

**Old rift faults never heal:
Recent earthquakes
of the St. Lawrence PaleoRift System
of eastern Canada**

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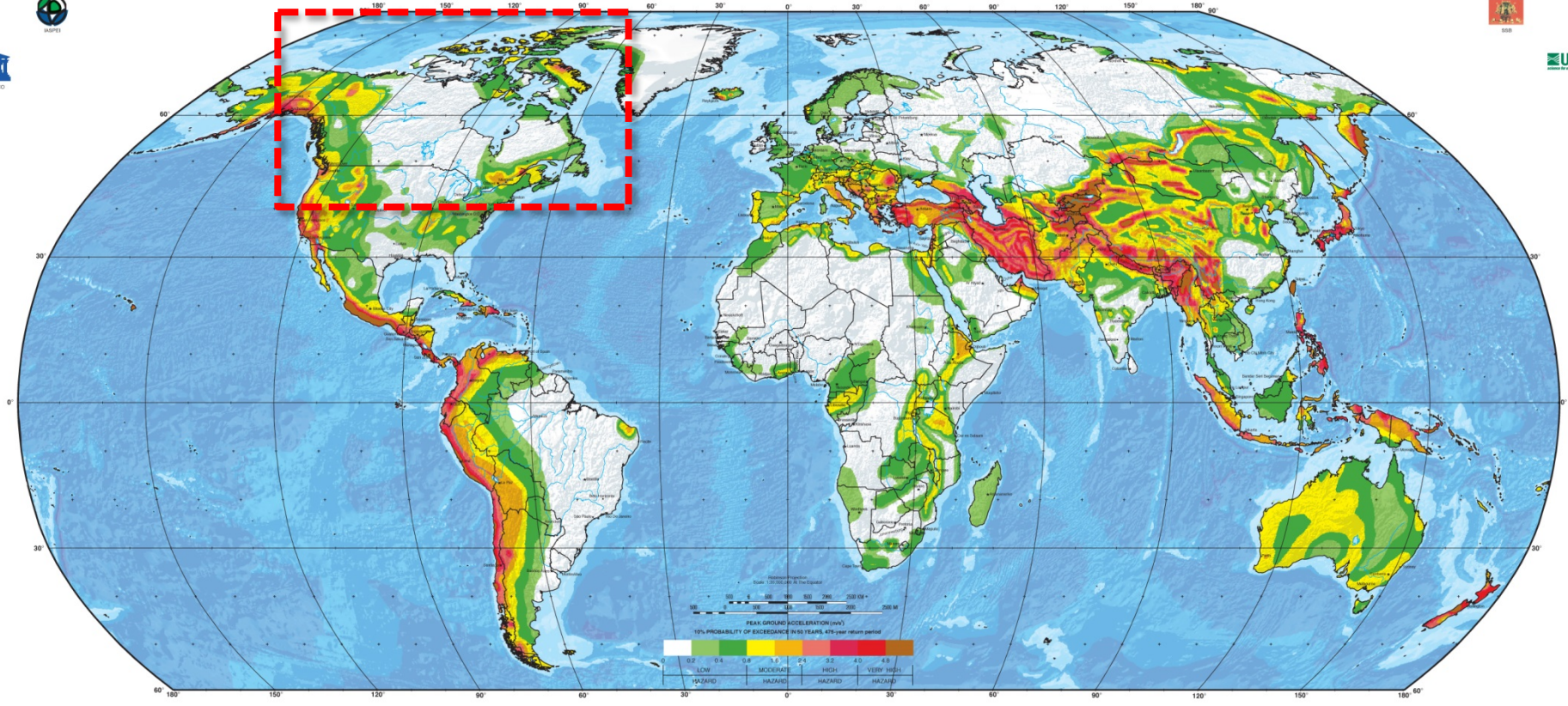
Today's presentation

1. Yes, we have earthquakes in Eastern Canada!
2. Most earthquakes occur in areas affected by rifting
3. In these areas, some correlation exists between mapped faults and earthquakes
4. Conclusions



GLOBAL SEISMIC HAZARD MAP

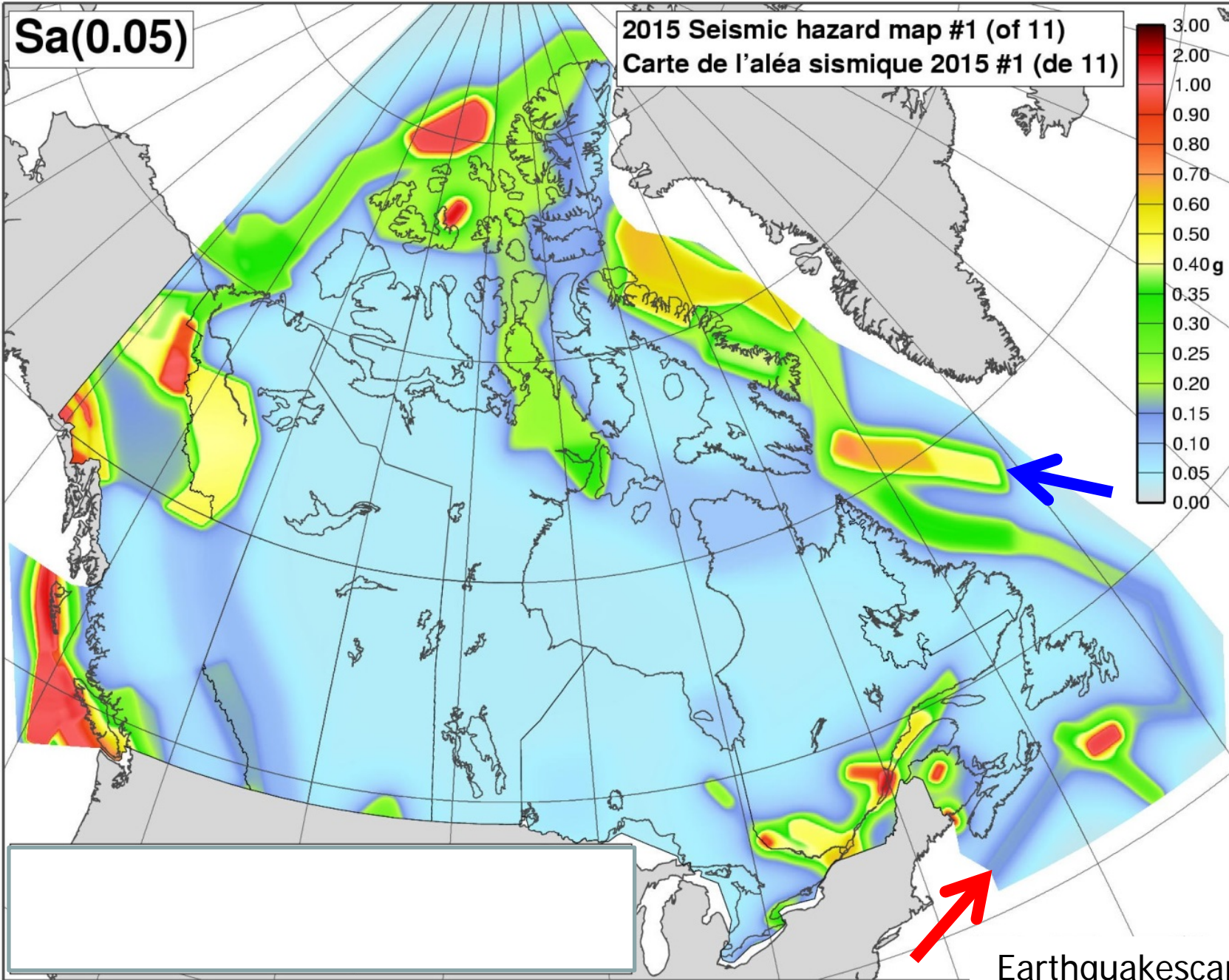
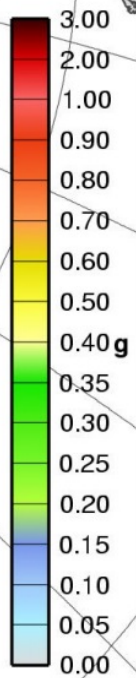
Produced by the Global Seismic Hazard Assessment Program (GSHAP),
 a demonstration project of the UN/International Decade of Natural Disaster Reduction, conducted by the International Lithosphere Program.
 Global map assembled by D. Giardini, G. Grünthal, K. Shedlock, and P. Zhang
 1999



10% in 50 years
 Giardini et al., 2003

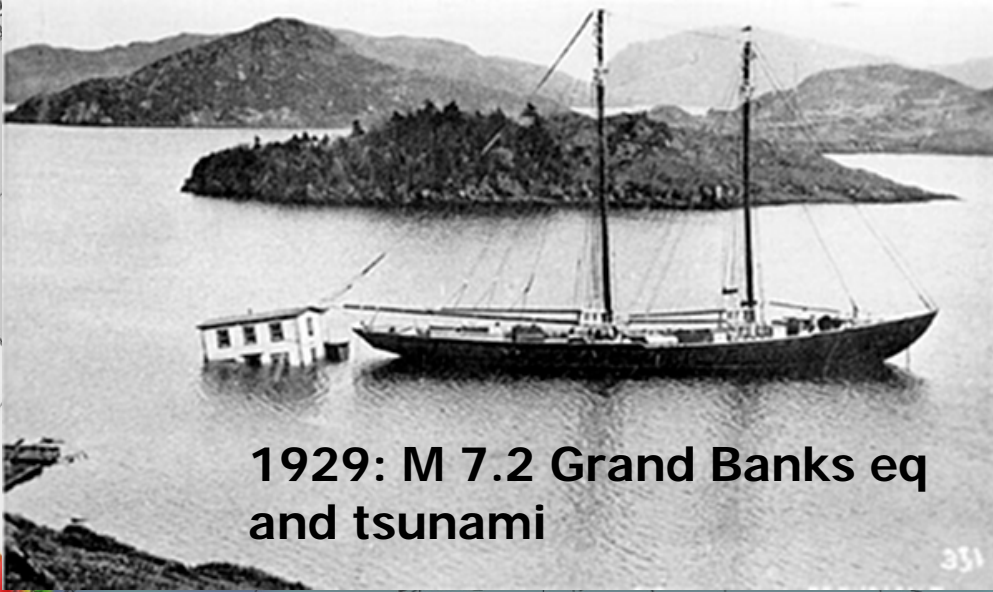
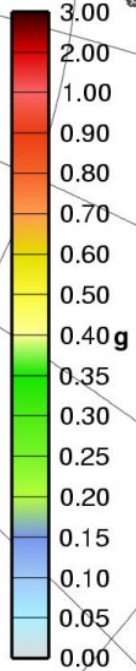
Sa(0.05)

