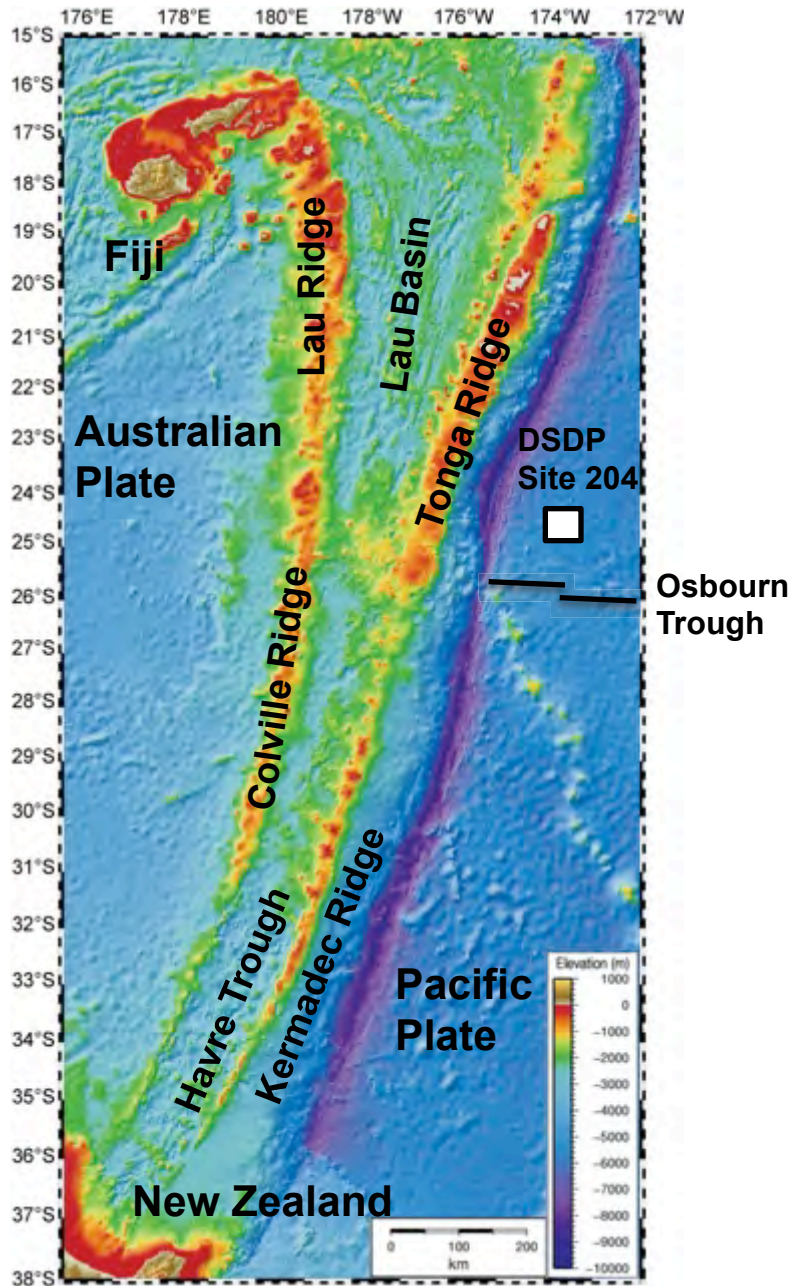


# THE KERMADEC ARC

OUR UNDERSTANDING ABOUT THE  
PRESENT AND PAST

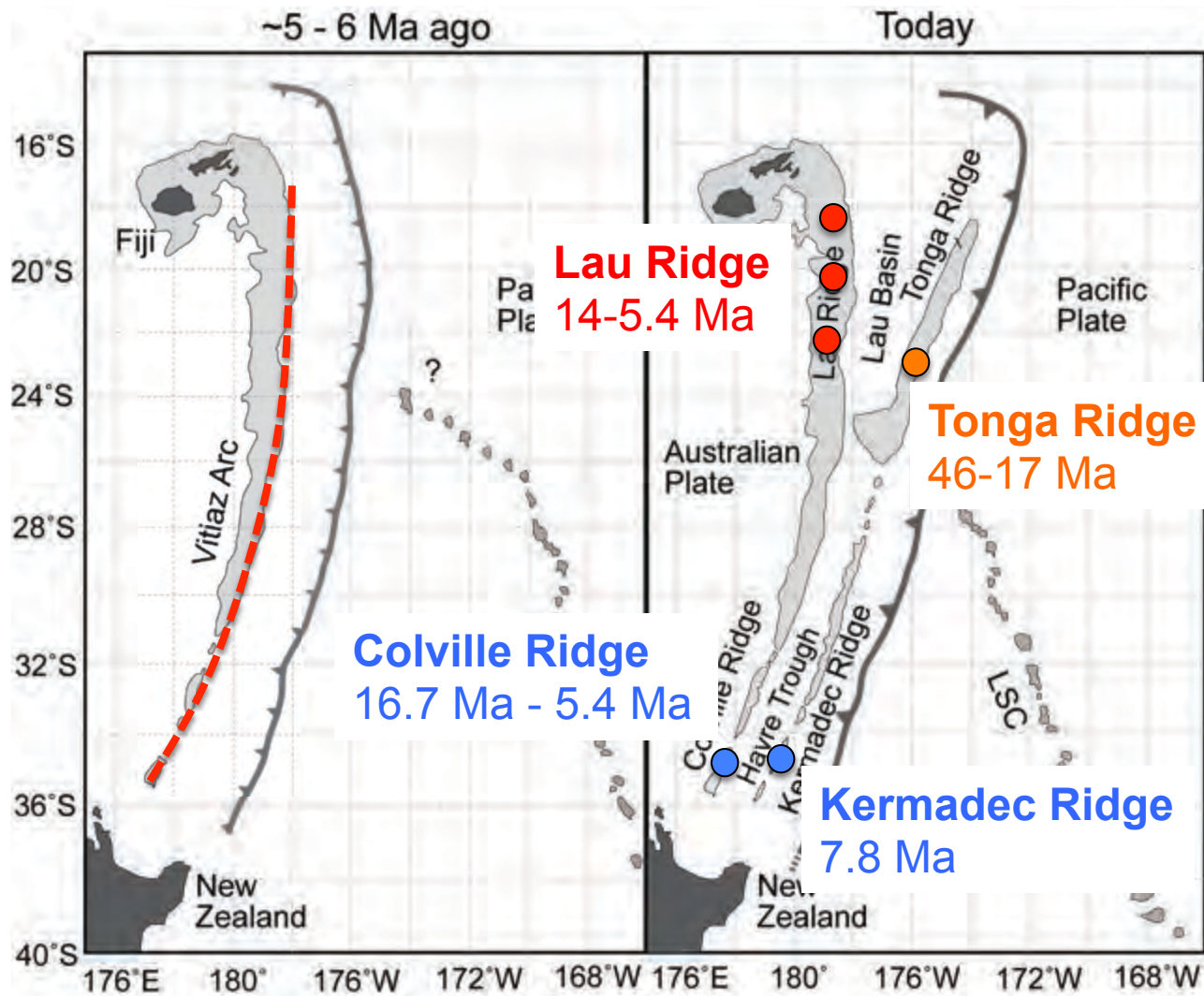


# Geographical Overview – Tonga Kermadec arc



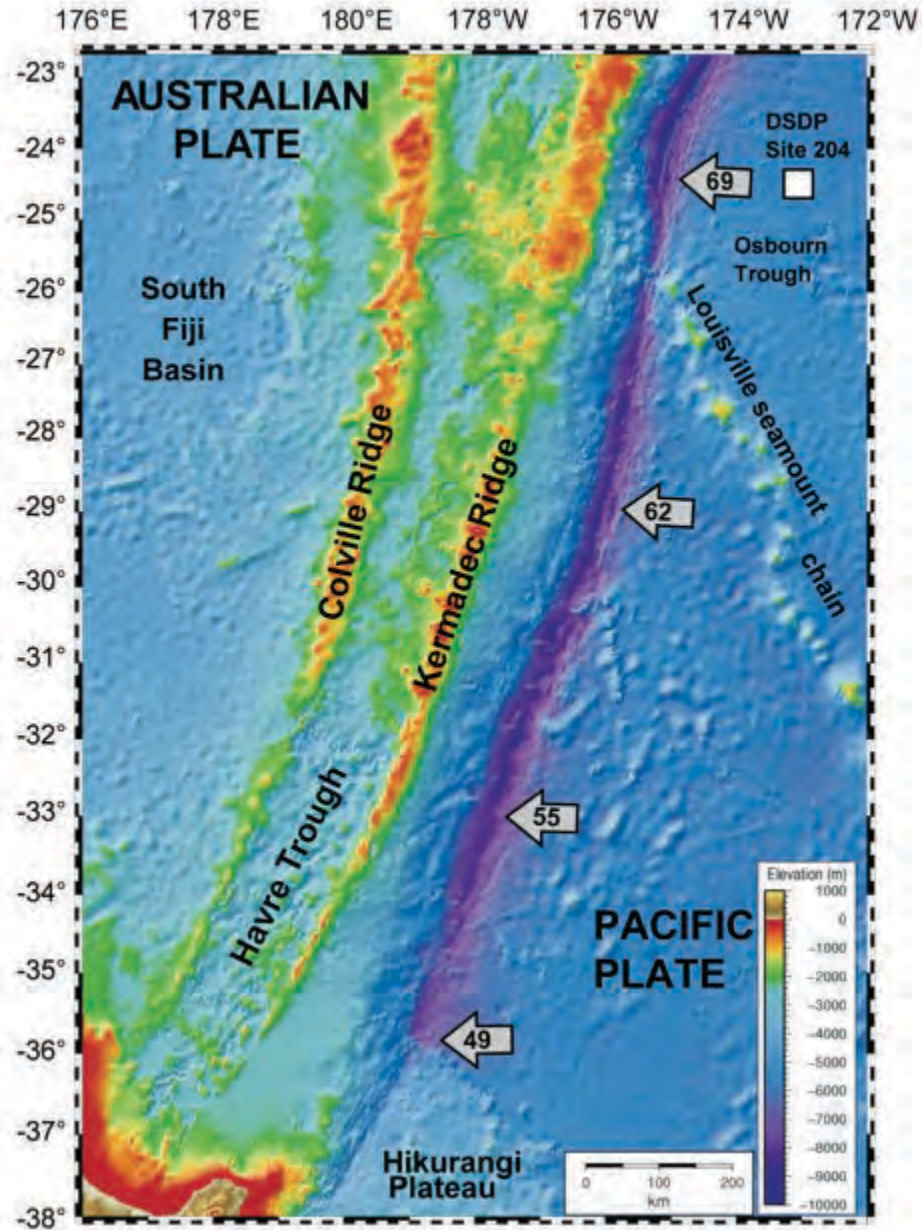
- Intra-oceanic, mostly submarine arc
- Extends ~ 2,500km N of New Zealand
