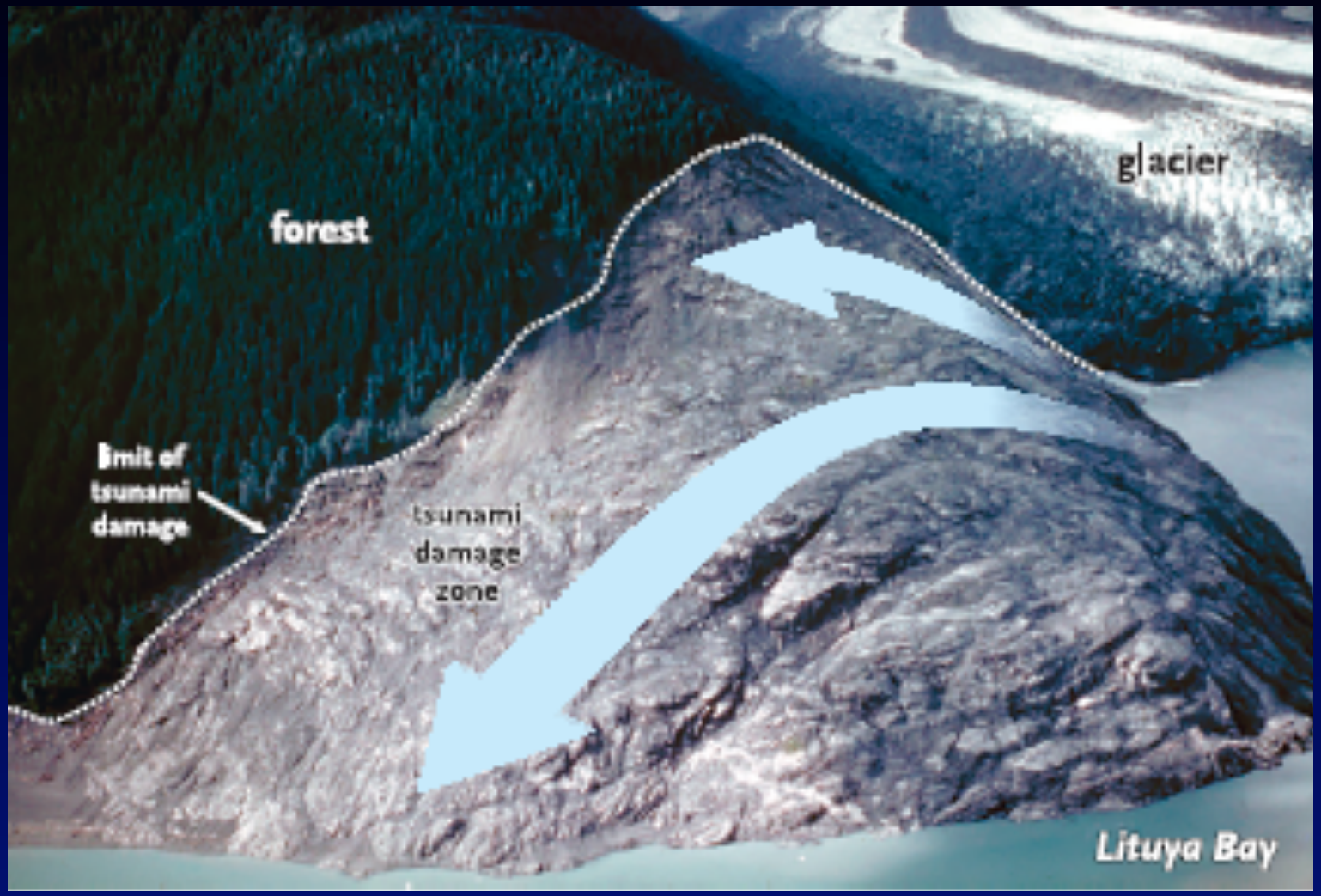
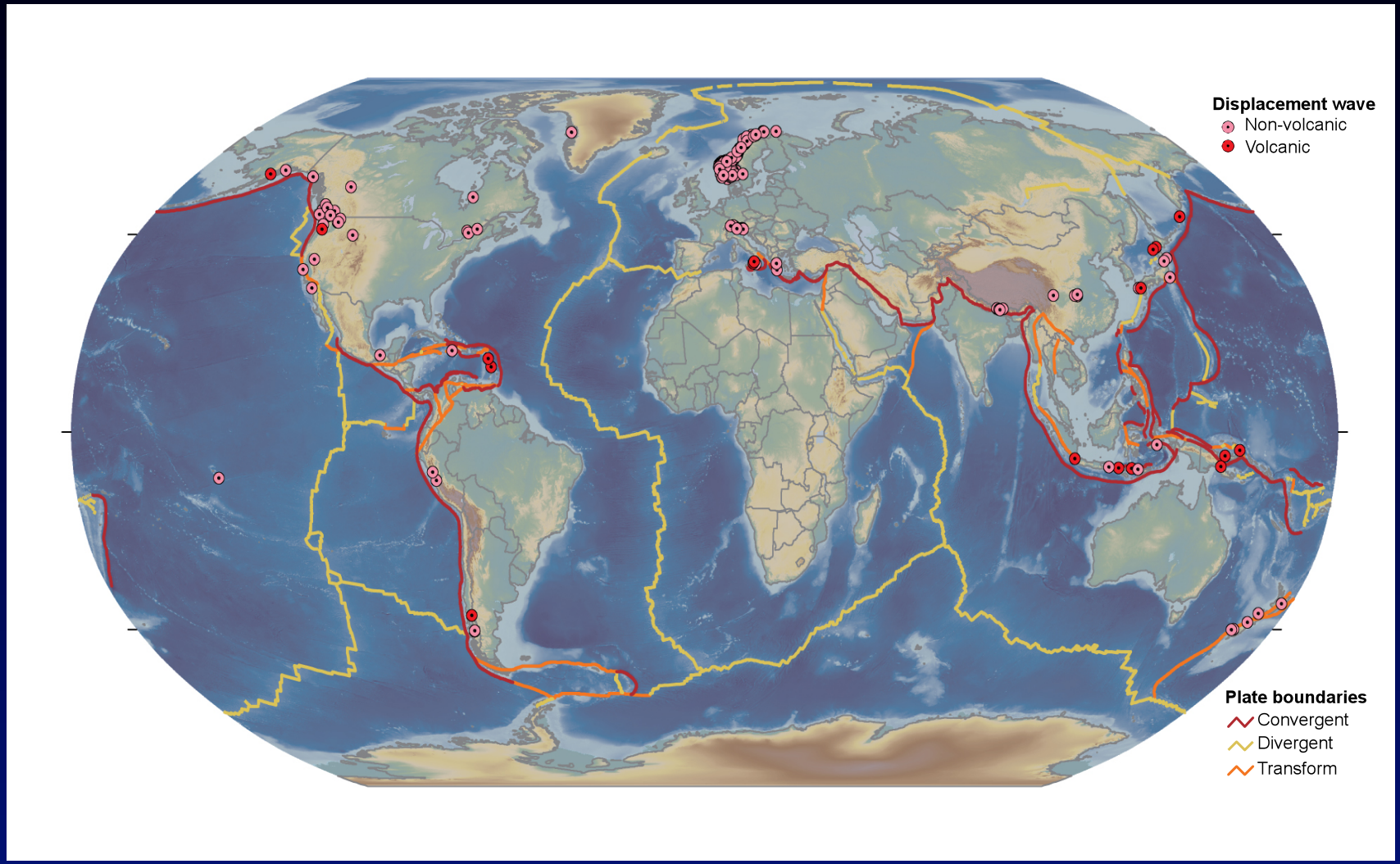
The underappreciated risk of of landslide-triggered tsunamis in British Columbia

