# Integrated field studies of the N Tofua & NE Lau Basin – the northern bookend of the Tonga-Kermadec system

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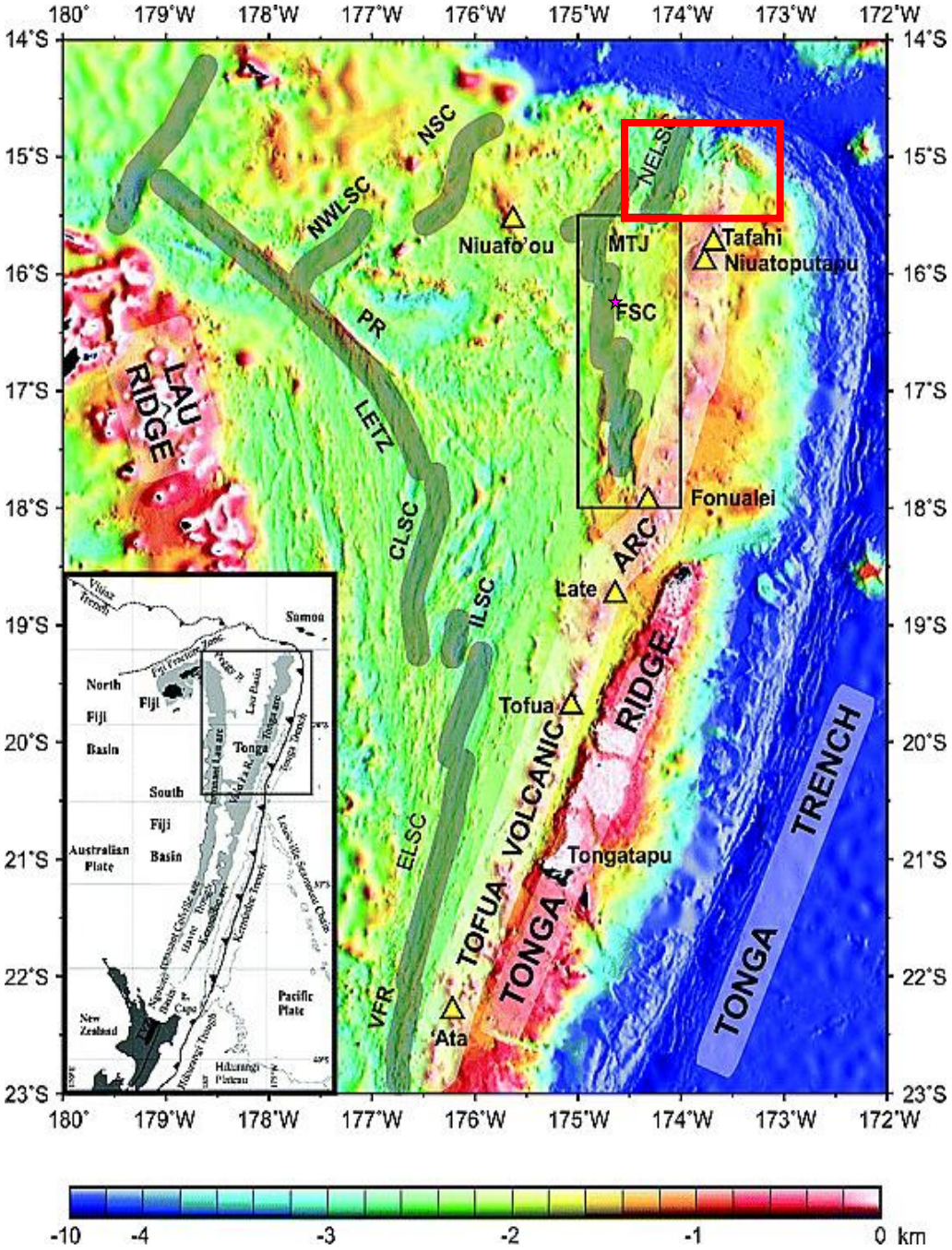
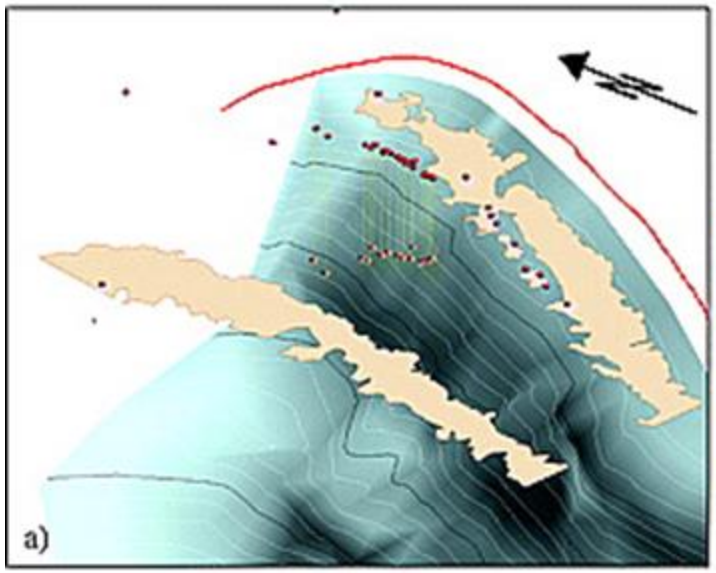
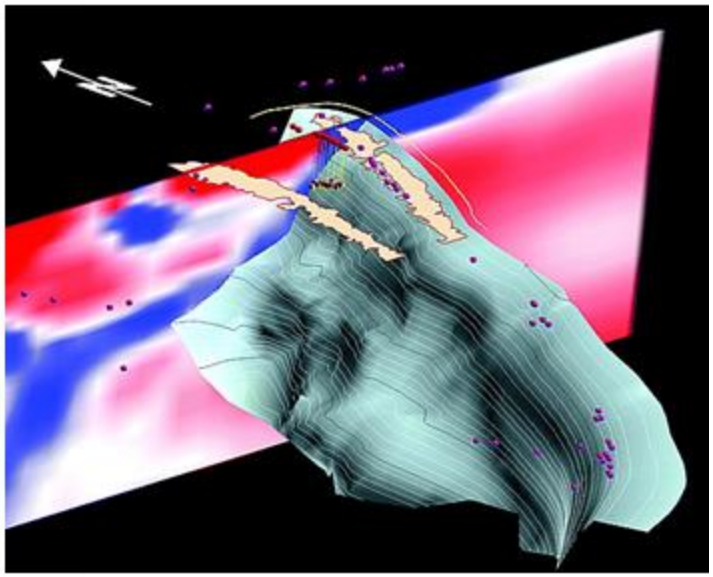
Joe Resing,
Ed Baker,
John Lupton,
Cornel de Ronde,
and others




