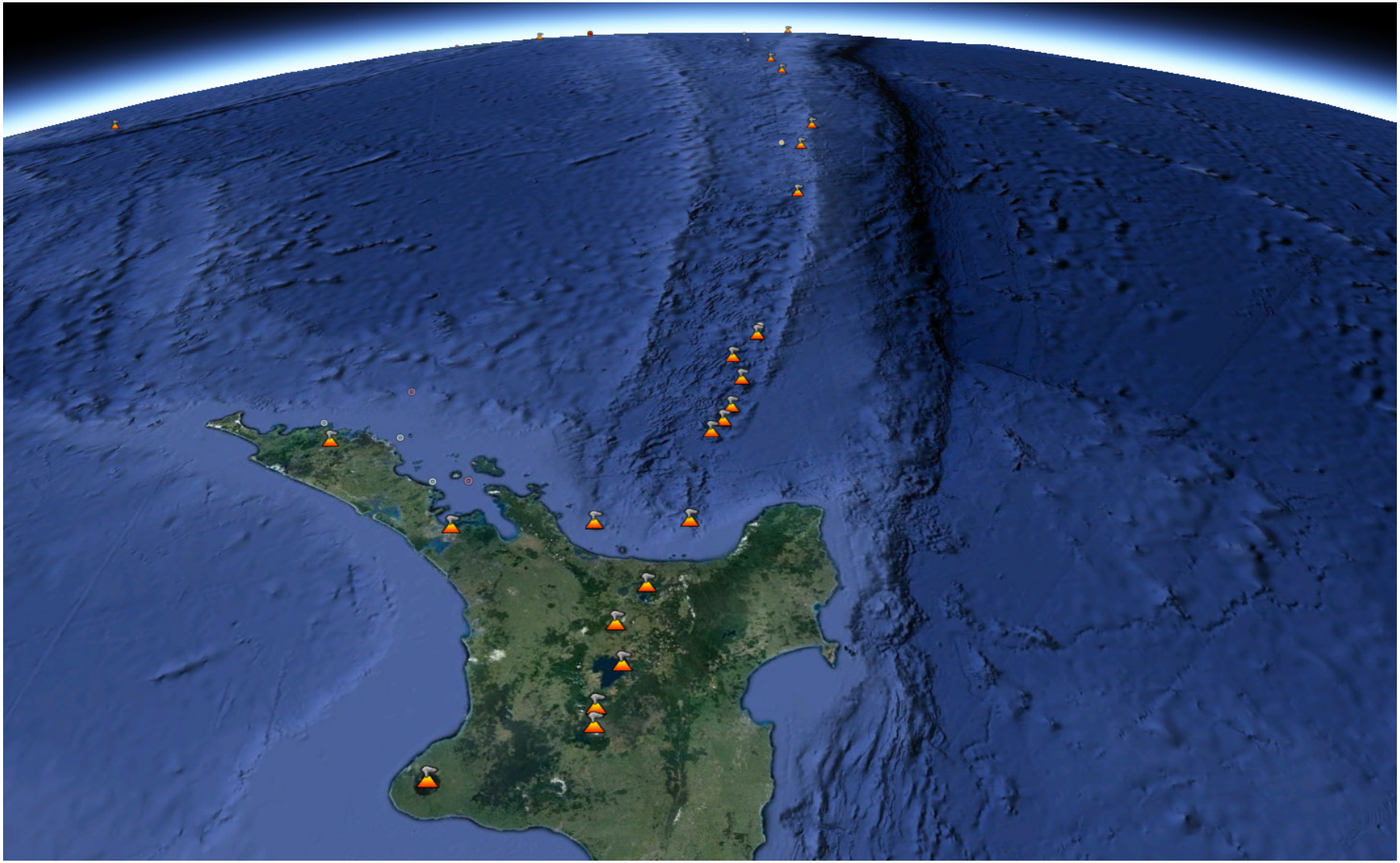
Arc Volcanism in New Zealand

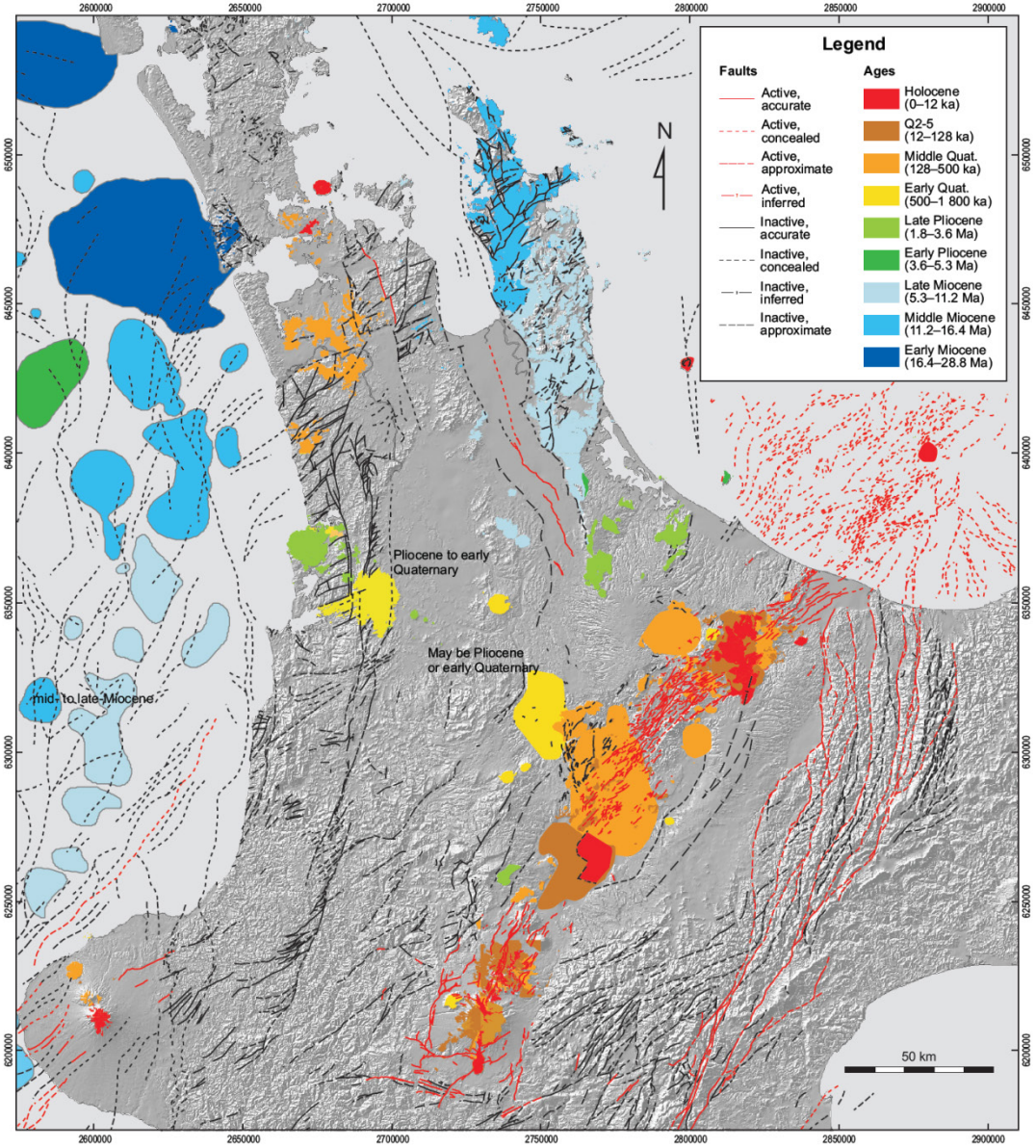
Graham Leonard

GNS SCIENCE
TE PŪ AO

New Zealand subduction zone and volcanic arc



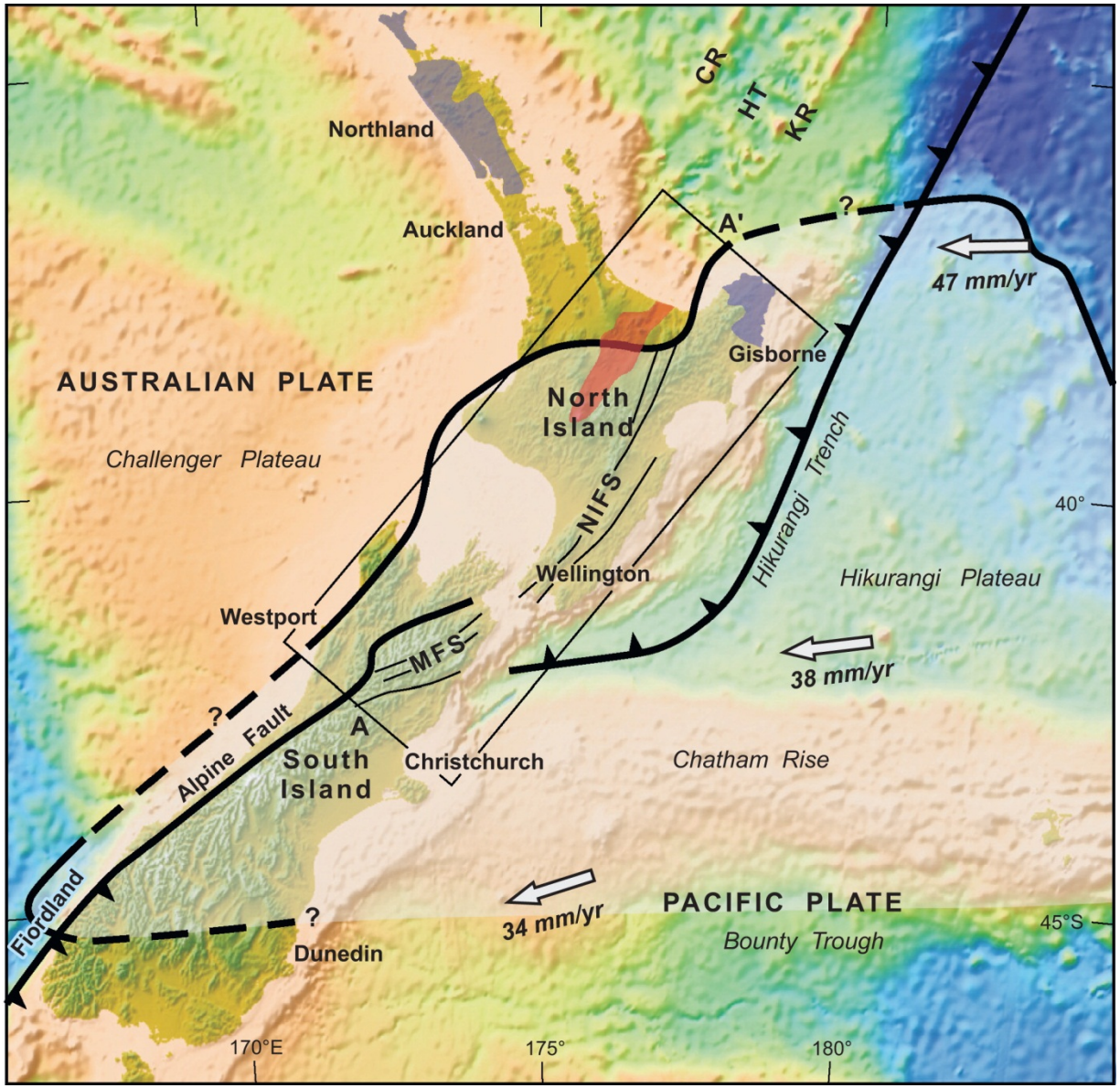
Ages of volcanism and faulting



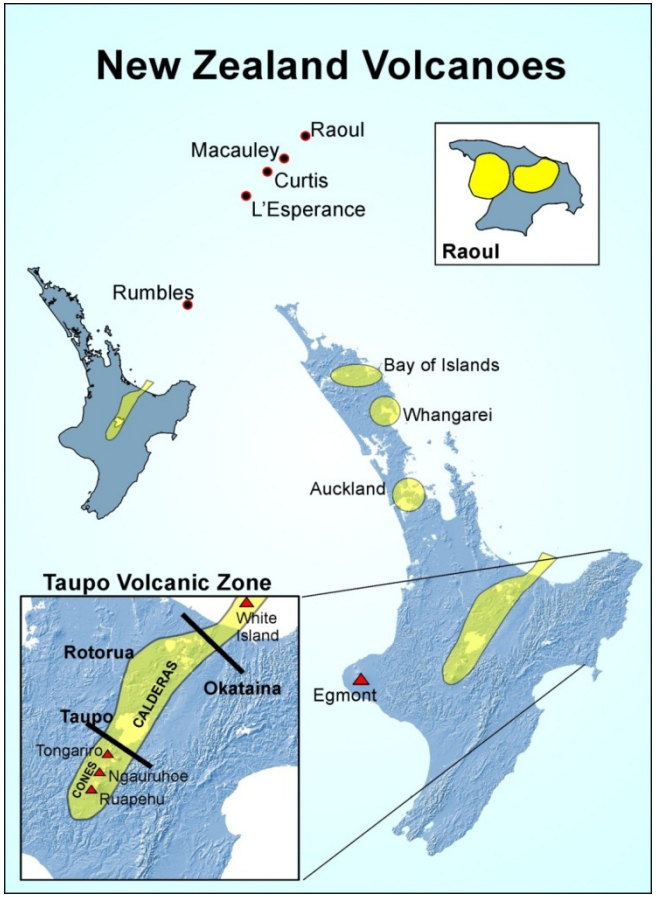
Leonard et al., 2010
(QMAP Rotorua)

