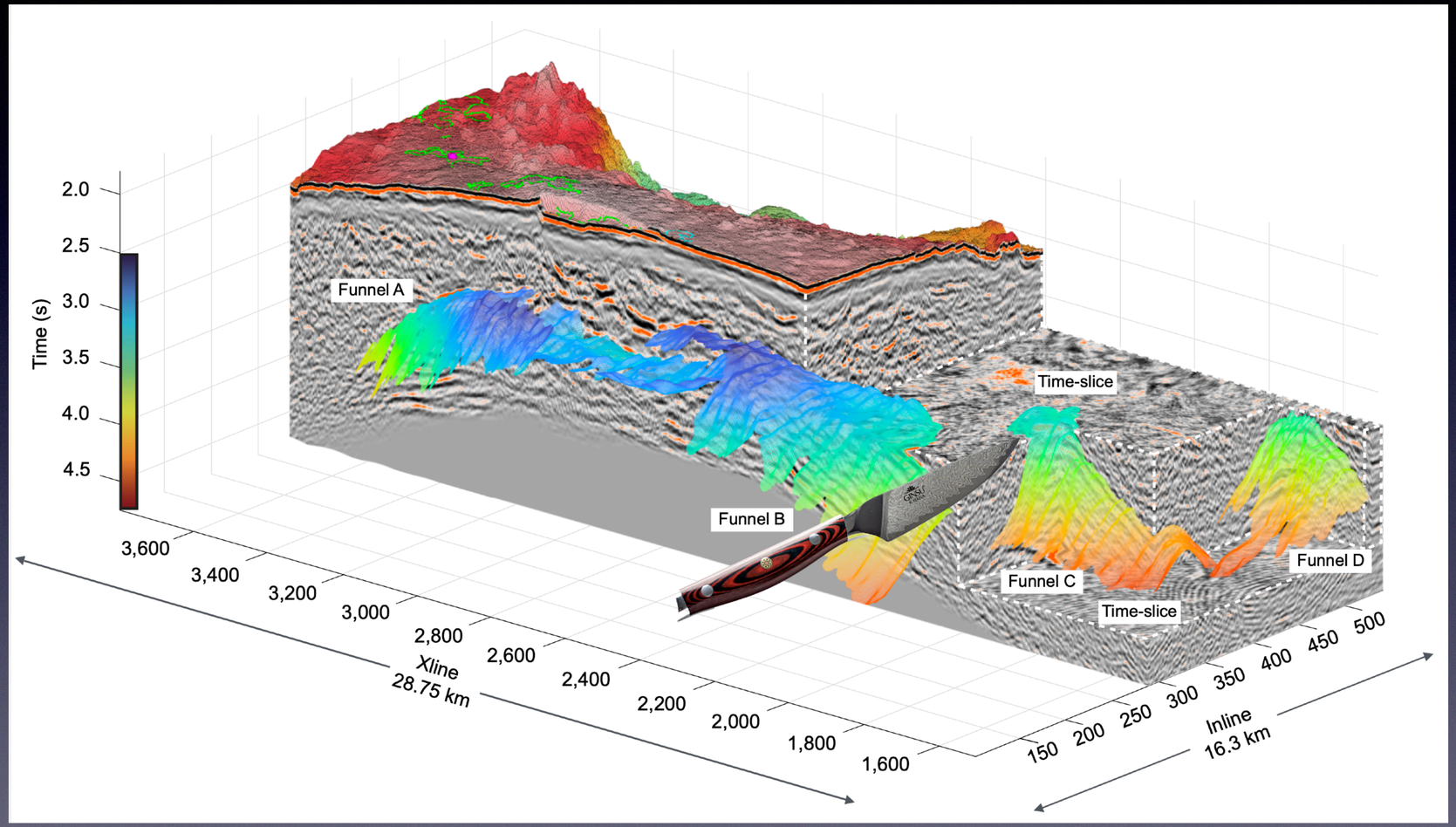
Axial volcano meets 'Ginsu' knife: Surprising insights from the 2019 3D seismic reflection survey

Dr. Graham Kent, Nevada Seismological Lab & IPGP Paris



OOIFB Town Hall, NOLA CC Rm 265-266, Mon. 1-2 PM

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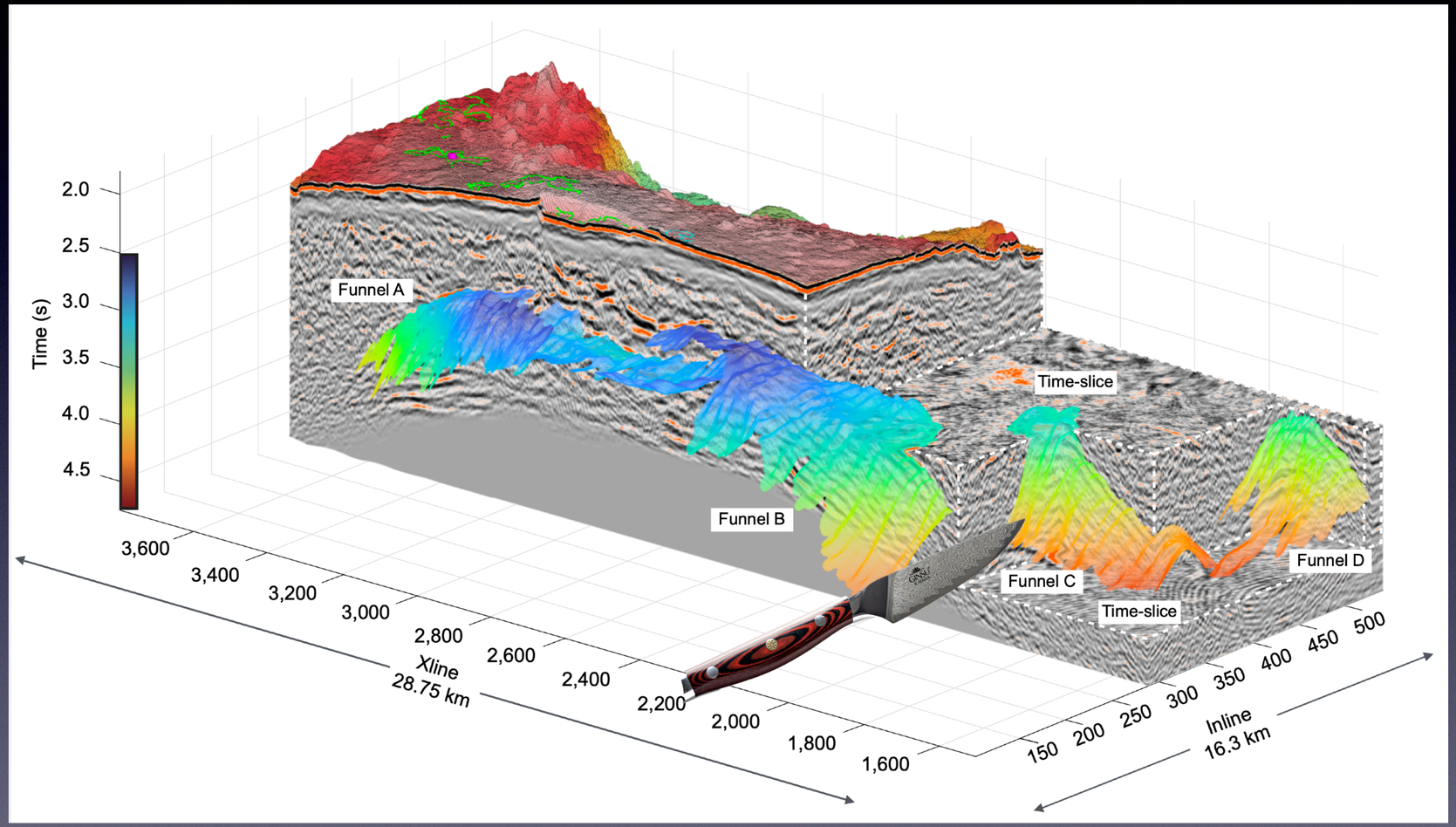