Keller et al., JGR, 2008

# NE Lau Basin – fast convergence, tear in plate, multiple spreading centers west of Tofua Arc

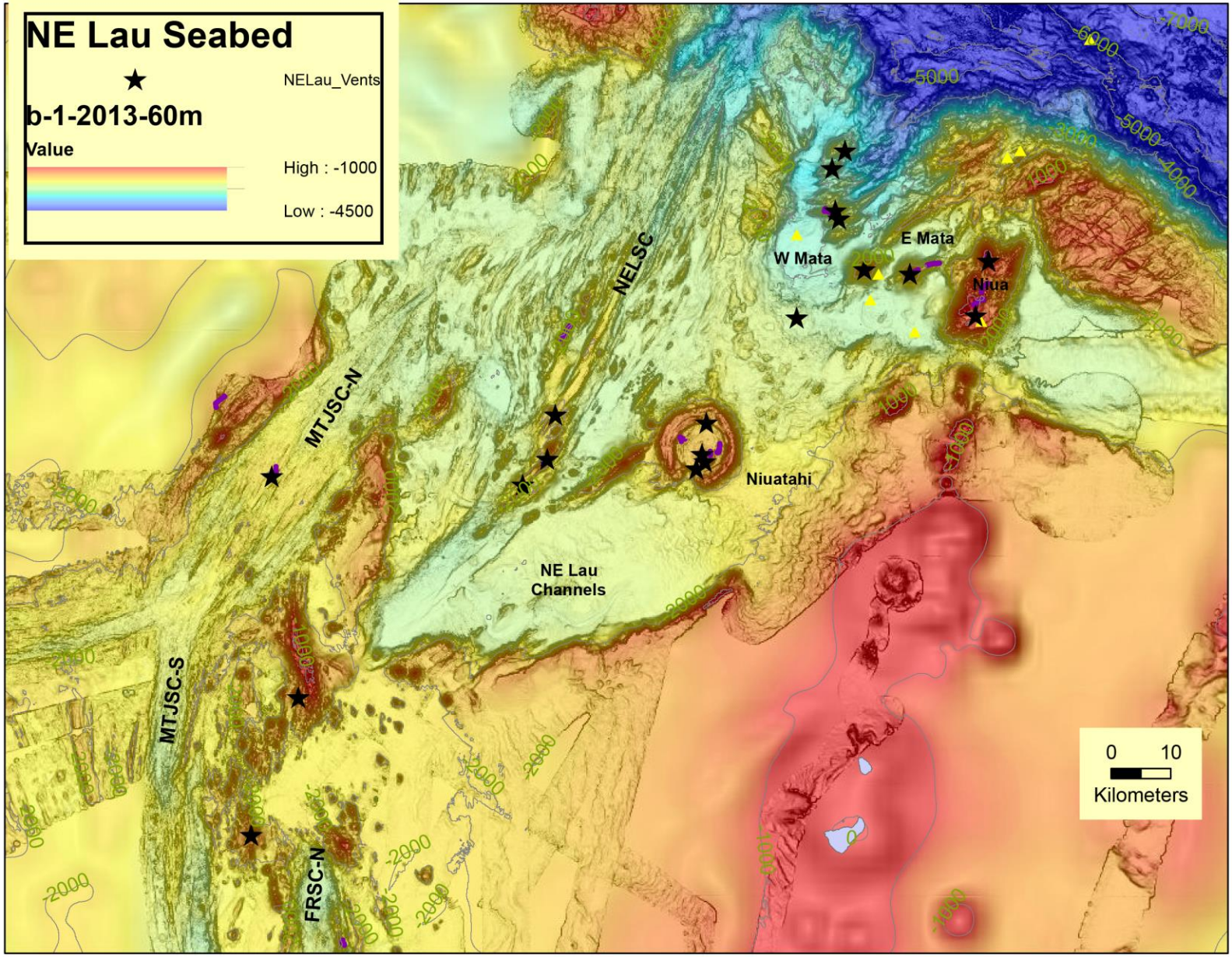



Keller et al., JGR 2008

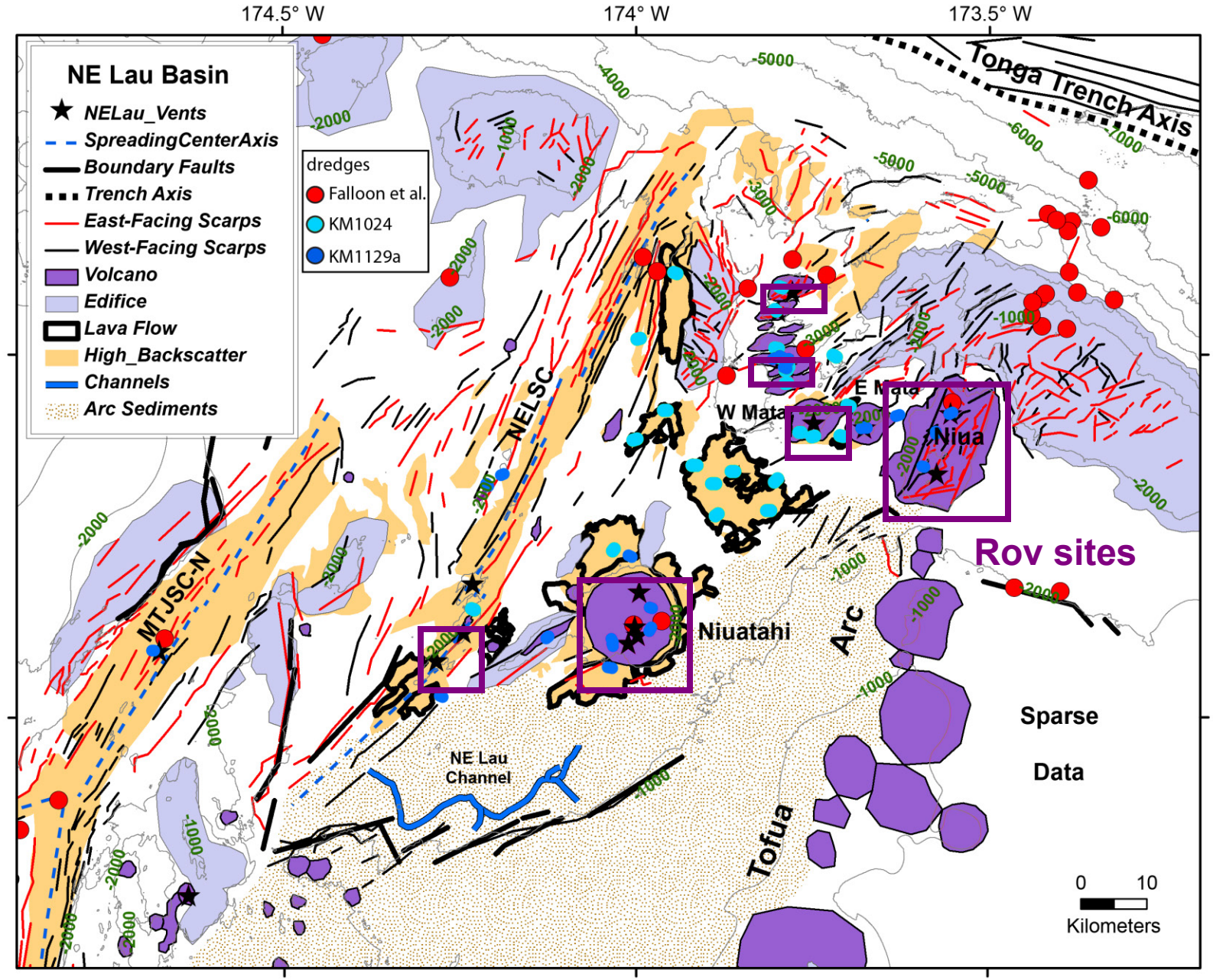
Three-dimensional reconstruction of the upper surface of the Pacific Plate dipping below Tonga and a seismic tomography slice. Beige areas represent the Lau Ridge on the left and the Tonga Ridge on the right, using a 1500 m bathymetry contour. Depth to the top of the subducting slab for each sample location.

Rubin T-K 2013 workshop

# NE Lau – 6 NOAA/UH/UW cruises since 2008




Embley, Rubin, et al., G3, unpub.

