

The NZ active faults database and onshore active faulting studies at NZ' s subduction zones



Nicola Litchfield on behalf of NZ earthquake geologists



NZ active faults database

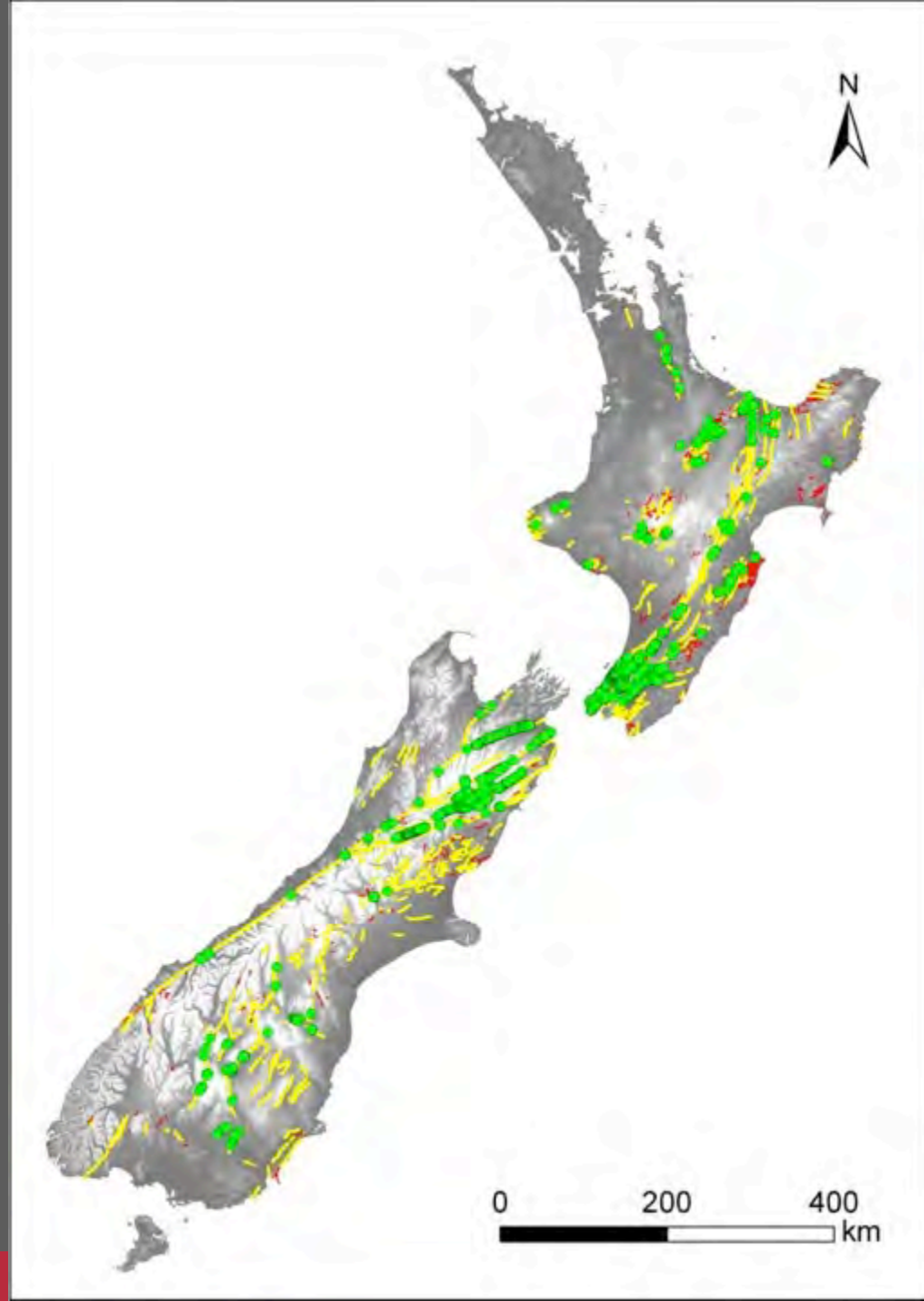
- **Terrestrial faults only**
- **History**
 - 1950' s paper compilations (Harold Wellman)
 - 1960' s shown on published geological maps
 - 1990' s digital (GIS) version
 - 1990' s onward – underpins national models (National Seismic Hazard Model, kinematic models)
 - 2004 web version
 - 2013 1:250,000 scale version identical to QMAP
- **Active fault = shows evidence of rupture in the last 125,000 years, Taupo Rift 25,000 years (see Pilar Villamors poster)**