OOIFB Town Hall, NOLA CC Rm 265-266, Mon. 1-2 PM

OUTLINE

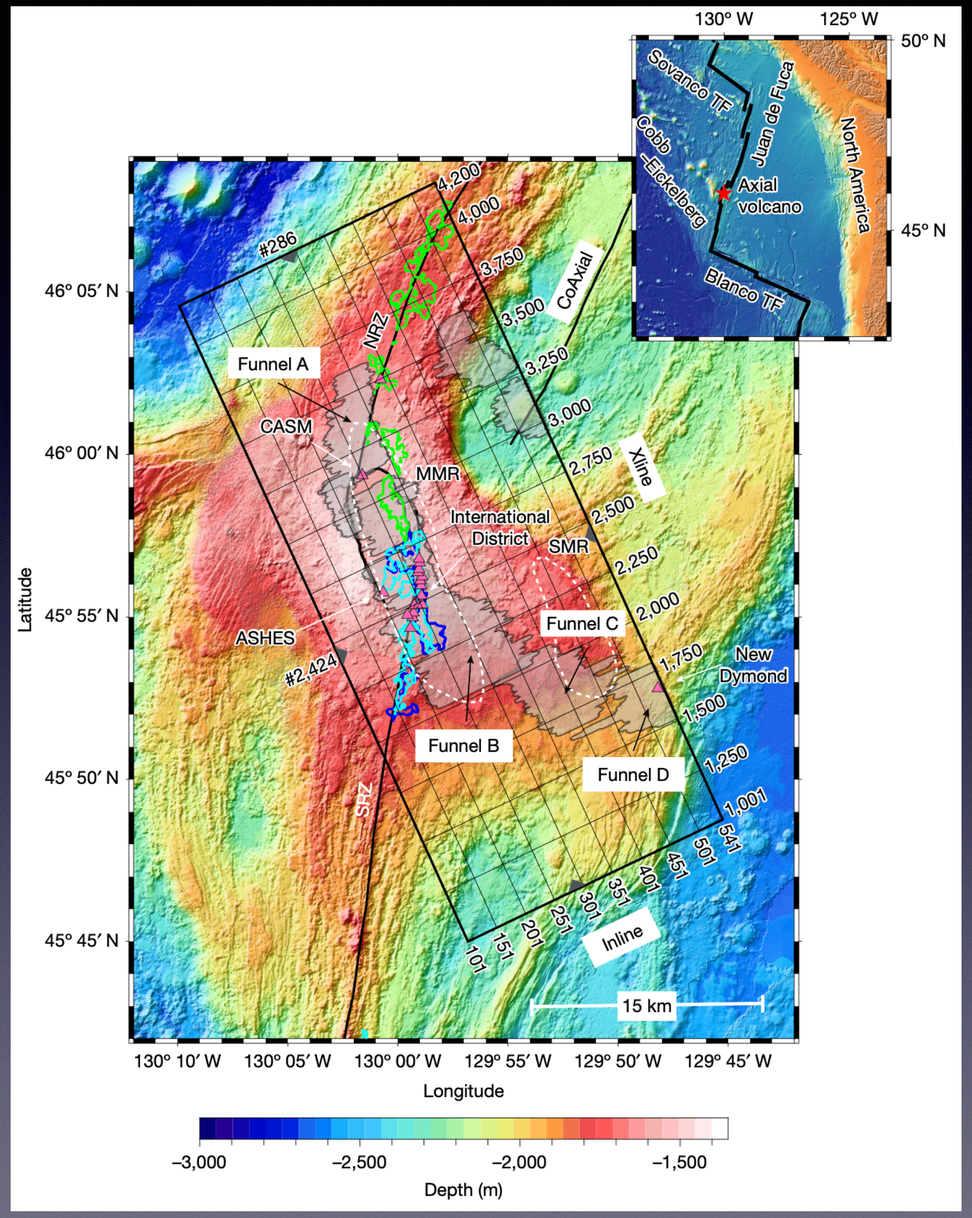
• Deep imaging of the complex ‘Magma Domain’ structure (bounded by the Lithosphere–Asthenosphere Boundary) below Axial volcano (*Nature*, Kent et al., 2025).

• Shallow imaging of volcanic layering (everywhere!) beneath Axial volcano and what does it mean? (*Nature Comm.*, Wu et al., resubmitted after reviewer edits)

• Imaging partial and total collapse features near the summit of Axial volcano and their linkages to hydrothermal sites. (Oral presentation at Fall AGU)

• Time-lapse of 'Magma Domain' structure across almost two decades: Future opportunities to do 4-D imaging of Axial volcano (Poster presentation at Fall AGU)

