

The faults and historical earthquakes in the Canterbury region

Presentation to the Canterbury Earthquakes Royal Commission

October 2011

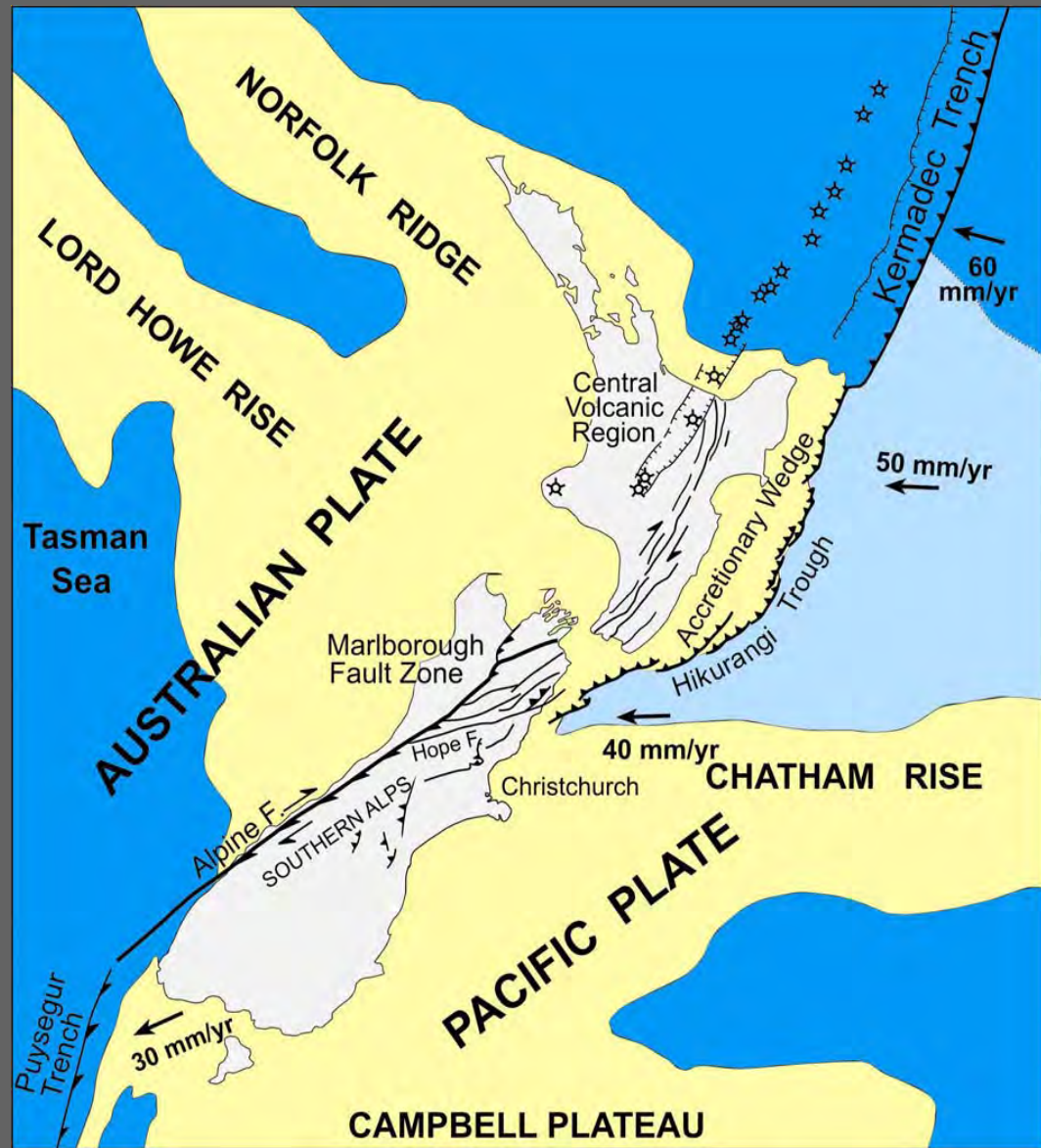
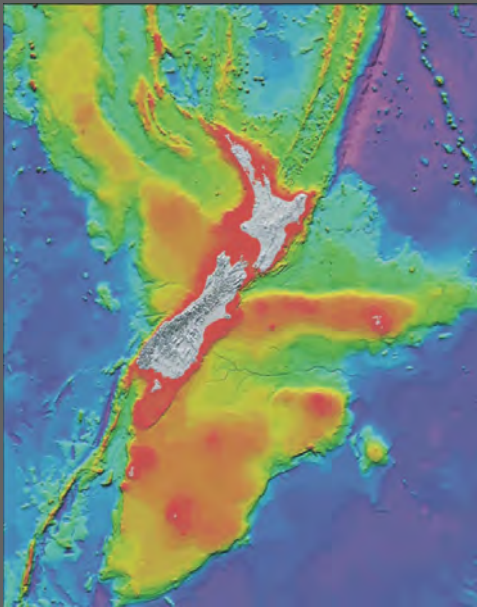


Photo: P Stalder

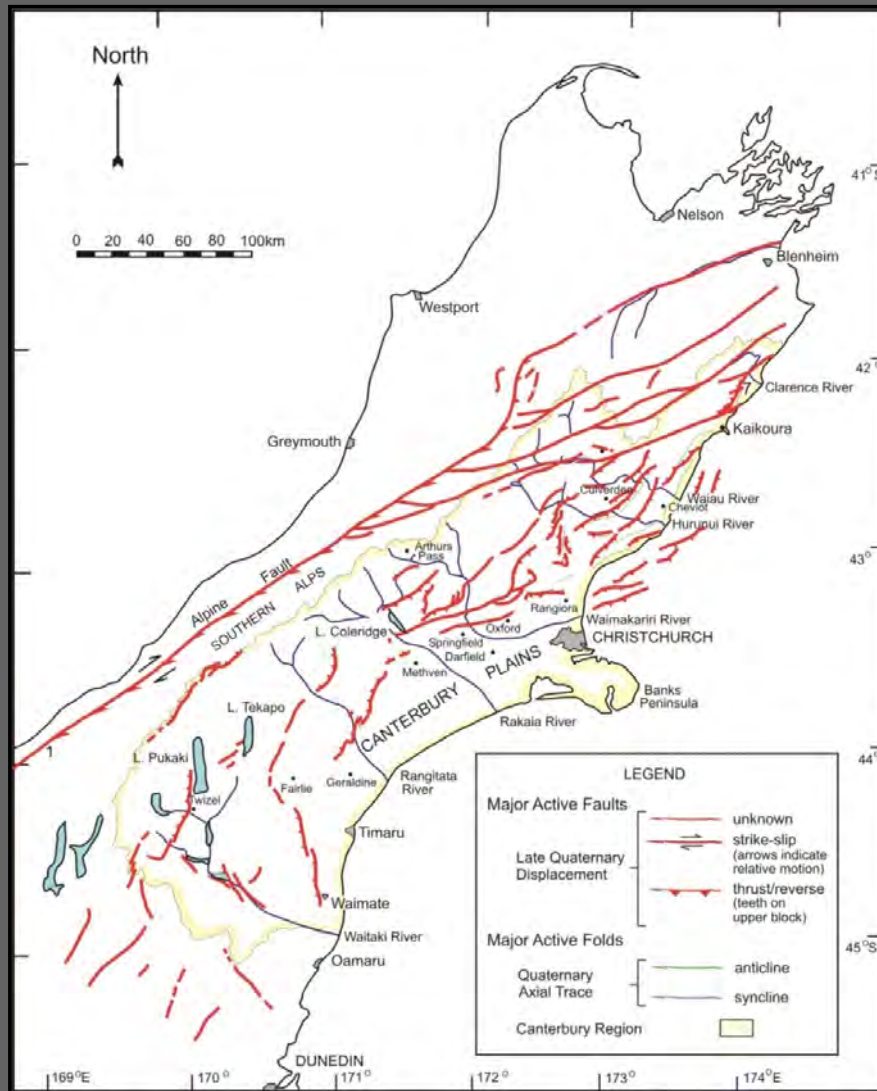
Prof. Jarg R. Pettinga
Head – Department of Geological Sciences
University of Canterbury



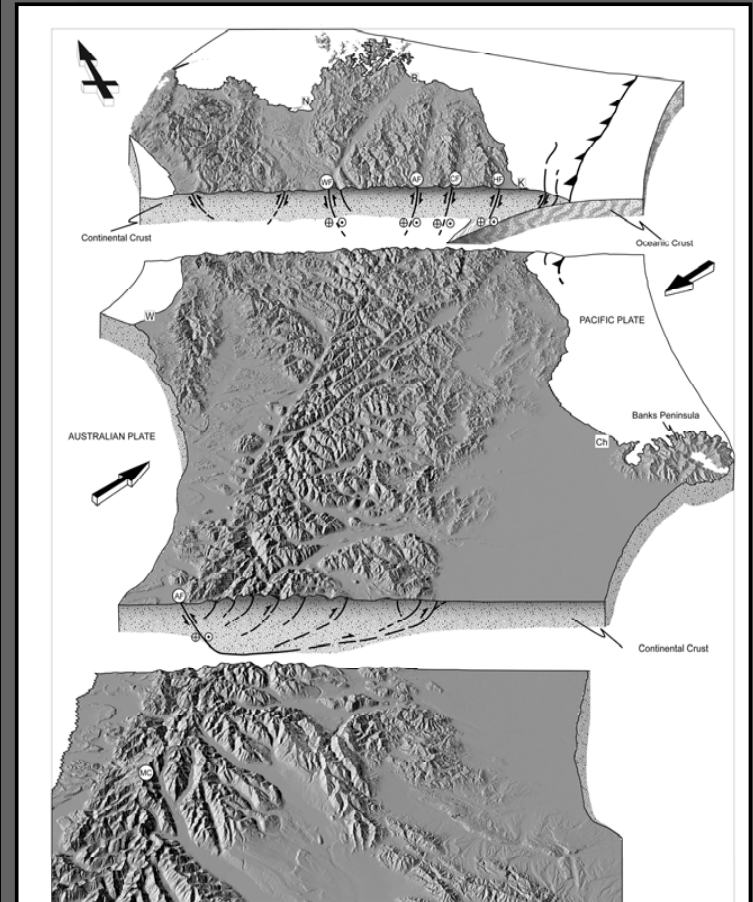
Plate Tectonics and the Shaping of NZ



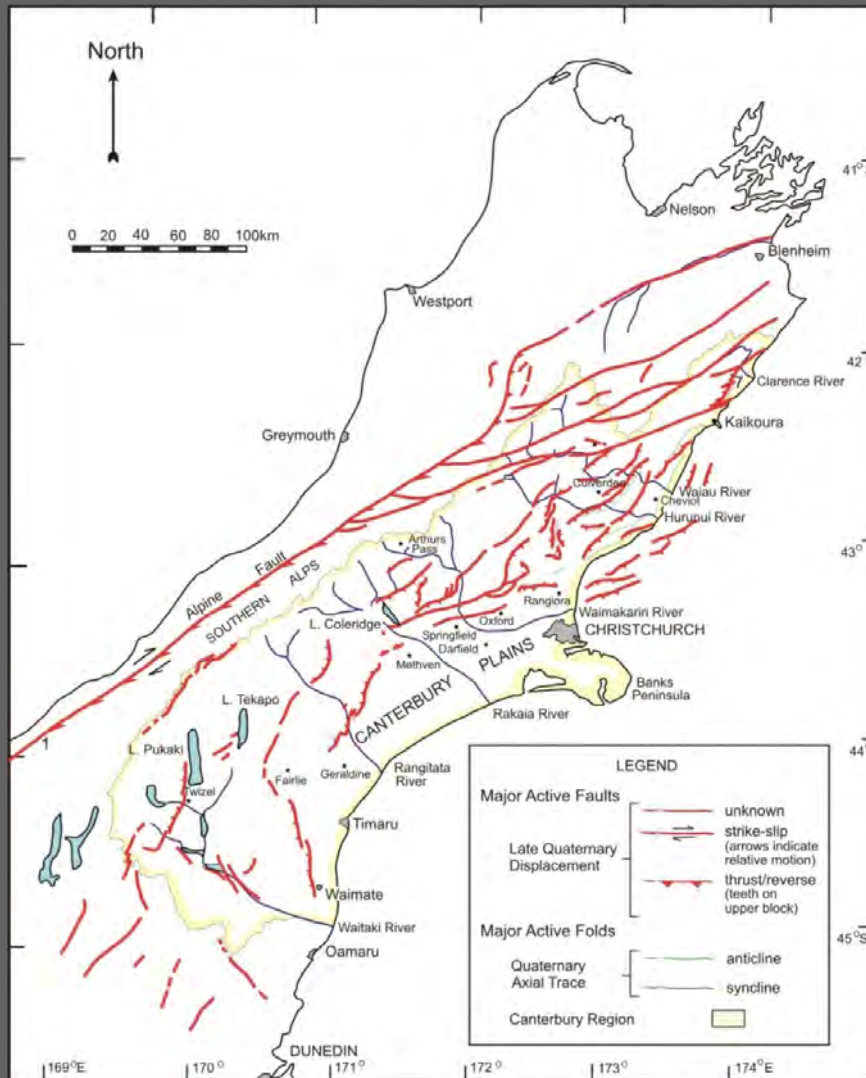
Faulting and the Earthquake-driven Landscape



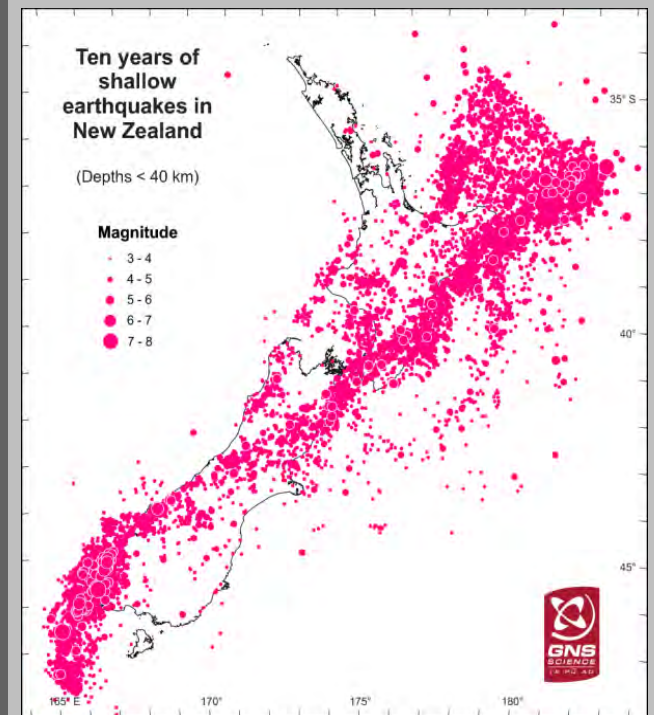
Canterbury has many active faults that contribute to the earthquake hazard



