

# ACTIVE FAULTS OF THE NELSON –RICHMOND URBAN REA AND TASMAN BAY OFFSHORE

Francesca C. Ghisetti  
TerraGeoLogica

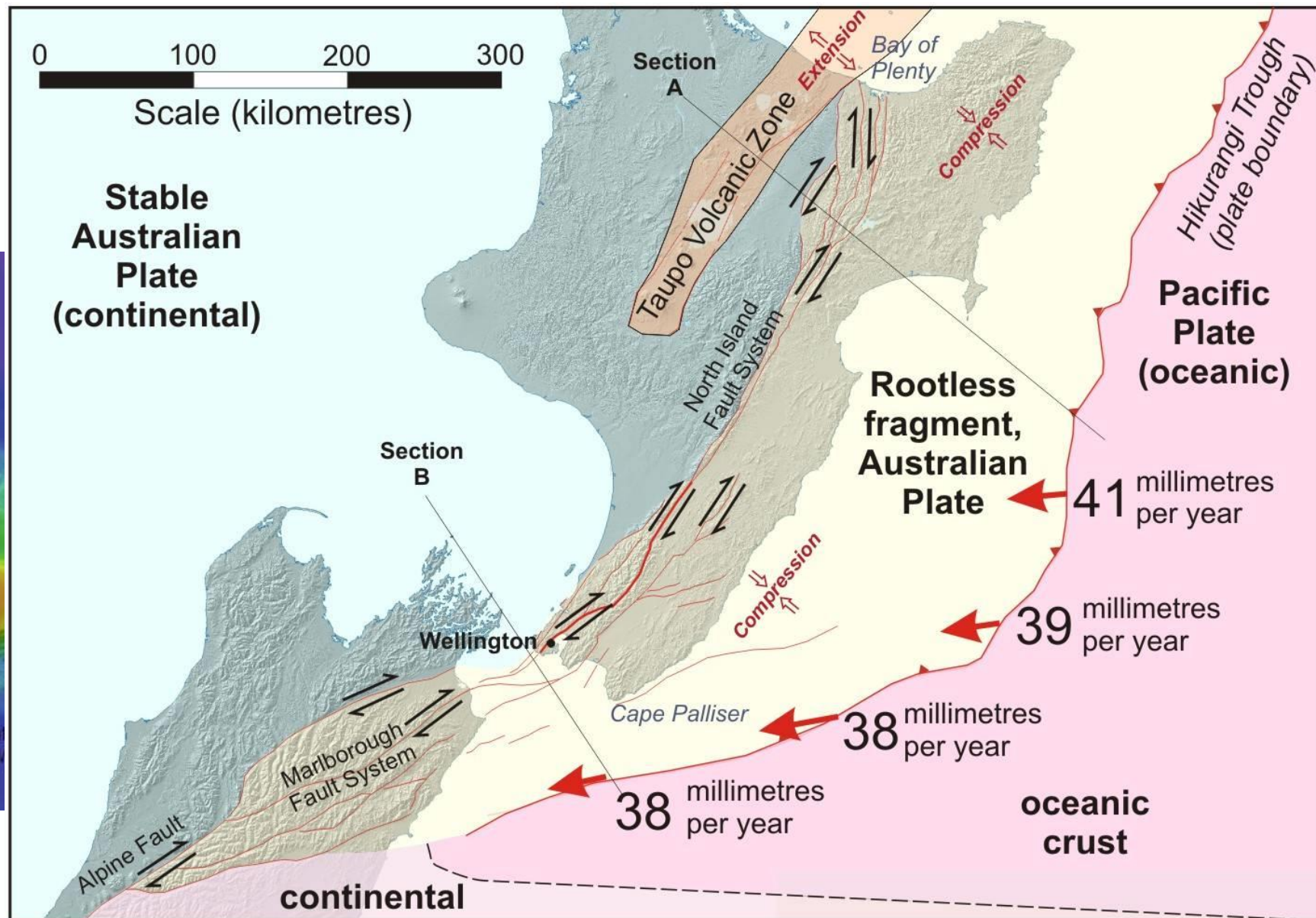
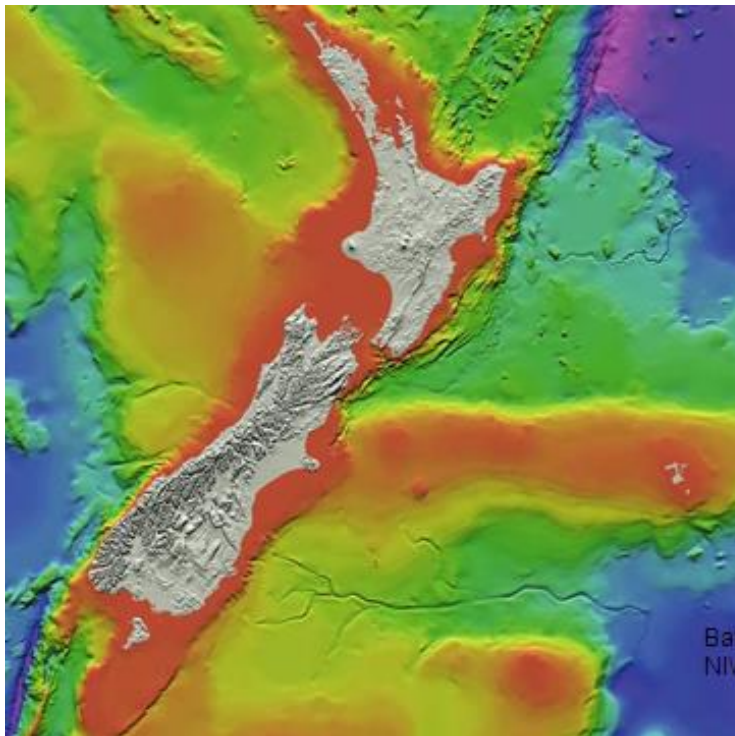