DEEP IMAGING



Article

Melt focusing along lithosphere–asthenosphere boundary below Axial volcano

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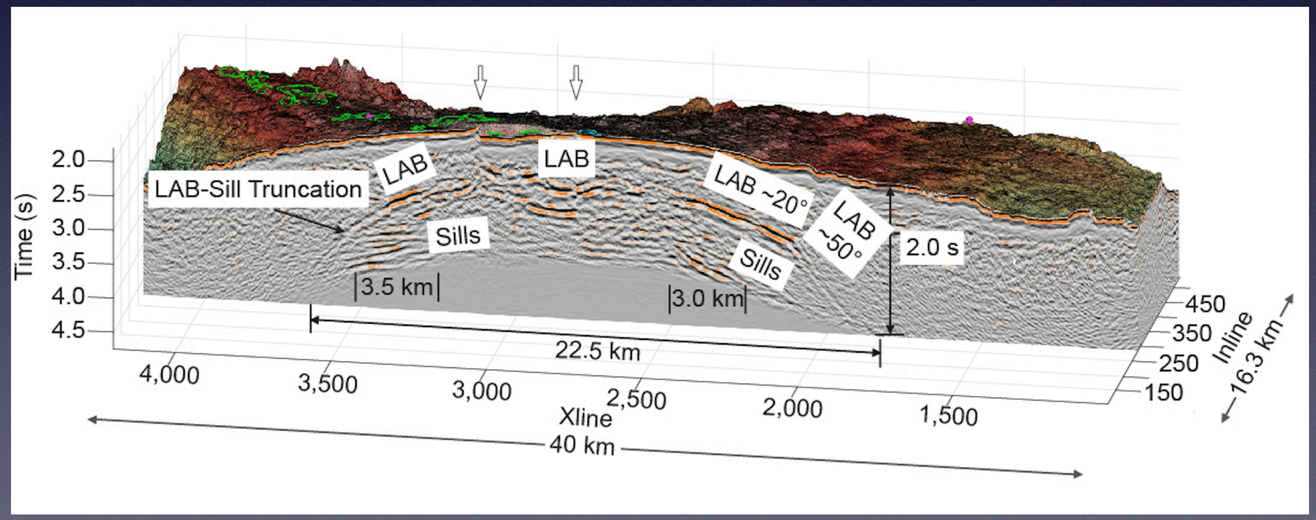
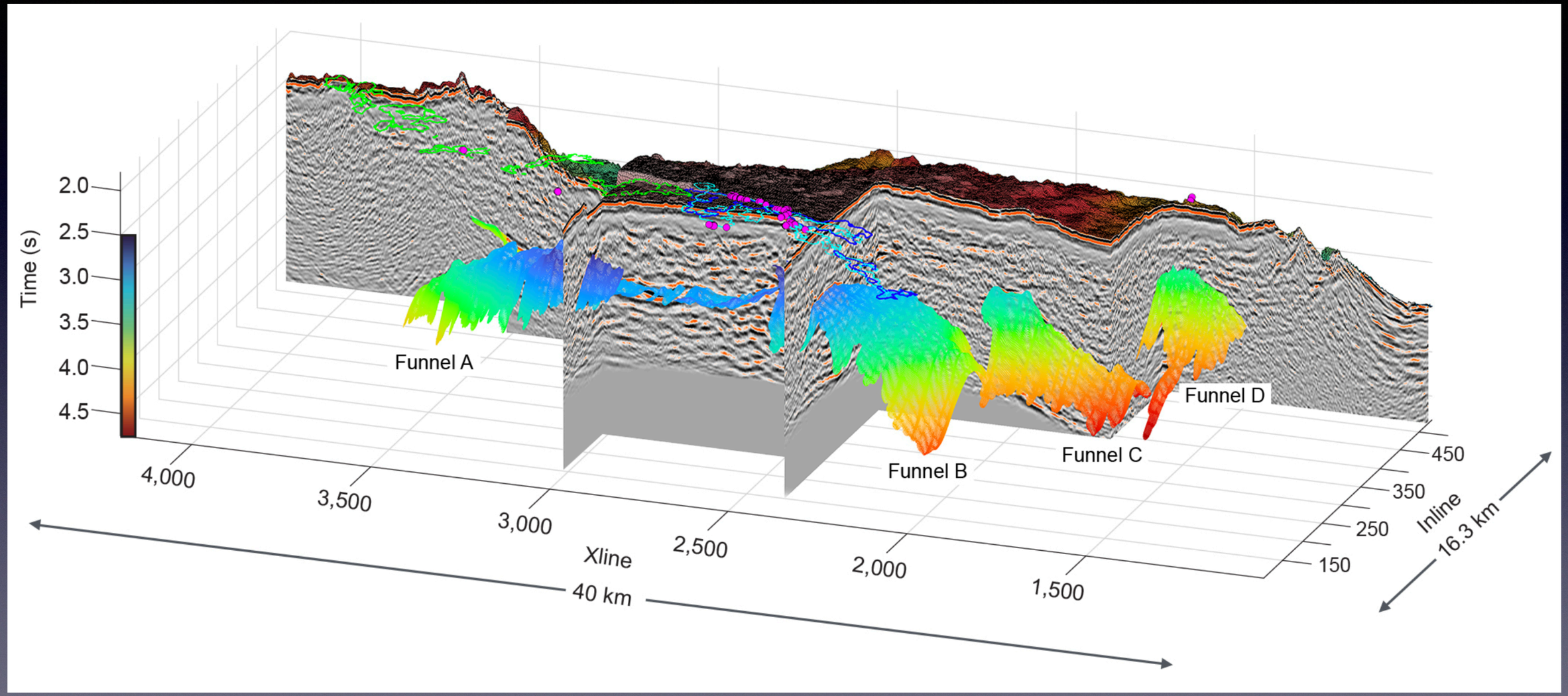
Beneath oceanic spreading centres, the lithosphere–asthenosphere boundary (LAB) acts as a permeability barrier that focuses the delivery of melt from deep within the mantle towards the spreading axis[1]. At intermediate-spreading to fast-spreading ridge crests, the multichannel seismic reflection technique has imaged a nearly flat, 1–2-km-wide axial magma lens (AML)[2] that defines the uppermost section of the LAB[3],