- Subduction of Cretaceous Pacific Plate beneath the Australian Plate
- Segmented by the subducting Louisville seamount chain into
  - Tonga arc system (N) and
  - Kermadec arc system (S)

# Colville-Kermadec Ridges – Evolution of the Kermadec Arc

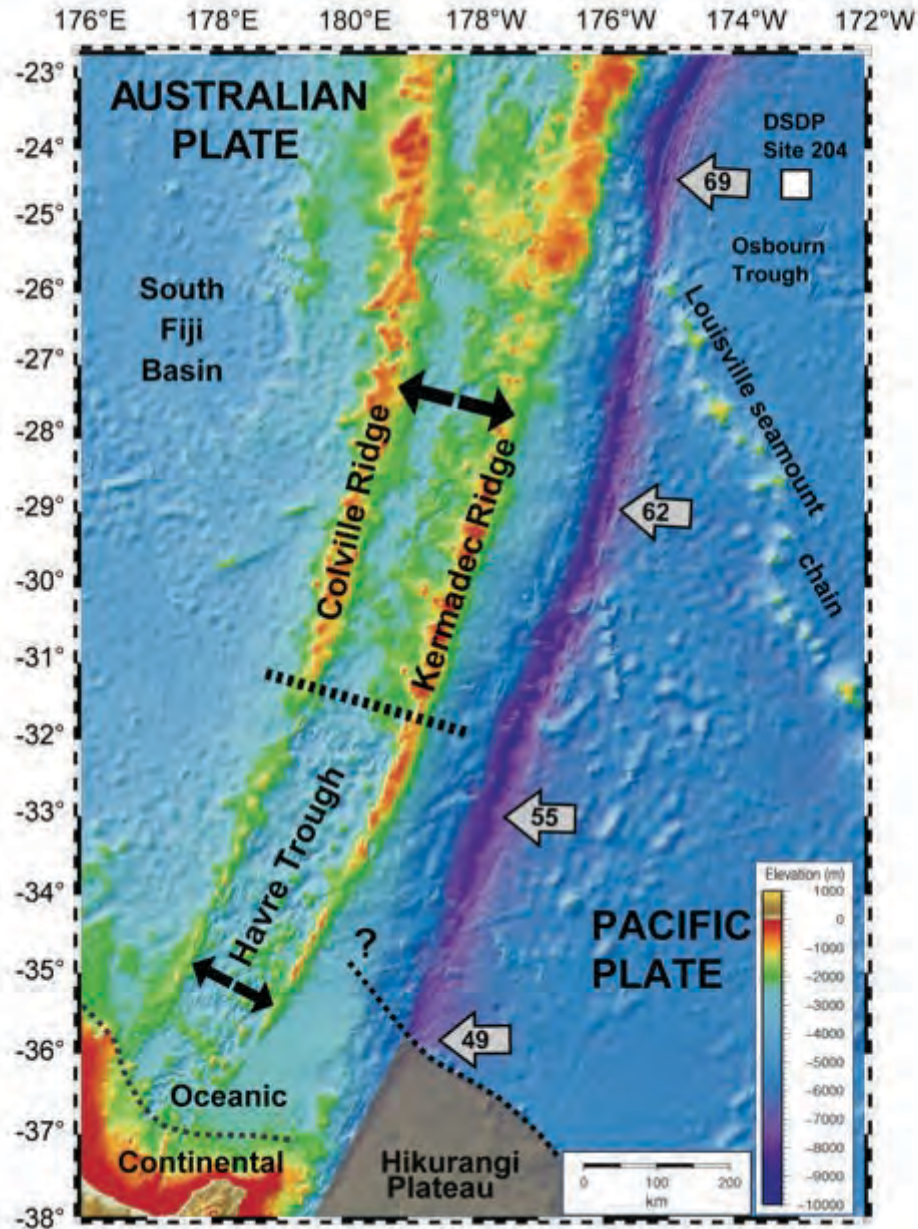


Modified after Ruellan et al. (2003)

