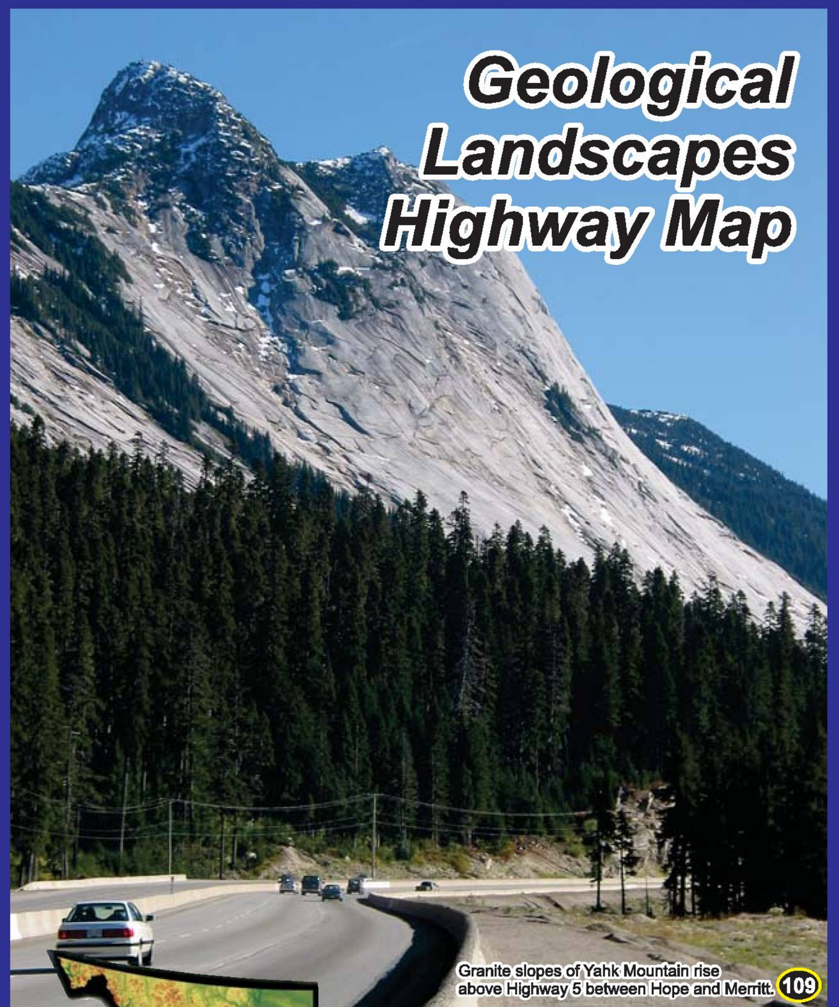
Southern British Columbia

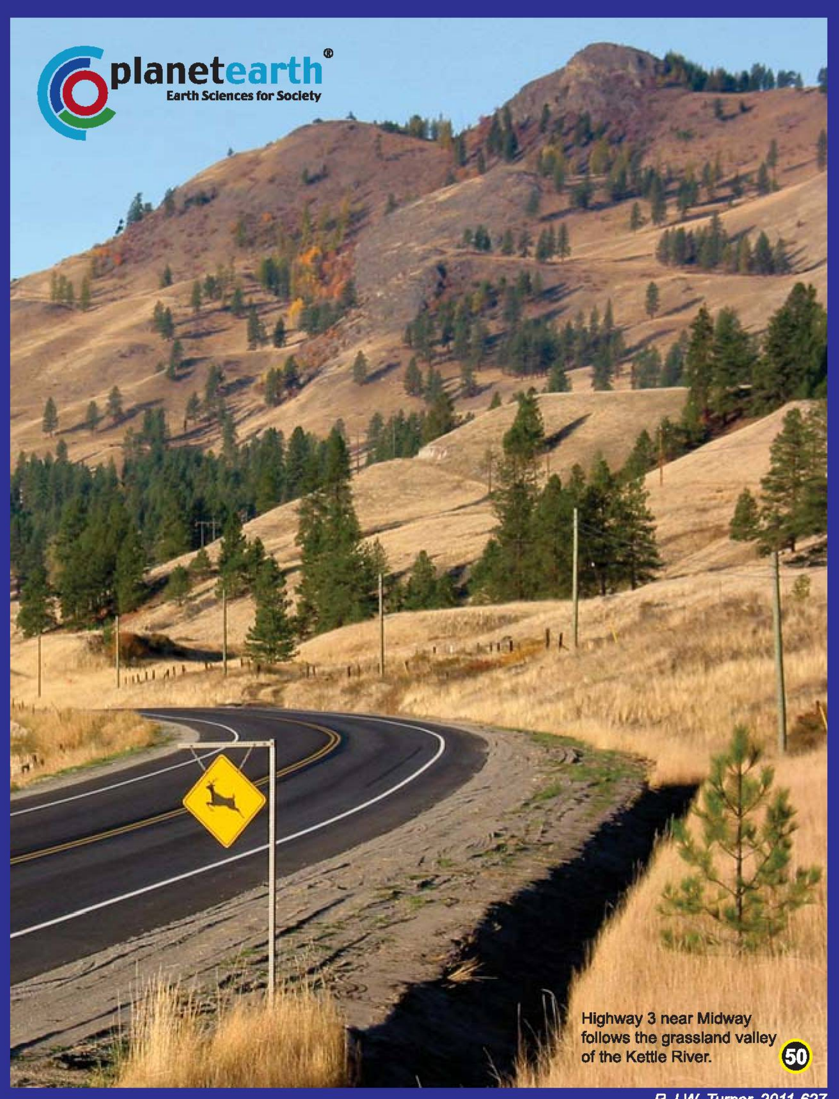
Geological Landscapes Highway Map



Granite slopes of Yahk Mountain rise above Highway 5 between Hope and Merritt. 109

R.J.W. Turner, 2011-539

Catalogue no. M41-9/98E-PDF
ISBN 978-1-100-20945-6



Highway 3 near Midway follows the grassland valley of the Kettle River. 50

R.J.W. Turner, 2011-627

Geological Survey of Canada Popular Geoscience 98E
(*also* British Columbia Geological Survey Geofile 2012-9)

