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Volcanoes of Canada

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C.J. Hickson and M. Ulmi, Jan. 3, 2006

Presentation Outline

- Global Volcanism and Plate tectonics
  - Where do volcanoes occur?
  - Driving forces
- Volcano chemistry and eruption types
- Volcanic Hazards
  - Pyroclastic flows and surges
  - Lava flows
  - Ash fall (tephra)
  - Lahars/Debris Flows
  - Debris Avalanches
  - Volcanic Gases
- Anatomy of an Eruption – Mt. St. Helens
- Volcanoes of Canada
  - Stikine volcanic belt
  - Anahim volcanic belt
  - Wells Gray – Clearwater volcanic field
  - Garibaldi volcanic belt
- USA volcanoes – Cascade Magmatic Arc

Volcanoes in Our Backyard

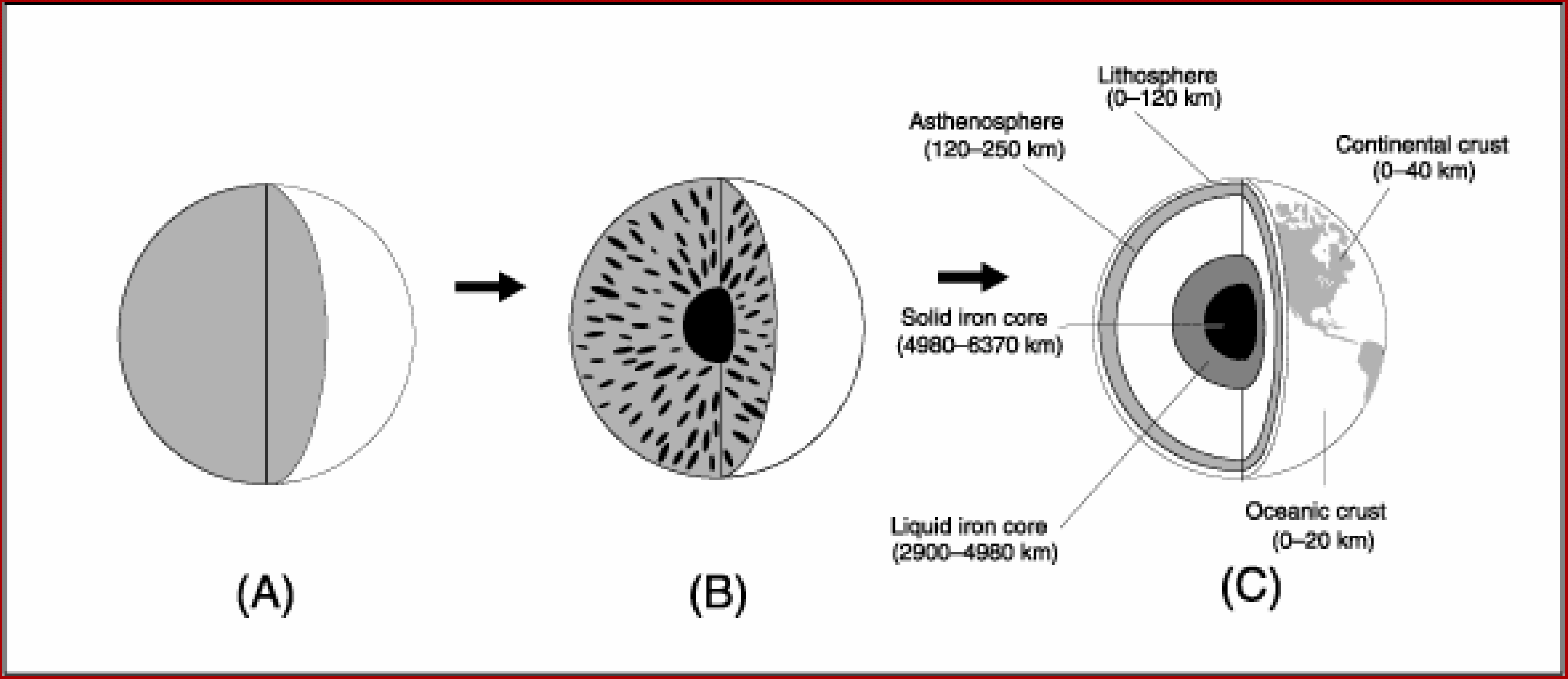
In Canada, British Columbia and Yukon are the host to a vast wealth of volcanic landforms.

How many active volcanoes are there on Earth?

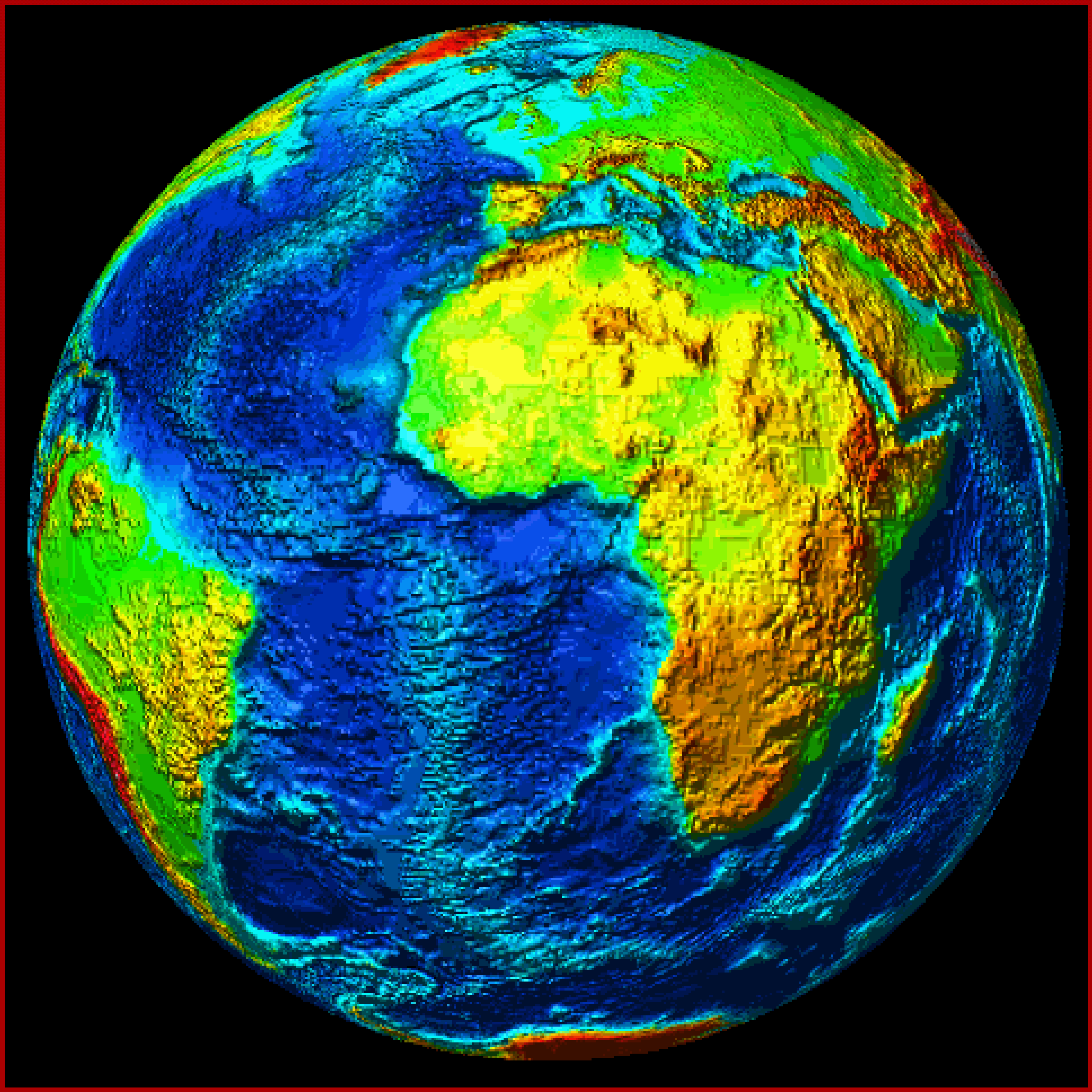
• Erupting now	about 20
• Each year	50-70
• Each decade	about 160
• Historical eruptions	about 550
• Holocene eruptions (last 10,000 years)	about 1500

Although none of Canada's volcanoes are erupting now, they have been active as recently as a couple of hundred years ago.

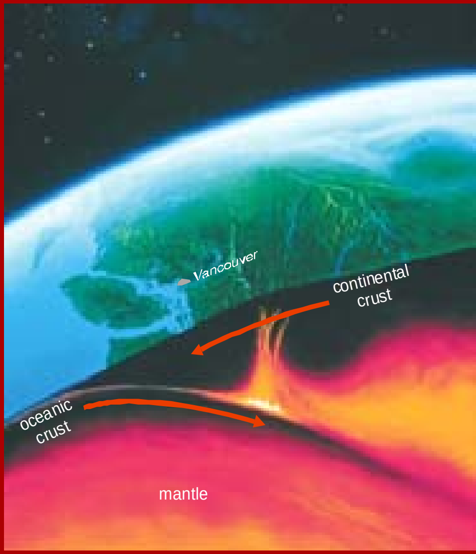
The Earth's Beginning



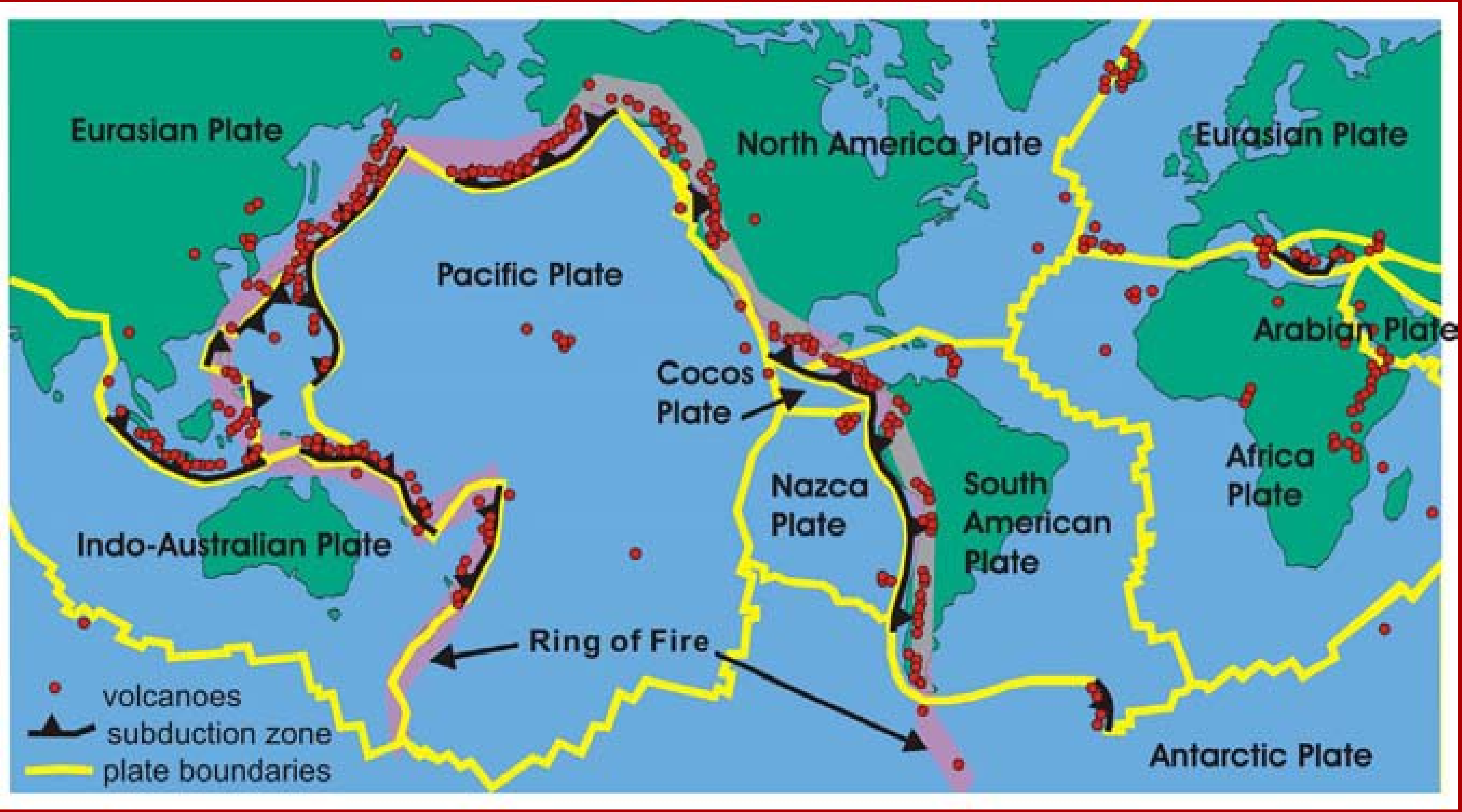
The Earth's Beginning



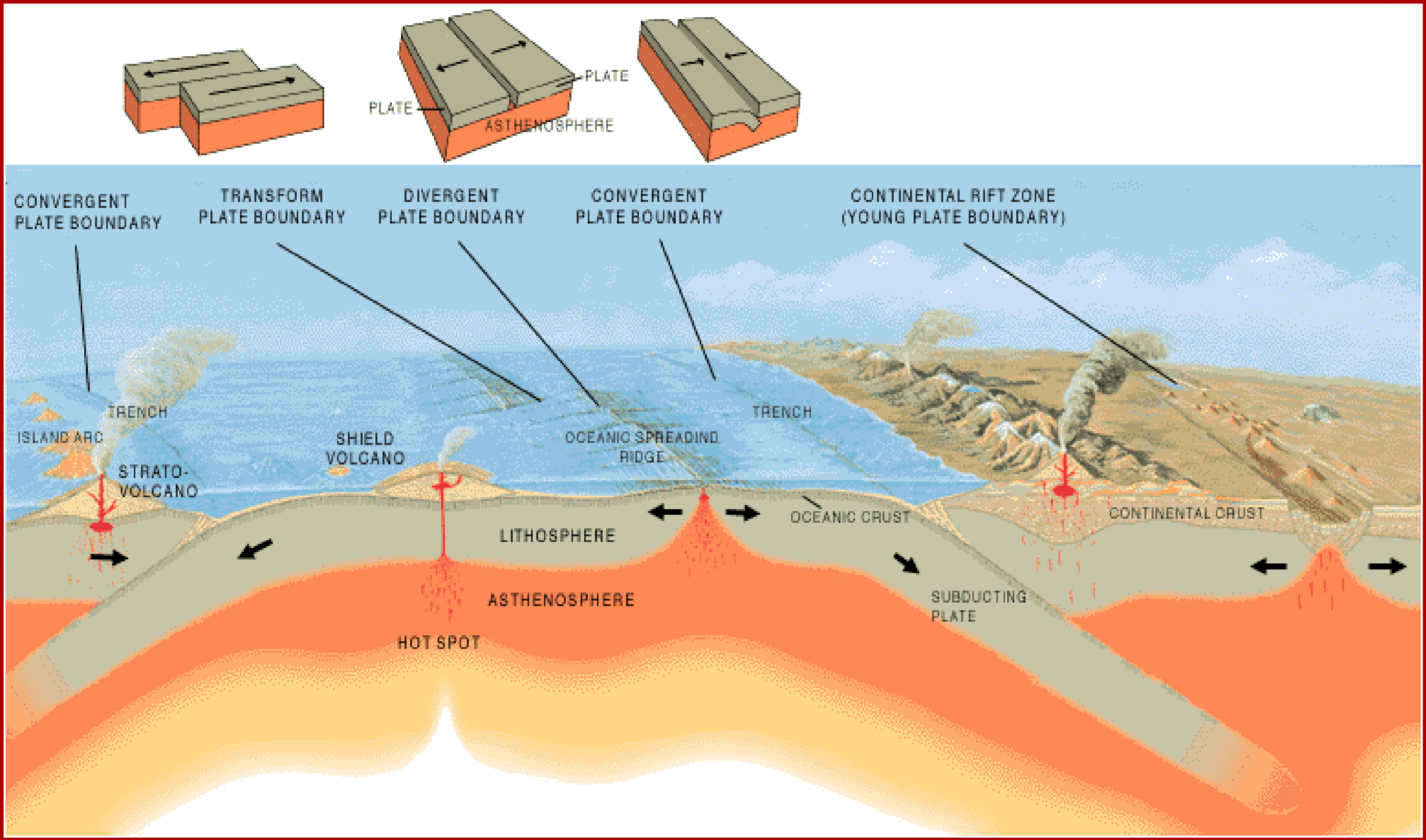
These global forces have created, mountain ranges, continents and oceans.



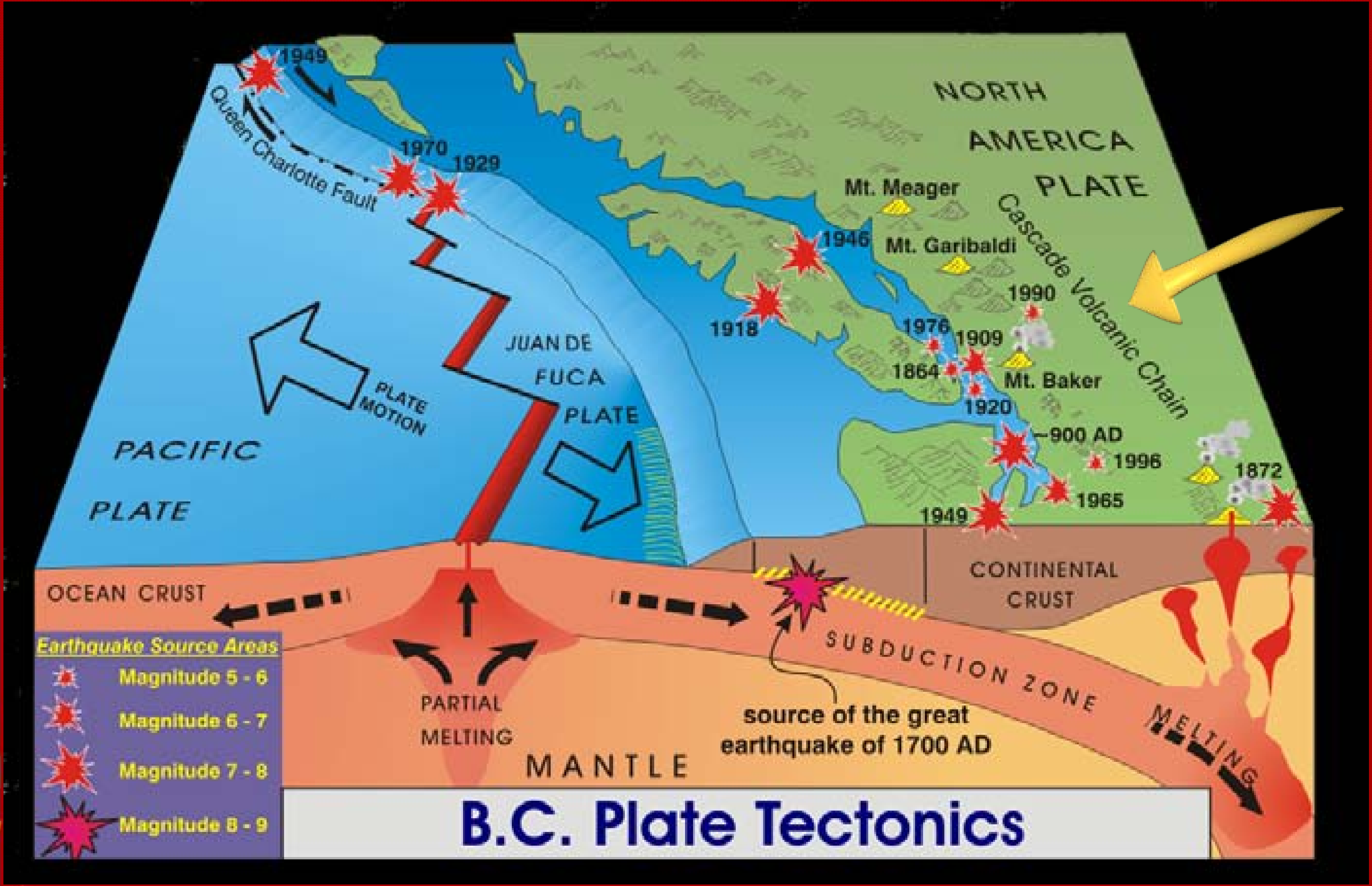
Where do volcanoes occur?



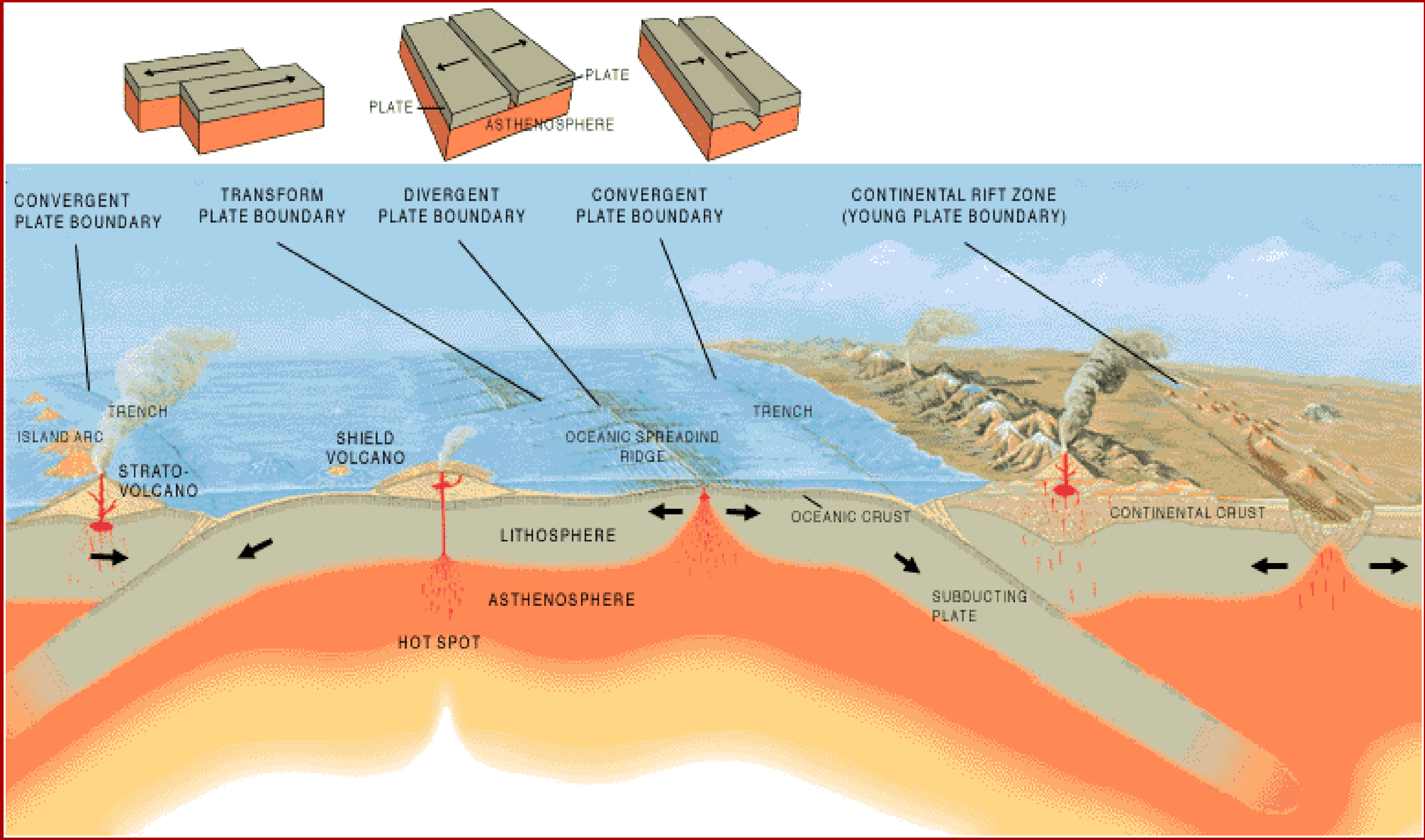
Driving Forces: Moving Plates



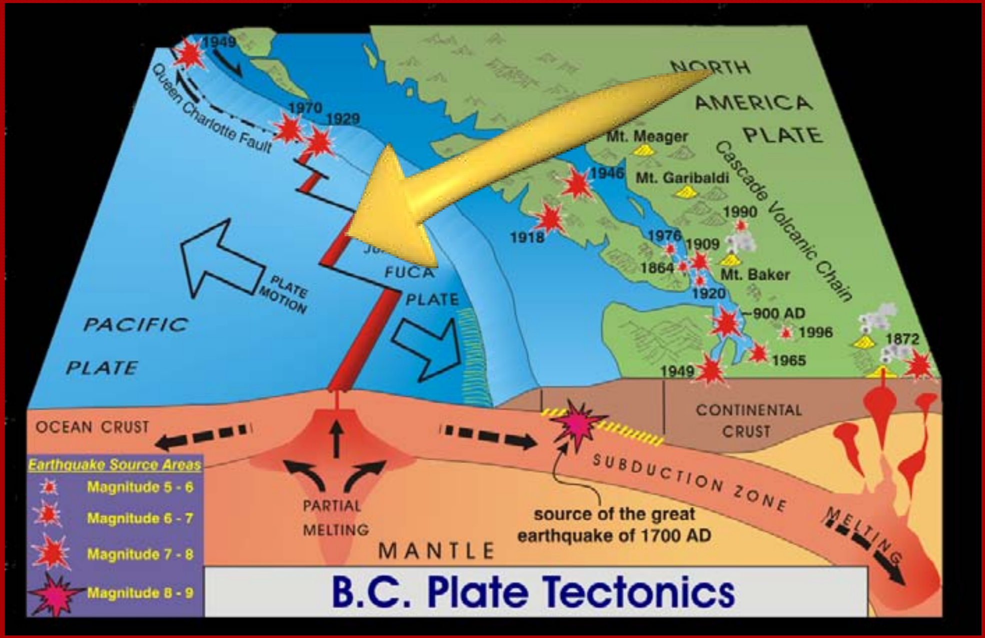
Driving Forces: Subduction



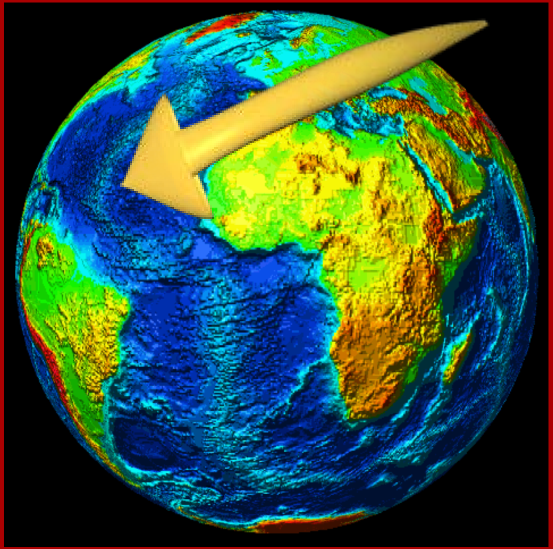
Driving Forces: Hot Spots



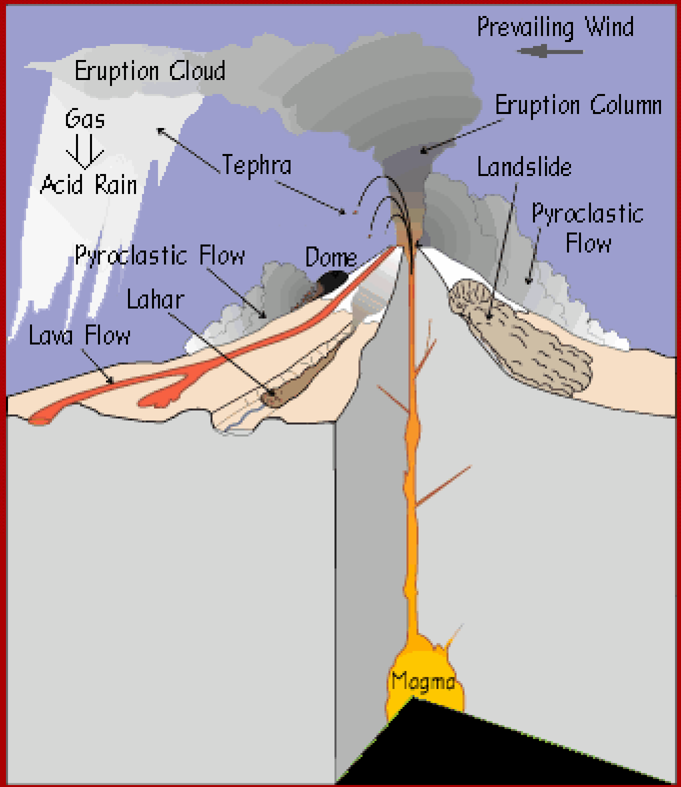
Driving Forces: Rifting



Ocean plates moving apart create new crust. The longest volcano in the world is the Mid Atlantic ridge!