Mapua, September 13. 2021





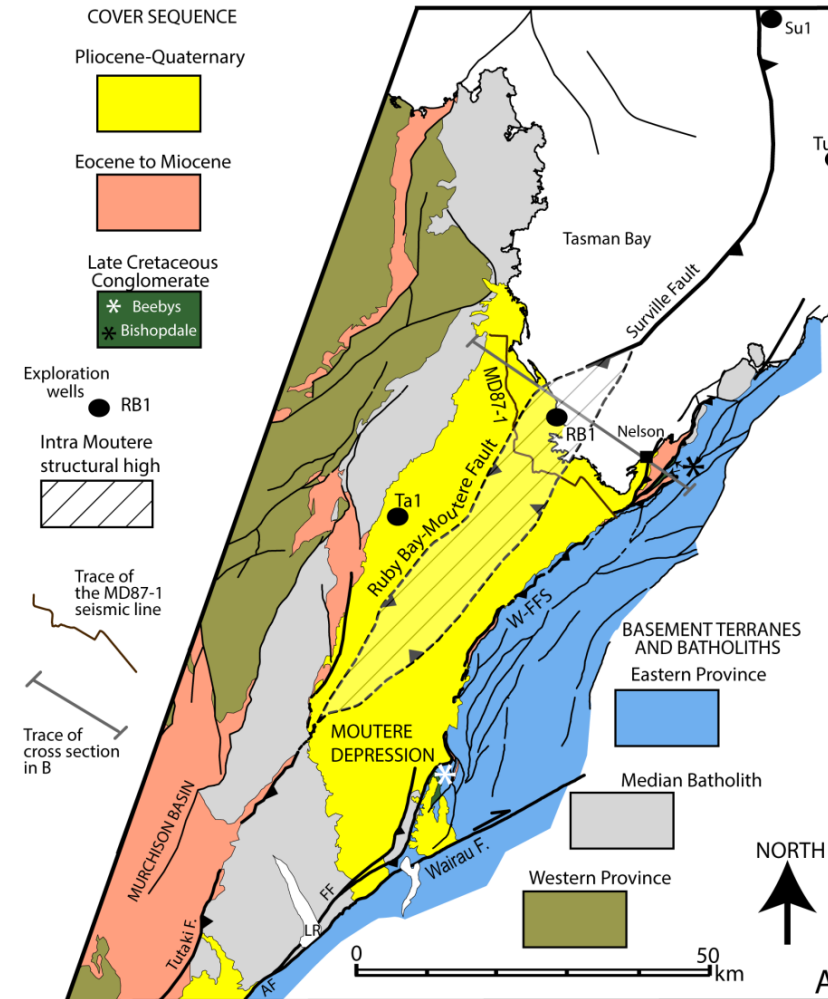
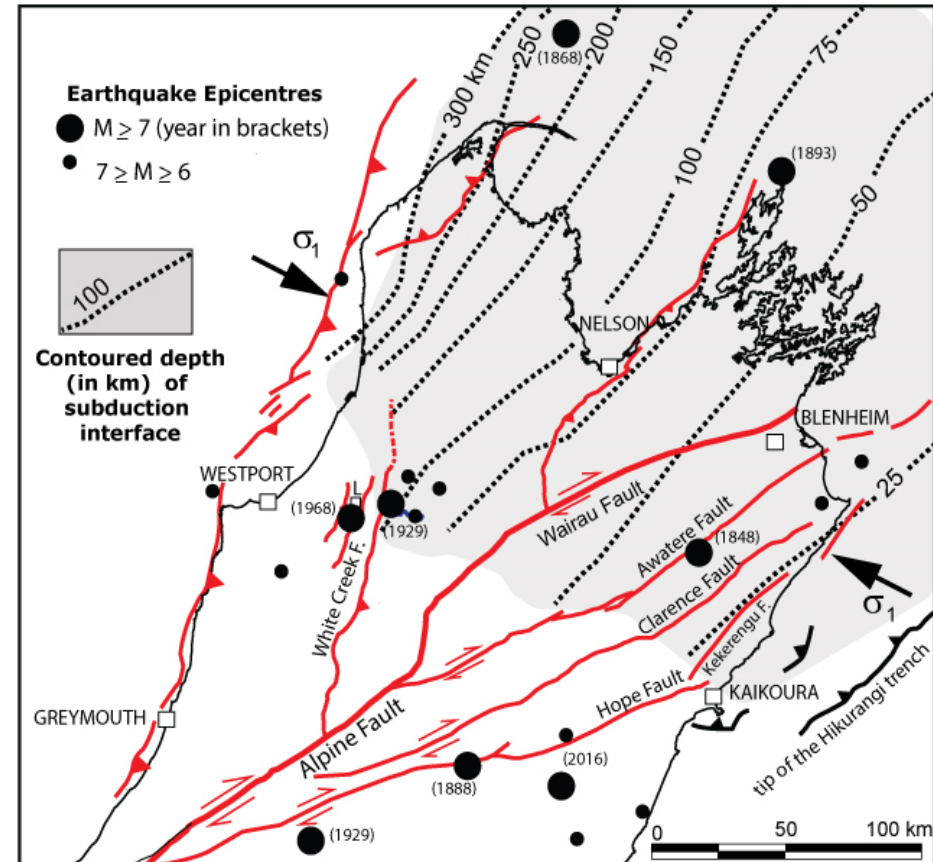
## Plate Tectonic Setting







## Active Faults in the central-northern South Island



Recognised active reverse faults close to Nelson-Richmond include the Waimea, Flaxmore, Eighty-eight and Whangamoia faults (**Waimea-Flaxmore Fault System**)

Capable faults within the Moutere Depression include the Ruby Bay-Moutere Fault (*Ghisetti et al. 2018*), continuous with the Surville Fault offshore



Nelson and Richmond cities and nearby urban agglomerates occupy lowland areas infilled with unconsolidated sediments and are located between mountain front scarps and the shoreline.

This setting creates **hazard potential** from:

**Seismic reactivation of a fault in the region**

**Tsunami**

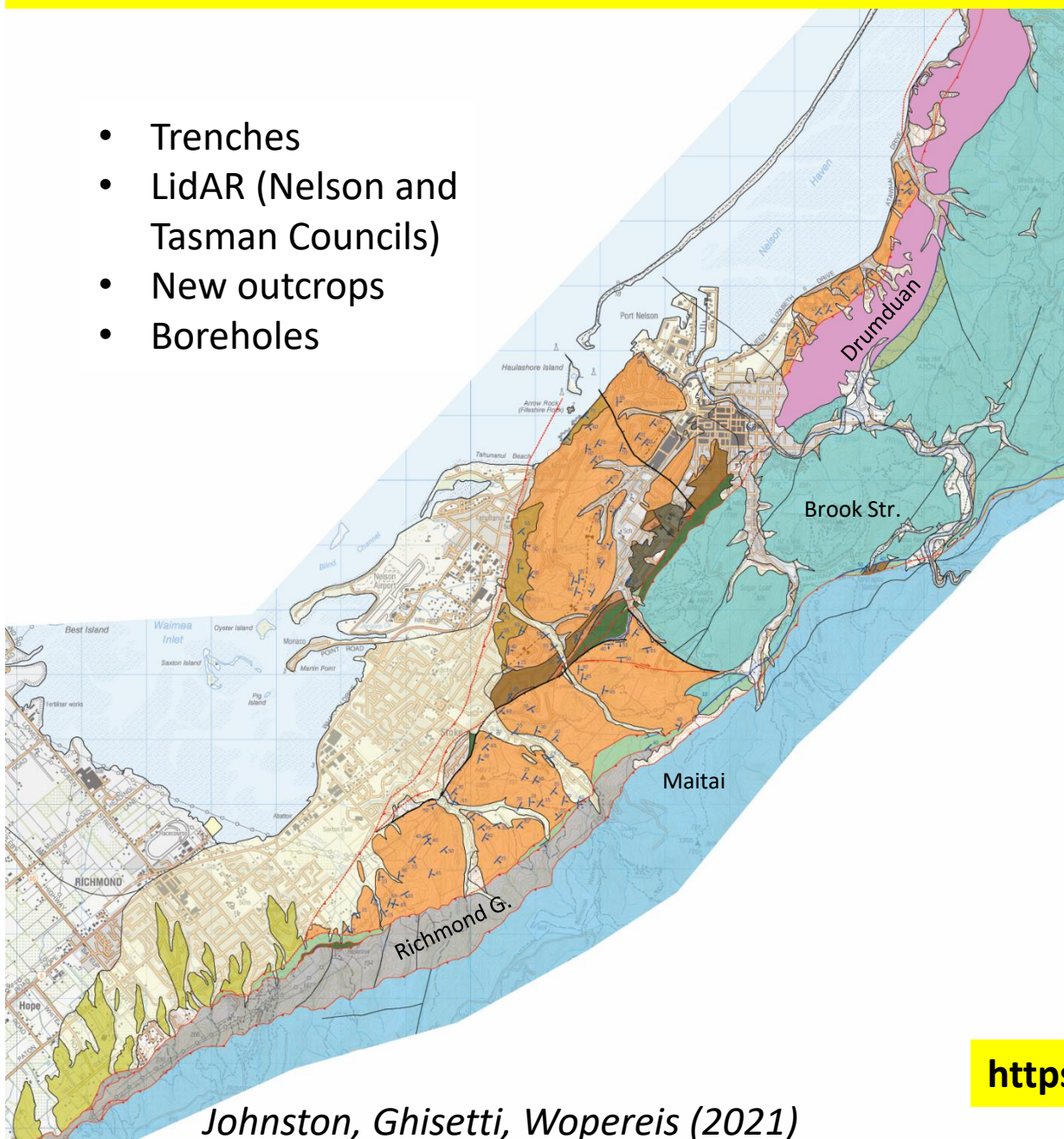
**Shaking and gravitative failure of unconsolidated sediments (landslides, liquefaction)**