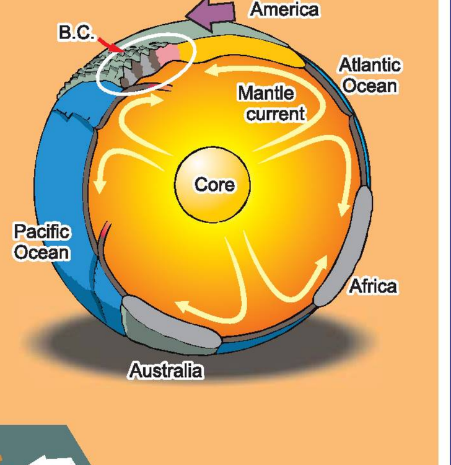
For more information
www.nrcan.gc.ca
www.mapplace.ca

Natural Resources Canada / Ressources naturelles Canada

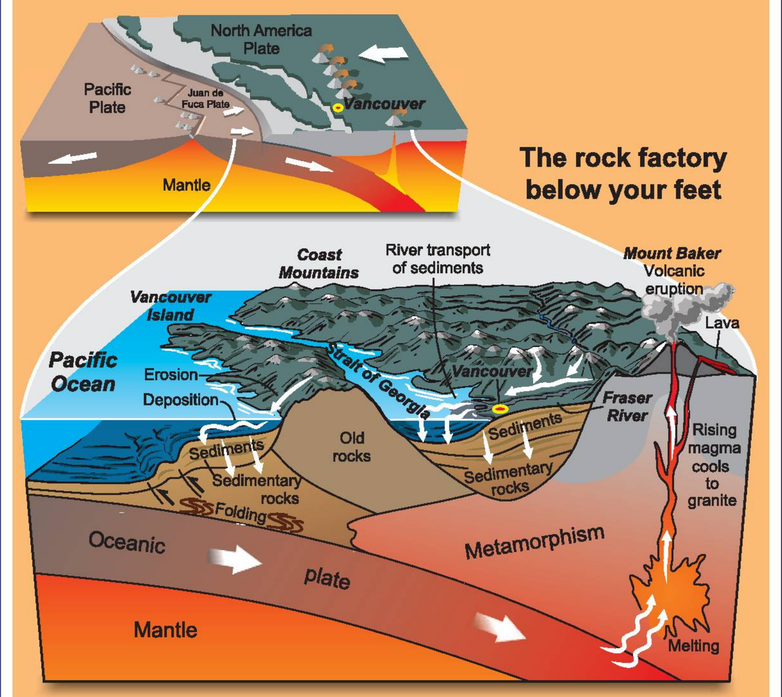
Recommended citation:
Turner, R.J.W., Anderson, R.J., Franklin, R., Ceh, M., Hastings, N., and Wagner, C.L., 2012. Southern British Columbia: geological landscapes highway map; Geological Survey of Canada, Popular Geoscience 98E (*also* British Columbia Geological Survey Geofile 2012-9). doi:10.4095/291880

Our Active Earth

British Columbia is at the leading edge of the westward-moving North American tectonic plate. Driven by flow in the Earth's mantle, British Columbia overrides an oceanic plate in a slow-moving collision. Earthquakes occur as the two plates deform and shift along faults. Collision triggers melting, and volcanoes erupt where molten rock rises to the surface. Rising molten rock heats the plate, causing expansion and mountains to rise.

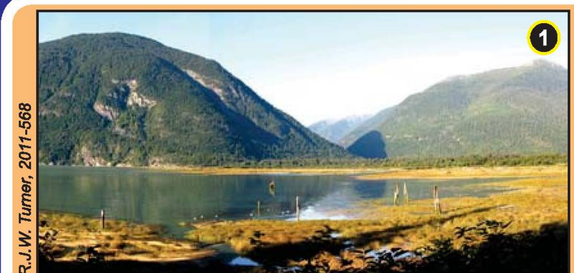


The rock factory below your feet



Rocks are forming today below British Columbia! Sediment eroded from mountains is carried by rivers to the sea where it accumulates and converts to rock as it is buried. Pressure and heat deform and transform deeply buried rocks. Rock melts, then crystallizes to form granite. When melted rock rises to the surface, volcanoes erupt. Over geological time, ongoing uplift and erosion of mountains raises deeply buried rocks to the surface.

Bella Coola valley



The Bella Coola River dumps its load of sand and mud to form an ecologically-rich estuary where it meets the sea. River-mouth deposition has filled 80 km of inlet since the end of the Ice Age, converting inlet to rich valley.

R.J.W. Turner, 2011-568

Highway 20 follows the steep-walled Bella Coola valley to the ocean. During the Ice Age, glaciers deeply scoured all of B.C.'s coastal river valleys. As glaciers melted, the ocean flooded these valleys, creating long finger-like inlets.

R.J.W. Turner, 2011-600

The grey, silt-laden Bella Coola River is fed by melt waters from glaciers in the Coast Mountains.

R.J.W. Turner, 2011-625

The clear waters of the Atnarko River reflect a lack of glaciers in its headwaters. Fisheries Pool is a popular bear-watching site in the fall when the salmon are running.

Grizzly bear at Fisheries Pool.

R.J.W. Turner, 2011-522

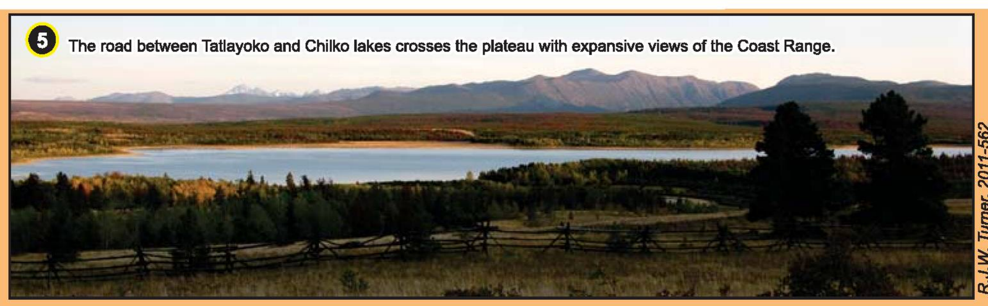
R.J.W. Turner, 2011-554

West of Heckman Pass, Highway 20 descends from high plateau to the deep Bella Coola valley.