KEY POINT: MELT MIGRATION AND ASSIMILATION ALONG THE CRUSTAL LAB

DEEP IMAGING

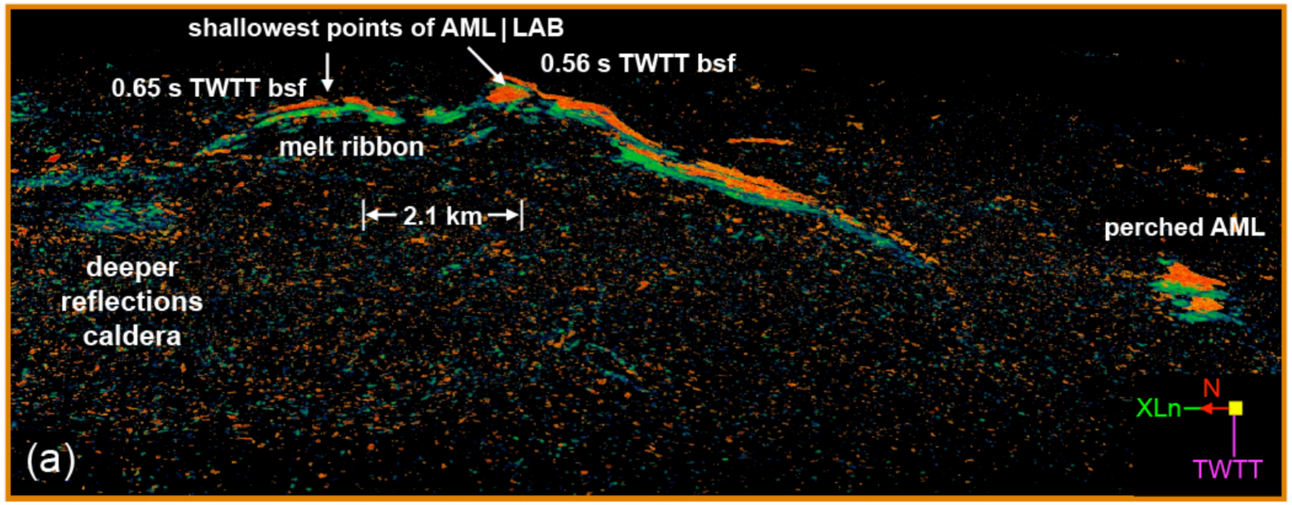
LAB Morphology

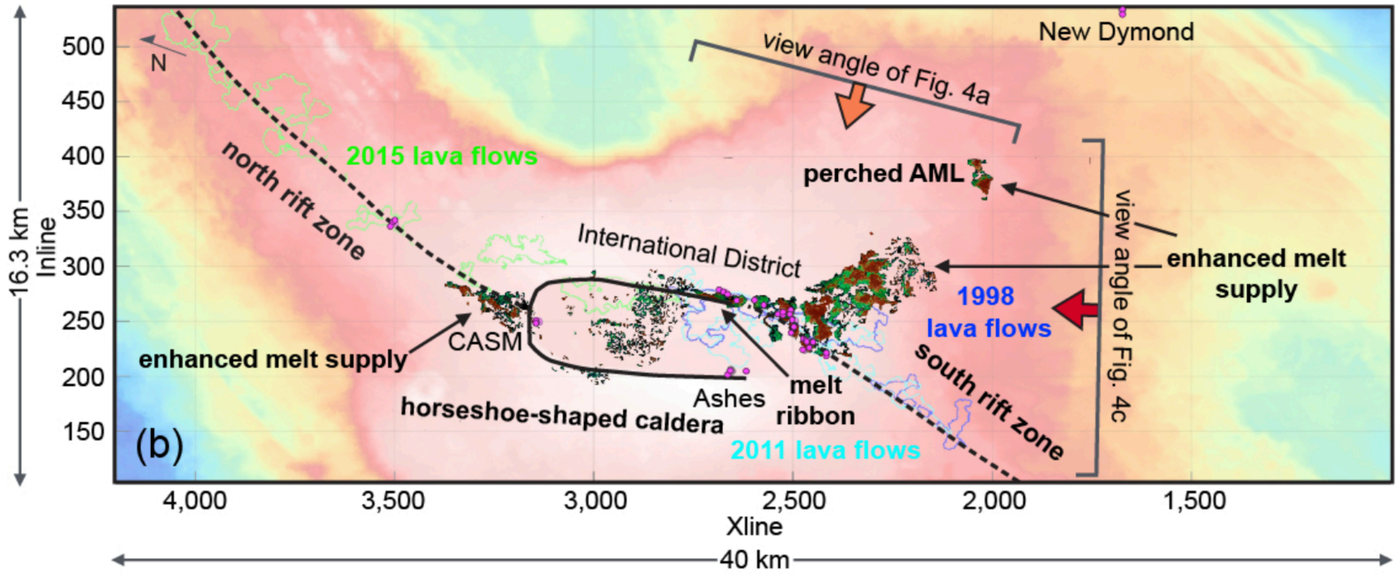


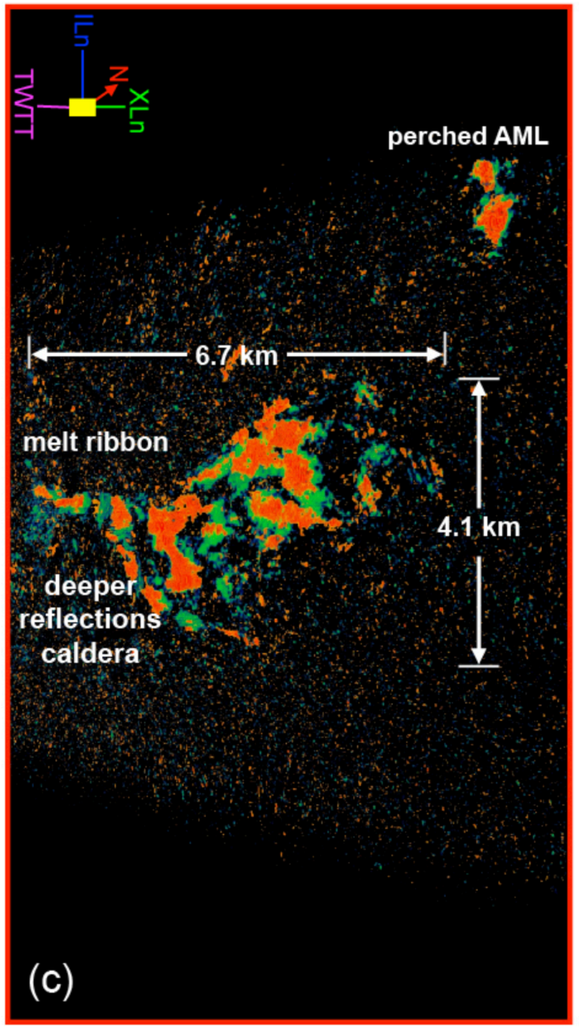
KEY POINT: LAB HAS COMPLEX FUNNEL SHAPES–EXTENDS TO SOUTHEAST

DEEP IMAGING