Major problems for identifying active faults: Urbanisation, alluvial covers masking deeper geological features; scarcity of offshore data



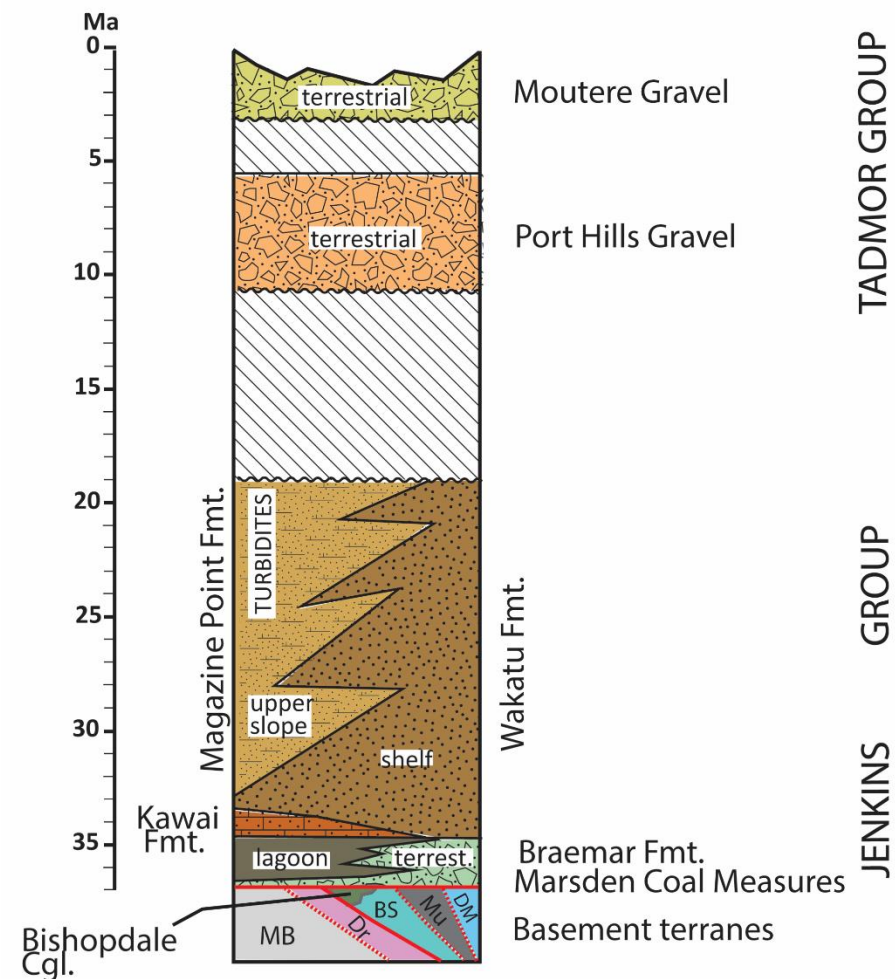
# Revision of the geology of the Nelson-Richmond urban areas

- Trenches
- LidAR (Nelson and Tasman Councils)
- New outcrops
- Boreholes



Johnston, Ghisetti, Wopereis (2021)