2015 Seismic hazard map #1 (of 11)
Carte de l'aléa sismique 2015 #1 (de 11)

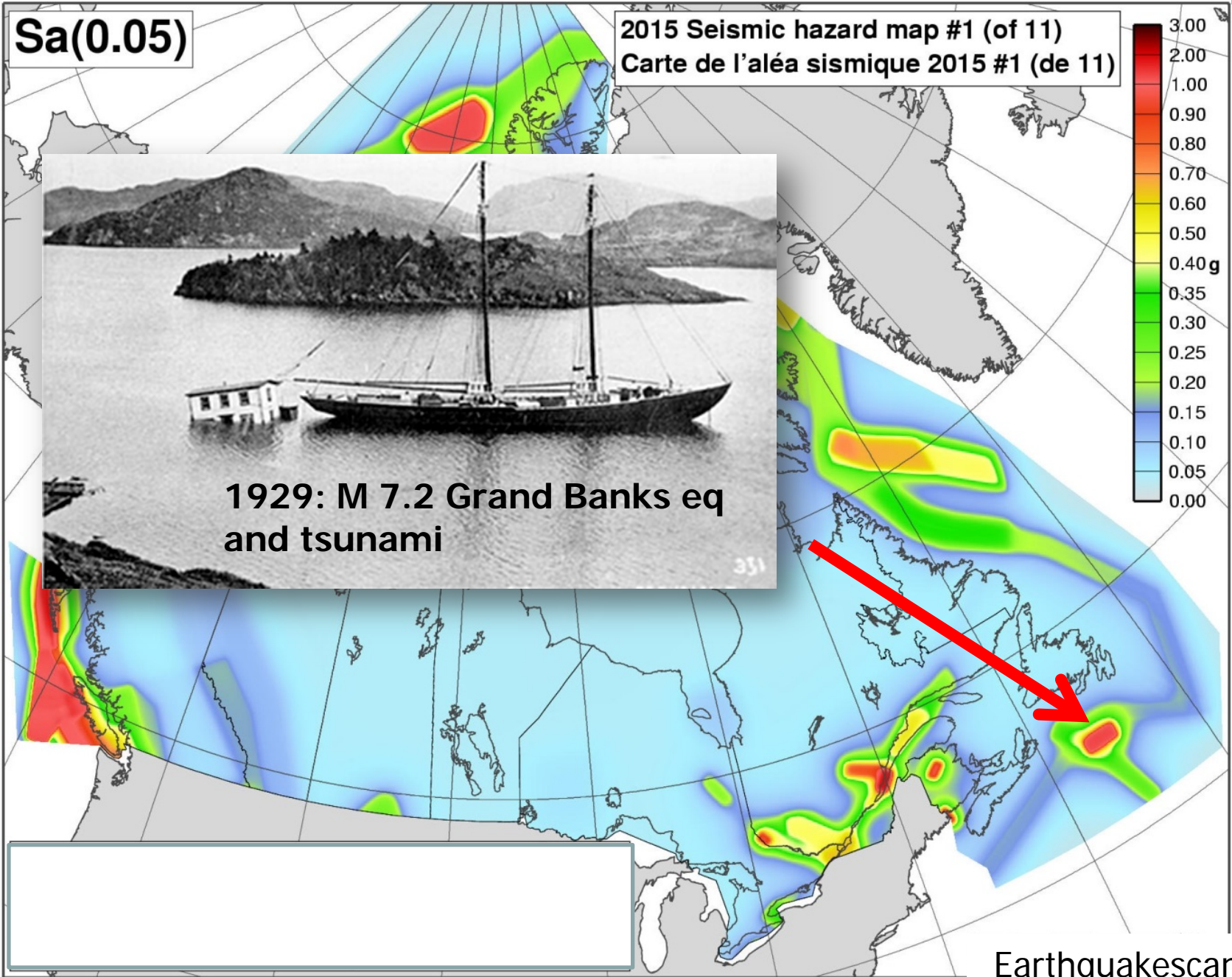


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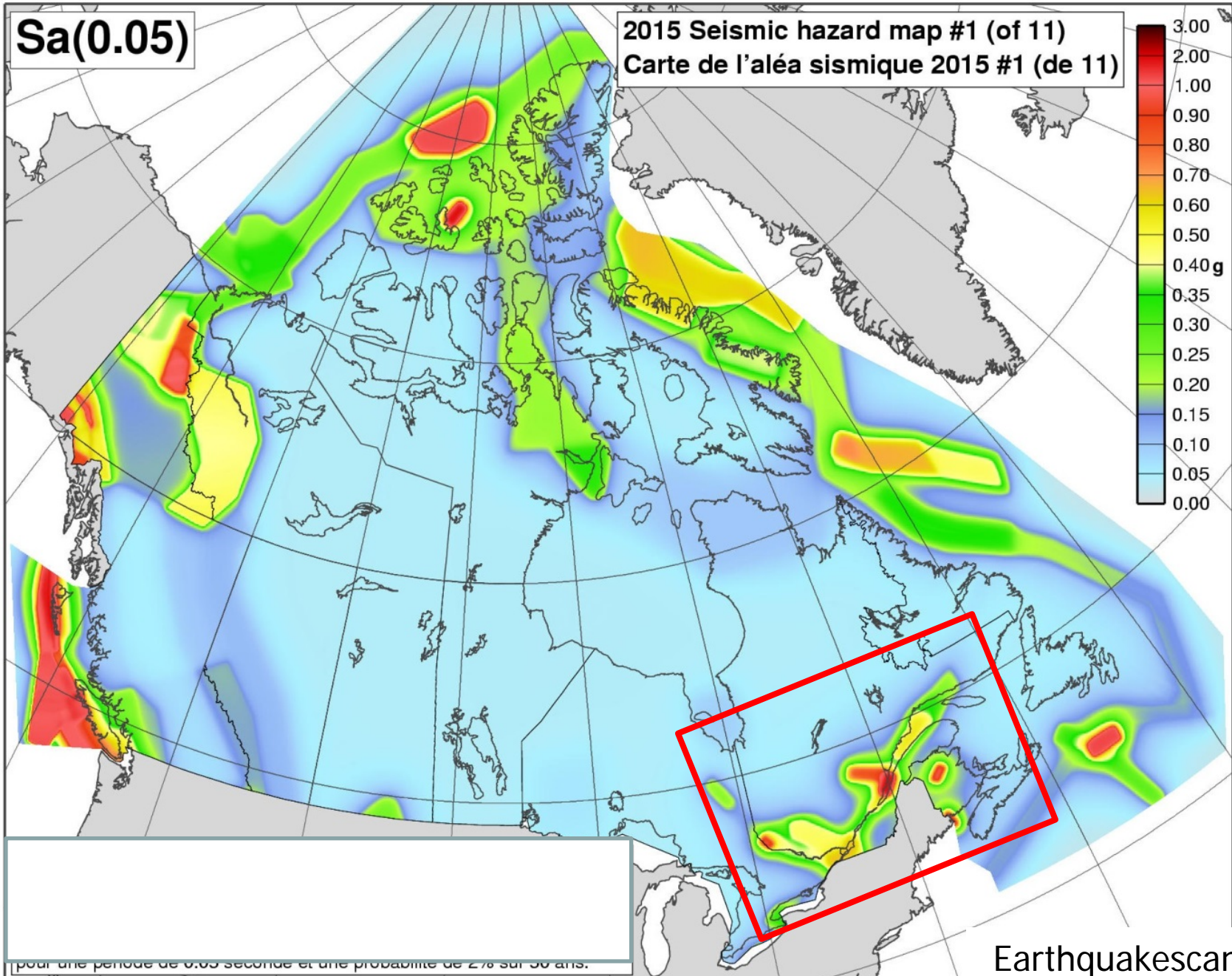
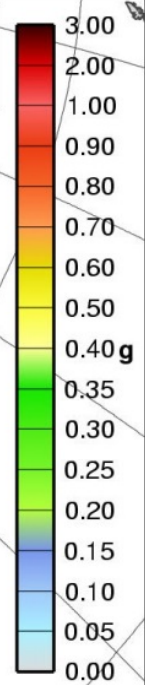