Melt Availability Map



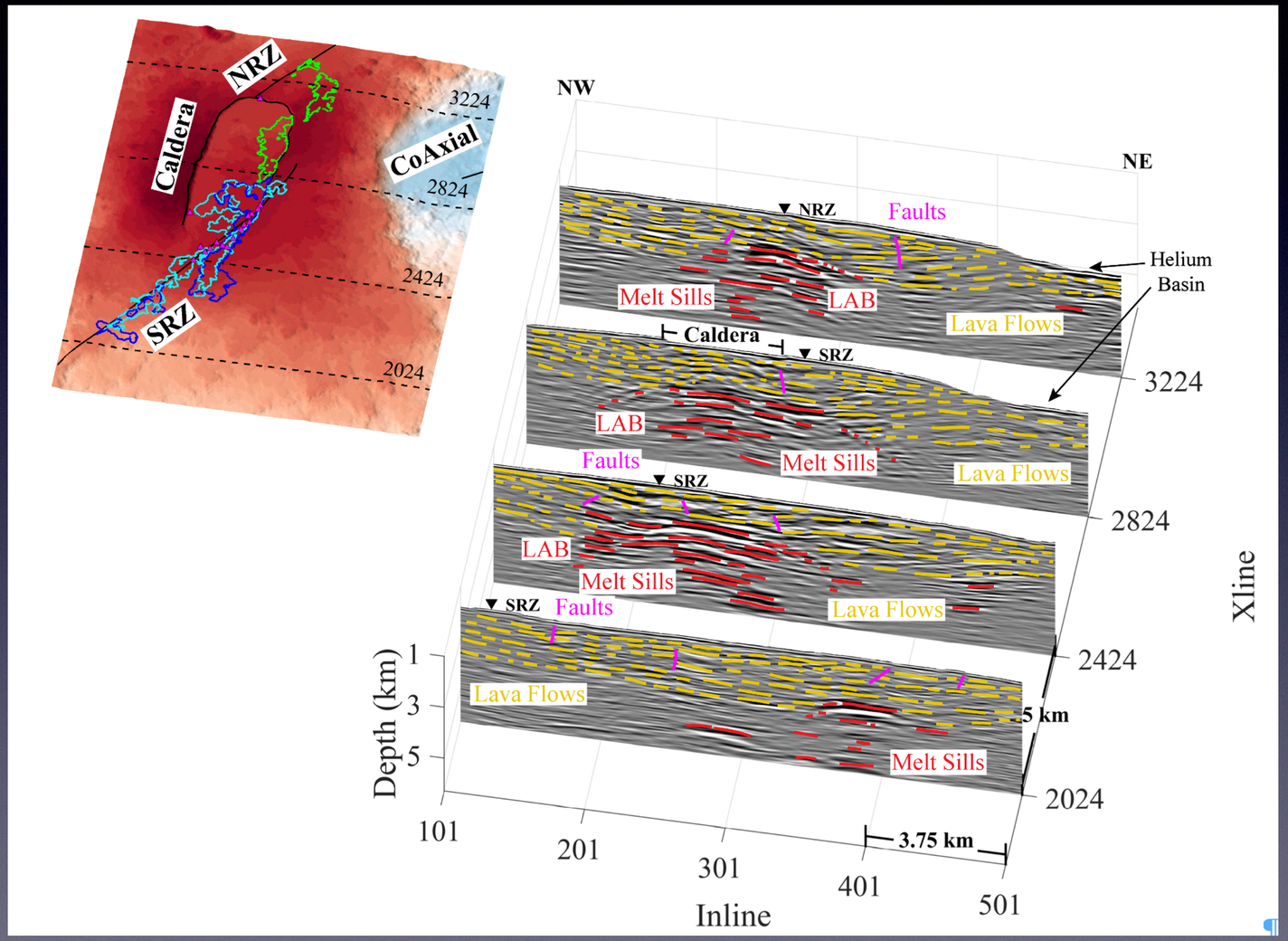




KEY POINT: SIGNIFICANT MELT IMAGED SOUTHEAST OF THE CALDERA

SHALLOW IMAGING

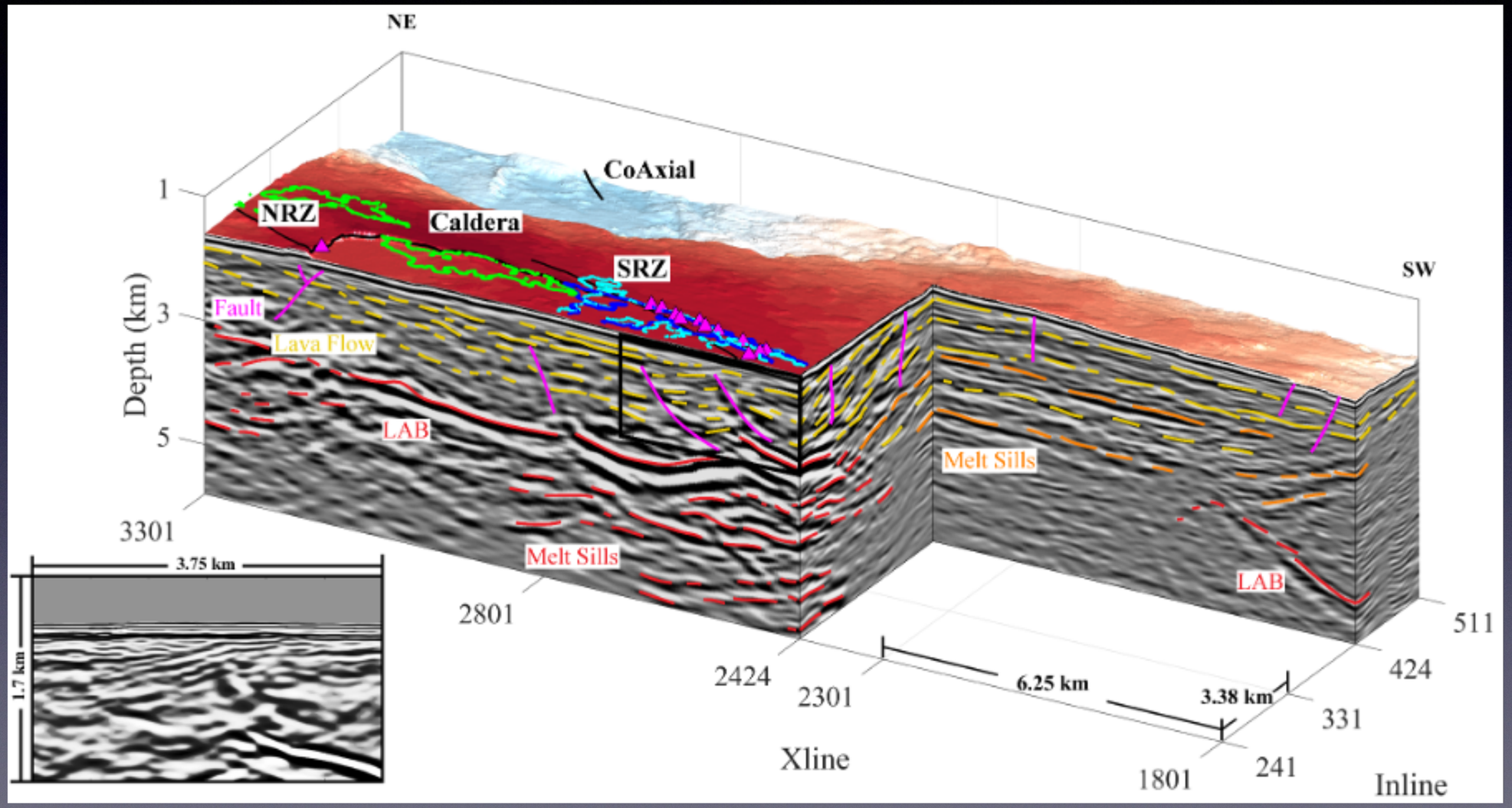
Rift Axis Dike Injection and Magma Withdrawal Below Caldera are the Mechanisms for Inward Tilted Layers