Volcano Schematic and Chemistry



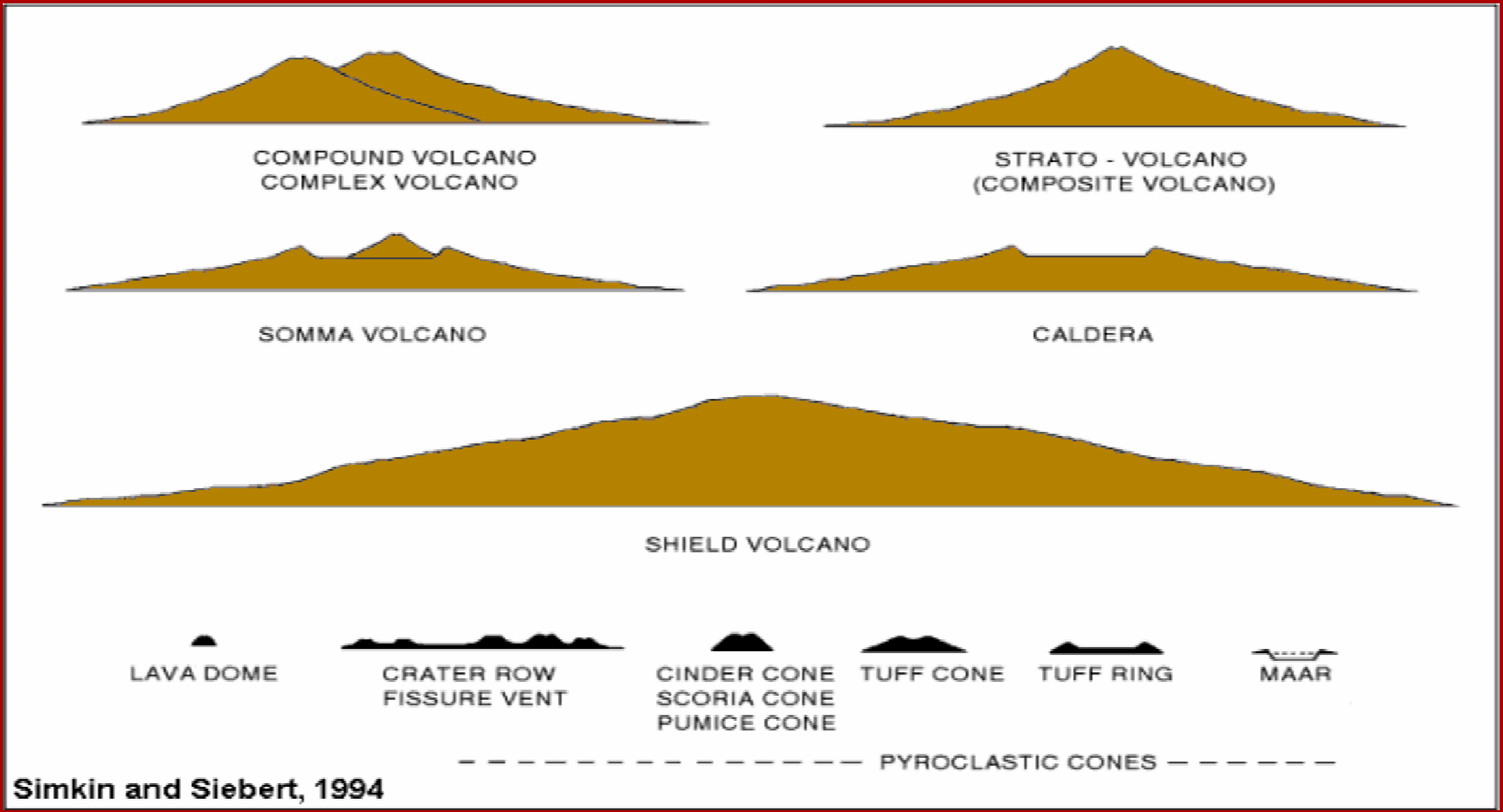
Some basic terminology used to describe volcanoes. Depending on the type of lava erupting, different types of volcanoes will form. The lava is classified by the amount of silica dioxide it contains.

Basalt	Andesite	Dacite	Rhyolite
45-52%	52-63%	63-68%	>68%

least explosive → **most explosive**

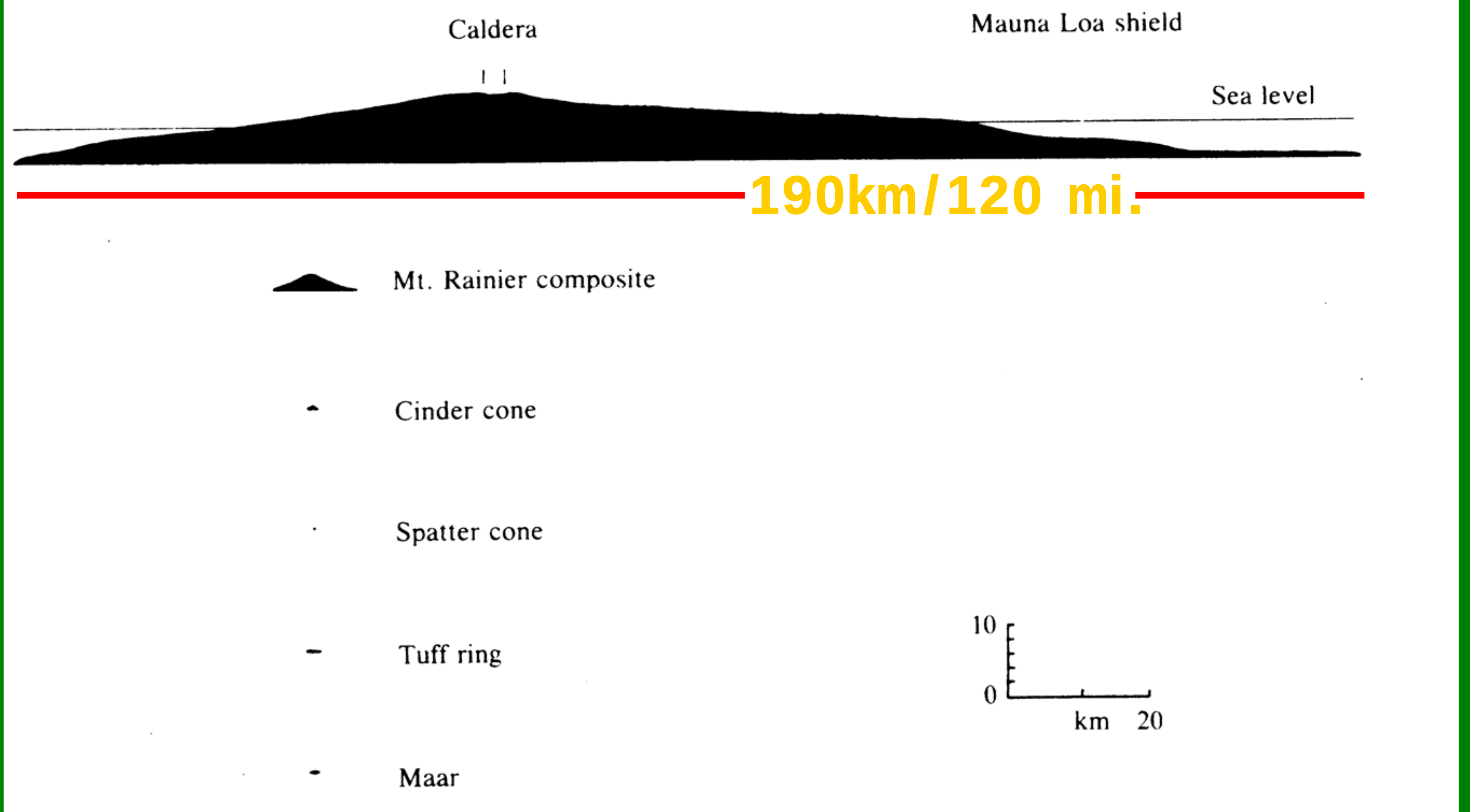
most fluid → **least fluid**

Volcano Types

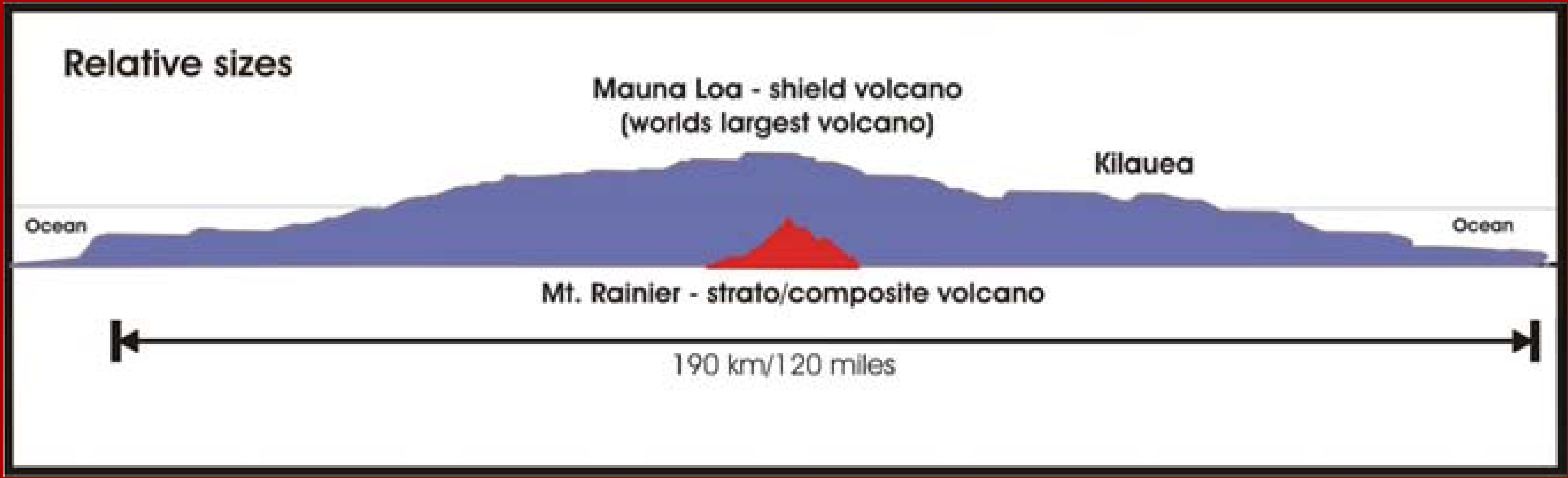


Volcanoes come in a variety of shapes and sizes. These names are used to define them.

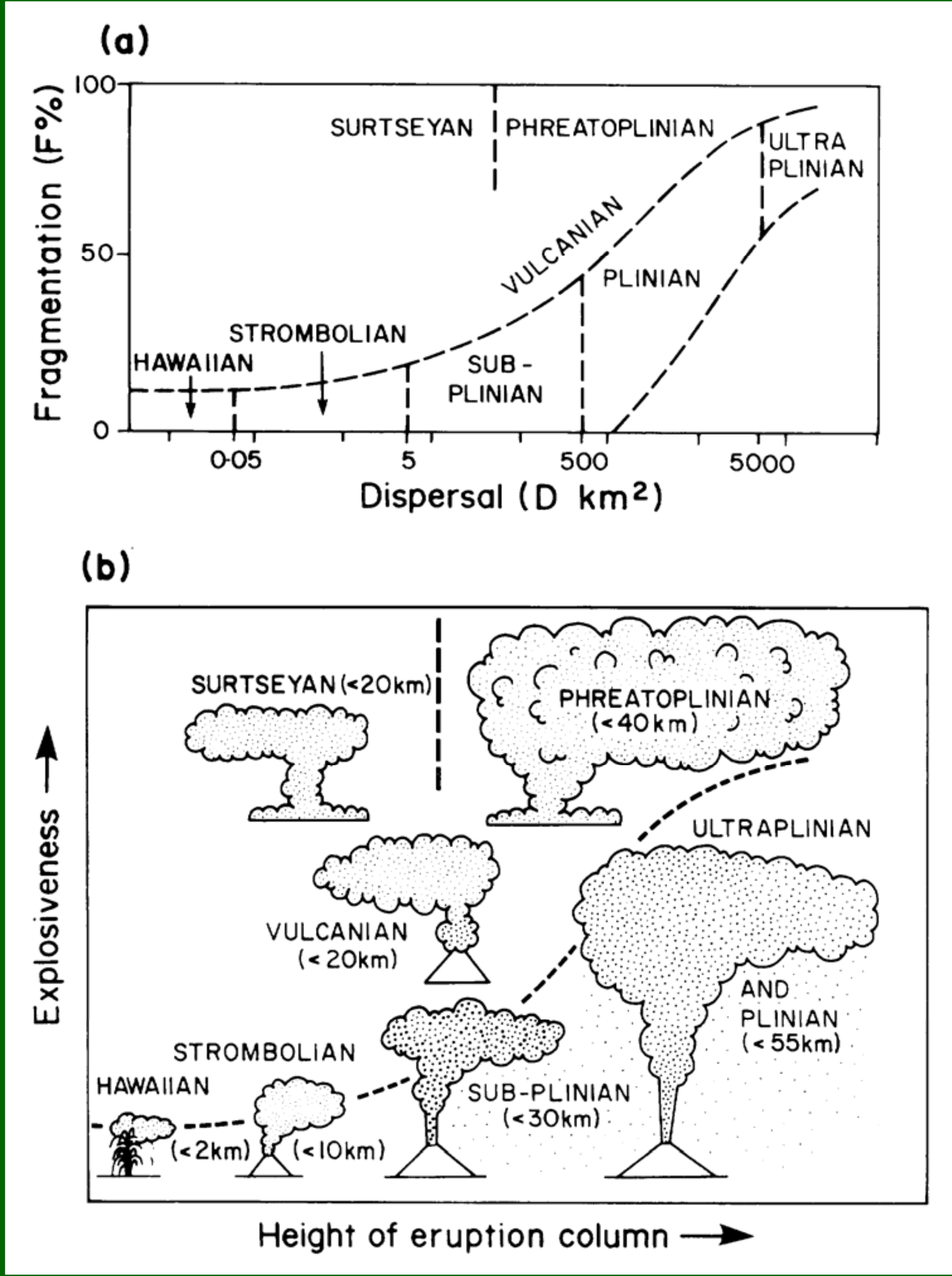
Relative Size of Volcano Types



Shield vs. Composite volcano



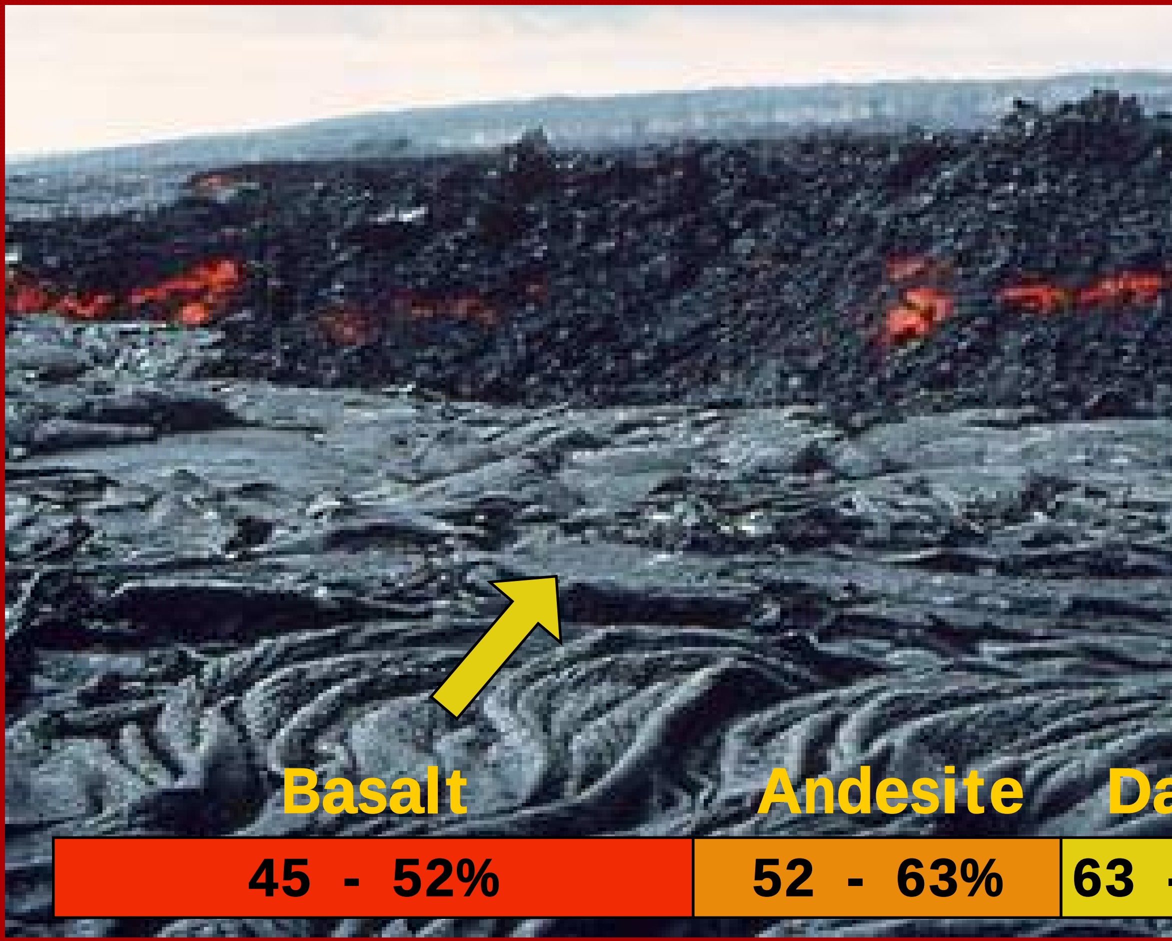
Stratovolcanoes are known for their powerful, explosive eruptions, but they are small in size relative to shield volcanoes, the largest volcanoes on earth.



Eruption Types

- Hawaiian
- Strombolian
- Vulcanian
- Pelean
- Plinian
- Surtseyan
- Subglacial
- Caldera Forming

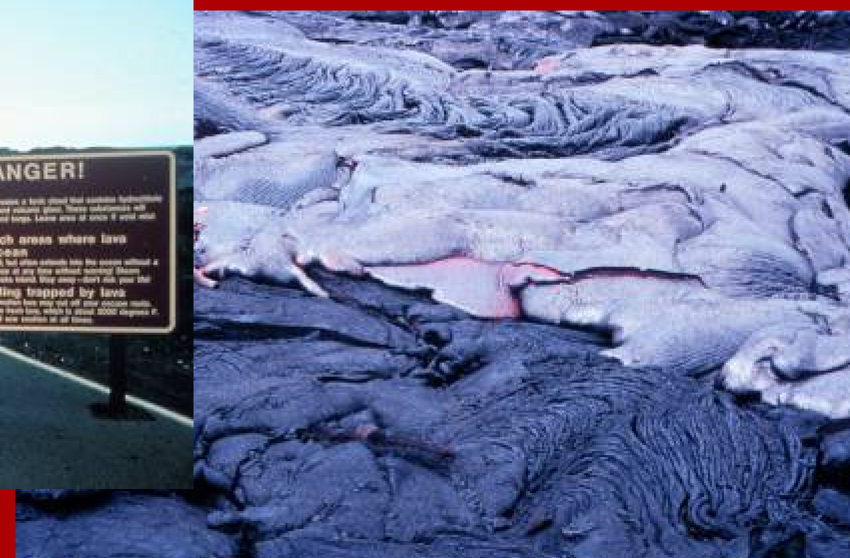
Lava Compositional Differences



Basalt	Andesite	Dacite	Rhyolite
45 - 52%	52 - 63%	63 - 68%	>68%

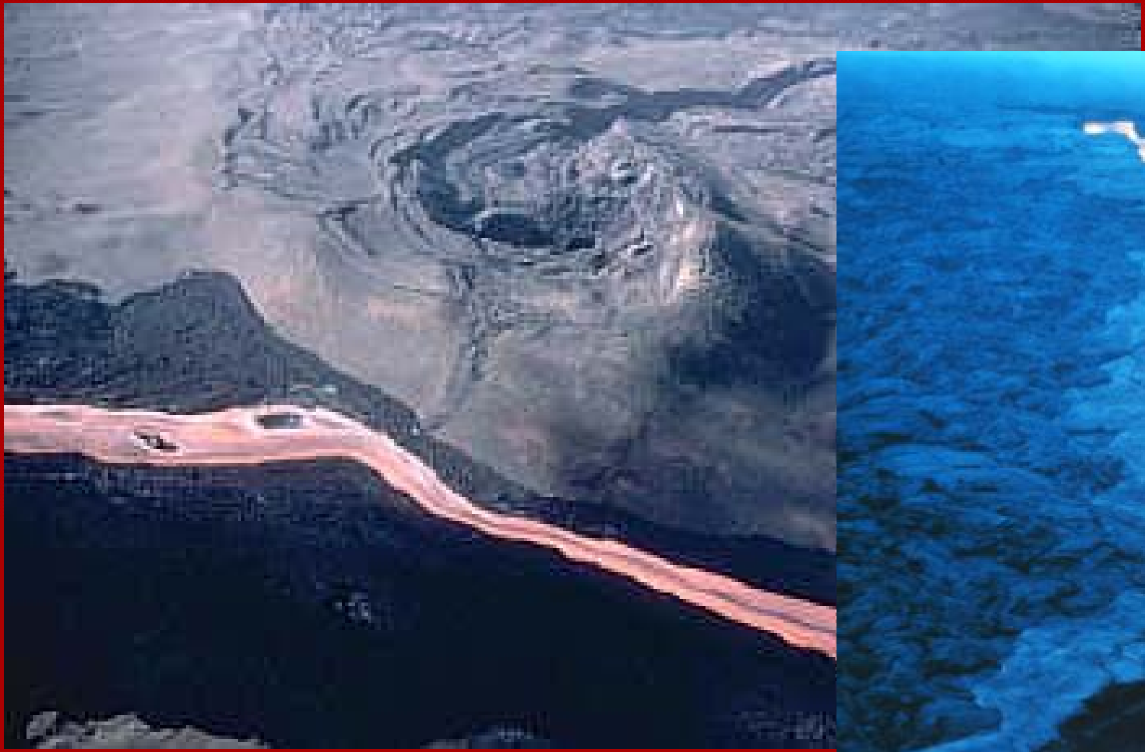
Due to compositional differences, lava erupts differently - either explosively, or more passively as flows.

Lava Flows



Basaltic lavas are among the least viscous. Large areas of central British Columbia are covered with basaltic lava flows.

Lava Rivers



Low viscosity basaltic lava can flow for 10's of kilometres

Smooth, Ropey Lava – Pahoehoe

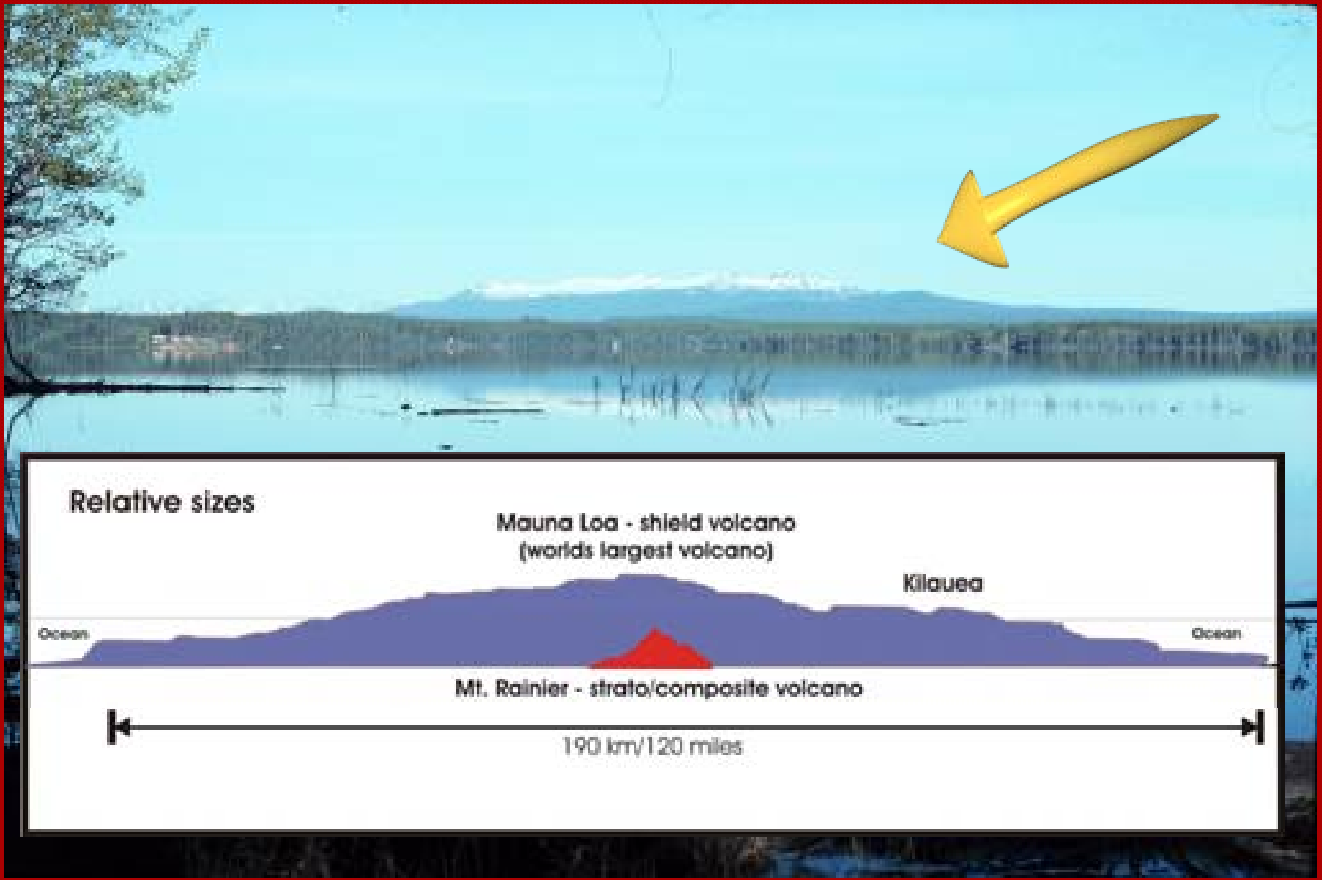
The surfaces of basaltic lava flows varies. Often it is smooth or ropey.

Rubbly Surface, Rough and Jagged – Aa Lava

Another common form of basaltic lava.

Lava flows with gas bubbles

Shield Volcanoes



Most shield volcanoes are formed of fluid basaltic lava flows, therefore, the edifices are not as visually dramatic as stratovolcanoes. Their volumes can exceed that of stratovolcanoes by several orders of magnitude and they often form during single long-term effusive eruptions. The Ilgatchuz range in west central British Columbia is an example of a shield volcano.

Lava Fountains (fire fountains)

Basaltic lava often erupts gas rich, the ejection of the gas can create spectacular fire fountains, often leading to the formation of cinder cones.

Cinder Cones

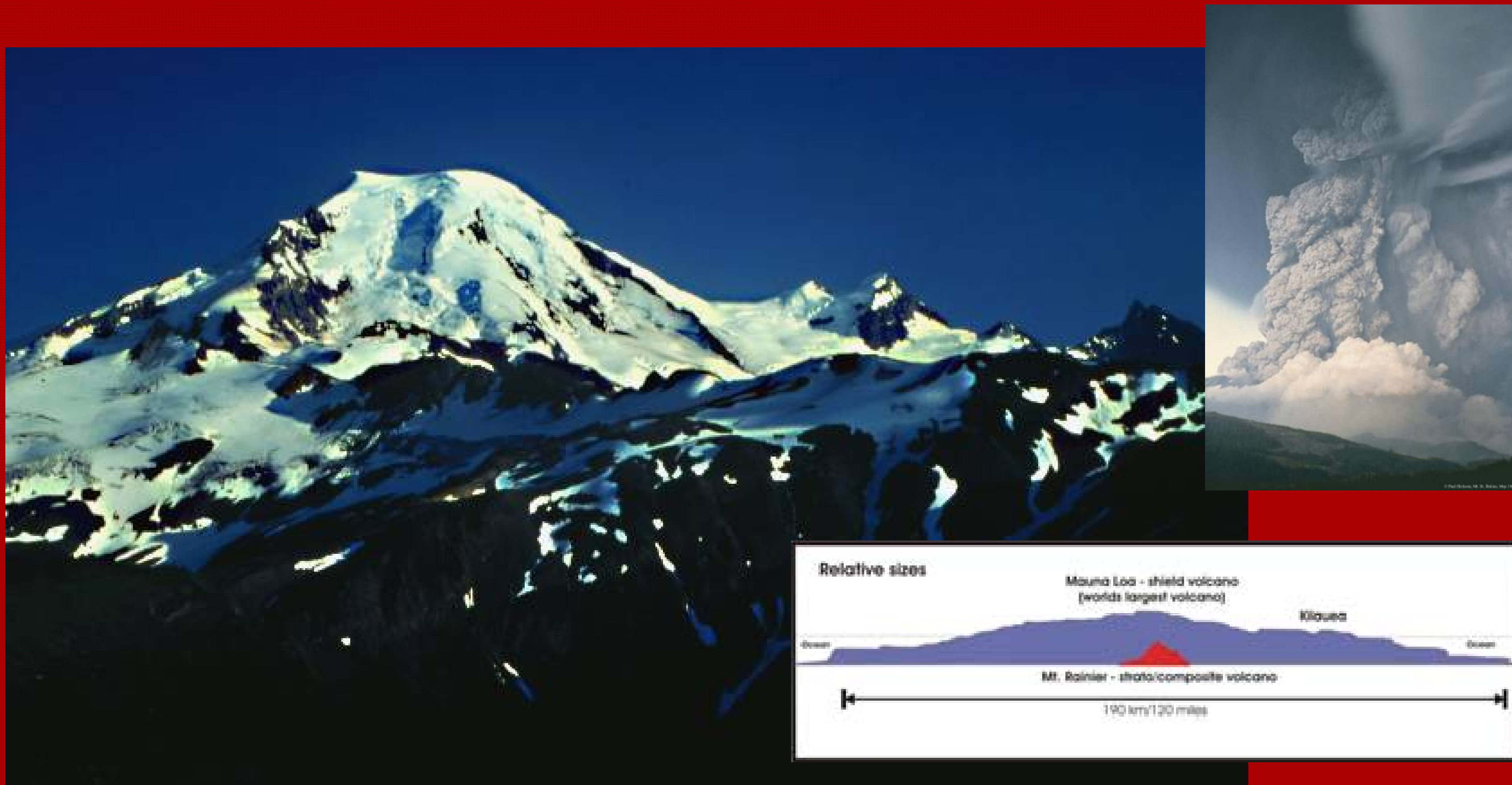
Also known as pyroclastic cones or scoria cones, can form rapidly, but remain active only for geologically short periods of time.