Subducting Plateau

M. Reyners. Earth and Planetary Science Letters
Volume 361, 1 January 2013, Pages 460–468

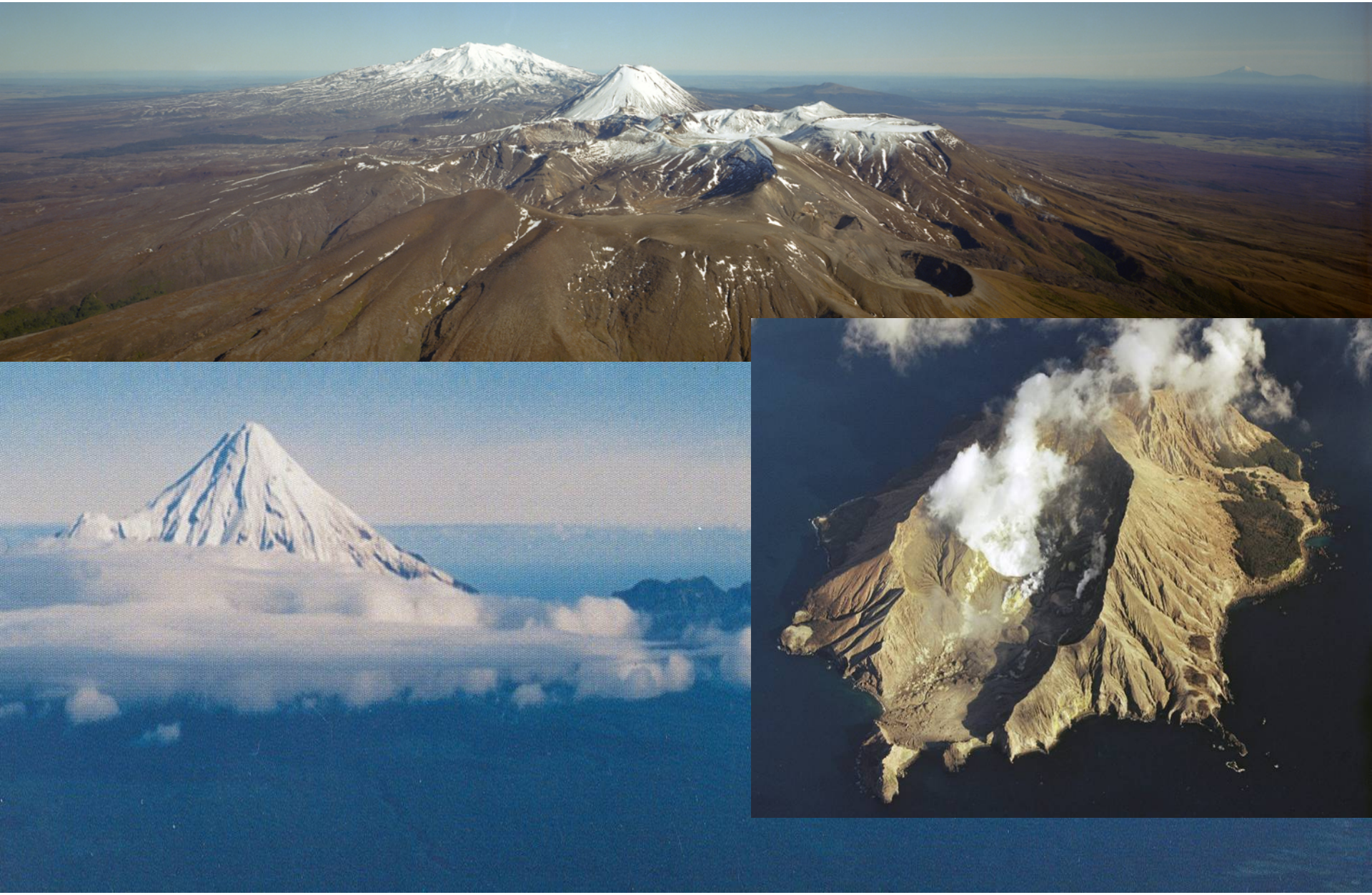


Active Volcanoes in NZ



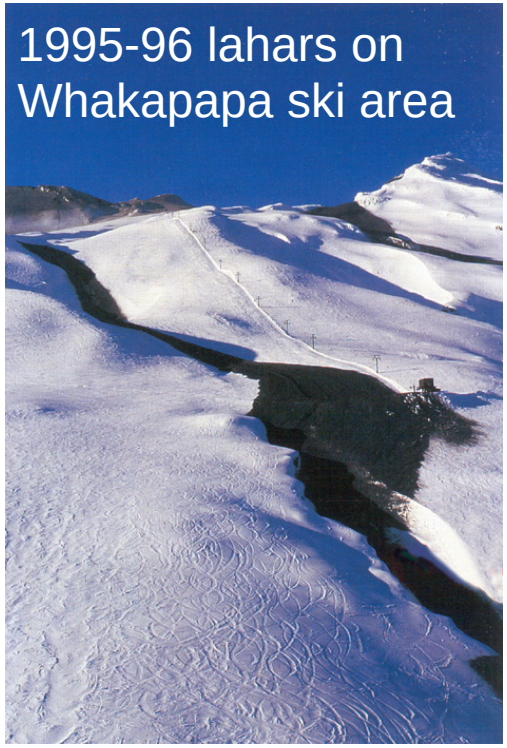
Taupo Volcanic Zone – rhyolite and andesite (and a hint of basalt)