KEY POINT: LAVA LAYERING DIPS TOWARD THE CALDERA

SHALLOW IMAGING

Dikes are Upwardly Injected into Dipping Lava Layers above the Magma Domain



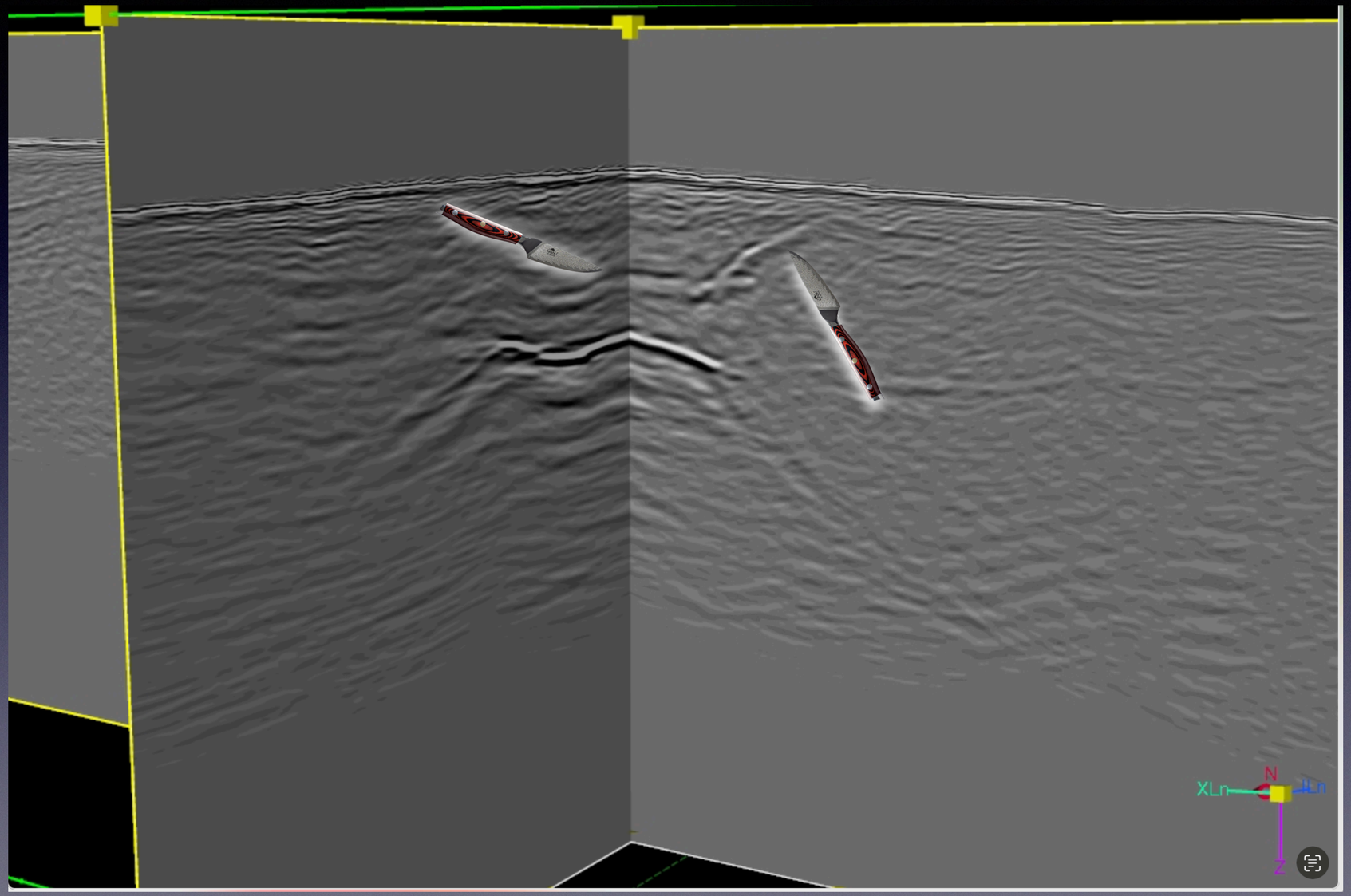
KEY POINT: LAVA LAYERING IS DIRECTLY ASSIMILATED INTO THE MAGMA DOMAIN

Where’s the Classic Sheeted Diked Complex ?

NEVER EMPLACED OR ASSIMILATED ?

SHALLOW IMAGING

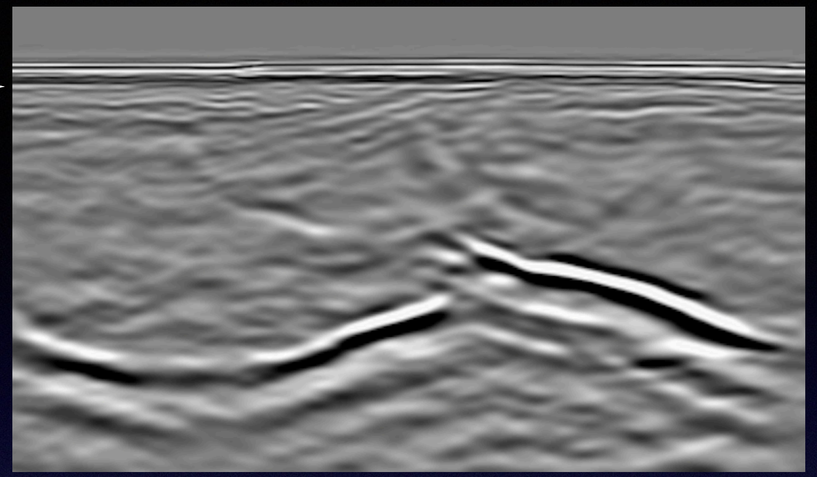
Diking is not Always a Simple Vertical Surface