Heirarchy and content

- **12,775 traces**
- **365 faults**
- **2054 points**

Selected key attributes:

- Expression
- Scale
- Data source
- Geometry (dip, dip direction)
- Kinematics (sense, slip rate)
- Paleoearthquake (Events, Single Event Displacement, Recurrence Interval)
- References



Web version and access

www.data.gns.cri.nz/af/

Query →
Map →

New Zealand Active Faults Database - Mozilla Firefox

File Edit View History Bookmarks Tools Help

New Zealand Active Faults Database

data.gns.cri.nz/af/

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New Zealand Active Faults Database

ACTIVE FAULTS DATABASE

- Active Faults Home
- About Active Faults
- Query the Database
- Data Entry
- Interactive Map
- Login

GNS Science maintains the New Zealand Active Faults Database. This database has been designed to hold all data collected from investigations of active faults. Along with the locations of active faults, the Active Faults Database contains the results from field measurements of offset features, trenching, and dating. It also stores interpretation of these results in the form of the average fault recurrence interval, slip rate, and date of last movement. This detailed information, which is collected at many points along a fault, has been summarised and presented here for each fault.

Hope Fault

Whilst the maps of fault locations presented on these pages are derived from detailed location data, the fault features have been generalised to assist presentation. The maps should be treated as overview maps only. They should not be used for as a substitute for detailed mapping.

Edgecumbe Fault scarp

The Active Faults Database is a growing database and will be subject to change as new information becomes available and new interpretations are developed. Consequently information presented on these pages will also change.

GNS has made every reasonable effort to ensure the information given on these pages is accurate, complete, and up-to-date. However GNS make no warranties or representations as to its accuracy or completeness and shall not be liable for any injury or death, or for damages of any kind arising out of access to, or use of the information, or any errors, omissions, misprints, or out-of-date information.

- Currently can't download data, but available upon request for research purposes
- 1:250,000 version should be available for download late 2013

Example – Wellington Fault query

The screenshot shows a web browser window displaying the New Zealand Active Faults Database. The page title is "New Zealand Active Faults Database" and the URL is "data.gns.org.nz/af/detail.asp". The page features a GNS Science logo and a navigation menu on the left. The main content area displays the "Wellington Fault" query results, including a table of key attributes, a map, a list of references, and a photo of the fault.

Wellington Fault

| | |
|---|-----------------|
| Fault Sense | dextral |
| Recurrence Interval | < 2000 |
| Last Event | Last Millennium |
| Slip Rate | Medium |
| Single Event Displacement | Moderate |

Click on the image above to open an interactive map

Selected References

Begg, J.G.; Johnston, M.R. 2000 Geology of the Wellington area : scale 1:250,000. Lower Hutt: Institute of Geological & Nuclear Sciences, *Institute of Geological & Nuclear Sciences 1:250,000 geological map 20*. 64 p.

Berryman, K.R. 1990 Late Quaternary movement on the Wellington Fault in the Upper Hutt area, New Zealand. *New Zealand Journal of Geology and Geophysics*, 33(2): 257-270

Van Dissen, R.J.; Berryman, K.R. 1996 Surface rupture earthquakes over the last ~1000 years in the Wellington region, New Zealand, and implications for ground shaking hazard. *Journal of Geophysical Research: Solid Earth*, 101(B3): 5999-6019

Groper, R.H.; Hardy, E.F.; Wellman, H.W. 1984 The Wellington, Mohaka, and Wairarapa faults. Wellington: Victoria University of Wellington. *Publication of Geology Department, Victoria University of Wellington 28*. 17 p.