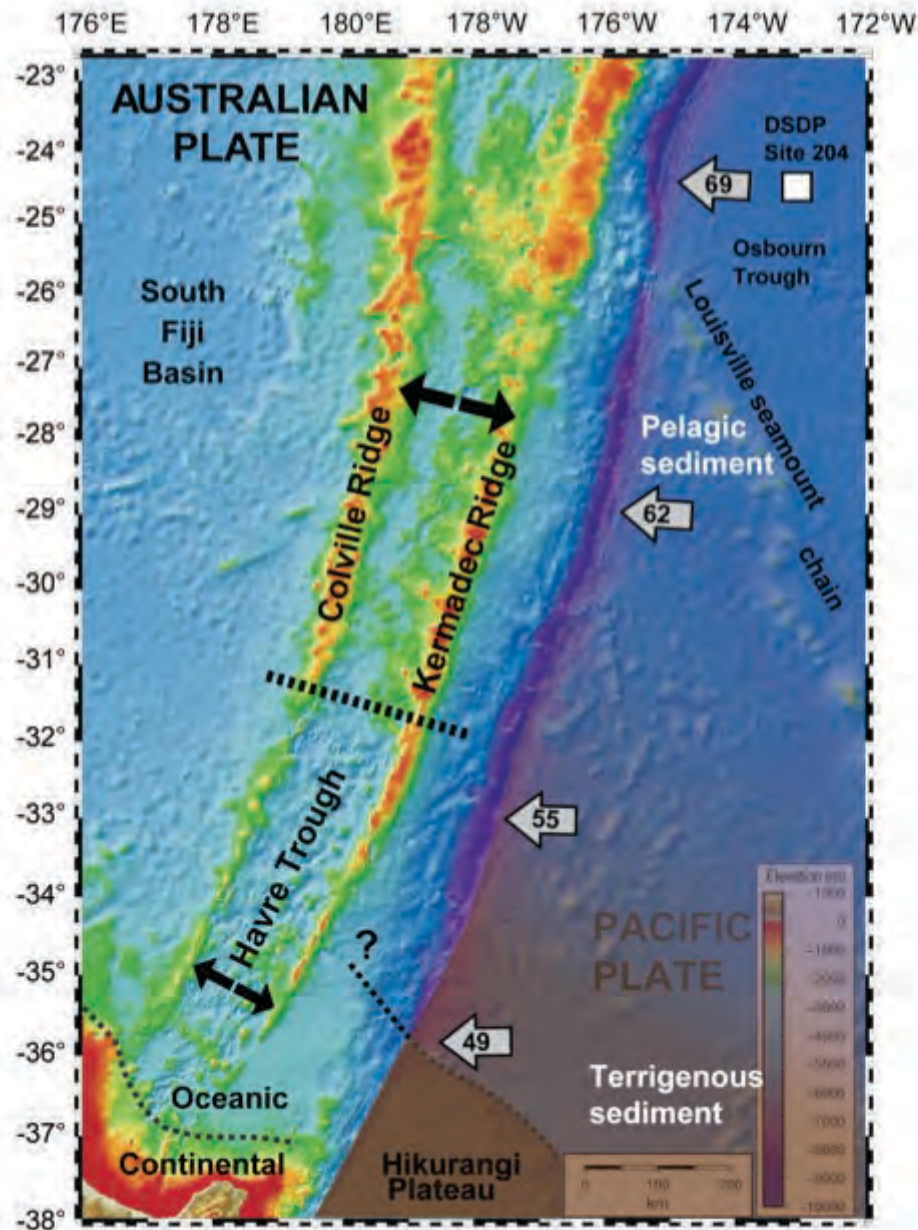
# The Kermadec Arc - Overview



# The Kermadec Arc - Features



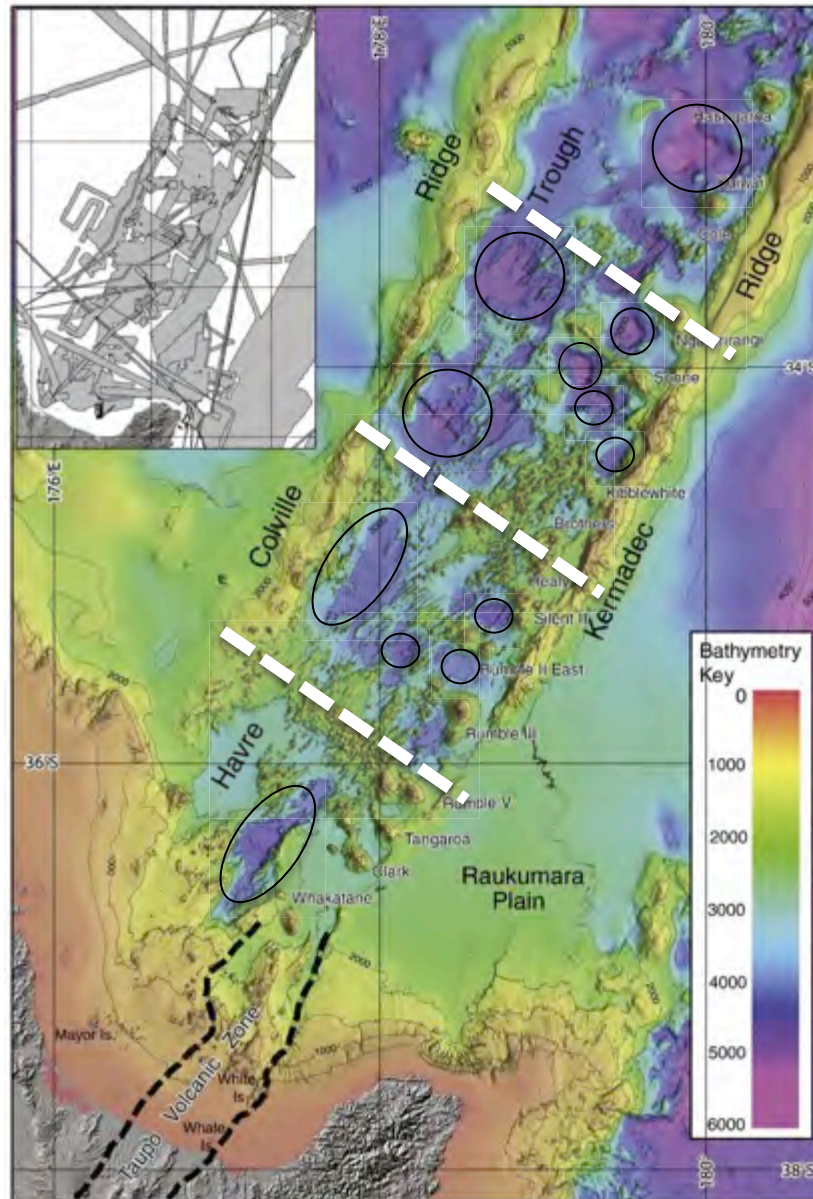
# The Kermadec Arc – Features



## Main features

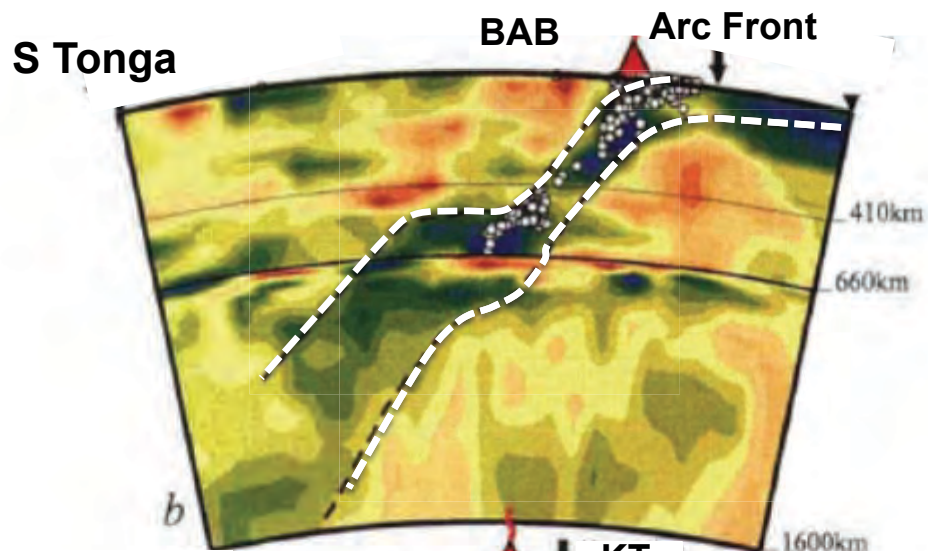
- Continental-oceanic transition between WI and Whakatane
- Change in morphology at ~31-32°S
- Subducting Hikurangi Plateau and Louisville seamounts and
- Increase in sediment coverage and change in sediment composition from north to south
- Increased fluid flux and tectonic erosion due to subducting Hikurangi Plateau?