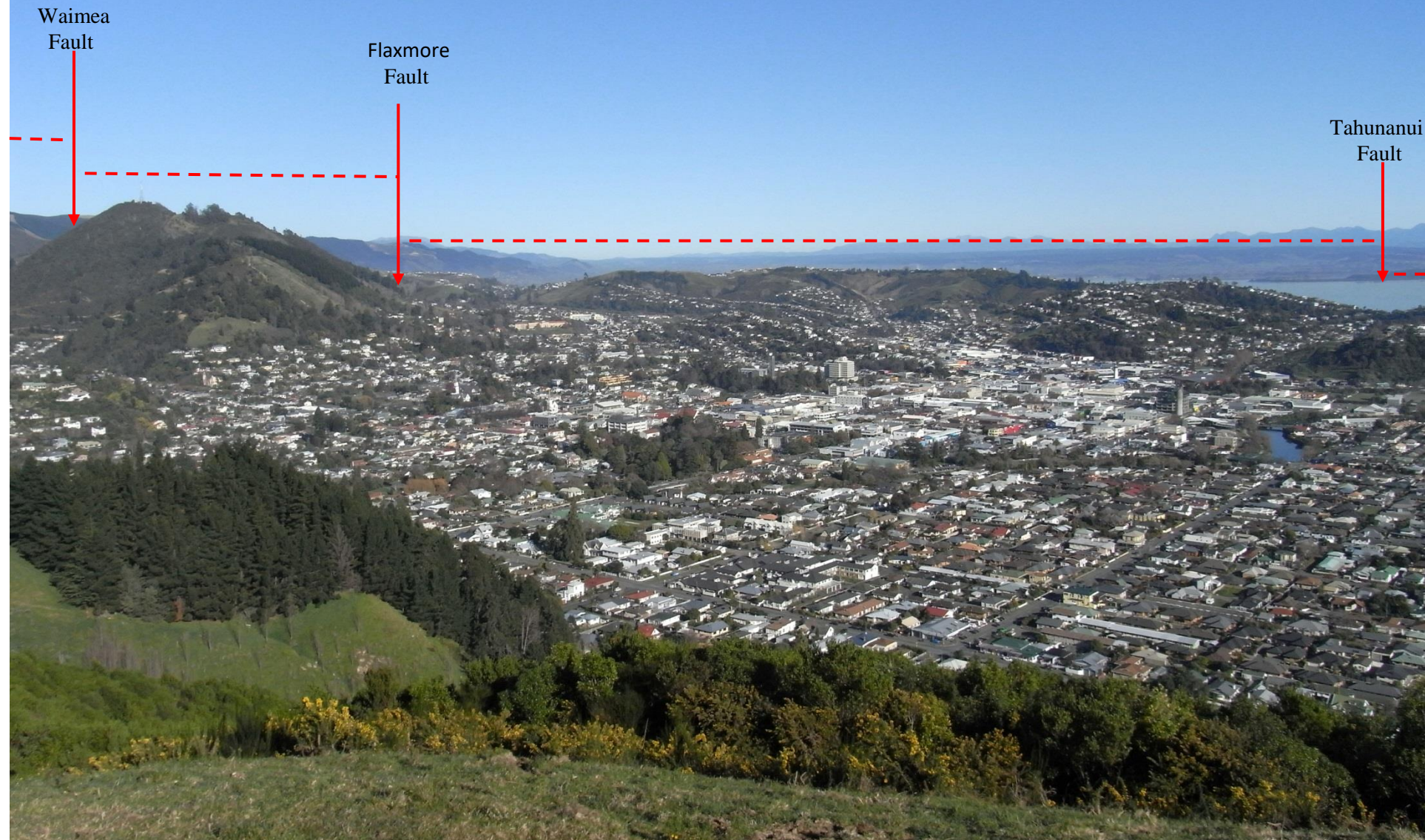
## Stratigraphic column



<https://nelson-richmond-geolmap.github.io/RGMap/>

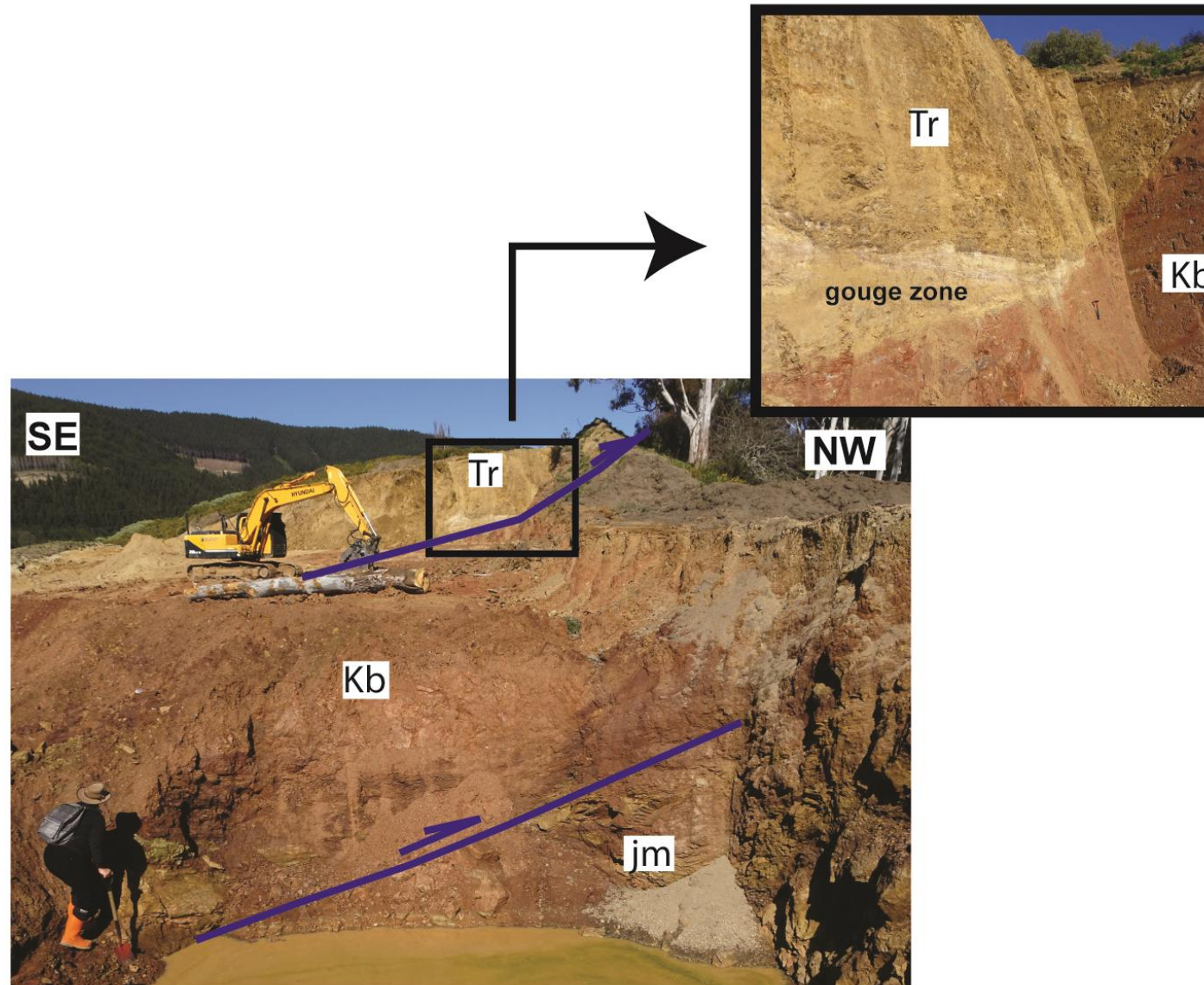
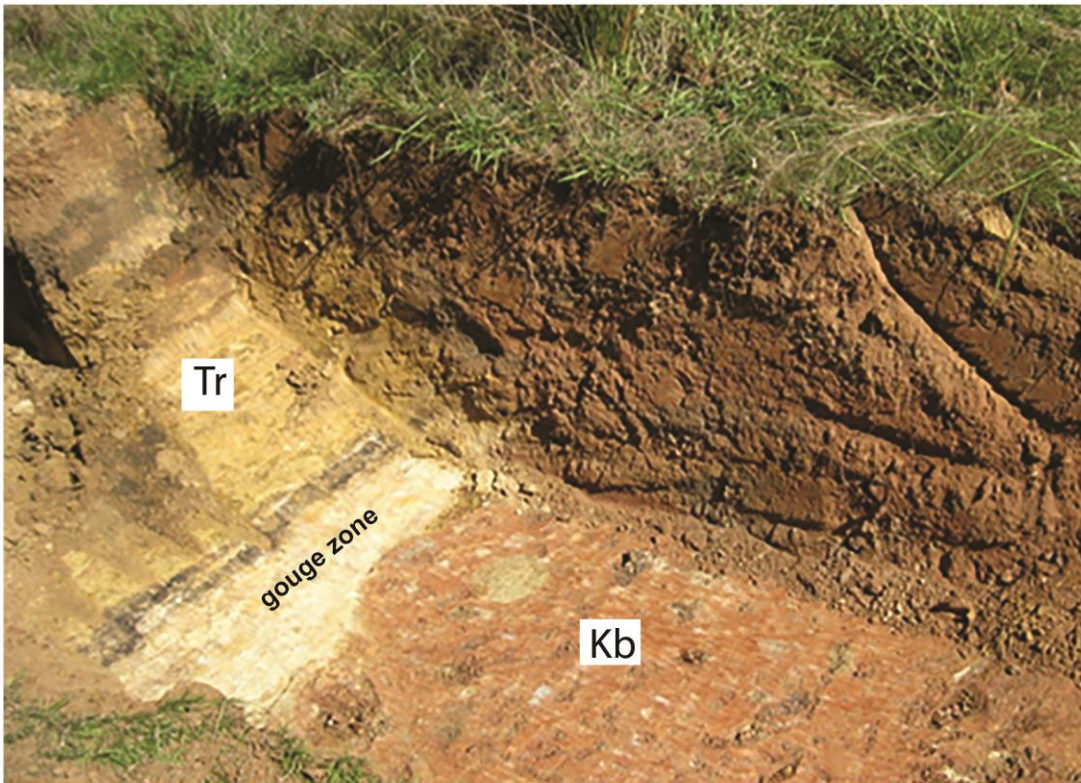


## Active faults in the Nelson city area





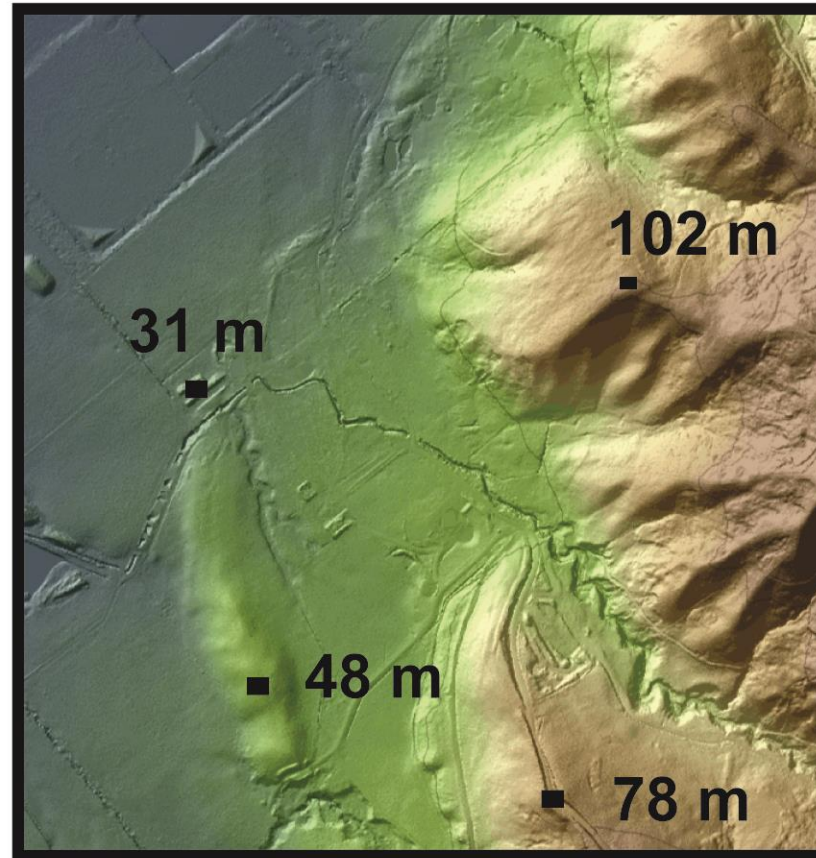
## Fault traces recently exposed by trenches and building excavations