Langridge, R.M.; Berryman, K.R.; Van Dissen, R.J. 2007 Late Holocene paleoseismicity of the Pahiatua section of the Wellington Fault, New Zealand. *New Zealand Journal of Geology and Geophysics*, 50(3): 205-226

Marden, M.; Neall, V.E. 1990 Dated Ohakēan terraces offset by the Wellington Fault, near Woodville, New Zealand. *New Zealand Journal of Geology and Geophysics*, 33(3): 449-453

Van Dissen, R.J.; Berryman, K.R.; Pettinga, J.R.; Hill, N.L. 1992 Paleoseismicity of the Wellington - Hutt Valley Segment of the Wellington Fault, North Island, New Zealand. *New Zealand Journal of Geology and Geophysics*, 35(2): 165-176

Langridge, R.M.; Berryman, K.R.; Van Dissen, R.J. 2005 Defining the geometric segmentation and Holocene slip rate of the Wellington Fault, New Zealand: the Pahiatua section. *New Zealand Journal of Geology and Geophysics*, 48(4): 591-607

Fault Images

Map

Key attributes
(categories)

References

Photos

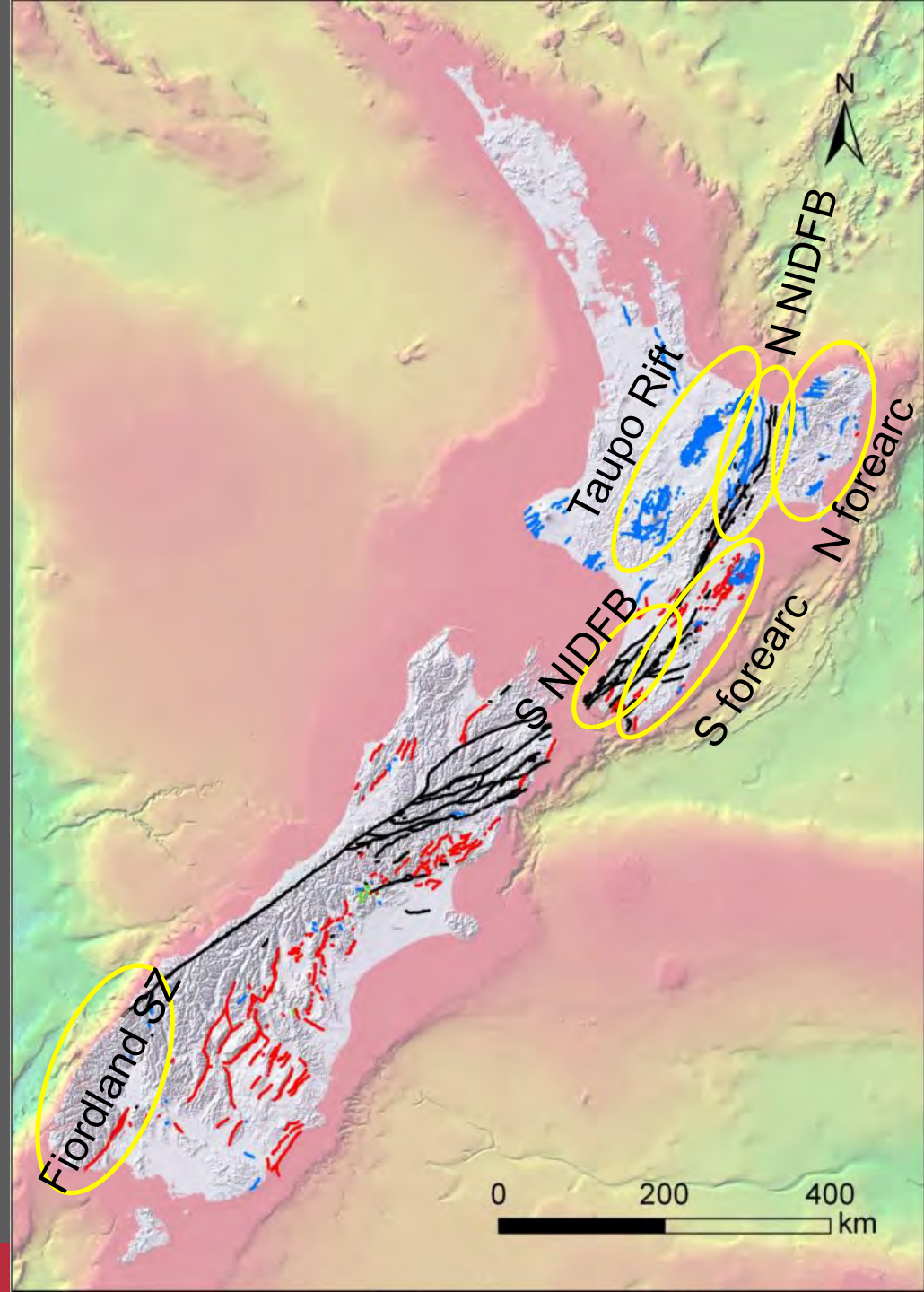
Limitations, uncertainties, omissions

- Only faults <125,000 or 25,000 yrs (cf USGS 1.6 Myr)
 - Hikurangi Subduction Zone no Plio-Pleistocene faults
- No folds or blind faults
- Attributes incomplete
 - Most have sense and recurrence interval attributes
 - others only compiled where there is good data
 - generally complete ≥ 1 mm/y
- Updates are irregular, few updates in last 2 years
- Faults likely to be missing
 - remote mountainous
 - vegetated areas
 - rapidly eroding areas
 - large alluvial basins