# Havre Trough – Rifting vs. spreading

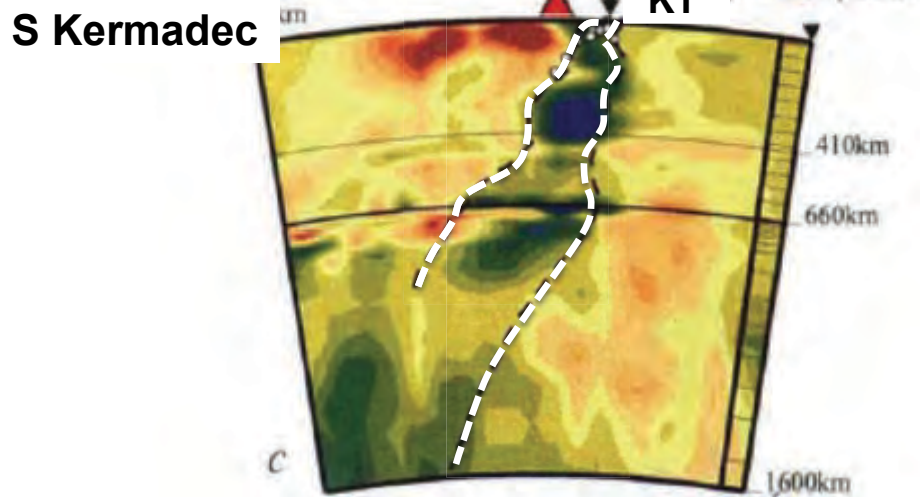


Map from Wysoczanski et al. (2010)

# The Kermadec Arc – Subduction angle



- Slab dip  $\sim 30^\circ$  until 100km and the steepens to  $\sim 45^\circ$



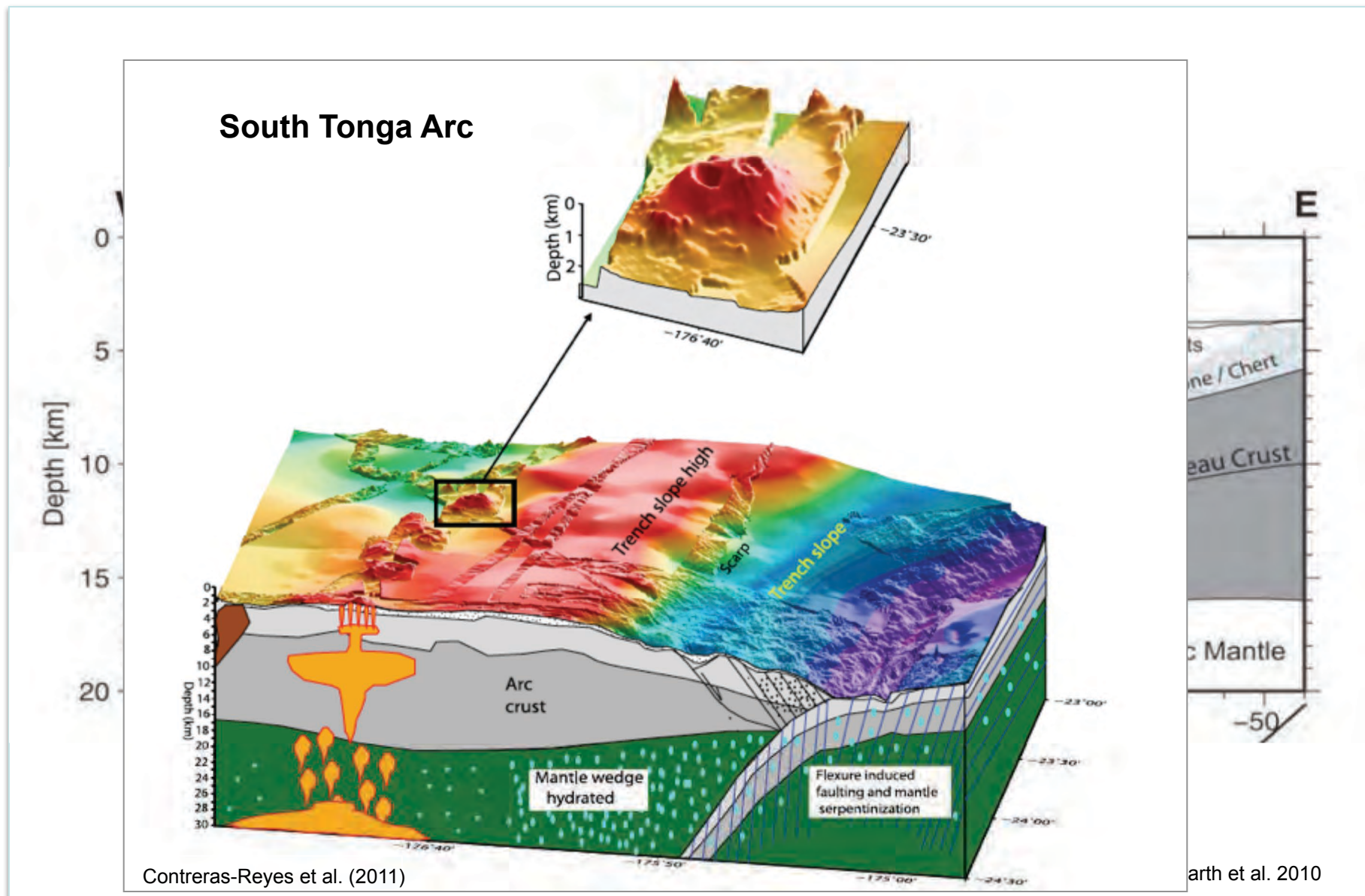
- Slab dip  $\sim 30^\circ$  until 100km and the steepens to up to  $60^\circ$