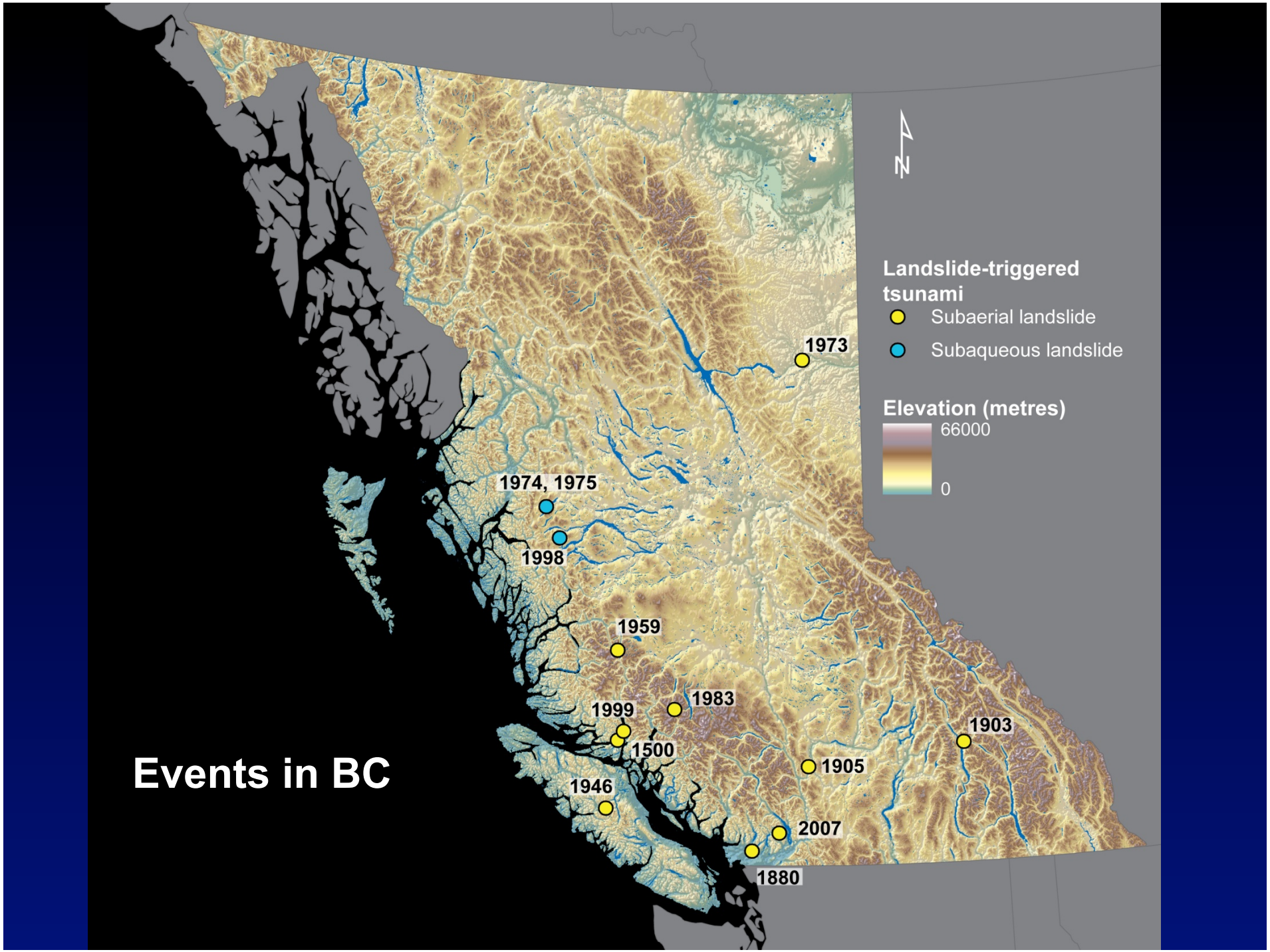


John J. Clague and Nicholas Roberts
SFU Centre for Natural Hazard Research

Global distribution

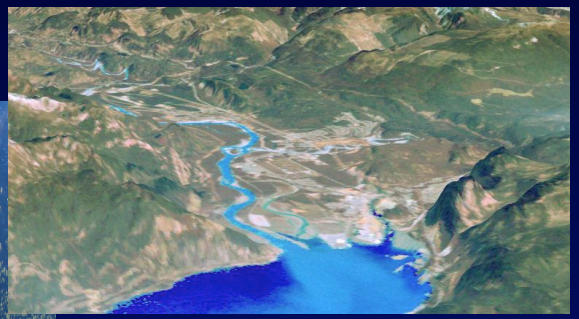


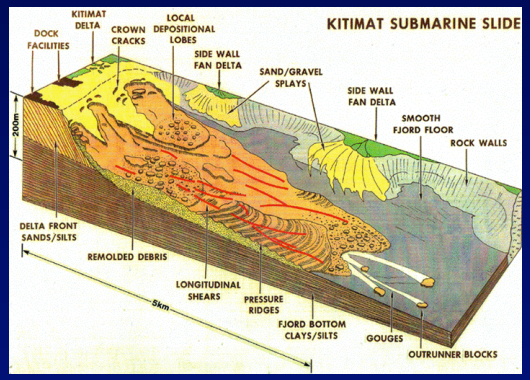