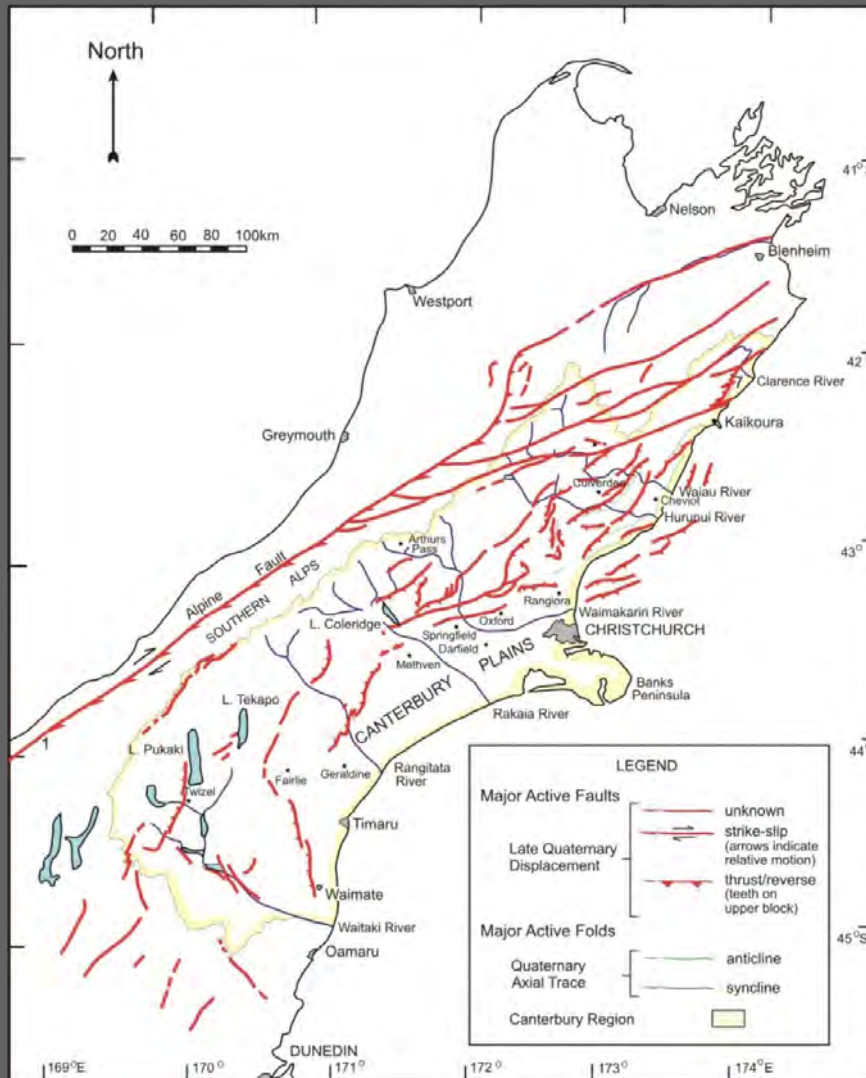
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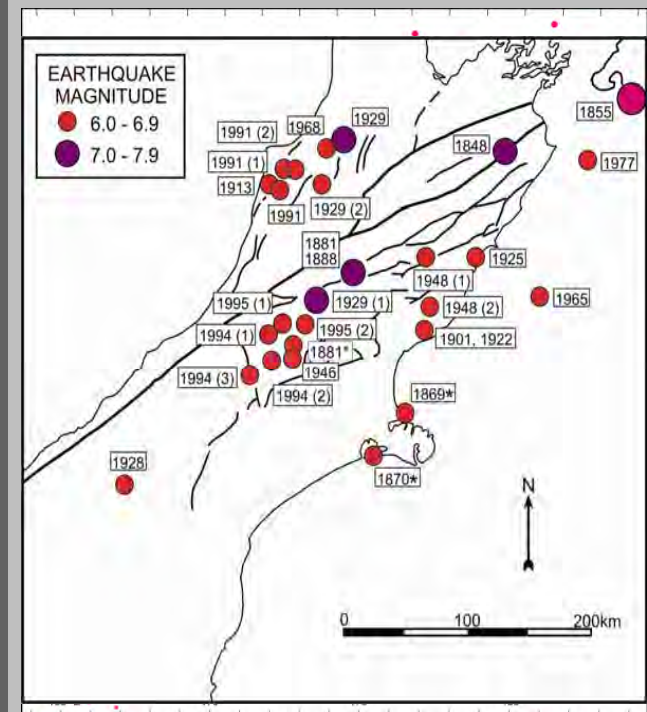
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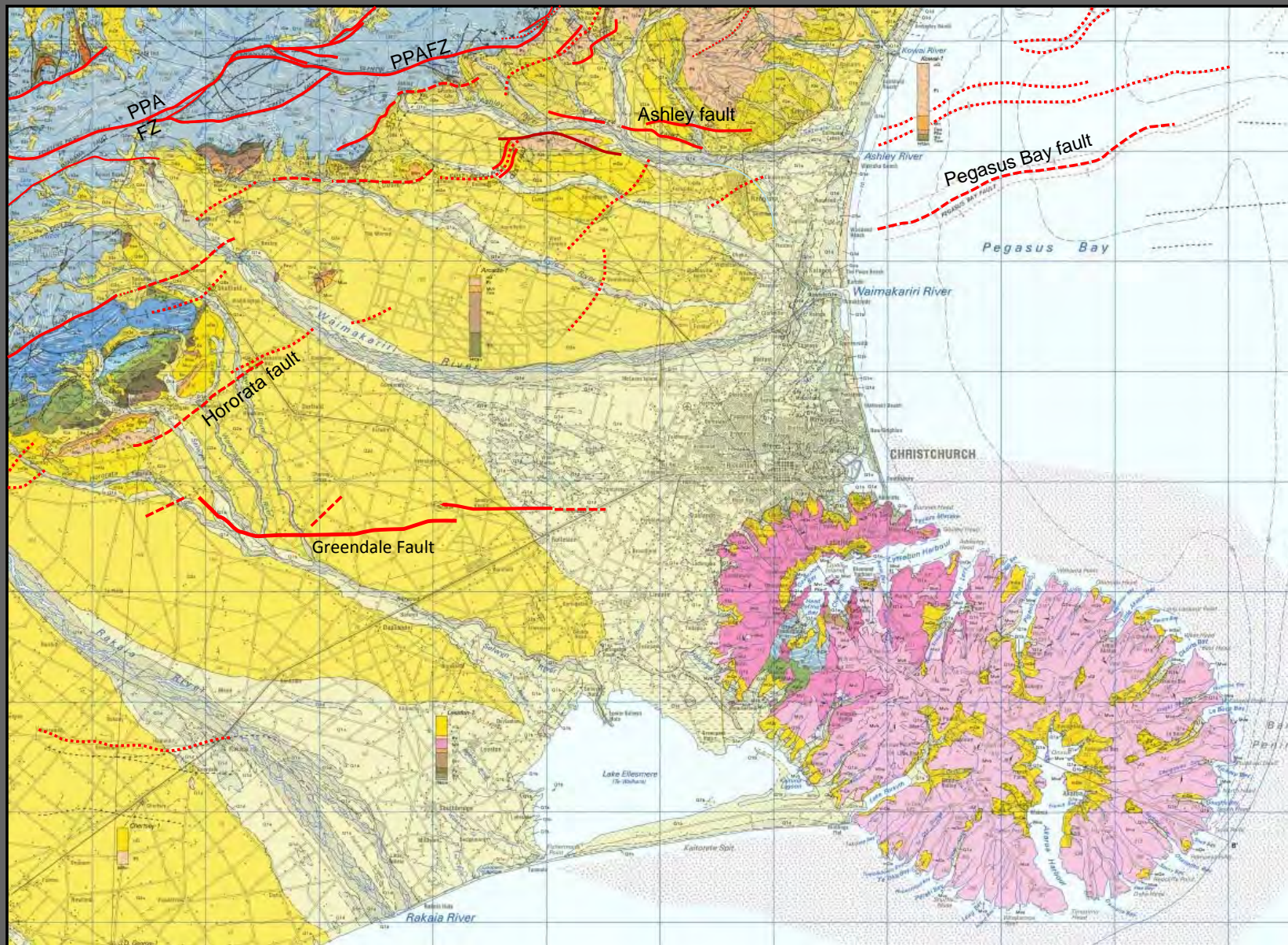


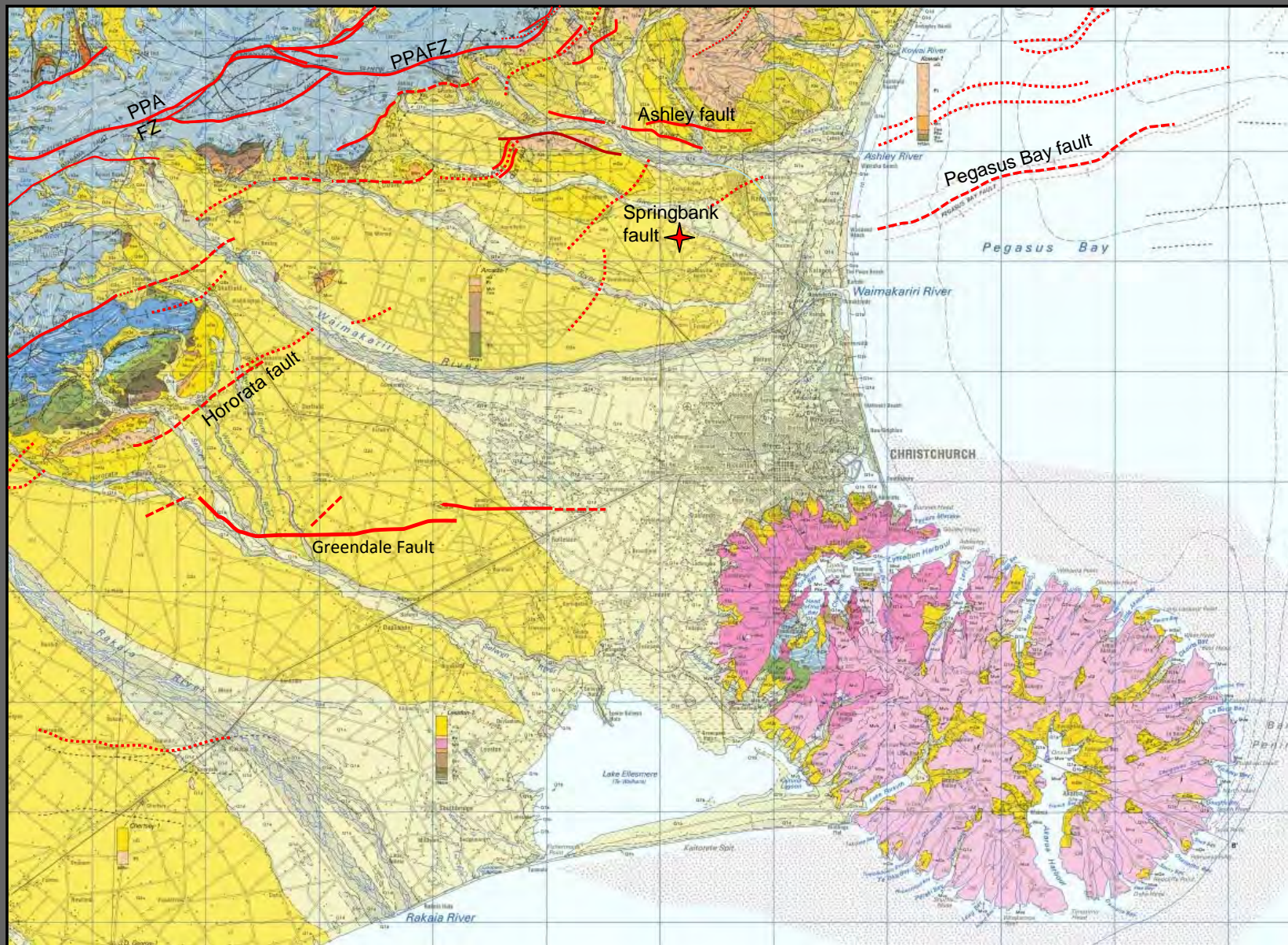
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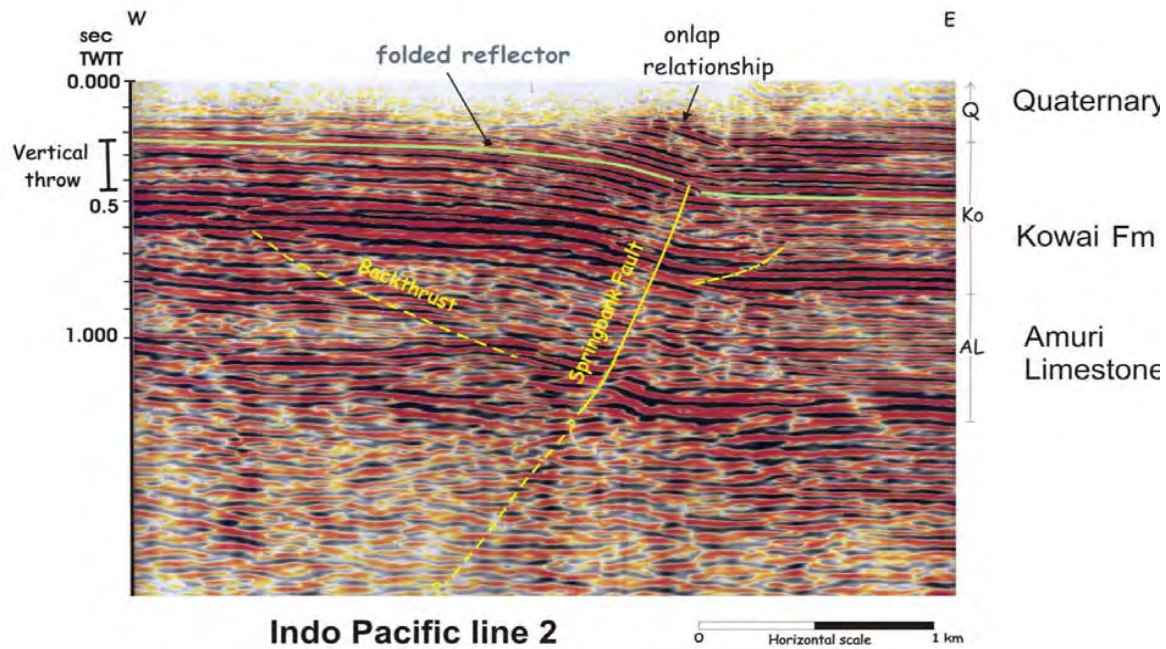


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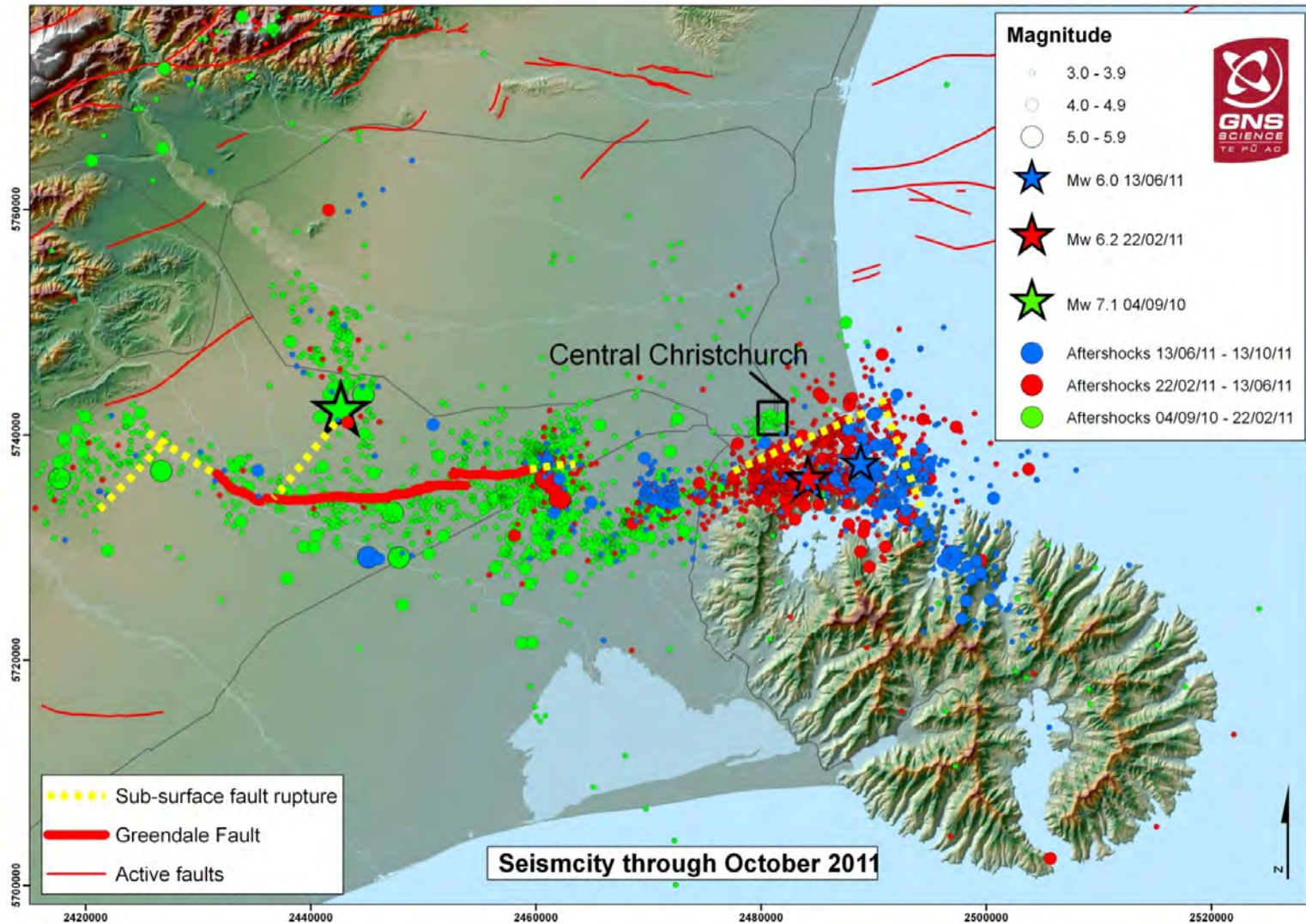