**1929: M 7.2 Grand Banks eq
and tsunami**

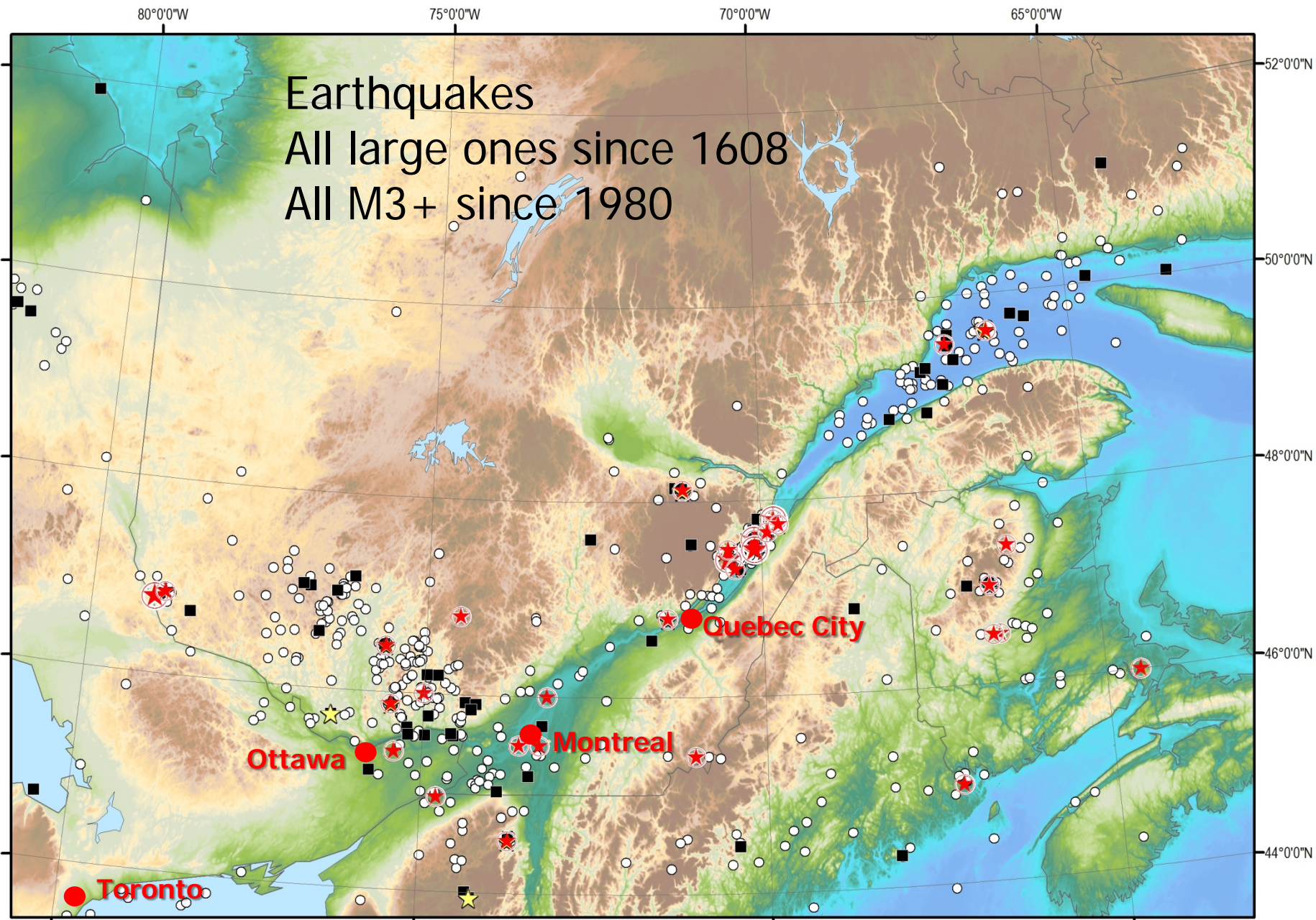


Sa(0.05)

2015 Seismic hazard map #1 (of 11)
Carte de l'aléa sismique 2015 #1 (de 11)



pour une période de 0.05 seconde et une probabilité de 2% sur 50 ans.

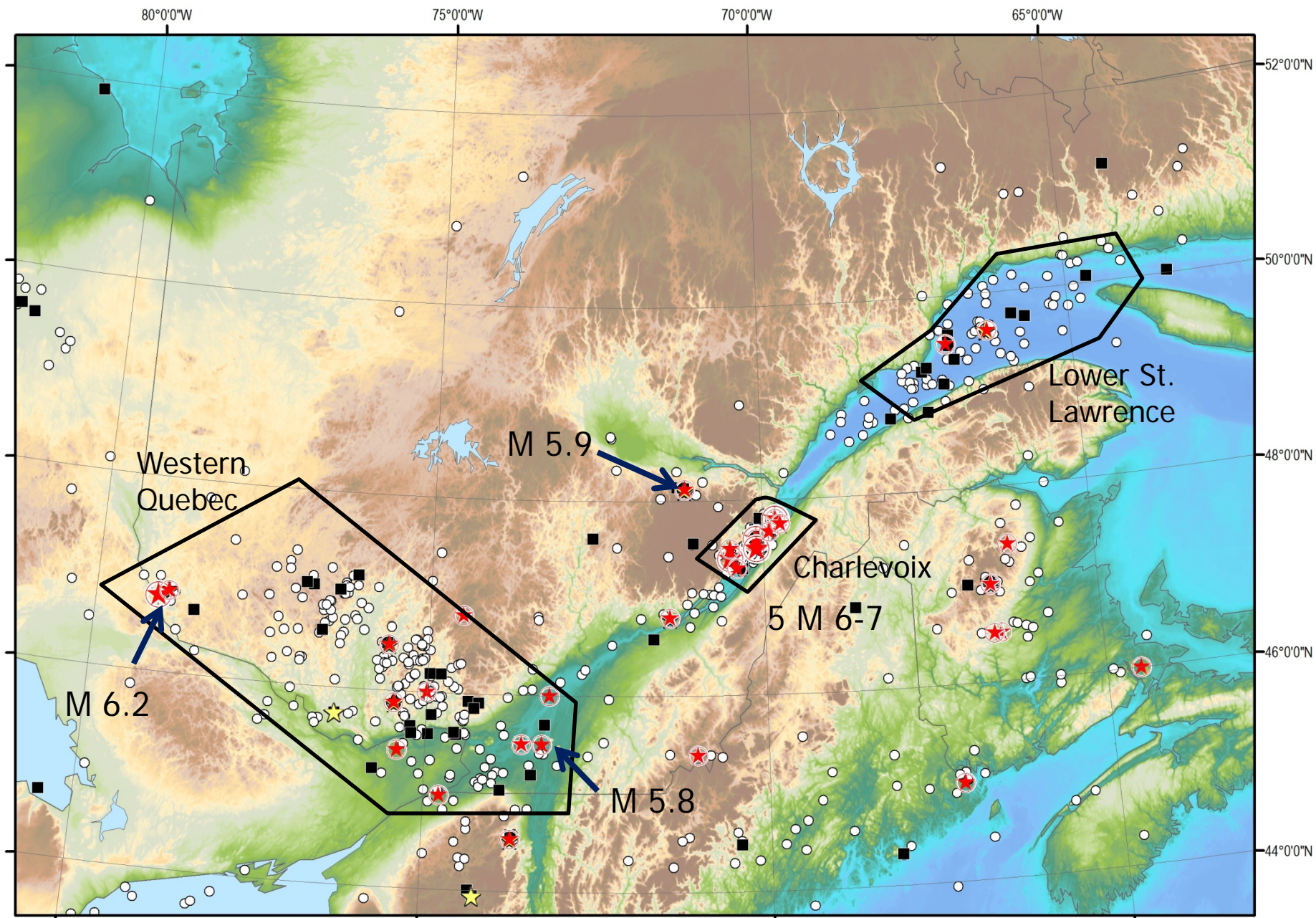


Legend

- M3.0 - M3.9
- M4 - M4.9
- ★ M5 - M5.9
- ★ Significant M4.3 - M5.9
- ★ Significant M6 - M7