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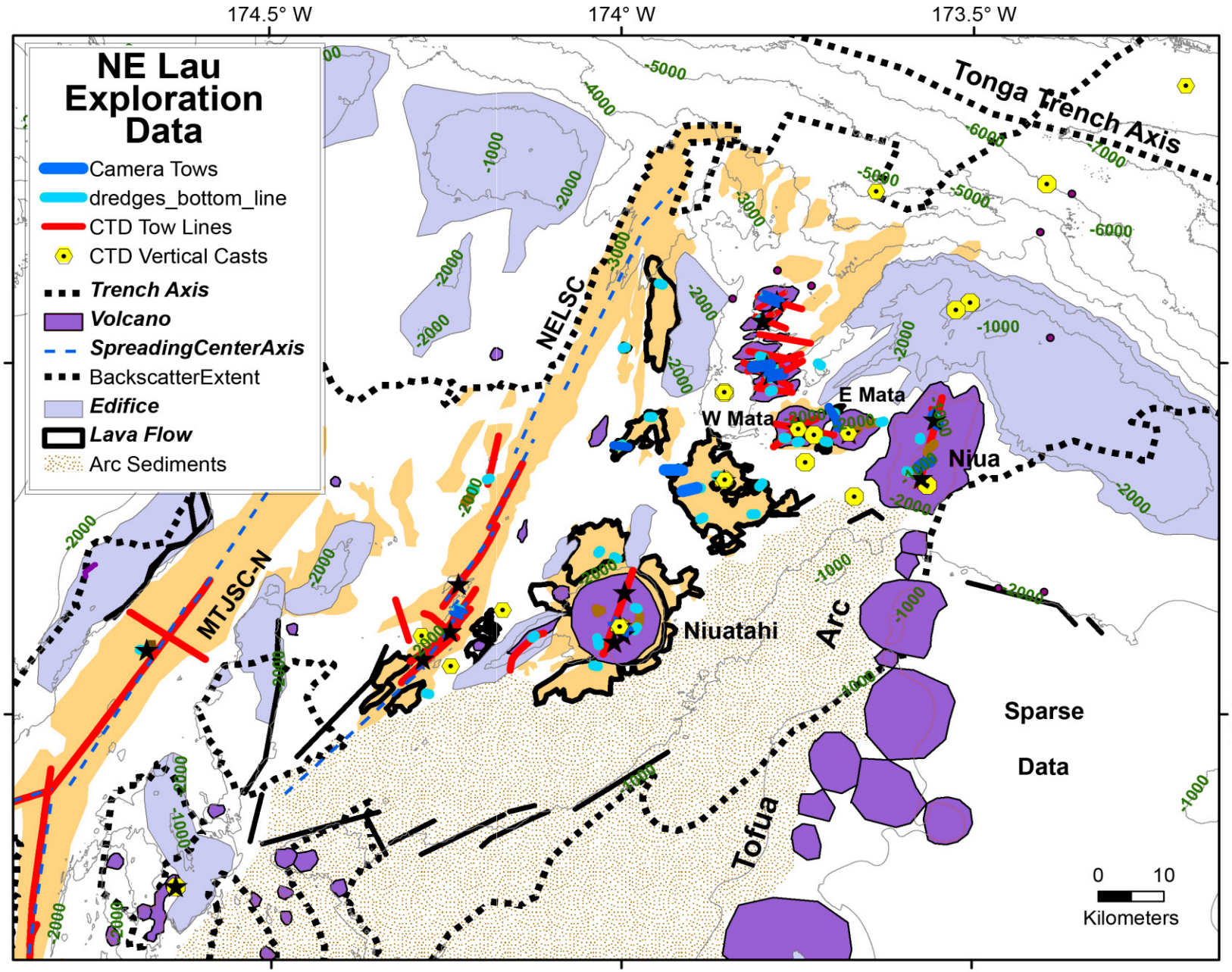