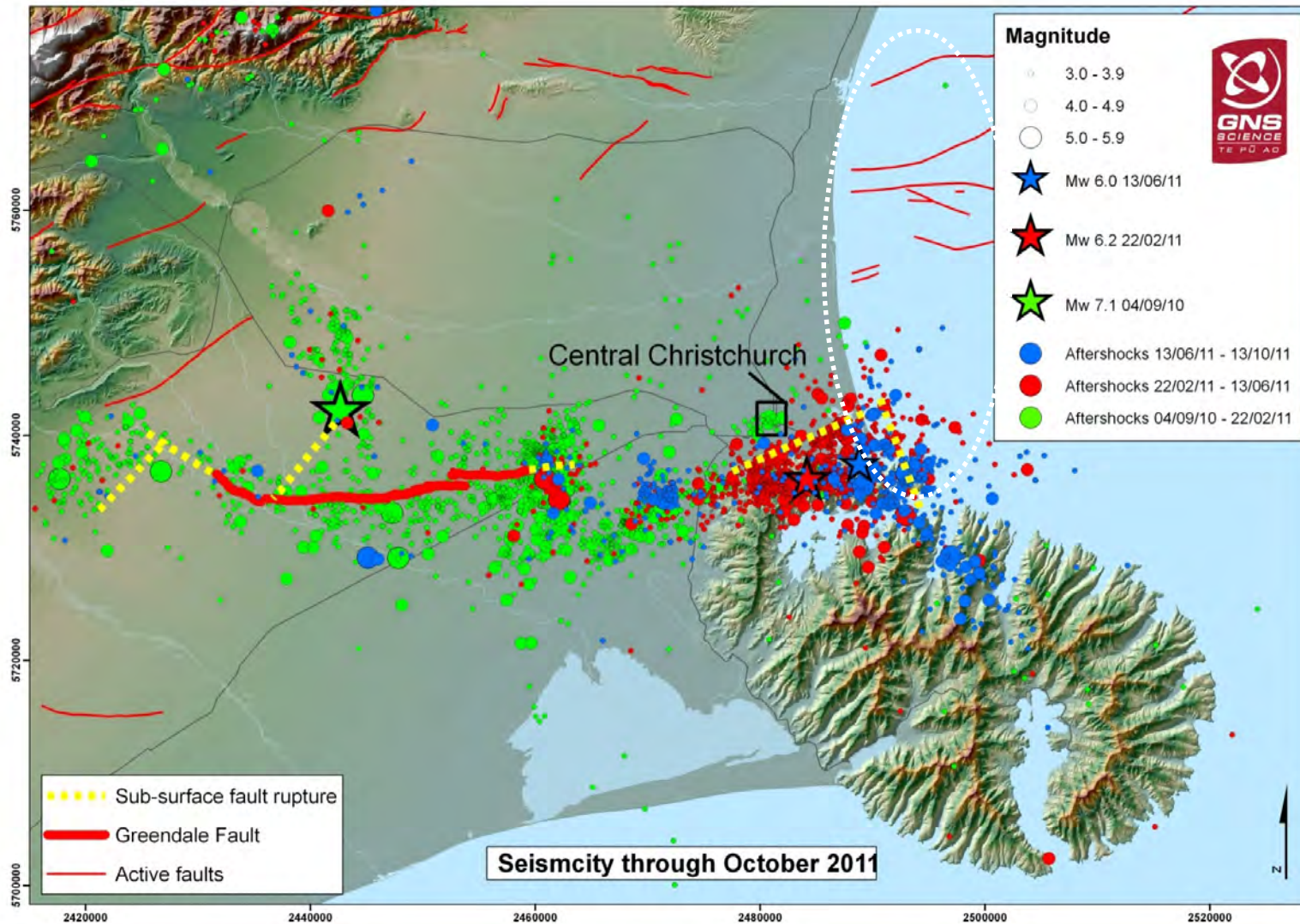
The Springbank Structure

Source: University of Canterbury

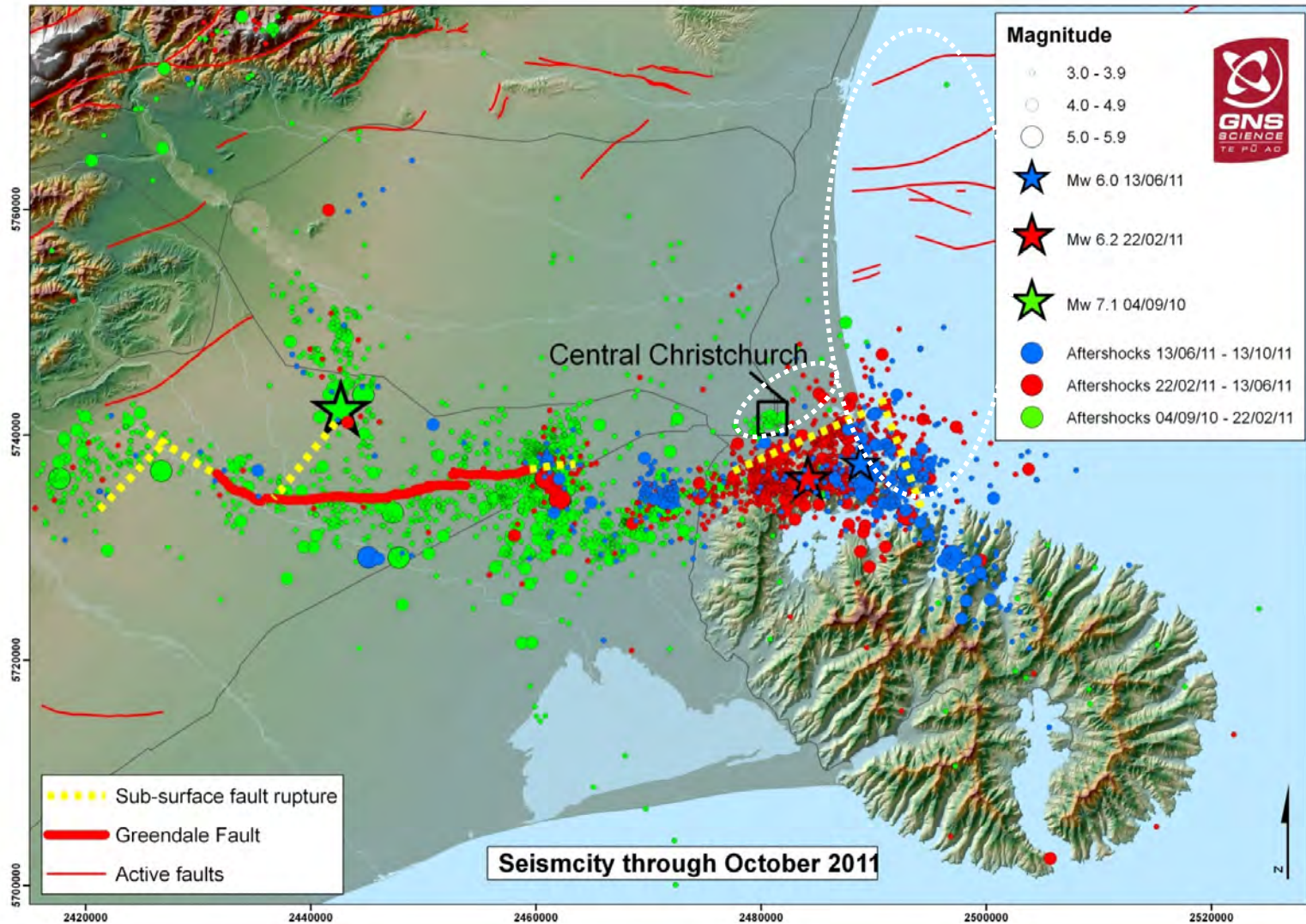
Seismic Reflection Surveying – targeting knowledge “gaps”



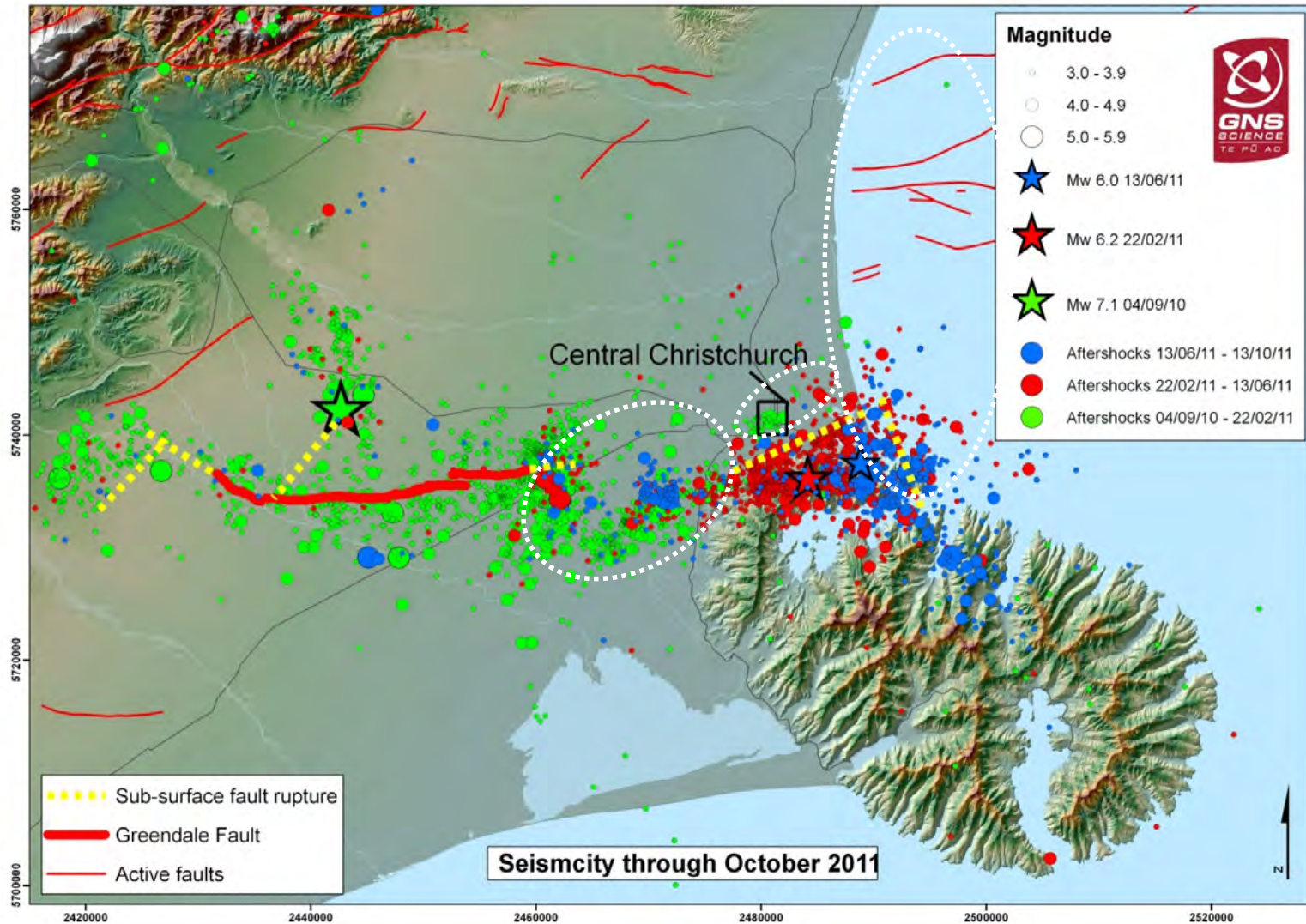
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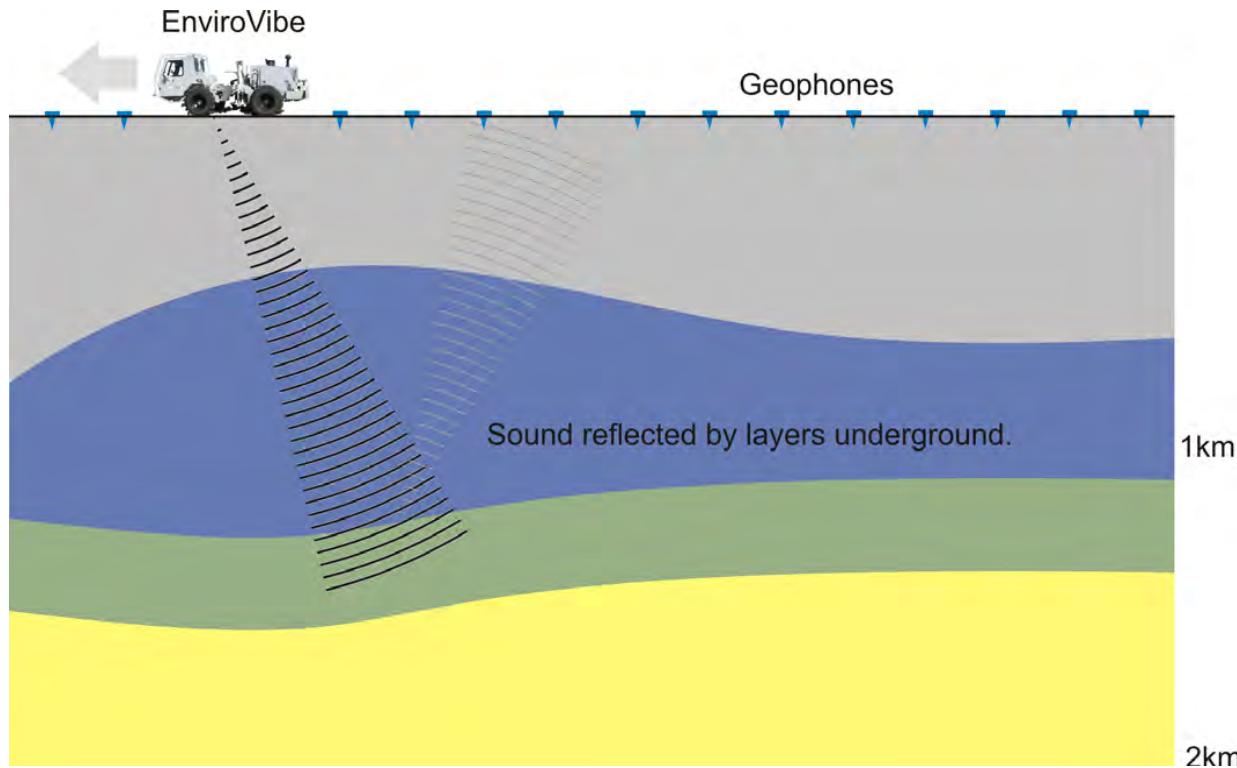


Seismic Reflection Surveying – targeting knowledge “gaps”

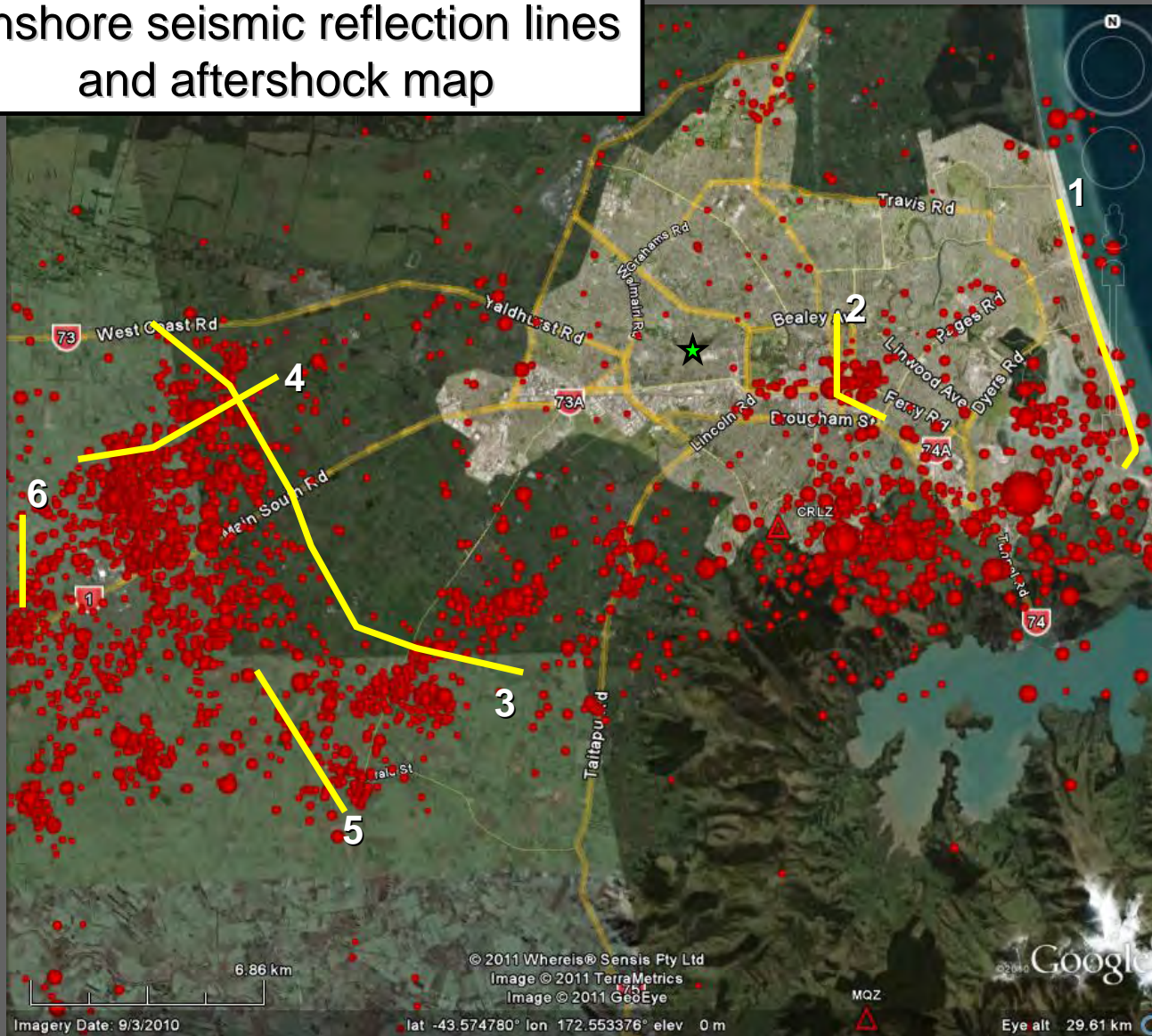


High-Resolution Seismic Reflection Survey

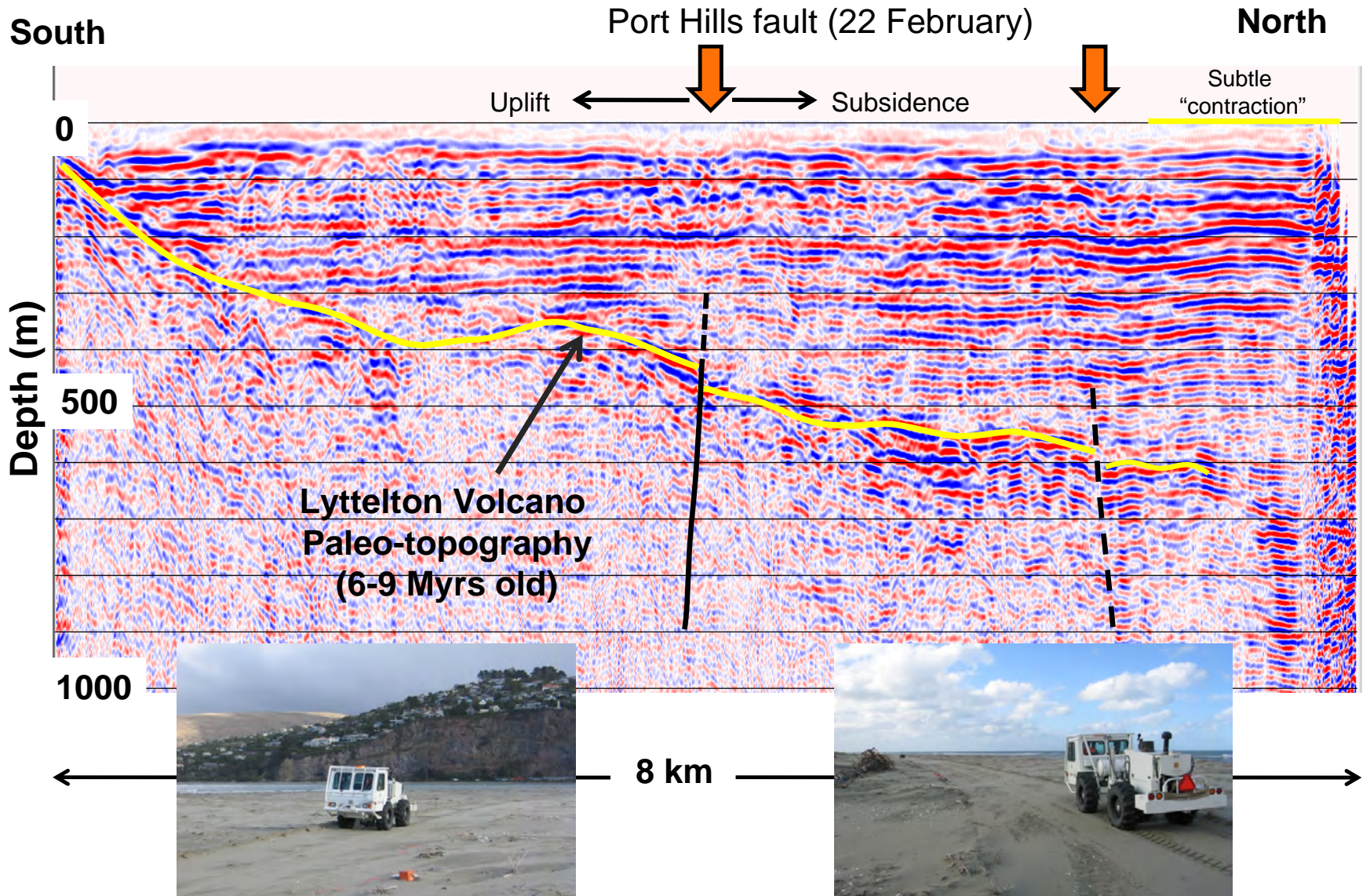
*Using 600-channel system and vibroseis truck
from
University of Calgary*