Onshore active faulting studies at NZ subduction zones

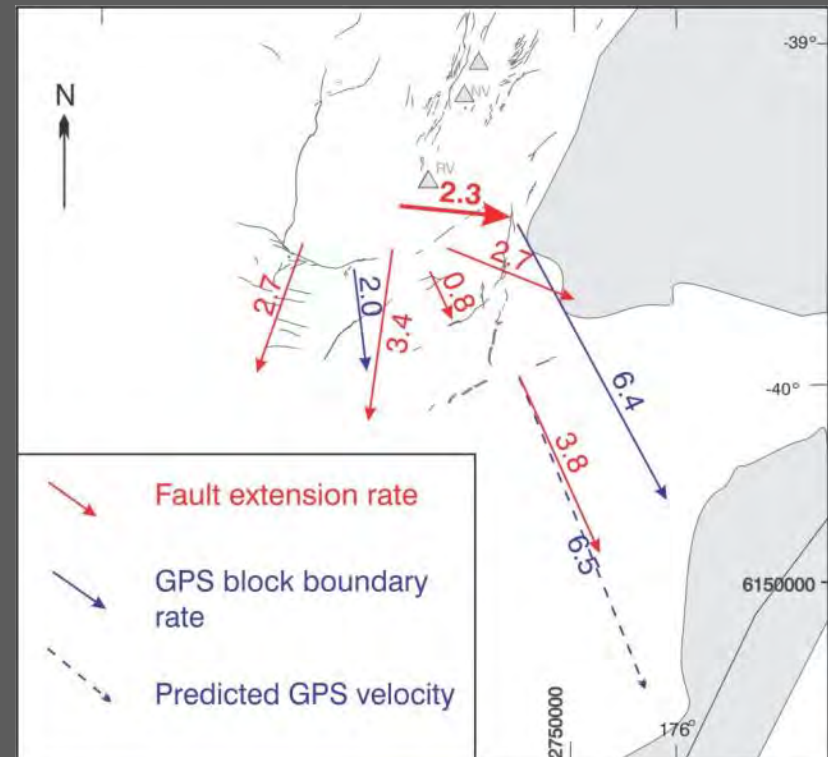
- Brief overview of paleoearthquake studies in parts of the subduction zones

NIDFB = North Island Dextral Fault Belt



Active fault studies, Taupo Rift

- Many studies
- Tephra age control (~every 2000 years)
- Paleoearthquakes and slip rates
- Taupo Rift extension rates