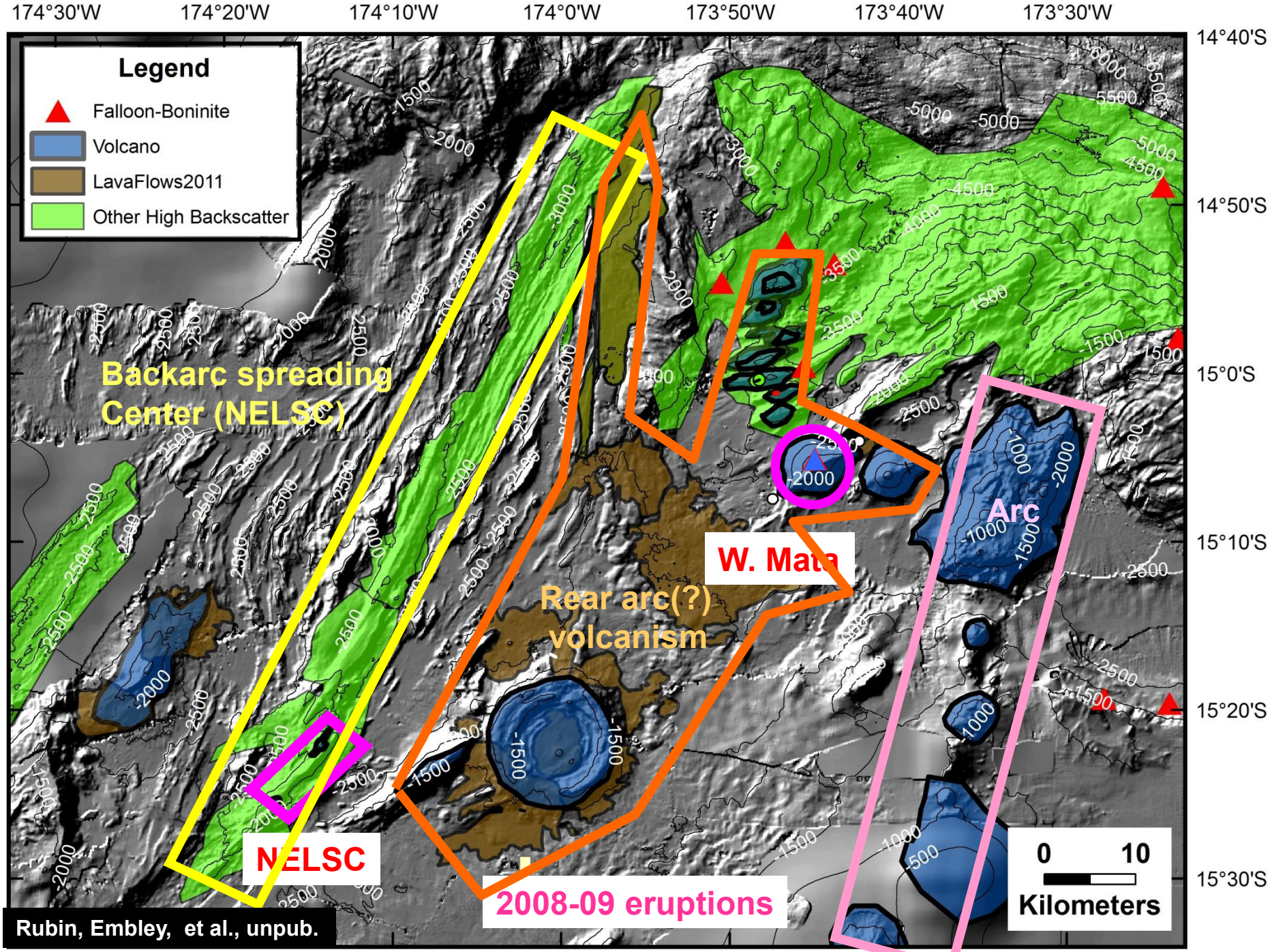
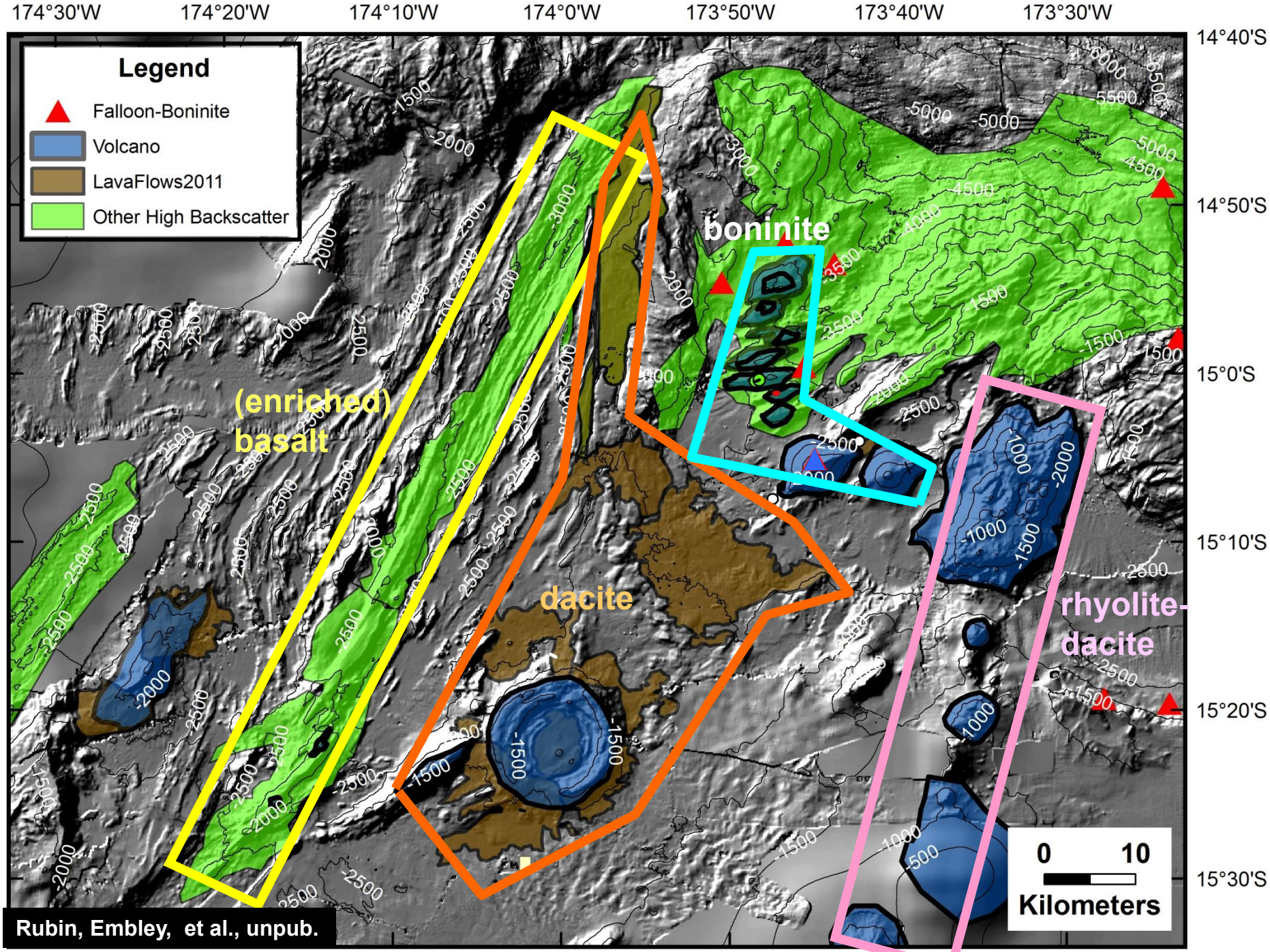