Cones Volcanoes



Ruapehu erupted most recently in 1995-96

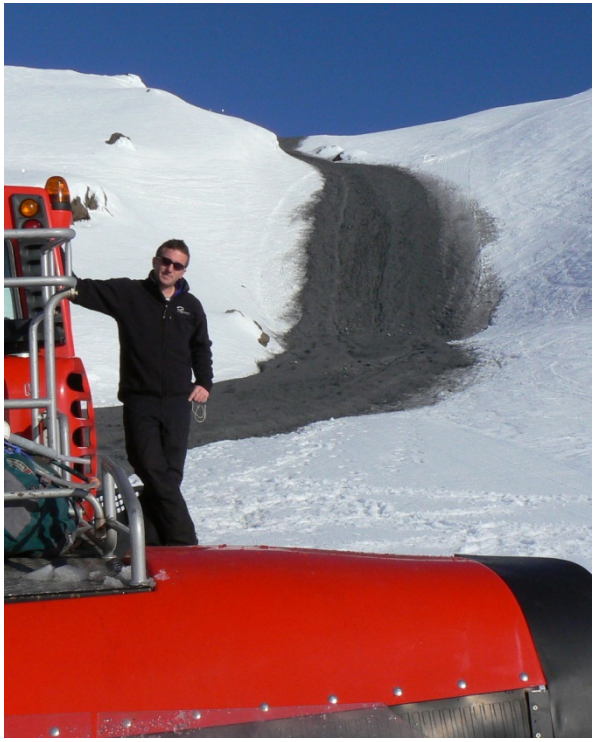
1995-96 lahars on Whakapapa ski area



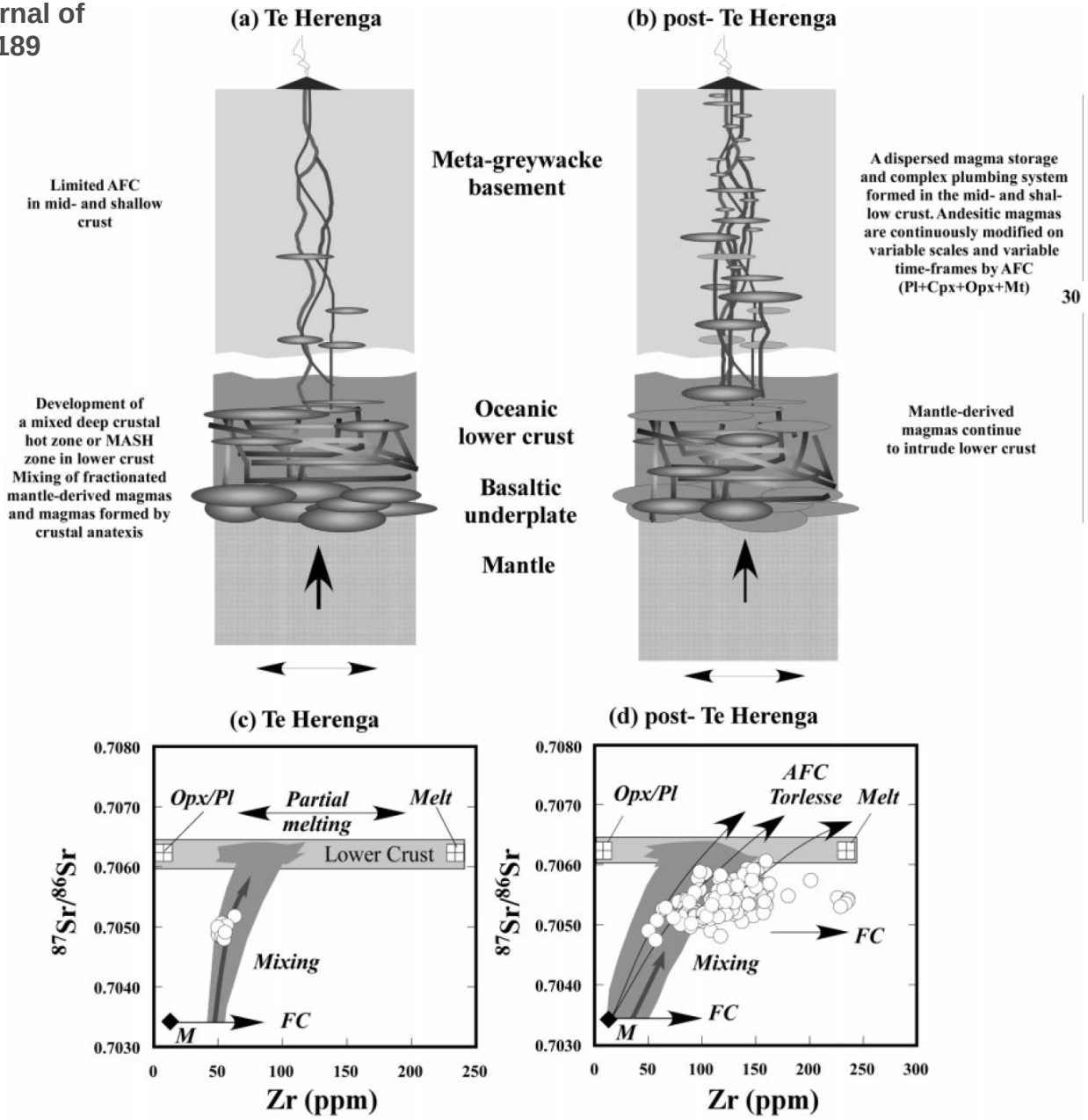
Lahar damage in 1975 eruption

Ruapehu
September 2007

2007

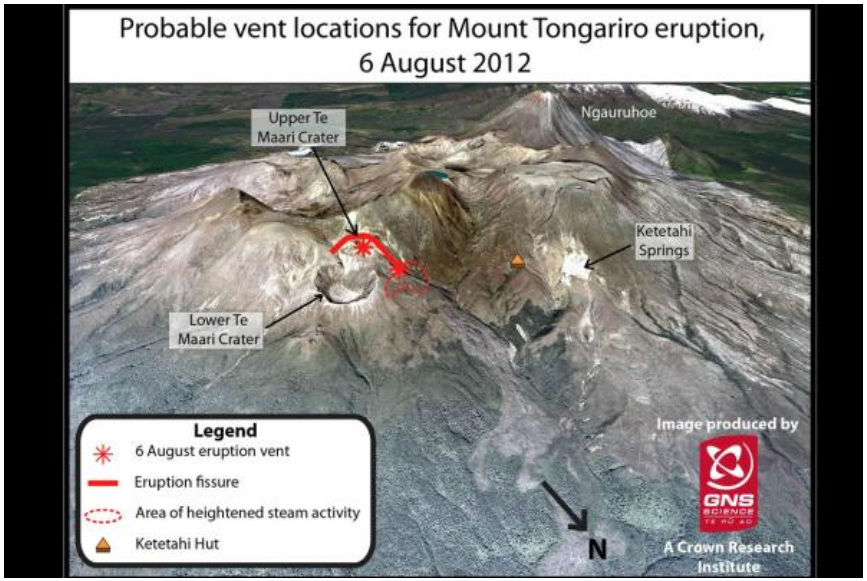


Price et al., 2012 Journal of Petrology 53 2139-2189

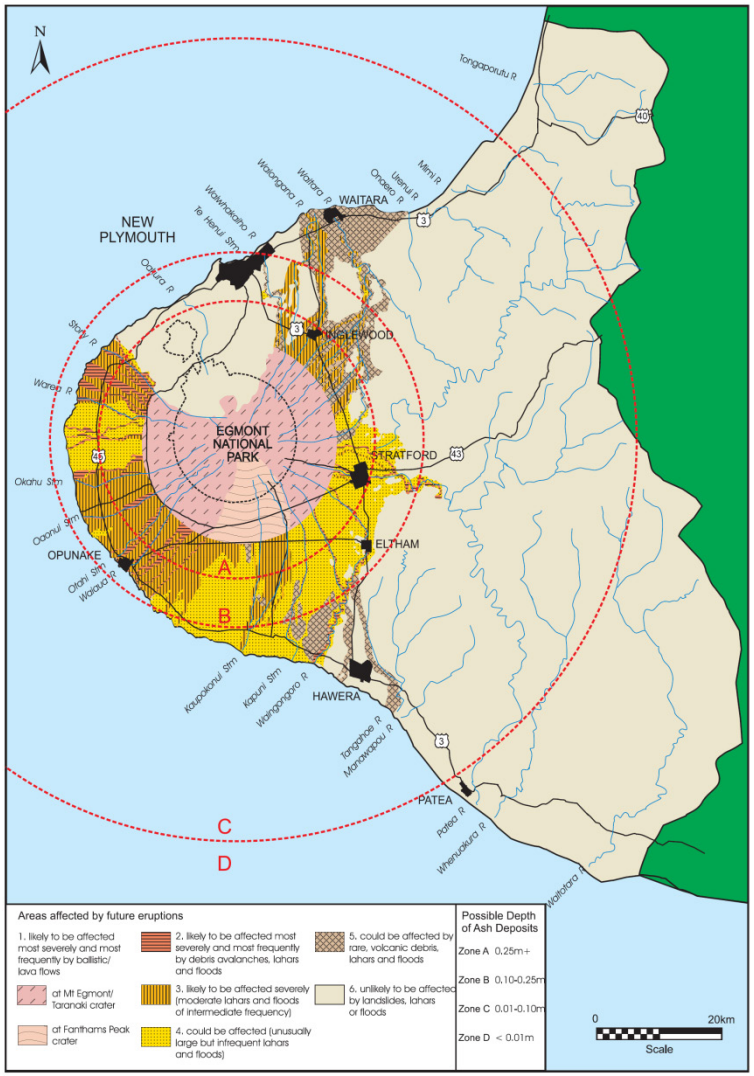


Ngauruhoe

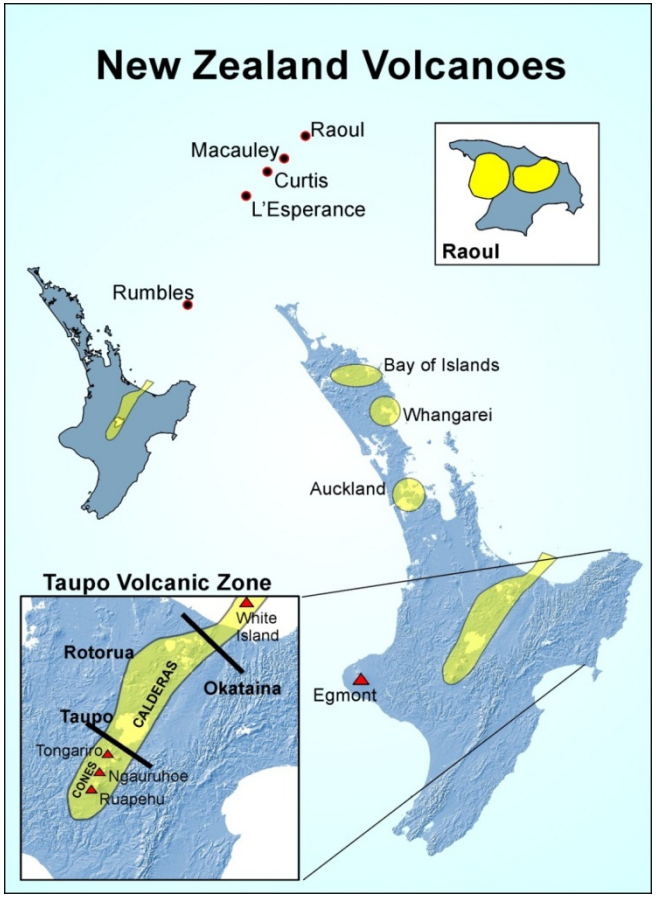
Tongariro 2012



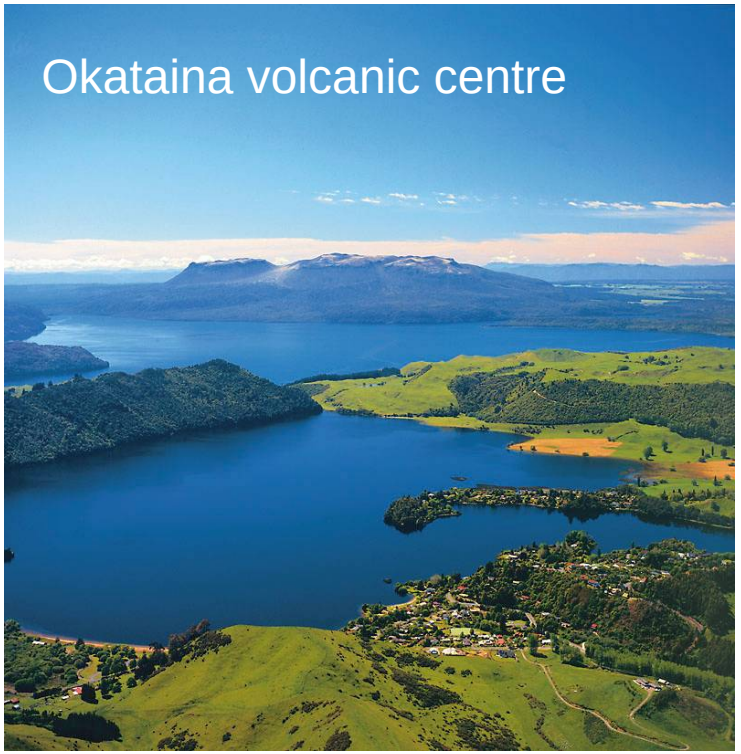
Taranaki volcano: Debris flow / lahars and nationally-significant lifelines

