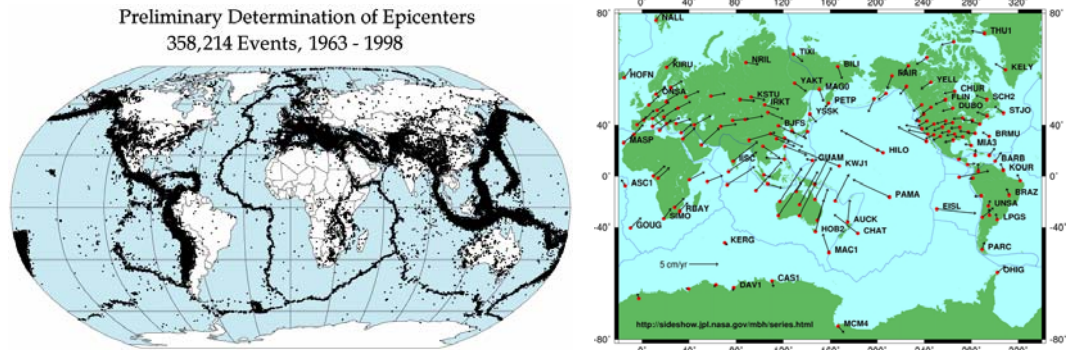


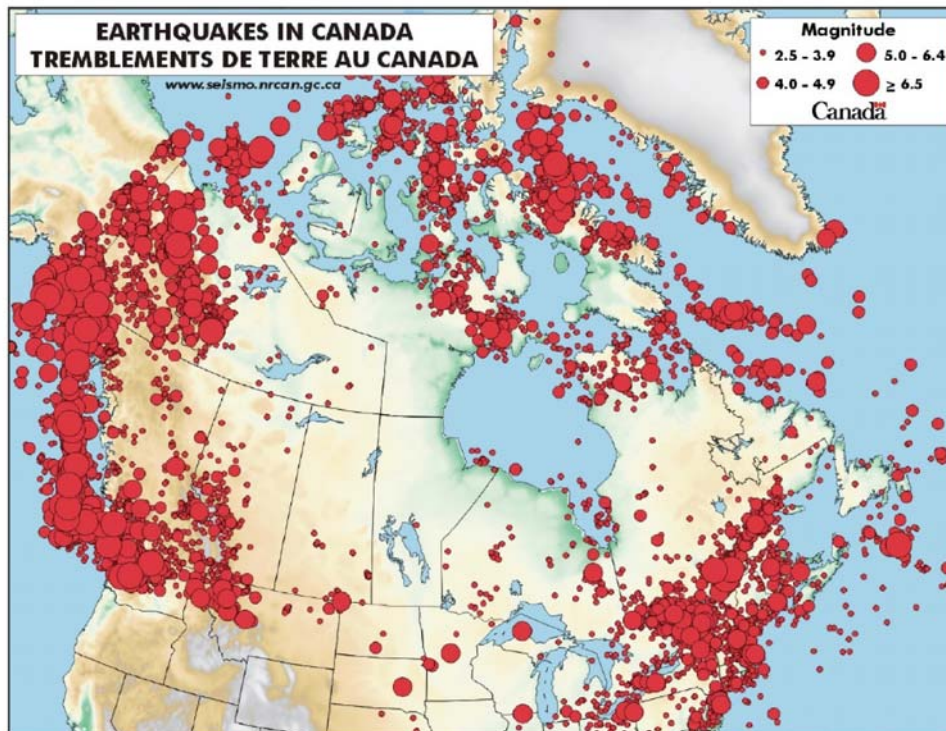
C2.1 Introduction to earthquake seismology

C2.1.1 Geographic distribution of earthquakes



<http://en.wikipedia.org/wiki/Earthquake>

- Distribution of earthquakes is very **non-uniform**.
- Clear relationship with plate motion and plate boundaries.
- **Three types** of plate boundary (convergent, divergent, transform)
- **Narrow zones** of deformation in the oceans and **broader** in continents
- Energy source to illuminate the interior of the Earth.



http://earthquakescanada.nrcan.gc.ca/historic_eq/canegmap_e.php

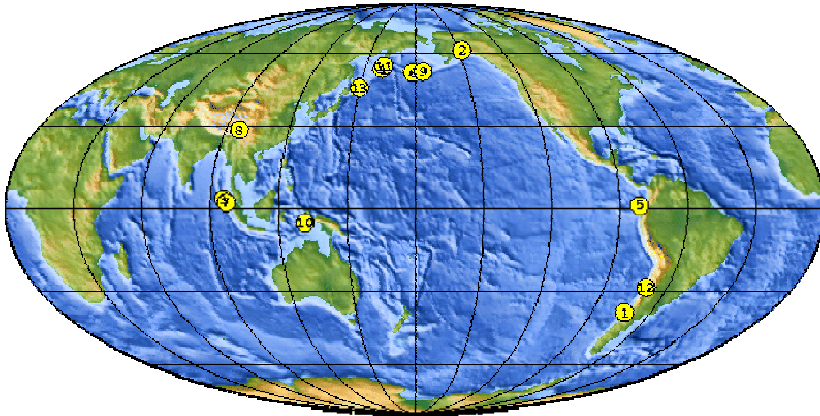
- What controls earthquake distribution in Canada?