Roberts et al. (2014)

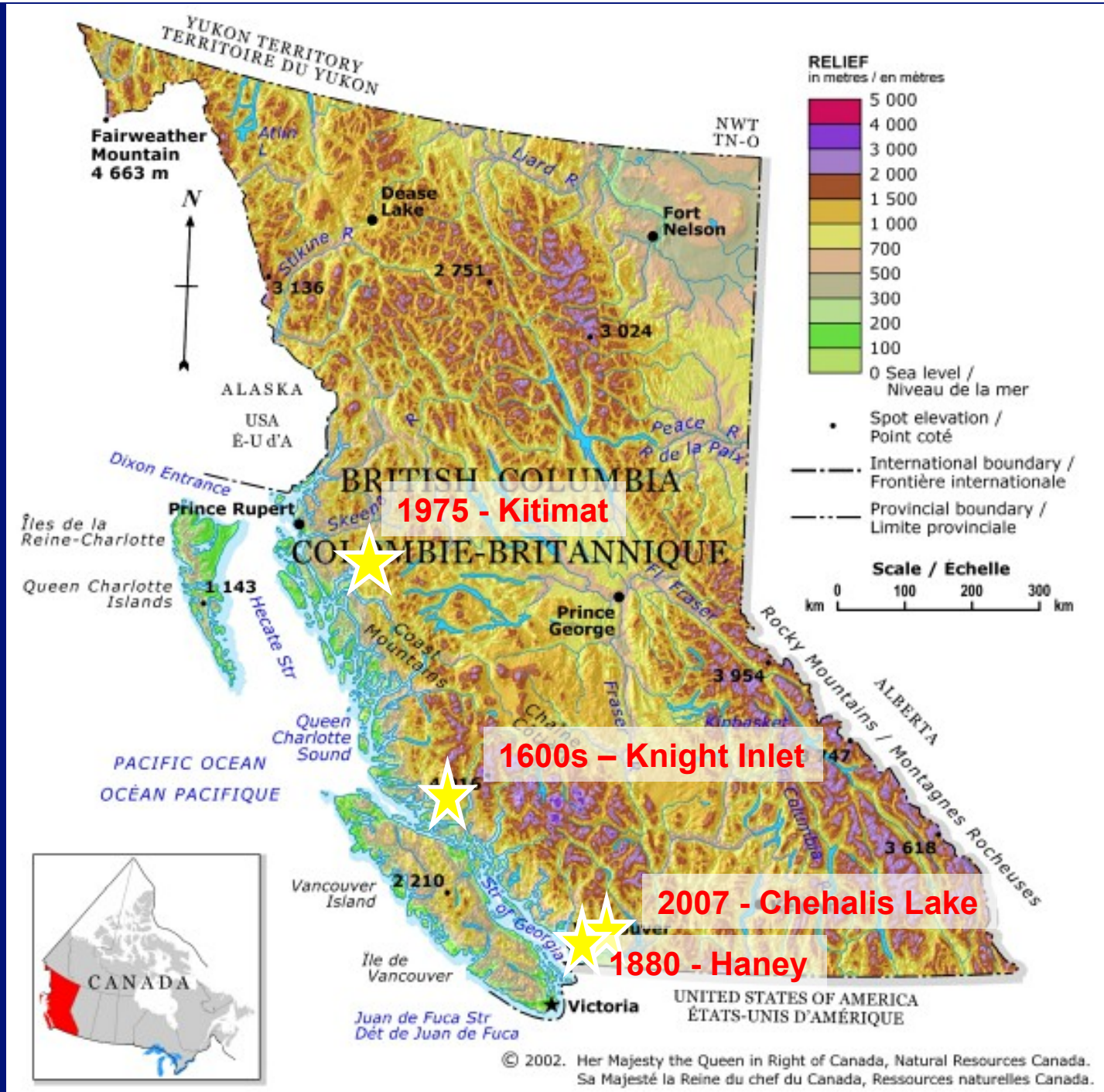

Events in BC
Landslide-triggered tsunami
Subaerial landslide
Subaqueous landslide
Elevation (metres)
66000
0
N
1973
1974, 1975
1998
1959
1983
1999
1500
1903
1905
1946
2007
1880