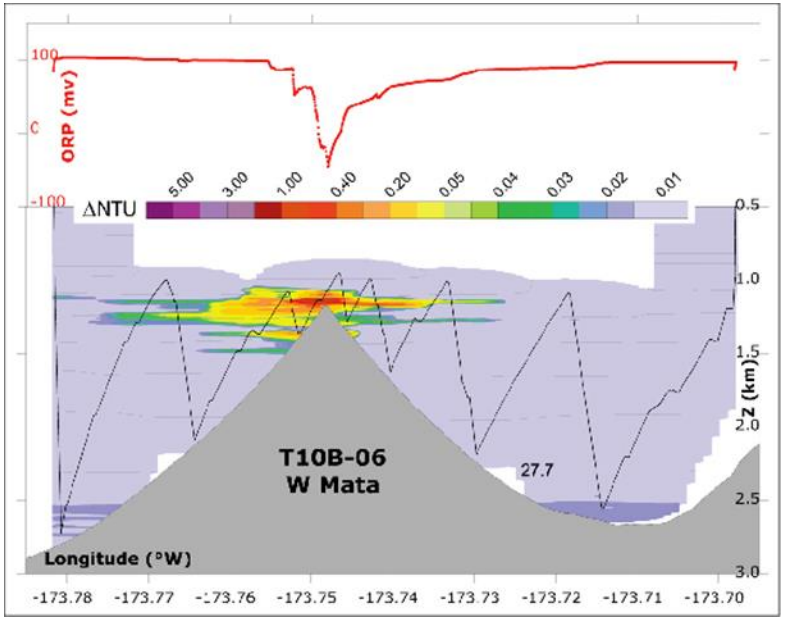

Embley, Rubin, et al., G3, unpub.


174°30'W
174°20'W
174°10'W
174°0'W
173°50'W
173°40'W
173°30'W
14°40'S
14°50'S
15°0'S
15°10'S
15°20'S
15°30'S
Legend
Falloon-Boninite
Volcano
LavaFlows2011
Other High Backscatter
Backarc spreading Center (NELSC)
Rear arc(?) volcanism
W. Mata
Arc
NELSC
2008-09 eruptions
0
10
Kilometers
Rubin, Embley, et al., unpub.