Onshore seismic reflection lines and aftershock map



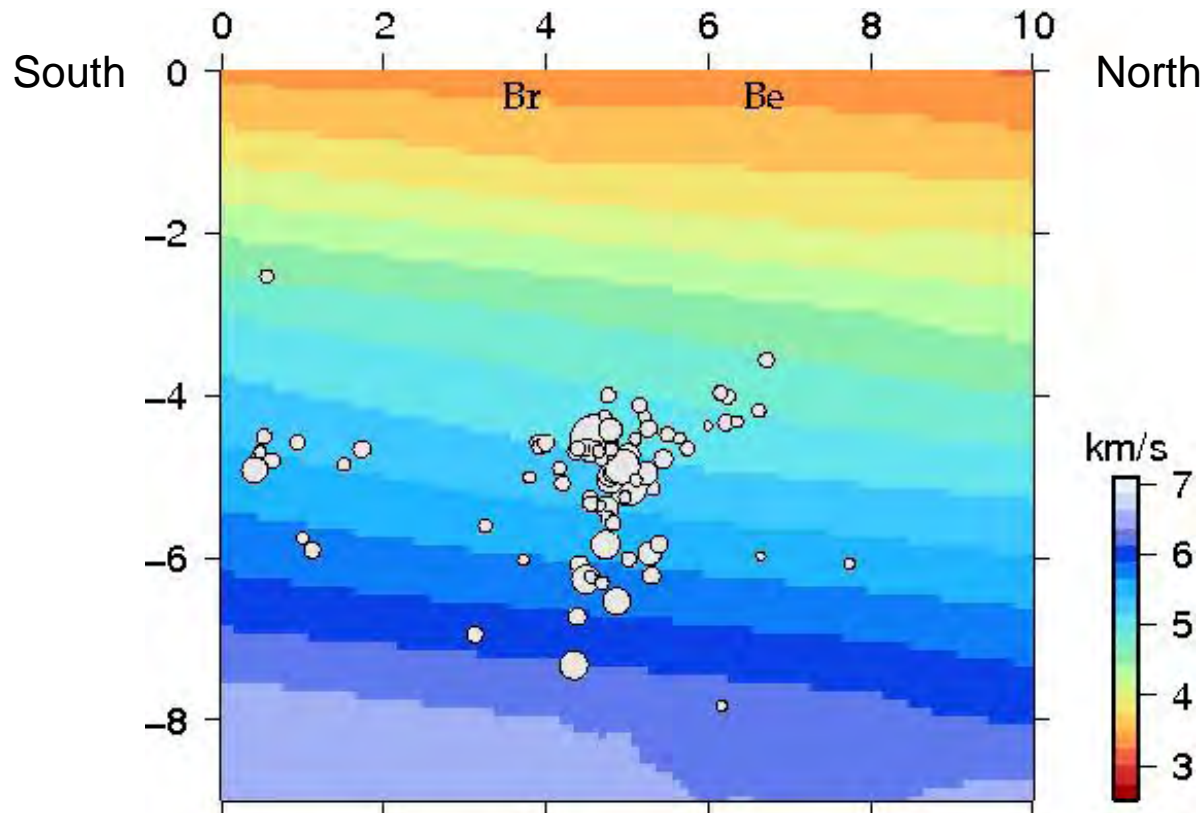
Line 1 - New Brighton Beach



CBD Seismicity



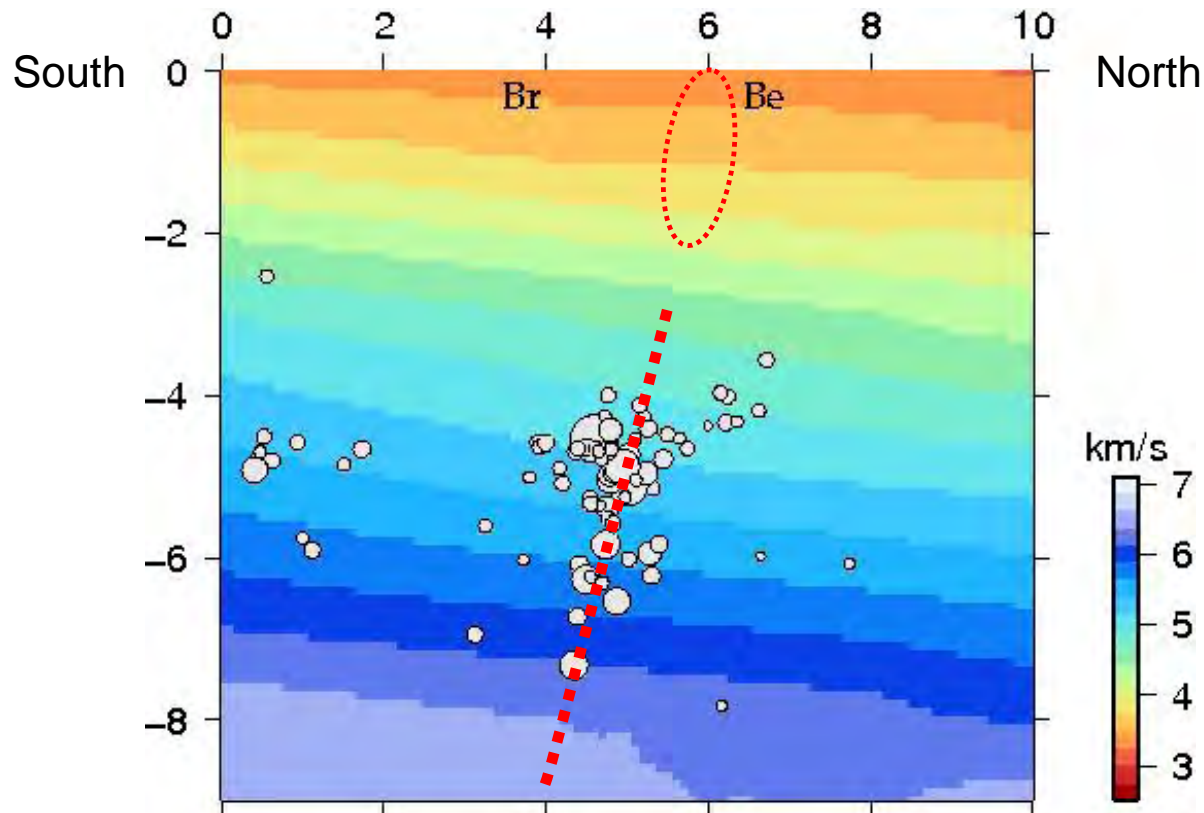
North-South cross section of CBD Seismicity



Br: Brougham St

Be: Bealey Ave

North-South cross section of CBD Seismicity



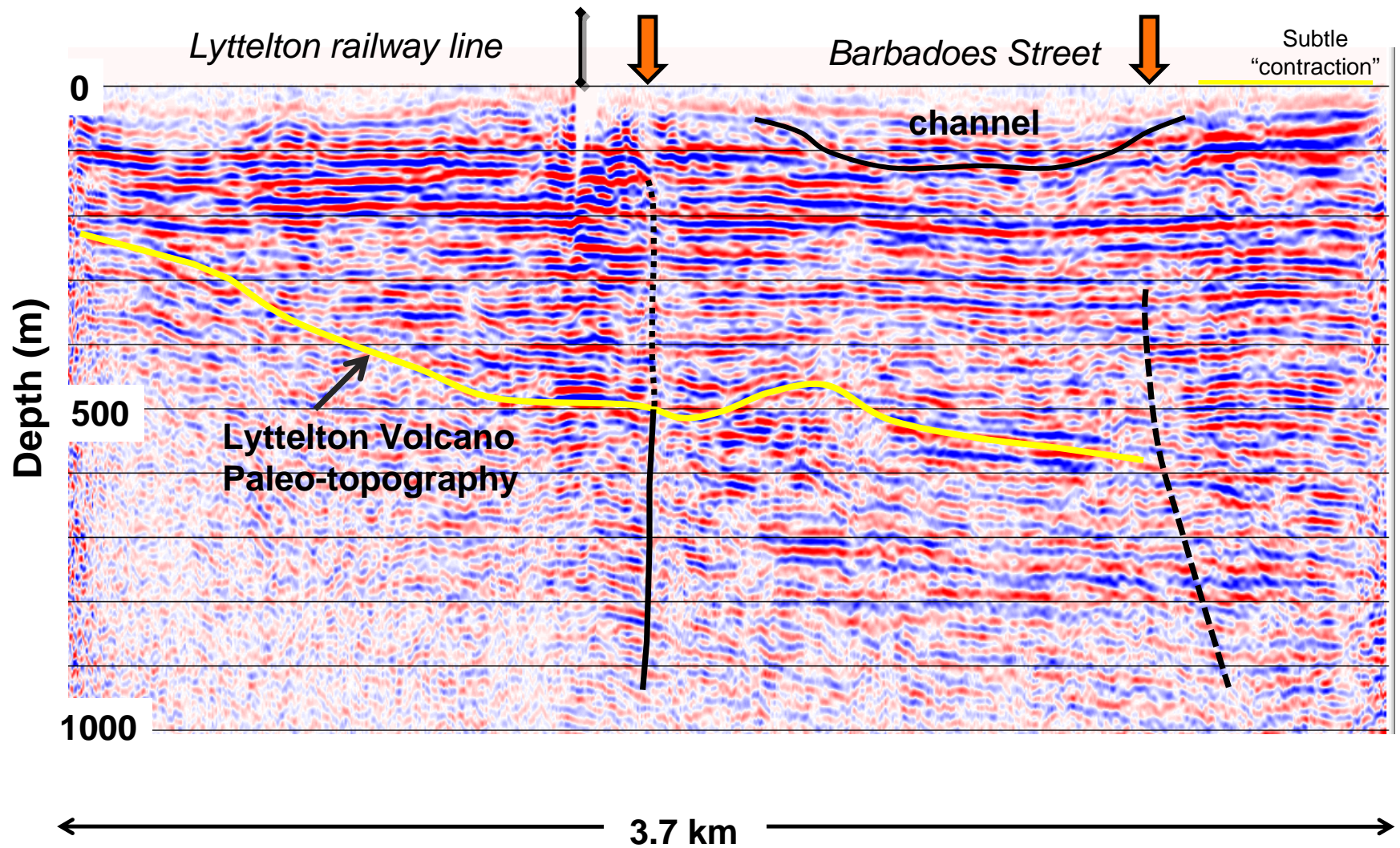
Br: Brougham St

Be: Bealey Ave

Line 2 - Barbadoes Street

South

North



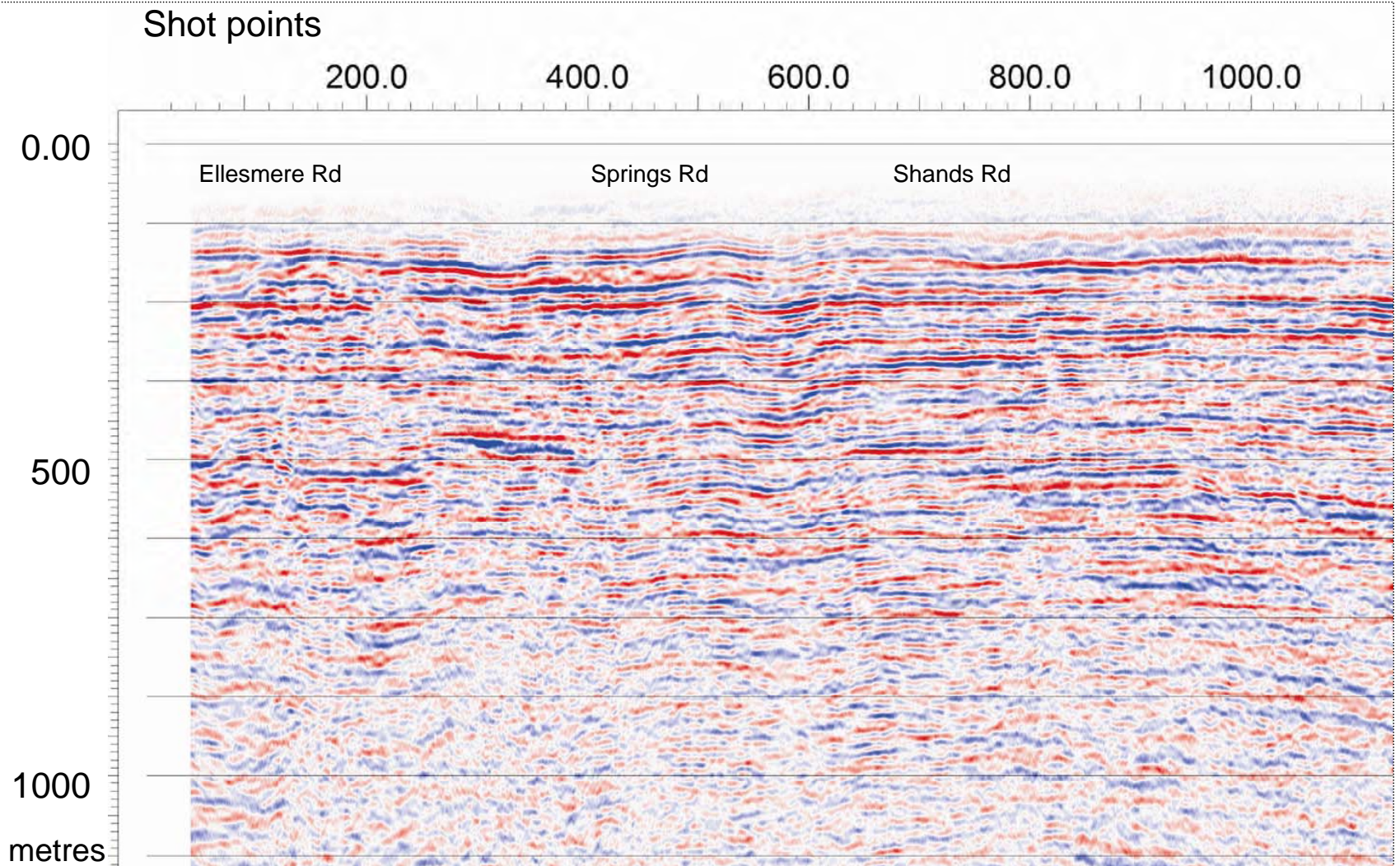
Christchurch Seismic Reflection Programme - Phase 2