Chilcotin–Bella Coola

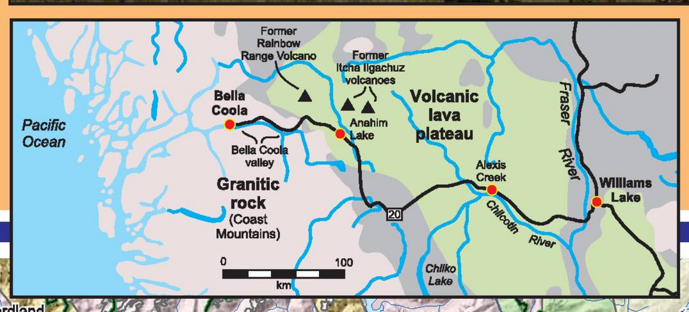
Highway 20 from Williams Lake to Bella Coola

Highway 20 crosses the Chilcotin plateau and Coast Mountains to connect the interior with the coast. Roads lead south across the plateau to beautiful glacier-carved finger lakes along the mountain front.



The road between Tatlayoko and Chilko lakes crosses the plateau with expansive views of the Coast Range.

R.J.W. Turner, 2011-562



Mountain front lakes

South of Tatla Lake, three magnificent finger-like lakes — Chilko, Tatlayoko, and Taseko — fill deep glacier-carved valleys along the mountain front.

Waters of Tatlayoko Lake flow west across the Coast Range to the Pacific Ocean. This odd fact may reflect that this river system existed prior to the rise of the Coast Mountains, and maintained its course as the mountains rose.

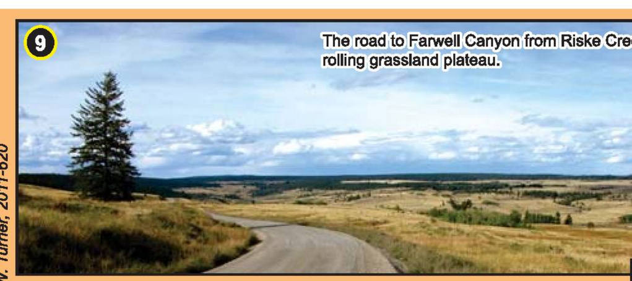
R.J.W. Turner, 2011-620

The day hike up Tullin Mountain in Ts'yl-os Provincial Park provides a dramatic view of Chilko Lake and Coast Mountains.

R.J.W. Turner, 2011-573

At Bull Canyon Park, the Chilcotin River has carved a canyon with lava cliffs that contain column-like fractures and caves.

R.J.W. Turner, 2011-593



The road to Farwell Canyon from Riske Creek crosses rolling grassland plateau.

R.J.W. Turner, 2011-610

Plateau country

Highway 20 crosses the Chilcotin plateau, an ancient lowland raised by Earth forces and smoothed by outpourings of lava 5 to 20 million years ago.

At Farwell Canyon, the glacier-fed Chilcotin River has cut a deep canyon with terraces and hoodoos in thick deposits of Ice Age silt, gravel, and glacier debris.

R.J.W. Turner, 2011-526

Fraser–Thompson

Highways 1 and 99

This diverse region ranges from rainforest to dry grassland to alpine. Rivers and glaciers carved the mountains from sandstone, shale, marble, granite, and even jade. Highway 1 follows the deep canyons of the clear-flowing Thompson and muddy Fraser rivers, while Highway 99 rises to the subalpine as it crosses a pass west of Lillooet.

Mount Meager volcano is Canada's most dangerous mountain. In August 2010, its flank collapsed forming Canada's second largest landslide. Landslides are frequent on its weak volcanic slopes, and giant mudflows descended the Pemberton valley in ancient times. Mount Meager also erupted 2400 years ago in a large eruption of ash and hot avalanches.

R.J.W. Turner, 2011-589

R.J.W. Turner, 2011-553

The heavy sediment load carried by the Lillooet River is filling Lillooet Lake. Active erosion of Mount Meager volcano feeds the river with sand and mud.

Highway 99 follows the deep and steep-walled river-cut canyon of Cayoosh Creek near Lillooet.

R.J.W. Turner, 2011-619

Large blocks of jade are on display in Lillooet. Jade is eroded from nearby mountains that contain ultramafic rocks from the Earth's mantle.

R.J.W. Turner, 2011-560

Marble Canyon
Highway 99 cuts through the Marble Range at Marble Canyon. These limestone rocks formed 200 million years ago in oceans near Asia, but today lie within British Columbia.

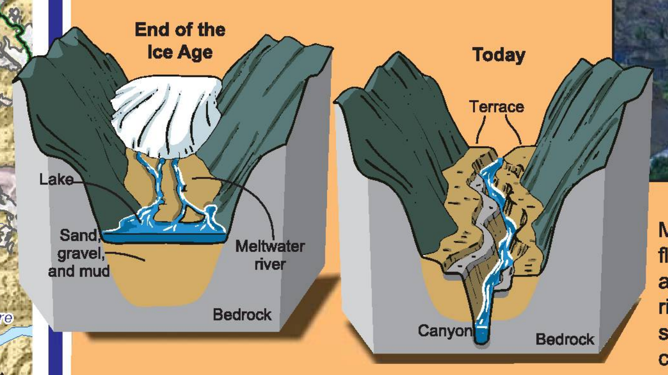
R.J.W. Turner, 2011-608

Spring-fed lakes in Marble Canyon have striking white shallows and green waters. Lime-rich groundwaters deposit white lime mud on the lake floor, creating the colours.

R.J.W. Turner, 2011-591

The Bridge River near Lillooet flows within a canyon flanked by a terrace.

R.J.W. Turner, 2011-533



River terraces

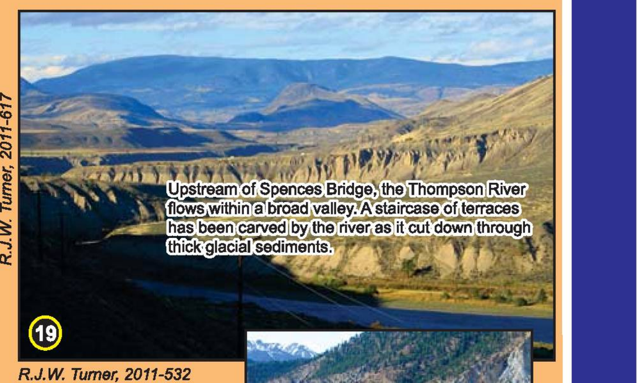
Many rivers flow within narrow canyons flanked by flat-topped terraces. Terraces are remnants of the Ice Age when glacial rivers filled valleys with thick deposits of sediment. Today's rivers have carved canyons in this thick sediment.

The glacial-blue Bridge River flows into the muddy Fraser River near Lillooet. Rapids on the Fraser River impede migrating salmon and create an important fishing site for First Nations.