Model after Van der Hilst, 1995



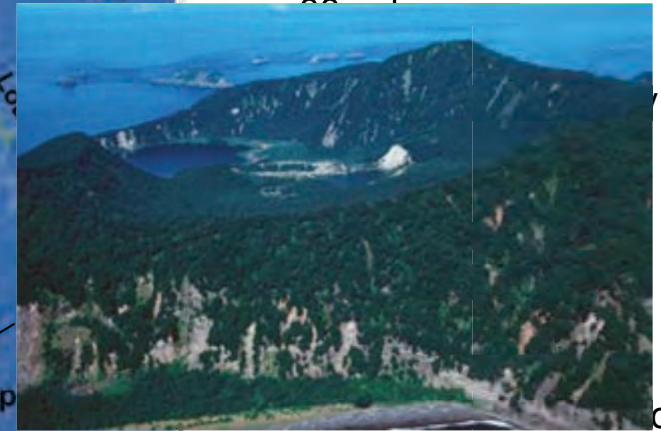
# The Kermadec Arc – Crust



# Kermadec Arc Volcanoes

176°E 178°E 180°E 178°W 176°W 174°W 172°W

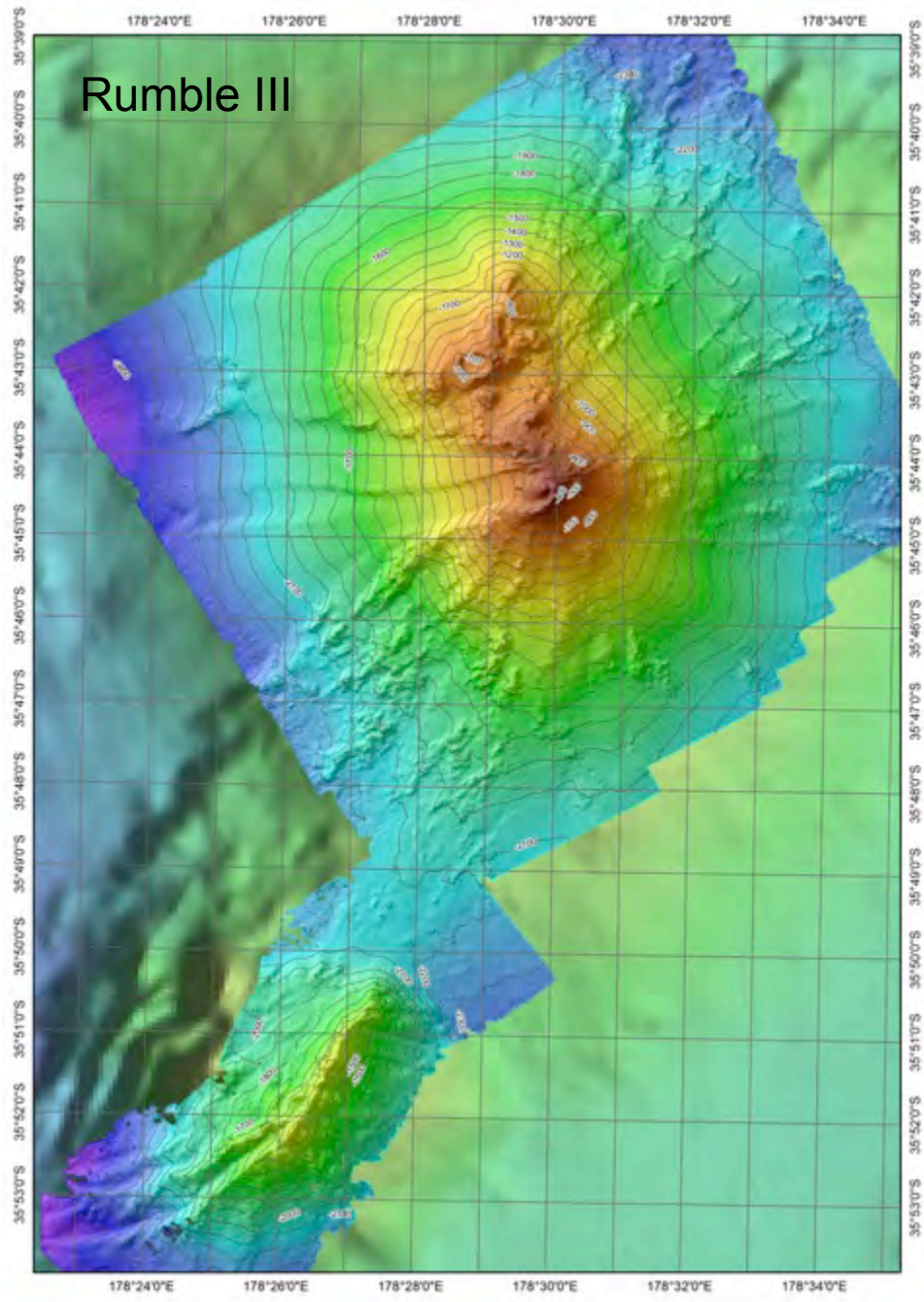
**Volcanically Active**



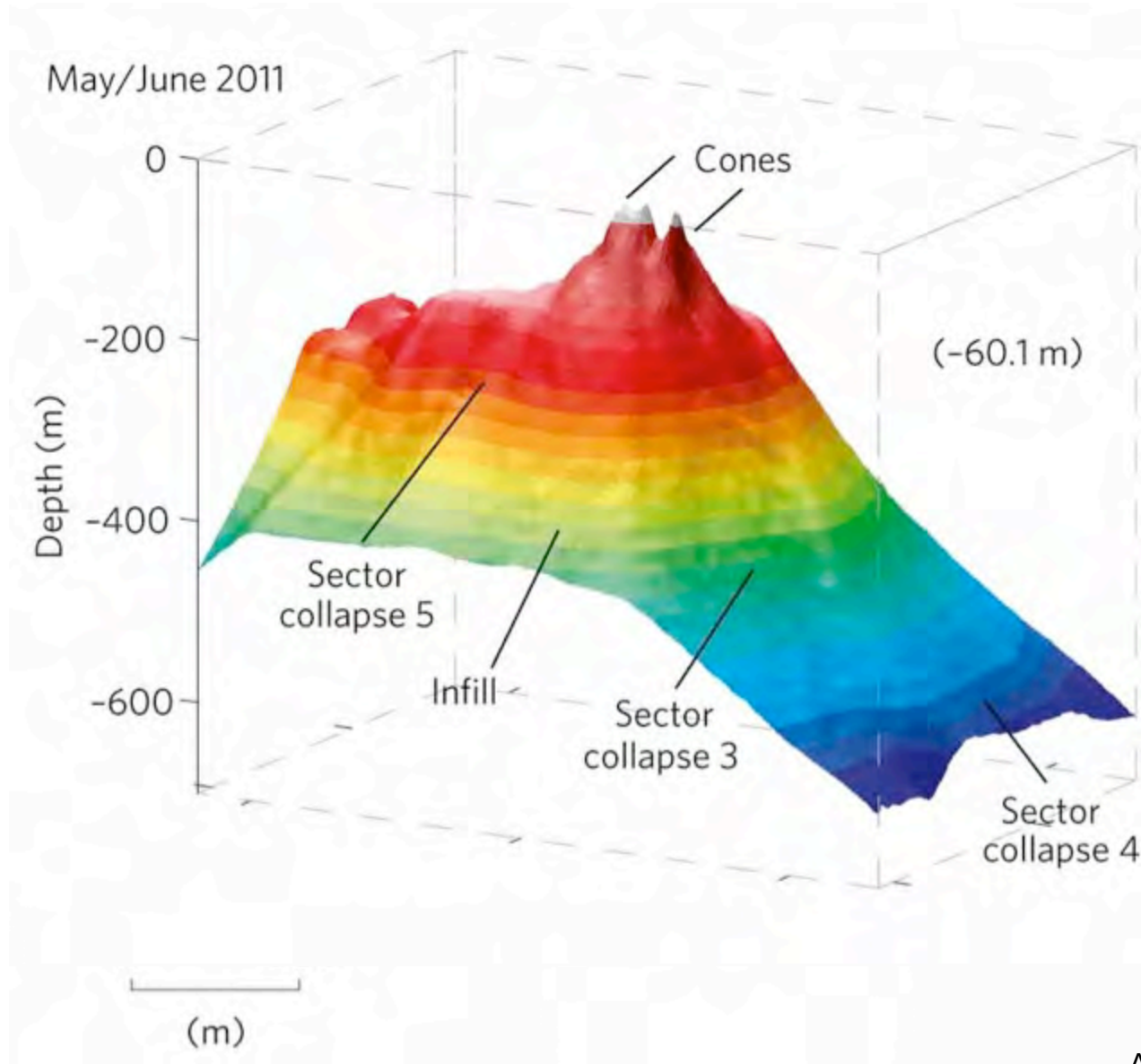
om  
uth

# Active Volcanoe

## Rumble III

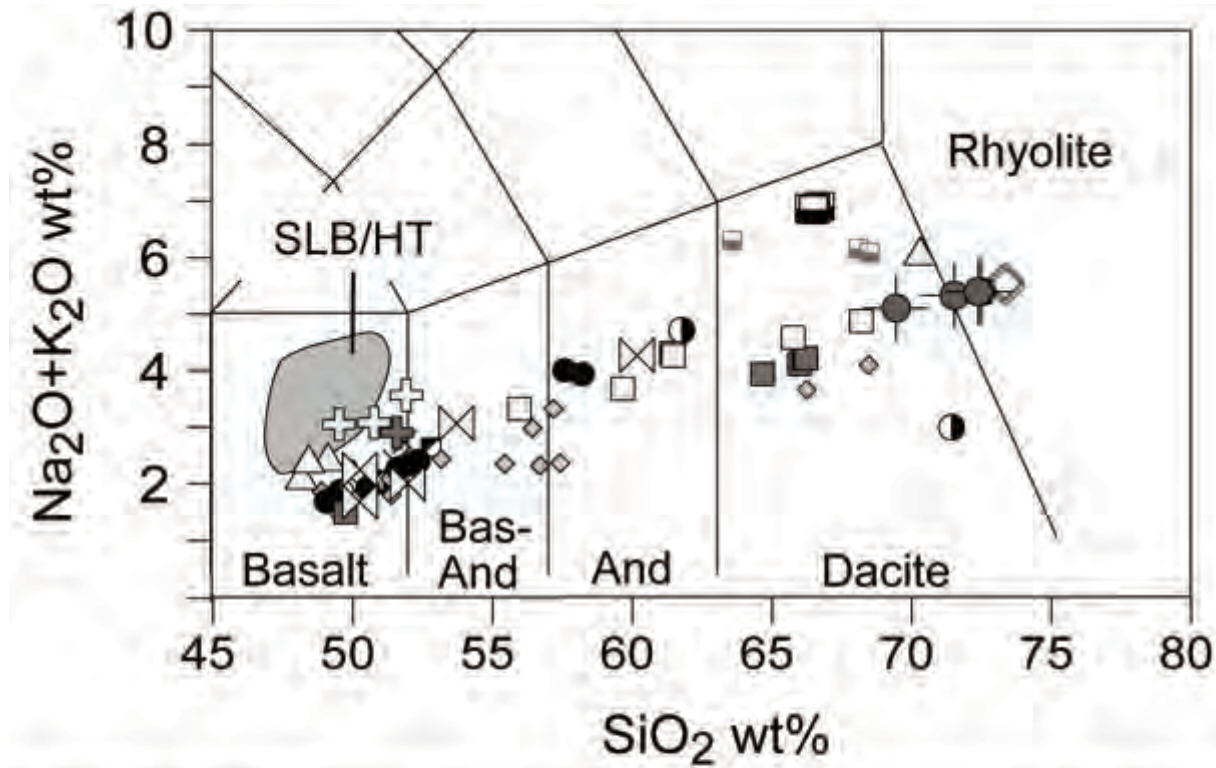


# Volcanically active - Monowai



After Watts et al. (2012)