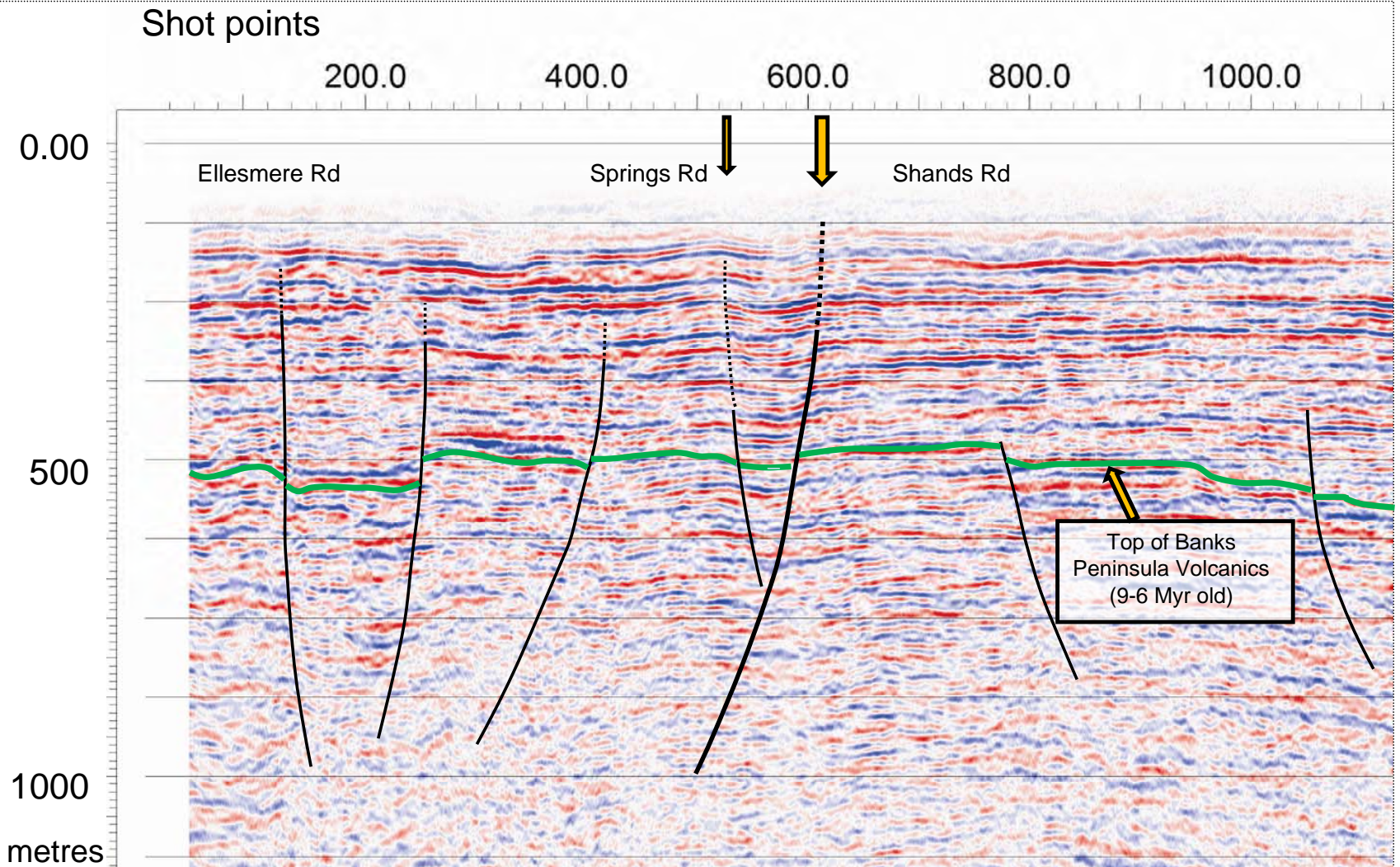
Robinsons Road (SE end)

Southeast

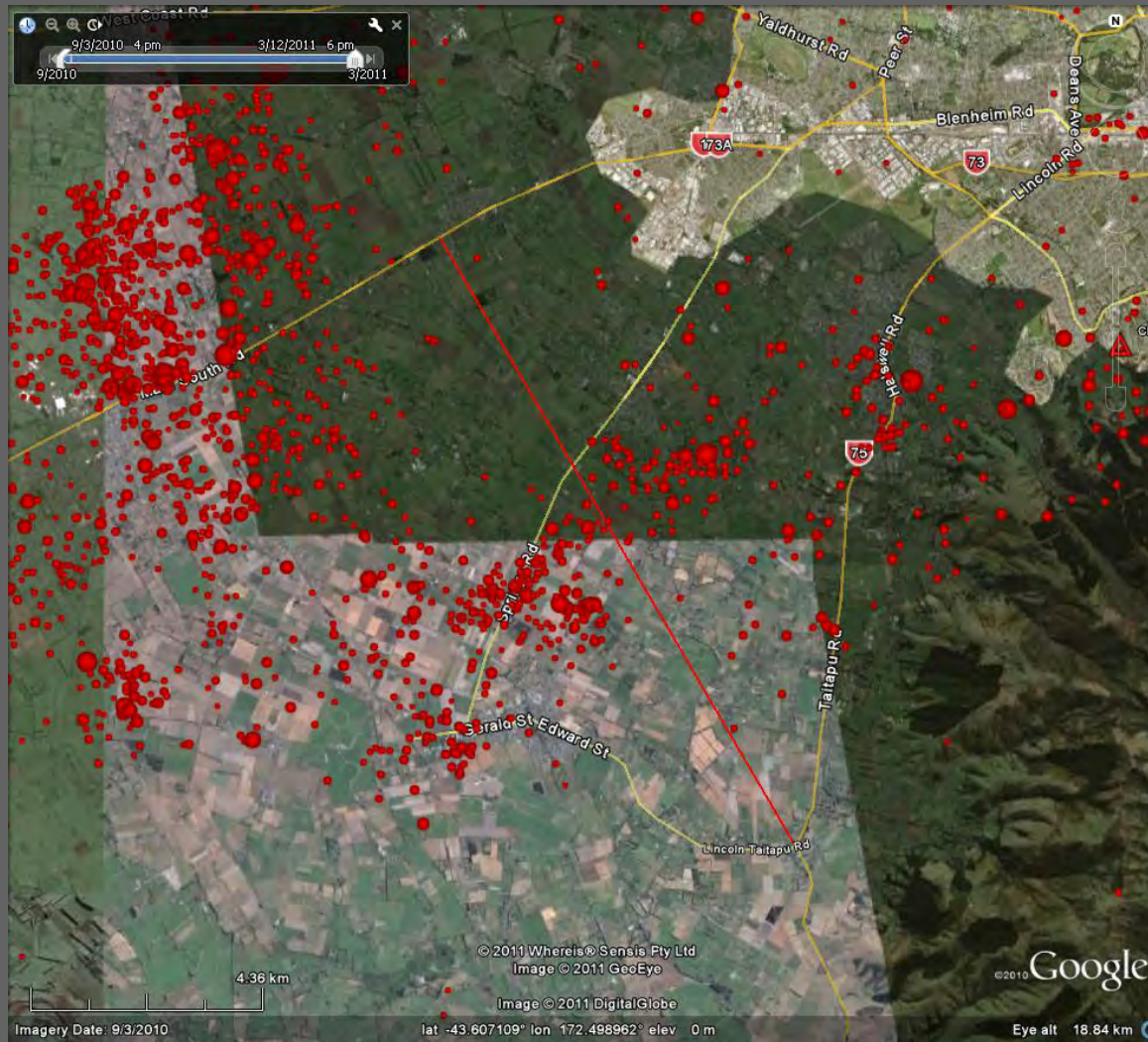
Northwest



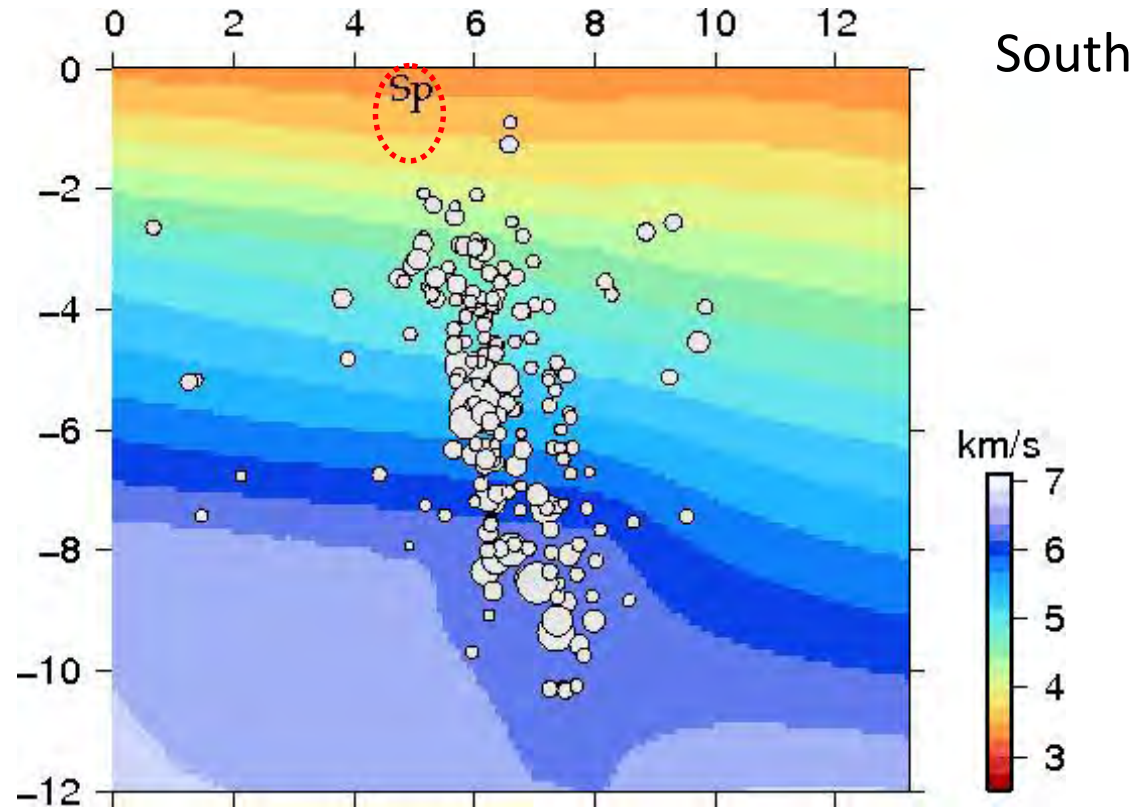
Robinsons Road (SE end)

Southeast**Northwest**

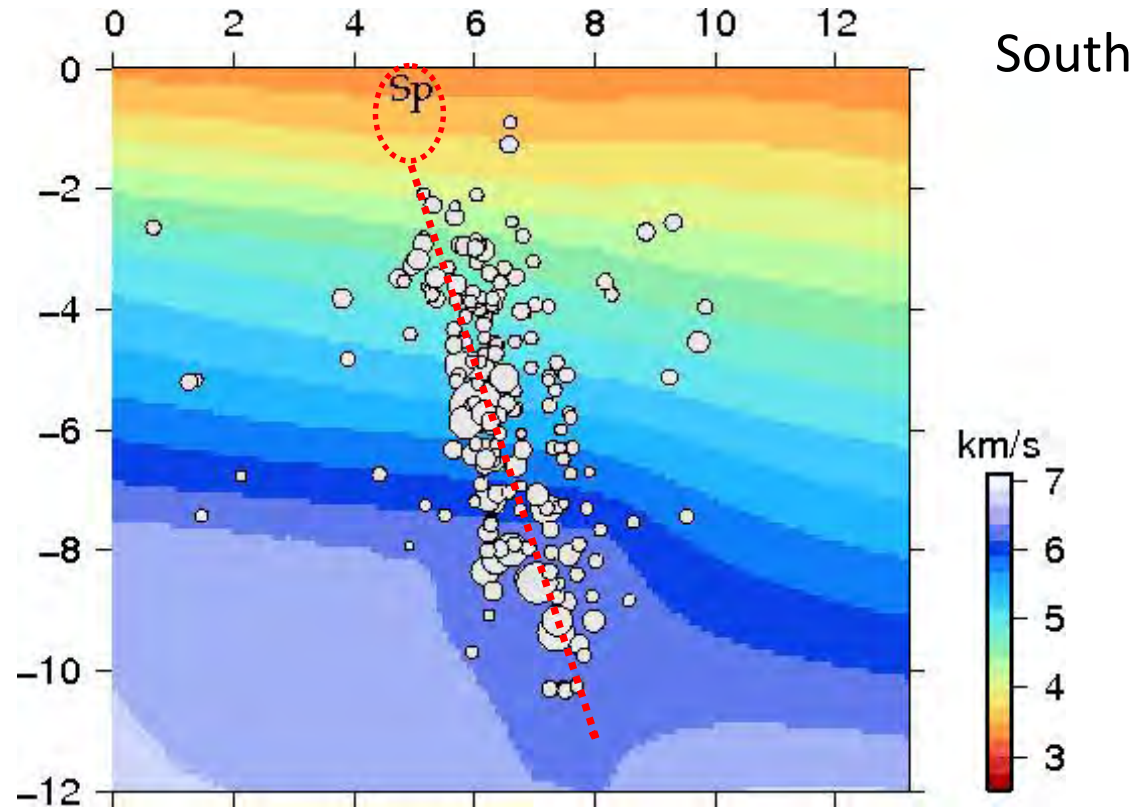
SW Step-over Seismicity



NW-SE step-over cross section



NW-SE step-over cross section

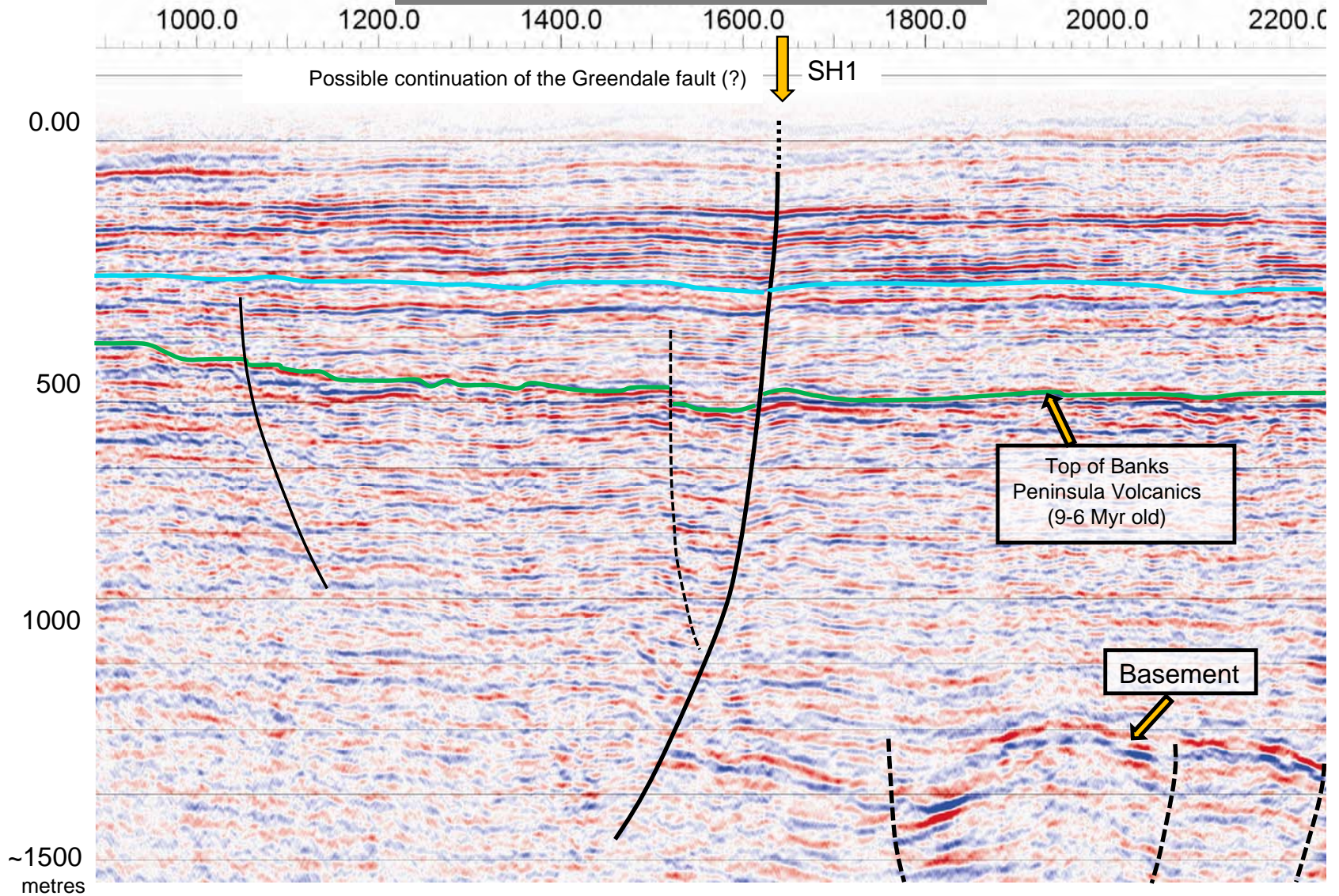


Search for the Wigram-Lincoln Structure



Christchurch Seismic Reflection Programme - Phase 2



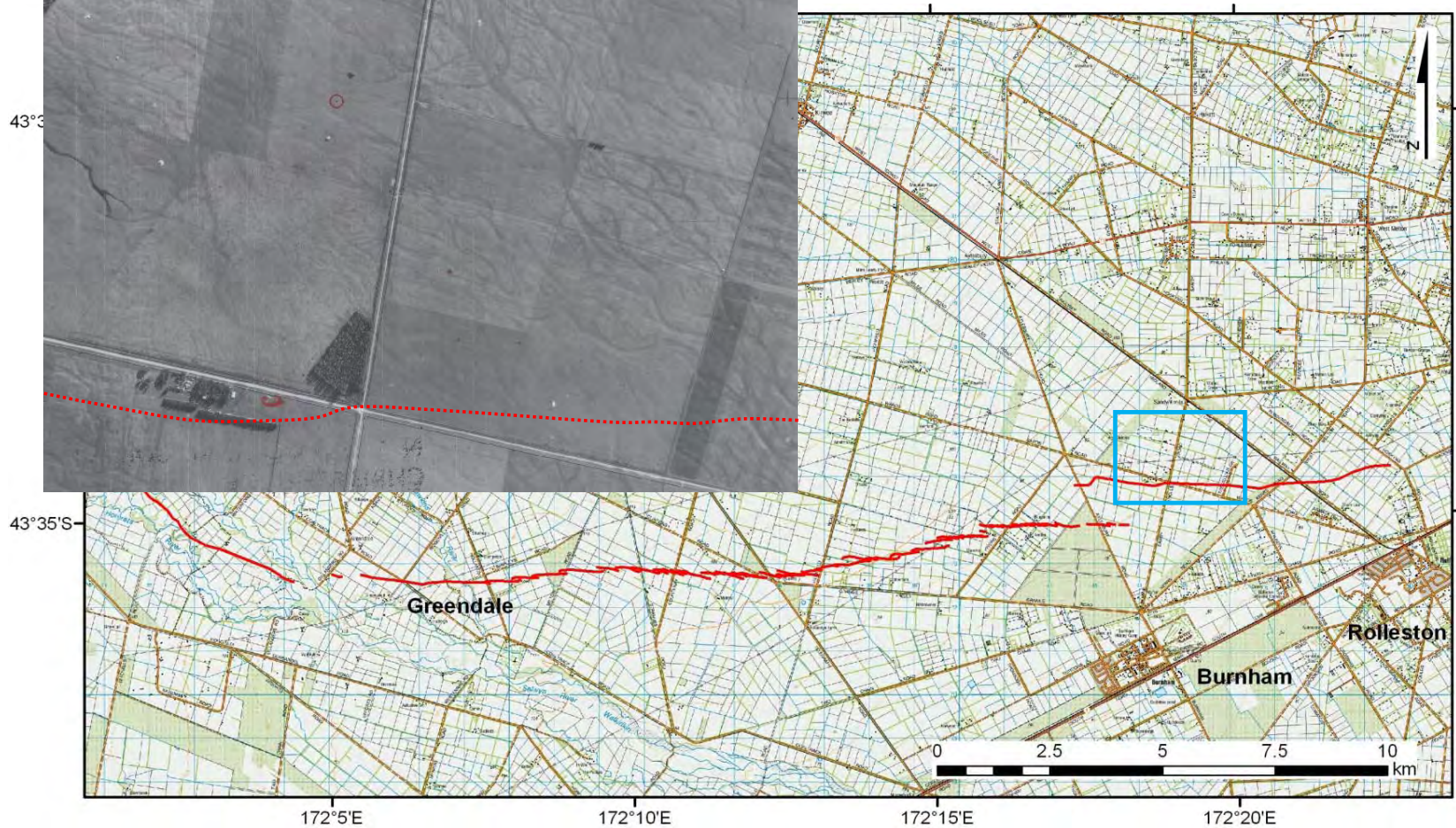
Southeast**Northwest****Robinsons Road (central)**