R.J.W. Turner, 2011-617

At Hells Gate, the Fraser River is deeper than wide, as it cuts a slot through walls of hard granite. A landslide into the river in 1913 blocked salmon migration and dramatically reduced Fraser River salmon stocks for 50 years.

R.J.W. Turner, 2011-521



Upstream of Spences Bridge, the Thompson River flows within a broad valley. A staircase of terraces has been carved by the river as it cut down through thick glacial sediments.

R.J.W. Turner, 2011-532

Downstream of Spences Bridge, the Thompson River flows through a rock canyon, such as here at Skihist Park. The river flows from Kamloops Lake, which acts as a giant settling pond, so the river water is clear.

R.J.W. Turner, 2011-595

Legend

Population

- 50 000 or more
- 10 000–50 000
- 5000–10 000
- 1000–5000
- 500–1000
- 0–500

- Major roads, paved
- Major roads, unpaved
- Minor roads, paved
- Minor roads, unpaved
- Ferry route
- Provincial parks and park boundaries
- Location of photograph

Mines (producer, past producer)

1=Britannia (copper), 2=Imperial (limestone), 3=Copper Queen (copper), 4=Gillies Bay (limestone), 5=Blubber Bay (limestone), 6=Mount Washington (copper), 7=Quinsam (coal), 8=Myra Falls (copper), 9=Zeballos (gold), 10=Monteith Bay (pyrophyllite), 11=Benson Lake (limestone), 12=Island Copper (copper), 13=Apple Bay (silica), 14=Mount Meager (pumice), 15=Pioneer (gold), 16=Bralorne (gold), 17=Congress (gold), 18=Blackdome (gold), 19=Nazko (aggregate), 20=Gibraltar (copper), 21=QR (gold), 22=Mount Polley (copper), 23=Keithley Creek (gold), 24=Red Lake (fullers earth), 25 =Ranchlands (zeolite), 26 =Pavilion Limestone (limestone), 27=Walhachin Quarry (railroad ballast), 28=Ashcroft (aggregate), 29=Highland Valley Copper (copper), 30=Lornex (copper), 31=Highmont (copper), 32=Bethlehem (copper), 33=Afton (copper), 34=Iron Mask (copper), 35=Ajax (copper), 36=Craigmont (copper), 37=Basin Coal (coal), 38a=Ingerbelle (copper), 38b =Copper Mountain (copper), 69=Pride of Emory (nickel), 70=Boss Mountain (molybdenum), 71=Bullion Pit (gold)

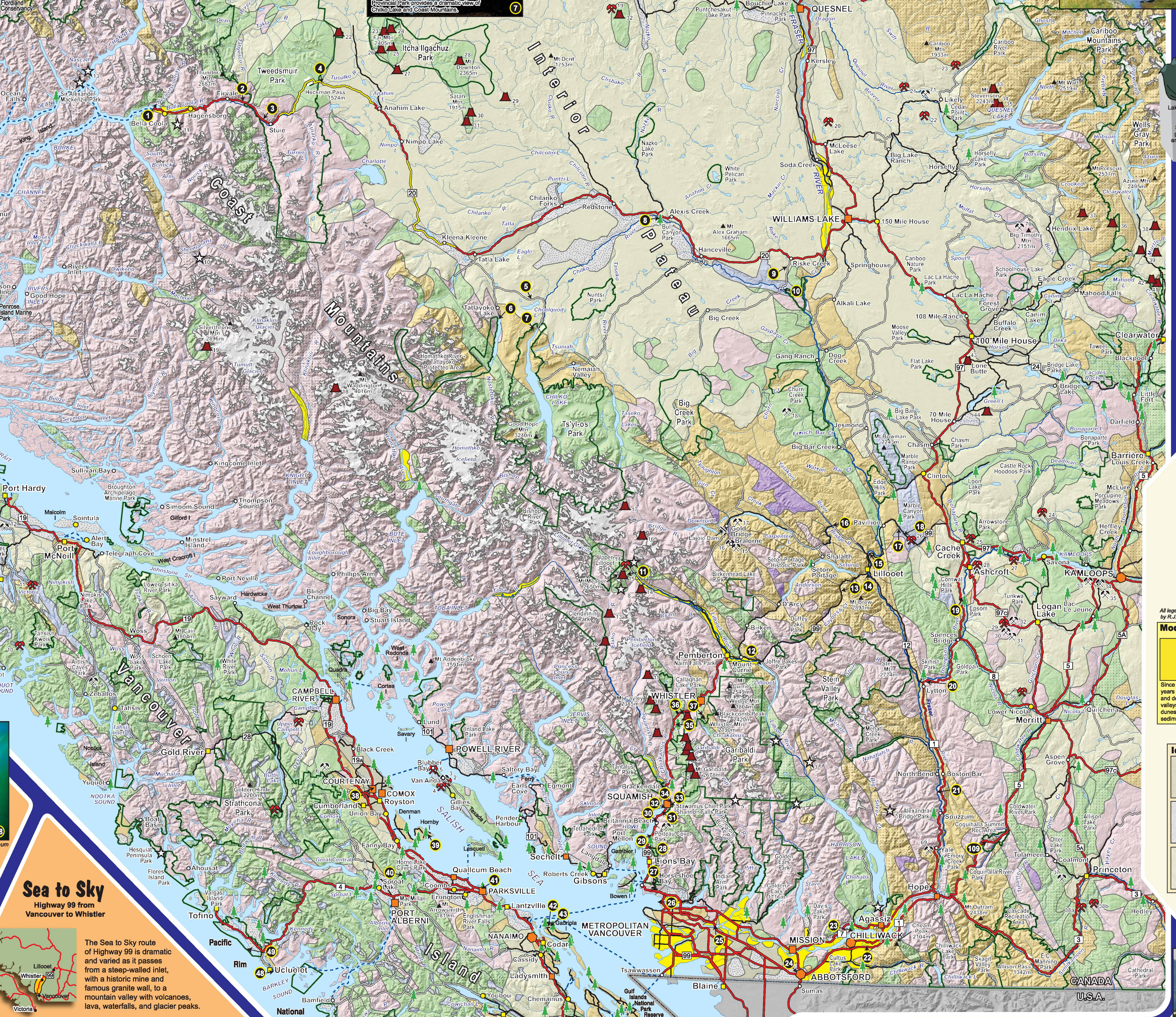
Hot springs

1=Harrison, 2=Clear Creek, 3=August Jacob's, 4=Sloquet, 5=Pitt River, 6=Skookumchuck, 7=Pebble Creek, 8=Meager Creek, 9=Hot Springs Cove, 10=Sheemahant, 11=Thorsen Creek, 12=Eucott Bay, 13=Nascall