Geologic contexts

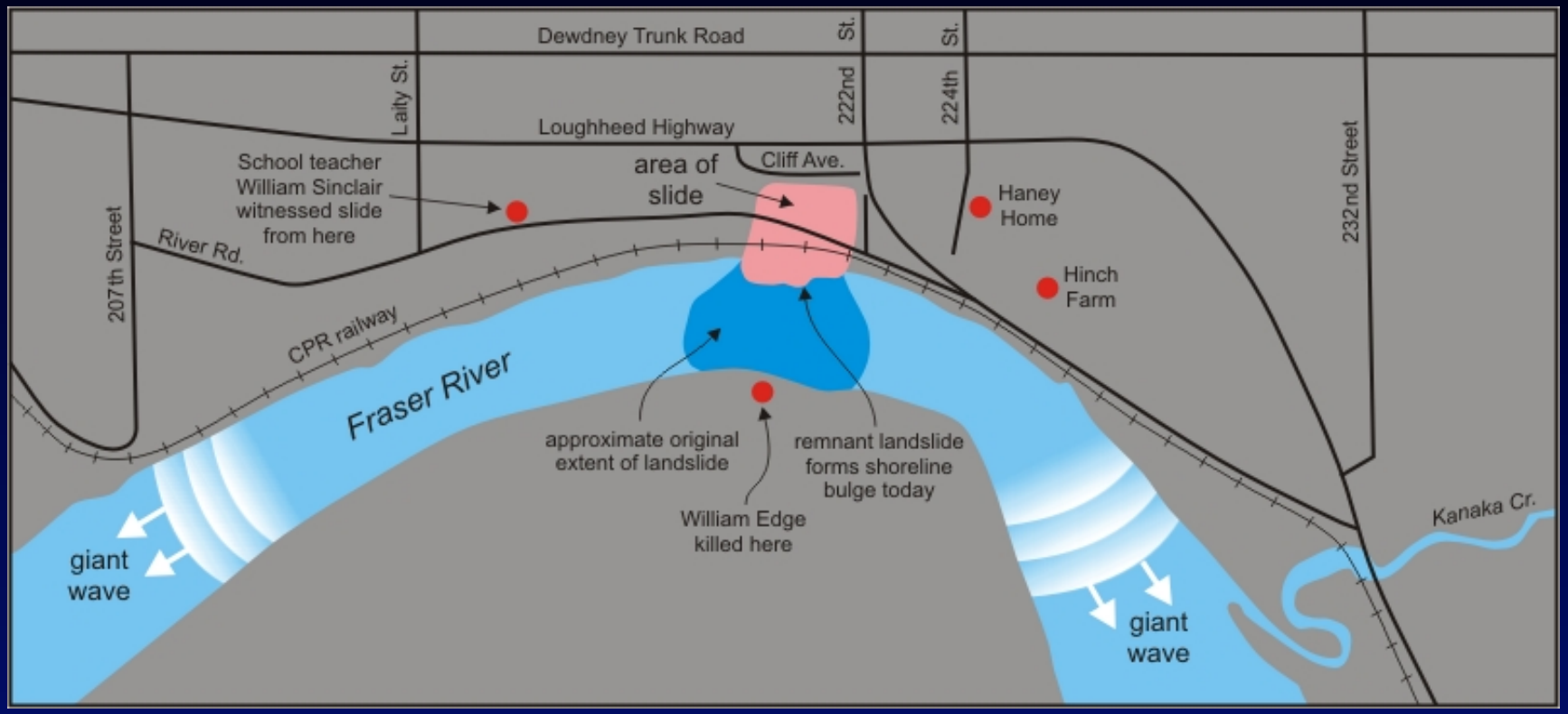
- Landslides into rivers
- Rockfalls/rockslides into lakes/reservoirs
- Rockfalls/rockslides into fjords and inlets
- Submarine landslides
- Failures of delta fronts in lakes






1975 - Kitimat
1600s – Knight Inlet
2007 - Chehalis Lake
1880 - Haney
YUKON TERRITORY
TERRITOIRE DU YUKON
NWT
TN-O
Fairweather Mountain 4 663 m
Dease Lake
Fort Nelson
Liard R
Atlin L
Stikine R
3 136
2 751
3 024
ALASKA
USA
É-U d'A
Peace R
R de la Paix
Dixon Entrance
BRITISH COLUMBIA
COLOMBIE-BRITANNIQUE
Prince Rupert
Îles de la Reine-Charlotte
Queen Charlotte Islands
1 143
Hecate Str
Prince George
Fraser R
Rocky Mountains / Montagnes Rocheuses
ALBERTA
3 954
Coast Mountains
Queen Charlotte Sound
PACIFIC OCEAN
OCÉAN PACIFIQUE
3 618
Vancouver Island
2 210
Str of Georgia
Île de Vancouver
Victoria
Juan de Fuca Str
Dét de Juan de Fuca
UNITED STATES OF AMERICA
ÉTATS-UNIS D'AMÉRIQUE
CANADA
RELIEF
in metres / en mètres
5 000
4 000
3 000
2 000
1 500
1 000
700
500
300
200
100
0 Sea level / Niveau de la mer
Spot elevation / Point coté
International boundary / Frontière internationale
Provincial boundary / Limite provinciale
Scale / Échelle
0 100 200 300 km
© 2002. Her Majesty the Queen in Right of Canada, Natural Resources Canada.
Sa Majesté la Reine du chef du Canada, Ressources naturelles Canada.