NZ Aerial Mapping photo (1942)

Greendale Fault (September 2010) NE Segment Surface Rupture

43°3'

43°35'S

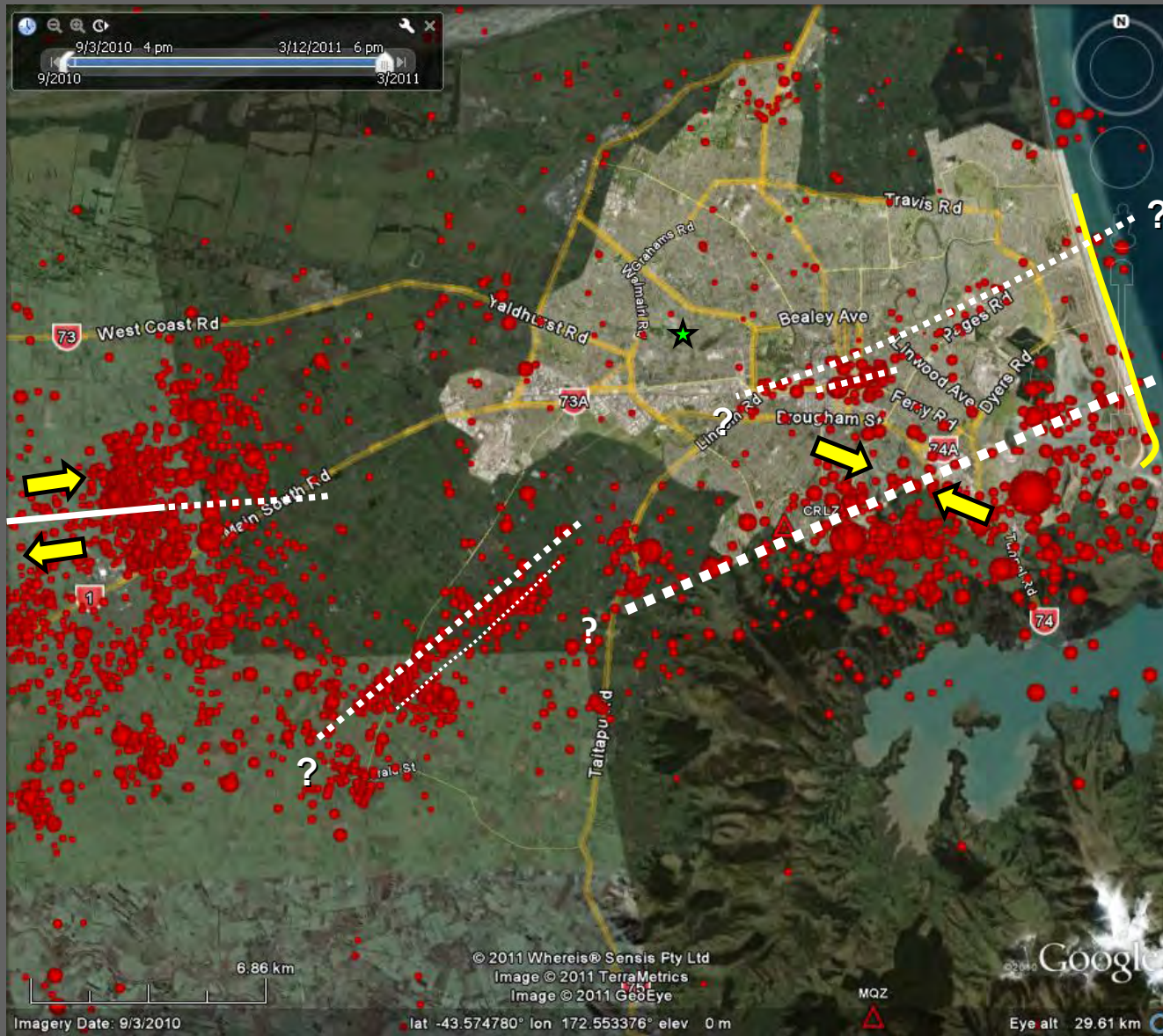


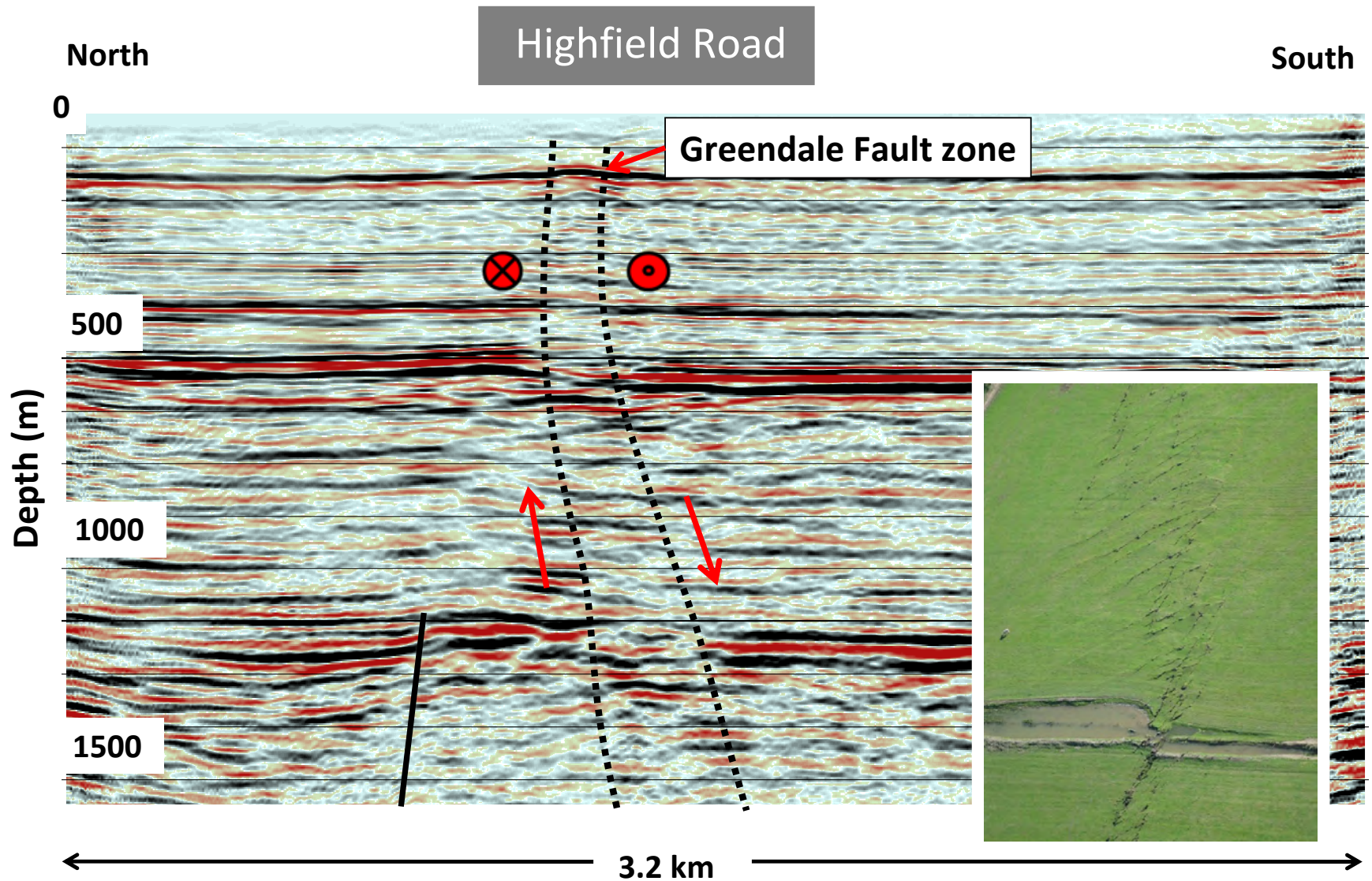
172°5'E

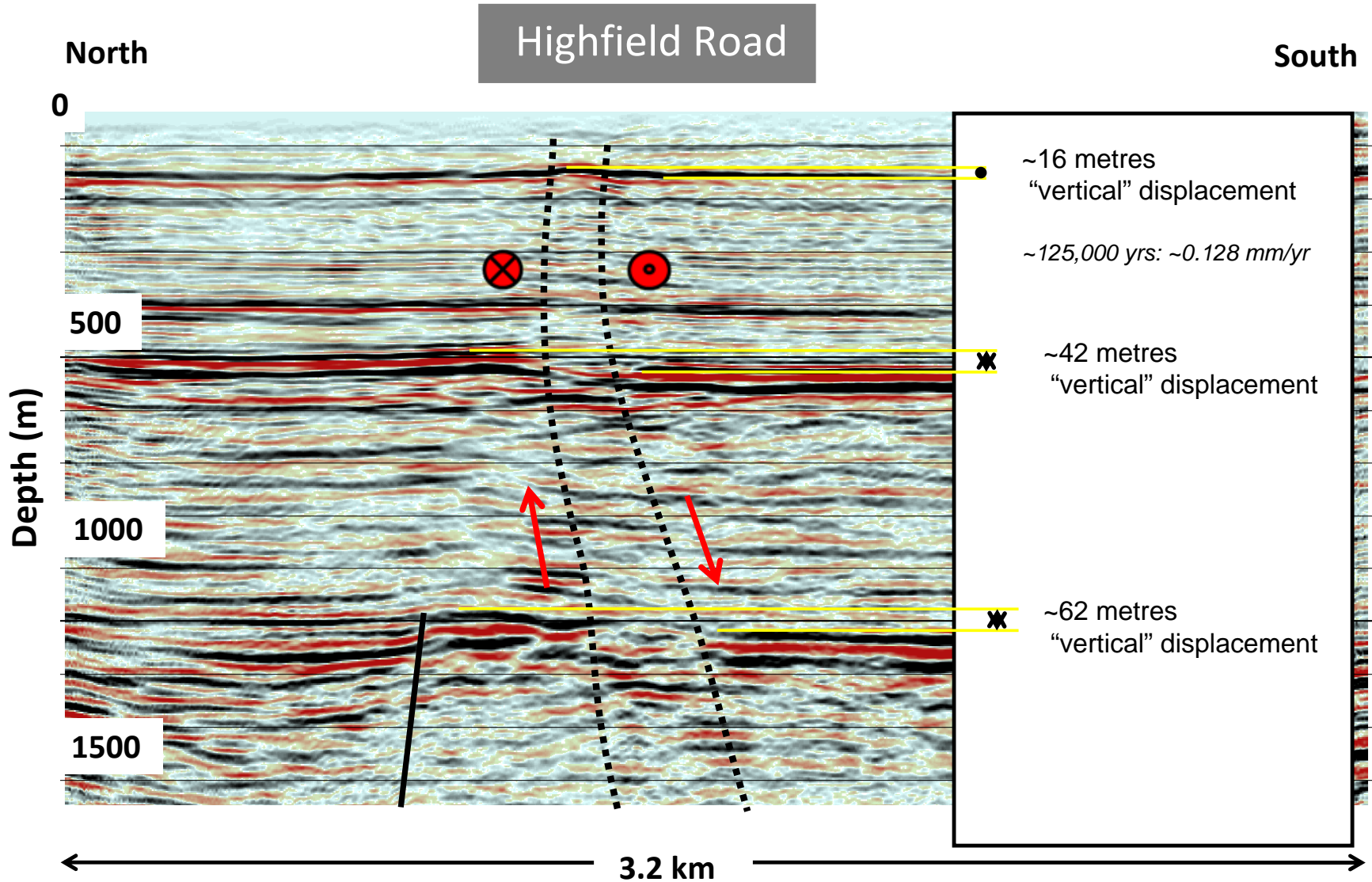
172°10'E

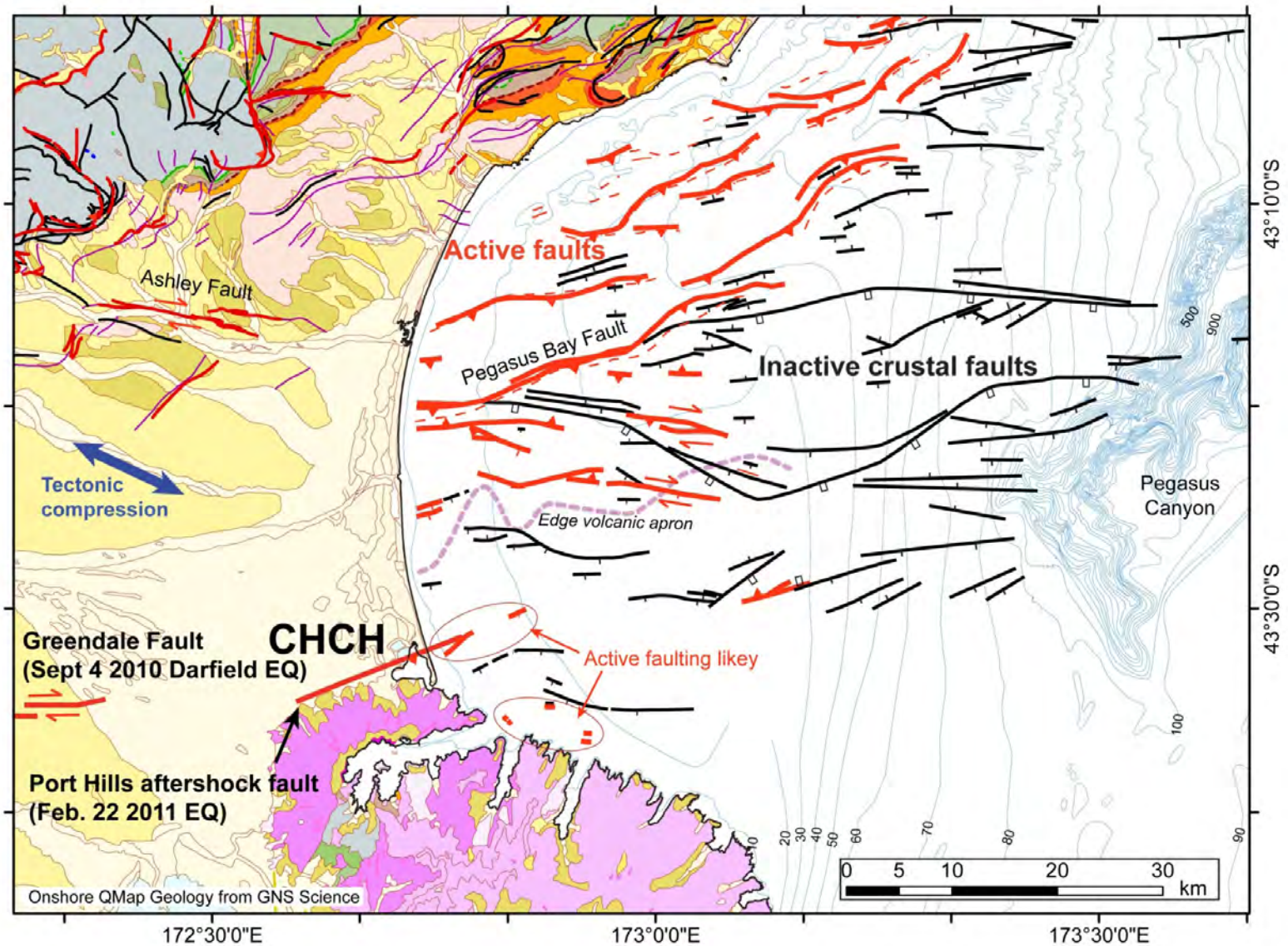
172°15'E

172°20'E

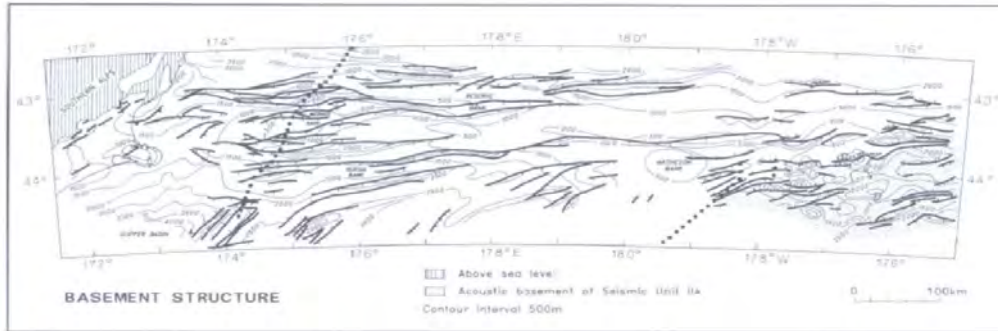




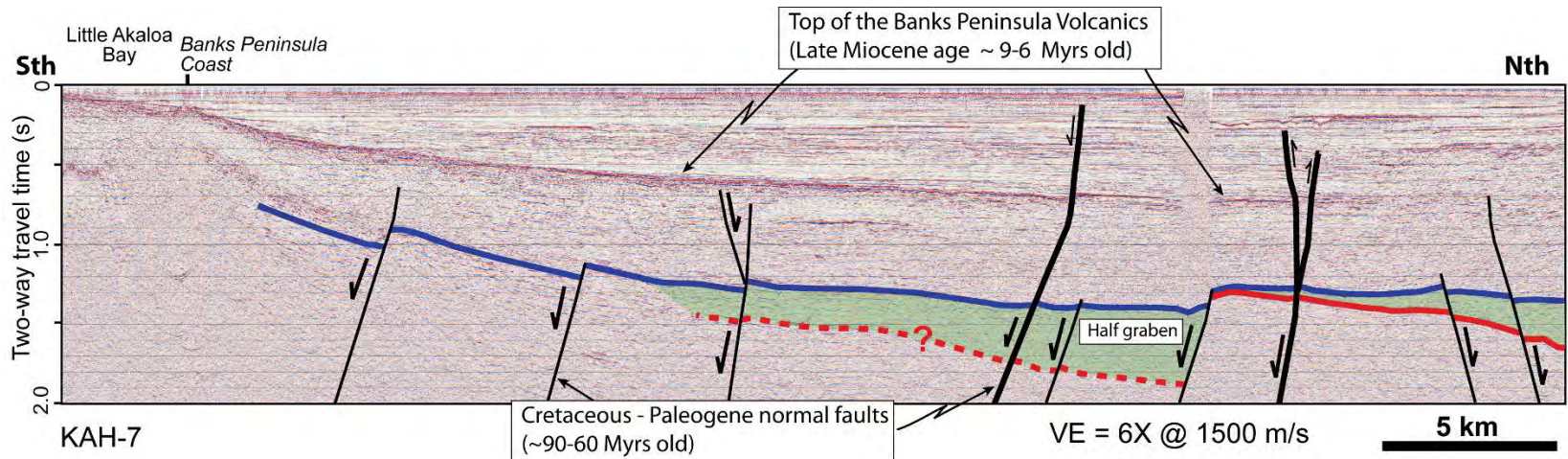
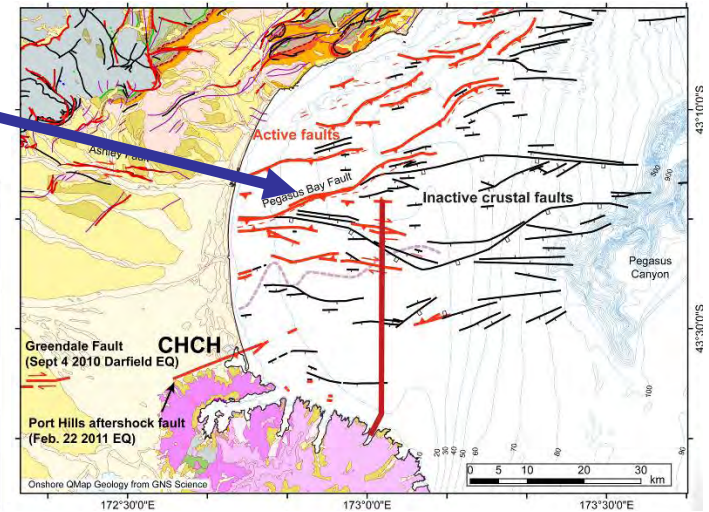