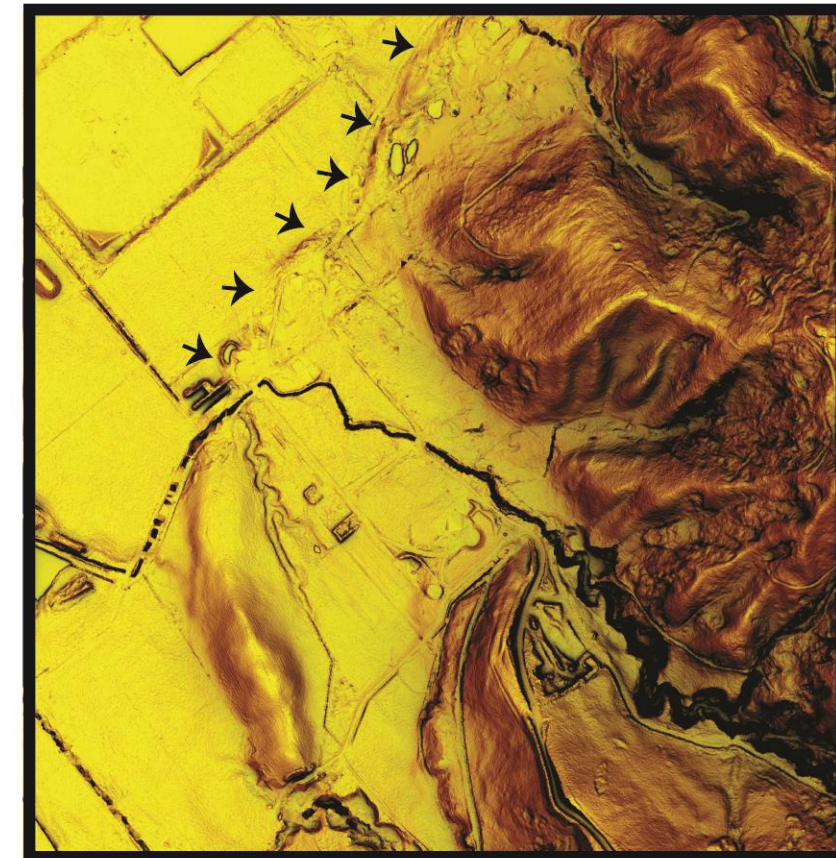




Blind reverse faults beneath alluvial cover



DEM from LiDAR points



LiDAR-derived map enhancing topographic scarp:  
active fault trace?



# Development of the New Zealand Community Fault Model



## Waimea Fault

Slip rates c. 0.2 mm/year

Recurrence intervals c. 6000 yr (M 6.5-7.4 earthquakes)