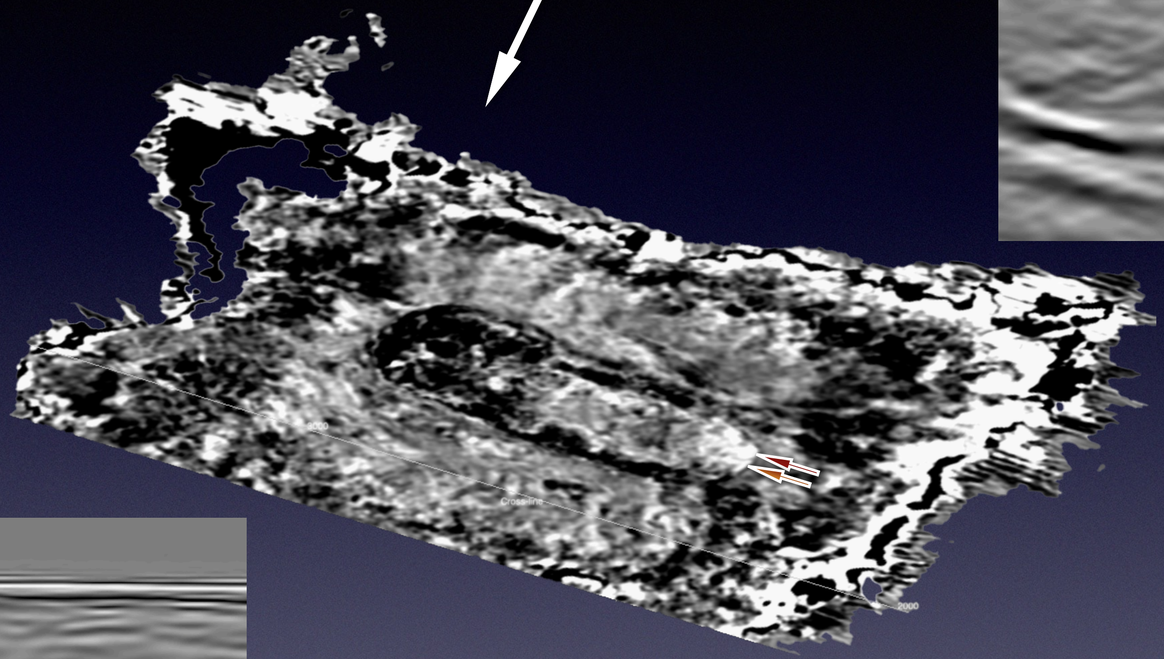
KEY POINT: DIKING BENEATH AXIAL VOLCANO IS COMPLEX

PARTIAL CALDERA COLLPASE, SE

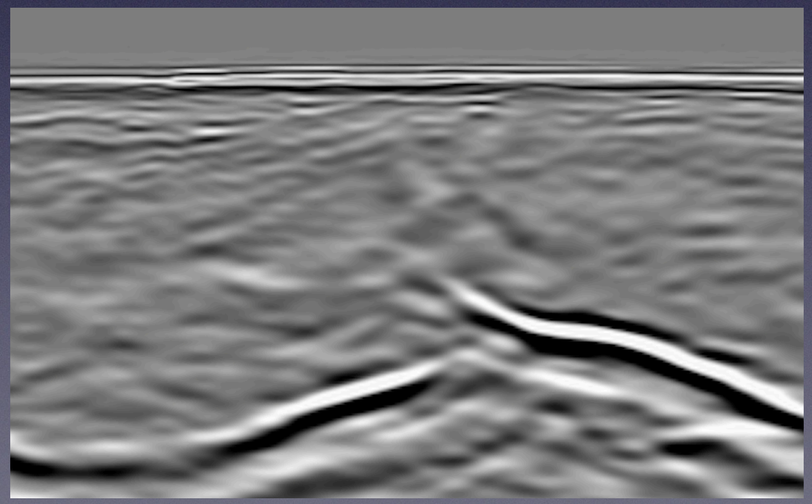
1,695 m



Inline #241



Depth Slice 1,695 m

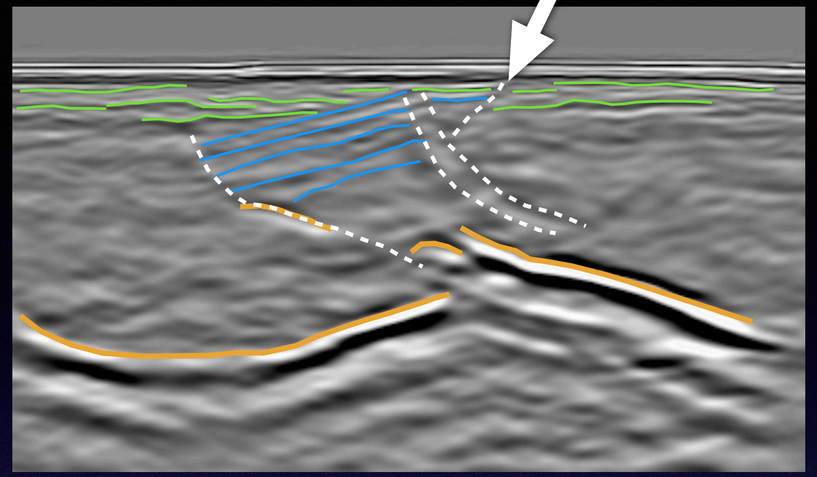


Inline #236

T22B-05 Linkages between large-scale caldera collapse, voluminous eruptions and extensive hydrothermal vent fields along the southeast portion of the caldera beneath Axial volcano, NE Pacific. **Rm 352 (NOLA CC). Tuesday, 16 December 2025 11:30-11:45**