Volcanoes

1=Mount Garibaldi, 2=Opal Cone, 3=Clinker Peak, 4=The Table, 5=Mount Price, 6=Black Tusk, 7=Tricouni SW, 8=Logger's Lake, 9=Mount Fee, 10=Mount Cayley, 11=Ring Mountain, 12=Elaho Valley 1, 13=Elaho Valley 4, 14=Elaho Side Valley, 15=Mount Meager, 16=Salal Glacier, 17=Sham Hill, 18=Franklin Glacier, 19=Silverthrone Caldera, 20=Helmet Peak, 21=Kitasu Hill, 22=Anahim Hill, 23=Cindercone, 24=Nana Peak, 25=Mount Scot, 26=Hump Mountain, 27=Baldy Mountain, 28=Mount Downton, 29=Chilcotin Creek Cone, 30=Satah - North, 31=Satah Mountain – East, 32=Nazko Cone, 33=Ishkloo Cone, 34=Grain Creek Cone, 35=Abbott Creek Cone, 36=Spanish Mump, 37=Boss Mountain, 38=Jack's Jump, 39=McLeod Hill, 40=Mosquito Mound, 41=Flatiron, 42=White Horse Bluff, 43=Lone Butte, 44=Tin Cup Mountain

25 0 25 50 kilometres



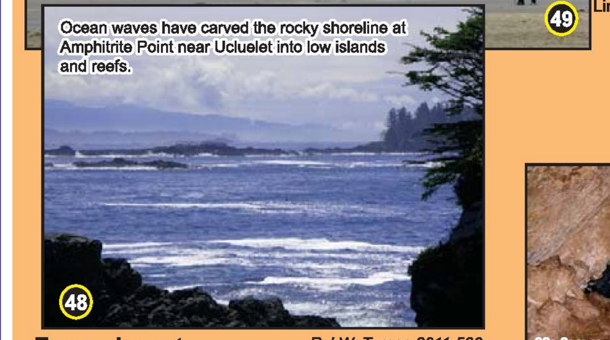
Vancouver Island

Highways of southern Vancouver Island

Diverse shorelines are the outstanding geological feature of southern Vancouver Island and adjacent Gulf Islands, but there are also clear-water rivers, caves, and even marine reptile displays.

R.J.W. Turner, 2011-621

Hard-packed sand at Long Beach in Pacific Rim National Park Reserve is eroded from nearby coastal bluffs of Ice Age sand and gravel.



Ocean waves have carved the rocky shoreline at Amphitrite Point near Ucluelet into low islands and reefs.

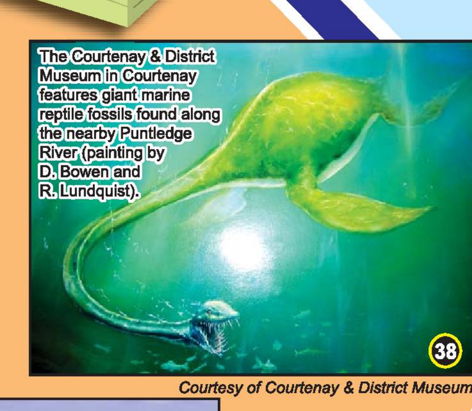
R.J.W. Turner, 2011-536

Caves

Vancouver Island has the highest density of caves in Canada. All of the caves occur in limestone that is widespread on the island.

Underground tours are available at Horne Lake Caves Park east of Parksville.

S.E.B. Irwin, 2011-549

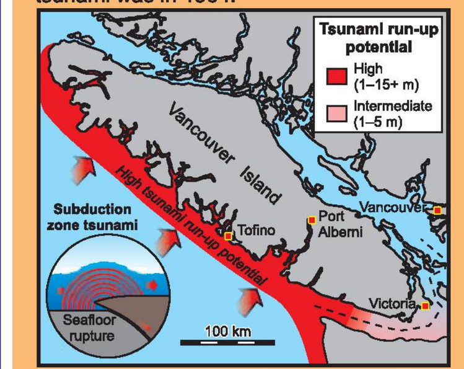


The Courtenay & District Museum in Courtenay features giant marine reptile fossils found along the nearby Puntledge River (painting by D. Bowen and R. Lundquist).

Courtesy of Courtenay & District Museum

Tsunami coast

The outer coast of Vancouver Island is vulnerable to tsunamis generated by seafloor earthquakes in the north Pacific Ocean. The last damaging tsunami was in 1964.



A rock formed of ancient gravel forms coastal bluffs at Helliwell Park on Hornby Island.

R.J.W. Turner, 2011-555

Honeycomb weathering of shoreline sandstone, such as here on Gabriola Island, reflects the combined action of water, salt, and sun that mobilize and redistribute soluble mineral cement.

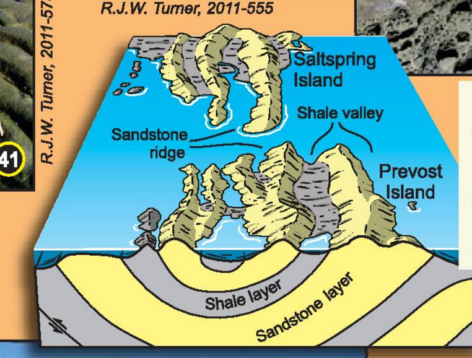
R.J.W. Turner, 2011-614

The flat rock platform at Botanical Beach near Port Renfrew has been carved by ocean waves. Tidal pools contain rich intertidal life.

R.J.W. Turner, 2011-571

Sand carried to the sea by the Englishman River forms extensive beaches at Parksville.

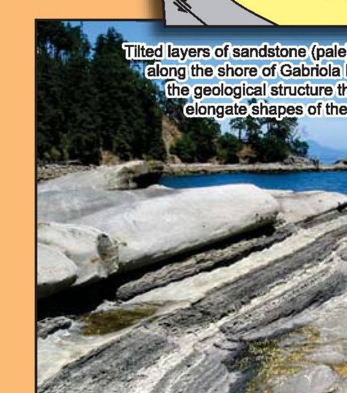
R.J.W. Turner, 2011-578



Gulf Islands

Differential erosion of tilted beds of resistant sandstone and less-resistant shale create the elongate islands, ridges, valleys, and bays characteristic of the Gulf Islands.

Tilted layers of sandstone (pale) and shale (dark) along the shore of Gabriola Island illustrate the geological structure that creates the elongate shapes of the Gulf Islands.