3 seismic events dated with radiocarbon techniques in trenches

15.3-20 ky

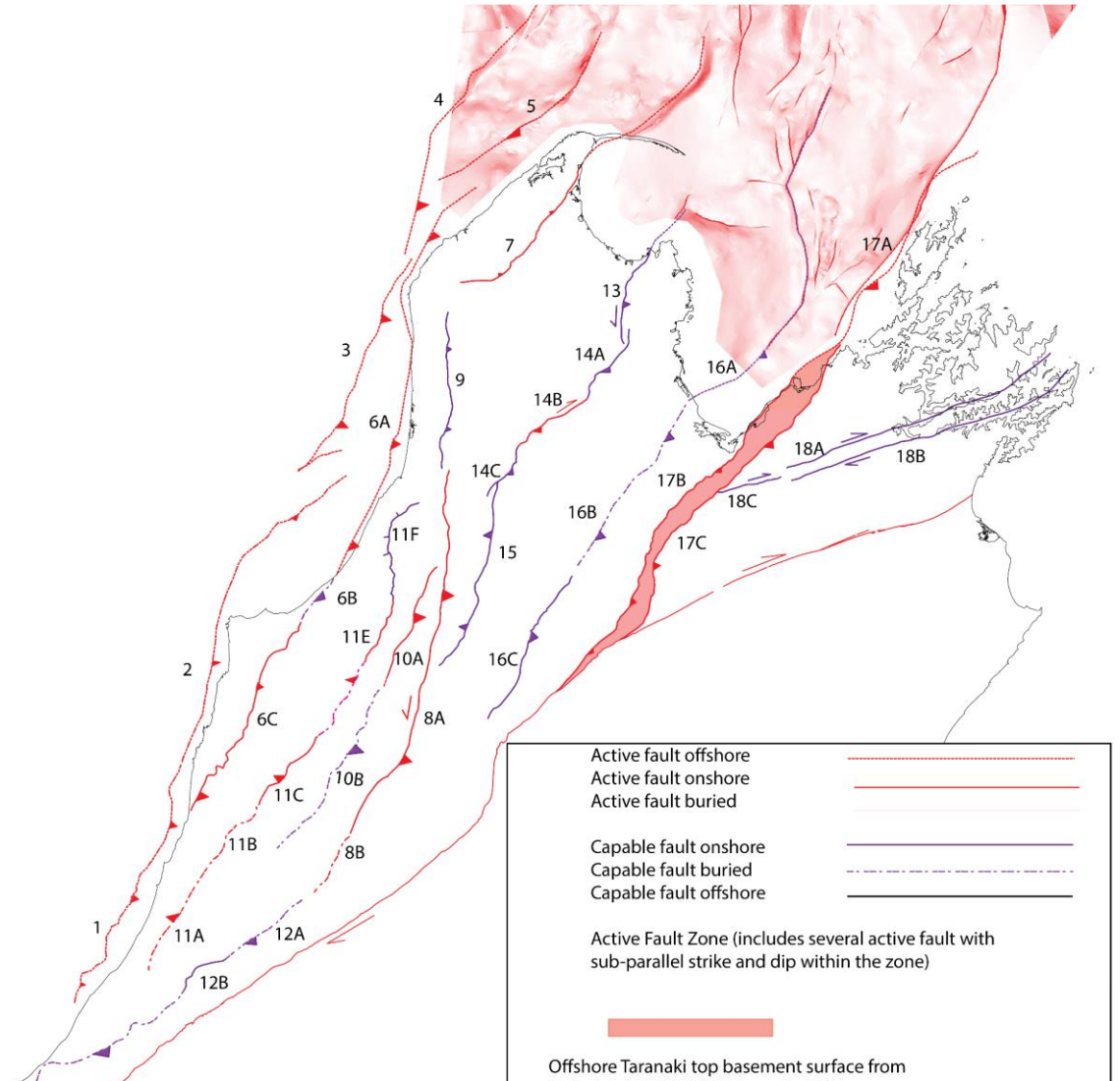
7.2-13.8 ky

5.7-6.8 ky BP

Average displacement/event: 1.2 m

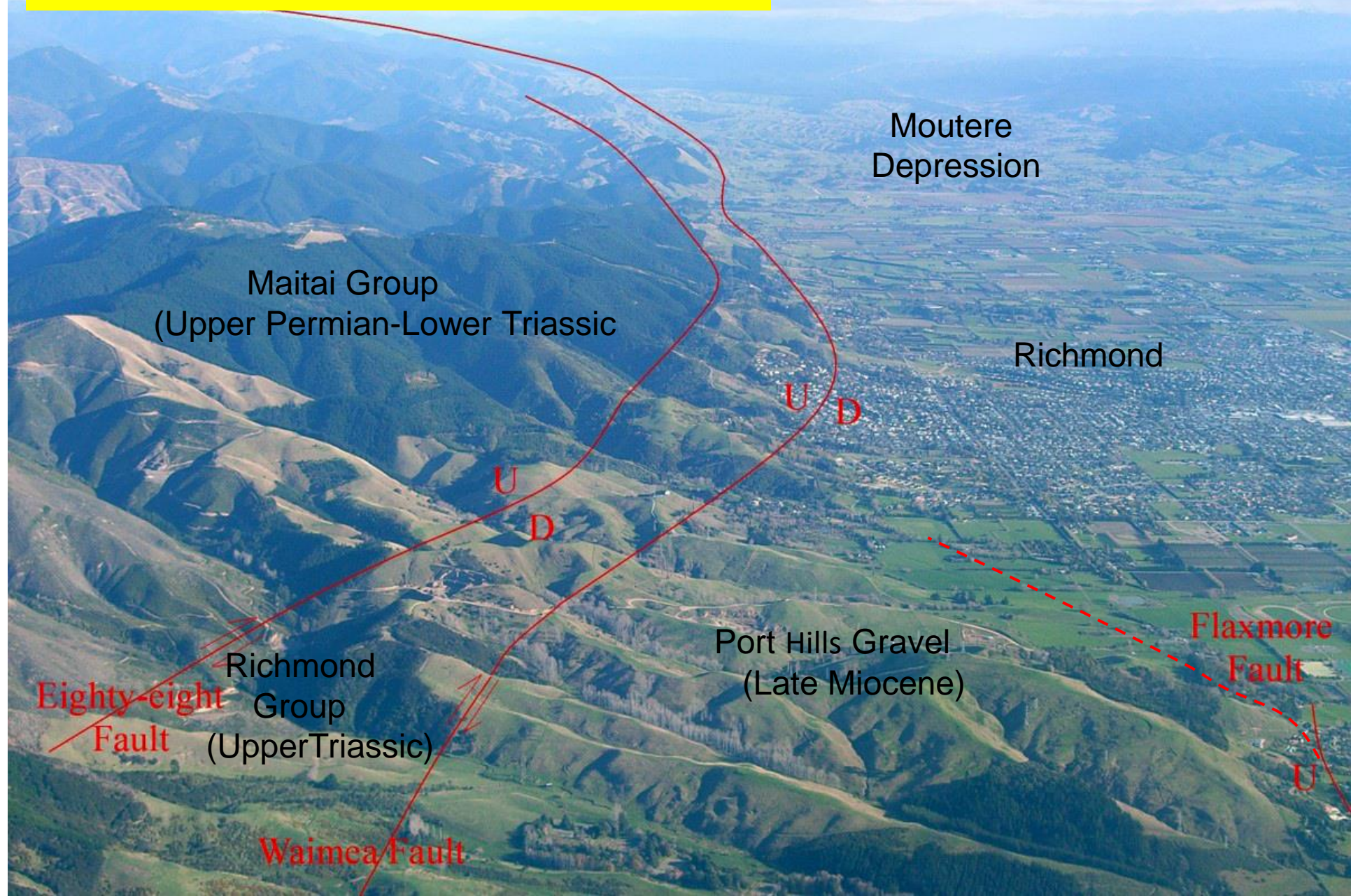
Cumulative displacement 3.5 m

(Fraser 2005, Johnston and Nicol 2013).

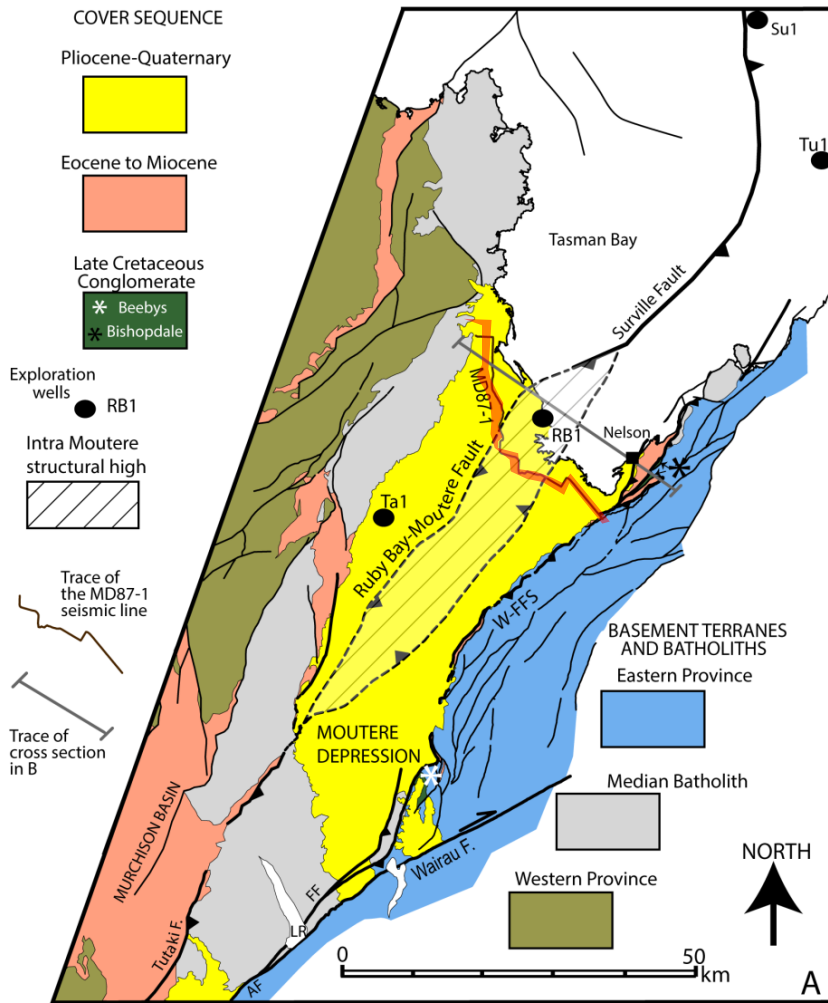




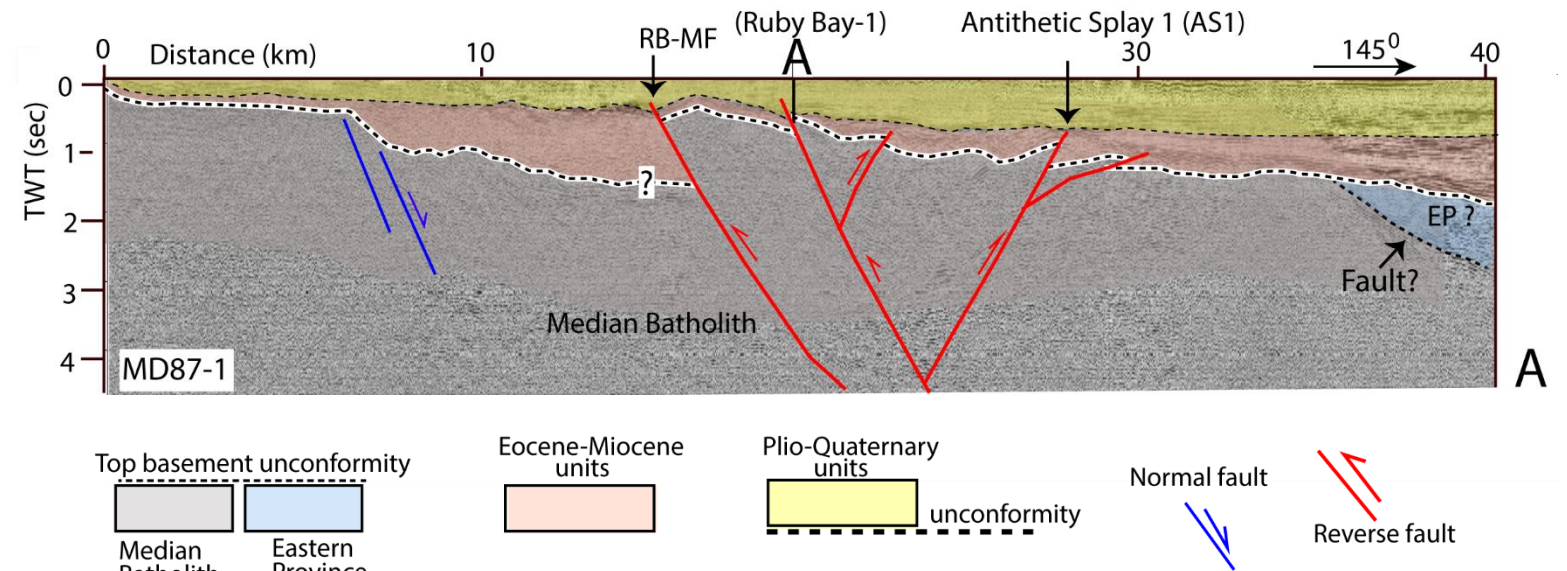
## Active faults in the Richmond city area