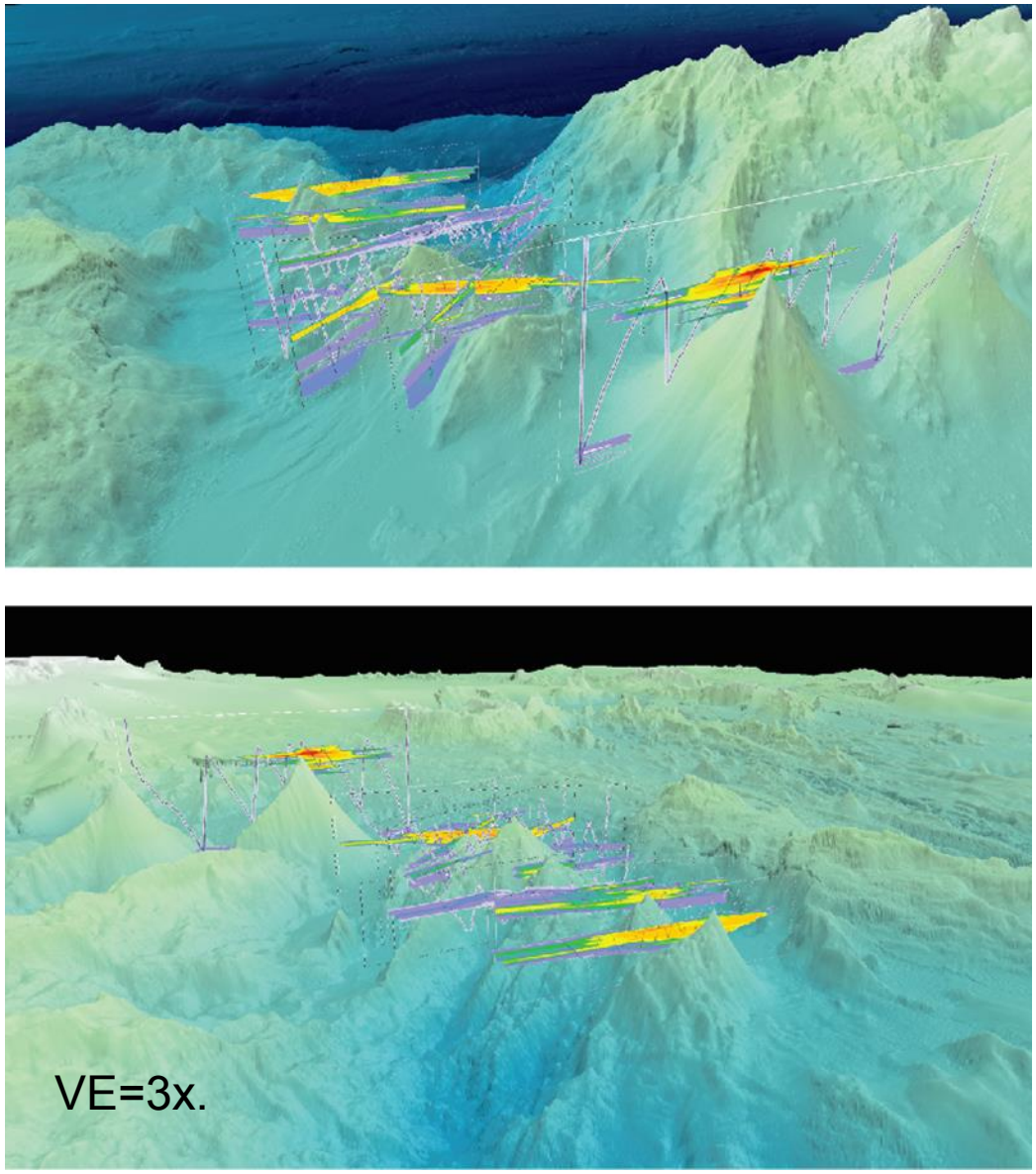

174°30'W
174°20'W
174°10'W
174°0'W
173°50'W
173°40'W
173°30'W
14°40'S
14°50'S
15°0'S
15°10'S
15°20'S
15°30'S
Legend
Falloon-Boninite
Volcano
LavaFlows2011
Other High Backscatter
boninite
(enriched) basalt
dacite
rhyolite-dacite
0
10
Kilometers
Rubin, Embley, et al., unpub.

# Boninite Province hydrothermal

Hydrothermal Plume Mapping by ctd tows allow plume identification, magmatic volatiles measurements, monitoring for changes (from repeat surveys), and calculating of fluxes more easily than at subaerial systems.