# Kermadec Arc Lavas – Major elements

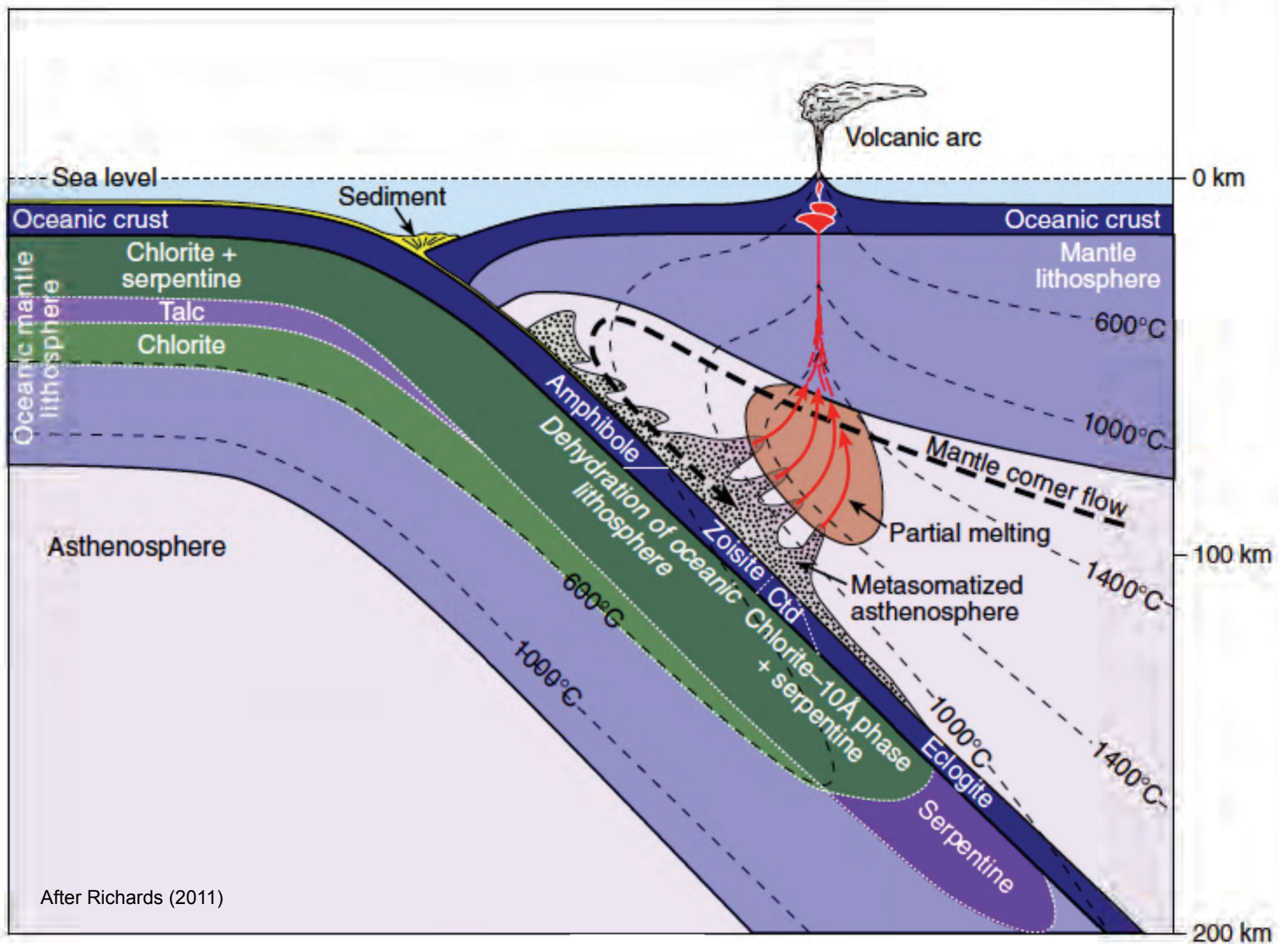


Fractional crystallization vs. crustal anatexis

● Monowai	⊙ Rakahore	□ Hinetapeka	● Volcanolog*	■ Brothers	⊕ Rumble IV*
○ Monowai*	◇ Gamble	◇ Raoul Island*	× L'Esperance*	▣ Brothers*	■ Clark*
■ Hinepuia	⊗ Putoto	△ Macauley*	⊕ Sonne Smt*	⊕ Rumble III*	

Data sources: Turner et al. (1997), Haase et al. (2002, 2006), Ewart et al. (1998), Graham et al. (2008), Smith et al. (2009), and Todd et al. (2011).