Haney – 1880

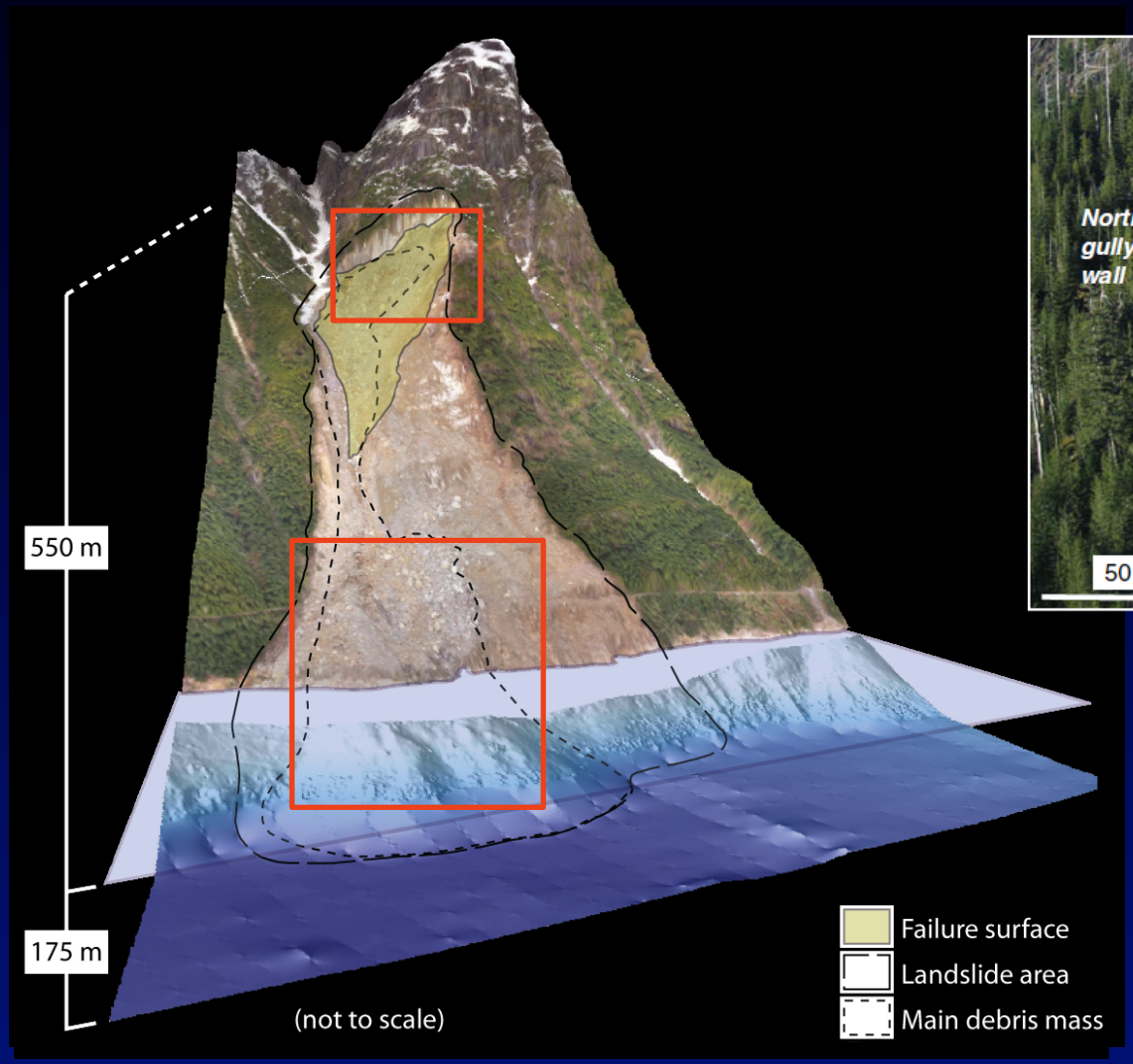


Clague et al., 2003

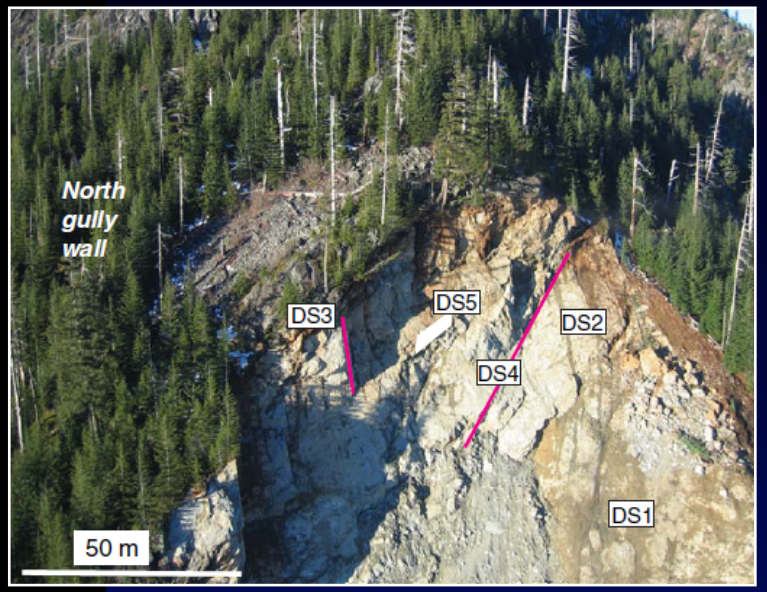
Roberts et al. (2013)