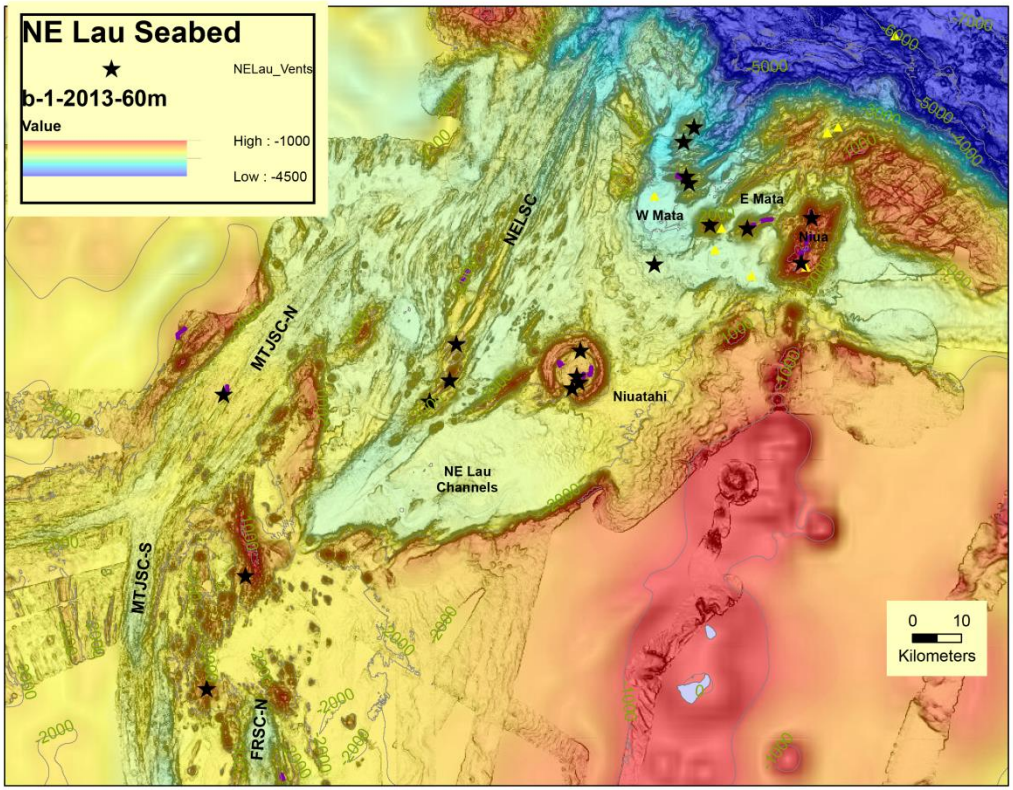

plume characteristics along a single cast (dashed line).



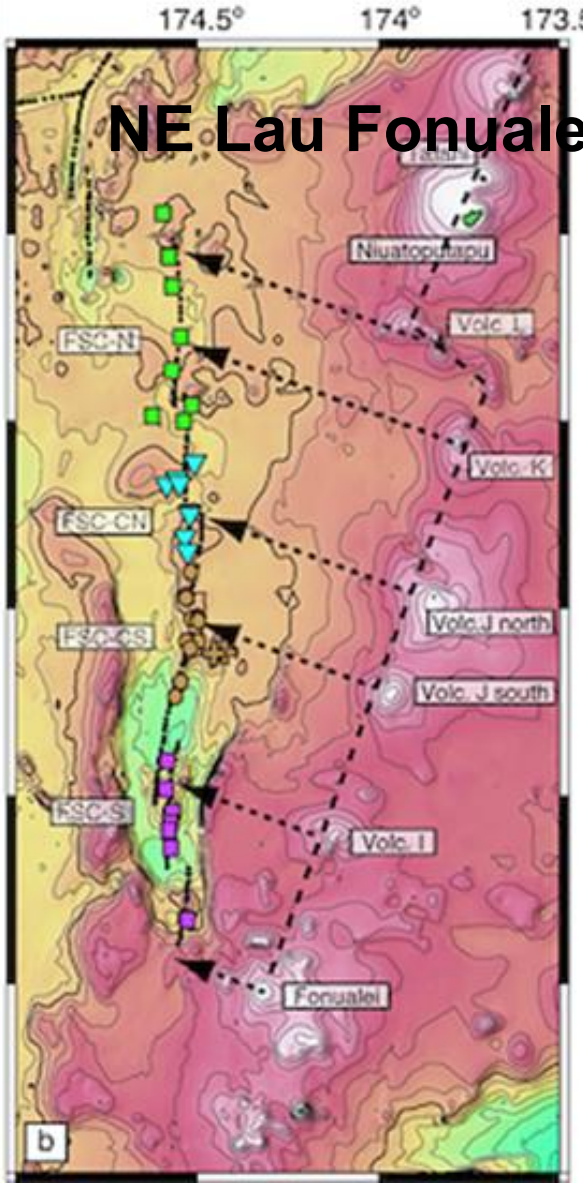

3-D images of the Mata volcanoes with 2-D CTD tow diagrams inserted. The CTD tow diagrams show the plumes as defined by light scattering values (DNTU). The sawtooth tow lines are the CTD track (barely visible in images). – Resing et al. unpub.

# NE Lau – Diffuse volcanism

# Fonualei – organized volcanism




Embley, Rubin, et al., G3, unpub.