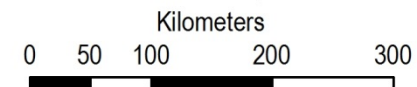
Kilometers

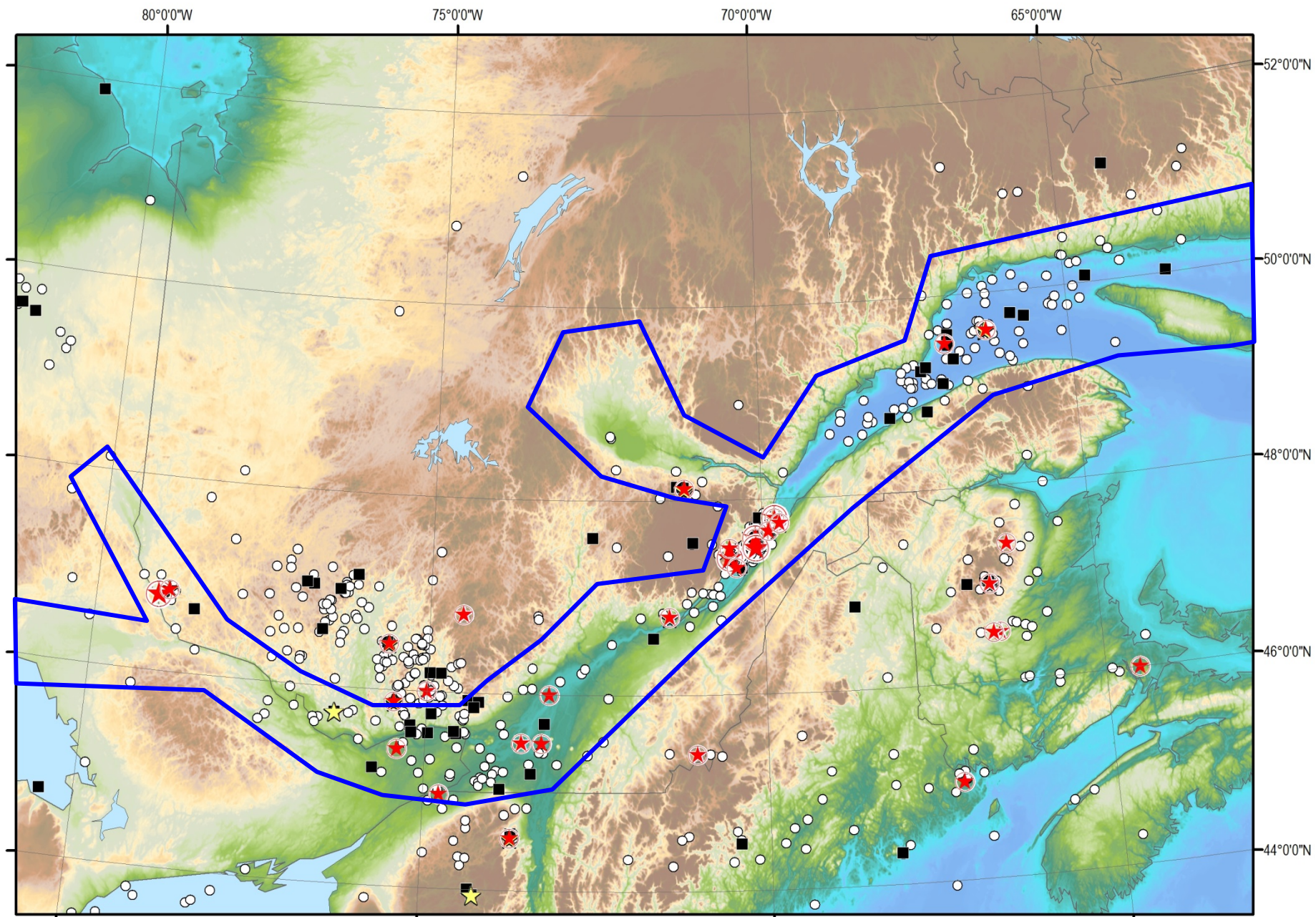




Legend

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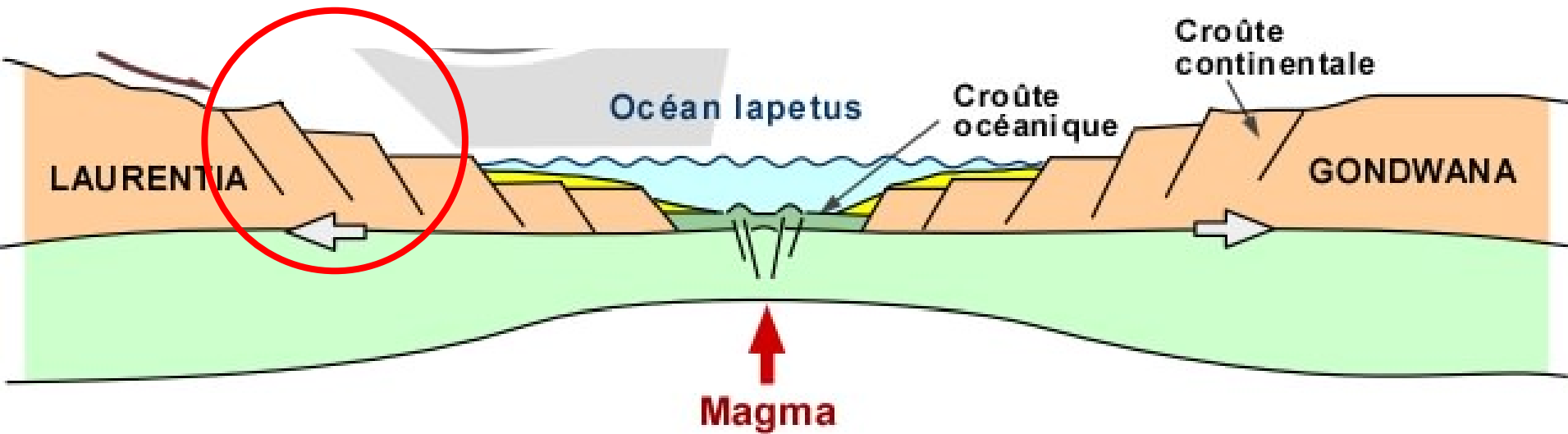
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Kilometers

0 50 100 200 300

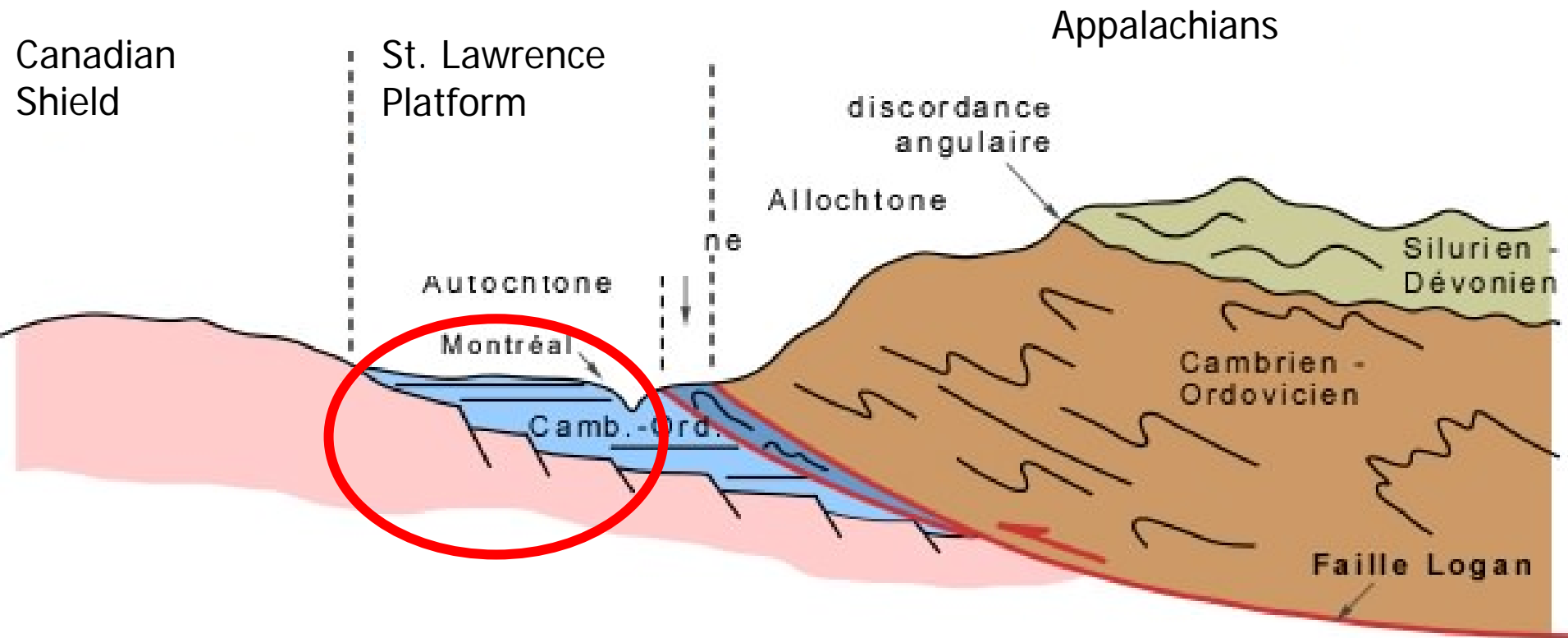
Faults were formed during creation of Iapetus Ocean (end of PreCambrian)



Source: Planète Terre / P.-A. Bourque, U. Laval

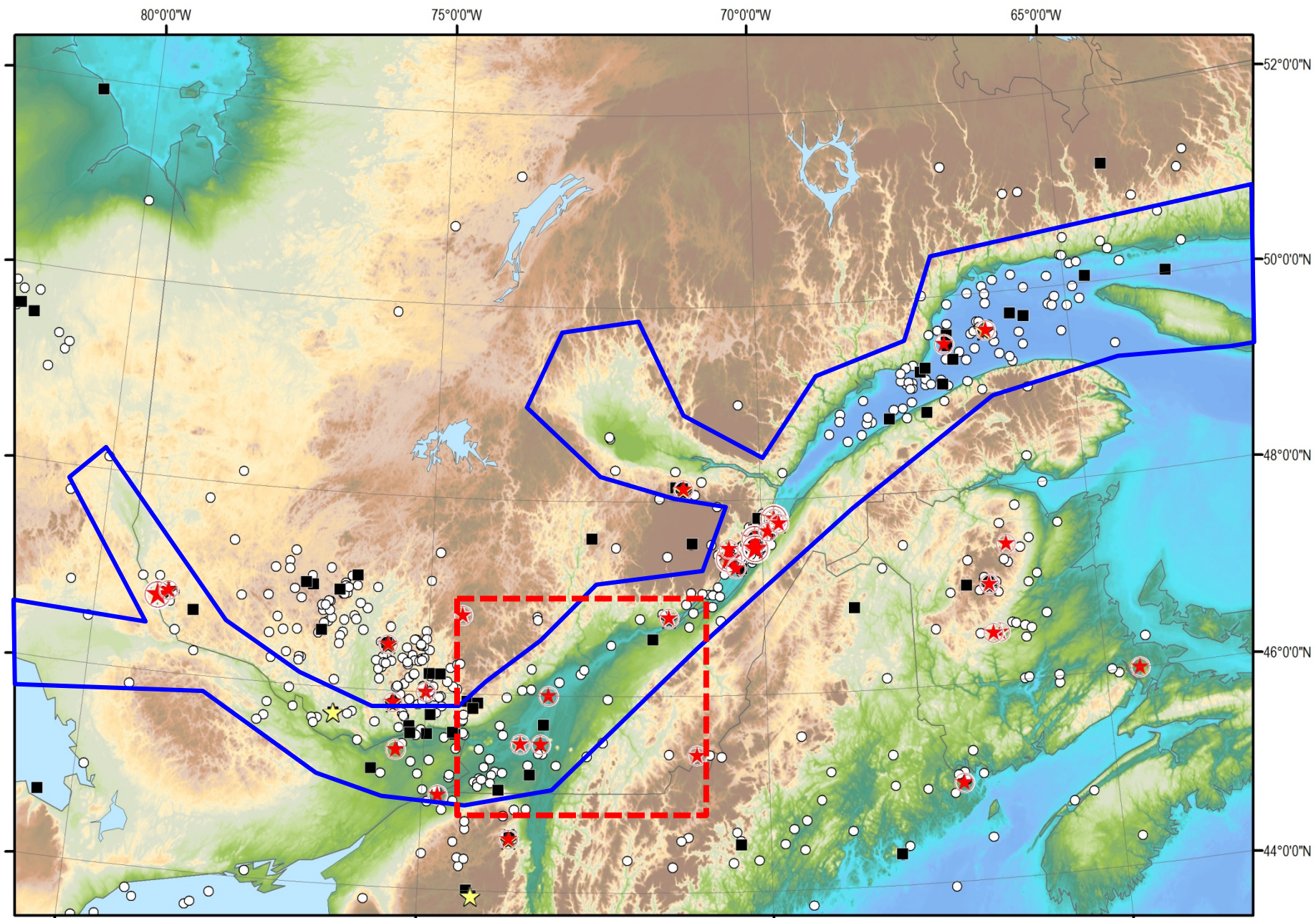


Taconic Orogeny (Ordovician)