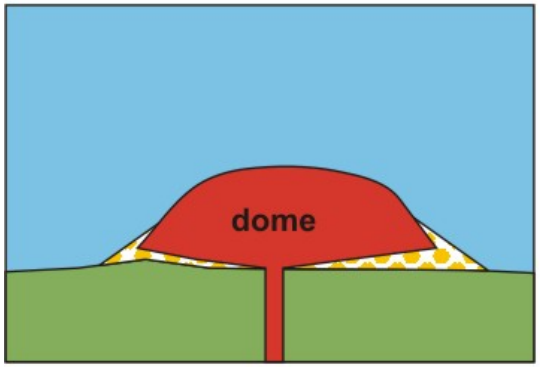


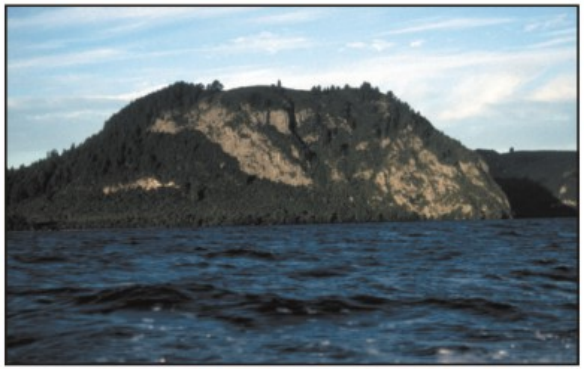
Active Volcanoes in NZ



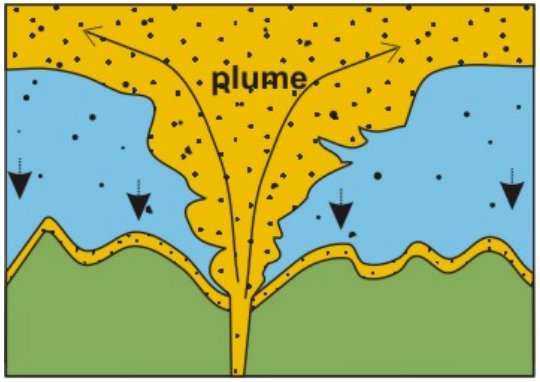
Taupo Volcanic Zone rhyolite volcanoes





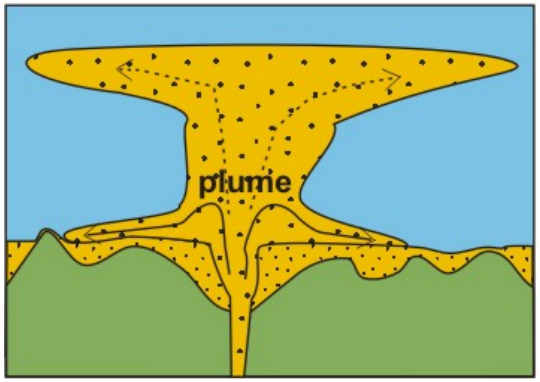


Side from C. Wilson: Eruptive styles

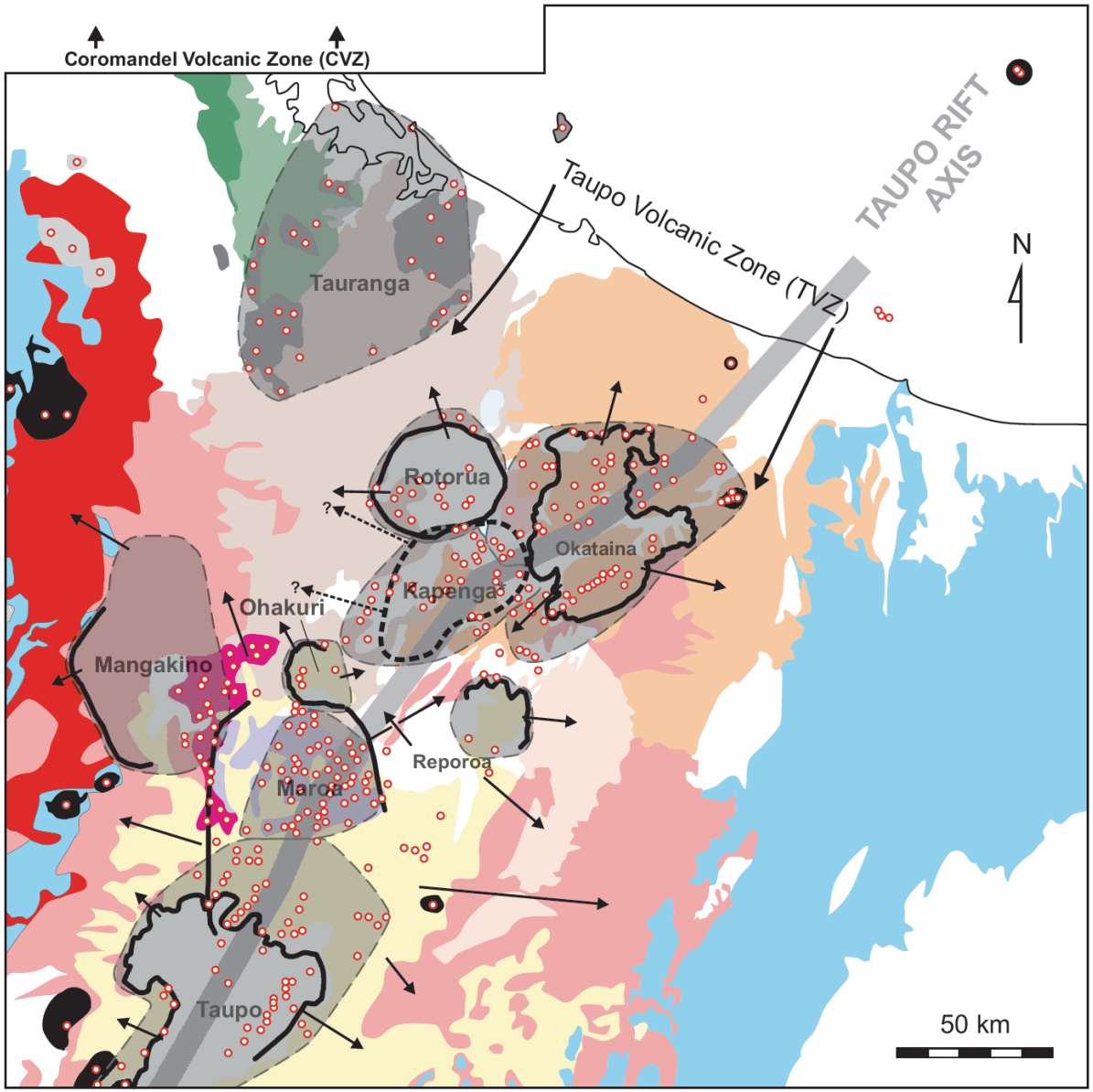


Viscosity of the magma

- Gas content in the magma
- Eruption rate
- Influence of external water

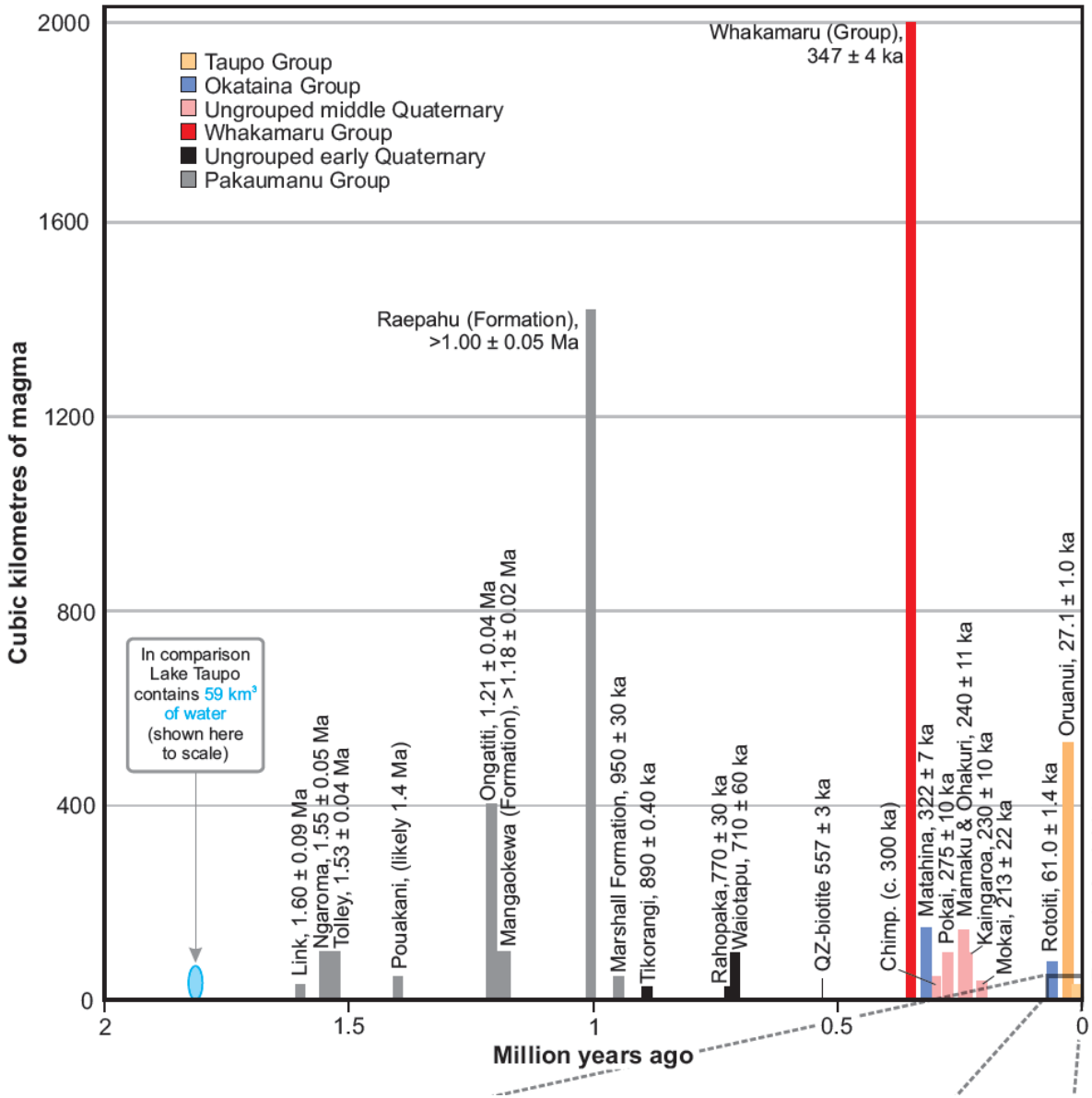


Rhyolite volcanic centres

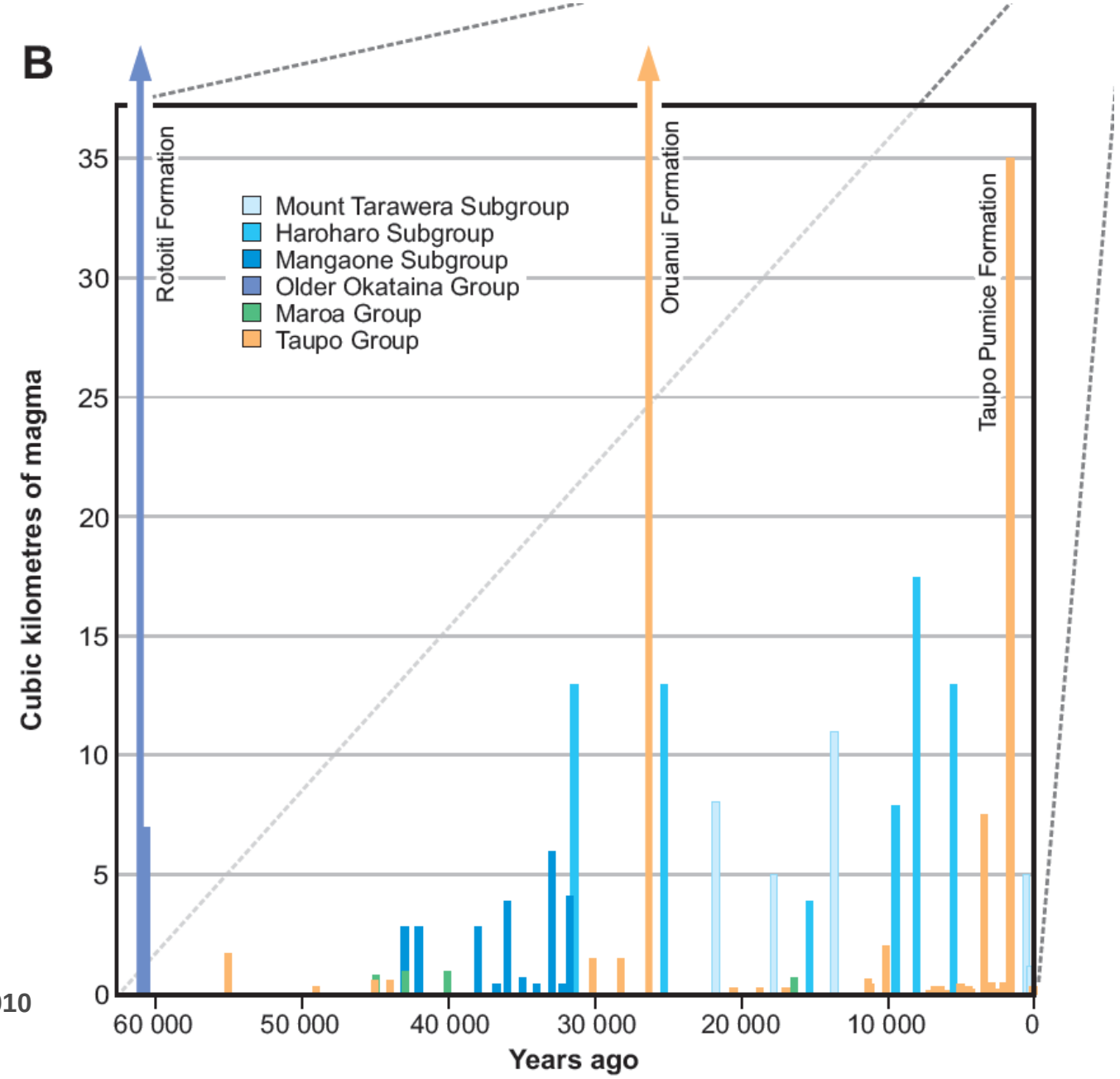


Leonard et al., 2010
(QMAP Rotorua)

Eruption tempo

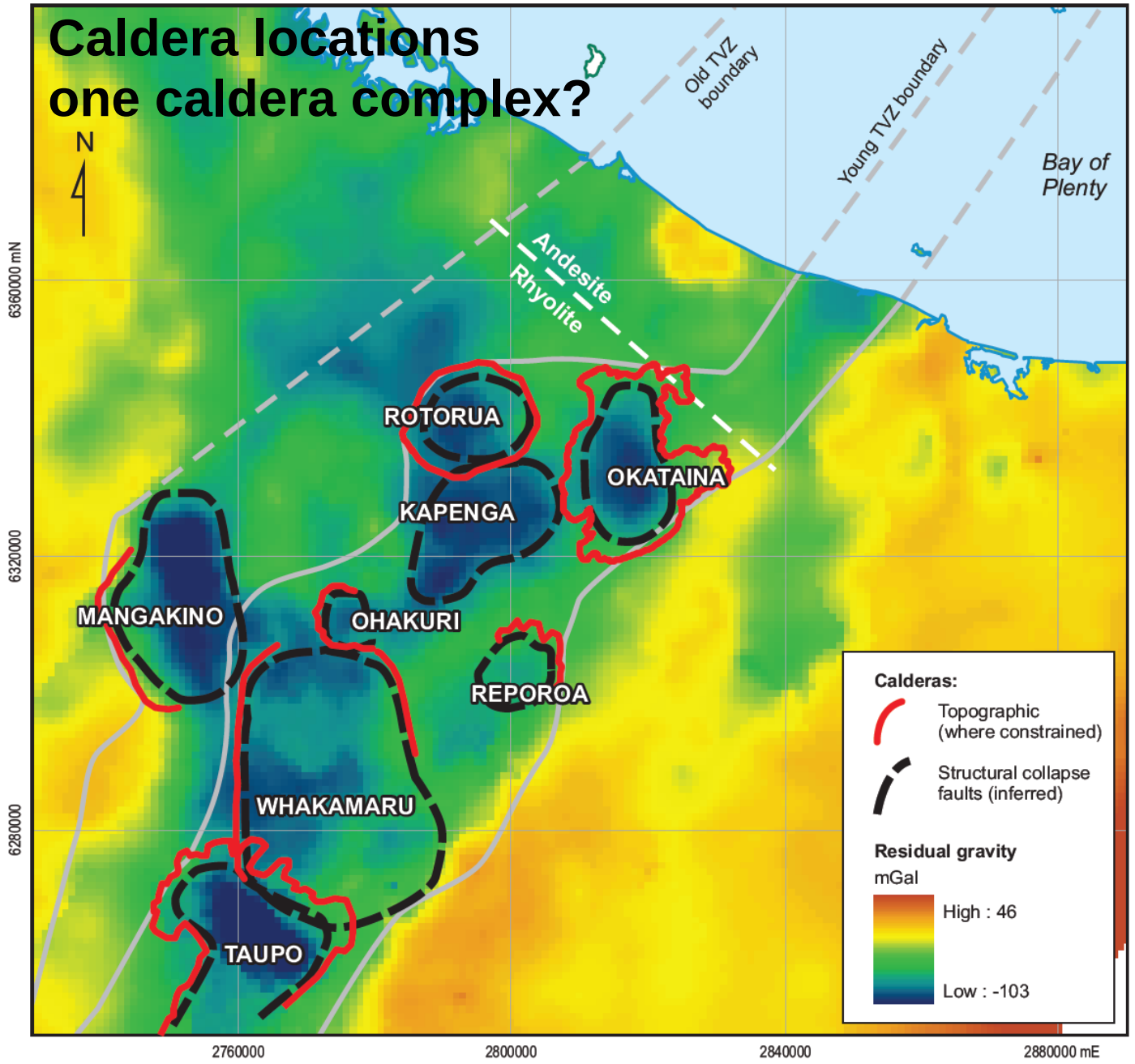


Leonard et al., 2010
(QMAP Rotorua)



Leonard et al., 2010
(QMAP Rotorua)

Caldera locations one caldera complex?

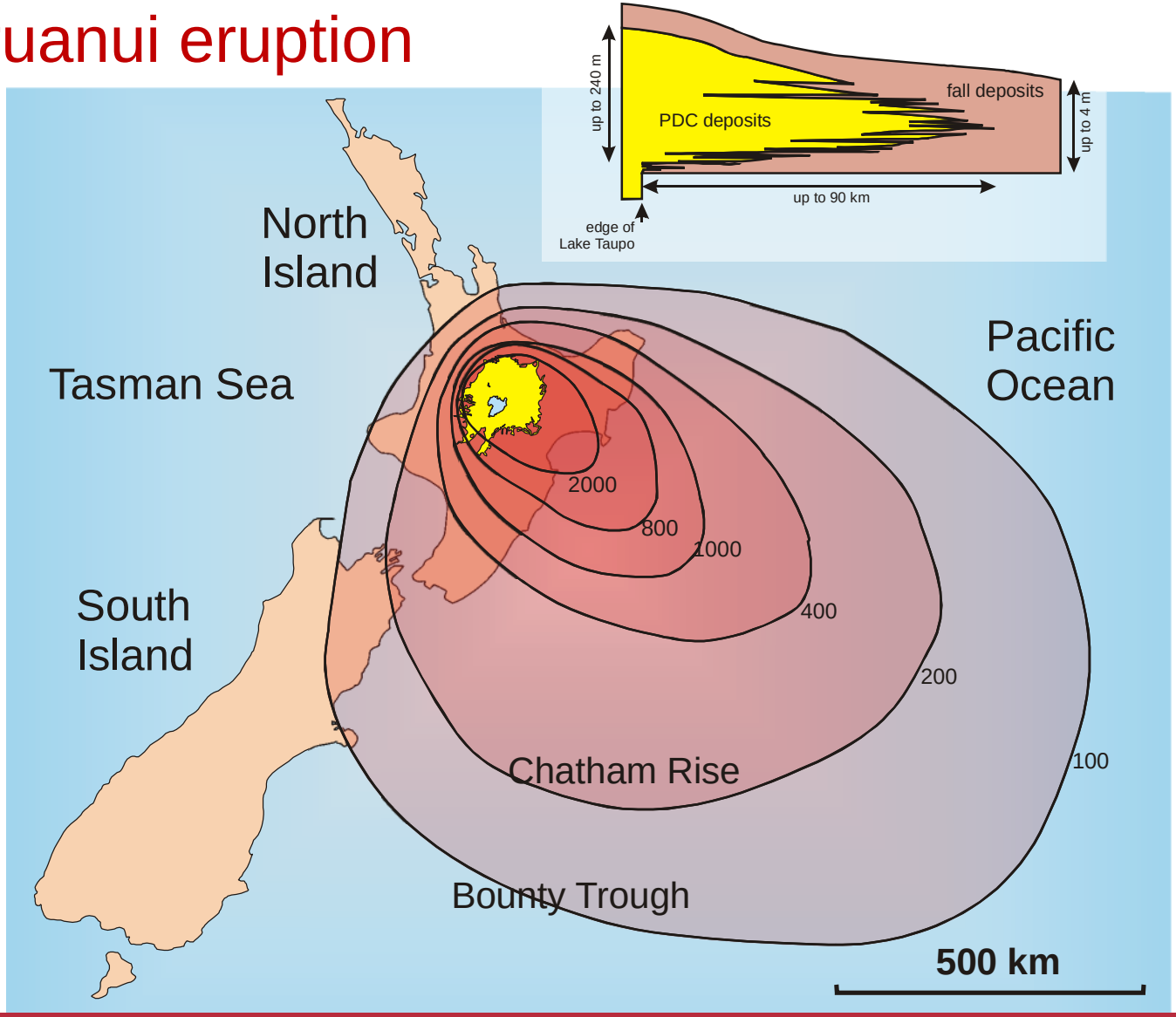


Leonard et al., 2010
(QMAP Rotorua)

Dispersal of pyroclastic fall and flow deposits from the 26,500 year ago Oruanui eruption

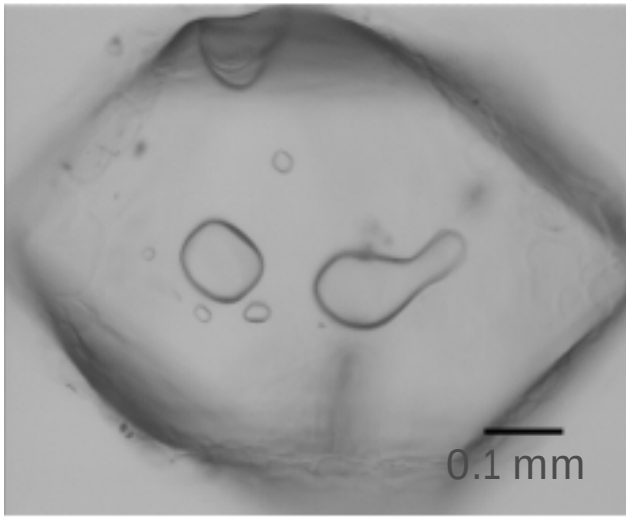
>500 km^3 dense rock equivalent of magma

C. Wilson

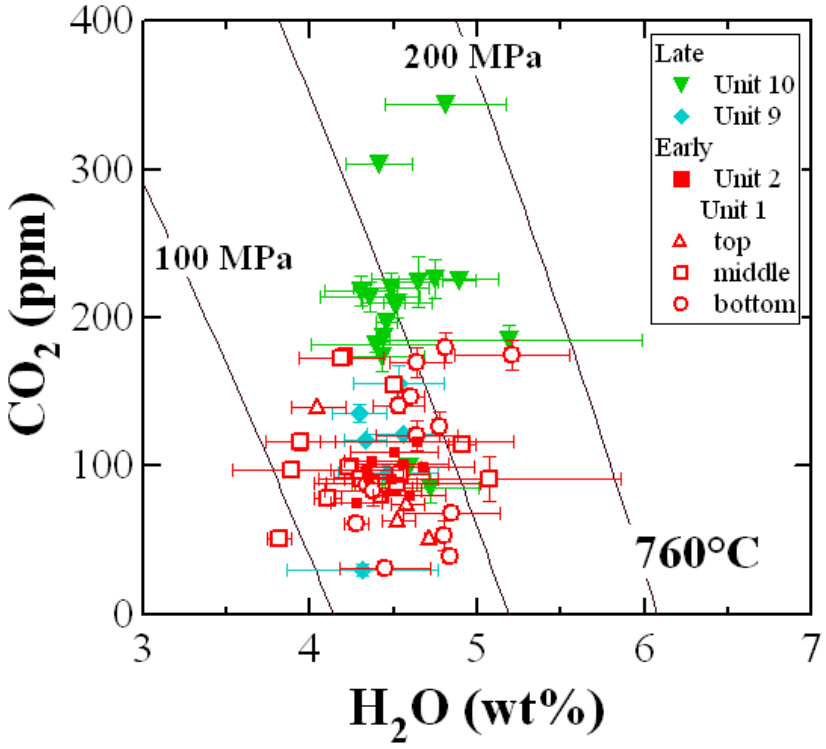


Slide from C. Wilson: Crystal histories

Quartz (particularly the melt inclusions)