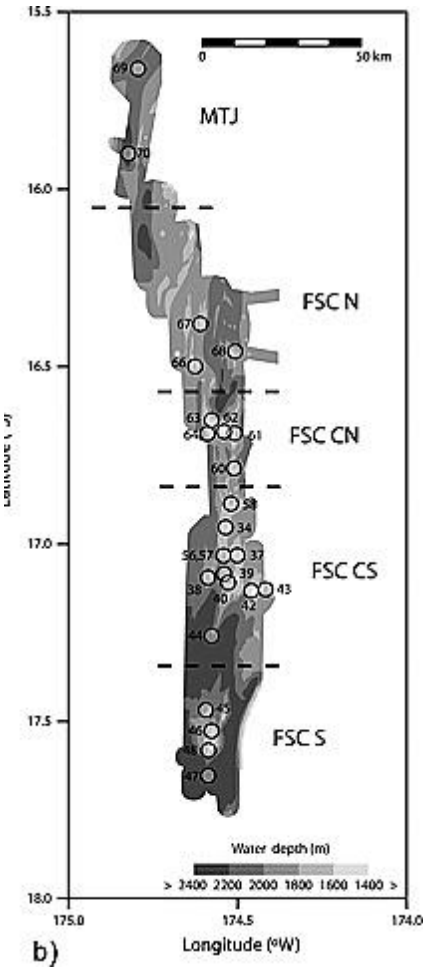



**Nested field study strategy:**

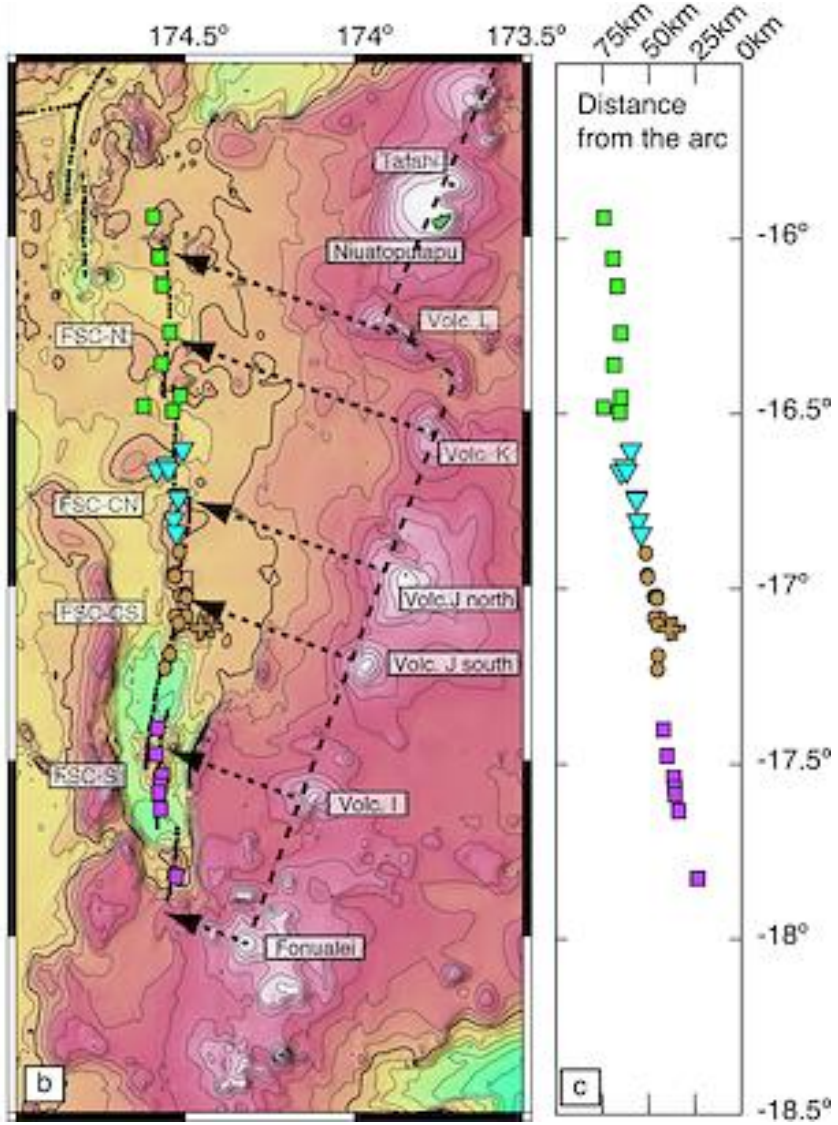
- **regional sea bed-plume mapping,**
- **cameras and dredges**
- **Auv**
- **Rov**

Escrig et al., G3, 2012

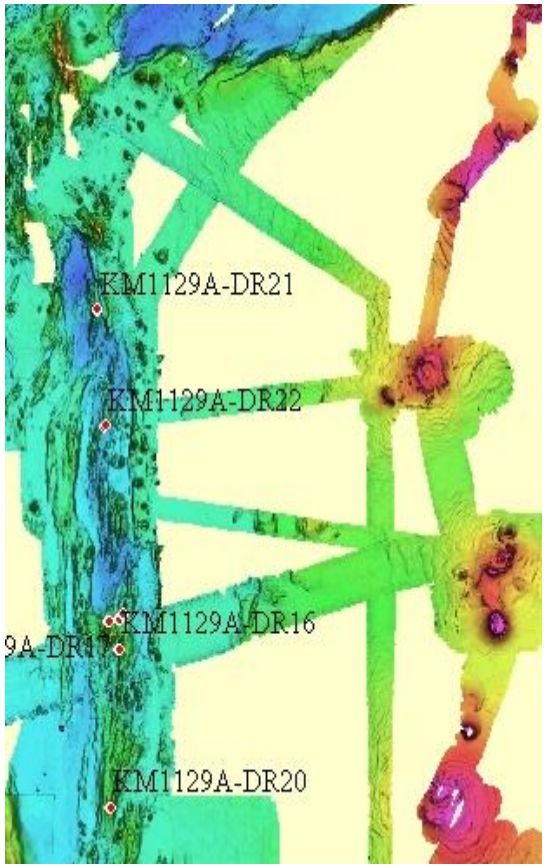
# Fonualei – in contrast: focused volcanism on a single well-defined BASC *3 – recent sample sets*




Keller et al., JGR 2008




Escrig et al., G3, 2012




Rubin/Embley 2011 dredges in collaboration with Nautilus Minerals, Inc.

**Contrasts in Arc/backarc slab flux partitioning and volcanic style (questions for Geoprisms to consider):**

NE Tonga Arc (Tofua) – weak to absent Holocene volcanism at northernmost volcanoes

NE Lau Basin – Highly productive, diffuse volcanism

- mostly boninite or its differentiates behind the arc
- Strong slab fluid signatures
- Appears to have captured slab flux from the arc proper

Fonualei – organized volcanism on next nearest Lau backarc region (adjacent to the south).

Southernmost Lau basin (Valu Fa and south): diffuse volcanism. Not much info on rock compositions in diffuse zone south of Valu Fa

Southernmost Kernmadec/Havre – apparently diffuse volcanism in the back arc (but not yet demonstrated with sampling and geochronology at fine enough scales)..

- Has there been recent volcanism or hydrothermal activity?
- Has it captured the slab flux? If not, what is the difference w/Lau?