Source: Planète Terre / P.-A. Bourque, U. Laval



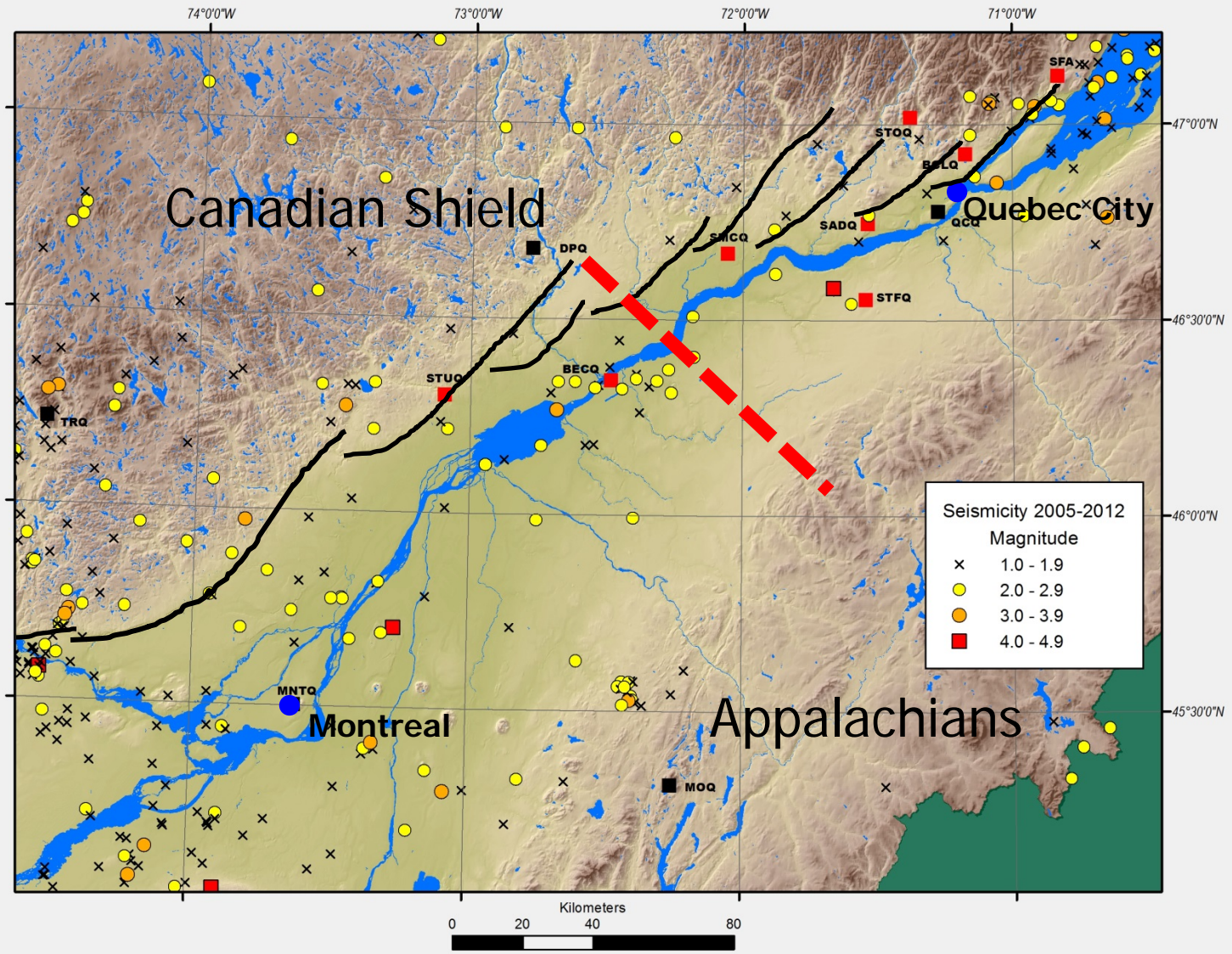


Legend

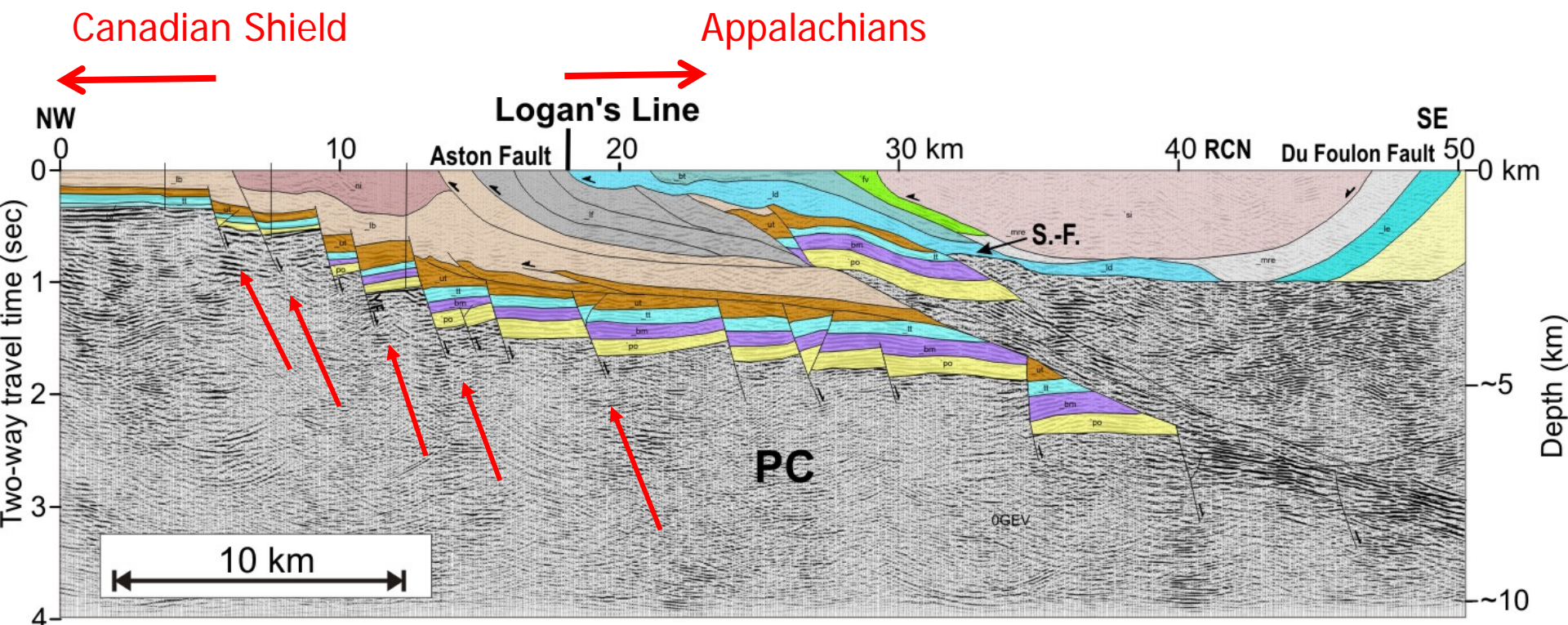
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Kilometers