PARTIAL CALDERA COLLPASE, SE

~1 km



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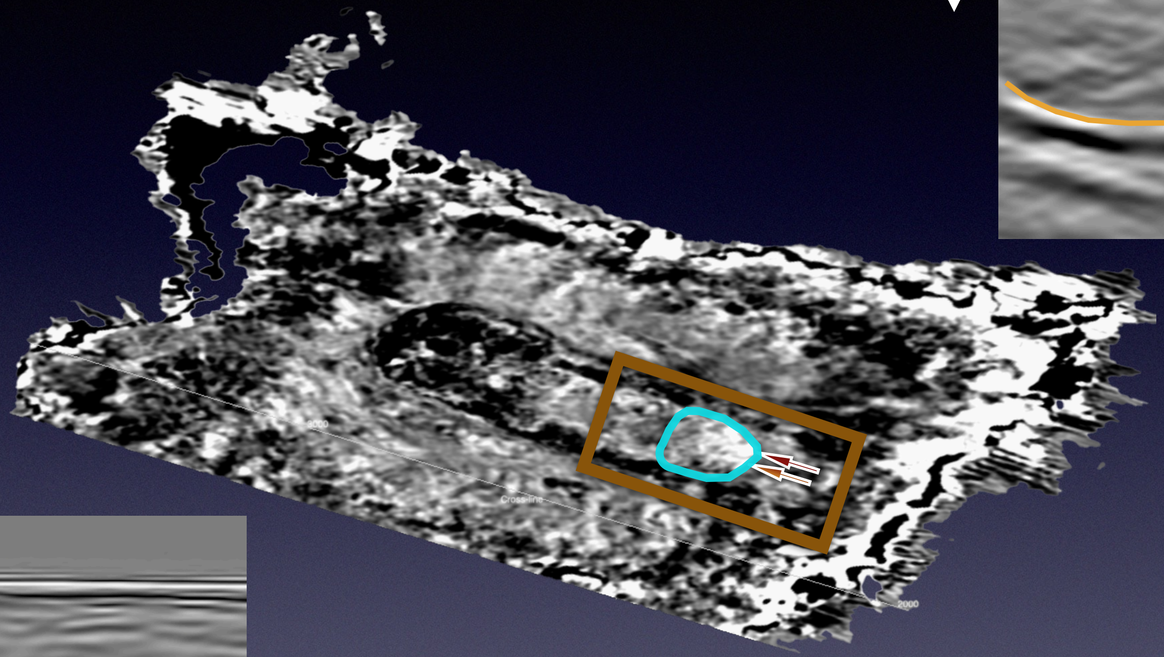

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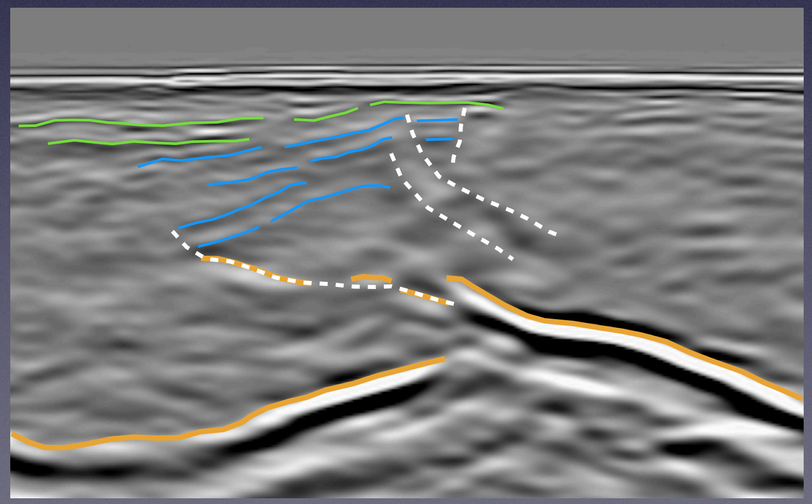


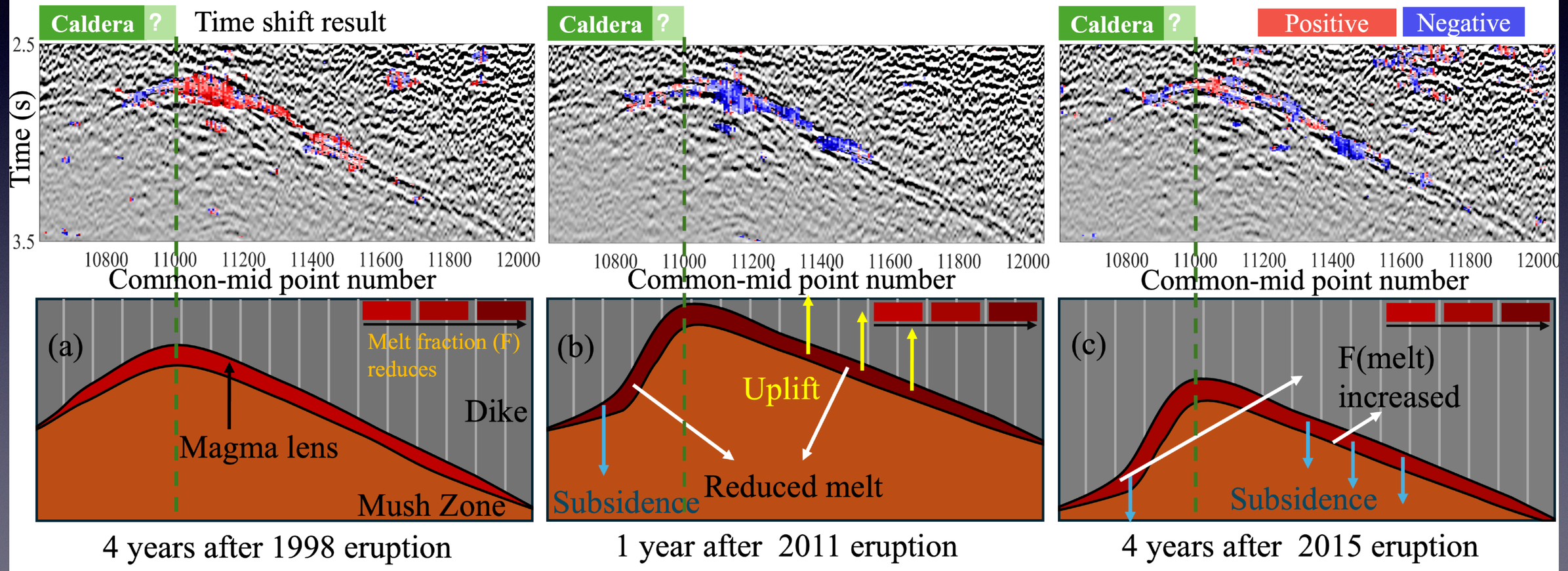
Inline #236

Dynamics of magma reservoir before and after volcanic eruptions at the Axial Volcano in the Eastern Pacific using time-lapse seismic imaging method

Yan Zhao[1], Hélène Carton[1], Satish Singh[1], Maryam Ardalan[1] , Graham Kent[2]

1 Université Paris Cité, Institut de Physique du Globe de Paris, CNRS, Paris, France

2 University of Nevada Reno, Reno, NV, United States



KEY POINT: CHANGES IN MAGMA DOMAIN OBSERVED ACROSS ~2 DECADES