C2.1.2 Energy release and the largest earthquakes

Energy release is distributed as follows:

- 75-80% of in circum-Pacific region
- 15-20% in Alpine-Himalayan belt
- 3-7% at mid-ocean ridges
- 1% in intraplate earthquakes

Largest earthquakes since 1900

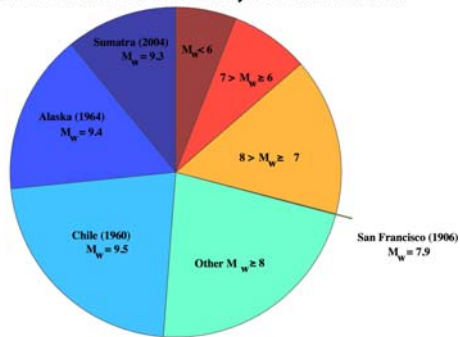


USGS National Earthquake Information Center

http://earthquake.usgs.gov/regional/world/10_largest_world.php

1.	Chile	M=9.5	1960
2.	Alaska	M=9.2	1964
3.	Sumatra	M=9.1	2004
4.	Kamchatka	M=9.0	1952
5.	Ecuador	M=8.8	1906
6.	Rat Islands, Alaska	M=8.7	1965
7.	Northern Sumatra	M=8.6	2005
8.	Assam- Tibet	M=8.6	1950
9.	Andreanof Island, Alaska	M=8.6	1957
10.	Banda Sea	M=8.5	1938
11.	Kamchatka	M=8.5	1923
12.	Chile-Argentina	M=8.5	1922
13.	Kuril Islands	M=8.5	1963

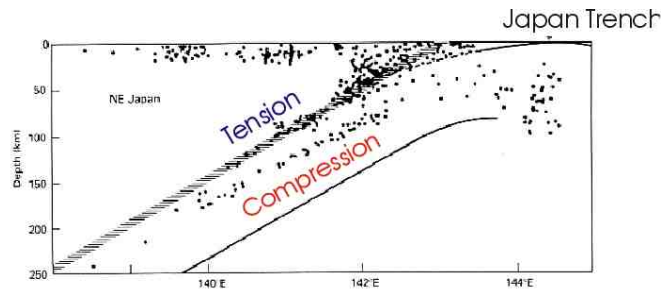
Global Seismic Moment Release January 1906 - December 2005



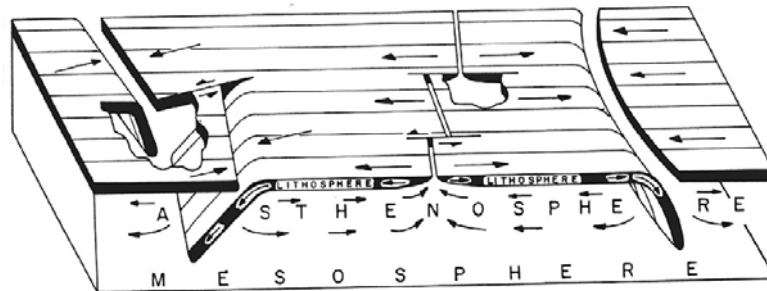
Total Moment: 1.0×10^{21} Newton-meters

C2.1.3 Depth variations of earthquakes

- Most earthquakes occur where the rocks are strong enough to undergo brittle failure. See details later.
- Increasing temperature with depth occurs a rate of 10-20° C per km. At mid-crustal depths this means that a temperature is reached which causes the behaviour of rock to change from brittle failure to creep under an applied stress. This is called the **brittle-ductile transition** and in the continents occurs in the mid-crust. This phenomena can be seen in the figure below under NE Japan.



- Deeper earthquakes can occur in subduction zones where one plate descends into the mantle. These regions were recognized in early 20th century and called Benioff zones. Earthquakes in these regions can extend to depths of hundreds of kilometres.



- In some subduction zones, the hypocentres define 2 parallel planes (double Benioff zone)
- Some subduction zone earthquakes may be caused by phase changes from one mineral to another, and are associated with a reduction of volume (equivalent to implosions)

C2.1.4 Some online earthquake resources

United States Geological Survey
Geological Survey of Canada
IRIS
POLARIS

<http://earthquake.usgs.gov/>
http://earthquakescanada.nrcan.gc.ca/index_e.php
<http://www.iris.edu/seismon/>
<http://www.polarisnet.ca>