Seismic profile across the St. Lawrence Valley



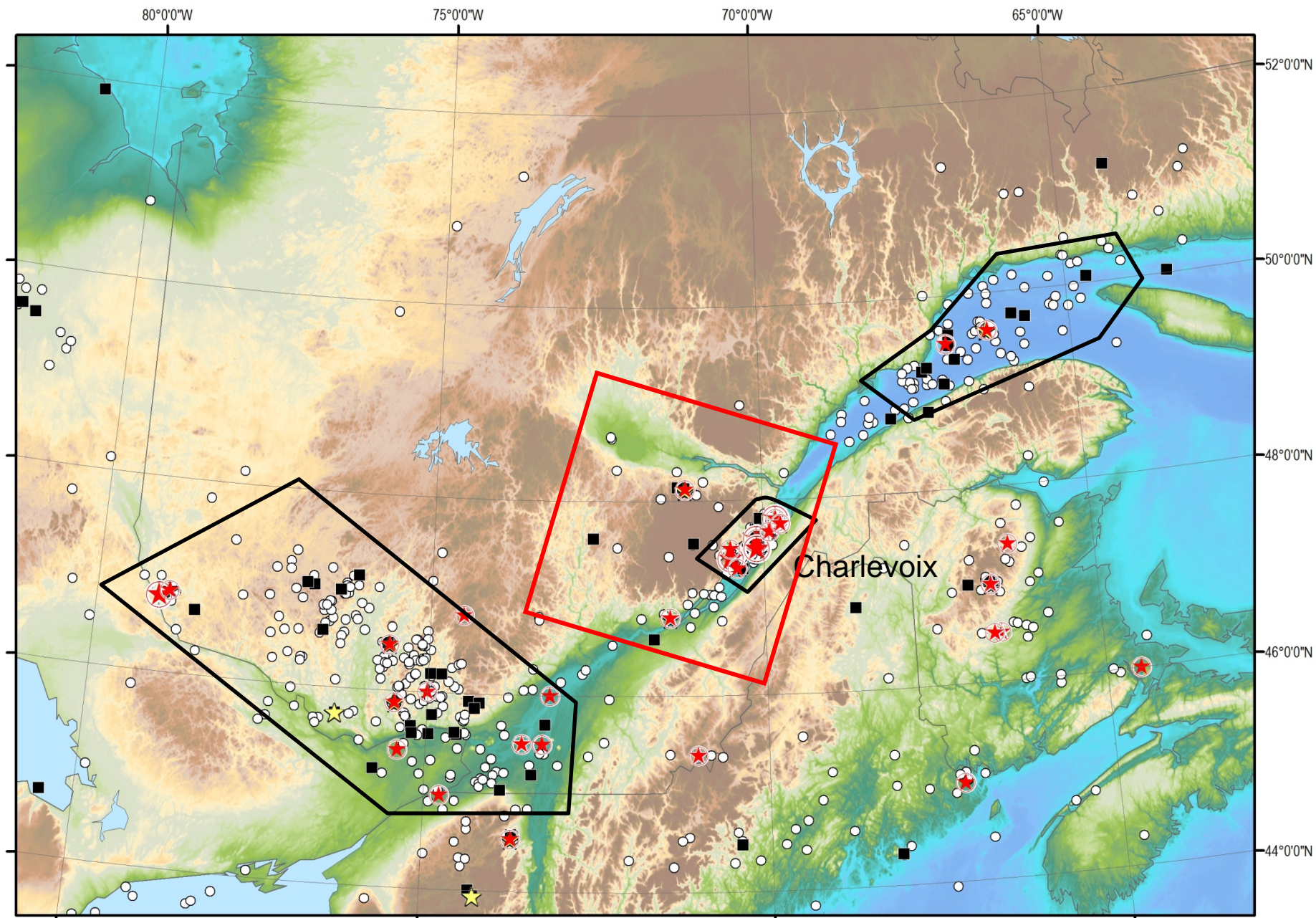
Source: Castonguay et al., 2010



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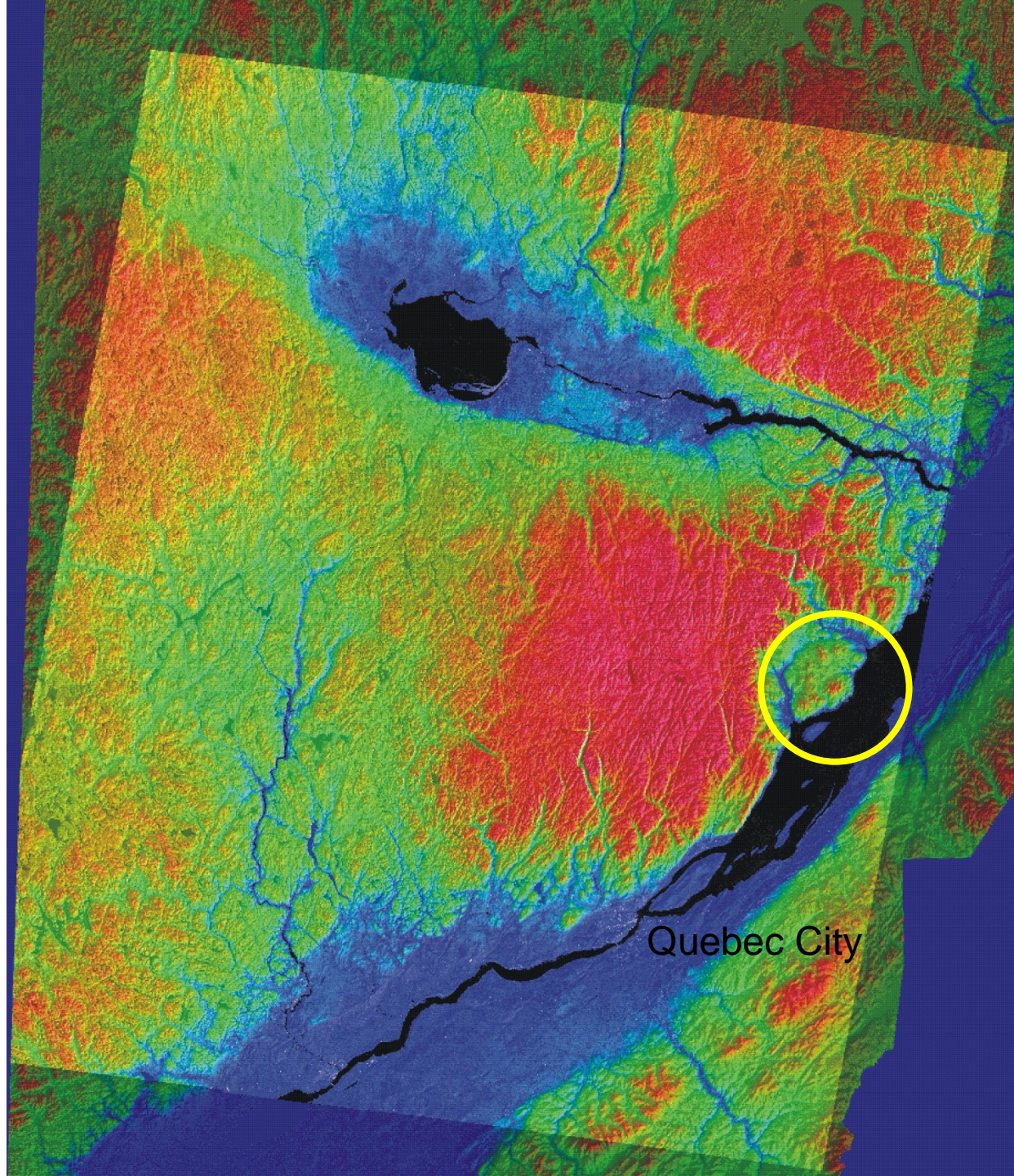
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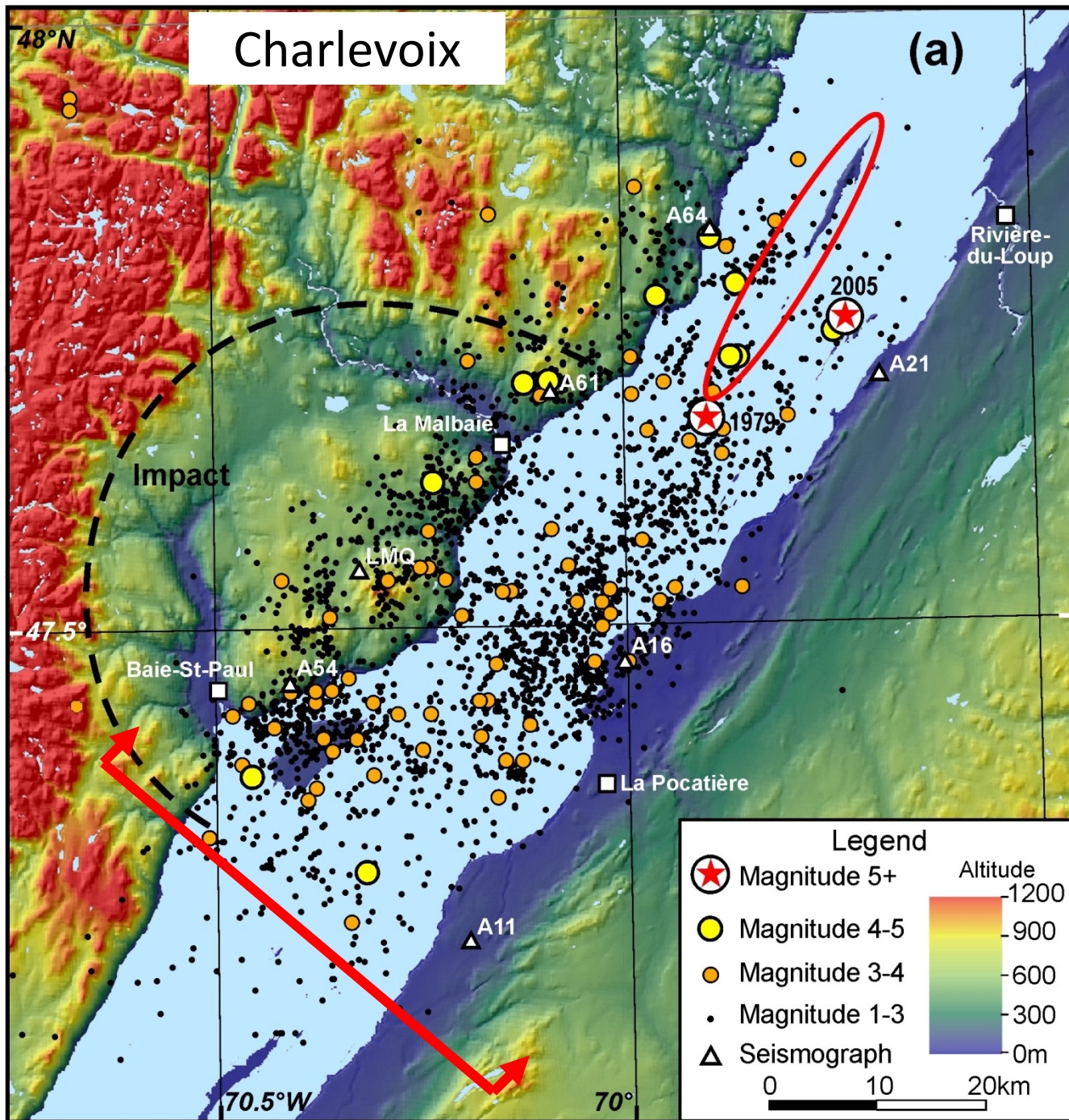
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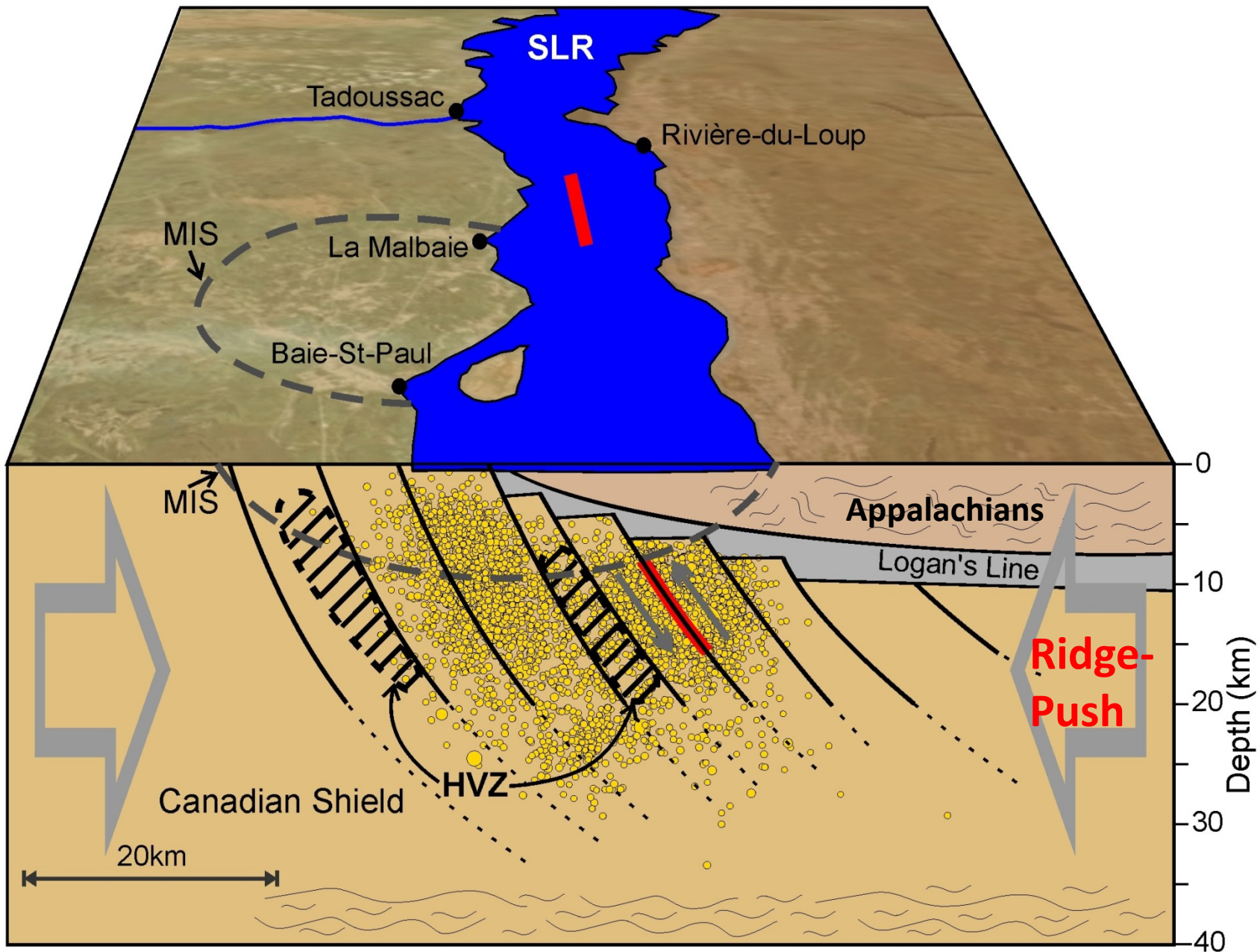
Kilometers