Chehalis Lake - 2007

- The 'wave-maker' -



Roberts et al. (2013)



Brideau et al. (2007)

Roberts et al. (2013)

50-cm-resolution LiDAR DEM

Tsunami impacts

- Erosional features -

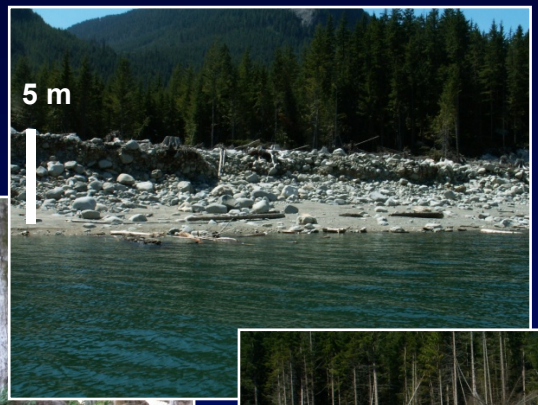
April 2006

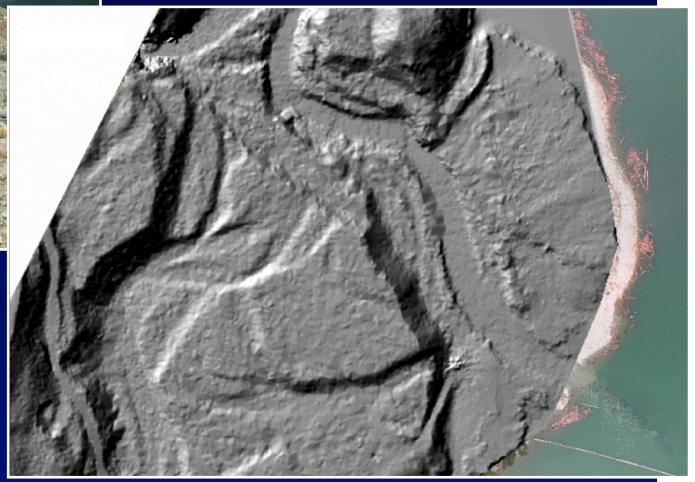
June 2009

(Photo: J. Darrell)