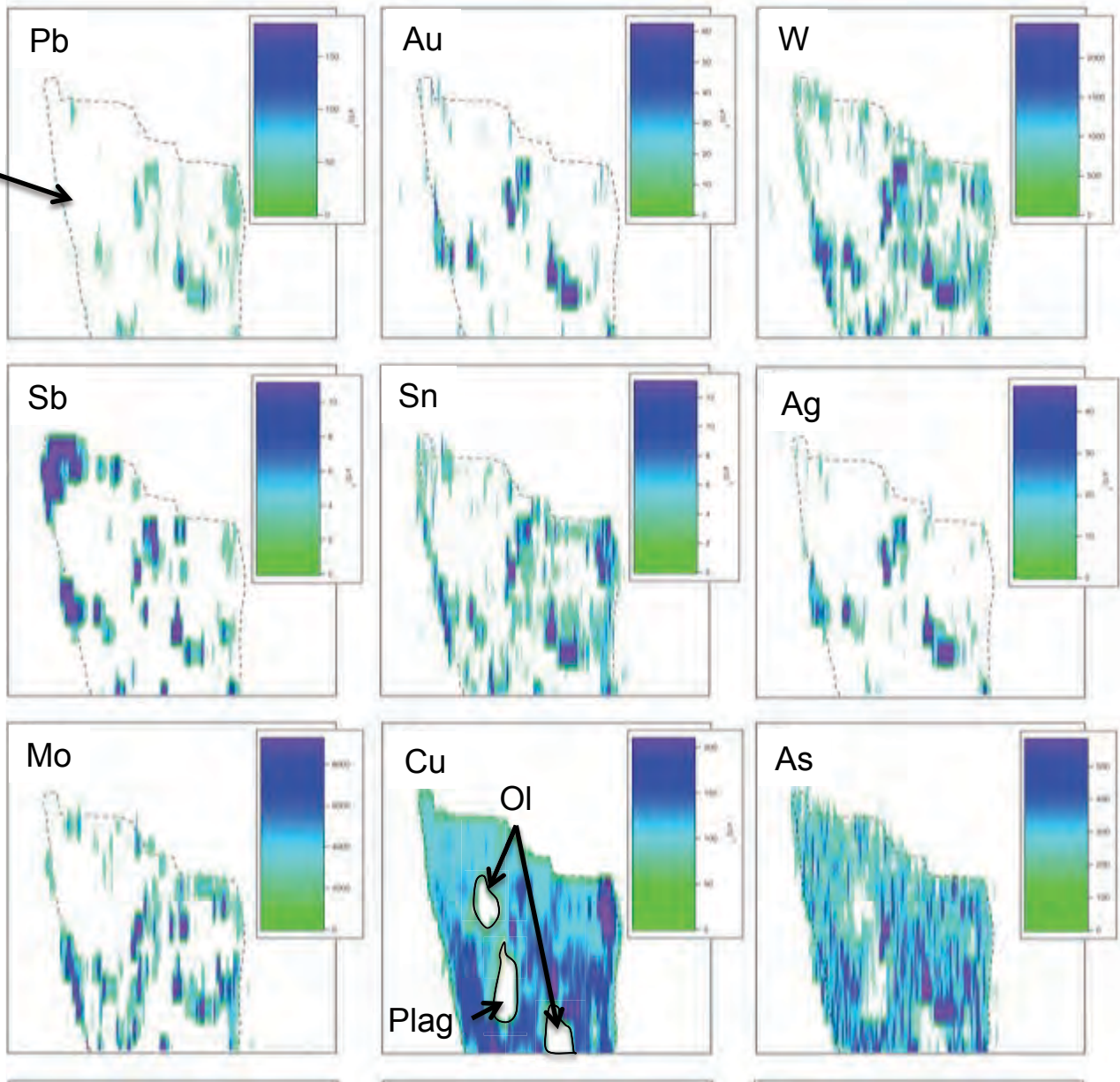
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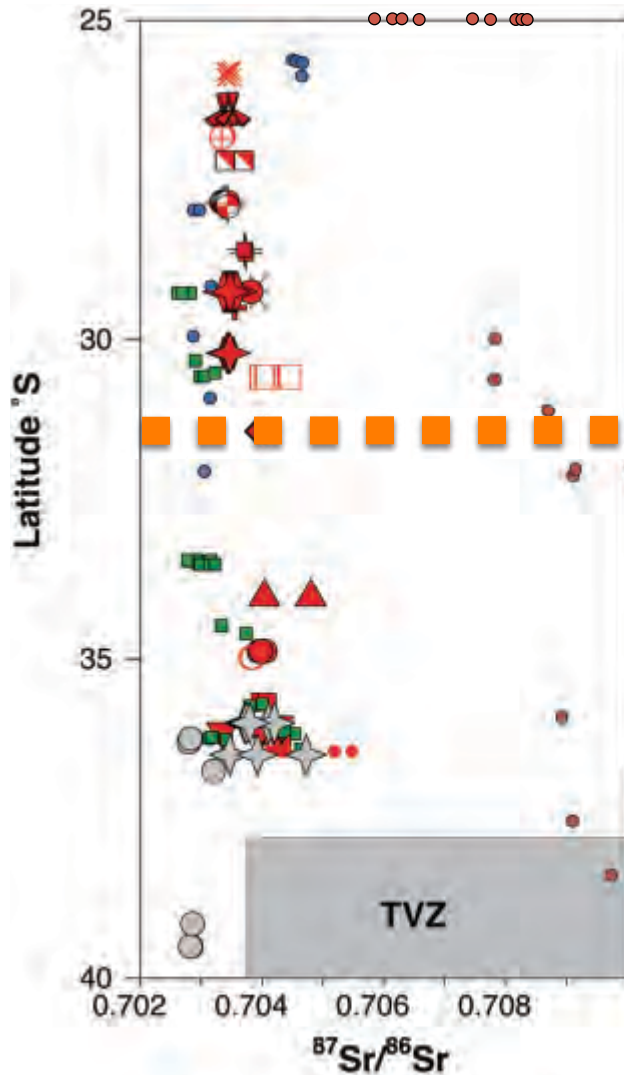
Timm et al. (2012) and references therein

# Kermadec arc lavas – heterogeneous glass

Glass chart



# Kermadec arc lavas – isotopes

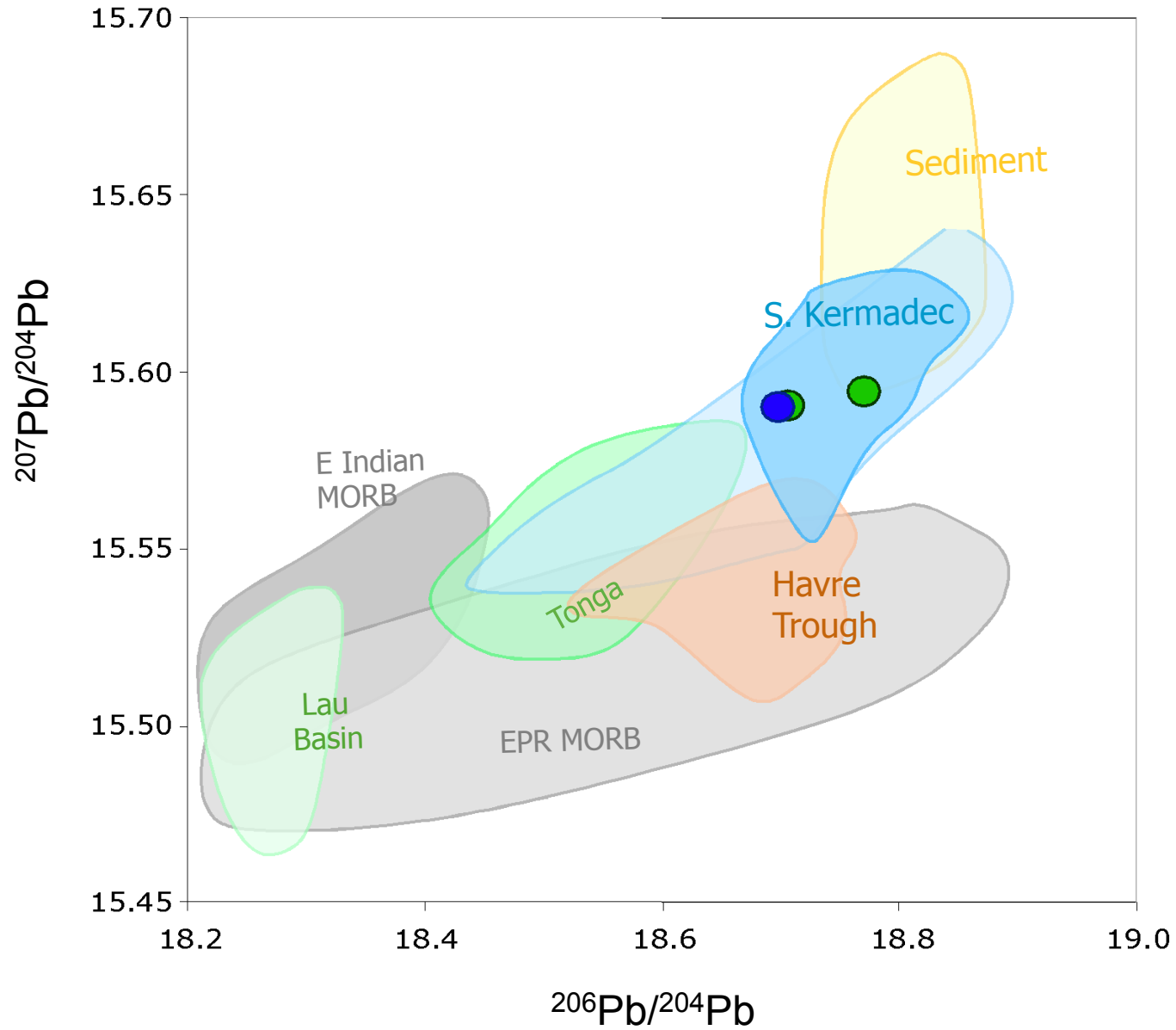


- Red Symbols = Kermadec arc front volcanoes
 ● Altered Pacific Crust
★ Hikurangi Plateau Basement
- Green Symbols = Havre Trough
 ● Subducting Sediments
● Hikurangi Plateau Seamounts