R.J.W. Turner, 2011-596

Salmon spawn in groundwater-fed gravel in the Goldstream River near Victoria.

Giant potholes at Sooke Potholes, popular for swimming, were carved by stones in a giant whirlpool.

R.J.W. Turner, 2011-561

Grooves and polish on shoreline rocks at Beacon Hill Park in Victoria reflect the action of Ice Age glaciers 15 000 years ago.

R.J.W. Turner, 2011-520

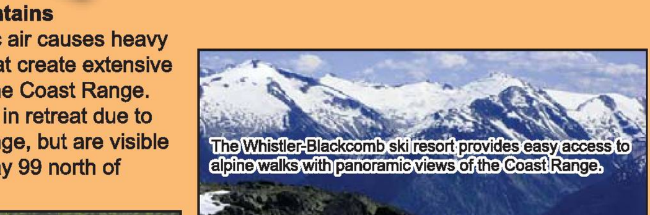
Sea to Sky

Highway 99 from Vancouver to Whistler

The Sea to Sky route of Highway 99 is dramatic and varied as it passes from a steep-walled inlet, with a historic mine and famous granite wall, to a mountain valley with volcanoes, lava, waterfalls, and glacier peaks.

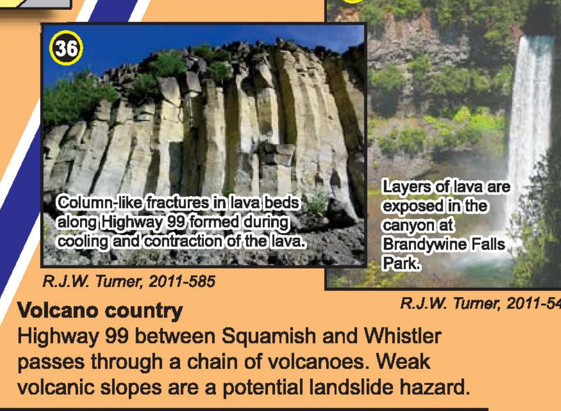
Coast Mountains

Moist Pacific air causes heavy snowfalls that create extensive glaciers in the Coast Range. Glaciers are in retreat due to climate change, but are visible from Highway 99 north of Squamish.



The Whistler-Blackcomb ski resort provides easy access to alpine walks with panoramic views of the Coast Range.

R.J.W. Turner, 2011-602



Column-like fractures in lava beds along Highway 99 formed during cooling and contraction of the lava.

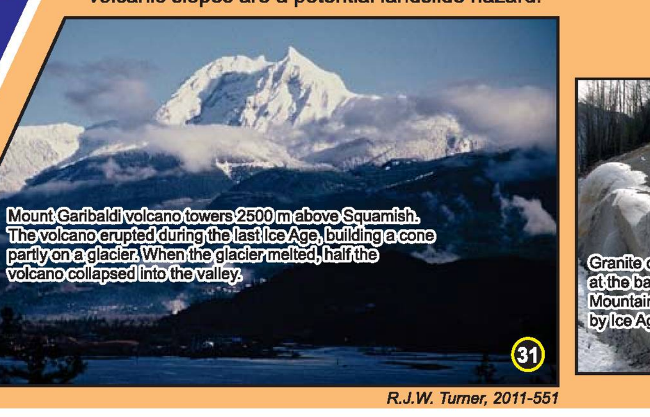
R.J.W. Turner, 2011-585

Layers of lava are exposed in the canyon at Brandywine Falls Park.

R.J.W. Turner, 2011-541

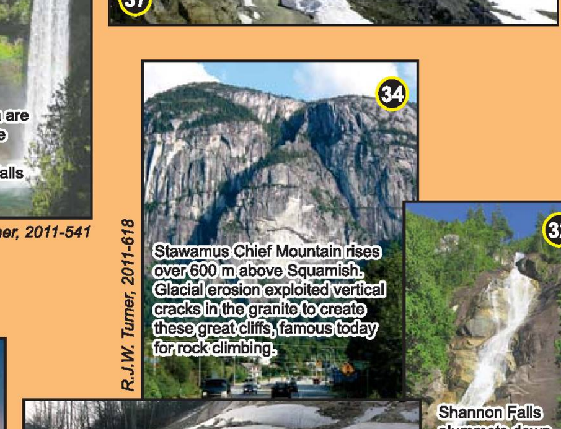
Volcano country

Highway 99 between Squamish and Whistler passes through a chain of volcanoes. Weak volcanic slopes are a potential landslide hazard.



Mount Garibaldi volcano towers 2500 m above Squamish. The volcano erupted during the last Ice Age, building a cone partly on a glacier. When the glacier melted, half the volcano collapsed into the valley.

R.J.W. Turner, 2011-551



Stawamus Chief Mountain rises over 600 m above Squamish. Glacial erosion exploited vertical cracks in the granite to create these great cliffs, famous today for rock climbing.

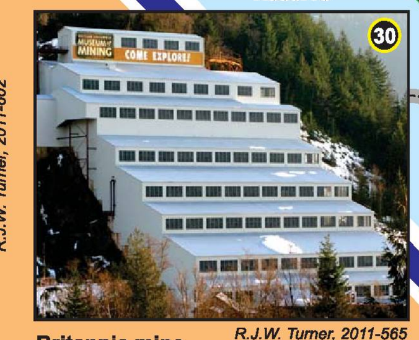
R.J.W. Turner, 2011-618

Shannon Falls plummets down the granite cliffs of Howe Sound.

R.J.W. Turner, 2011-581

Granite outcrops along Highway 99, at the base of Stawamus Chief Mountain, are sculpted and polished by Ice Age glaciers.

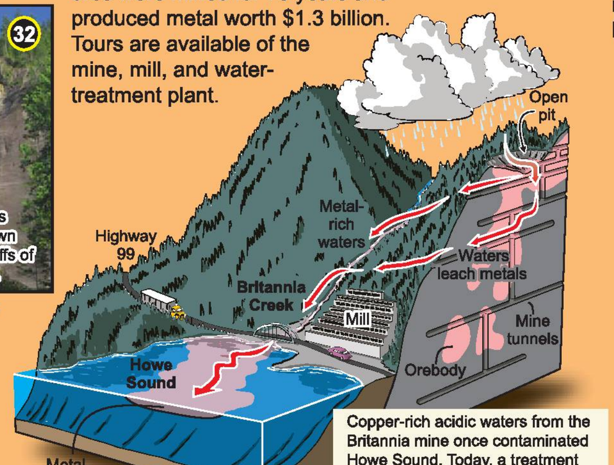
R.J.W. Turner, 2011-534



Britannia mine

The former Britannia mine is now the BC Museum of Mining. The copper ores were mined for 70 years and produced metal worth $1.3 billion. Tours are available of the mine, mill, and water-treatment plant.