The compositions of the melt inclusions tell us that the Oruanui magma body accumulated between 4 to 8 km below the Earth's surface



Amounts of water (H_2O) and carbon dioxide (CO_2) tell us about the pressure at which the inclusion was trapped, hence depths below the surface

(From: Liu et al., Contrib Mineral Petrol 151, 71, 2006)

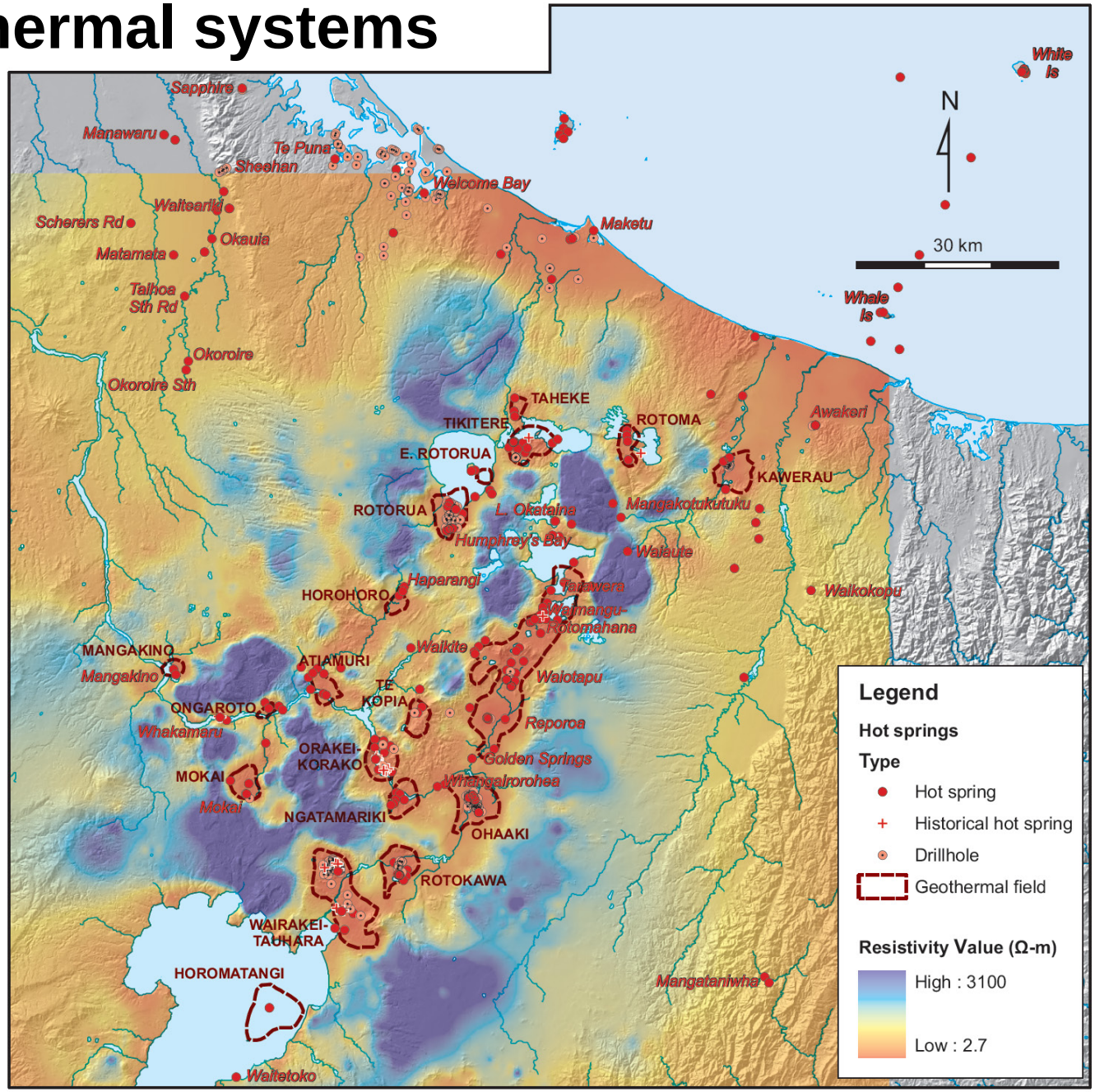
Calderas

D. Townsend

Rhyolite lava domes

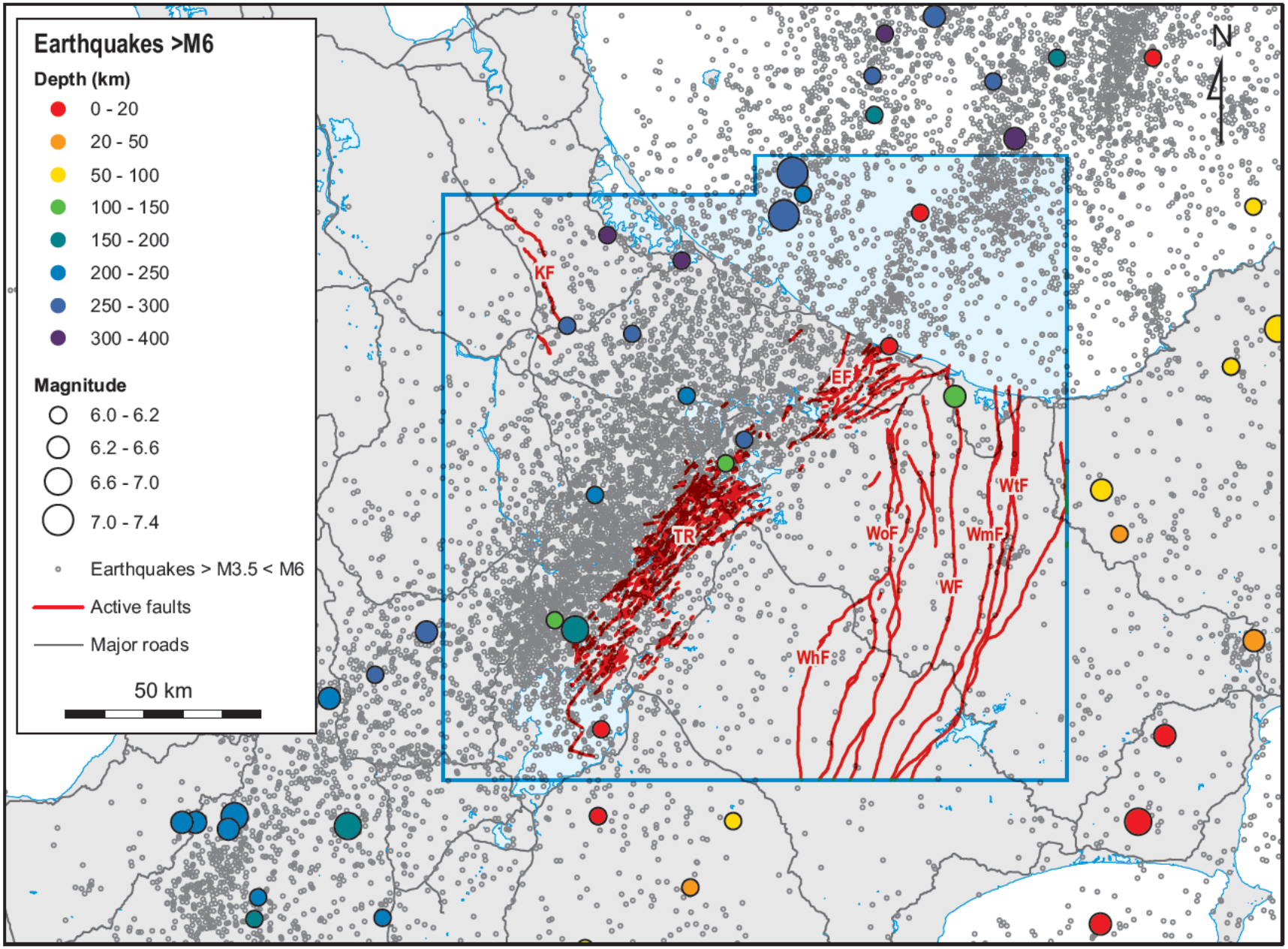
D. Townsend

Geothermal systems



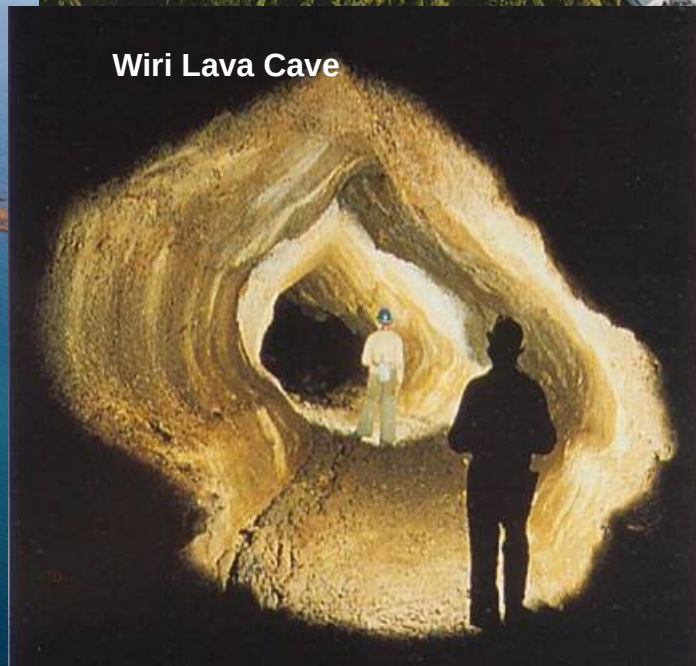
Taupo Rift

D. Townsend


Earthquakes >M6
Depth (km)
0 - 20
20 - 50
50 - 100
100 - 150
150 - 200
200 - 250
250 - 300
300 - 400
Magnitude
6.0 - 6.2
6.2 - 6.6
6.6 - 7.0
7.0 - 7.4
Earthquakes > M3.5 < M6
Active faults
Major roads
50 km
N
KF
EF
TR
WoF
WtF
WmF
WF
WhF