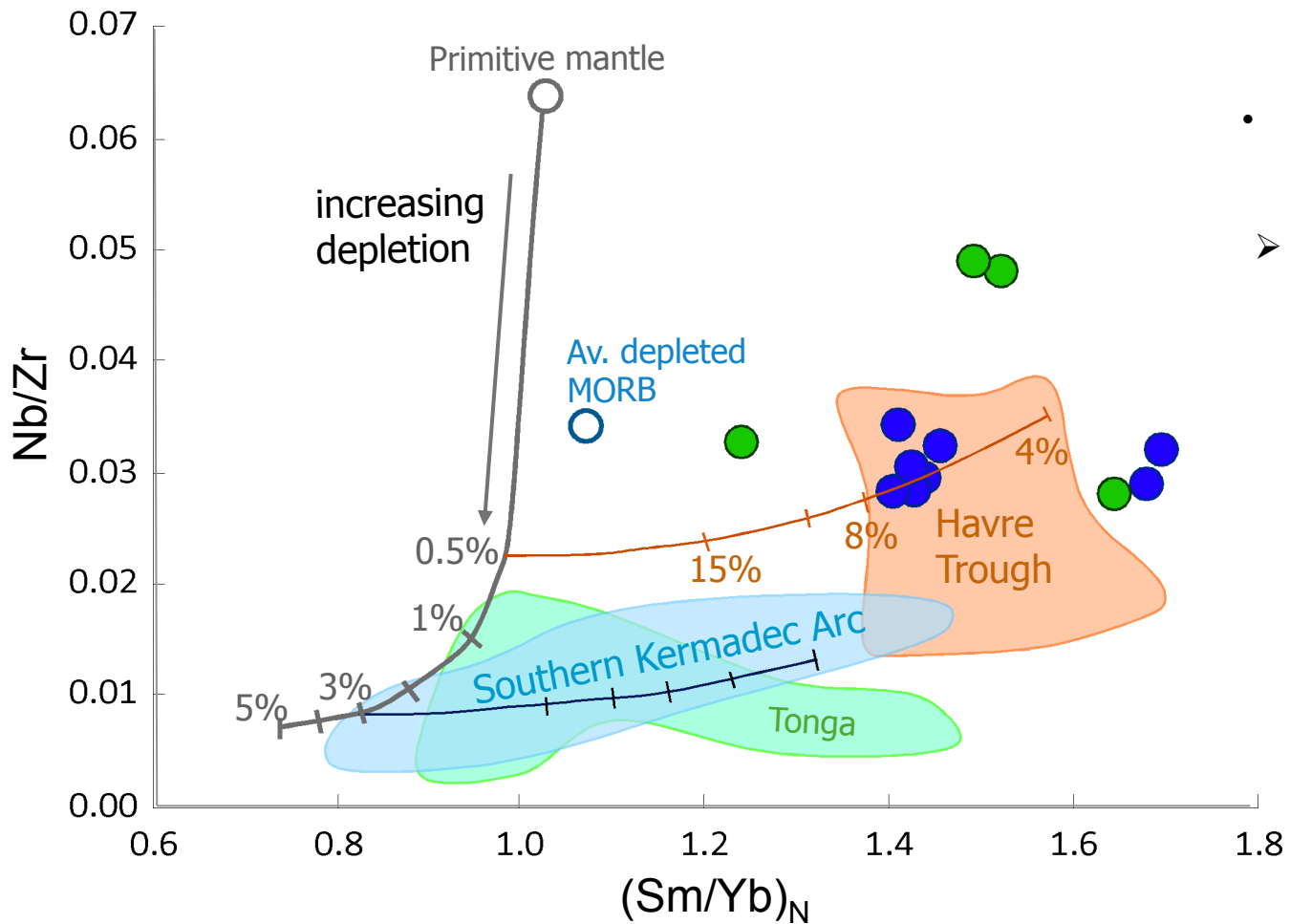
Data sources: Barker et al 2012; Turner et al. (1997), Haase et al. (2002, 2006), Ewart et al. (1998), Graham et al. (2008), Smith et al. (2009), and Todd et al. (2011), Timm et al. 2011; 2013; Hoernle et al. 2010; Castillo et al., 2009; Worthington et al., 2006, Gamble et al., 1996; Timm, unpublished data, etc.



# Colville-Kermadec Ridge Lavas – Pb isotopes

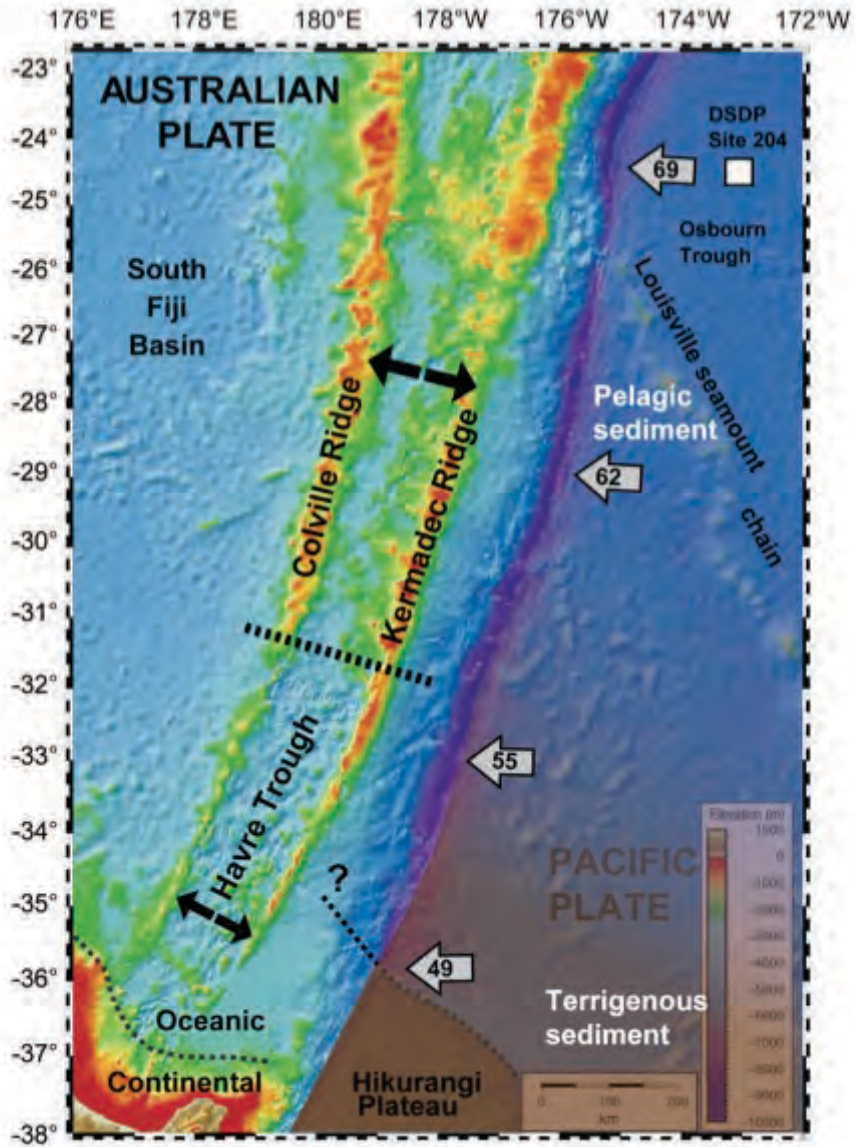


# Colville-Kermadec Ridge Lavas – Trace element ratios



- Less depleted mantle in the past
- (no melt previous melt Extraction as no BAB)

# Kermadec Arc – Summary



- Old arc: Colville and Kermadec Ridges (17-5 Ma)
- Havre Trough: Spreading vs. Rifting
- Change in bathymetry at ~31-32°S
- Increasing slab dip from N to S
- Varying mantle and crustal composition
- Role of subducting features (HP, LSC, Sediments etc.) on, for example, melt genesis, eruption style and hydrothermal systems

RV Tangaroa



RV Thomas G Thompson



RV Yokosuka



RV Ka'imimoana



RV Sonne



**Bon voyage ...**