Tsunami impacts

- Erosional features -



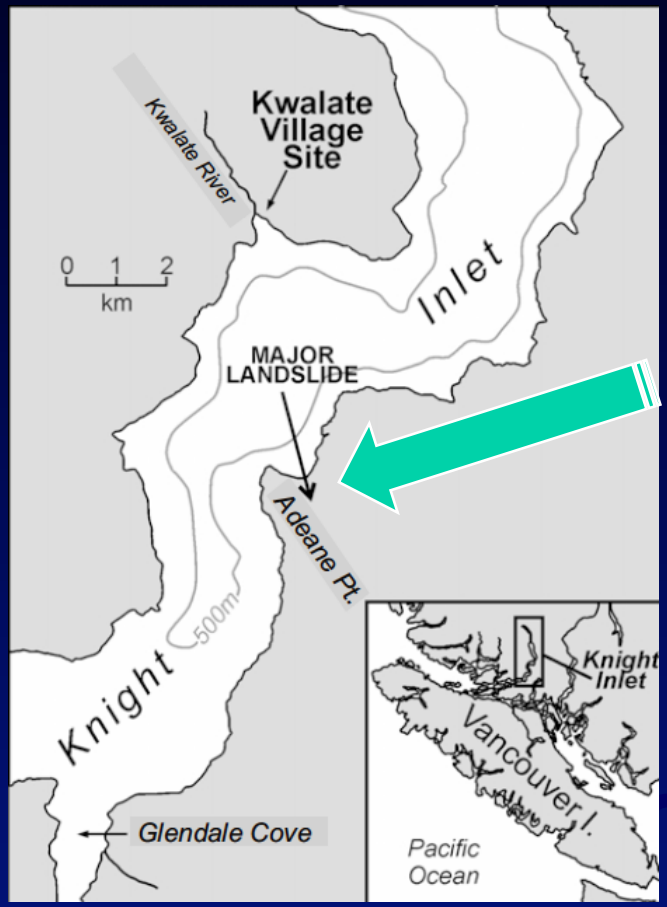


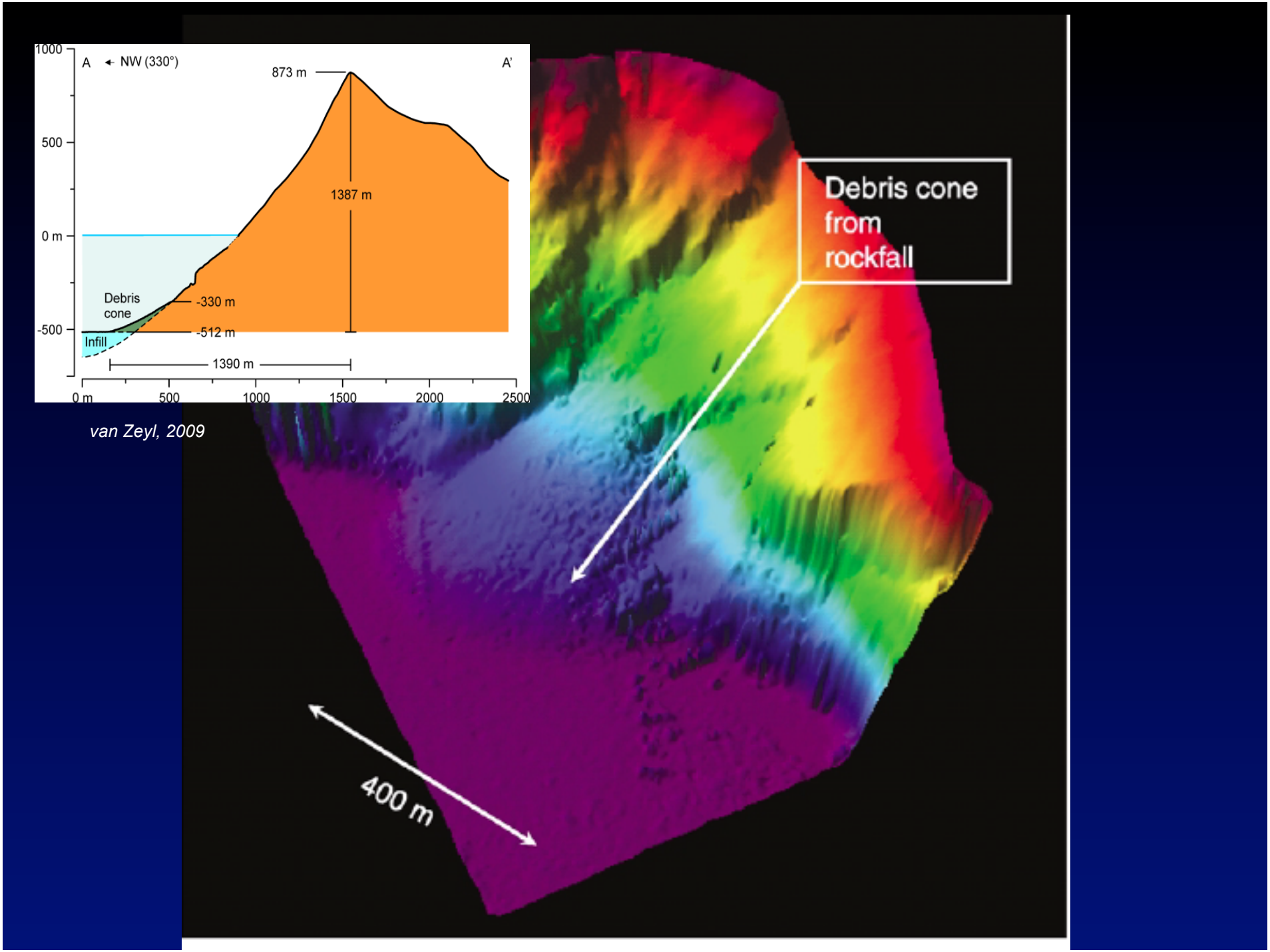
Run-up

Roberts et al. (2013)