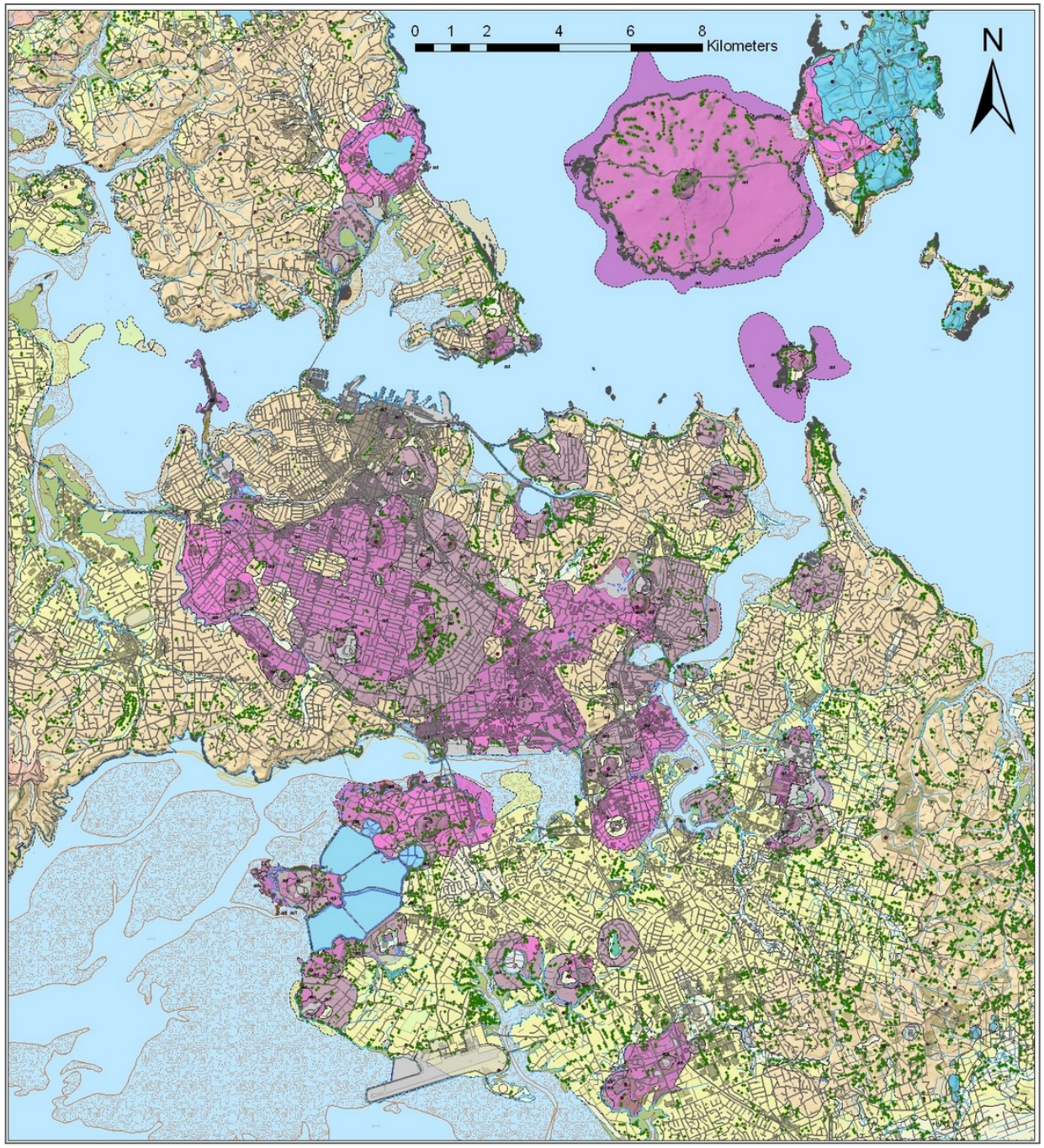
Auckland Volcanic Field

Motukorea (Brown's) Island

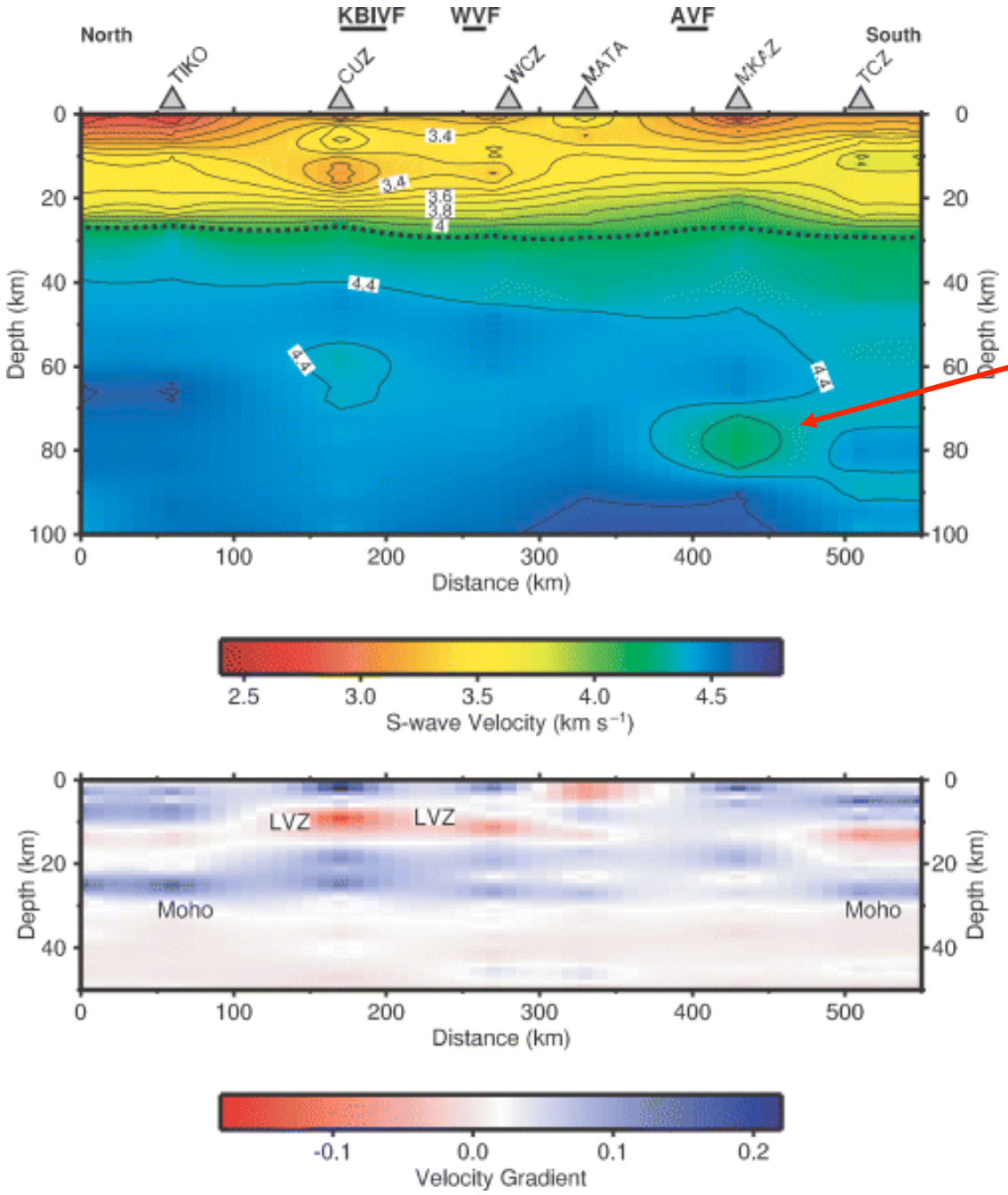


Wiri Lava Cave

Hochstetter (1859)



Kermode, 1992 and
LINZ cultural data



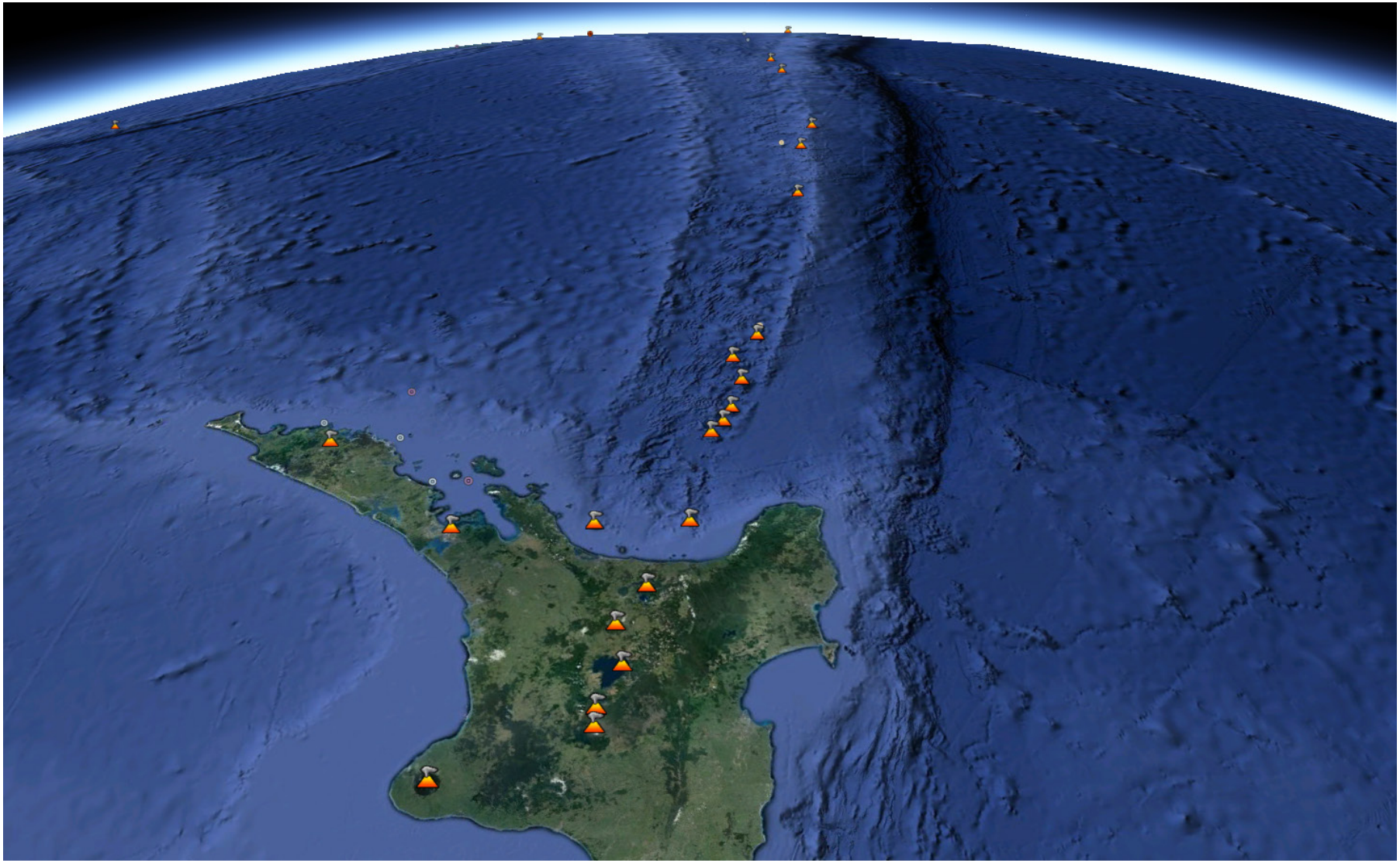
The magma is there….

Auckland volcanic field magma

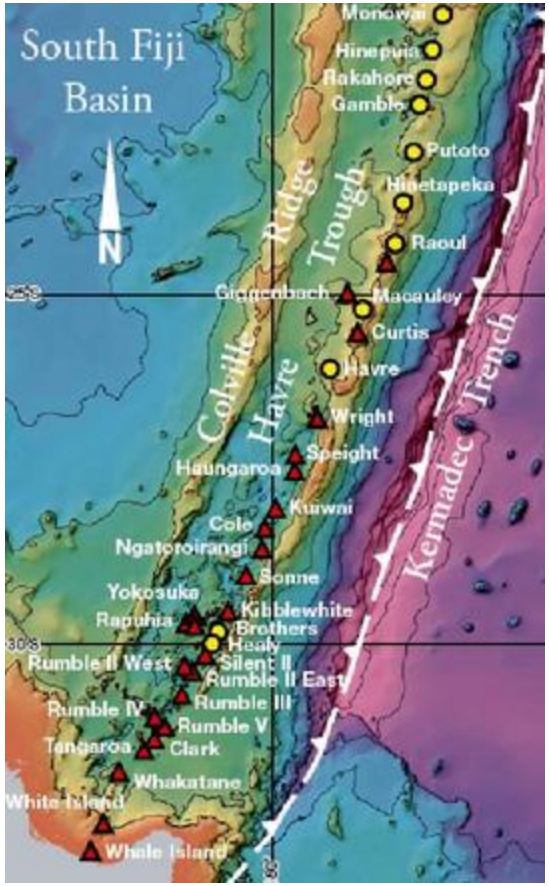
(from new seismic surveys; Nick Horspool et al., 2006).

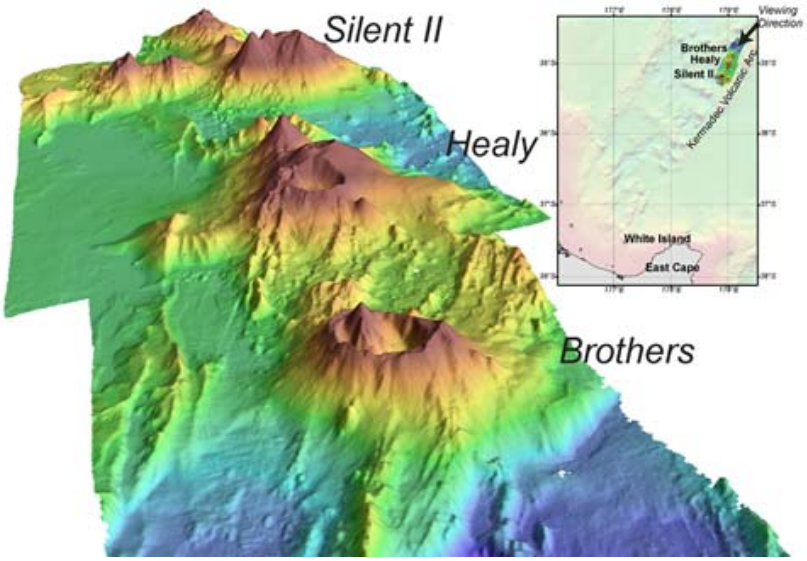
Figure from: Horspool et al., 2006, Geophys. J. Intl. 166, 1466-1483