Is there active faulting south of the Pegasus Bay Fault?

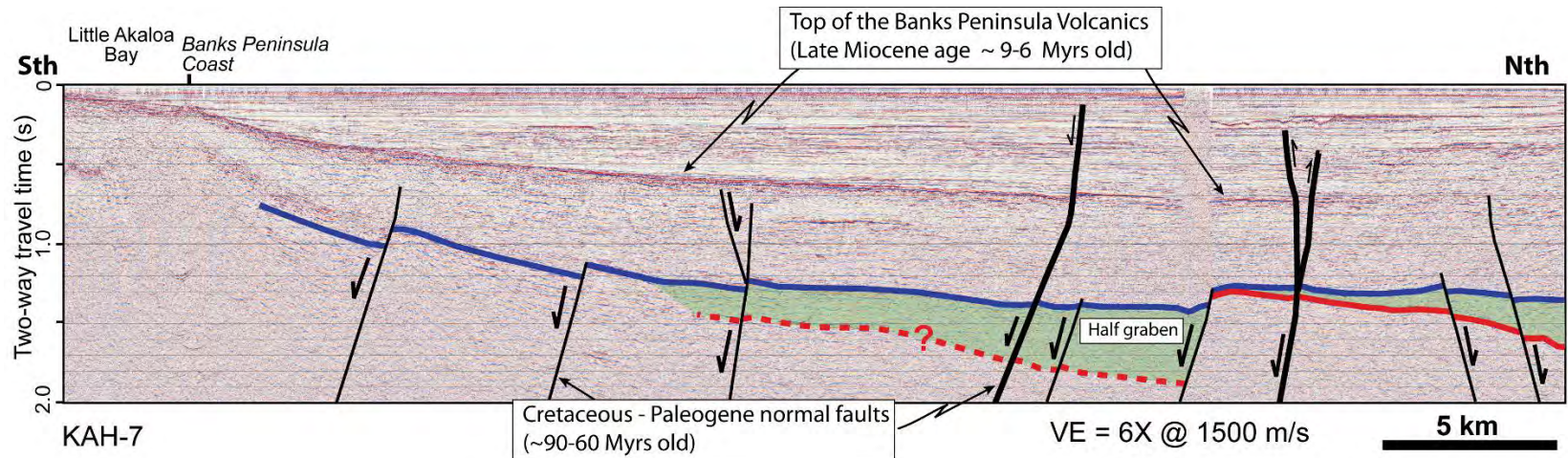
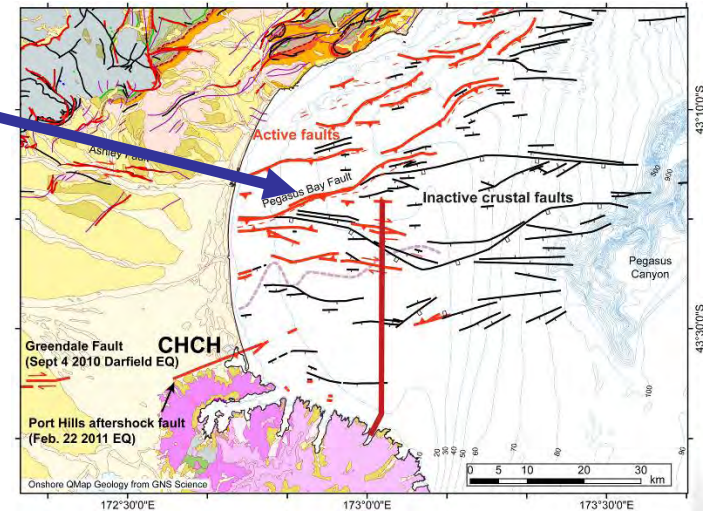


Wood et al. (1993)



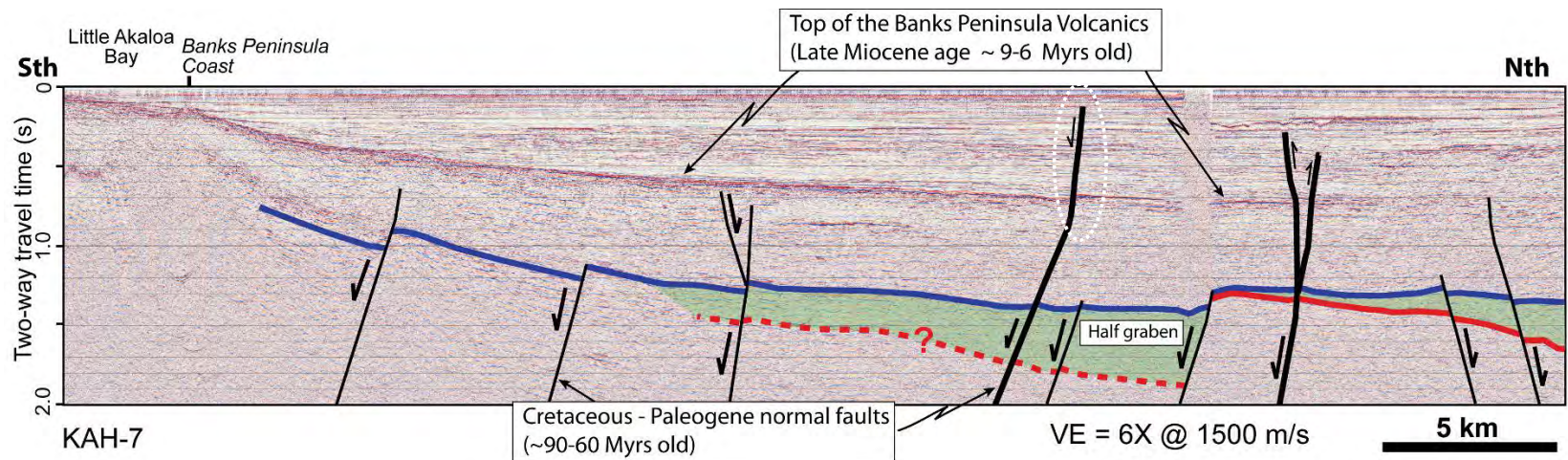
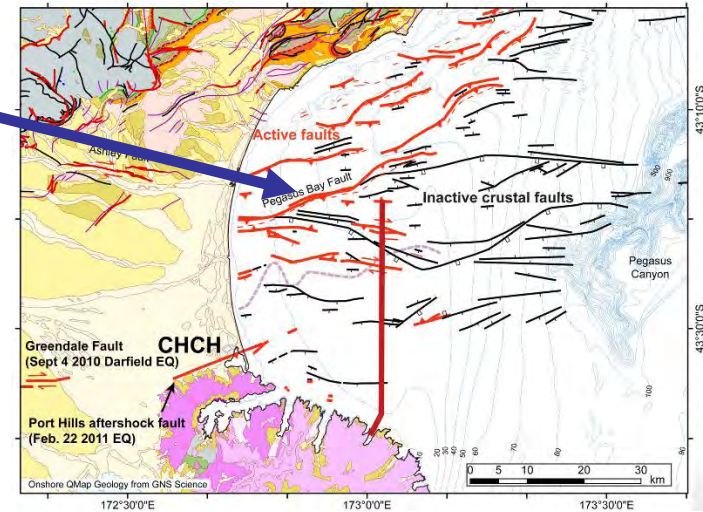
Is there active faulting south of the Pegasus Bay Fault?

Note: based on preliminary processing and analysis, may be subject to further revision

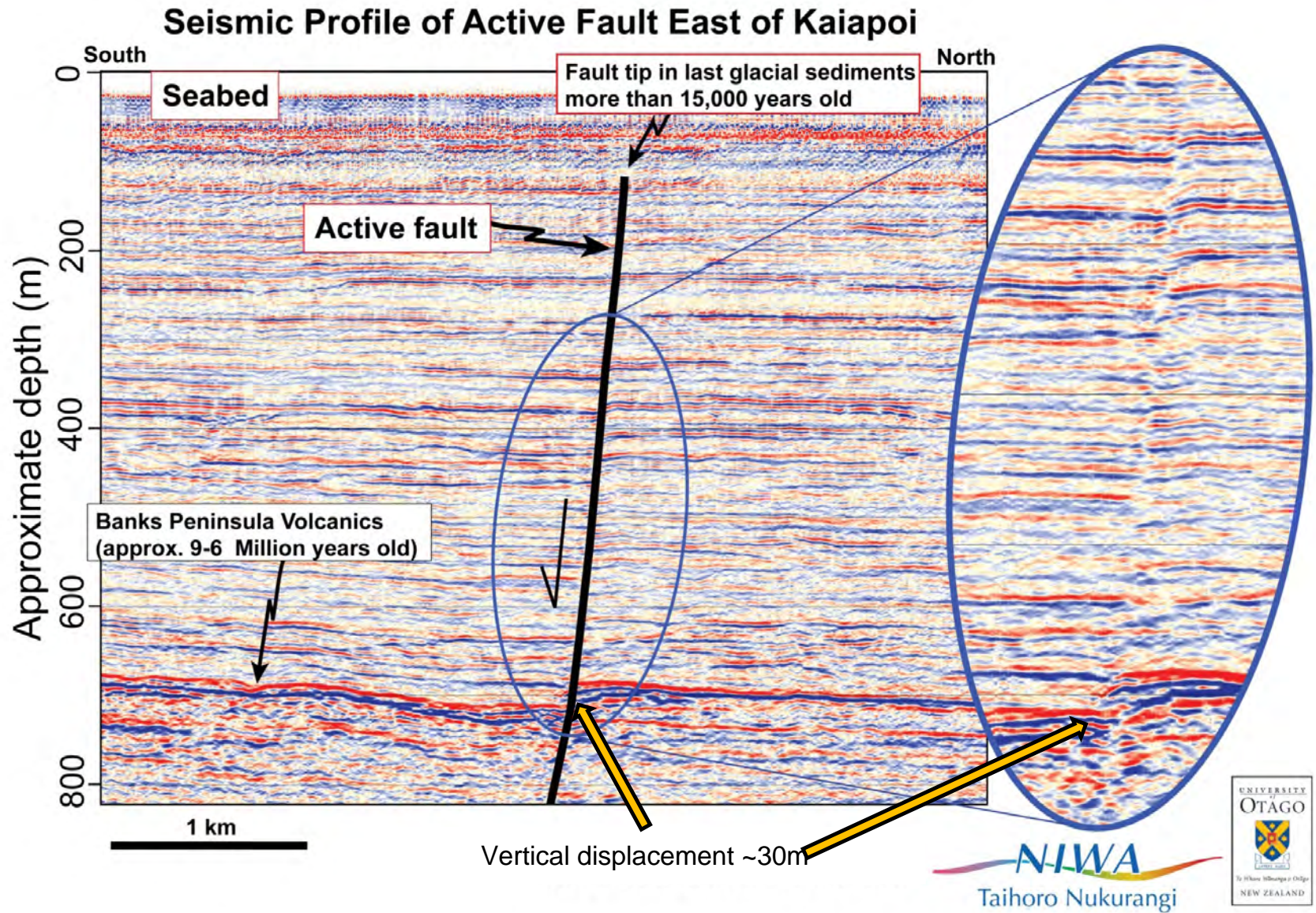


Is there active faulting south of the Pegasus Bay Fault?