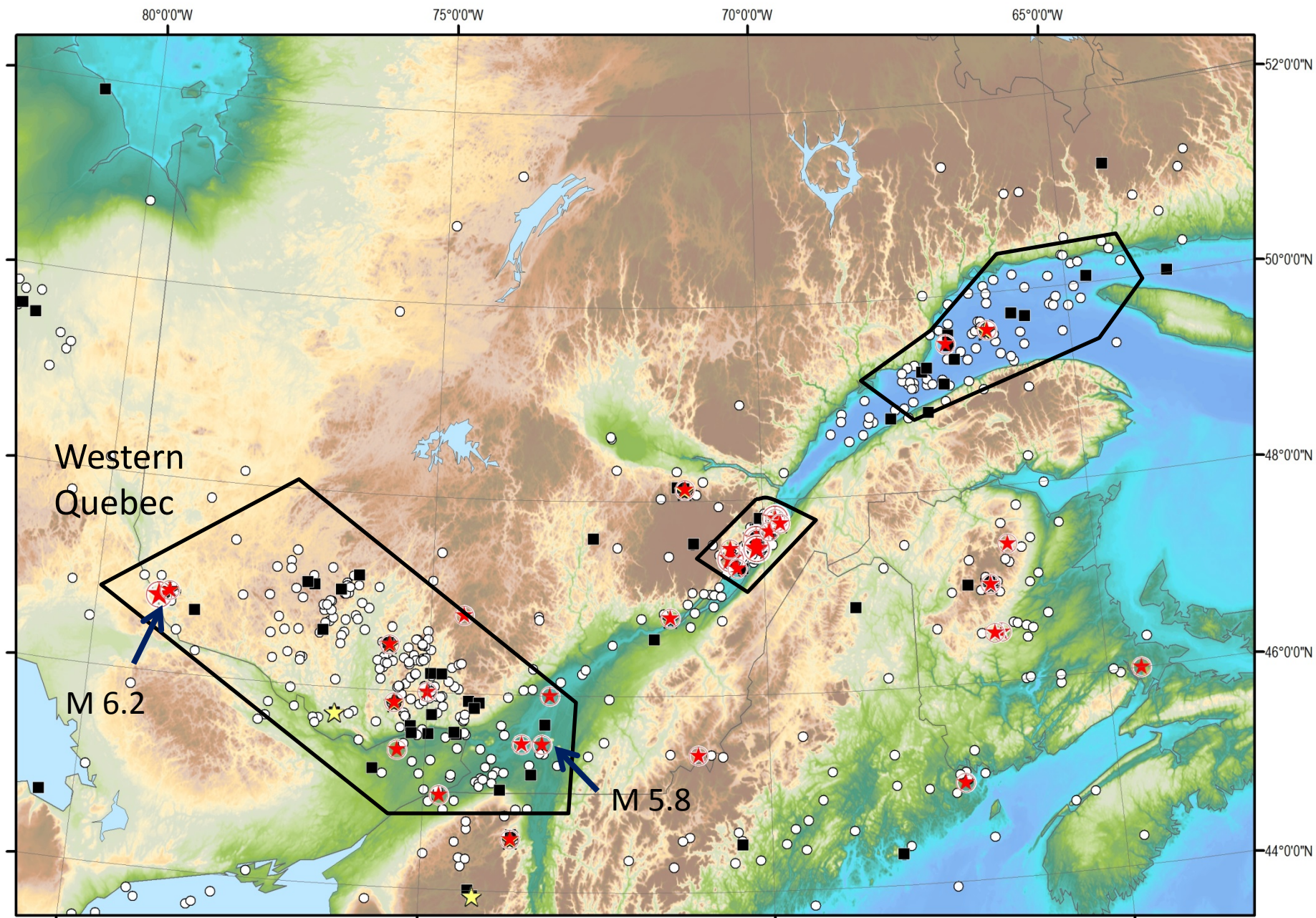


Radar + elevation





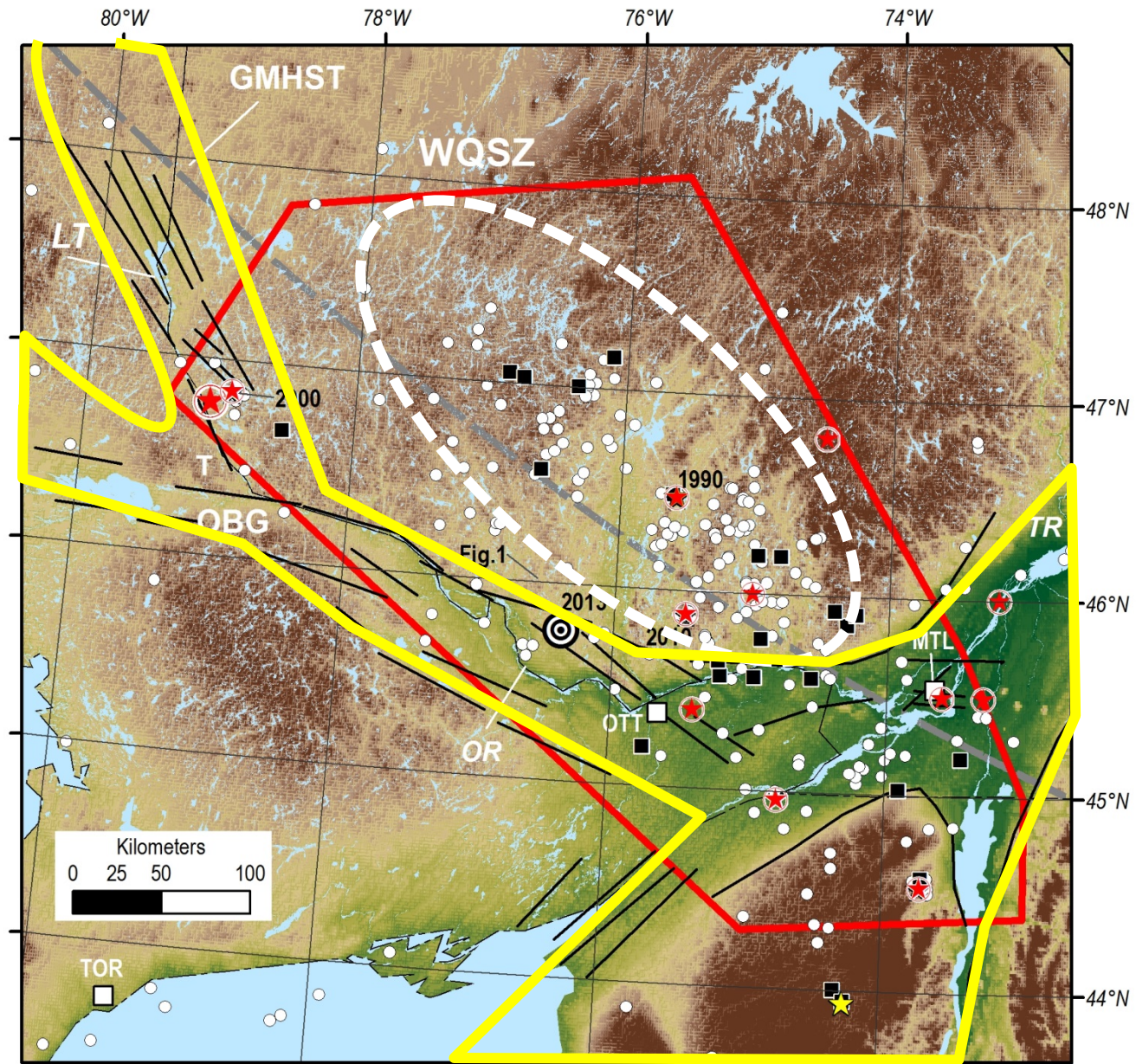




Legend

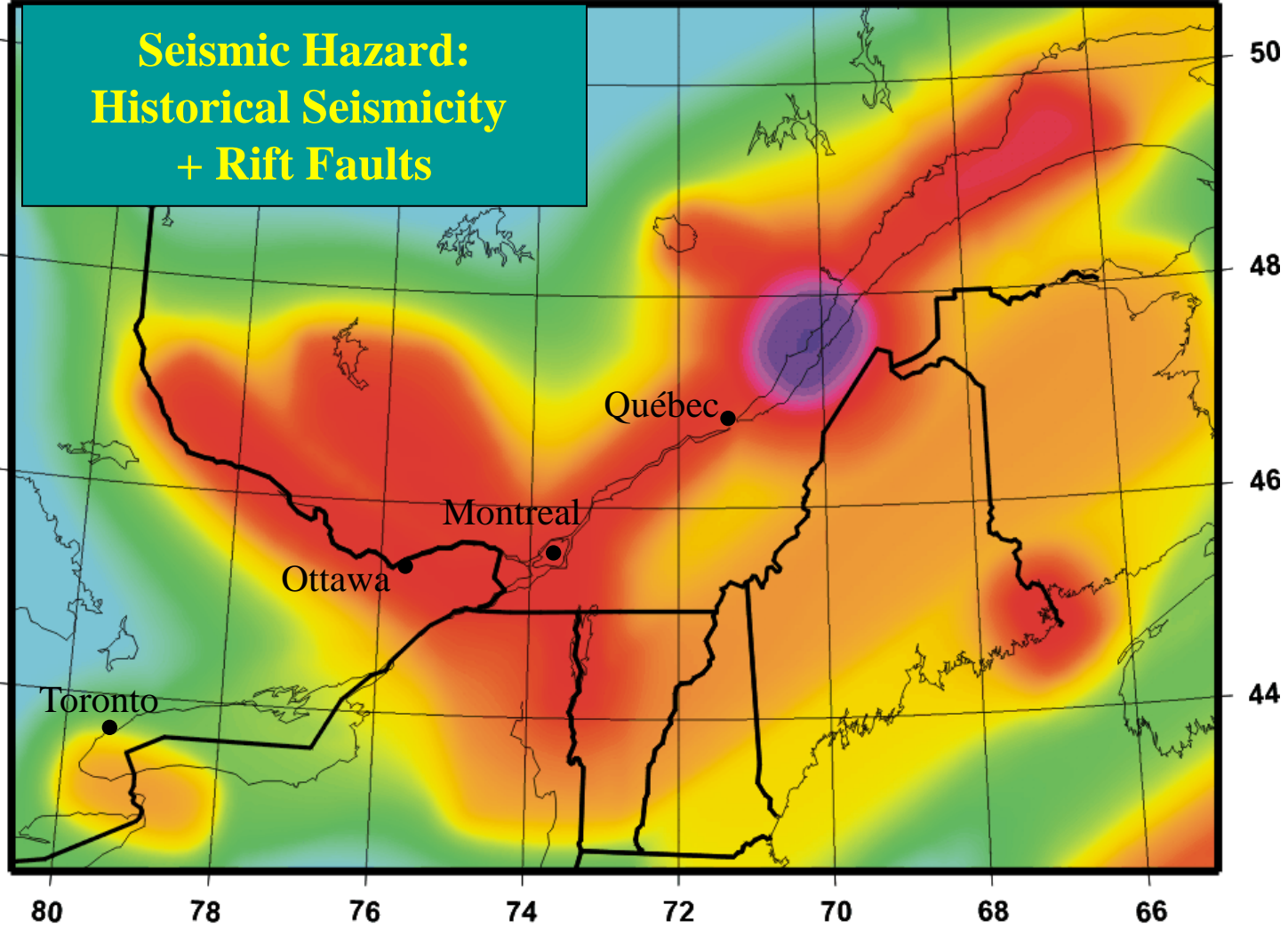
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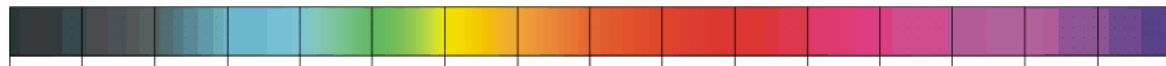