Cinder cones typically range from a few tens of metres to a few hundred metres in height and are most often formed during single eruptions, when explosively ejected material accumulates around the vent in a process called fire fountaining.

Calderas

Calderas are large volcanic depressions formed after an eruption when the mountain collapses into its underlying magma chamber. The magma chamber is emptied by the explosive eruption or the effusion of large volumes of lava flows.

Composite or Stratovolcanoes



Stratovolcanoes are classic cone-shaped mountains formed from repeated eruptions of viscous lava and are common in subduction zones. Explosive eruptions are often associated with these volcanoes.

Eruptions are Natural Hazards

Volcanic Explosivity Index (VEI)

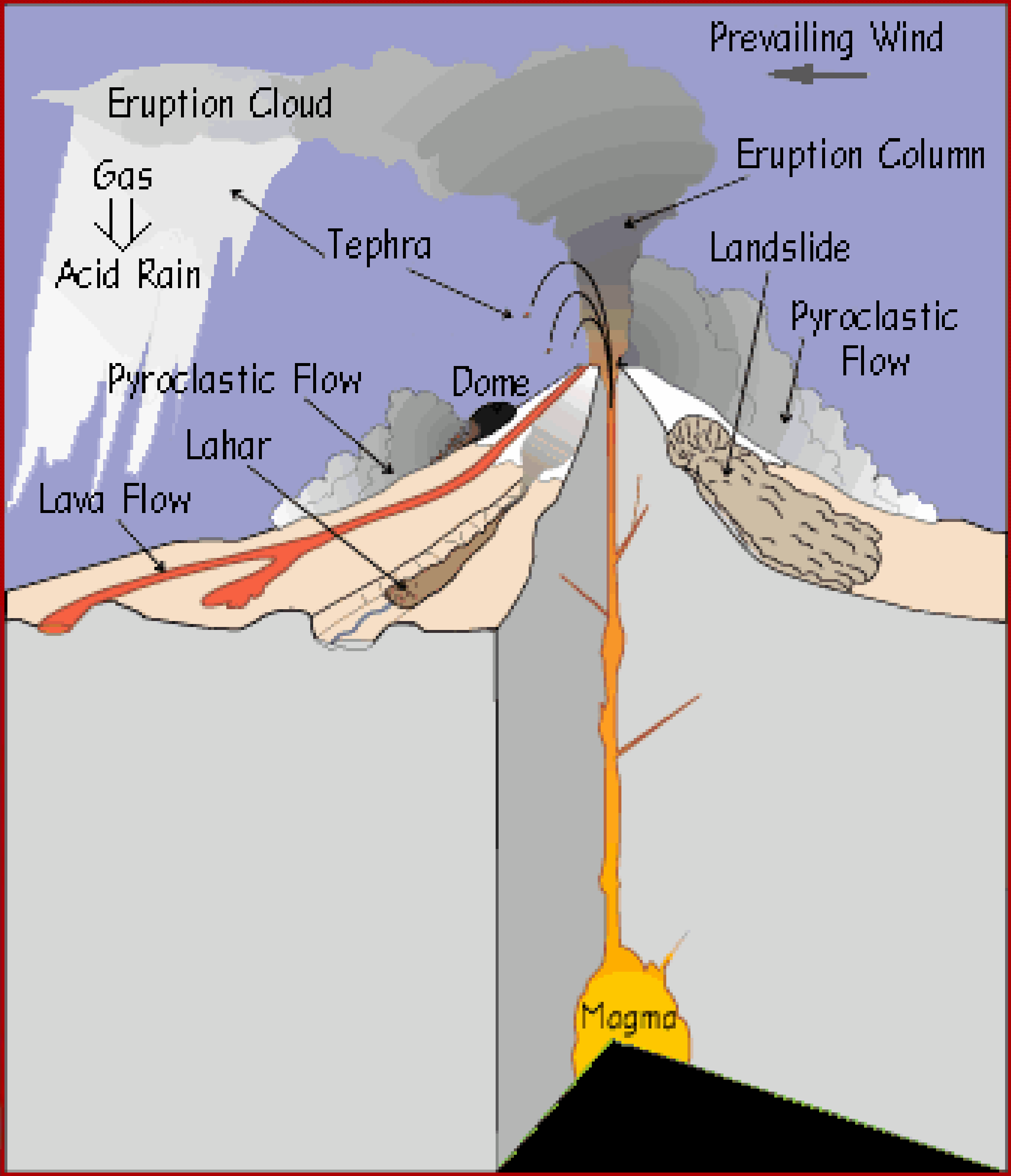
The size of a volcanic eruption is quantified using a scale called the Volcanic Explosivity Index (VEI). This scale takes into account the volume of material erupted, the height of the eruption cloud, the duration of the main eruptive phase, and other parameters to assign a number from 0 to 8 on a linear scale.

Hawaiian
VEI 1 - 2

1992, Pinatubo
VEI 6

Most Deadly Eruptions since 1500 AD

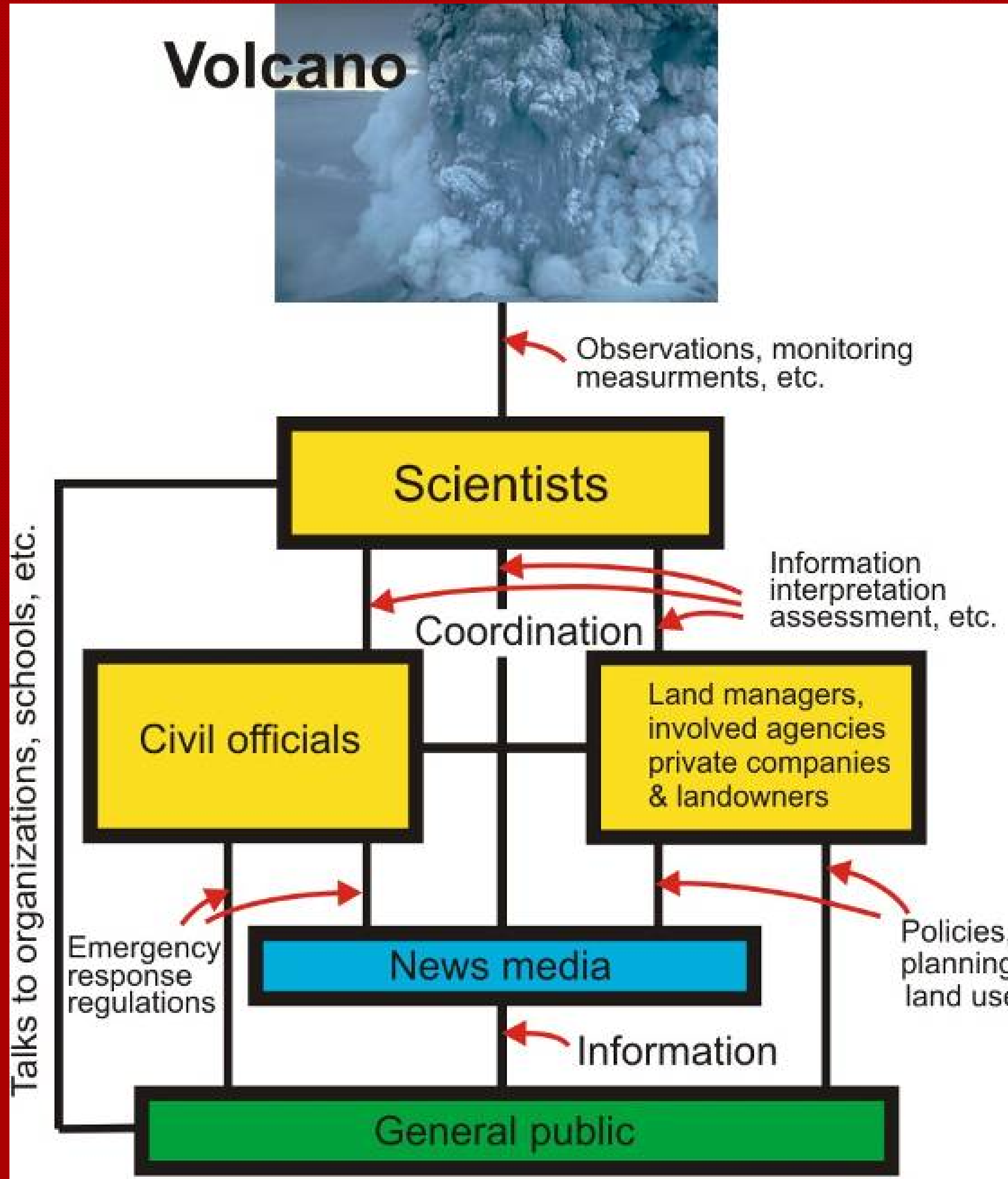
Volcano	Year	Casualties (causes)	VEI
Nevado del Ruiz, Colombia	1985	25,000 (mudflow)	3
Mont Pelee, Martinique	1902	40,000 total, 29,000 (pyroclastic flow)	4
Santa Maria, Guatemala	1902	6,000 (pyroclastic flow)	5
Krakatau, Indonesia	1883	36,000 (tsunami)	6
Tambora, Indonesia	1815	12,000 (pyroclastic flow) 80,000 (starvation)	7
Unzen, Japan	1792	15,000 (tsunami)	3
Lakagigar (Laki), Iceland	1783	9,000 (starvation)	4
Kelut, Indonesia	1586	10,000 (mudflow)	4



Hazards Associated with Volcanic Eruptions

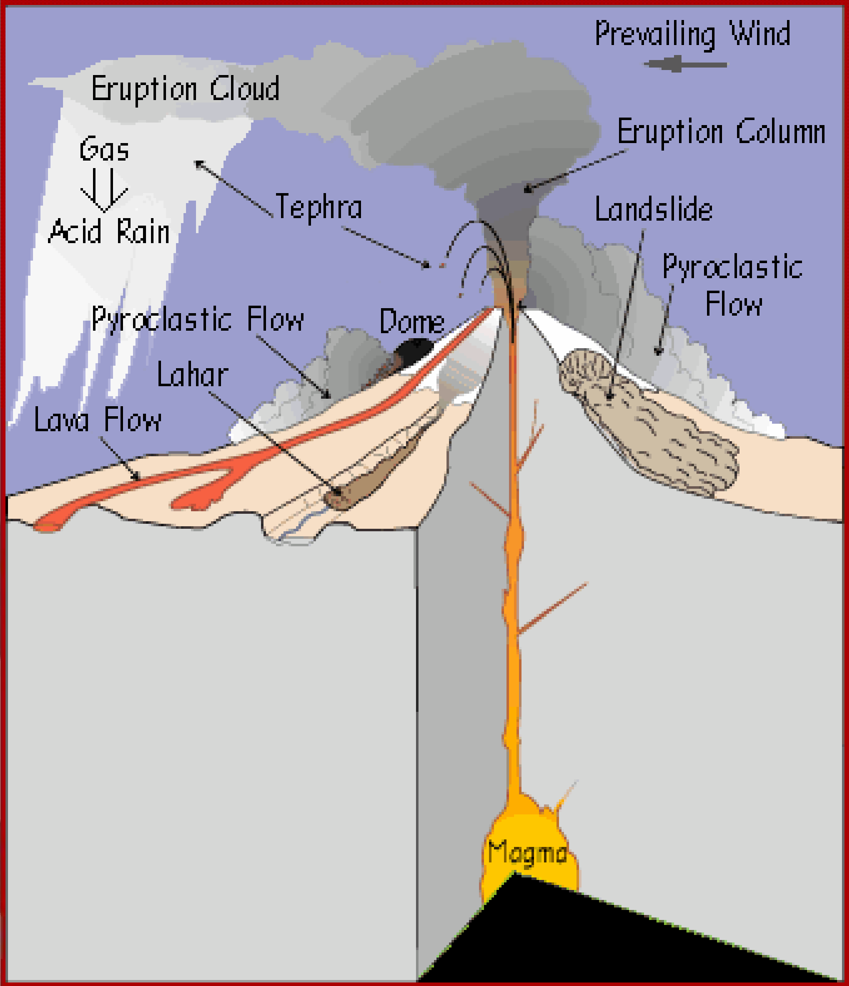
Erupting volcanoes can generate many primary hazards including lava flows, pyroclastic flows, pyroclastic surges, volcanic bombs, ash clouds, landslides, debris flows, and clouds of poisonous gas.

Role of the scientist



Hickson 2005; modified from Peterson 1986)

Main types of Volcanic Hazards



- Pyroclastic flows and surges
- Lava flows
- Ash falls (tephra)
- Lahars/Debris flows
- Debris avalanches
- Volcanic gases

Hazard: Pyroclastic Flow

Pyroclastic flows are dense avalanches of hot gas, hot ash, and blocks (tephra) that cascade down the slopes of the volcano during an eruption.

Pyroclastic flow at Mt. St. Helens

Hazard: Pyroclastic Flows

Pyroclastic flow deposits are often lobe-like and contain large blocks of pumice. The largest pumice blocks are commonly found at the flow's surface.

Hazard: Pyroclastic Surge

Pyroclastic surges are dense clouds of hot gas and rock debris, that are generated when water and hot magma interact. They are more violent and travel much faster than pyroclastic flows; surges have been clocked at over 360 km/h.

Pyroclastic surge at Mt. St. Helens, May 18, 1980

Pyroclastic surge/flow

Pyroclastic surge over the ocean at Montserrat.

Impact: Pyroclastic Flow/Surge

Risk Reduction Methods: hazard mapping, hazard zonation, monitoring, public education, evacuation

- Extends km's to 10's of km's
- People → death
- Equipment → destruction

Hazard: Lava Flow

Lava flows commonly accompany volcanic eruptions of basaltic and andesitic compositions. They are among the least hazardous processes associated with a volcanic eruption. Flows travel slowly, a few kilometres an hour to a fraction of a kilometre an hour, and people and animals can normally move easily out of the way, however immobile objects (houses, buildings etc.) are usually doomed.

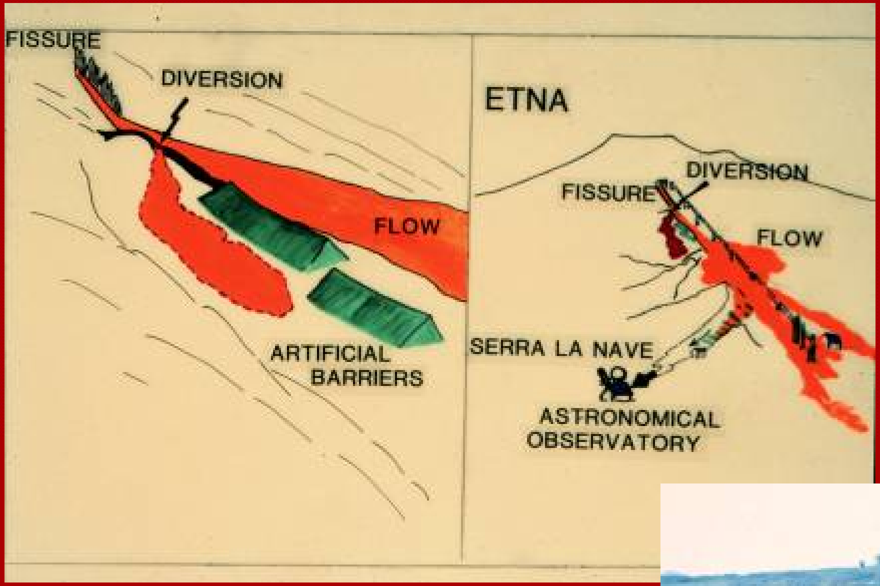
Basaltic lava flow on Mt. Etna

Impact: Lava Flow

- Extend km's to 10's of km's
- People → discomfort, displacement
- Equipment → destruction

Risk Reduction Methods: hazard mapping, hazard zonation, engineering diversion structures, evacuation, monitoring, public education, evacuation

Impact: Lava Flow



Lava flow diversion attempt at Mount Etna

Hazard: Lahar/Debris Flow

Lahars or debris flows, are slurries of water and rock particles that behave like wet concrete. Because of the range of particle size - from flour-sized to blocks as large as houses - they are extremely destructive. Lahars are topographically controlled and usually follow river valleys where they are confined to valley bottoms.

Debris flows have resulted in huge losses of life.

Toutle River lahar, Mt. St. Helens, May 18, 1980

Hazard: Debris Flow

For months or even years following an eruption, vast areas around a volcano may be covered by loose, unconsolidated ash and blocks (tephra). This material is easily mobilized by heavy rainfall, forming mudflows and debris flows.

Hazard: Lahar/Debris Flow

Between August 1992 and July 1993, debris flows triggered by heavy rains around Mt. Unzen volcano, Japan, damaged about 1,300 houses

Impact: Lahar/Debris Flow

Risk reduction methods: hazard mapping, hazard zonation, engineering diversion and retention structures, monitoring/alerting systems, public education, evacuation

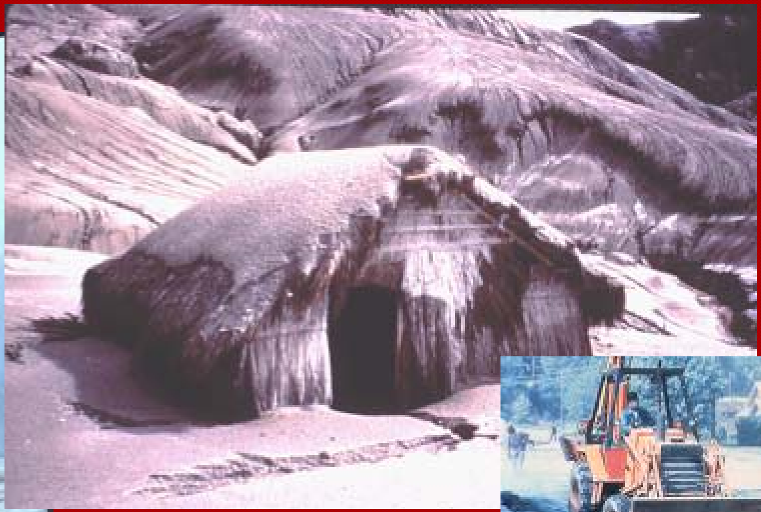
- Extend km's to 10's of km's
- People → death, displacement
- Equipment → destruction

Sediment retention structures built to control debris flows in Japan.

Hazard: Tephra (ash)

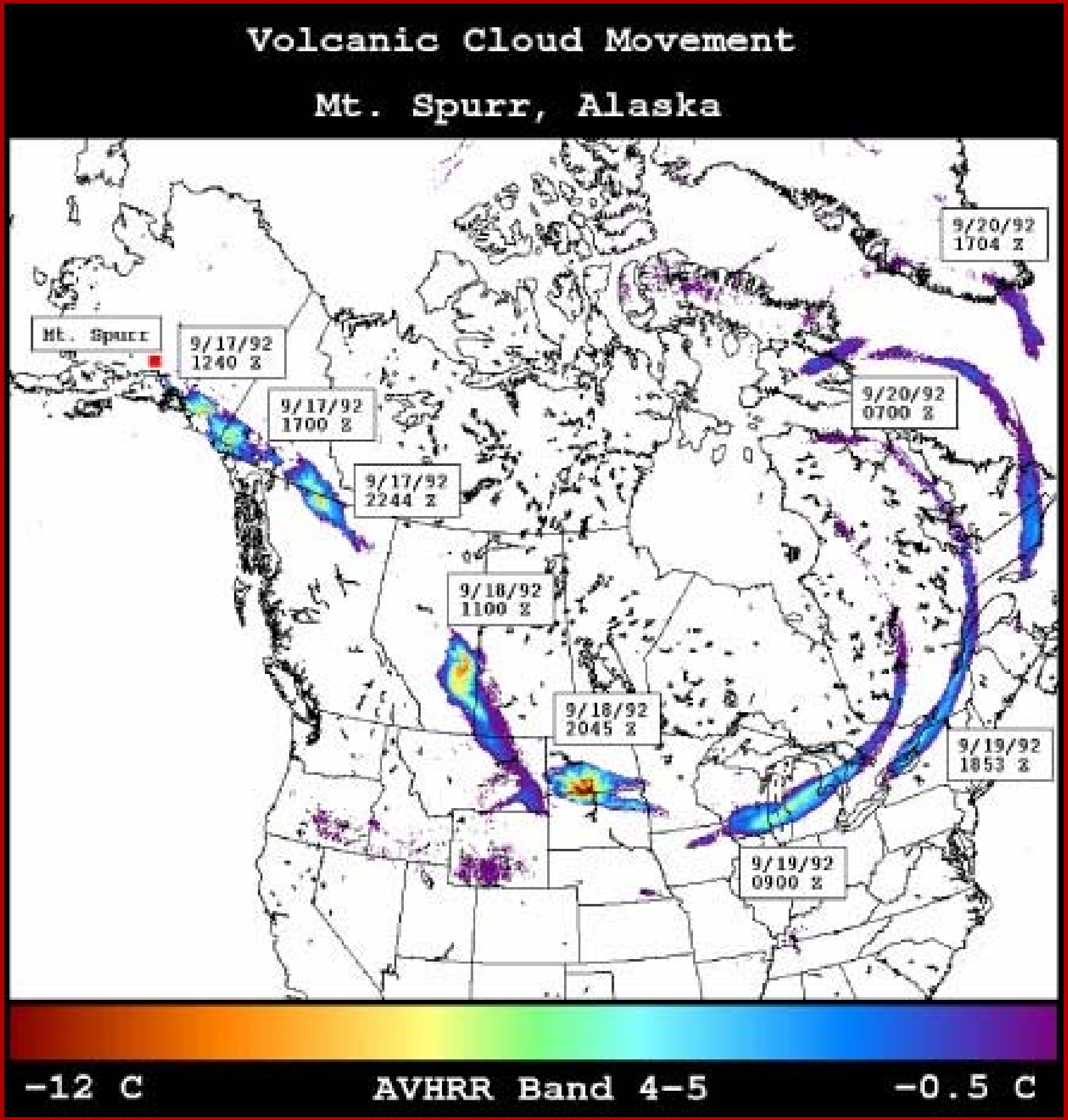
Tephra (ash) is finely broken volcanic rock and is a product of explosive volcanic eruptions. In very energetic eruptions, tephra is carried upward into the upper atmosphere and the finest tephra can be carried by the jet stream for hundreds and thousands of kilometres. Significant quantities of tephra in the atmosphere can affect the climate.

Hazard: Tephra

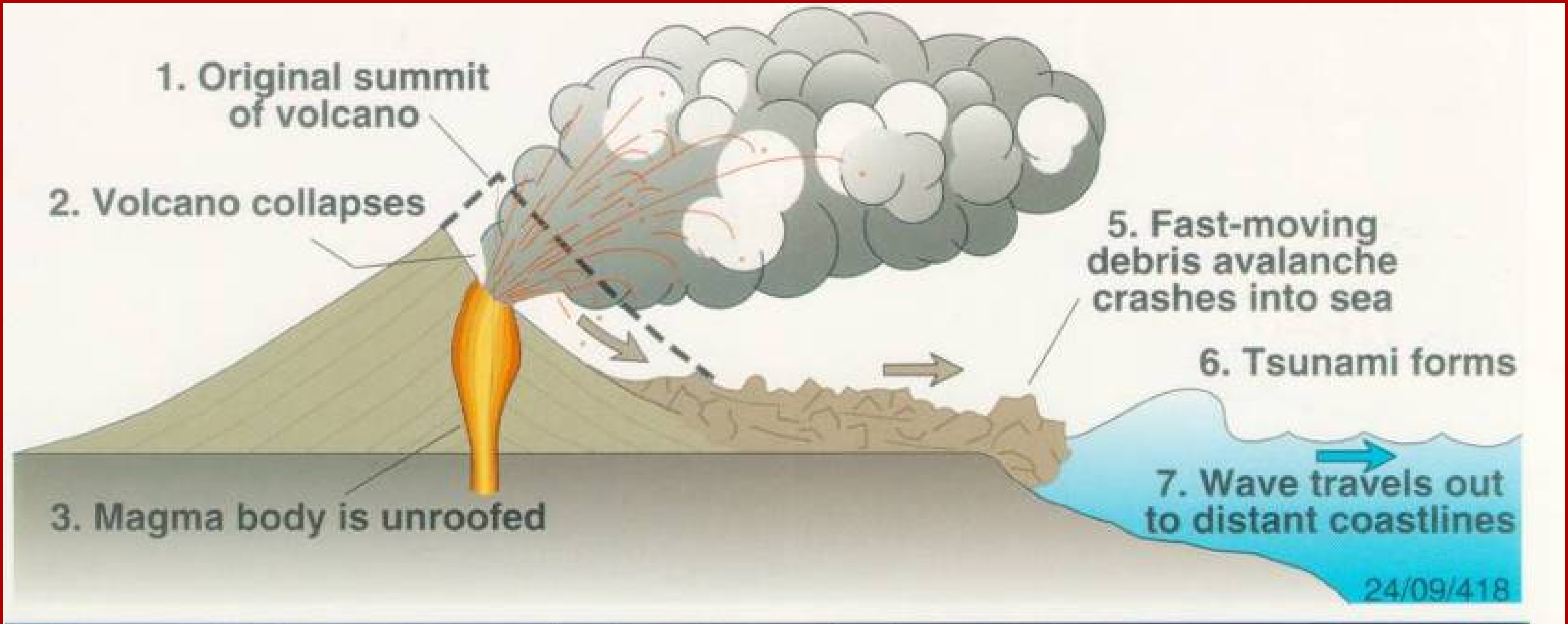


Volcanic tephra can be a significant health hazard and create economic problems over a wide area. It can pollute water supplies and disrupt transportation; thick accumulations of heavy ash can cause buildings or other structures to collapse. Inhaled ash can aggravate respiratory conditions such as asthma and bronchitis.

Tracking Tephra



Hazard: Debris Avalanches/ Sector collapse



The sequence of events that can take place when a volcanic cone collapses.

Collapse of part of a volcanic edifice can create a much larger than anticipated eruption. Almost instantaneous unroofing can create massive explosions. The debris avalanche can be very far travelled, and if it hits a water body, can create a tsunami.

Debris Avalanches

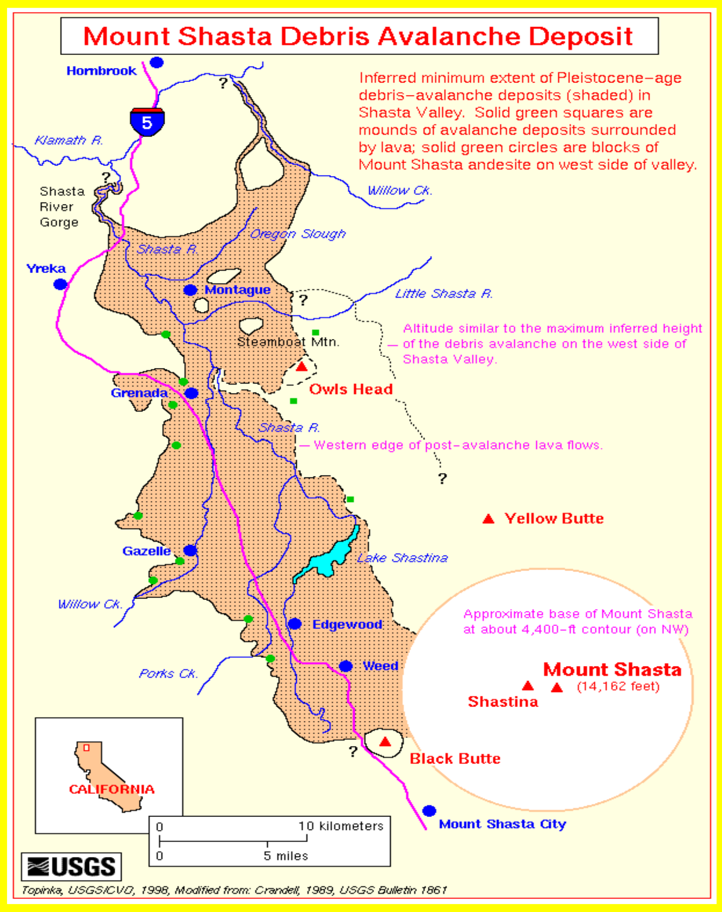
Hummocks recognized for the first time at Mt. St. Helens. The avalanche was 2.8 km^3 in size and traveled ~ 22 km

Debris Avalanches

Sector collapse leading to a debris avalanche was first observed at Mt. St. Helens and opened up a whole new aspect to hazard studies at temperate, snow clad volcanoes.