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YES, but the faults must have very low vertical slip rates

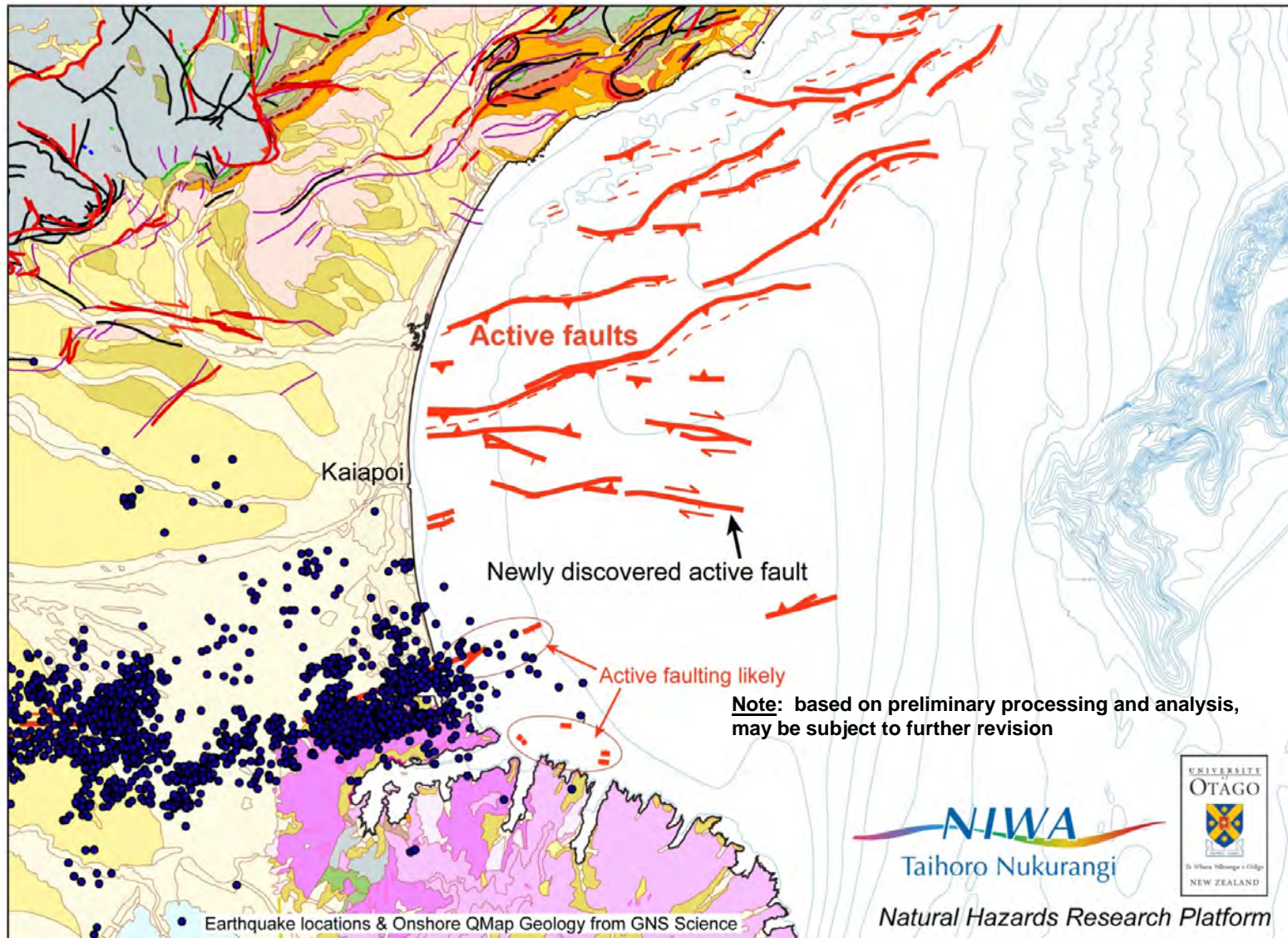


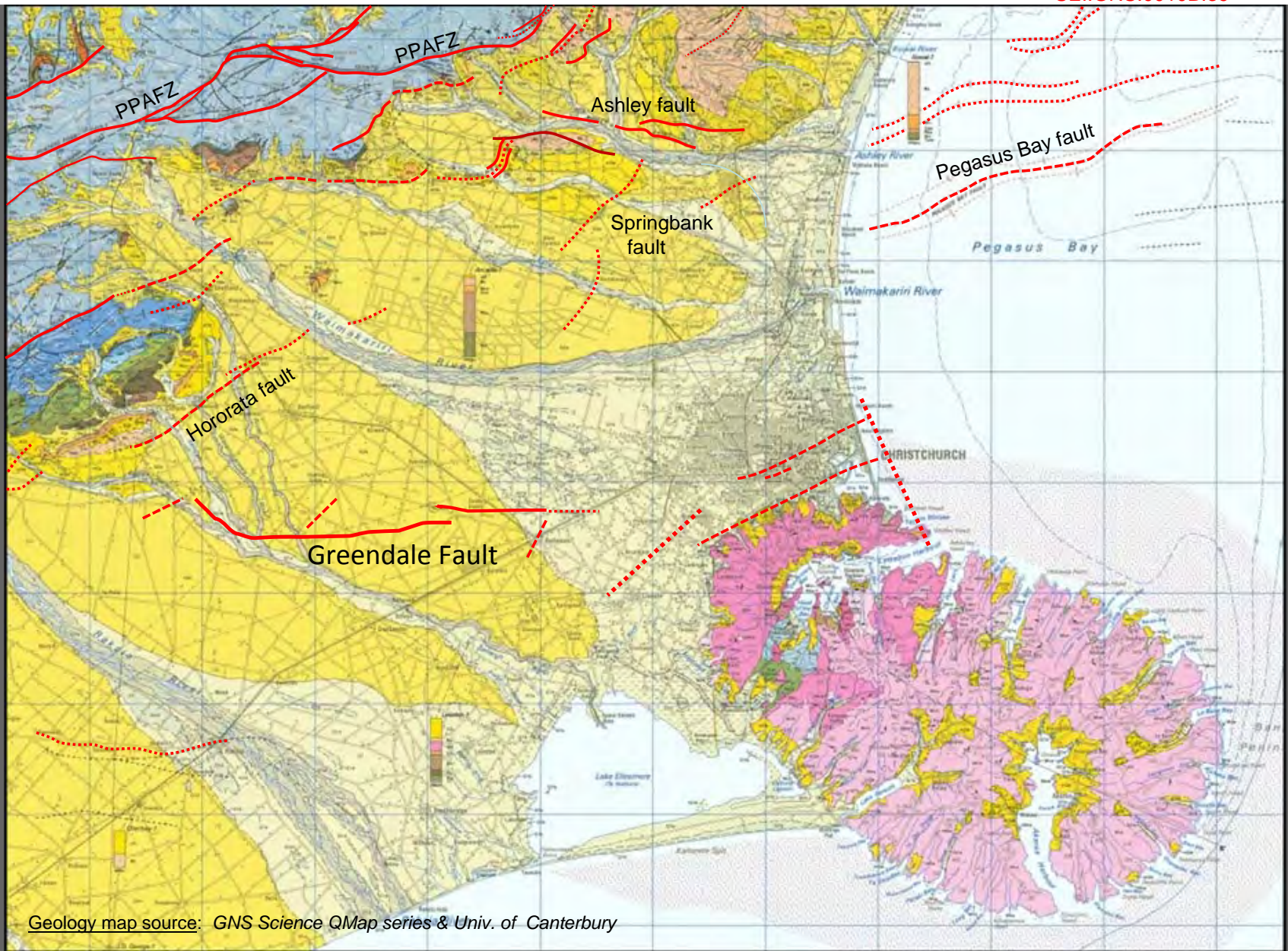
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Data courtesy of P. Barnes - NIWA

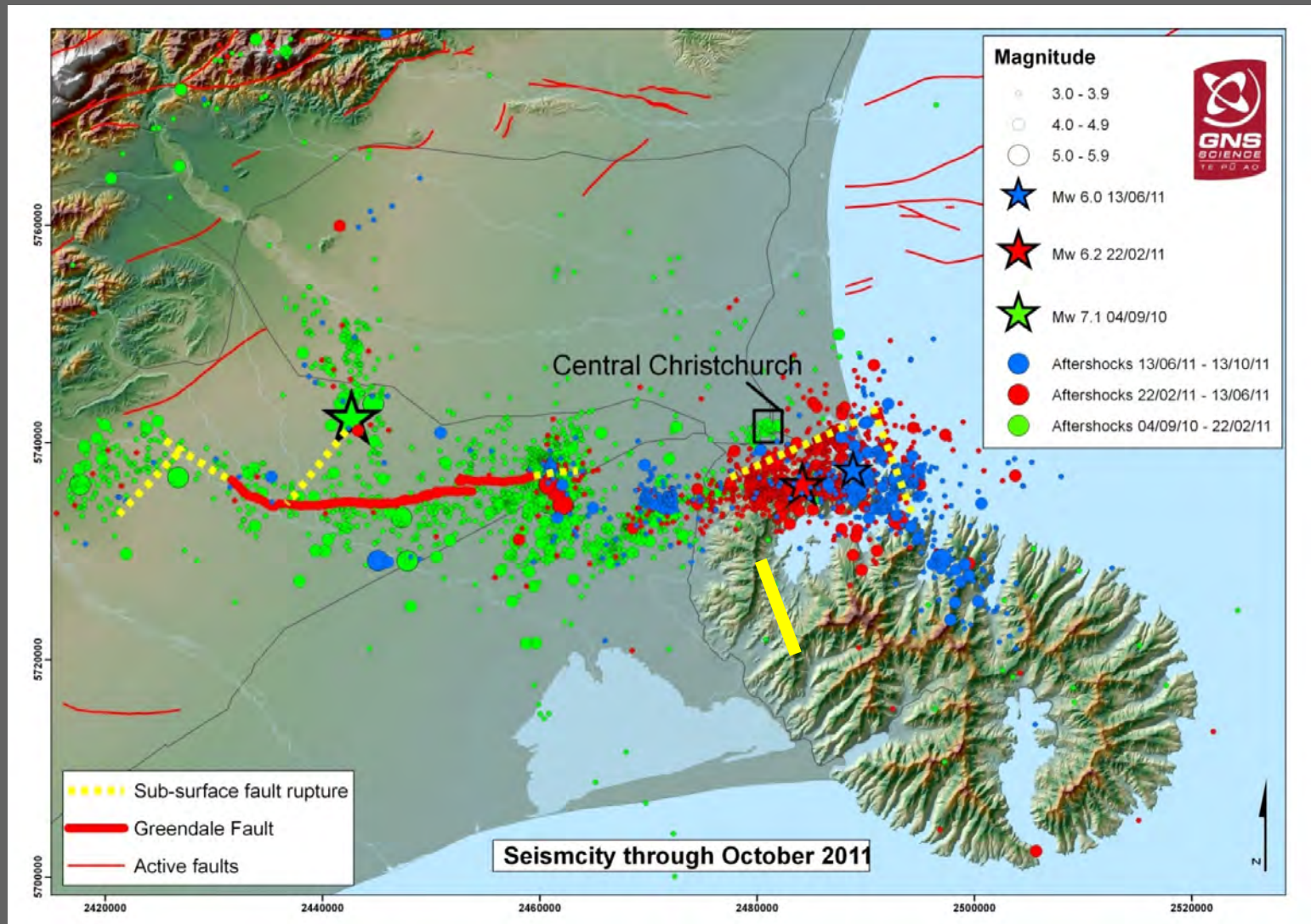
GNS Science and the University of Canterbury

Active Submarine Faults Beneath Pegasus Bay

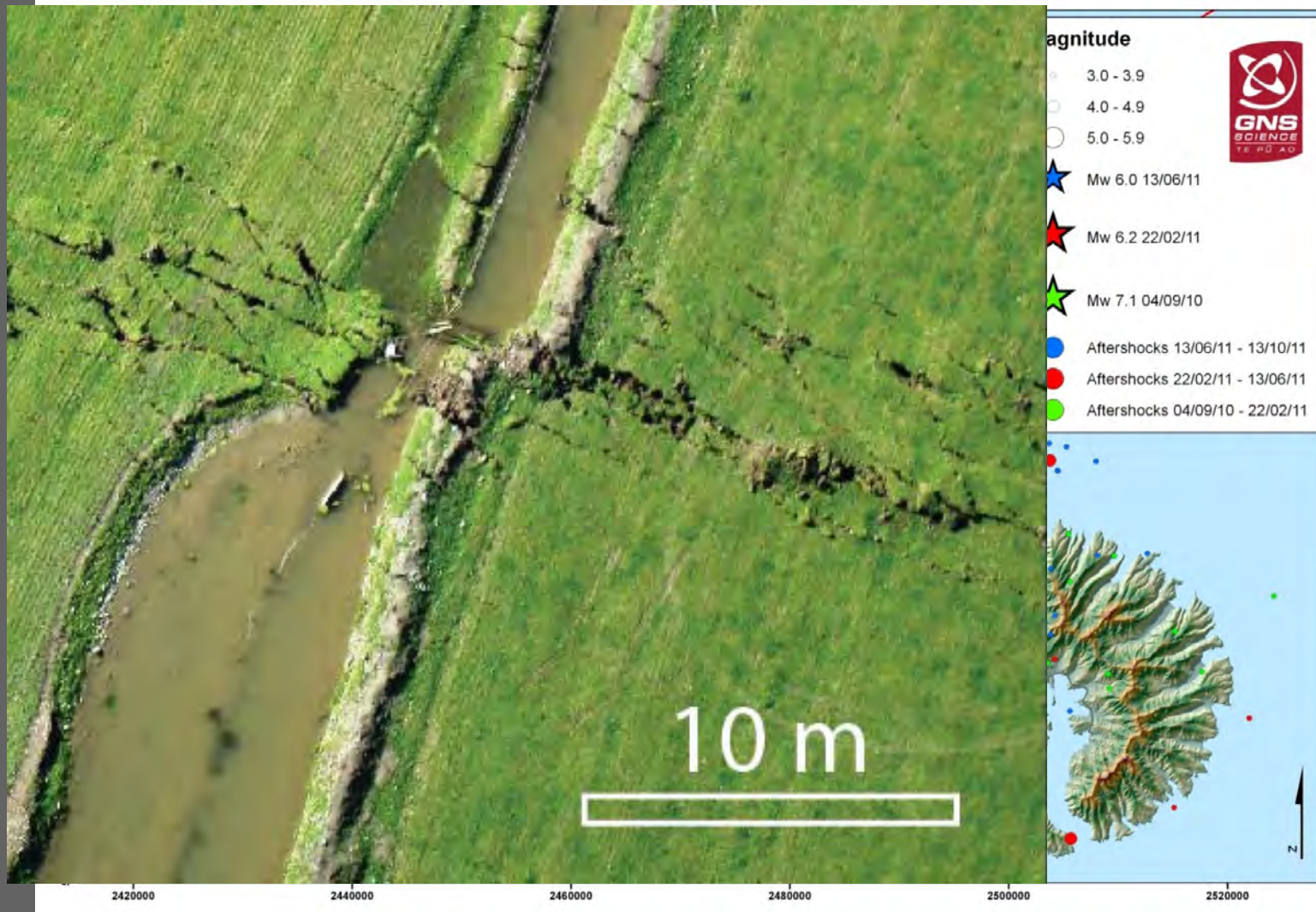




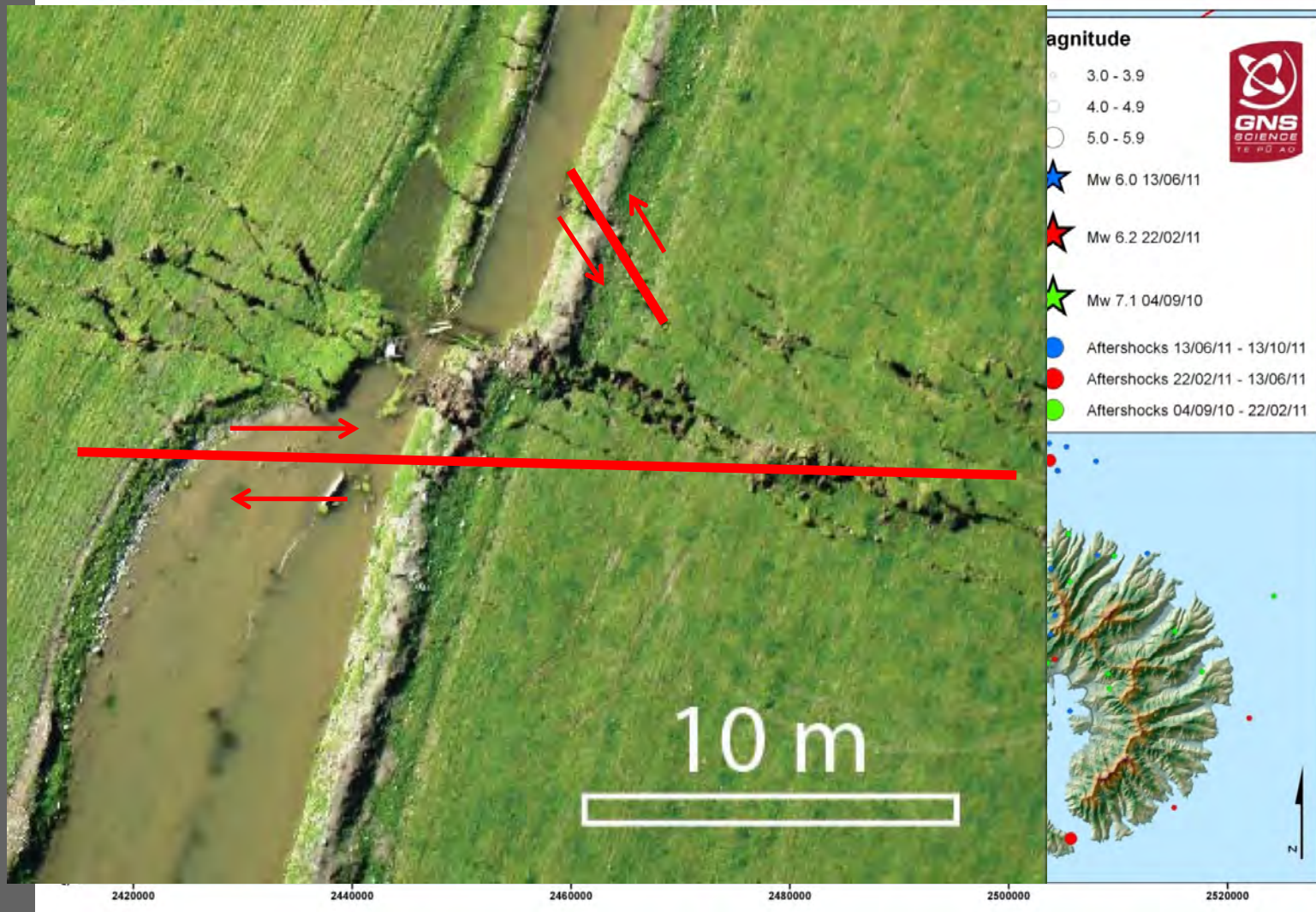
Geology map source: GNS Science QMap series & Univ. of Canterbury



The June 13th Christchurch M_w 6.0 earthquake: a very differently oriented fault with a very different type of motion from the Feb 22 event?



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In the Canterbury region there are other known major faults capable of generating large earthquakes.