*Ghisetti, Johnston, Wopereis, Sibson (2018)*



Vintage sub-surface data (MD-87) linked to the Tapawera-1 well shed some light on sub-surface structure

**Evidence of reverse faults with the same geometry of the Waimea-Flaxmore Fault System located beneath the sedimentary cover of the Moutere Depression**

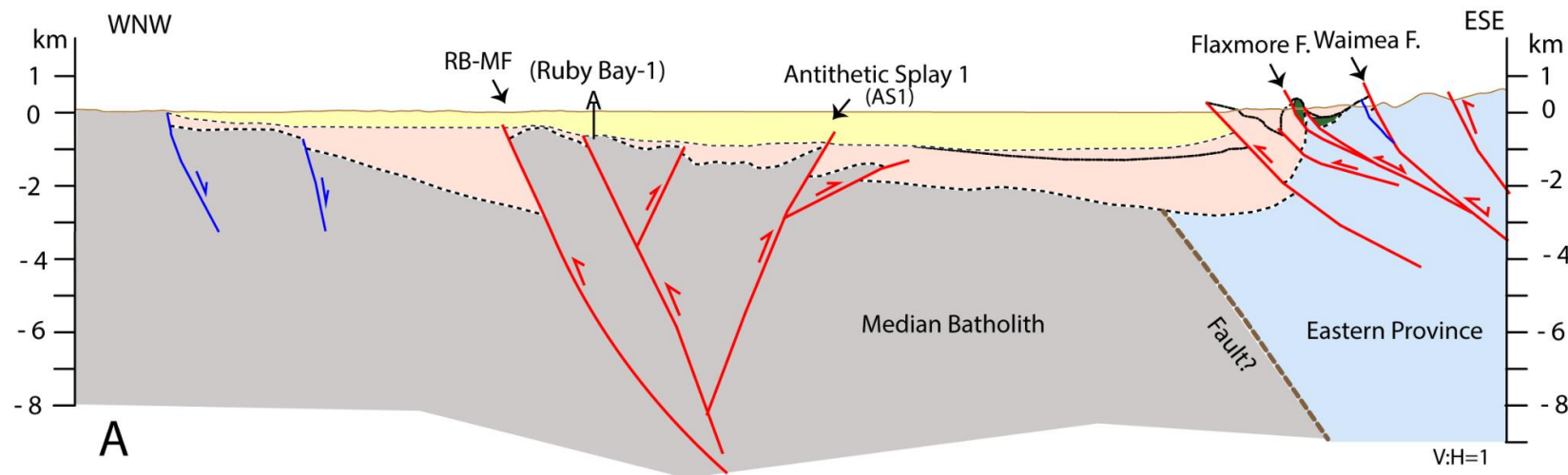


## Most recent fault activity documented by geological markers is pre 3 My

Faults remain beneath the surface: decay in fault activity or long recurrence intervals?

slip-rates : 0.11 mm/year i.e. much lower than those of the Waimea Fault

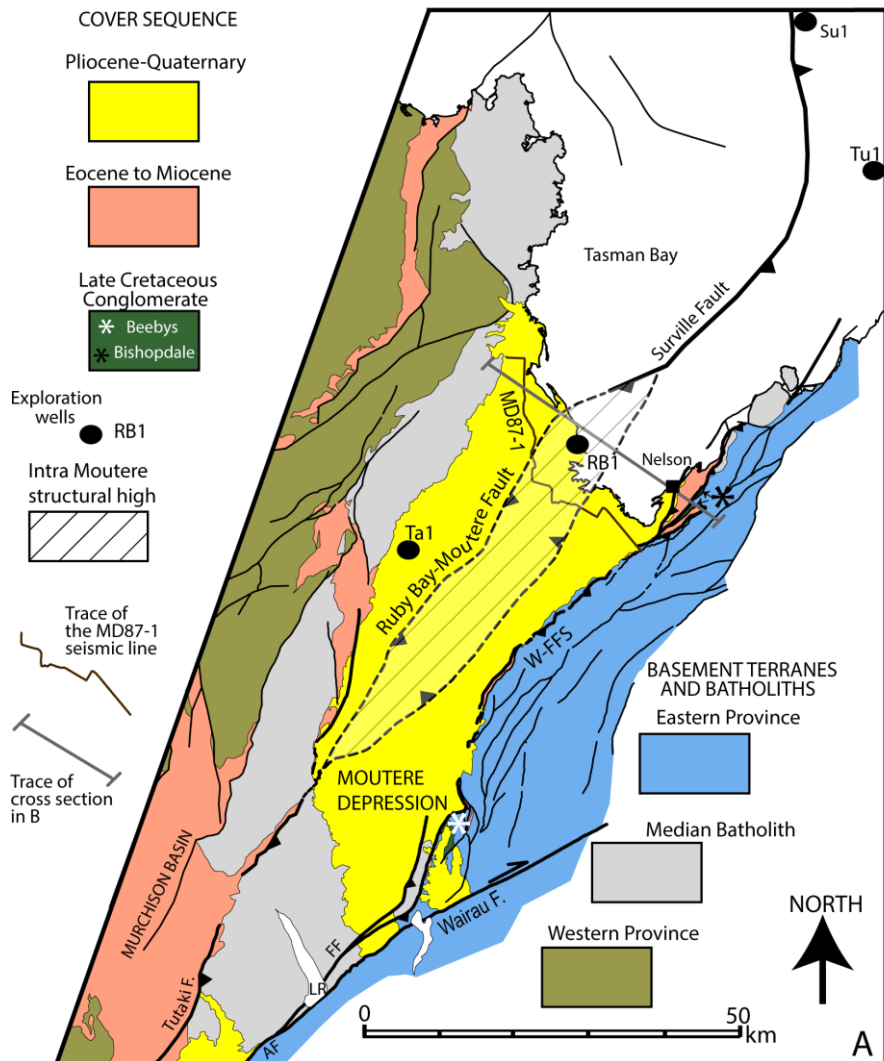
The faults are considered capable of being reactivated in the present day tectonic regime