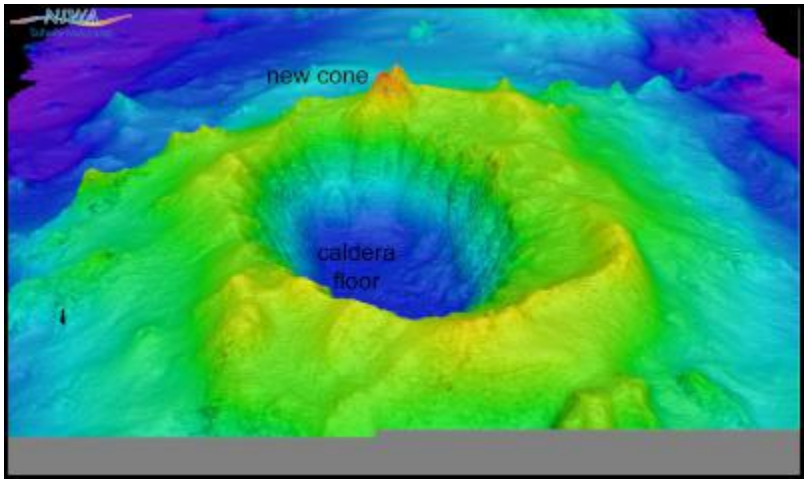
Tonga-Kermadec arc



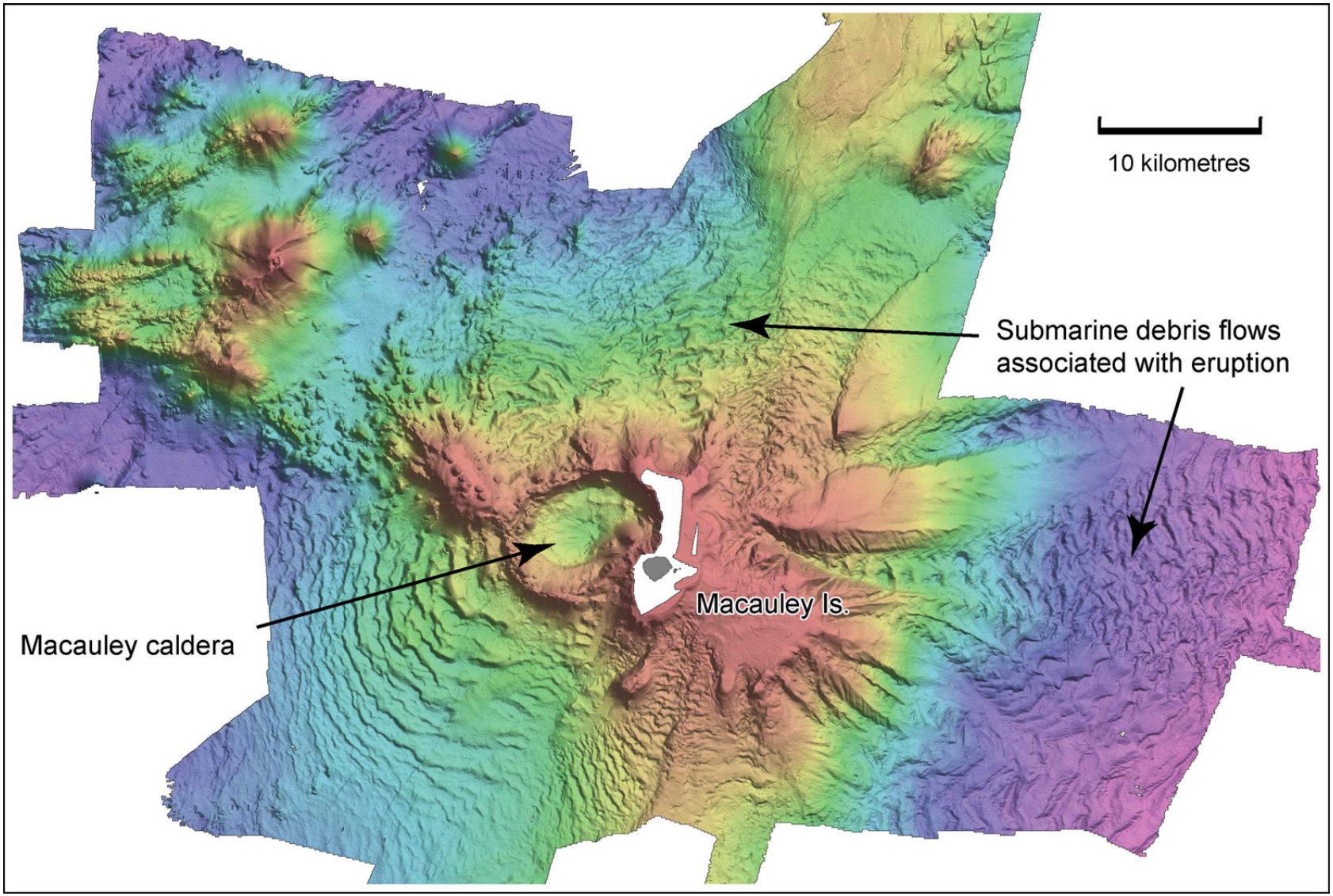
Kermadec arc
NIWA images







Macaulay Volcano (NIWA image)

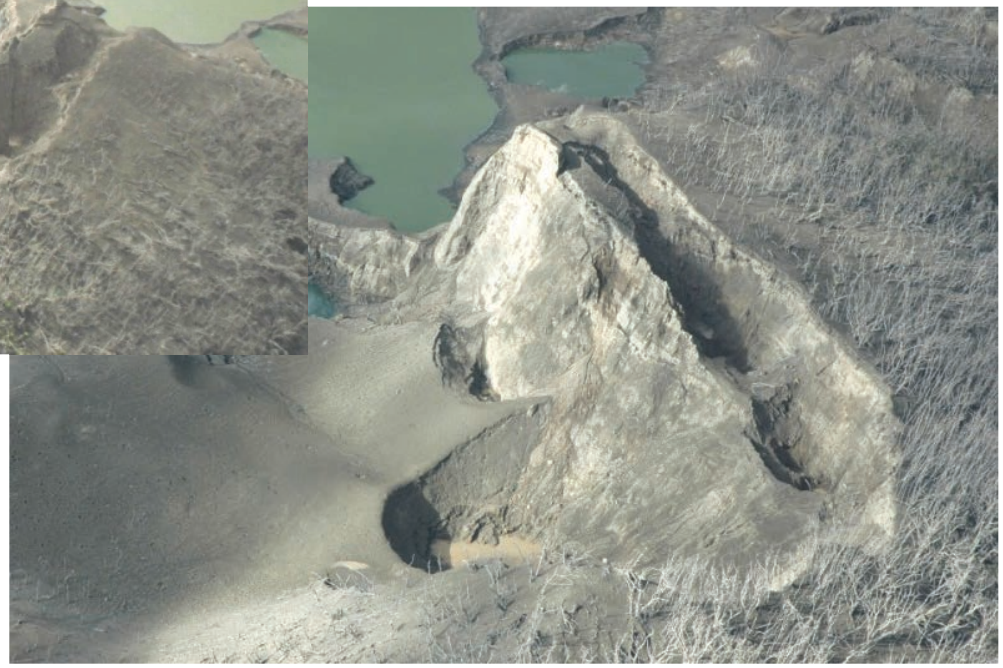


White Island and Raoul Island (andesite)

Courtesy of Vulcan Helicopters

White Island 2012 (11 days at Level 2)

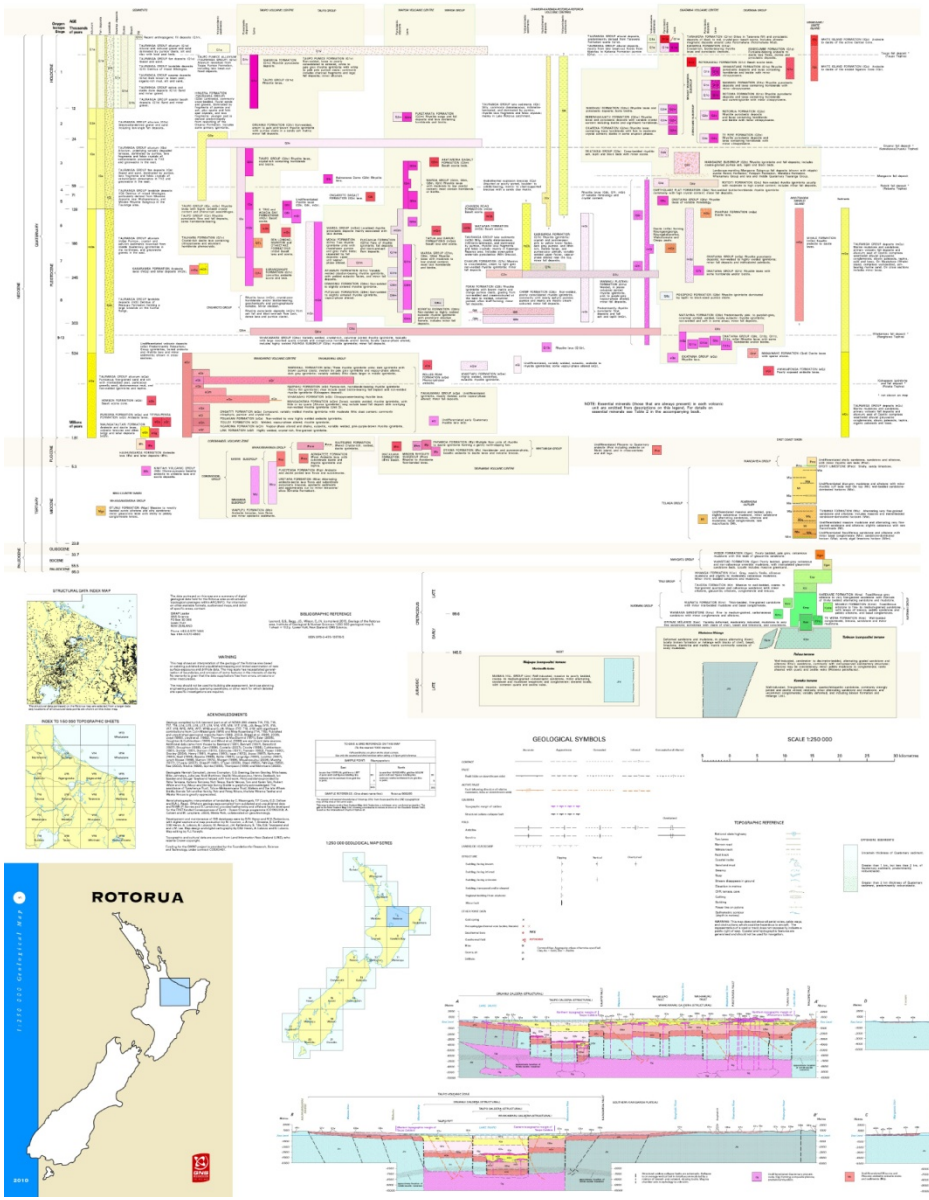
Raoul Island 2006

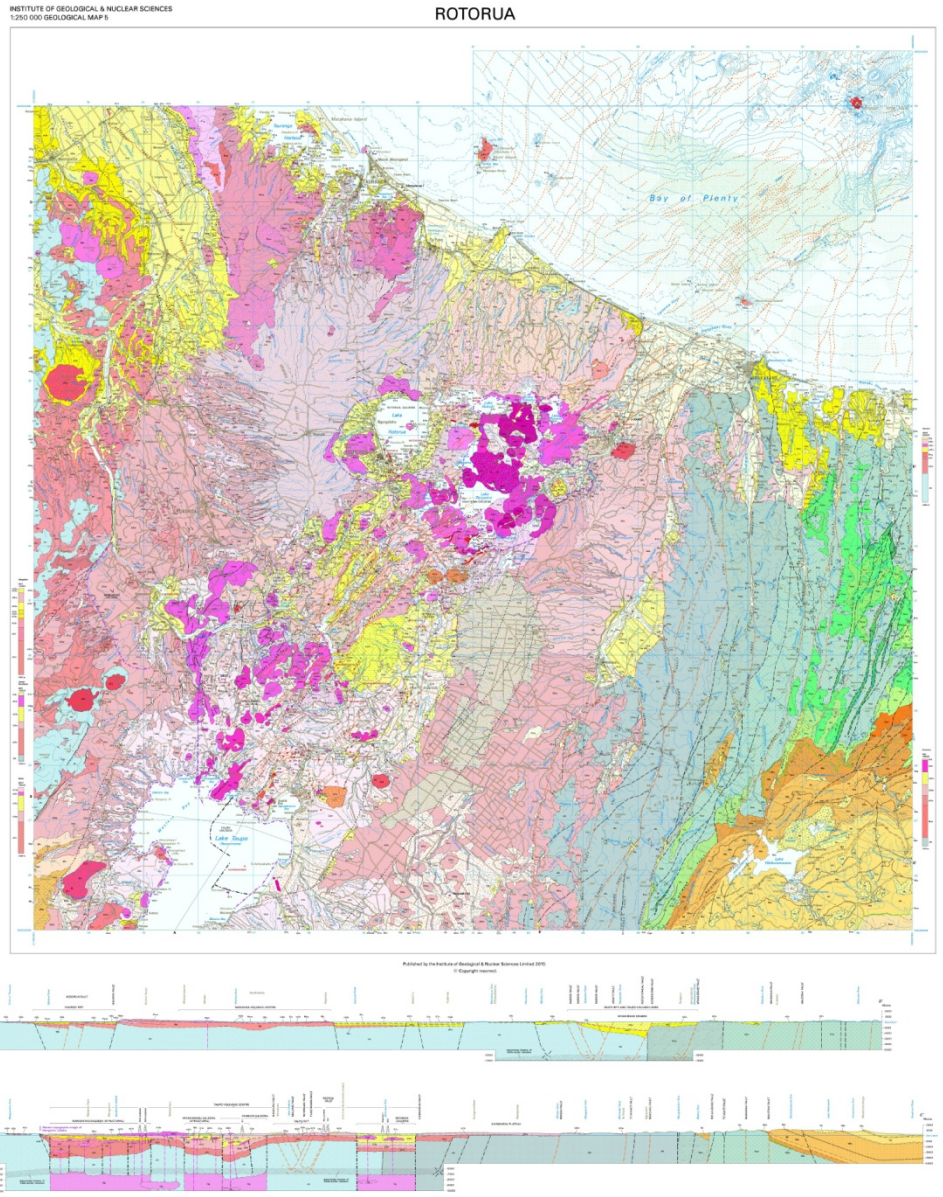


My research

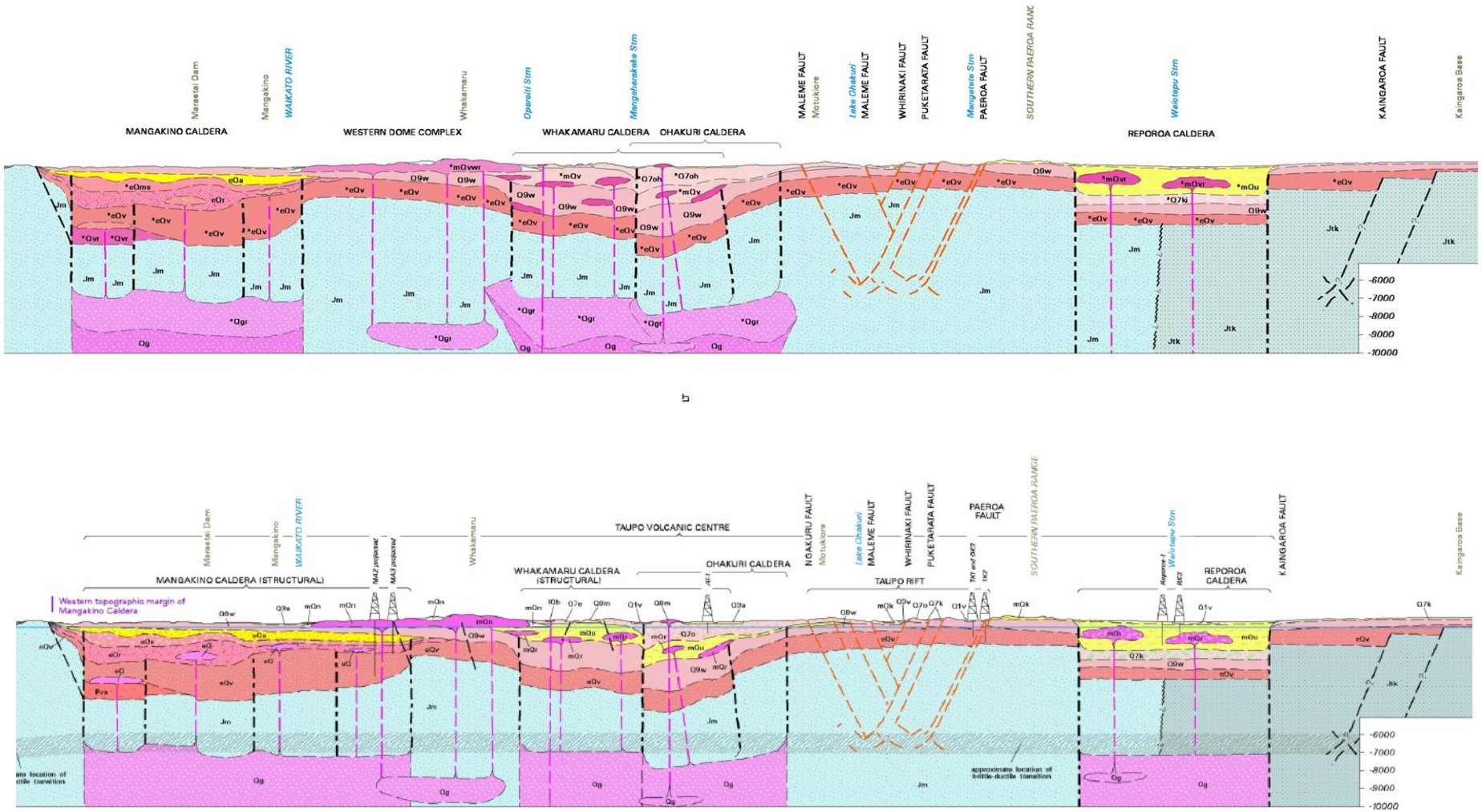
- Volcanic mapping
- Volcanic geology
- Geochronology
- Stratigraphy
- Hazard mapping and planning