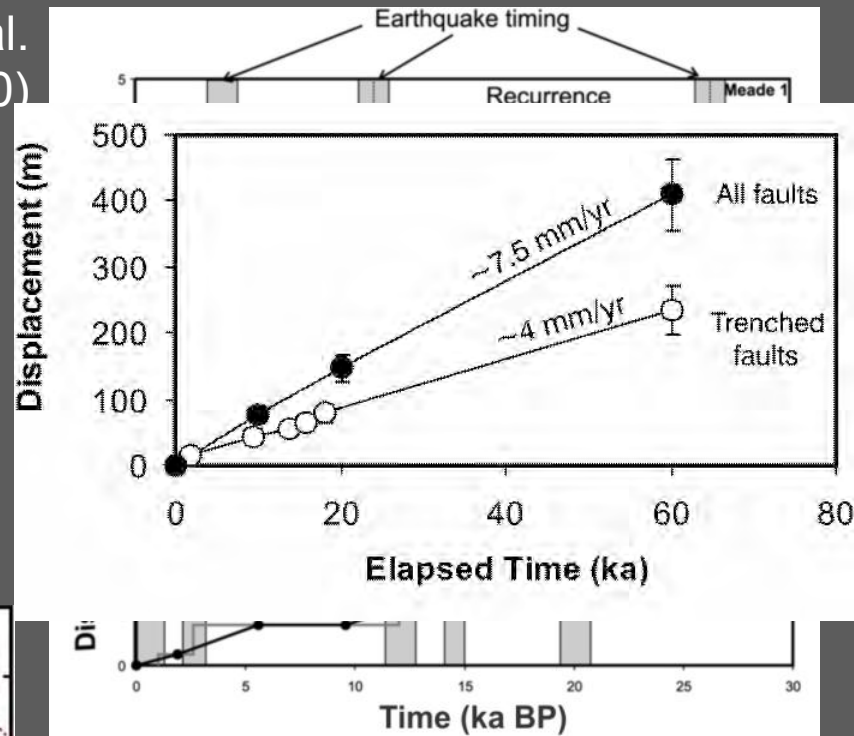


Villamor & Berryman (2006)

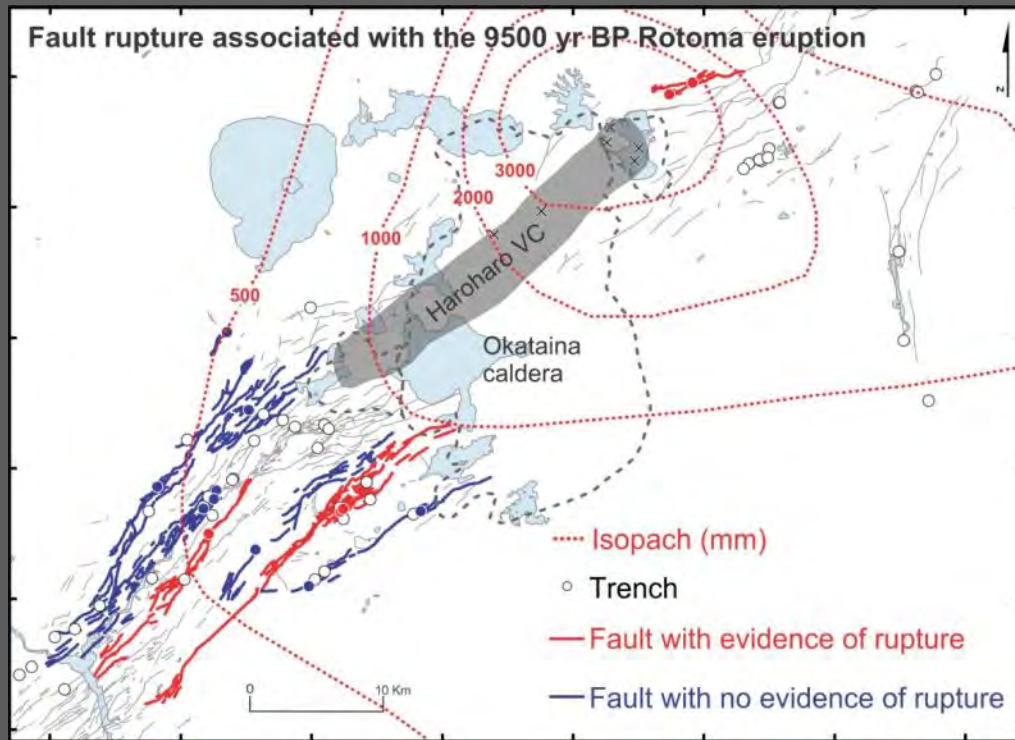
Taupo Rift cntd

- Fault-fault interactions and migration of locus of activity

Nicol et al. (2010)



Nicol et al. (2006)