Debris Avalanches

- Mount Shasta, USA,
- 40 cubic km, run-out ~ 50 km



Shortly after the May 18, 1980 eruption of Mt. St. Helens, the hummocks at Mt. Shasta were recognized for what they were - evidence of a major, catastrophic failure of the mountain.

Impact: Debris Advances

- Extend km's to 10's of km's
- People → death, displacement
- Equipment → destruction

Risk reduction methods: hazard mapping, hazard zonation, monitoring, public education

Secondary impact:

- larger than anticipated explosion/eruption
- Tsunami generated if impacts a water body

Hazard: Poisonous Gases

Mostly H_2O, but often contains:

- Carbon dioxide (CO_2) – concentrates in crater lakes and topographic lows, present during non eruptive periods. Causes asphyxiation.
- Sulphur Dioxide (SO_2) – combines with water to form sulphuric acid, present during non eruptive periods. Causes eye and lung irritation.
- Fluorine (F) – rare, coats ash, when ingested by live stock results in death

“VOG” volcanic smog, Hawaii

Impact: Poisonous Gases

Damaged broccoli plants, Hawaii

Risk reduction methods: hazard mapping, hazard zonation, public education

Secondary impact
Long term impact on water supplies, crops

- Extends 100s of meters to km's
- People → death, displacement, bronchial complications
- Equipment → corrosion
- Pollution of water supplies

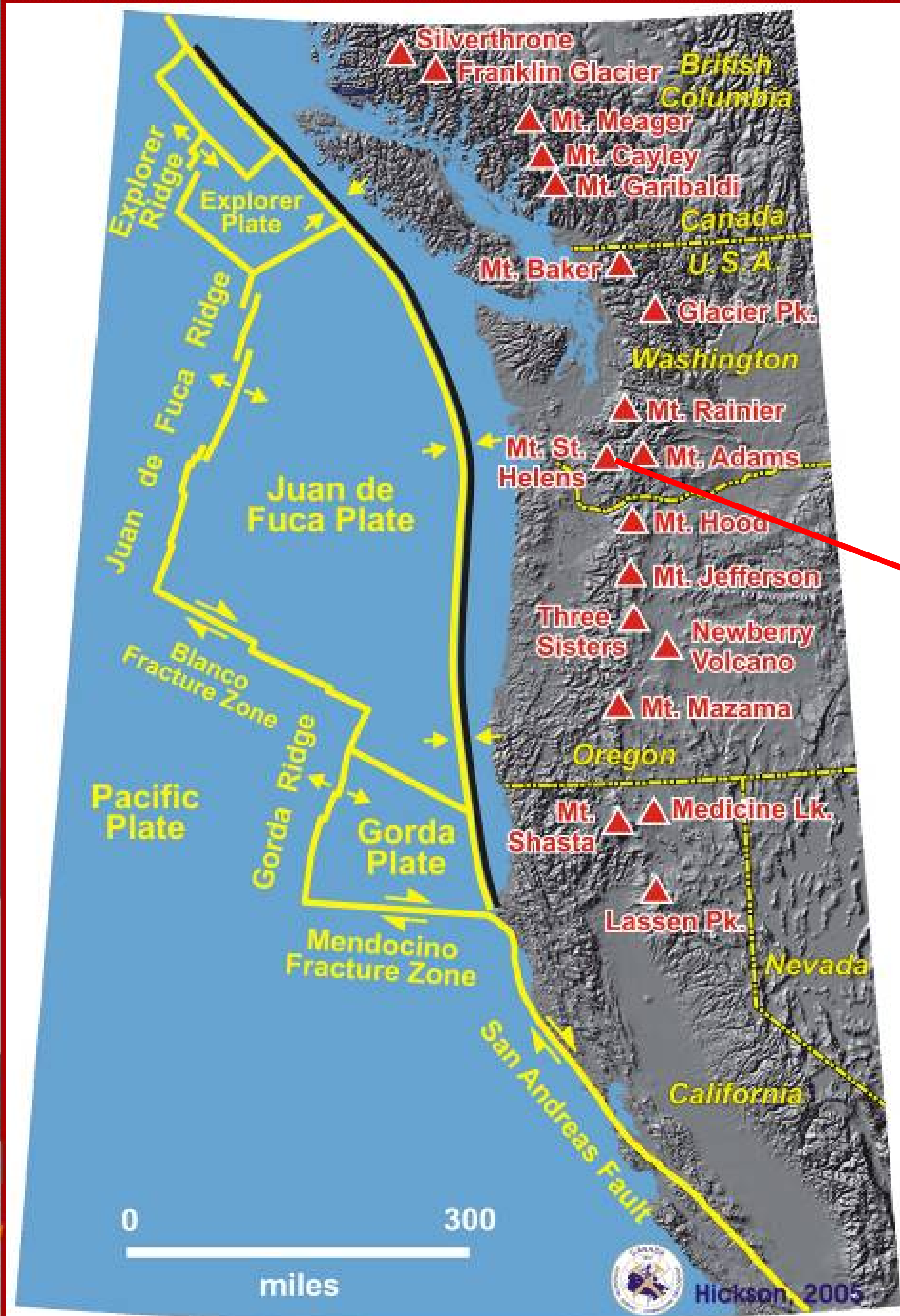
Secondary Hazards

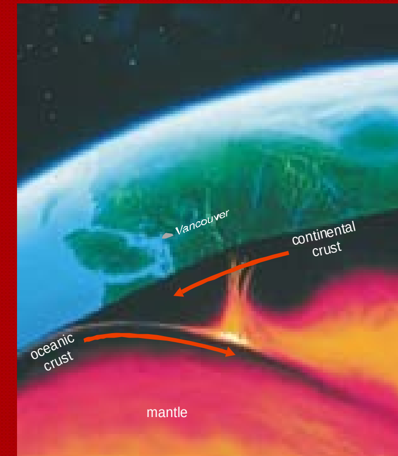
Secondary hazards are those that are not associated with an eruption, but rather result from the environment created by the volcano. They include landslides, mudflows, debris flows, landslides, ground and surface water contamination, and soil contamination. In addition, lava flows, debris flows, debris avalanches and pyroclastic flows can dam the natural drainage. Failure of these dams can lead to catastrophic flooding. The impact of a volcanic eruption can last decades.

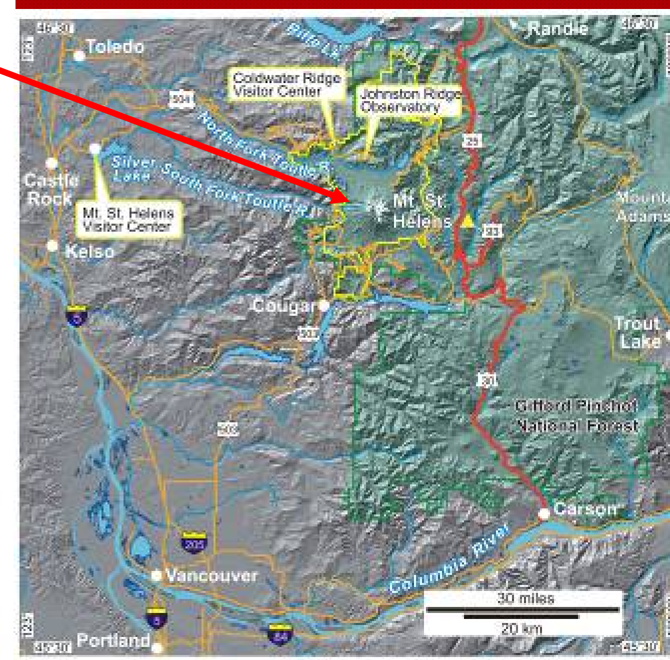
Volcanoes can also have positive impacts such as the enrichment of soil, expansion of arable land, creation of mineral deposits and building material.

Mt. St. Helens, May 18, 1980 and ongoing activity
Anatomy of an eruption

Mt. St. Helens

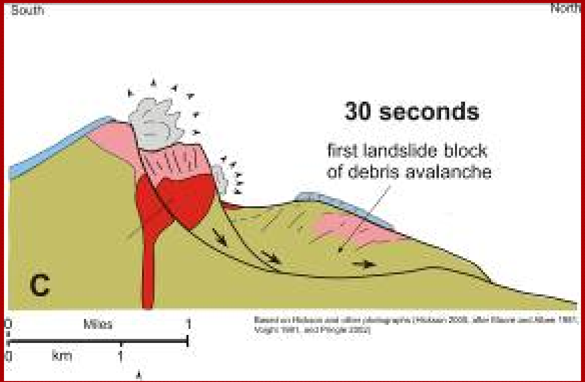


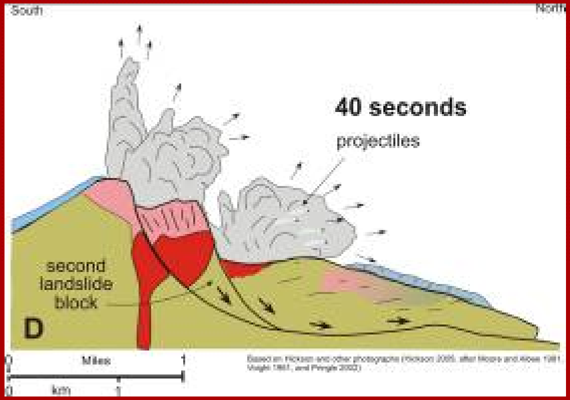


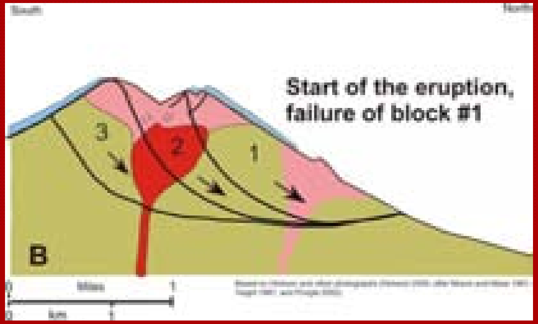


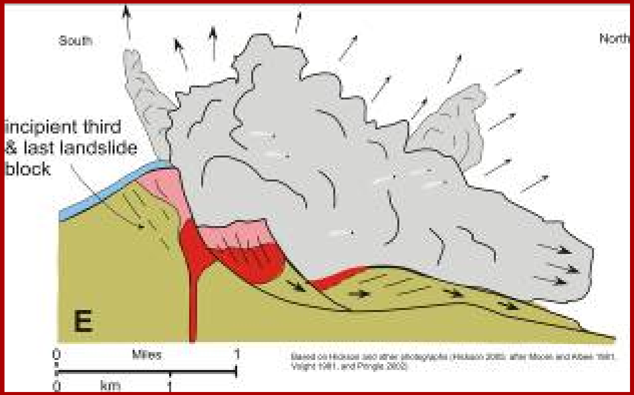
Mt. St. Helens: Surviving the Stone Wind, Hickson 2005

Mt. St. Helens



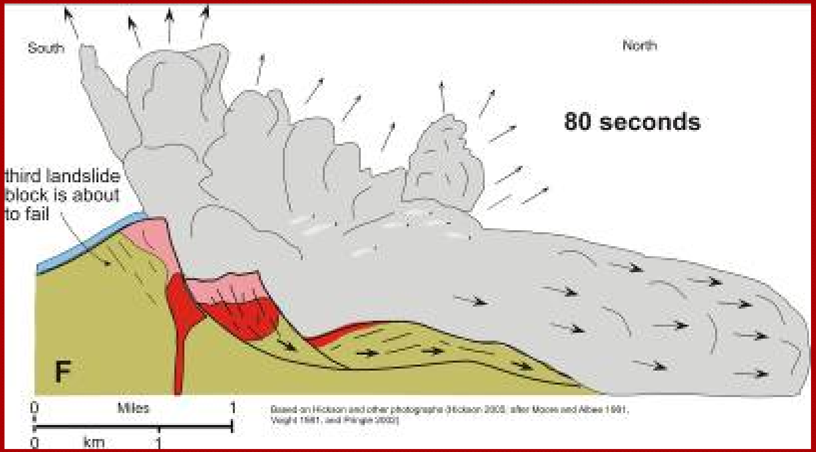




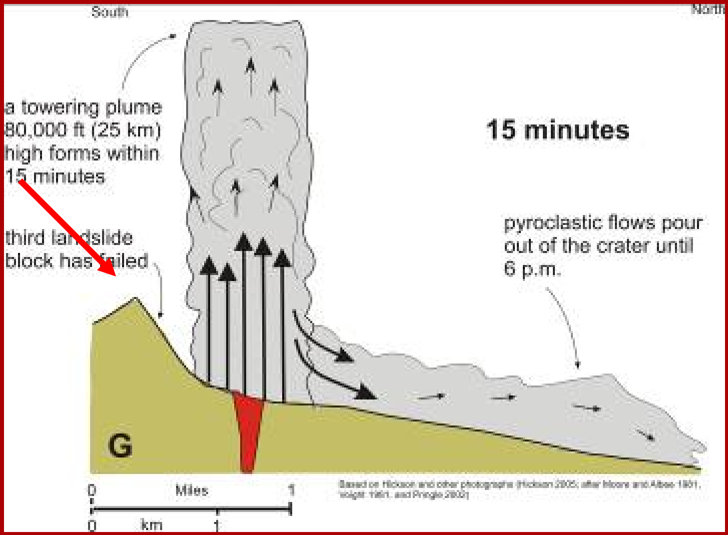


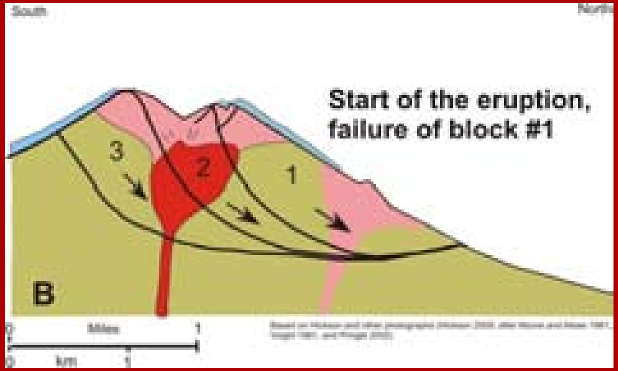
May 18, 1980 sector collapse and phreatomagmatic expl

Mt. St. Helens



May 18 1980 sector collapse (debris avalanche/ landslides) and phreato-magmatic explosion





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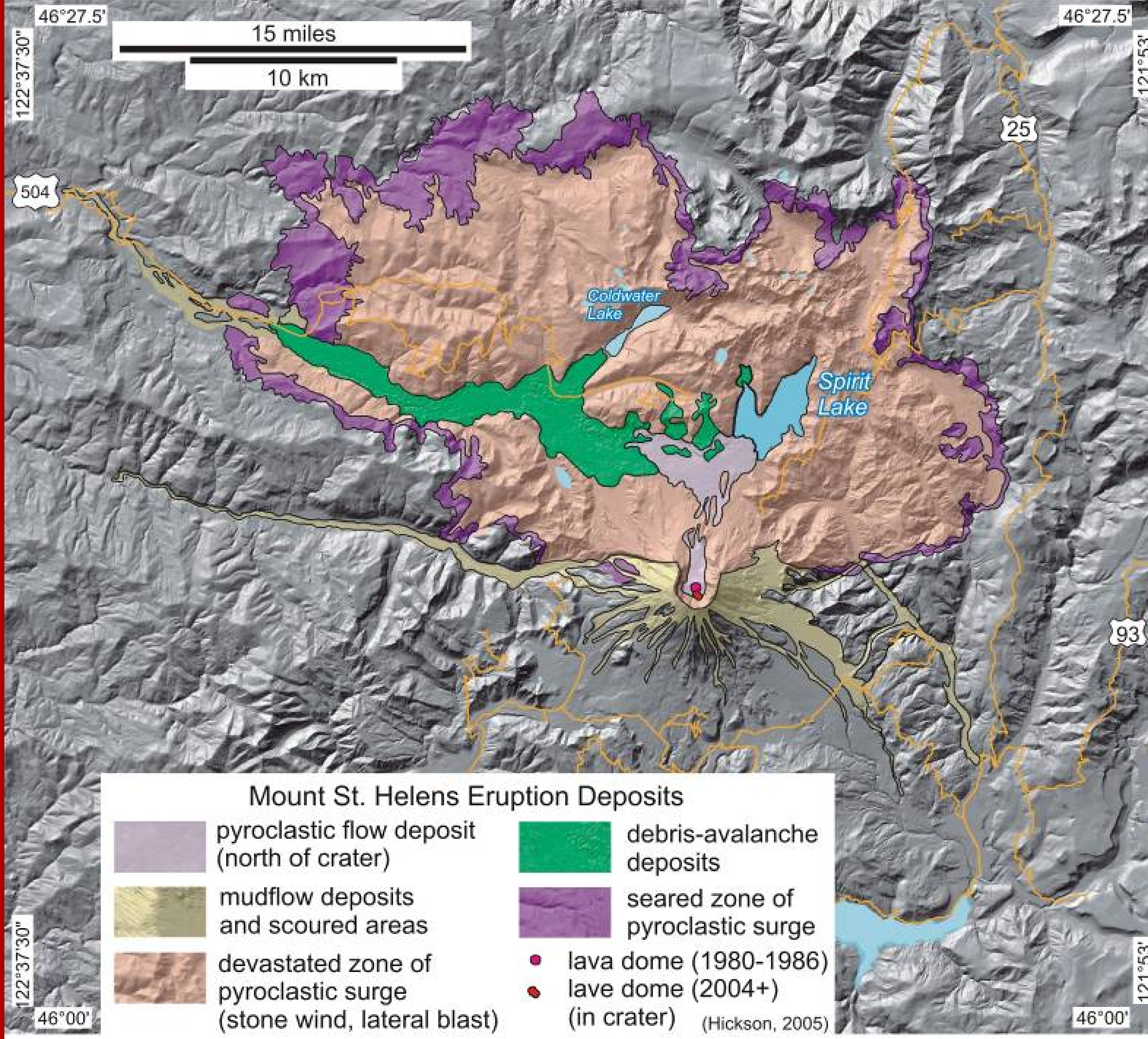
Mt. St. Helens: Devastated zone



"Before:" Mount St. Helens, May 17, 1980; Summit elevation 2,950 m (9677 ft)

Largest ever observed landslide, and first ever observed sector collapse and pyroclastic surge

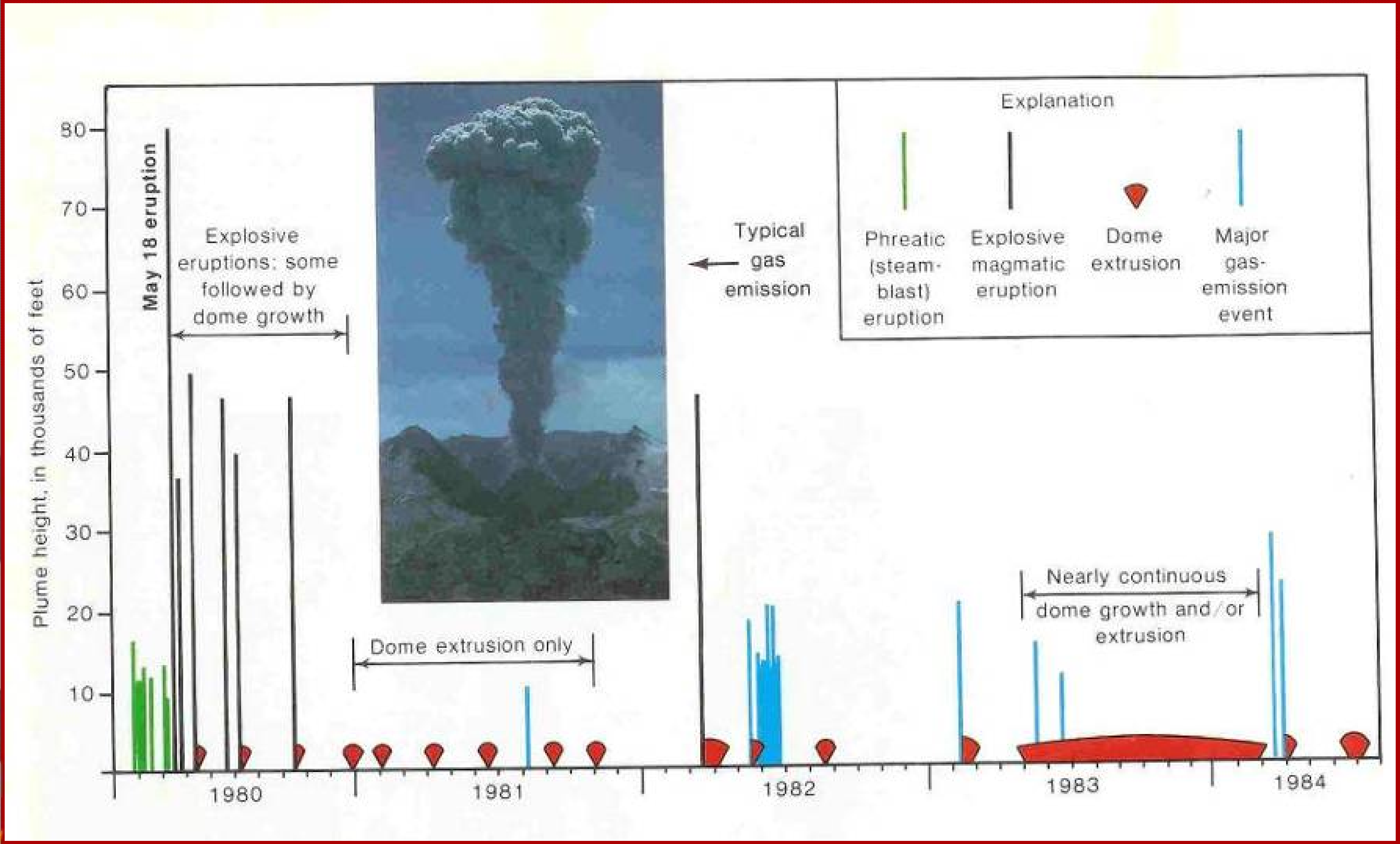
"After:" Same view, after debris avalanche and blast. Summit Elevation 2,549 m (8,363 ft.), 400 m and 2.8 cubic km (1,314 ft and 0.67 cubic mi) removed by avalanching.

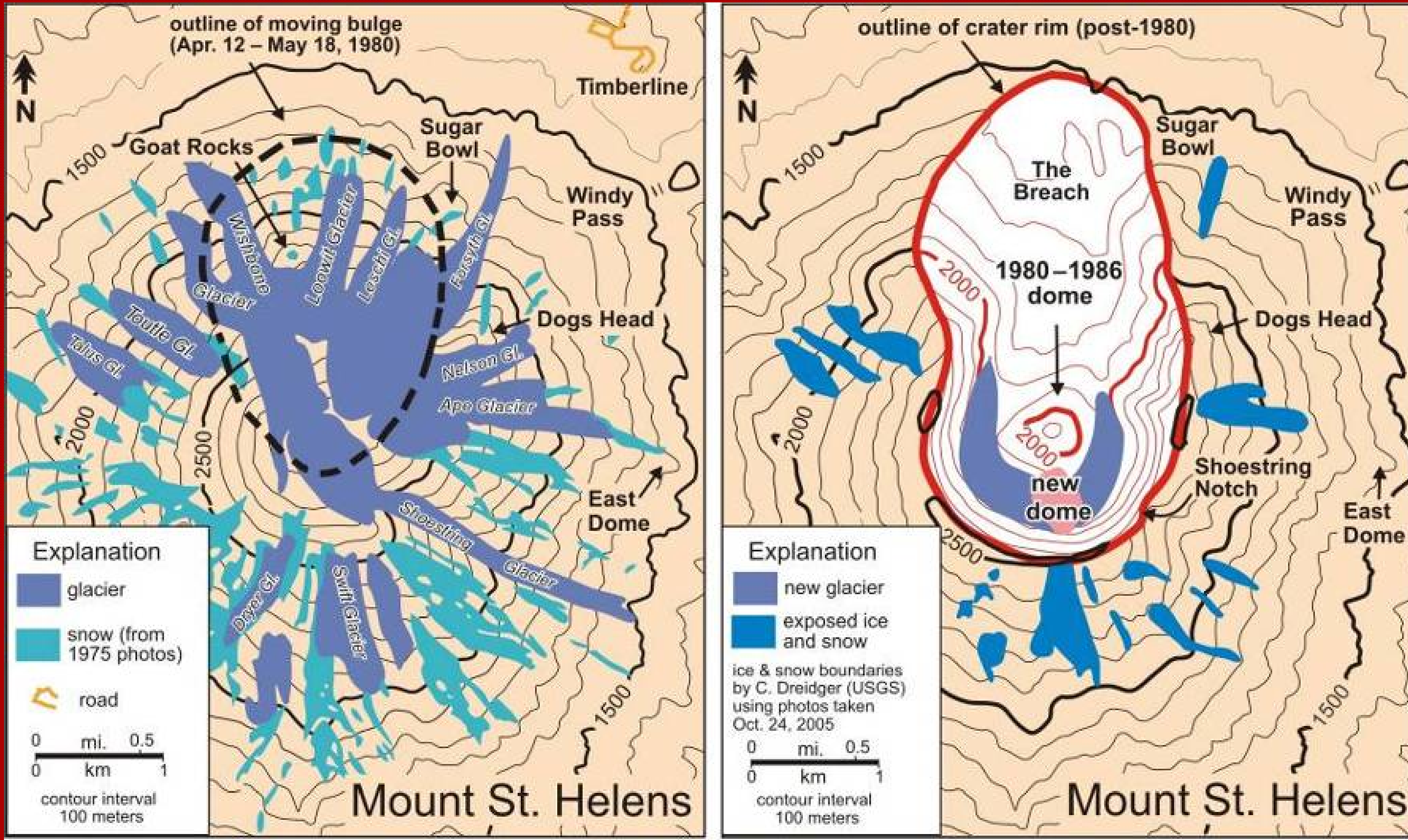
Over 632 km² of alpine to sub alpine environment was destroyed. Virgin timber was blasted away from many areas and blown over in others.

The pyroclastic surge killed most of the 57 people who died in the eruption.

The debris avalanche (sector collapse that created the gaping amphitheatre), transformed Spirit Lake and the Toutle River Valley.

Graphical time-series of MSH eruptions, 1980-86



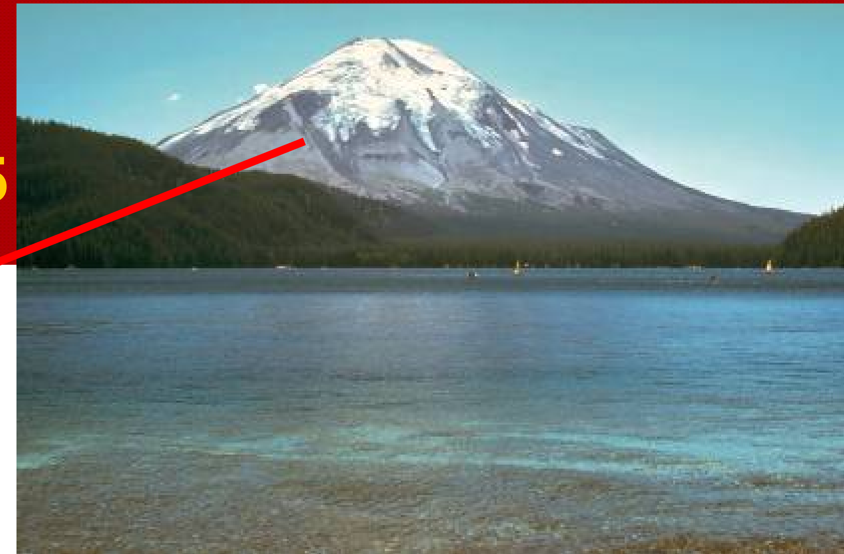


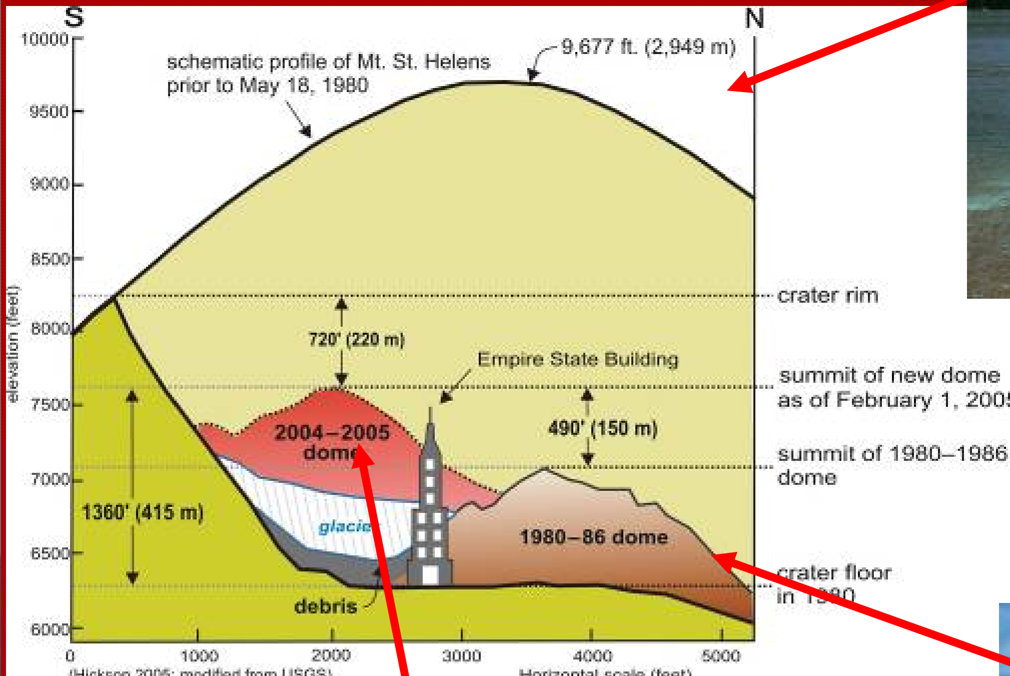
Hickson, 2005; after Pringle 2004 and Brugman 1981

The crater formed from the landslides is outlined in red (right). Snow began accumulating almost as soon as the 1980-1986 dome finished growing.