Legend ○ M3.0 - M3.9 ■ M4 - M4.9 ★ M5 - M5.9

Seismic Hazard: Historical Seismicity + Rift Faults

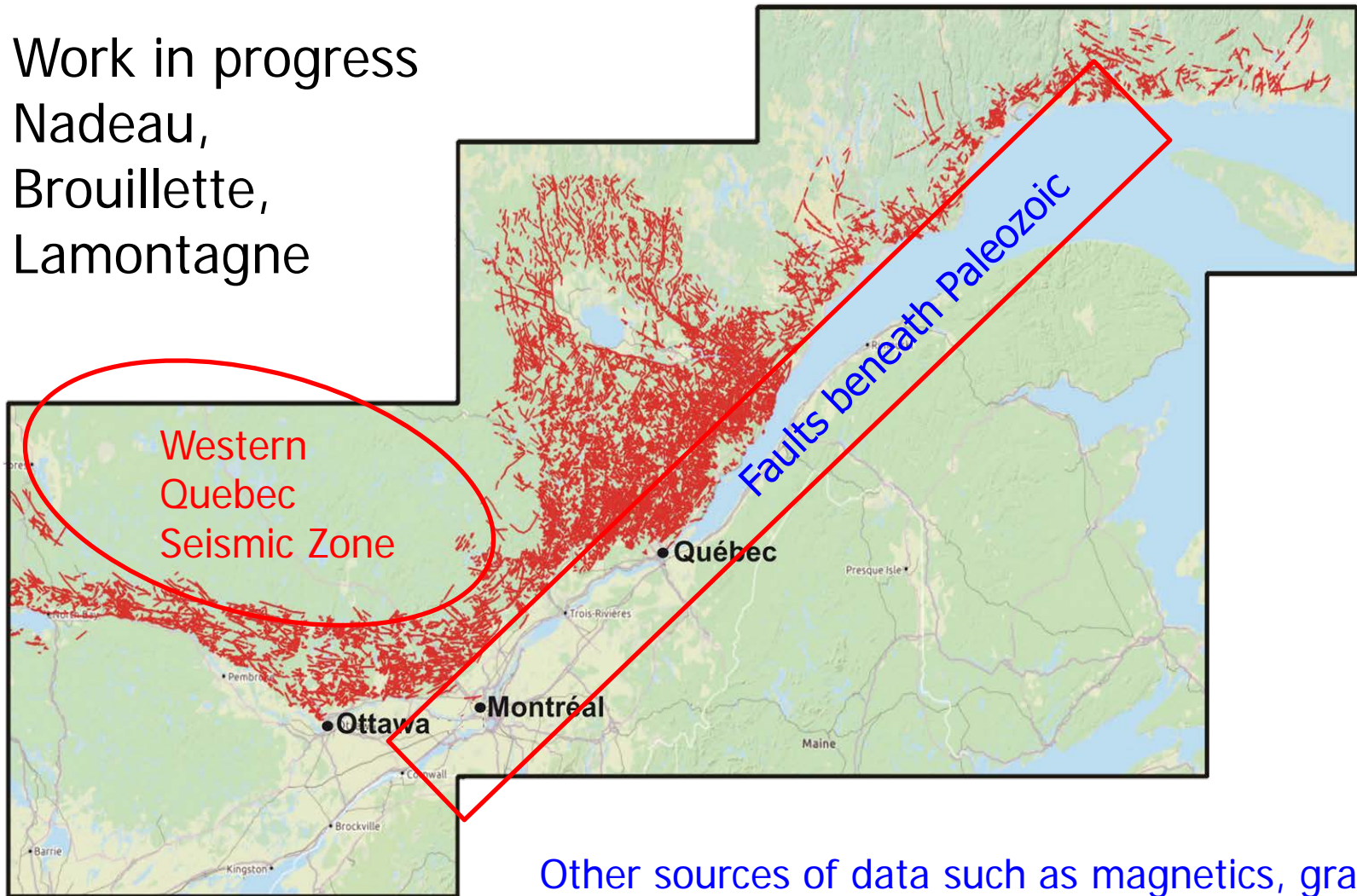


Increasing Hazard 



Spectral Acceleration (%g) $S_a(0.2)$

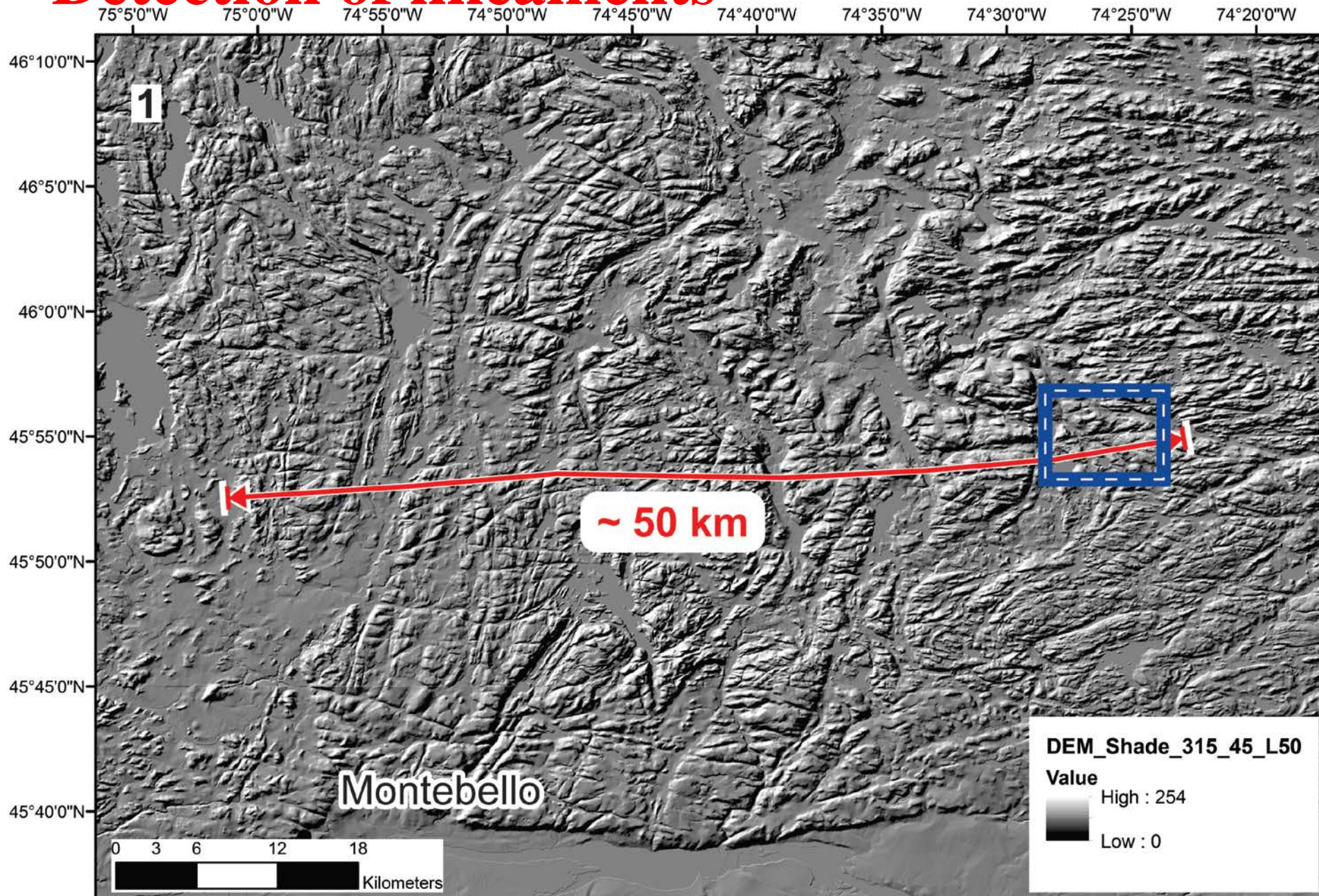
Work in progress
Nadeau,
Brouillette,
Lamontagne



Other sources of data such as magnetics, gravity,
bathymetry and Lidar (for Charlevoix)



Detection of lineaments



Conclusions

1. Most earthquakes in Quebec occur within boundaries of the SLRS
2. Most $M > 5+$ earthquakes correlate well with known faults
3. For smaller earthquakes, other faults may be reactivated
4. Local stress enhancement or weak faults?
5. There is on-going mapping of the SLRS faults... stay tuned





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