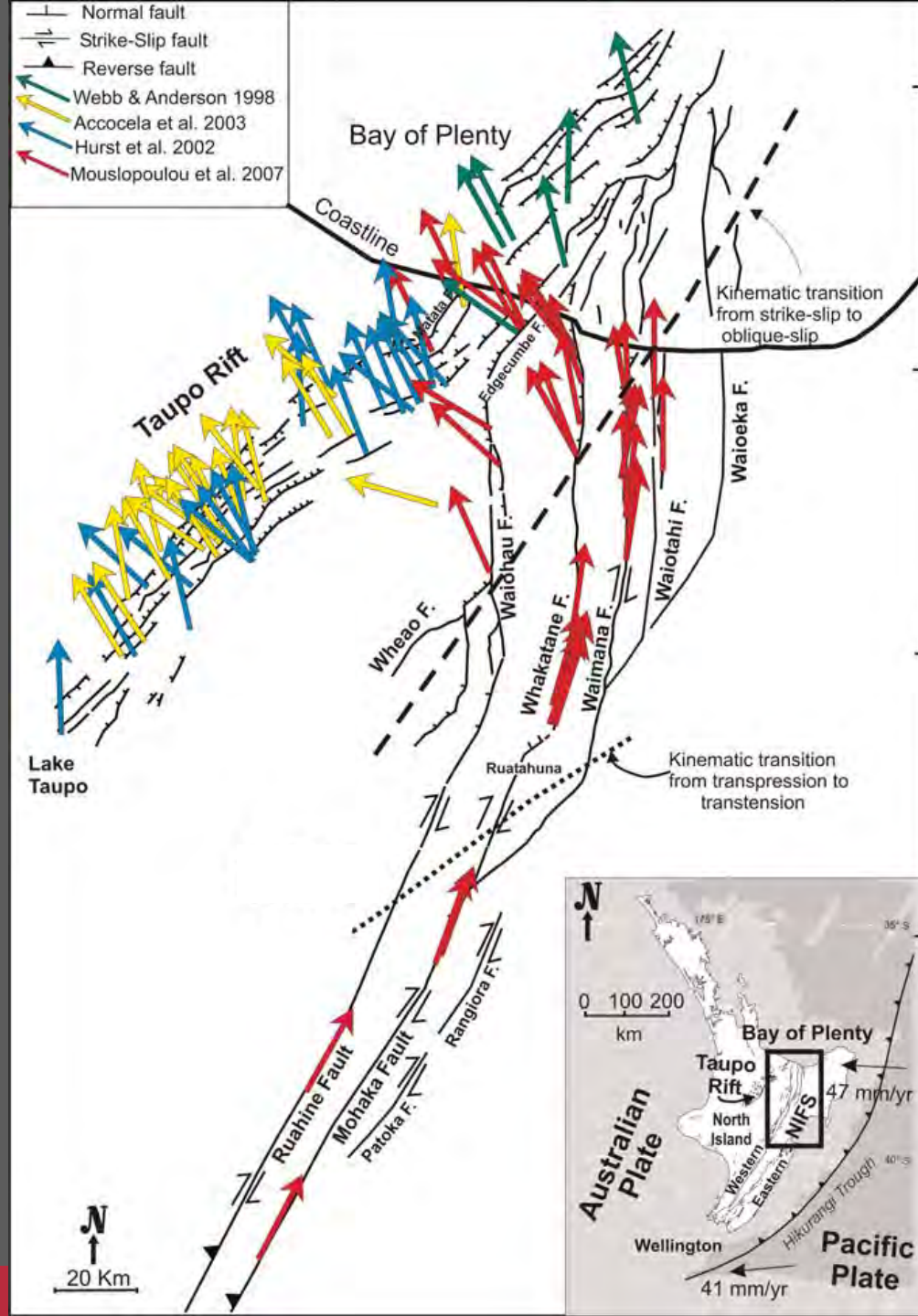


- Fault-volcano interactions

Villamor et al. (2011)

Northern & central N. Is. Dextral Fault Belt

- Several paleo-earthquake studies
- Paleoearthquakes, slip rates
- Along-strike changes
- Interaction with the Taupo Rift
- Difficult access