Mt. St. Helens

The volcano began growing a second dome, Sept. 29, 2005





1980 – 1986 dome

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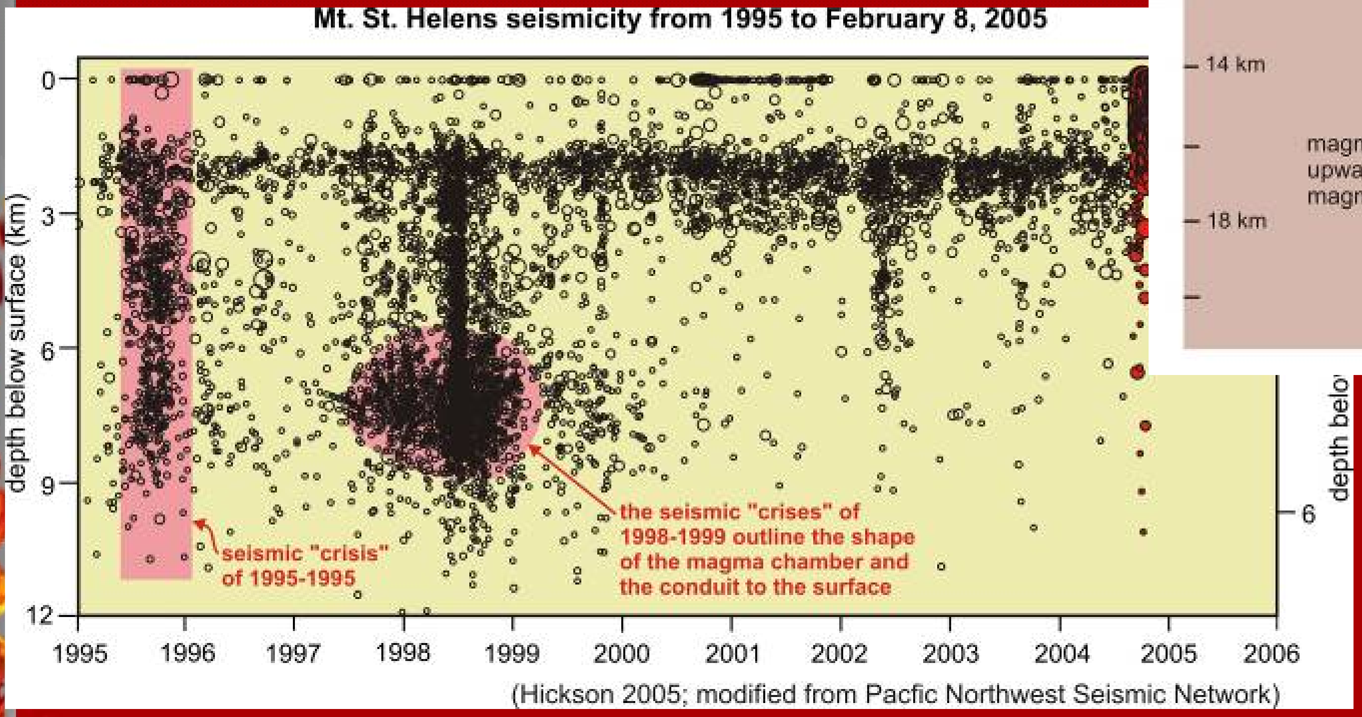
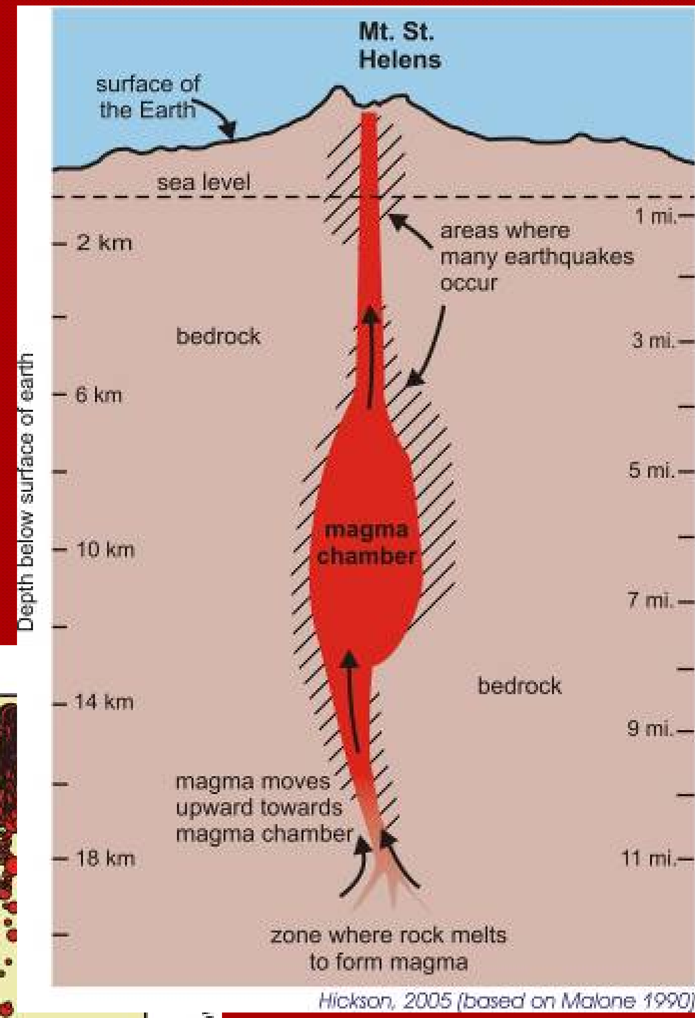
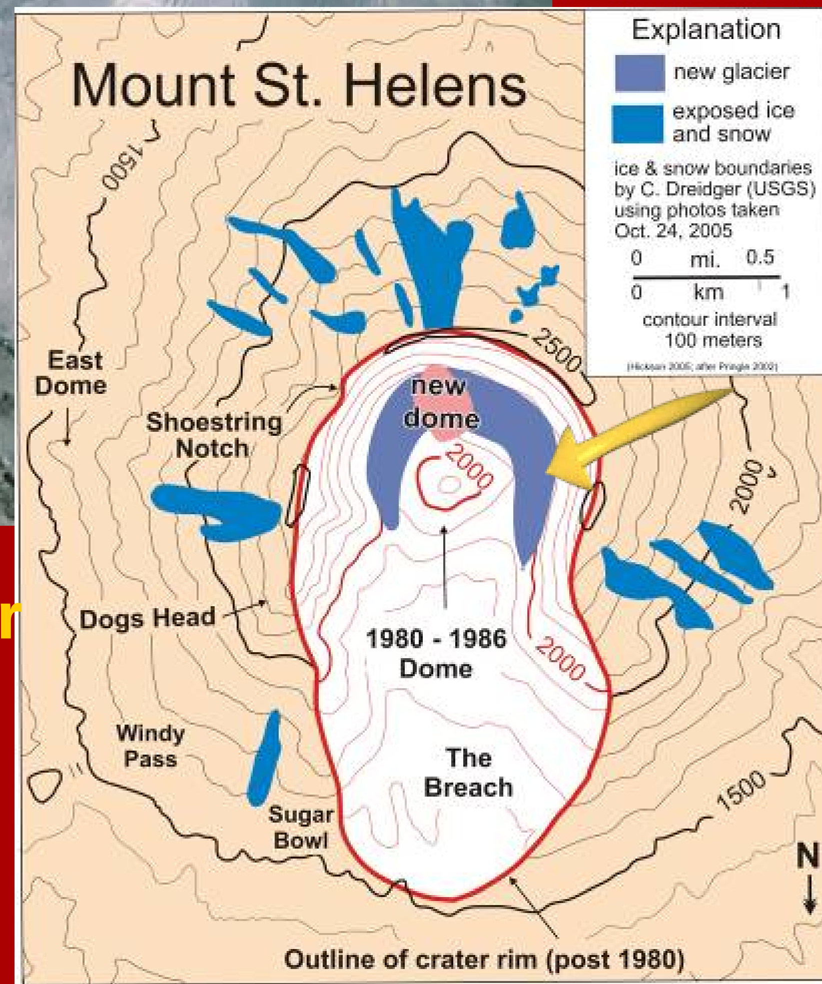
Mt. St. Helens

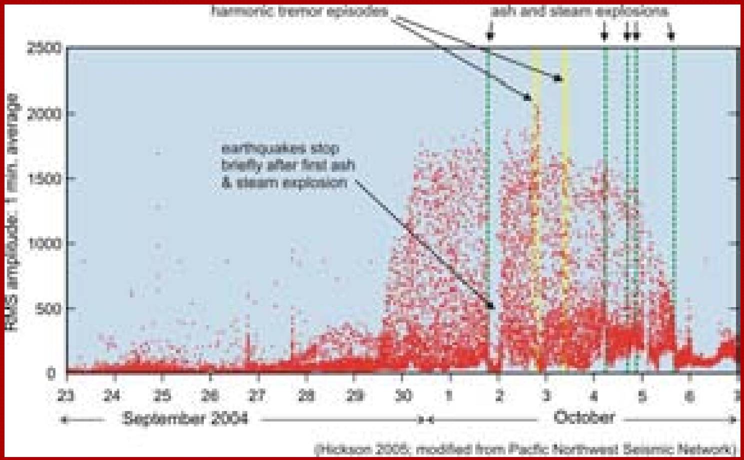
Although Mt. St. Helens had been outwardly quiet since 1986, inwardly significant seismic activity was present. Two seismic crises were cause for concern, but didn't lead to an eruption until the seismic activity started again on Sept. 28, 2005.



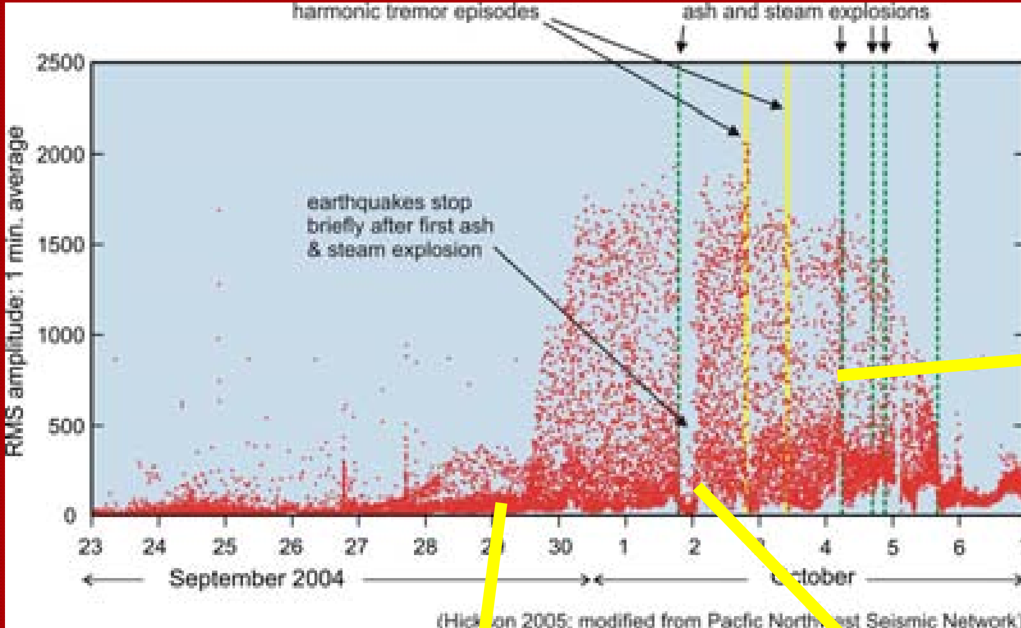


From 1986 onward, a glacier grew behind the 1980-1986 dome. The mountain was outwardly tranquil, but, inwardly there was turmoil.





The seismic crises built rapidly and very soon the media was "tuned" to the mountain.



The first explosion was Oct. 1, but the glacier behind the 1980-1986 dome was heavily fractured and moving upwards prior to the first explosions. Soon a large crater had formed

Bezymianny, Russia

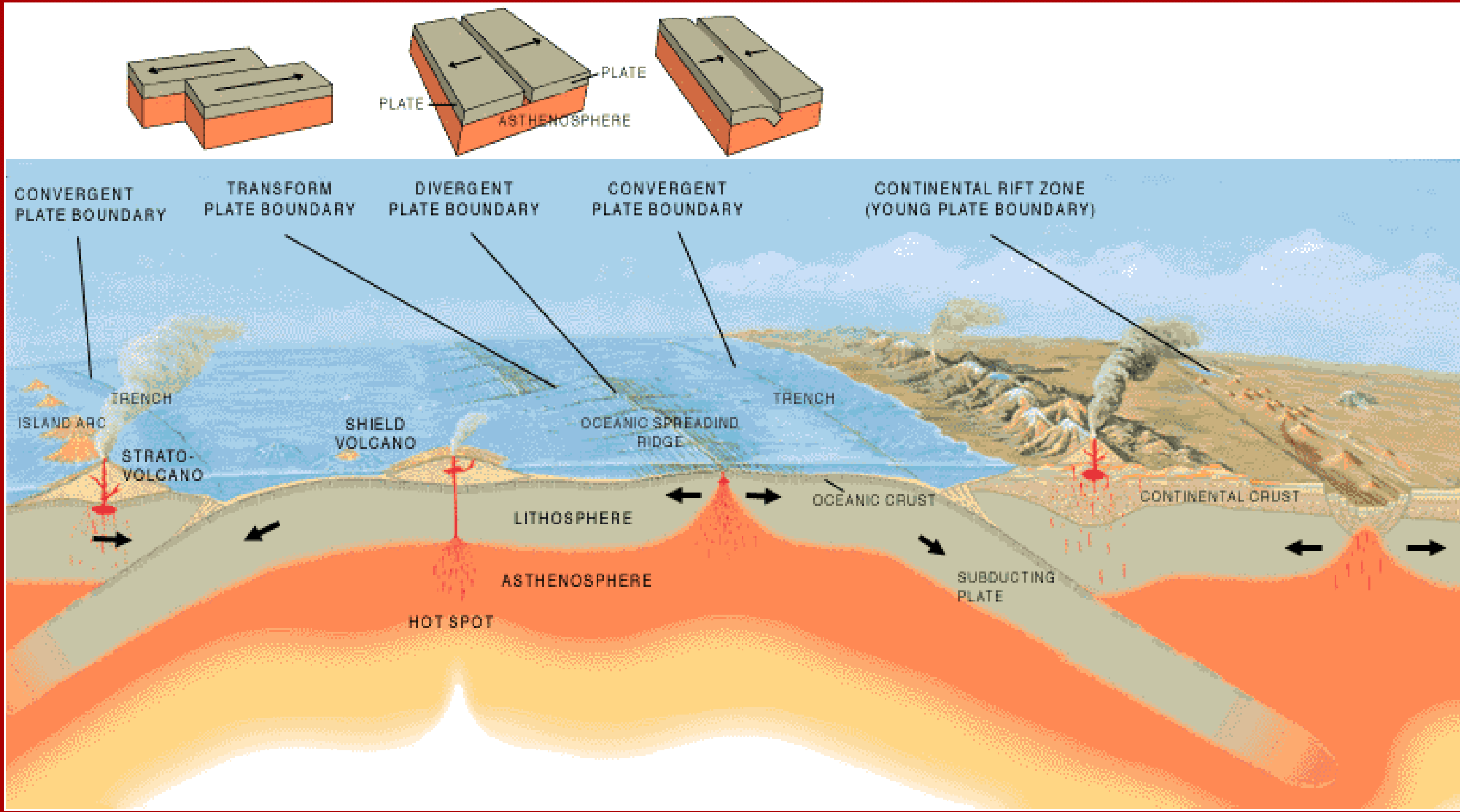
Mt. St. Helens, March 15, 2005

Volcanoes in Our Backyard

In Canada, British Columbia and Yukon are the host to a vast wealth of volcanic landforms. This section provides a brief overview of these volcanoes, starting in the north.

British Columbia's place in the Pacific Ring of Fire

Driving Forces - subduction, crustal rifting and a hotspot

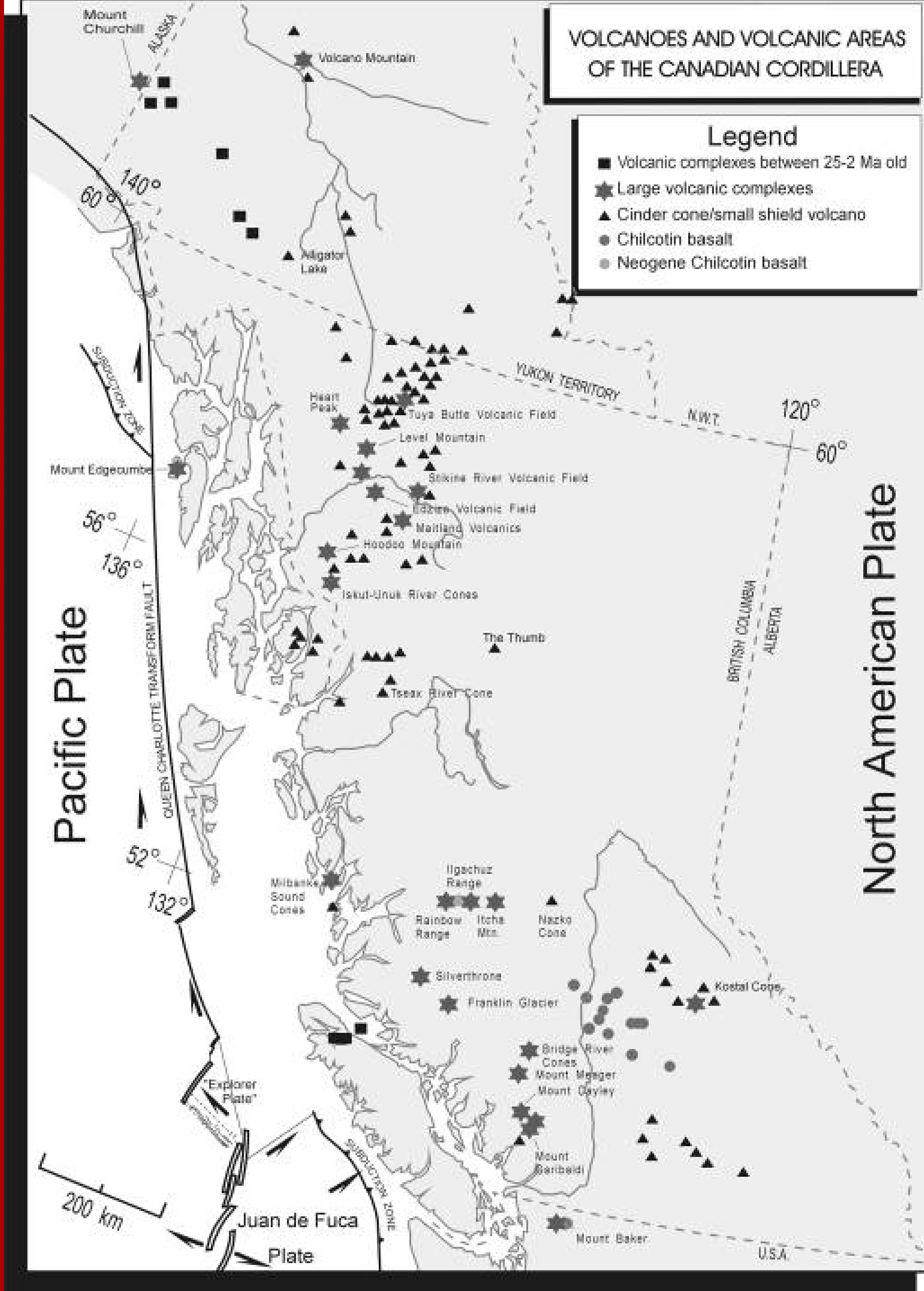


Western Canada has all tectonic elements found globally subduction zones, hotspots and crustal rifting.

Volcanoes of Canada

Canadian Volcanic Regions

Over 200 volcanic centres exist in British Columbia and Yukon that have been active in the last two million years.



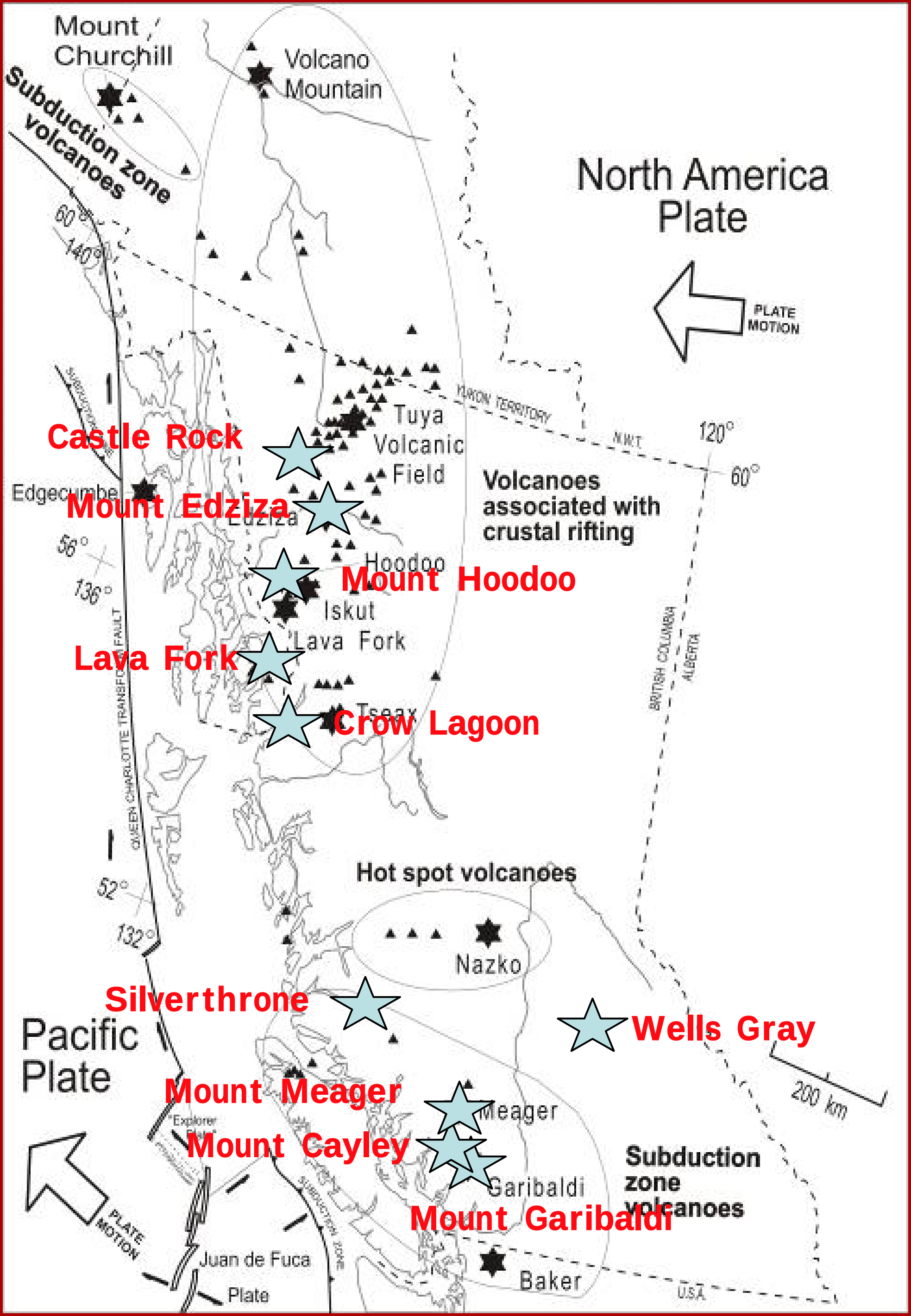
Canadian Volcanic Regions

The volcanoes younger than about 5 million years in western Canada can be grouped into 6 volcanic regions with specific tectonic origins:

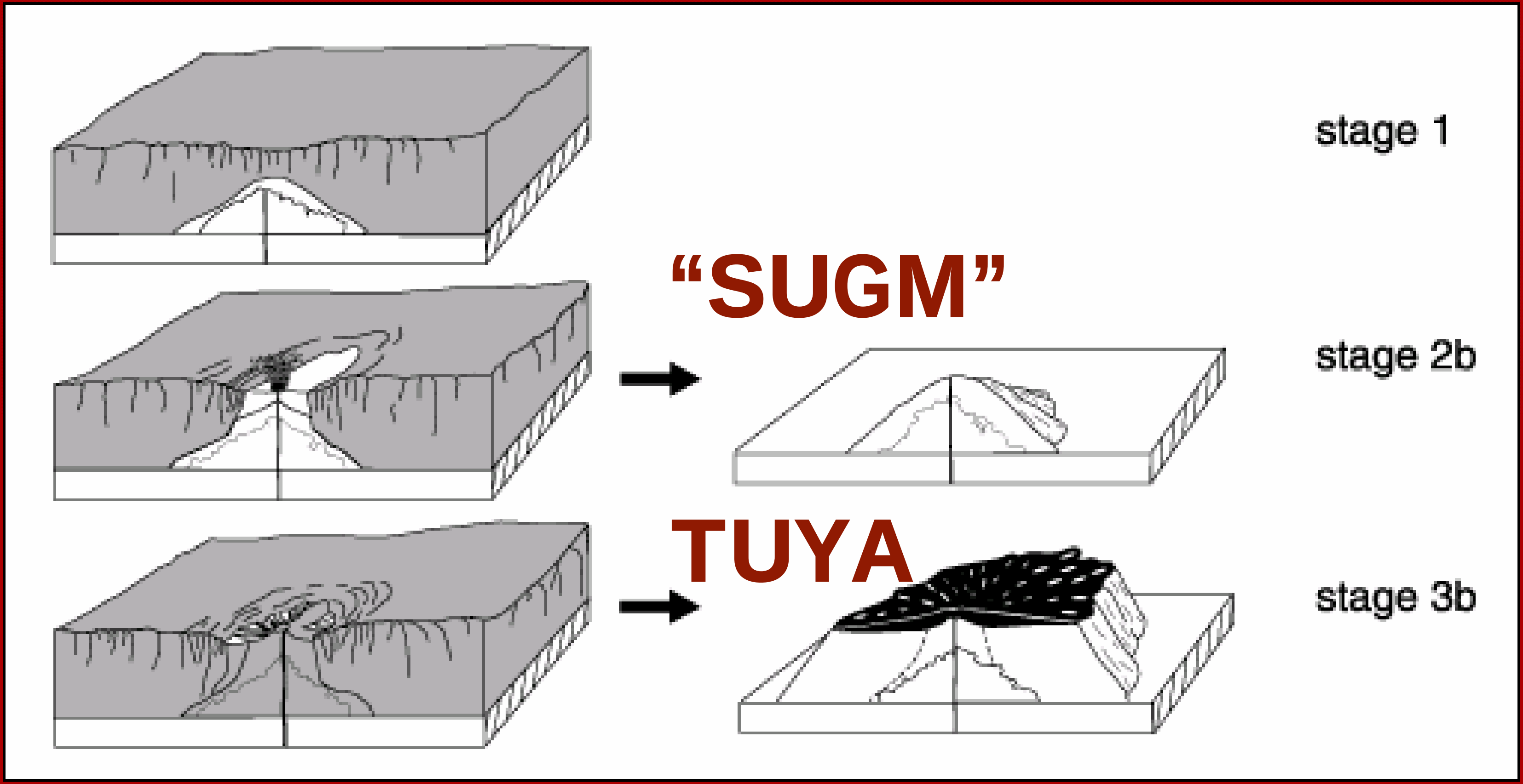
- Wrangell Volcanic Belt - subduction
- Stikine Volcanic Belt - continental rifting
- Anahim Volcanic Belt - hotspot
- Wells Gray-Clearwater Volcanic Field crustal weakness?
- Chilcotin Plateau Basalts - back arc
- Garibaldi Volcanic Belt - subduction

Top 10 Canadian Volcanoes, based on Recent Seismic Activity; There are over 200 geological young volcanic centres.