QMAP Rotorua – rhyolite volcanoes (2010)



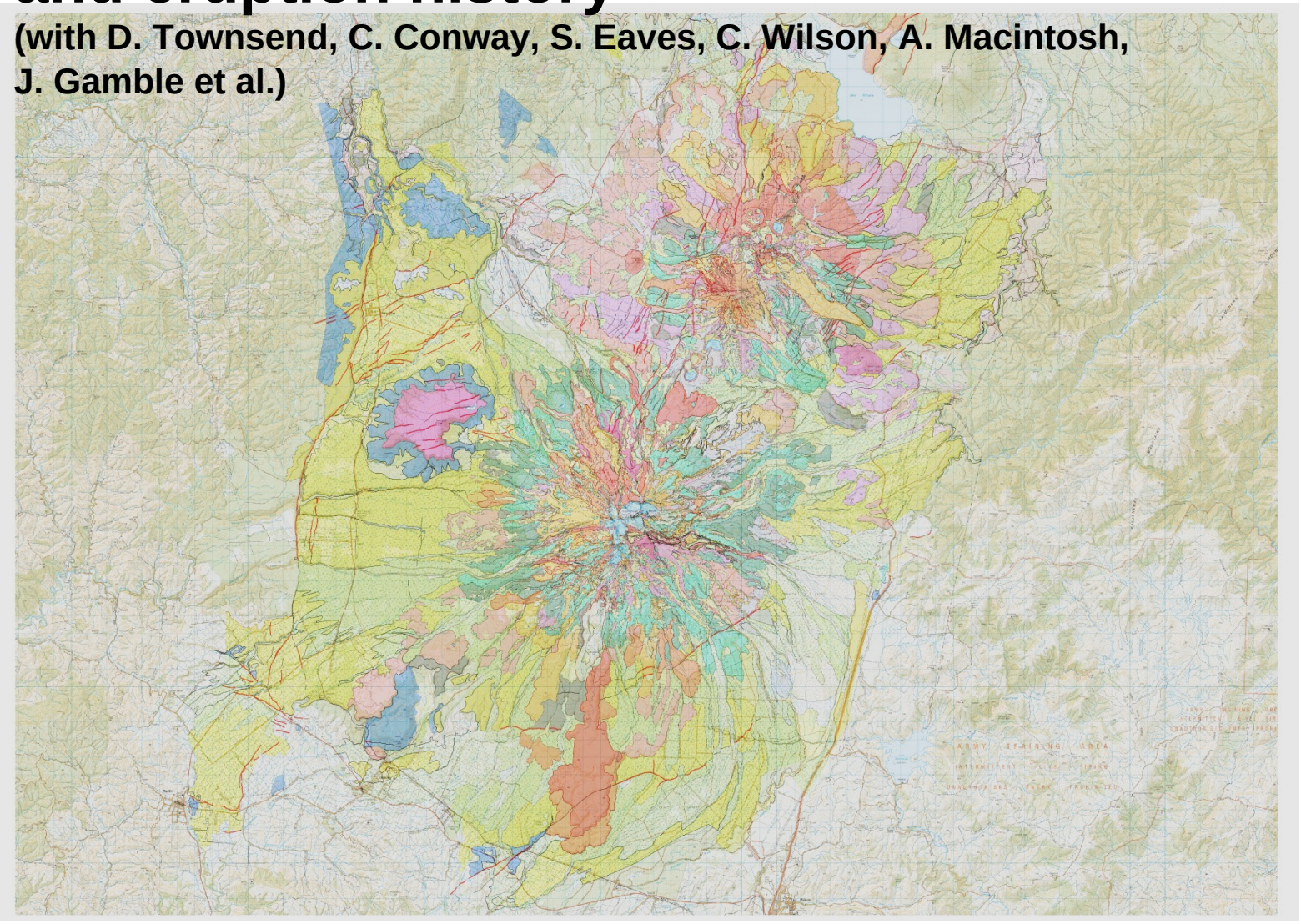


QMAP Rotorua (2010) shows TVZ calderas in cross section – but which model(s) are less wrong?



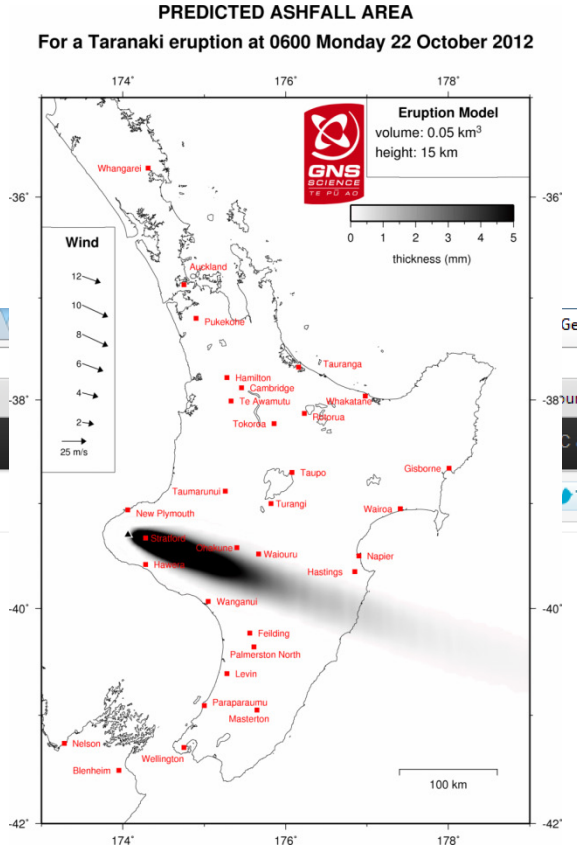
2010 onwards:
Tongariro National Park volcano mapping and eruption history

(with D. Townsend, C. Conway, S. Eaves, C. Wilson, A. Macintosh, J. Gamble et al.)



Glacio-volcanism at Tongariro National Park

www.geonet.org.nz



www.geonet.org.nz/volcano/info/tongariro

DOI Remote Access | Phone List Search | GNS Online | NetStorage | Google News | Rags | external-phone | Other bookmarks

GeoNet | Latest News | Connect | Maps | Quakes | Volcano | Tsunami | More

Tongariro

Volcano Alerts

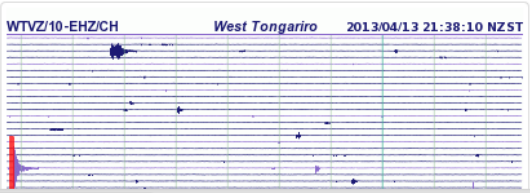
The current status of Tongariro.

Volcanic Alert Level: 1

Aviation Colour Code: GREEN

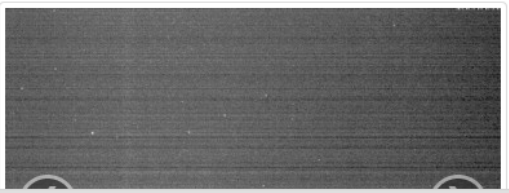
Volcano Drums

Showing seismic activity over the last 24 hours.



Volcano Cameras

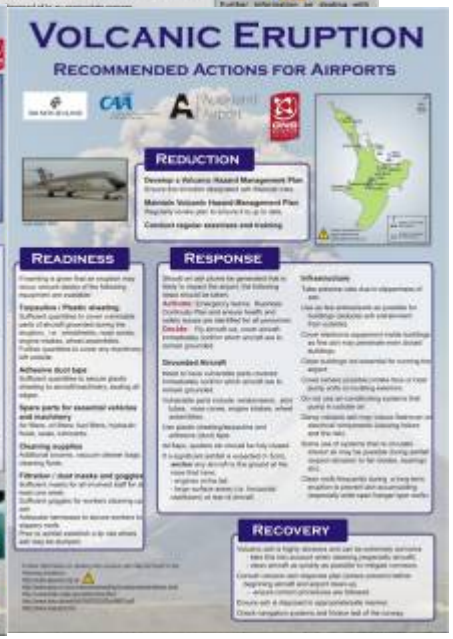
Showing the most recent images from our cameras.

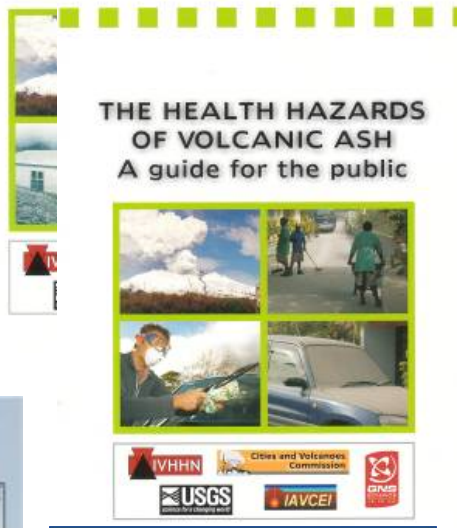


kermadec-volcanoes....jpg

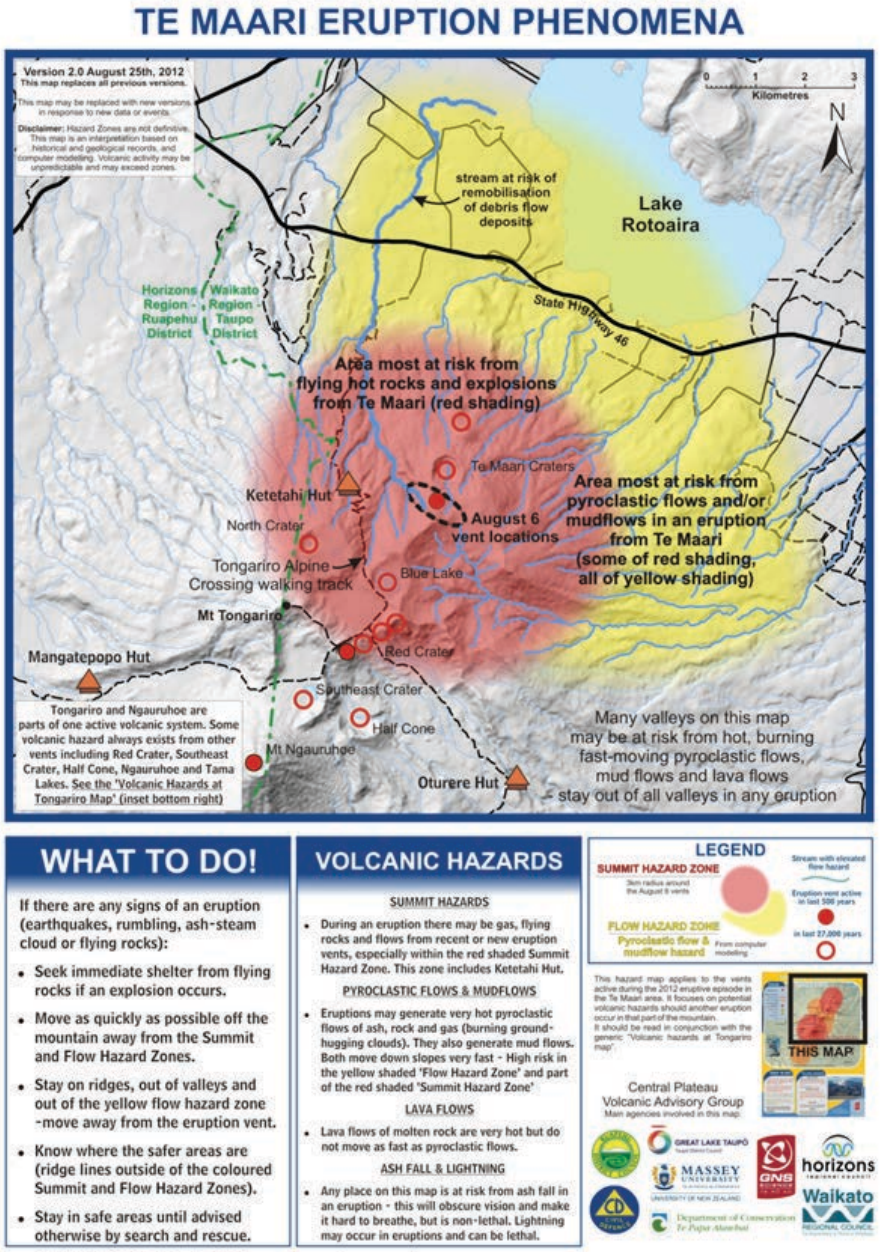
Show all downloads...

Infrastructure Ash Management Posters
Volcano Hazard Posters





Crisis hazard maps



Volcanic hazard management:
Areas of comparative study and cooperative planning

(with overseas agencies and NZ communities and organisation)

- **Warnings** (timing, message, method, uncertainty)
- Effectiveness of warnings (response)
- **Ash testing:** physical and chemical
- **Airports**
- Stormwater & Sewage
- **Water** Supply
- Ash **cleanup** and disposal
- **Agriculture** (livestock, dairy, horticulture)
- **Electricity** generation and transmission
- **Communications** (emergency and public)
- **Health** and safety in an ash environment
- **Emergency** response and recovery **planning**
- Research into health impacts to water supply