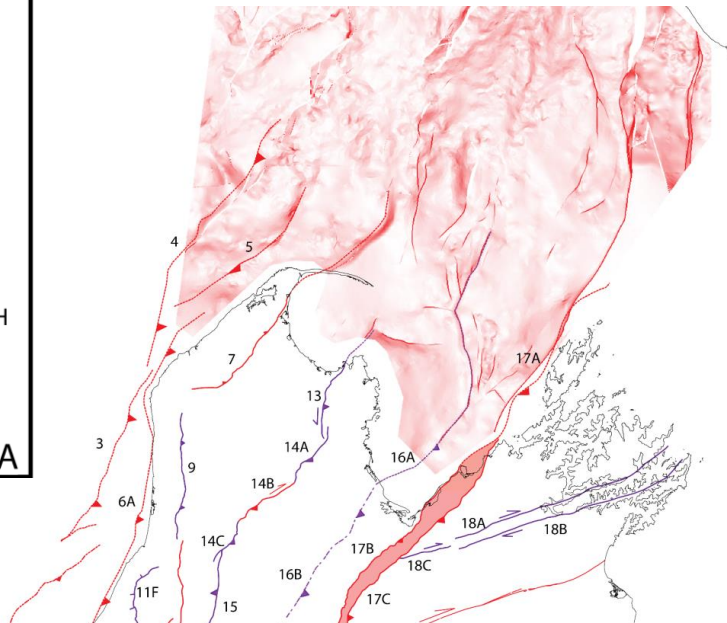
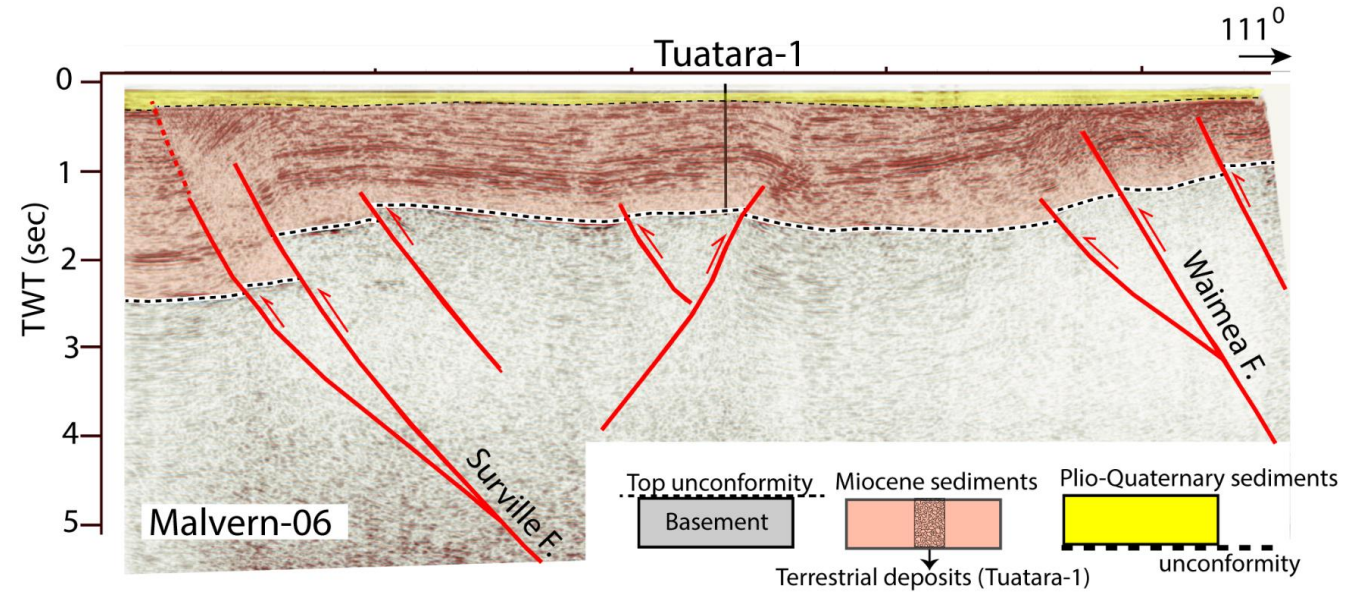
*Ghisetti , Johnston, Wopereis, Sibson (2018)*



# WHAT DO WE KNOW ABOUT ACTIVE FAULTS IN THE TASMAN BAY OFFSHORE?



Ghissetti, Johnston, Wopereis, Sibson (2018)



What are the structural features of the Waimea-Flaxmore Fault in the near offshore, close to the urban centres, with potential of tsunamigenic coseismic rupture?



**WORK IN PROGRESS FUNDED BY NIWA, NCC,  
TDC WITH FURTHER FUNDING REQUESTED  
THROUGH EQC**

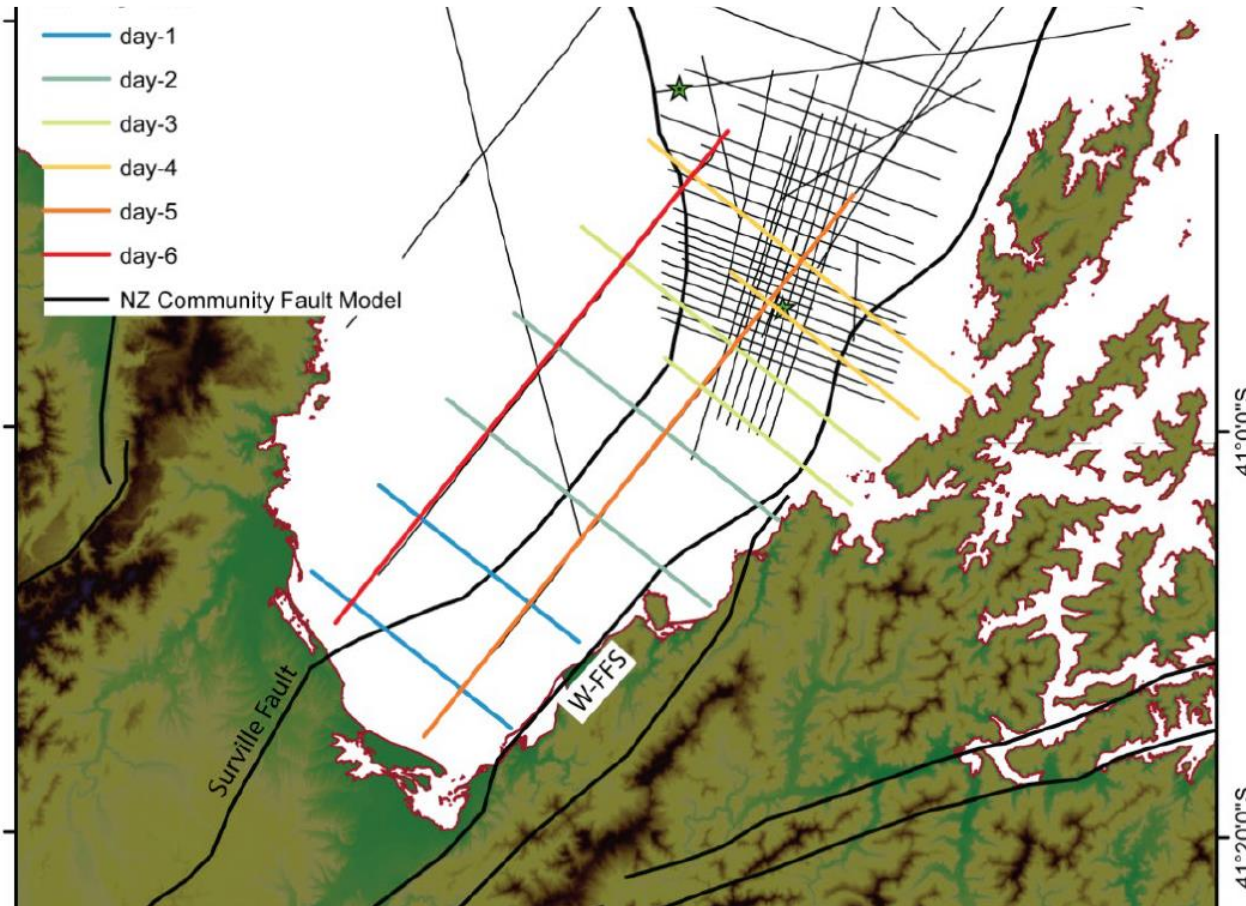
# Voyage Plan for marine geophysical investigation of active faulting in Tasman Bay

*RV Ikatere*

August 2021

Boomer Seismic System

TOPAS sub-bottom profiler system



**NEW DATA UNDER PROCESSING  
AND INTERPRETATION**



## CONCLUSIONS

The escarpment of the active reverse Waimea-Flaxmore Fault System dominates the landscape of Nelson and Richmond.

Field data and structural reconstructions suggest that the Flaxmore and Waimea reverse faults have been continuously reactivated in the last 20 My, with the last large earthquake ( $M$  6.5-7.4) c. 6000 years ago.

Deformation for blind faults (e.g. Tahunanui and Ruby Bay-Moutere faults) may occur by long-term accumulation of shortening, followed by rapid, seismic fault movement, eventually with surface break-through.

Identification of active faults in the Nelson-Richmond area has relevant implications for urban development and infrastructure.