- Castle Rock
- Mt. Edziza
- Mt. Hoodoo
- Lava Fork
- Crow Lagoon (basaltic field)
- Wells Gray – Clearwater (basaltic field)
- Silverthrone
- Mt. Meager
- Mt. Cayley
- Mt. Garibaldi



Fire and Ice –
Canada's peculiar subglacial volcanoes

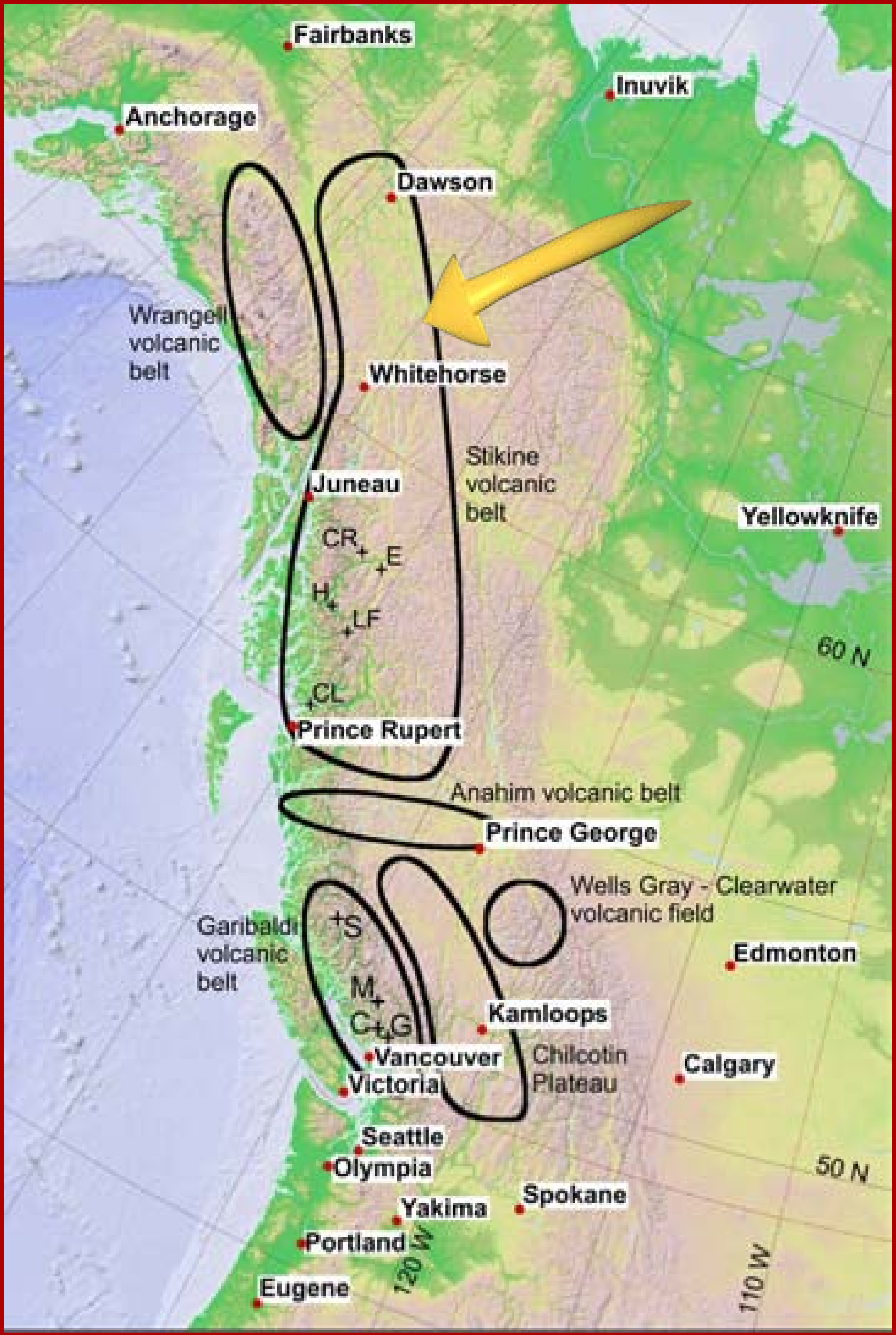


In addition to shield volcanoes, stratovolcanoes, cinder cones, etc., many volcanoes in Canada formed when they were covered, or surrounded by glacial ice. This interaction has lead to specific "subglacial" landforms.

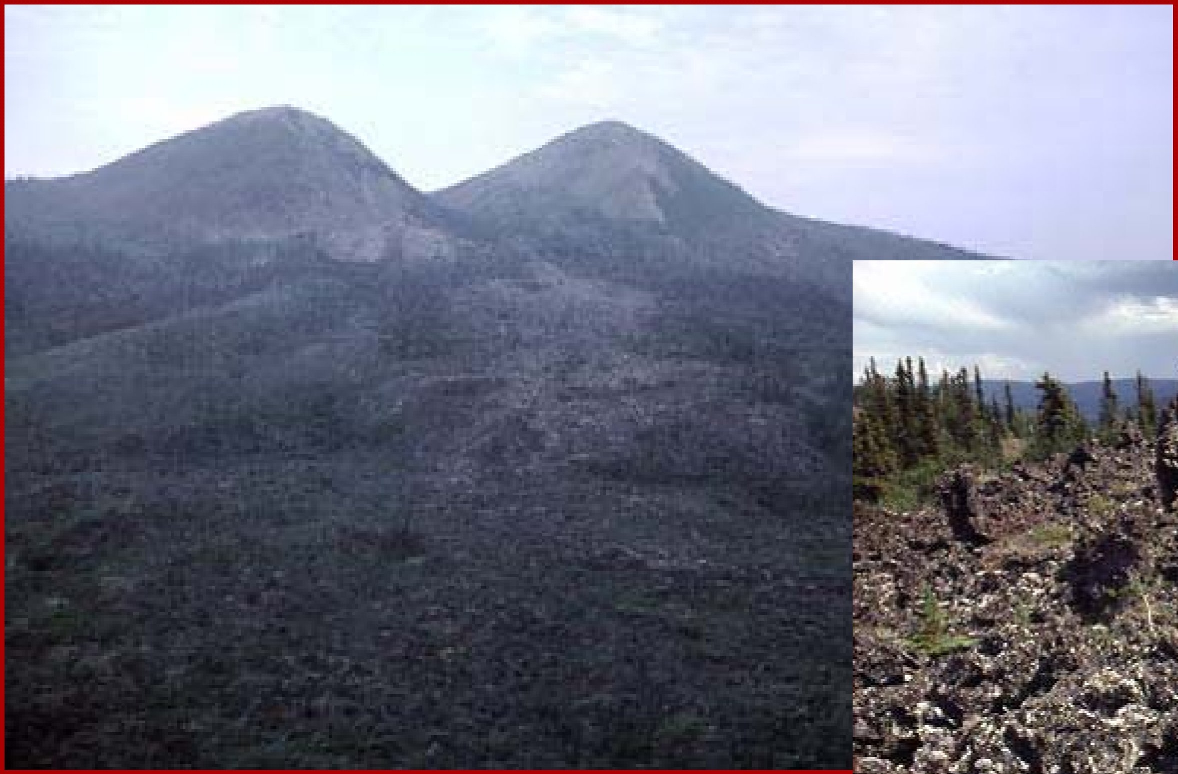
Fire and Ice –
Canada's peculiar subglacial volcanoes

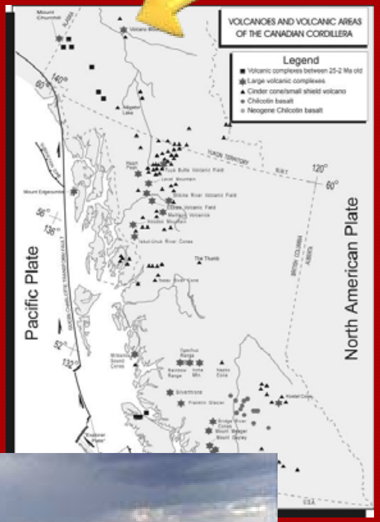
As the volcano grows in its subglacial prison, lava pours out and forms "pillows". As the mound of pillows grows, the pillows start to role down the sides. The rolling pillows break apart and form "hyaloclastite" – a rock made up of broken pillows and the glassy rinds of the pillows.

Stikine Volcanic Belt crustal rifting



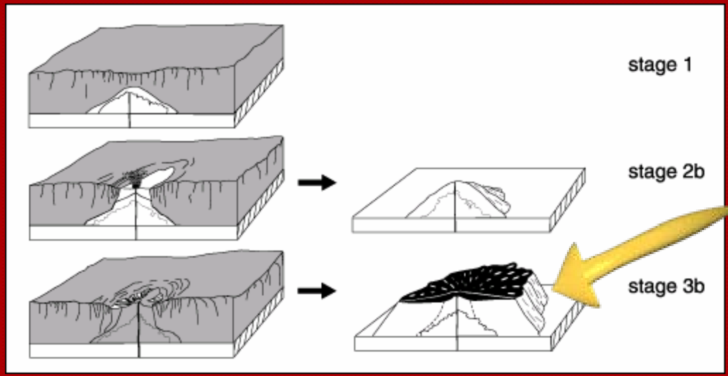
Volcano Mountain, Yukon





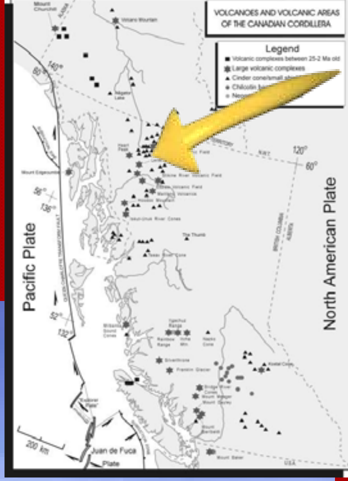
Volcano Mountain is a small, asymmetrical cinder cone approximately 300 m high in the Stikine Volcanic Belt. The surface of the lava from the vent broke into chunks as it flowed, creating the clinkery surface.

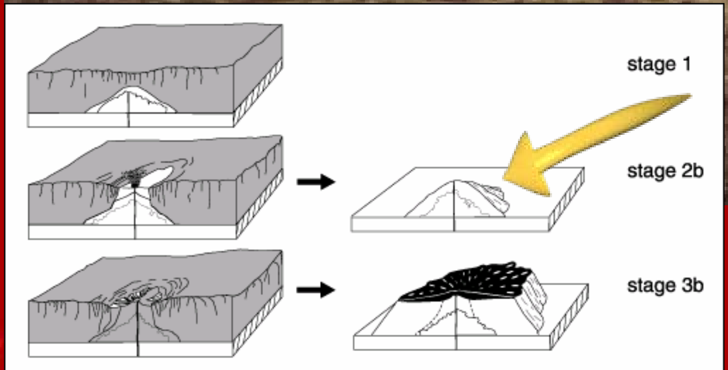
Tuya Butte, Stikine Belt



Tuya Butte is the type locality for “tuyas” – flat topped, steep sided subglacial volcanoes.

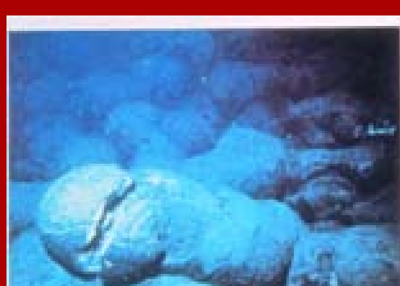
Caribou SUGM, Stikine Belt

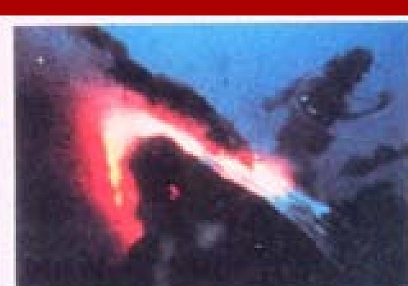




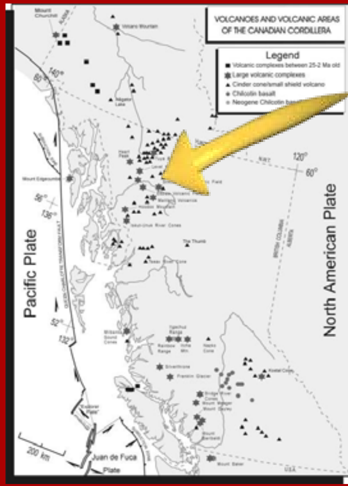
Pillows and breccia, Stikine Belt

As most of the volcanoes in the Tuya Butte area have formed sub glacially, extensive deposits of pillows and hyaloclastite can be found in the area.





Mt. Edziza, Stikine Belt

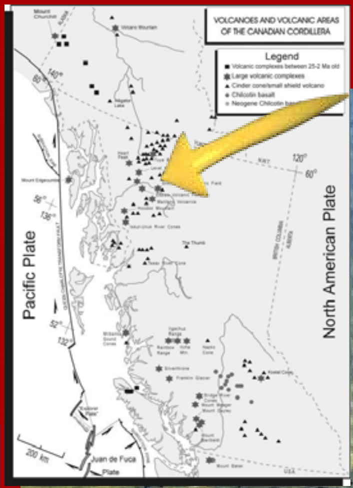


Pyramid Mountain, Stikine Belt

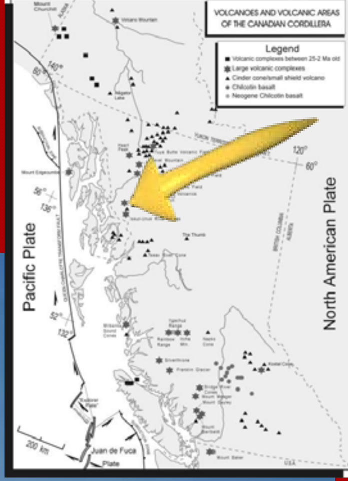
Volcanoes of Canada

V4

Eve Cone near Mount Edziza

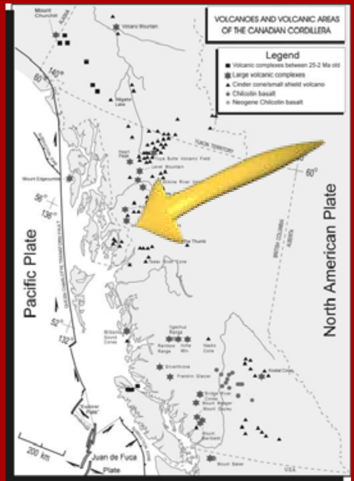


Hoodoo Volcano, Stikine Belt



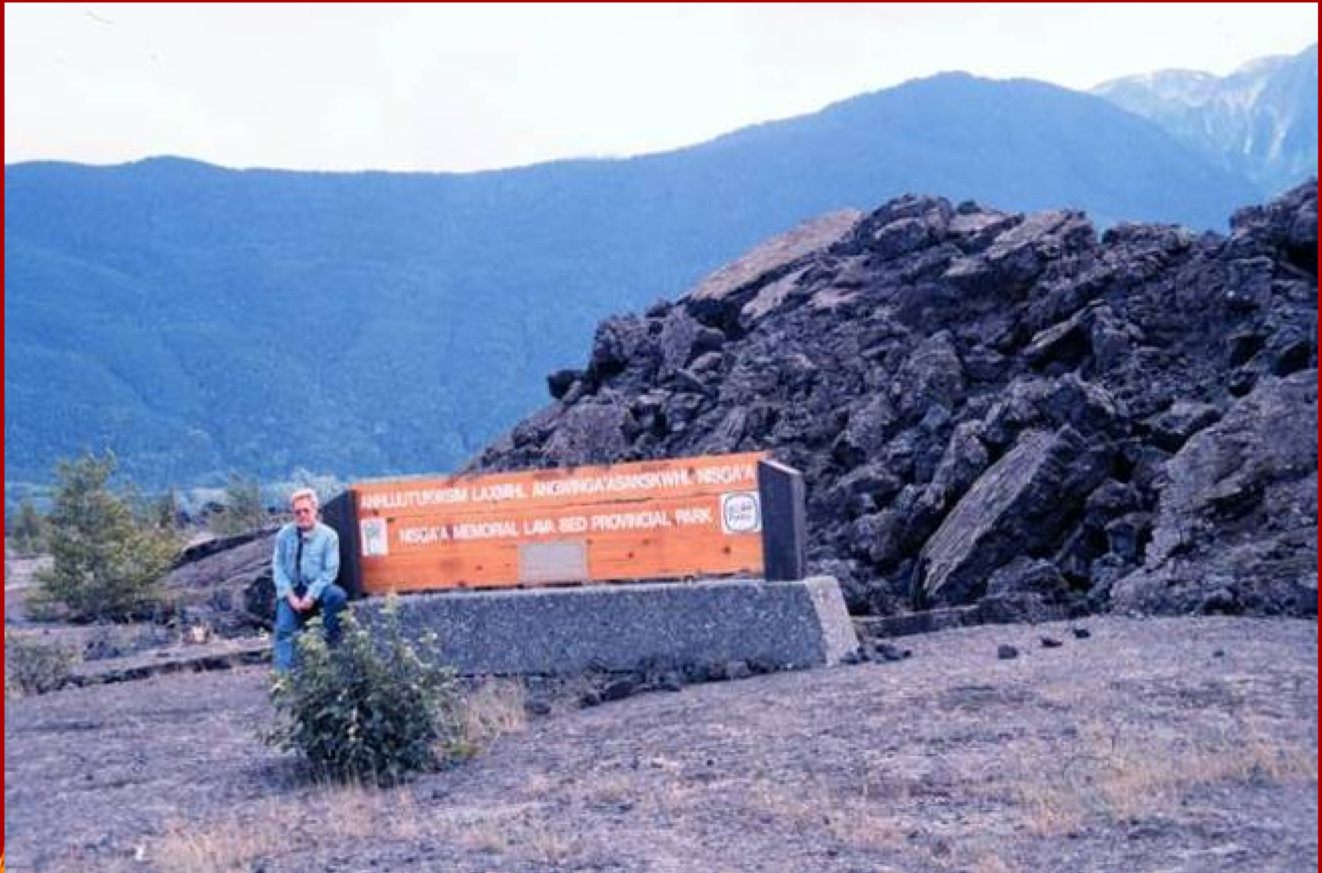
Lava Fork, Stikine Belt

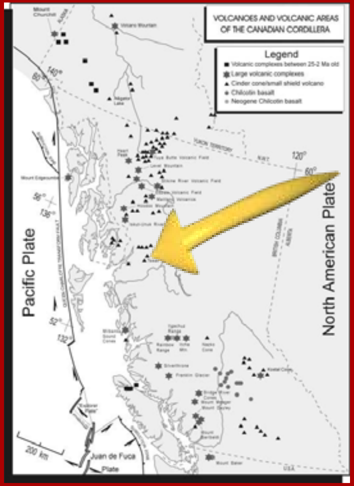
Although the vent area at Lava Fork Volcano is relatively nondescript, significant quantities of lava poured down the steep slopes into the valley below, traveling over 15 km. At about 150 years old, it may be Canada's youngest volcano.



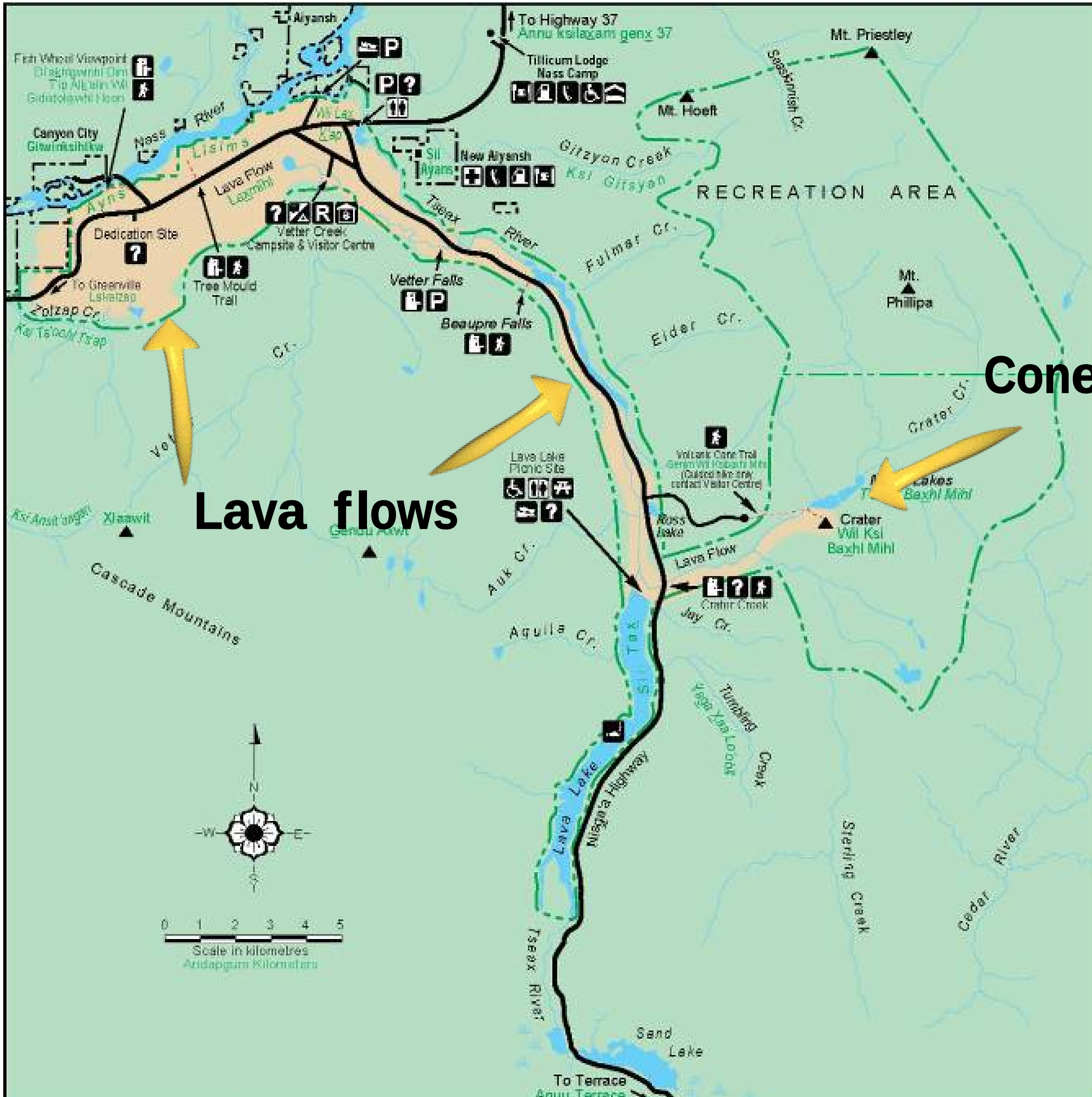
Nisga'a Memorial Lava Bed Provincial Park

Tseax Cone and lava flows in the Stikine Belt, is the site of one of Canada's worst geological disaster - an estimated 2000 people died of "poison smoke" (most likely CO_2).





Map of Memorial Park



LEGEND – ADAAWAK

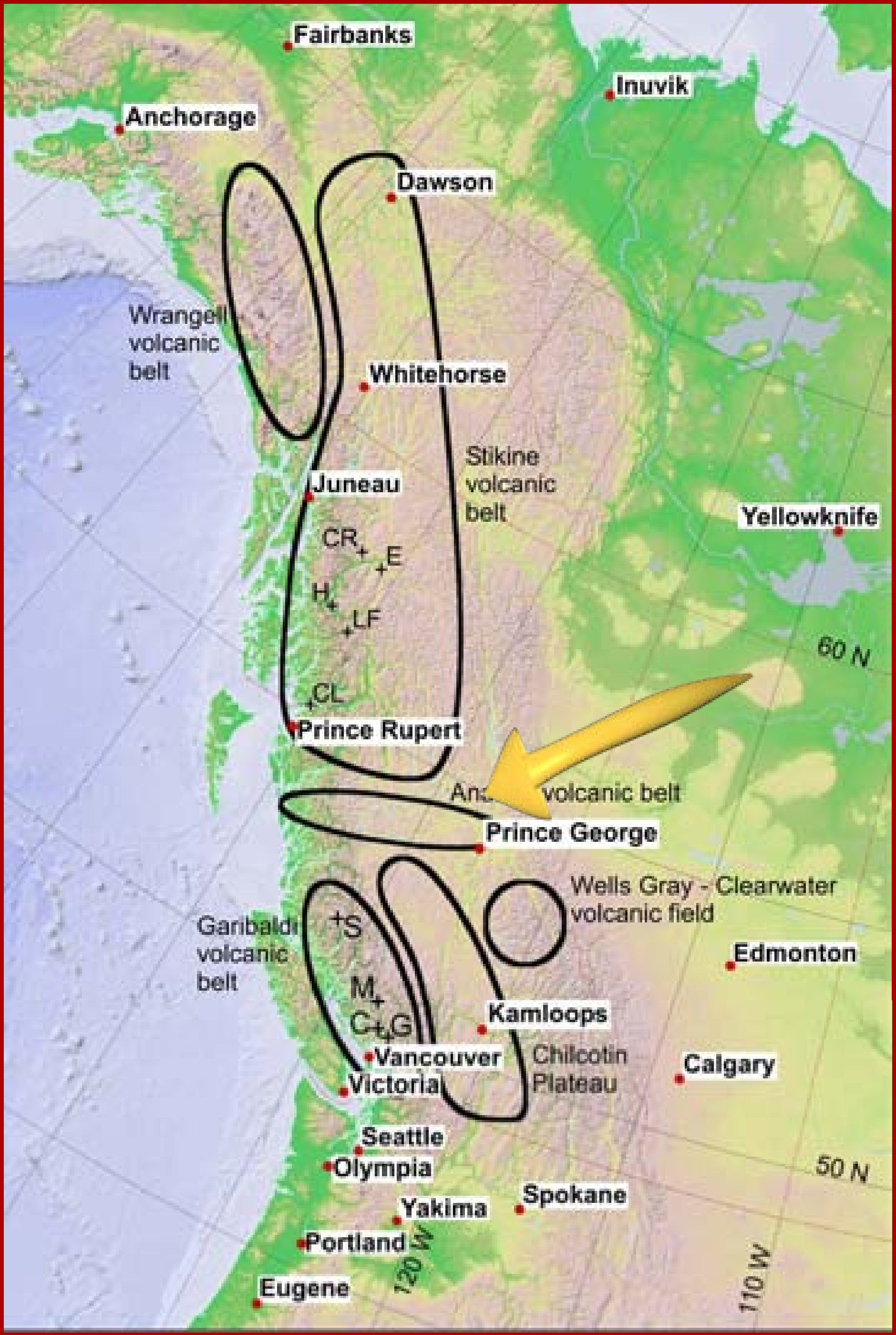
Crater Creek and Tseax River valley

The Nass River valley was inundated by the lava flows from Tseax Cone

Tseax lava flows contain abundant tree moulds and caves, formed from draining of the lava flows.

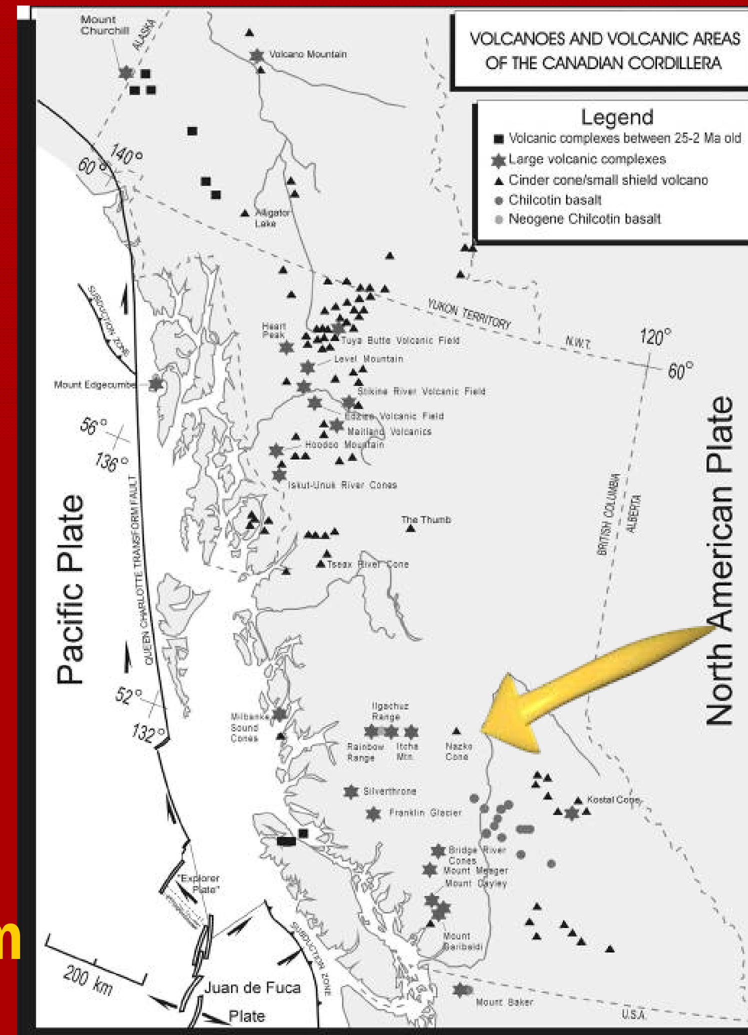
Tseax volcano first nation's story of destruction, Canada's worst known geophysical disaster. Over 2000 people killed from poison smoke (most likely CO_2).