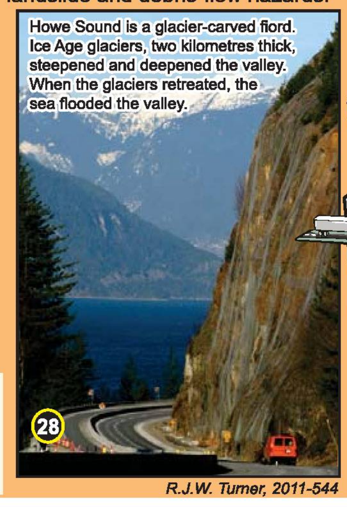
R.J.W. Turner, 2011-565



Copper-rich acidic waters from the Britannia mine once contaminated Howe Sound. Today, a treatment plant removes metals from mine waters and environmental recovery is underway.

Mountain hazards

Between Vancouver and Squamish, the highway hugs the steep walls of a coastal inlet. Engineered works protect against landslide and debris-flow hazards.

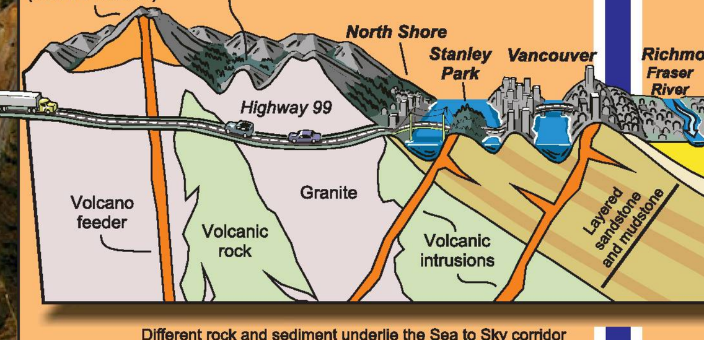


Howe Sound is a glacier-carved fiord. Ice Age glaciers, two kilometres thick, steepened and deepened the valley. When the glaciers retreated, the sea flooded the valley.

R.J.W. Turner, 2011-544

Seaward-sloping cracks in granite near Porteau Cove are stabilized by long steel bolts. A landslide here in 2007 blocked the highway for 3 days.

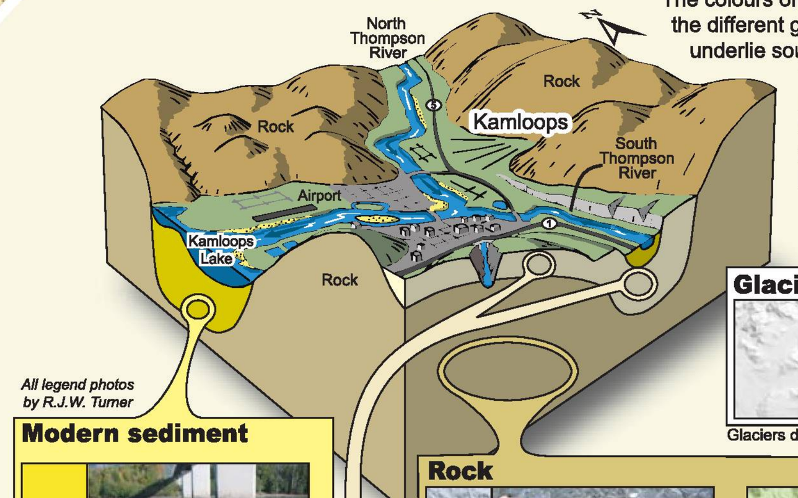
R.J.W. Turner, 2011-812



Different rock and sediment underlie the Sea to Sky corridor and Fraser valley.

How do I use this map?

The colours on the main map represent the different geological materials that underlie southern British Columbia. This diagram of the Kamloops area illustrates the three major materials that typically underlie the landscape.



All legend photos by R.J.W. Turner

Modern sediment

Mud, sand, and gravel (2007-116)

Since the end of the Ice Age 10 000 years ago, rivers have eroded valleys and deposited **modern sediments** in valleys and estuaries. Peat bogs, sand dunes, and beaches are other modern sediments.

Ice Age sediment

- Silt (glacial lake bottom) (2007-105)
- Sand and gravel (glacial river channels) (2007-137)
- Till (glacial debris) (2007-118)

Ice Age sediments form a widespread blanket overlying rock throughout much of British Columbia. They were deposited during the Ice Age when continental glaciers, similar to those in Antarctica today, covered most of Canada.

Glaciers

Glacier ice (2007-158)

Glaciers displayed in British Columbia only.

Rock

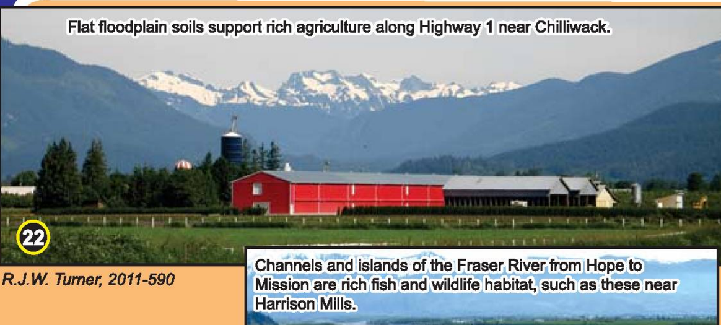
- Limestone and dolostone (2007-098)
- Volcanic rock (2007-143)
- Sandstone and shale (2007-124)
- Metamorphic (altered) volcanic rock (2007-117)
- Metamorphic (altered) sandstone and shale (2007-122)
- Granite (2007-093)
- Gneiss (2011-575)
- Ultramafic rock (ancient ocean plate) (2007-156)

Rock of the Earth's crust underlies all of British Columbia. It is widely exposed at surface in mountainous areas, but is commonly buried beneath thick layers of sediments in valleys and on plateaus.