Adeane Point – 16th century

- The 'wave-maker' -

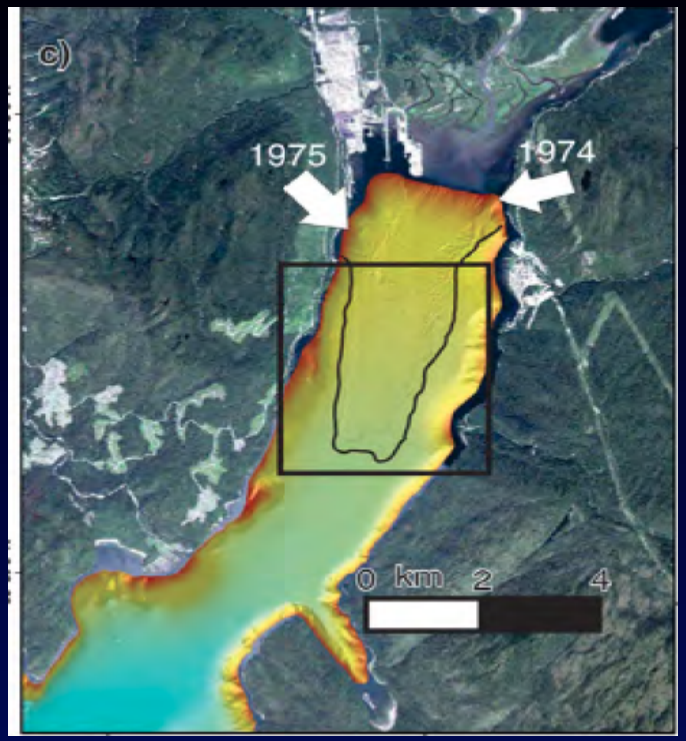




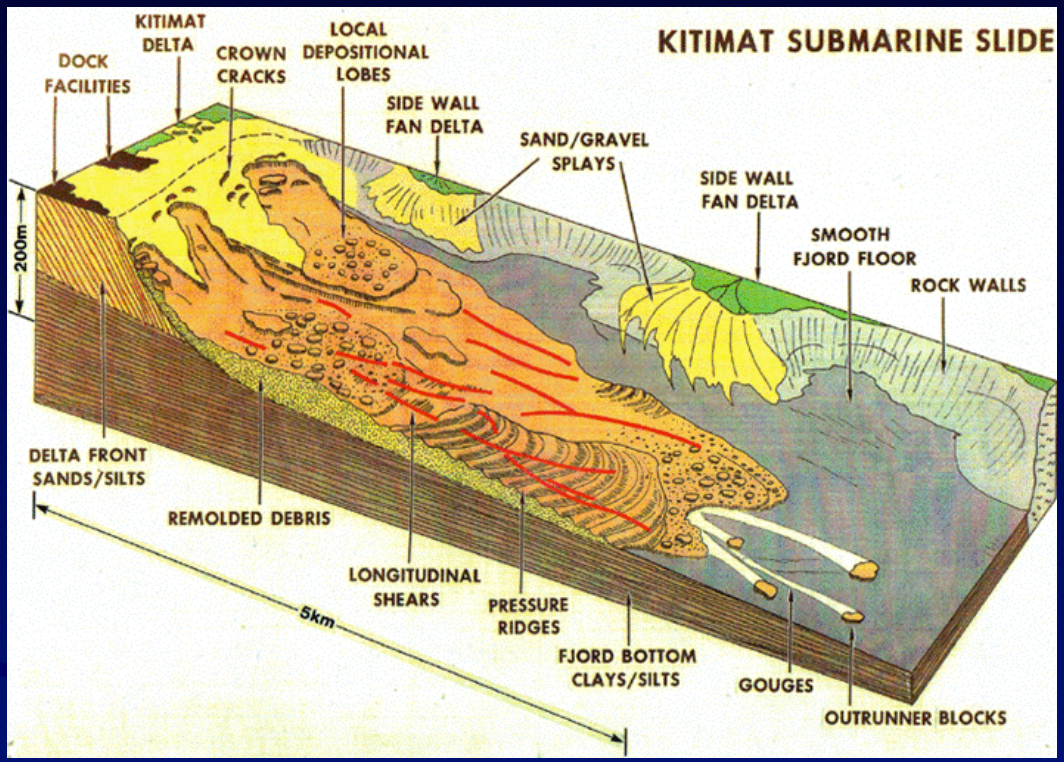
van Zeyl, 2009

Kitimat – 1975

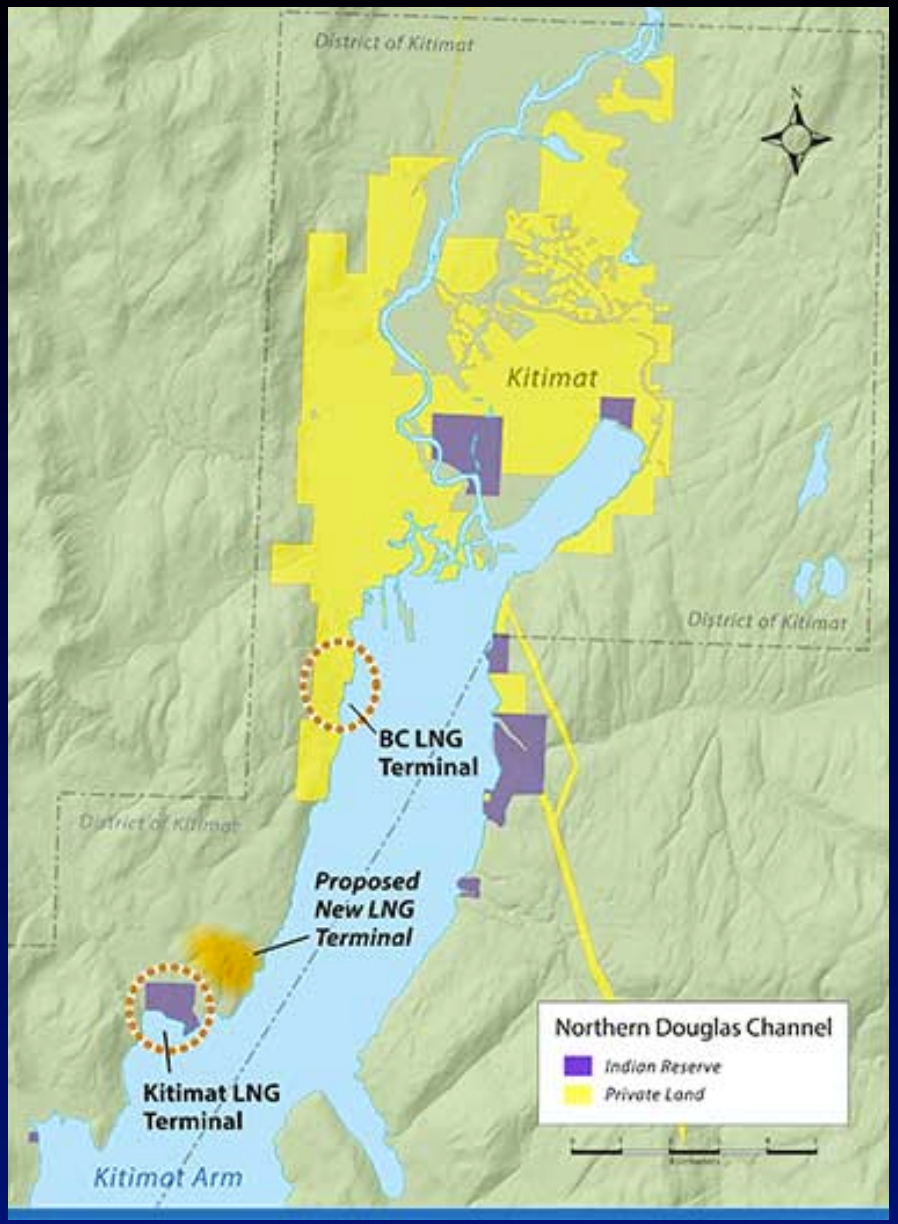
- The 'wave-maker' -



Conway et al., 2012



D.B. Prior


District of Kitimat
Kitimat
District of Kitimat
District of Kitimat
BC LNG Terminal
Proposed New LNG Terminal
Kitimat LNG Terminal
Kitimat Arm
Northern Douglas Channel
Indian Reserve
Private Land

Summary

- *There is no public or official awareness of the risk posed by landslide-triggered tsunamis in British Columbia*
- *A fatal landslide-triggered tsunami in BC is inevitable*
- *It would be in the public interest to systematically inventory steep rock walls in BC fjords and inlets to identify instabilities*
- *Ditto for steep rock walls bordering BC natural lakes and reservoirs*

The End

The End