Anahim Volcanic Belt
Hot spot



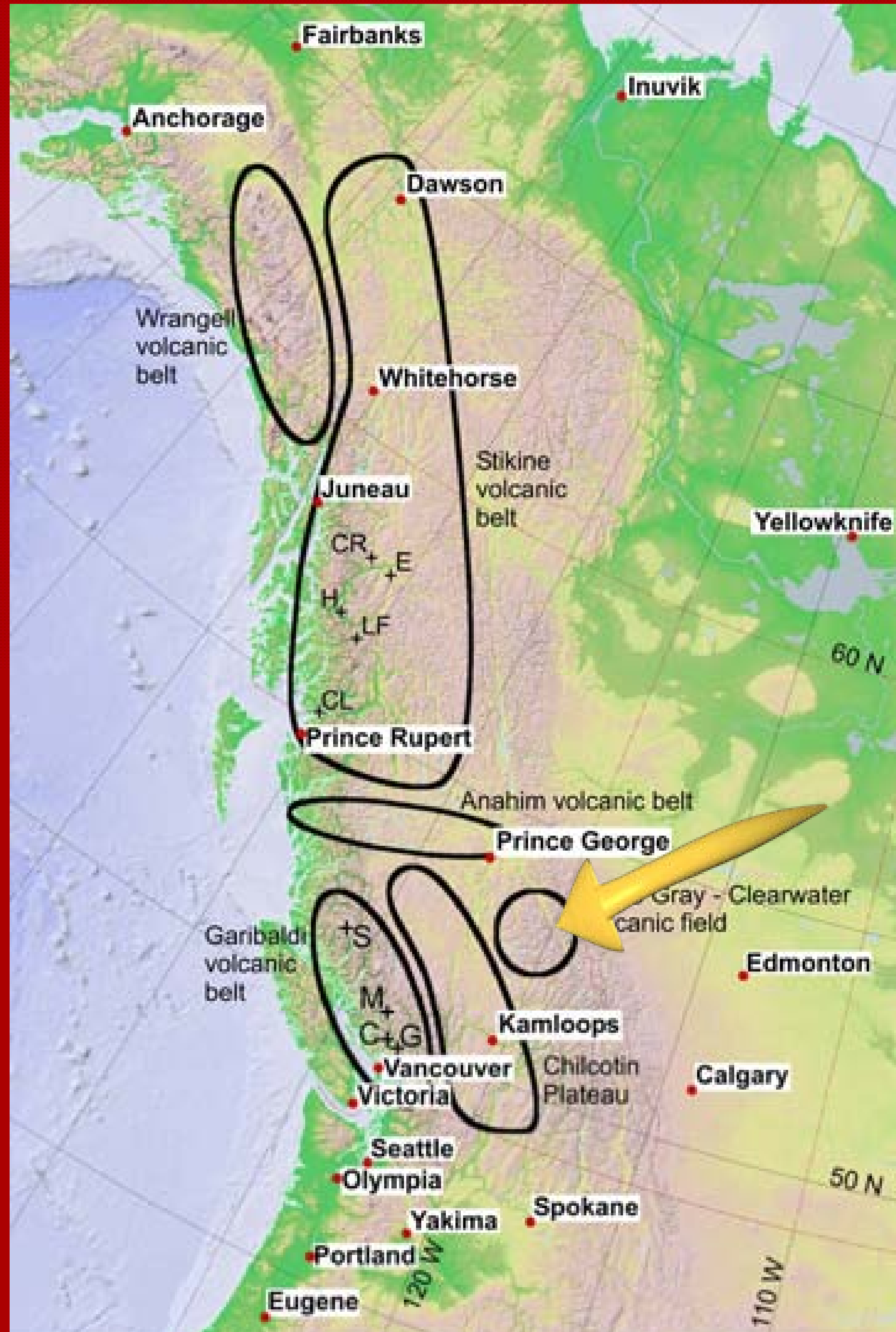
Ilgatchuz Range – Anahim volcanic Belt

Ilgatchuz Range – a major shield volcano in the belt.

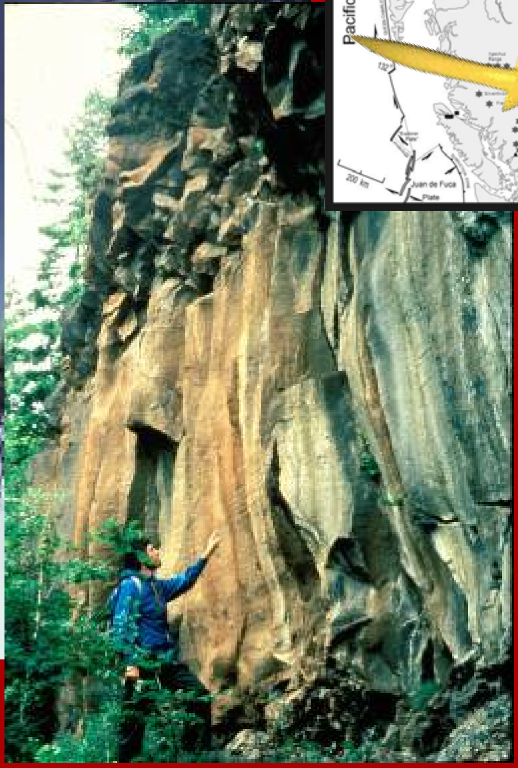


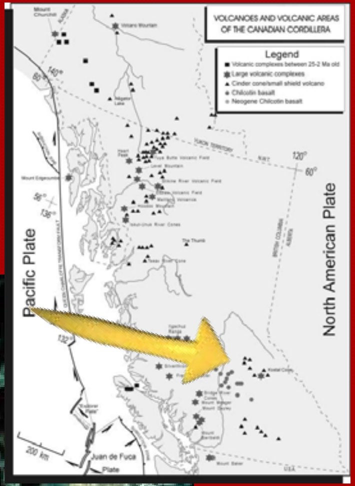
Canada's hot spot track – the Anahim volcanic belt, extends from the pacific Ocean to Nazko cone, west of Quesnel. The volcanoes range in age from 12 million (western end) to a few thousand (western end).

Wells Gray - Clearwater Volcanic Field
Crustal rifting?



Wells Gray - Clearwater volcanic field





The Wells Gray region of east-central British Columbia is a volcanic field made up of numerous, small, basaltic volcanoes, many modified by glacial interaction.

Dragon Cone, Wells Gray - Clearwater

Dragon Cone is the source of the 15 km long Dragon's tongue lava flow that dams Clearwater Lake. The cone, made up of cinders, blocks, and bombs, is perched on the side of a ridge of metamorphic rock.

Hyalo Ridge, Wells Gray - Clearwater

Hyalo Ridge is an example of a tuya: a sub-glacial volcano with a characteristic flat-top. Tuya's have subaqueous deposits such as pillows.

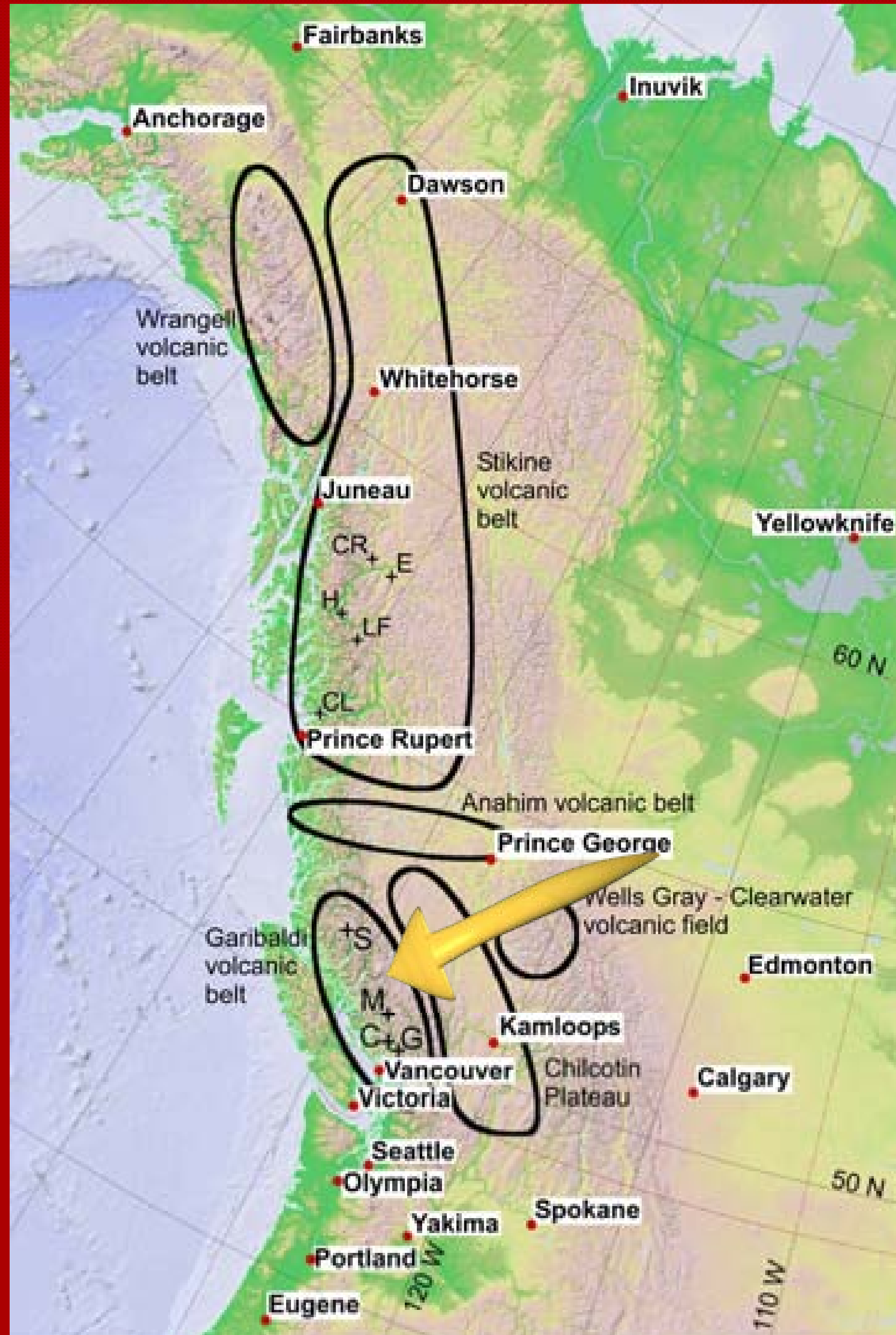
Whitehorse Bluff, Wells Gray - Clearwater

Whitehorse Bluff is a sub-aqueous volcano composed of fragmented volcanic glass. The glass is the result of explosive interaction of the lava with water.

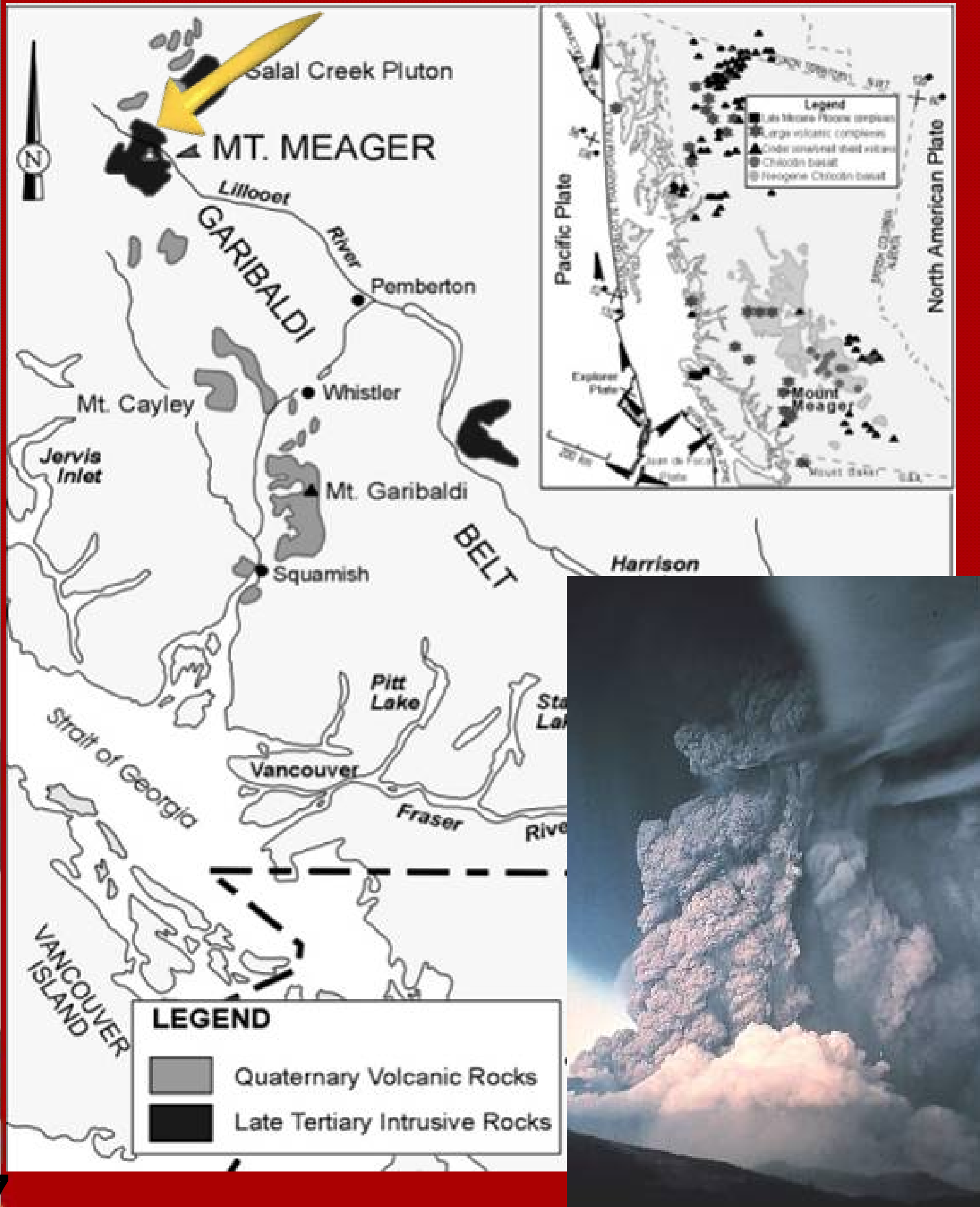
Pyramid Mountain, Wells Gray - Clearwater

Pyramid Mountain was formed below several thousand metres of glacial ice. The eruptions ceased before it became the characteristic “tuya” shape of subglacial volcanoes.

Garibaldi Volcanic Belt Subduction



Mt. Meager, Garibaldi Volcanic Belt

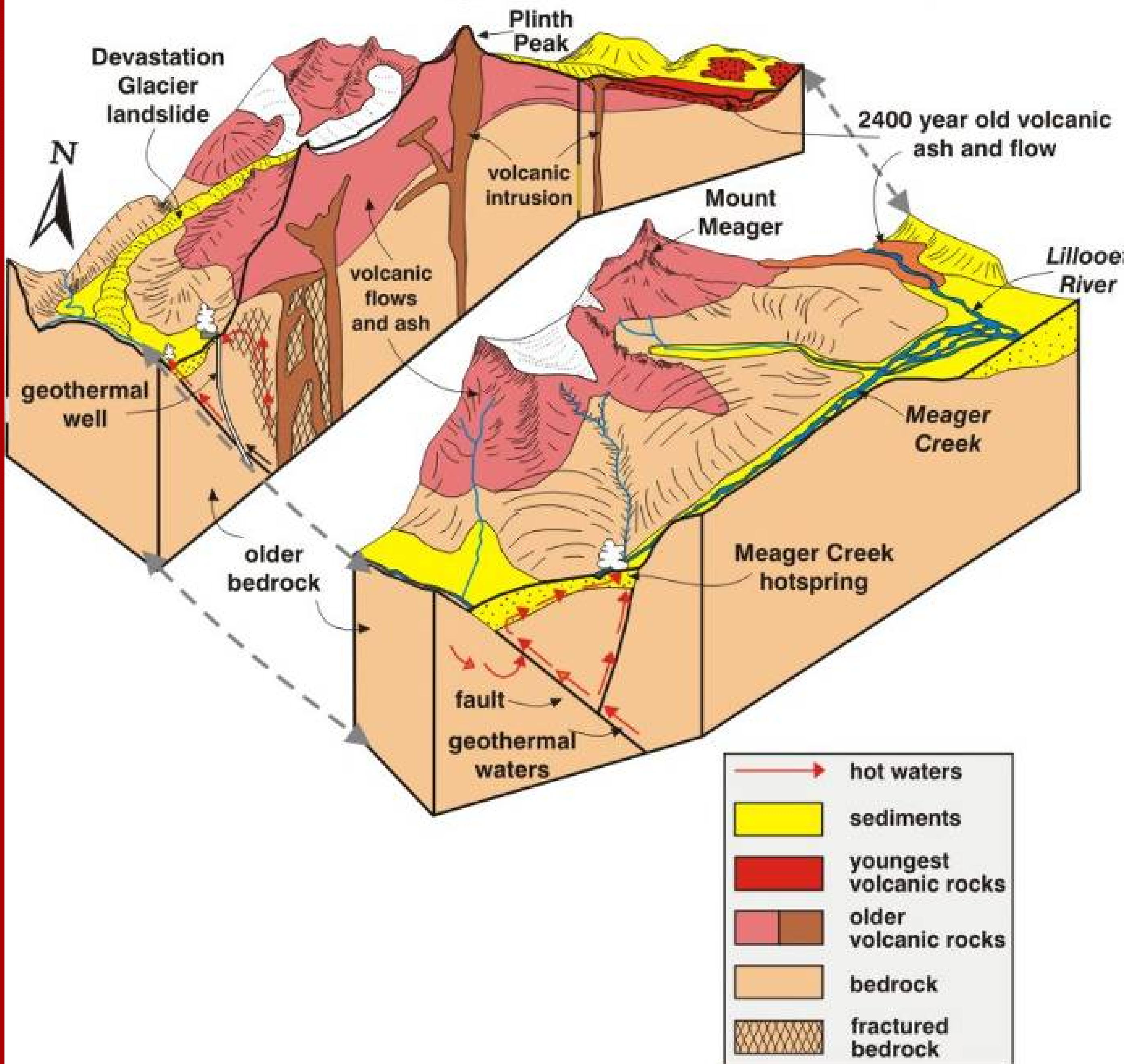


150 km north of Vancouver is the youngest of four overlapping stratovolcanoes. Recent volcanic activity started 2350 years ago from a vent on the northeast side of the mountain and consisted of a massive, dacitic, Plinian eruption, similar in size to the May 19, 1980 eruption of Mt. St. Helens.

Mt. Meager, Garibaldi Volcanic Belt

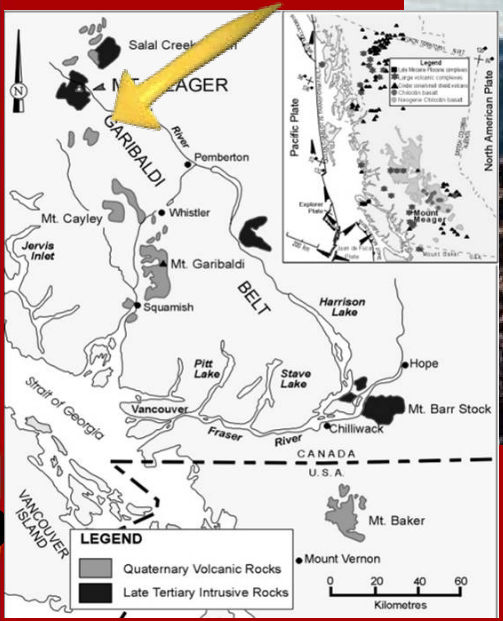
Mt. Meager's most recent eruption was from the amphitheatre shaped area on the volcano's flank. Falls Creek, a nearby waterfall cuts through the dacite columns formed by the lava flows that followed the explosive phase of the eruption.

Mt. Meager Volcanic Complex

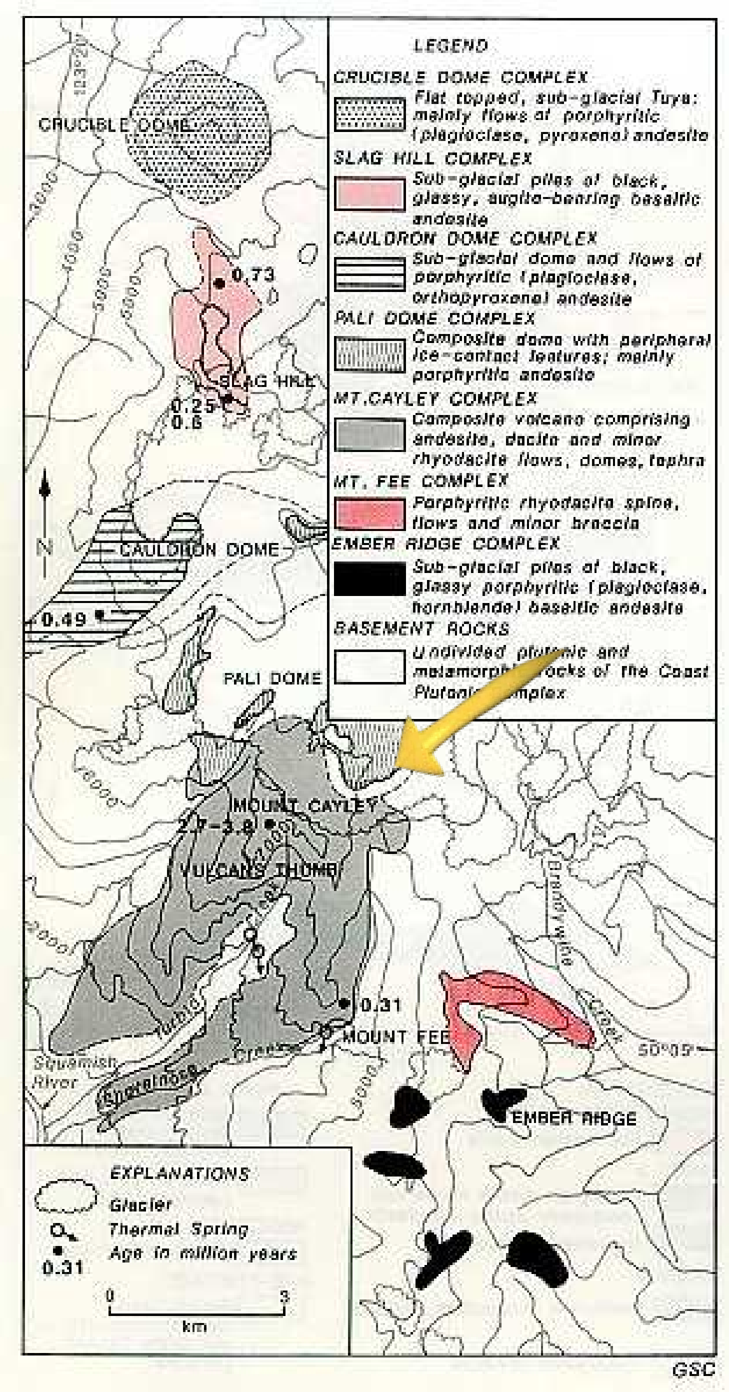


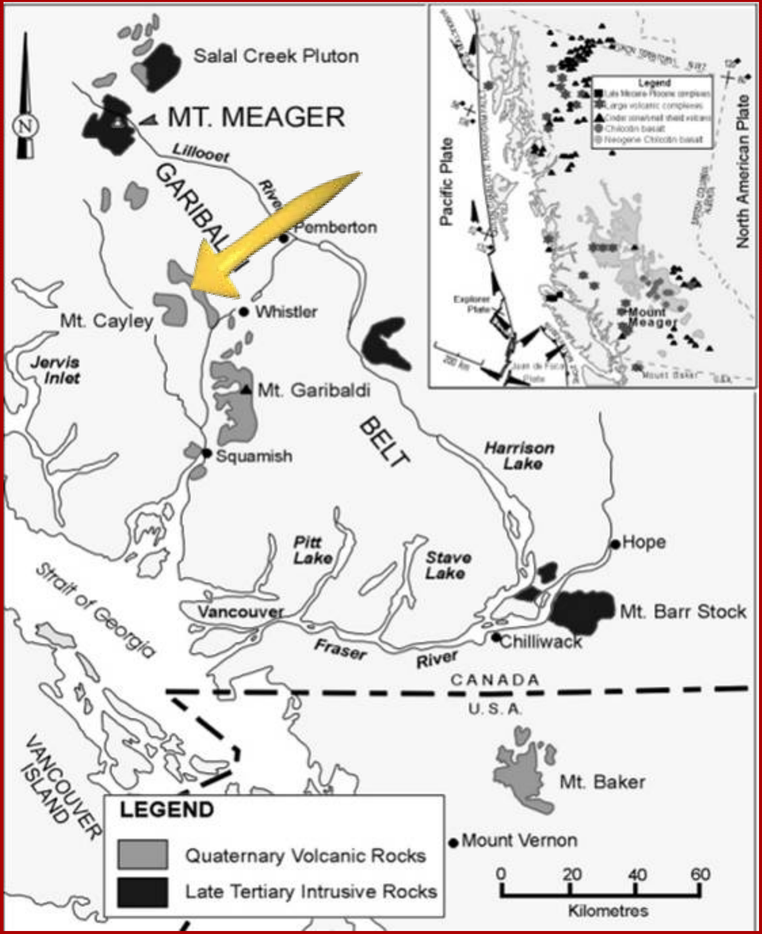
Little Ring Mt., Garibaldi volcanic belt

Little Ring Mountain, a subglacial volcano.