Vancouver–Fraser Valley

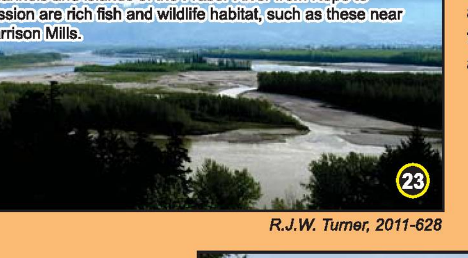
Highway 1 from Vancouver to Hope

Highway 1 follows the Fraser valley from Hope to Vancouver with views of the Fraser River, steep mountain walls, rich farmlands, Mount Baker volcano, and metropolitan Vancouver. Near Vancouver, the Fraser River pours its waters and sediment load into the sea.



Flat floodplain soils support rich agriculture along Highway 1 near Chilliwack.

R.J.W. Turner, 2011-590

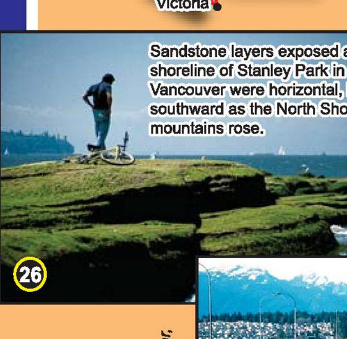


Channels and islands of the Fraser River from Hope to Mission are rich fish and wildlife habitat, such as these near Harrison Mills.

R.J.W. Turner, 2011-628

Upper Fraser valley

Near Hope, the Fraser River flows from its canyon into a broad valley. The river widens, loses energy, and drops its sediment load, creating gravel bars and islands. Flanking the river is a plain of rich silt and sand, deposited by thousands of years of annual floods.

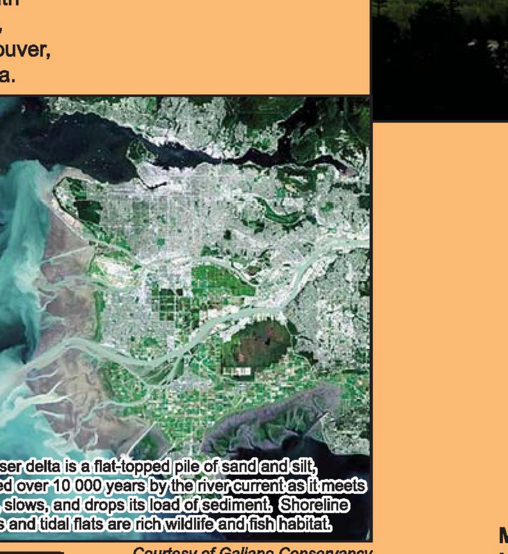


Sandstone layers exposed along the shoreline of Stanley Park in Vancouver were horizontal, but tilted southward as the North Shore mountains rose.

R.J.W. Turner, 2011-552

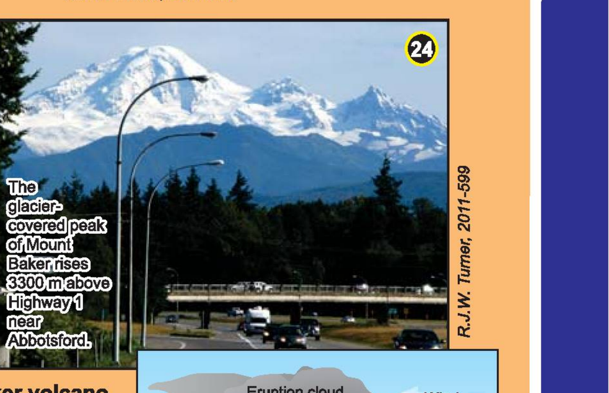
Ski areas in the North Shore mountains provide views across the Fraser Valley and Strait of Georgia to Vancouver Island.

R.J.W. Turner, 2011-535



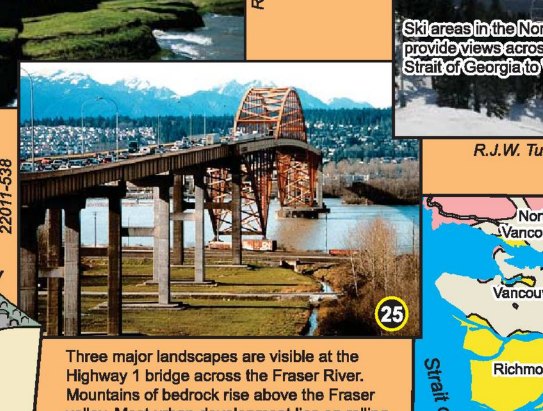
The Fraser delta is a flat-topped pile of sand and silt, deposited over 10 000 years by the river current as it meets the sea, slows, and drops its load of sediment. Shoreline marshes and tidal flats are rich wildlife and fish habitat.

Courtesy of Galiano Conservancy



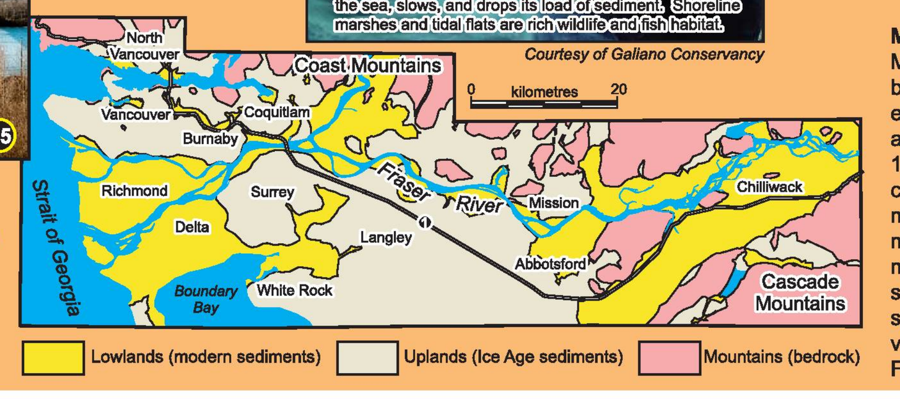
The glacier-covered peak of Mount Baker rises 3300 m above Highway 1 near Abbotsford.

R.J.W. Turner, 2011-599



R.J.W. Turner, 22011-538

Three major landscapes are visible at the Highway 1 bridge across the Fraser River. Mountains of bedrock rise above the Fraser valley. Most urban development lies on rolling uplands of Ice Age sediments. Flat lowlands support agriculture, but are prone to flooding.



Mount Baker volcano

Mount Baker has been built by repeated volcanic eruptions of lava and ash, the last during the 1800s. A future eruption could melt glaciers, mobilizing loose volcanic material into deadly mudflows that descend stream valleys, or spread damaging volcanic ash over the Fraser valley.