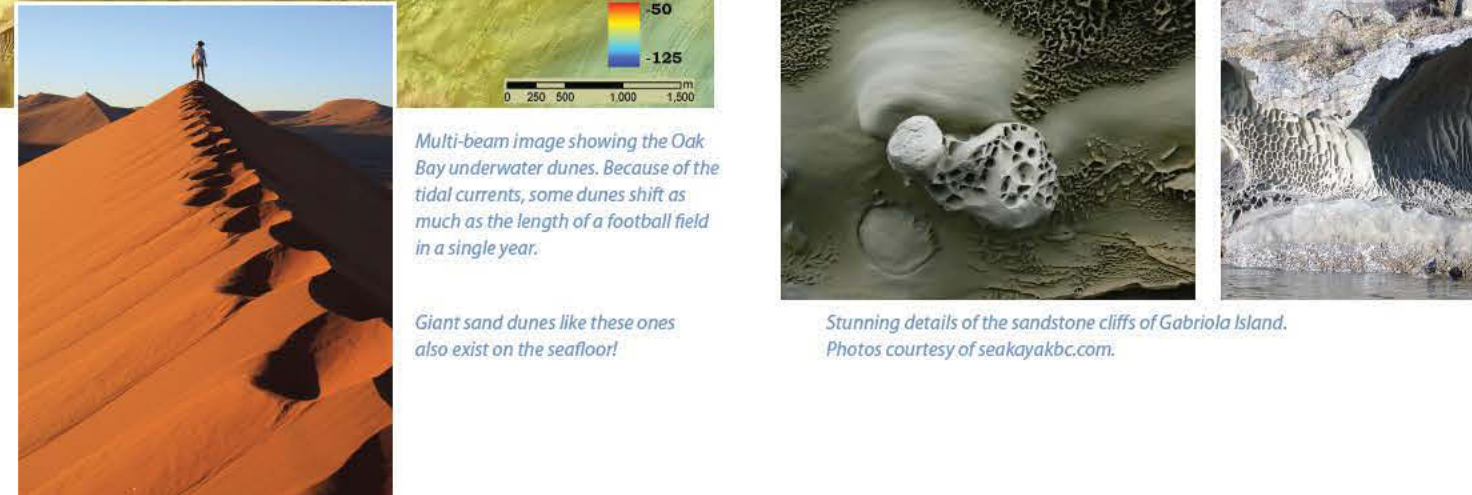


6 OAK BAY SAND DUNES

Just off the beach at Oak Bay, strong tidal currents have created giant underwater sand dunes. They've been measured at tall as 26 metres high, 300 metres wide, and 1,200 metres long and are some of the biggest in the world.



Multi-beam image showing the Oak Bay underwater dunes. Because of the tidal currents, some dunes are off as much as the length of a football field in a single year.



7 SALTSRING ISLAND

During the last Ice Age, ice and water eroded the softer sandstone and shale on the Gulf Islands, creating the valleys and bays. The harder, erosion resistant sandstone remained, creating dramatic headlands and ridges.



9 ISLAND VIEW BEACH

The cliff at the southern end of Island View Beach is a wonderful record of the glacial history of the area. The topmost layer in the cliff, about 40 metres high, shows the sea level during the last glacial period, about 13,000 years ago. The layers at the base of the cliff may be as old as 80,000 years old; rare evidence of one of the oldest glacial events on Vancouver Island.



11 SAANICH INLET

For thousands of years, an underwater ridge at the entrance to Saanich Inlet has allowed sediments in the inlet to accumulate undisturbed. These sediments tell scientists many stories, including the History of earthquakes in the area. When earthquakes occur, landslides deposit discrete layers of sediment on the seafloor. Scientists can date the layers to specific periods of time. These sediments show that a very large earthquake occurs in this area about once every 500 years, with many smaller earthquakes in between.



12 MOUNT FINLAYSON

Survey Mountain Fault – Best seen from the Visitor's Centre at Goldstream Park, the exposed cliff of Mount Finlayson is the site of a massive collision between two ancient pieces of the Earth's crust. The upper half of the cliff is older rock that was pushed up over the younger rock, seen at the bottom of the cliff. The crumpled looking area in the middle marks the collision zone. The Survey Mountain Fault is one of many ancient, inactive faults under and around Victoria.



10 JAMES ISLAND

Best viewed from Island View Beach, only half of James Island is still above water. The southern end of James Island is now just a shallow part of the sea floor. Wind and waves are slowly eroding the glacial sands and gravels, re-depositing them on both sides of the island and in deeper water.



13 PARKSVILLE

When ice from the last Ice Age melted 13,000 years ago, shorelines were between 60 and 120 metres higher. Today, gardeners in places like Parksville often find shells in their gardens – evidence the area was once part of the seafloor.



14 MOUNT WASHINGTON

Between 45 and 52 million years ago, two pieces of the Earth's crust crashed into the piece of crust Vancouver Island was sitting on. This massive crash thrust ancient rock skyward and created Vancouver Island's mountain ranges, including Mount Washington. However, the mountains we see today are a little lower than they once were. Scientists estimate up to ten kilometres of rock has been eroded since the mountains were formed.



15 RIPPLE ROCK

The twin peaks of this underwater mountain caused many maritime disasters until the top of the mountain was blown off in 1958. At low tide, the mountain was less than three metres below the surface. The explosion displaced 65,000 tons of rock and left the twin peaks a somewhat safer 14 metres below the surface of Seymour Narrows.



17 SPOOKUMCHUK NARROWS

Every day 200 billion gallons of seawater rush between Jervis Inlet and Sechart Inlet, creating some of the fastest moving tidal rapids in North America. The water rushes over a bedrock lip, and the difference in sea level on each side of the lip can exceed two metres, creating spectacular whirlpools and whitewater.



BRITISH COLUMBIA

WASHINGTON

Sunshine Coast

Central Vancouver Island

16 POWELL LAKE

The lake is actually a 300 metre deep land locked inlet, cut off by a rocky isthmus. While the top layer is fresh water, samples taken 121 metres below the surface produced salt water. Water at the bottom of the lake is thought to be 10,000 years old.



15 RATTLE ROCK

Rattle Rock photos courtesy of the Campbell River Museum.



14 GALIANO MOUNTAIN

All Rattle Rock Beach in Parksville, the wind is moved offshore during winter storms, and redeposited during the summer when the waves are smaller and wind is calmer.