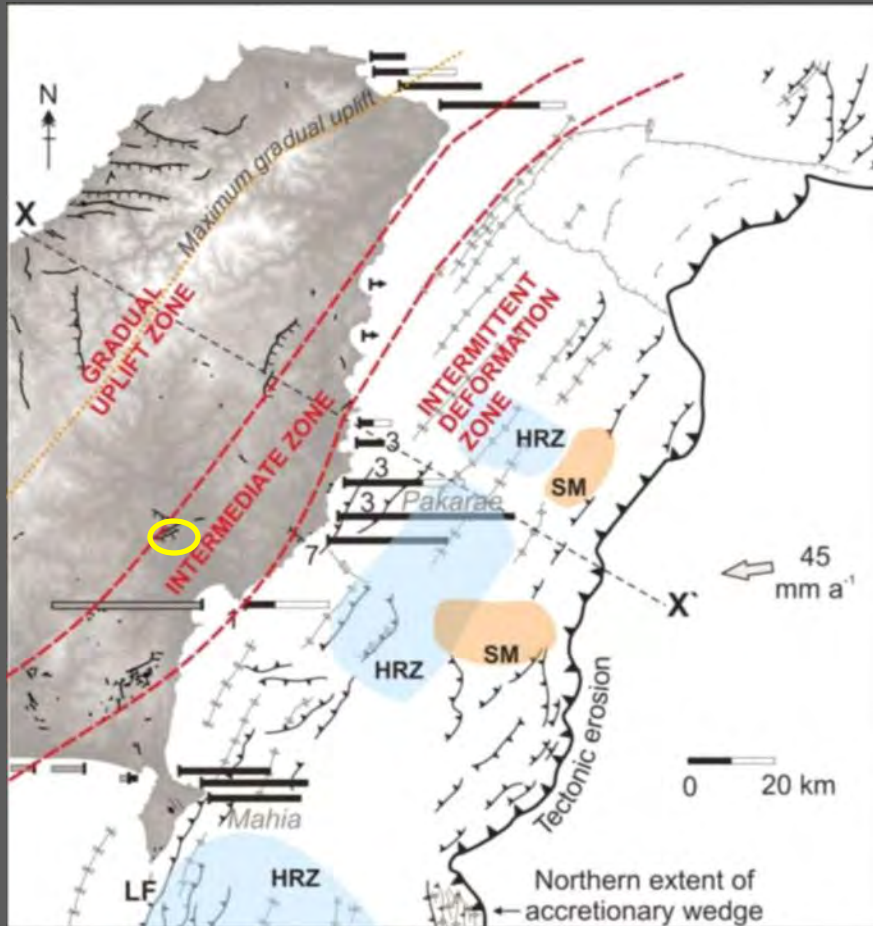


Northern Forearc

- 1 paleoearthquake, several terrace studies



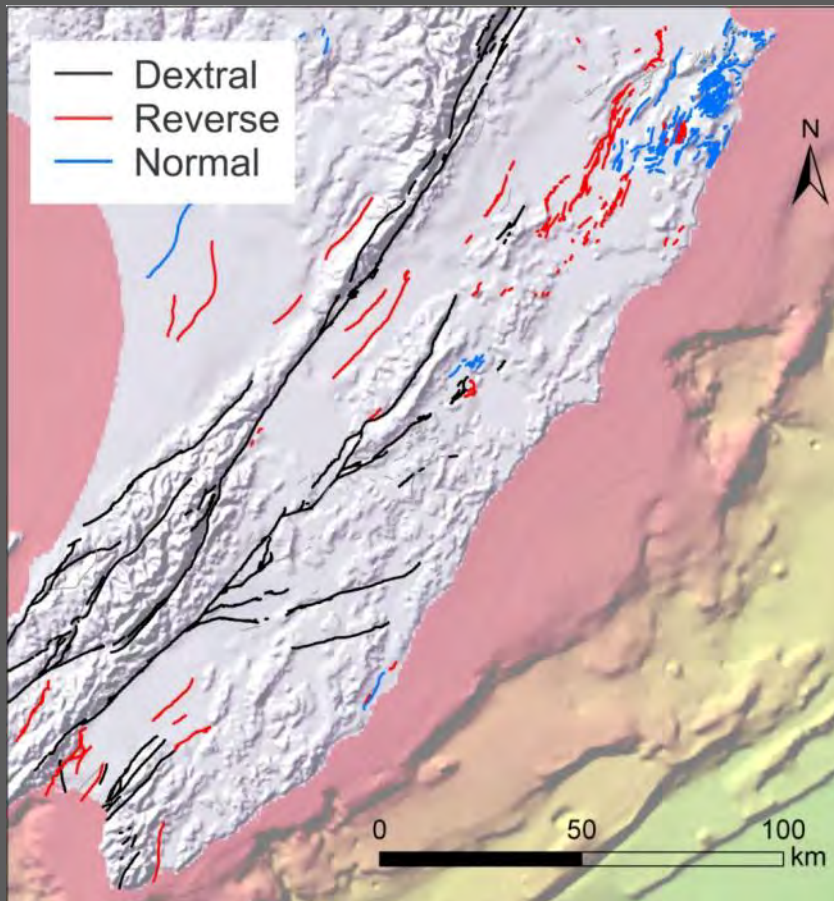
- Secondary normal faulting
- Nearshore faults / subduction earthquakes (see Ursula Cochran's poster)
- Rapid erosion



1931 Napier Earthquake, Poukawa Fault



Henderson (1933)