Geology of Mt. Cayley Area, Garibaldi volcanic belt



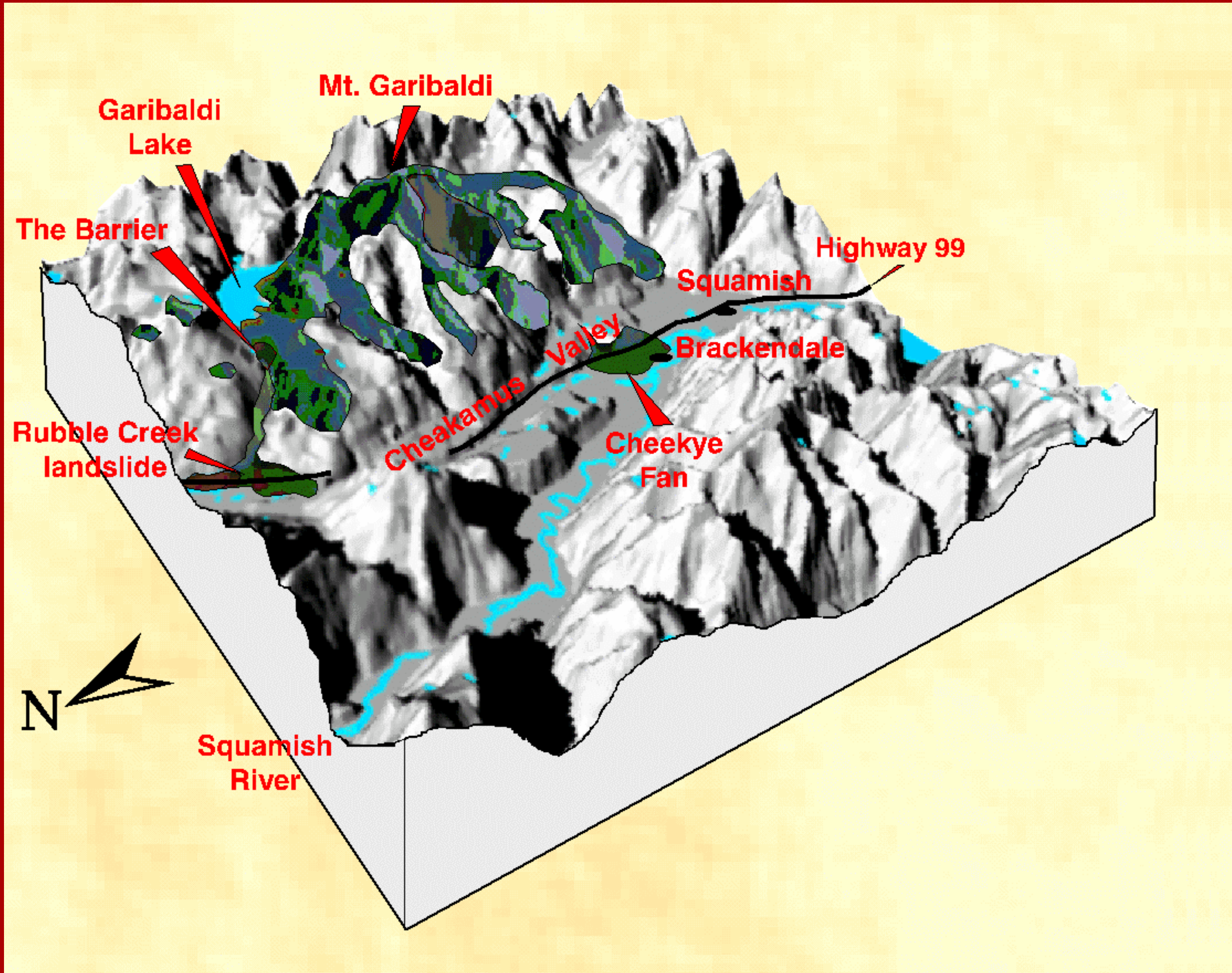


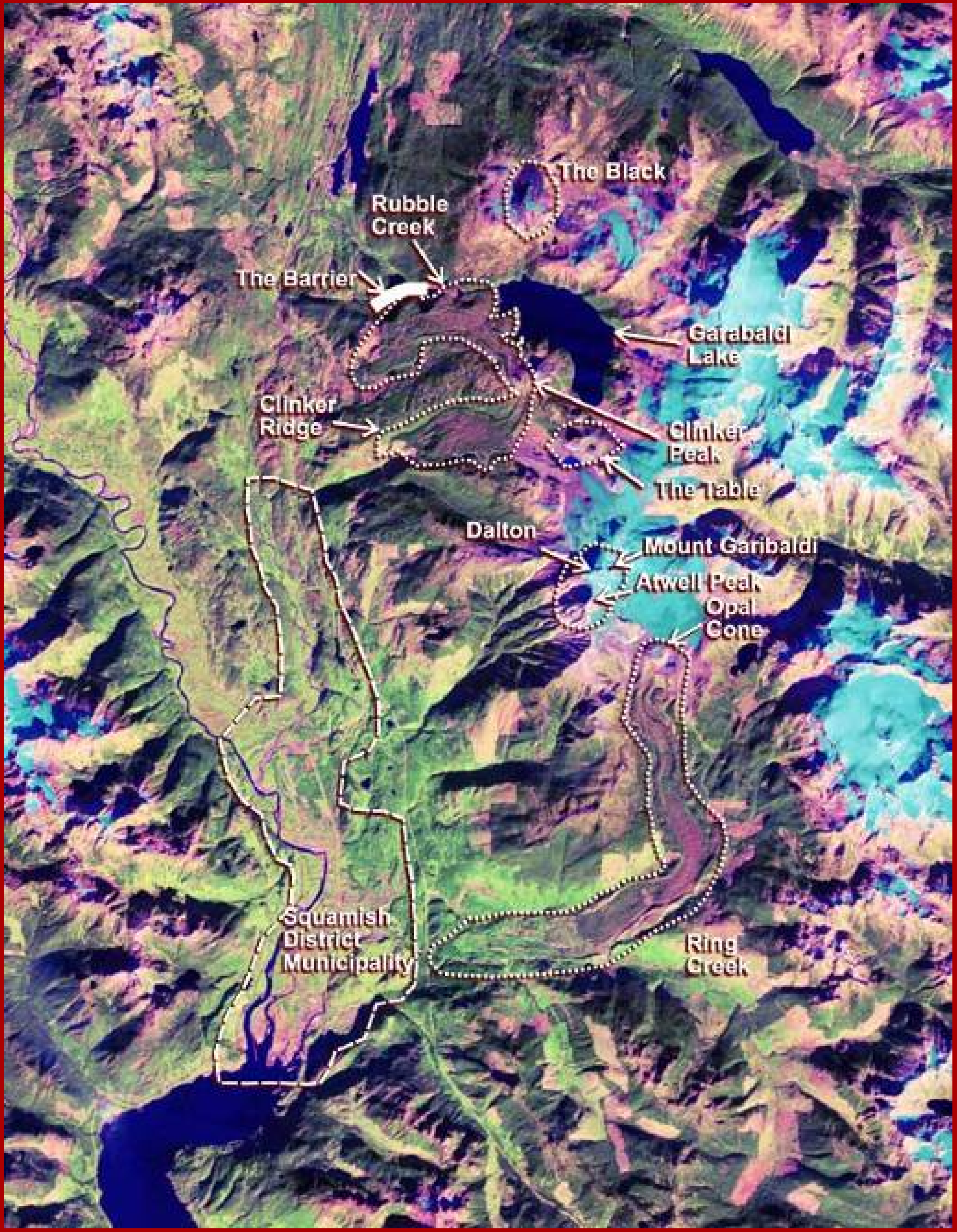
Mt. Cayley, Garibaldi Volcanic Belt

Mt. Cayley is still the site of several hot springs and anomalous geophysical properties.

Mt. Fee, Garibaldi Volcanic Belt

To the east of the Cheakamus valley are many volcanoes – shown here in shades of green. These volcanoes are all part of the Garibaldi Volcanic Belt.

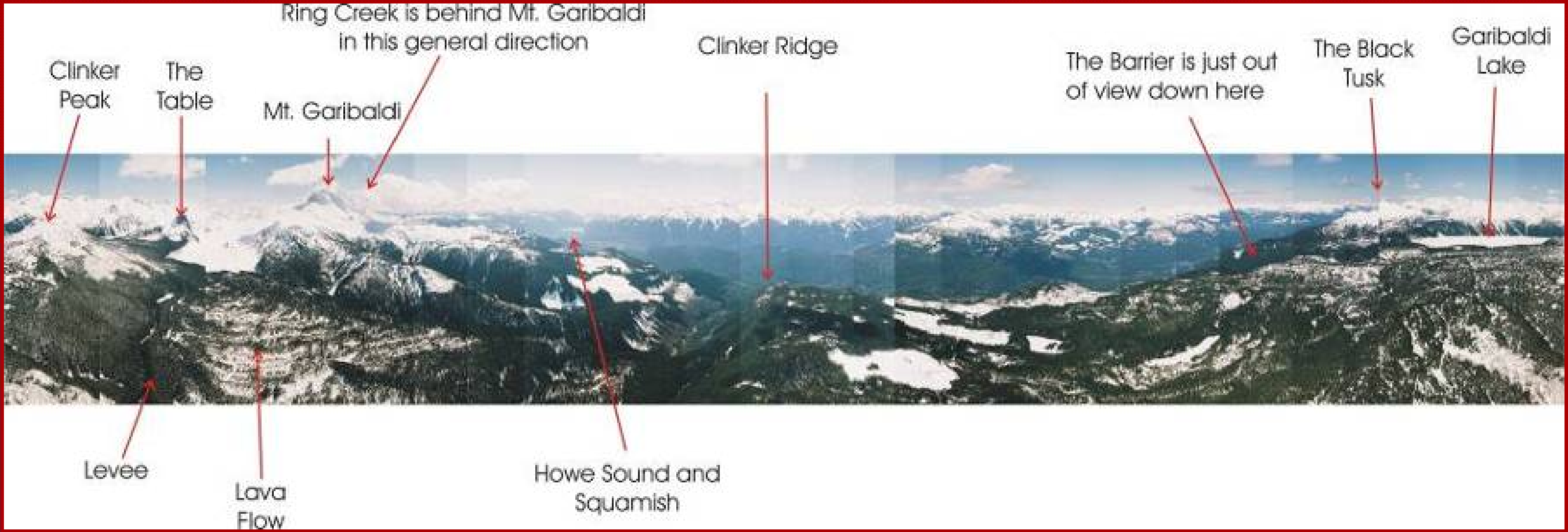




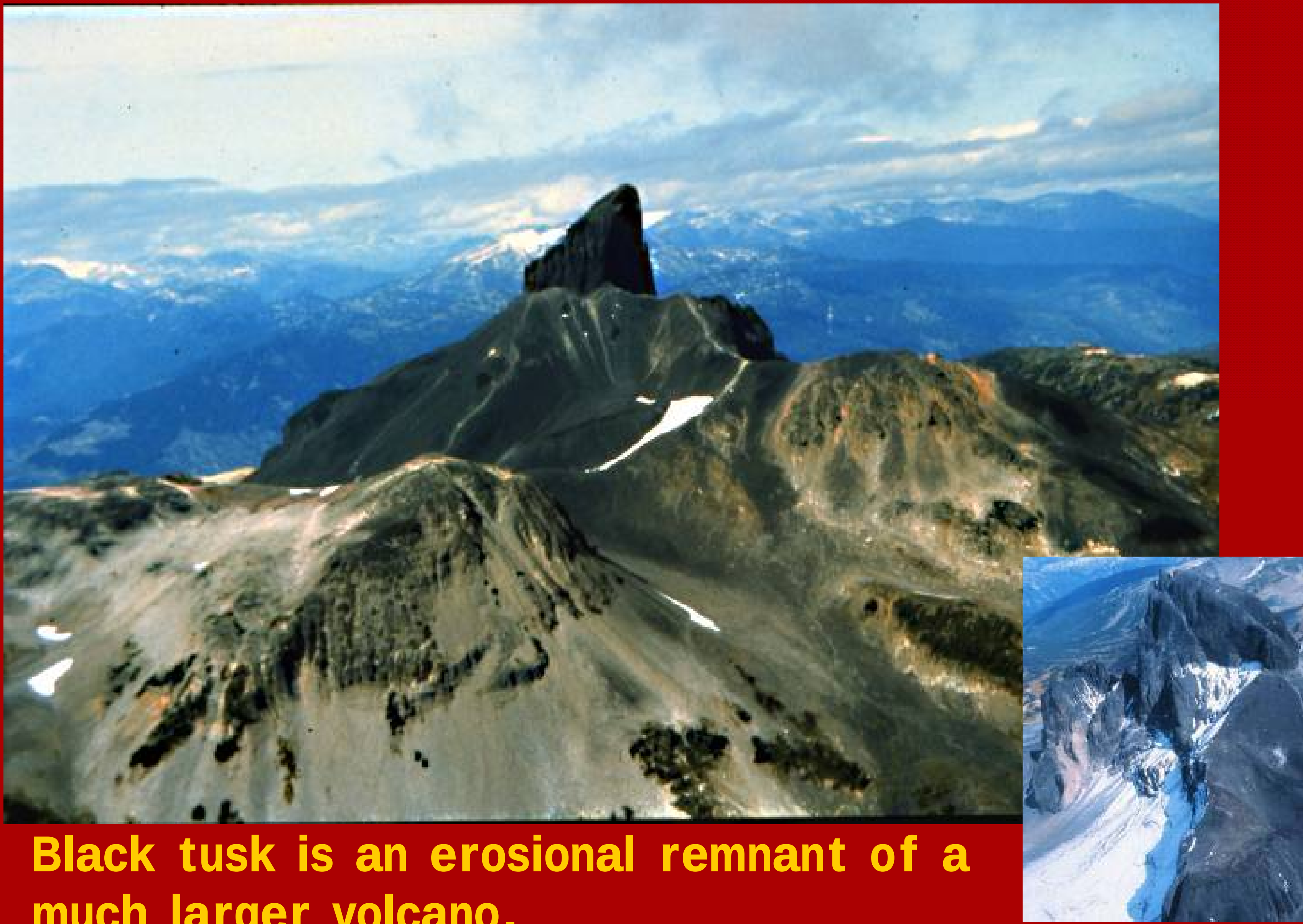
Garibaldi satellite imagery

This LandSAT image shows several different volcanic features including lava flows (Ring Creek), a volcanic neck (Black Tusk), a subglacial volcano (the Table) and a partly eroded stratovolcano (Garibaldi).

Garibaldi Area Panorama



Black Tusk, Garibaldi Volcanic Belt

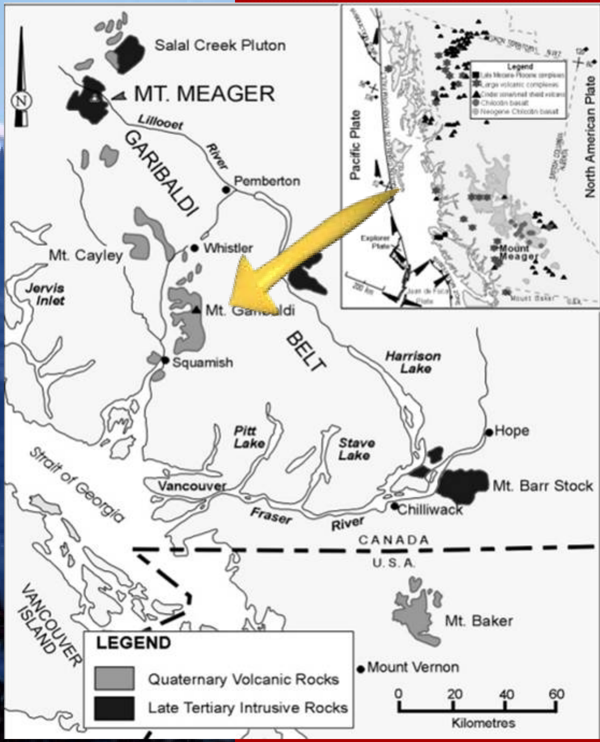


Black tusk is an erosional remnant of a much larger volcano.

The Table, Garibaldi Area

The Table is composed of lavas that cooled in contact with glacial ice, probably in a chimney like void in the ice.

Mount Garibaldi: BC’s Best Known Volcano



Volcanoes of Canada

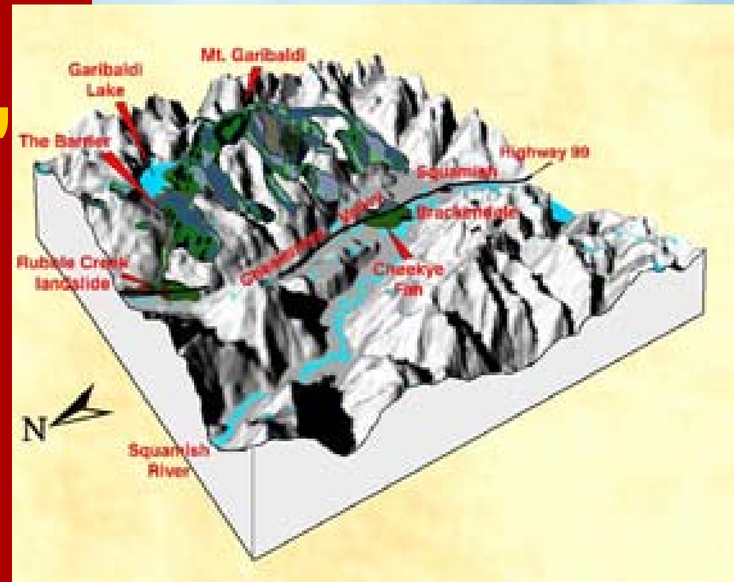
Mount Garibaldi, Atwell Peak and Dalton Dome - the three peaks that make up Garibaldi Volcano

Formed from multiple eruptions, the volcano was built out onto glacial ice that filled the valley. The failure after the ice melted left this steep, precipitous cliff on the volcanoes SE flank.

Garibaldi Area Volcanoes

Garibaldi volcano consists of 3 peaks – Mt. Garibaldi, Atwell Peak, and Dalton Dome, seen here in the background. From left to right, Table Mountain is a flat-topped, steep-sided volcano that erupted under glacial ice. Clinker Peak and Mt. Price are the volcanoes in the foreground.

The Barrier, Garibaldi Area

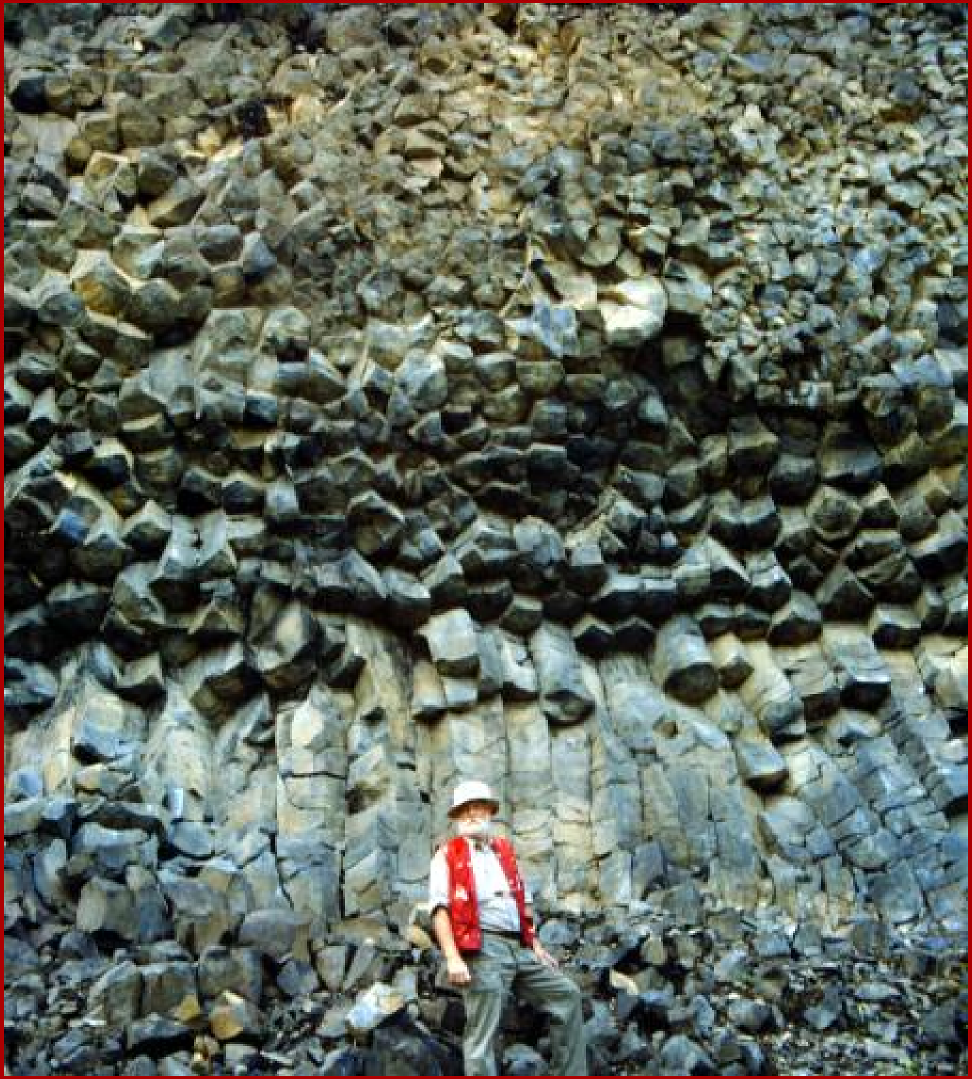


Clinker Peak lava flow was stopped by glacial ice filling the Cheakamus valley during eruption. The steep flow front has failed in a series of large landslides.

Clinker Peak and Mt. Price, Garibaldi volcanic belt

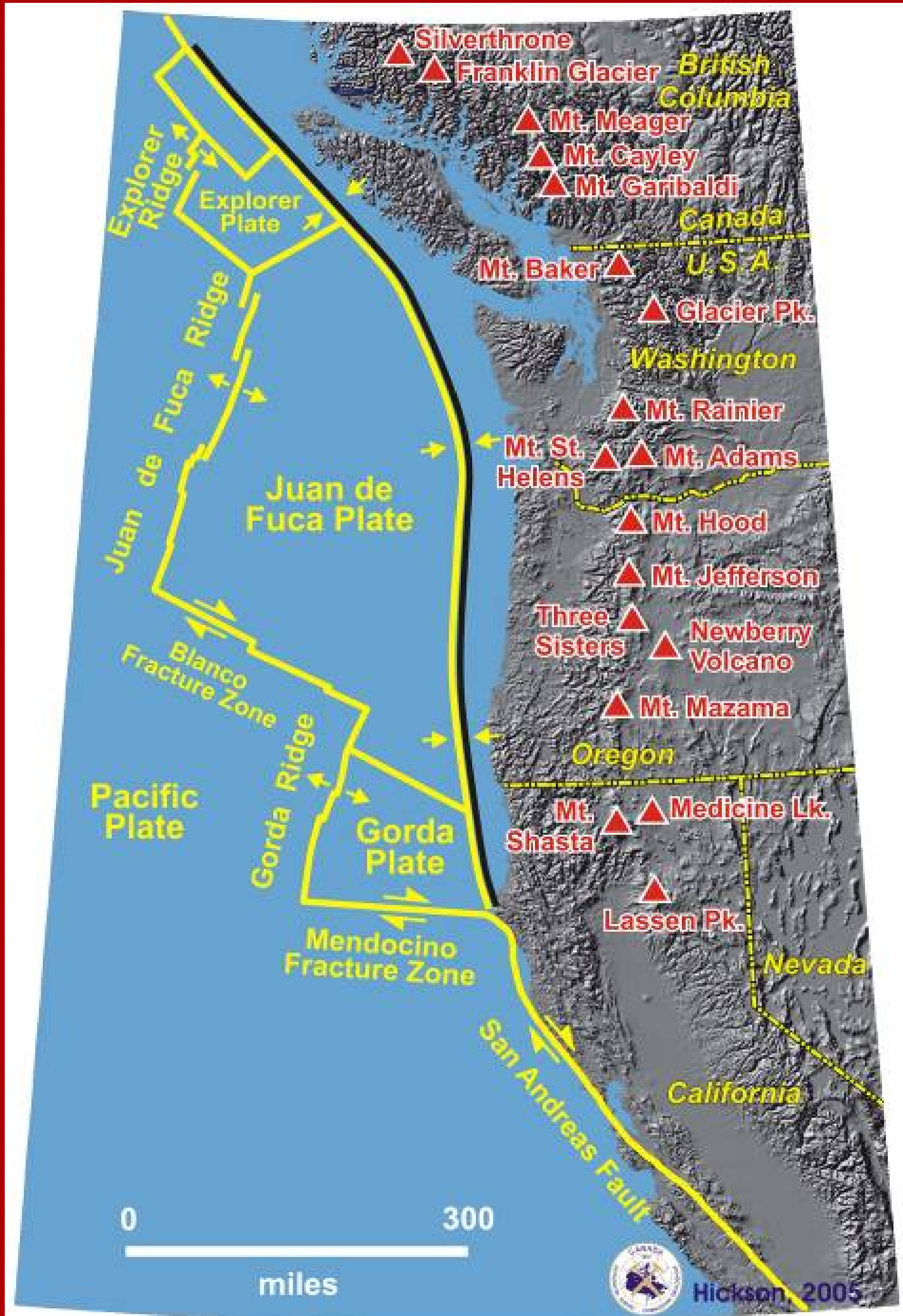
Mt. Price and Clinker peak are the source of the barrier lava flow. This flow dams and forms Garibaldi Lake.

Columnar basalt near Brandywine Falls Garibaldi Volcanic Belt



Volcanoes of Canada

USA volcanoes



Our neighbours to the south

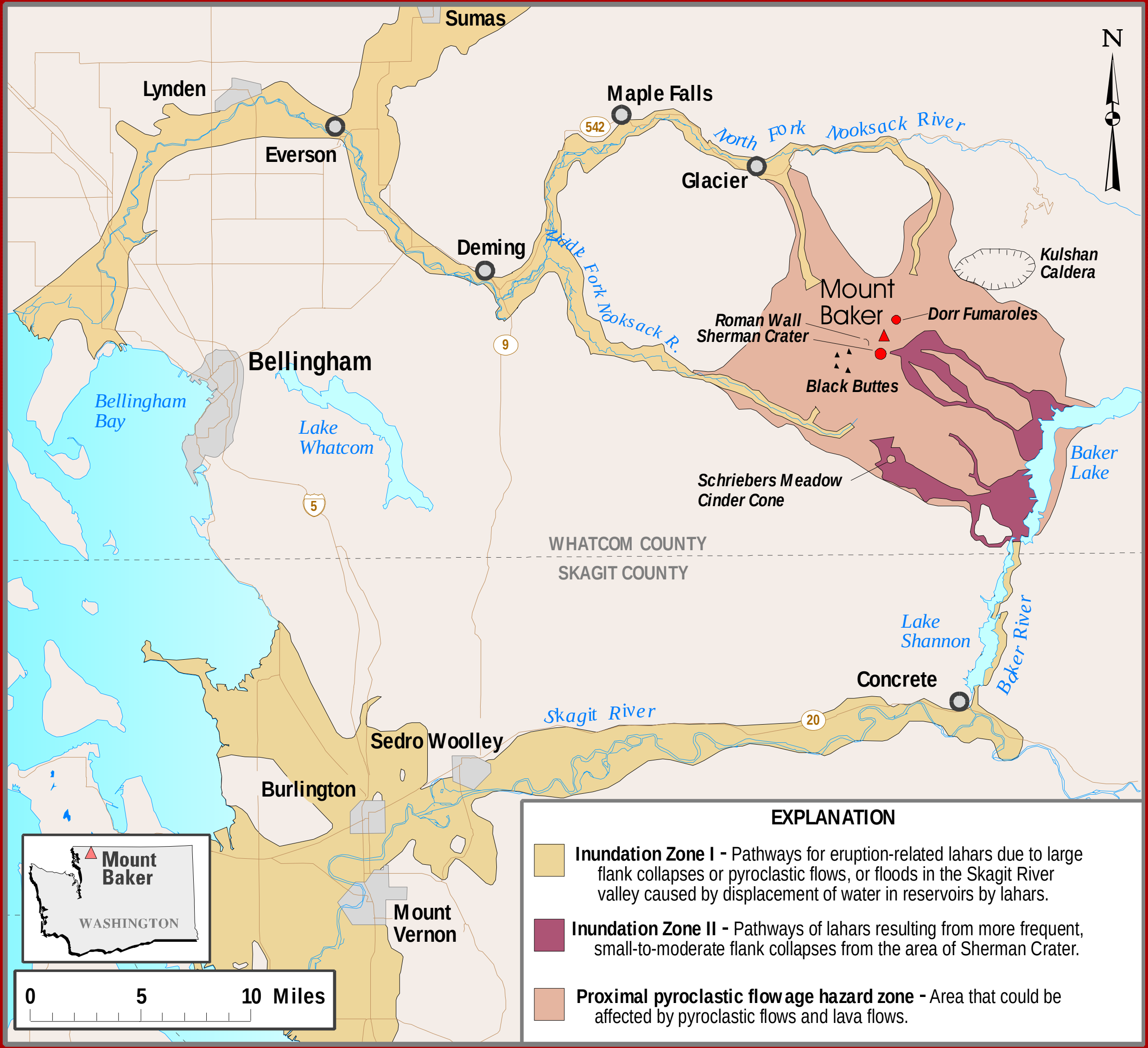
The Garibaldi Volcanic belt is the northern extension of the “Cascade Magmatic Arc” – the name used in the United States for the chain of volcanoes that extends northward from California.

Closest to us are Mt. Baker and Glacier Peak

Mount Baker, Cascade Magmatic Arc

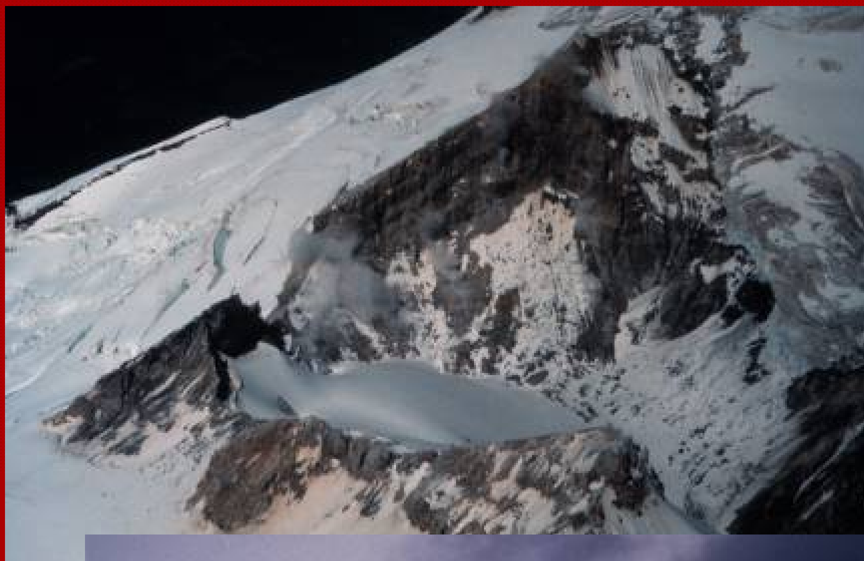
Mount Baker is a towering stratovolcano that last erupted in the 1800's.

Mount Baker Hazard Map



USA volcanoes

Mount Baker, Sherman Crater



Sherman Crater, near Baker’s summit, is the hottest geothermal field in the Cascade Magmatic arc.

Glacier Peak, Washington, USA

Glacier Peak Hazard Map

Web Resources

Volcano sites:

Volcanoes of Canada:
www.nrcan.gc.ca/gsc/pacific/vancouver/volcanoes

USGS Volcanic Hazards Program:
http://volcanoes.usgs.gov

Smithsonian Institution Global Volcanism Program:
www.volcano.si.edu/index.cfm