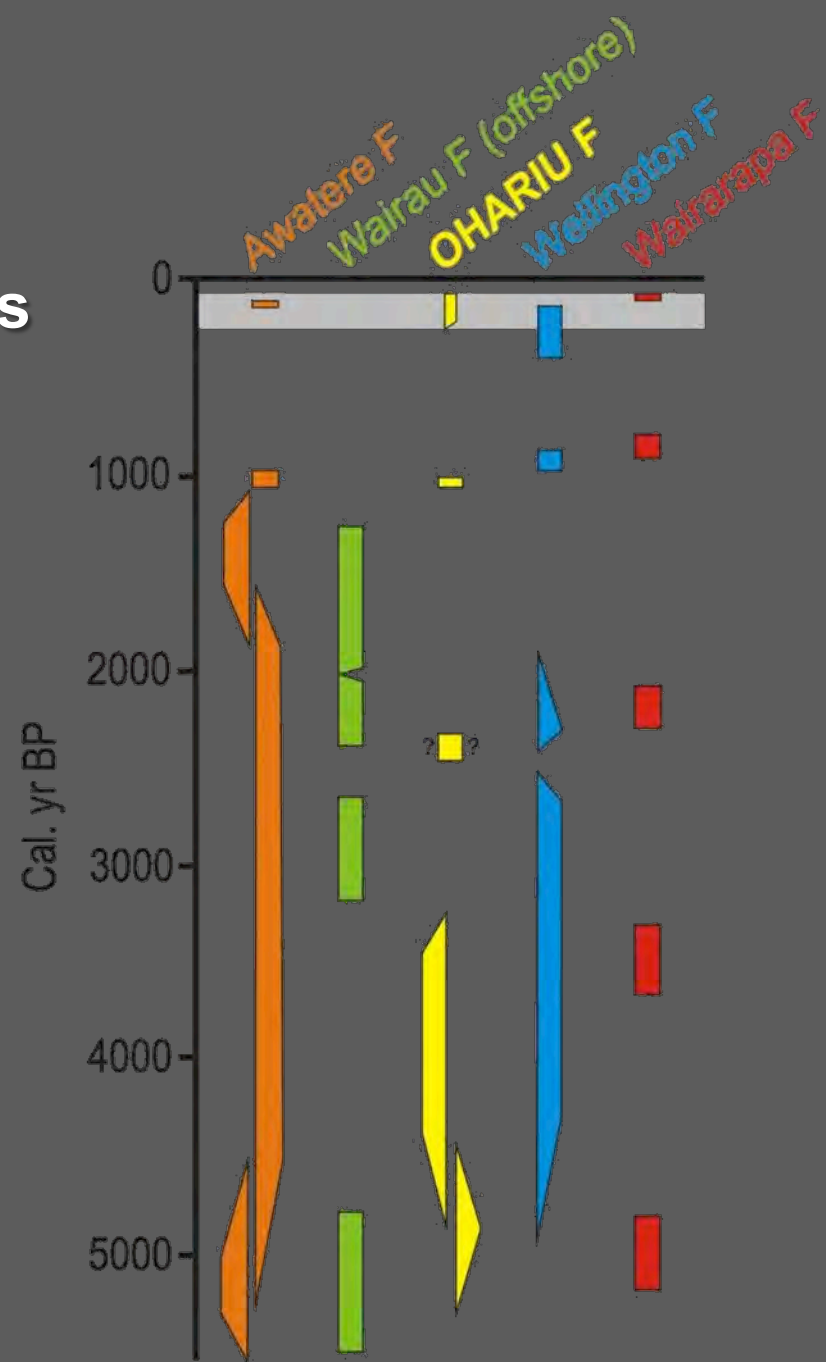
Southern Forearc

- Few paleoearthquake studies, but mapping and kinematic studies
- Historical ruptures
- Along-strike changes
- Folding
- Moderate-high erosion rates & some complex faults

Southern North Island Dextral Fault Belt

- Many paleoearthquake studies
- Paleoearthquakes, slip rates, Single Event Displacement, Recurrence Interval
- Fault interactions

Synthetic seismicity model (n=58) Inter-event times



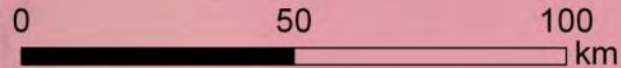
Fiordland Subduction Zone



NZ active fault database



Photo: Phaedra Upton



References

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