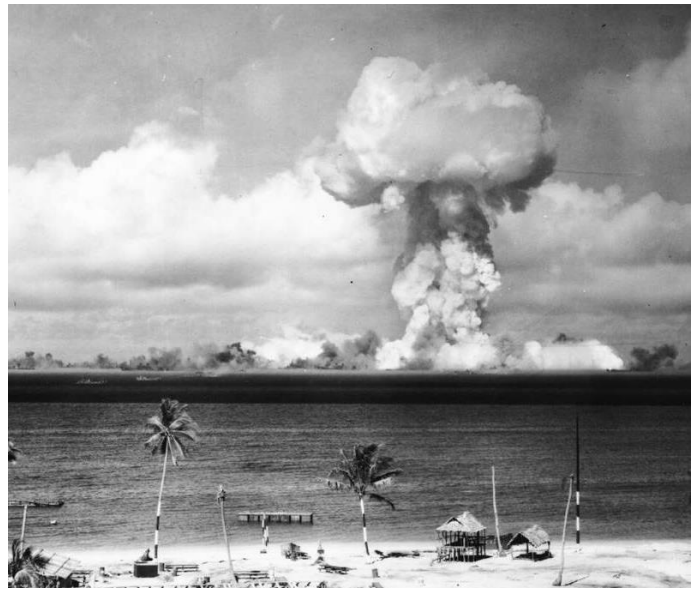
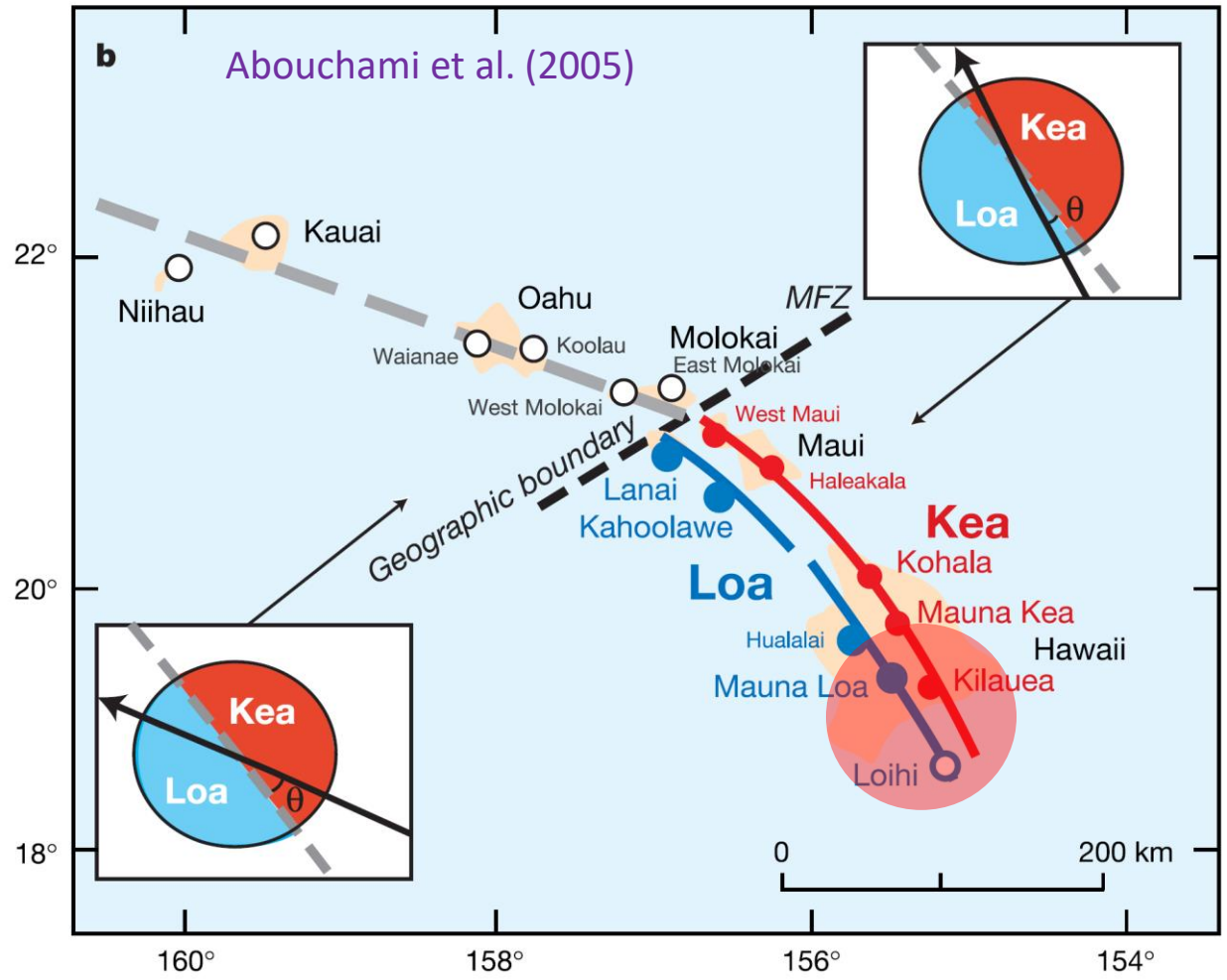
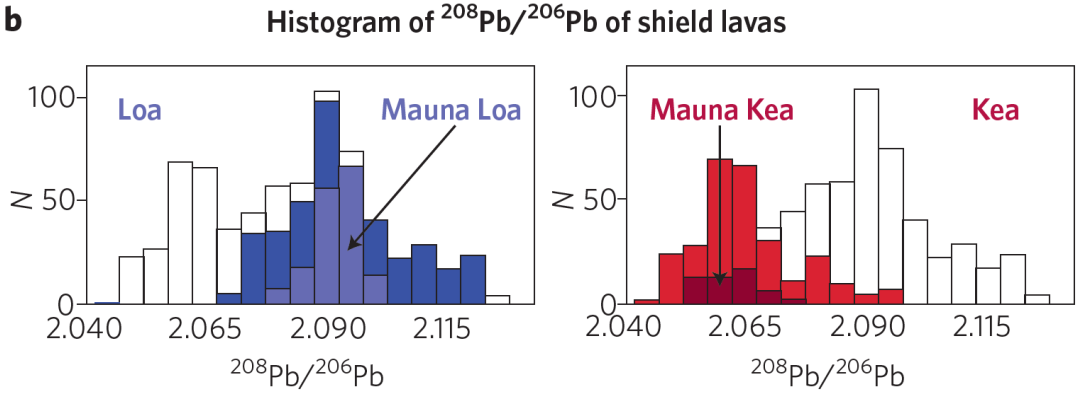
Maxim D. Ballmer & Valerie Finlayson

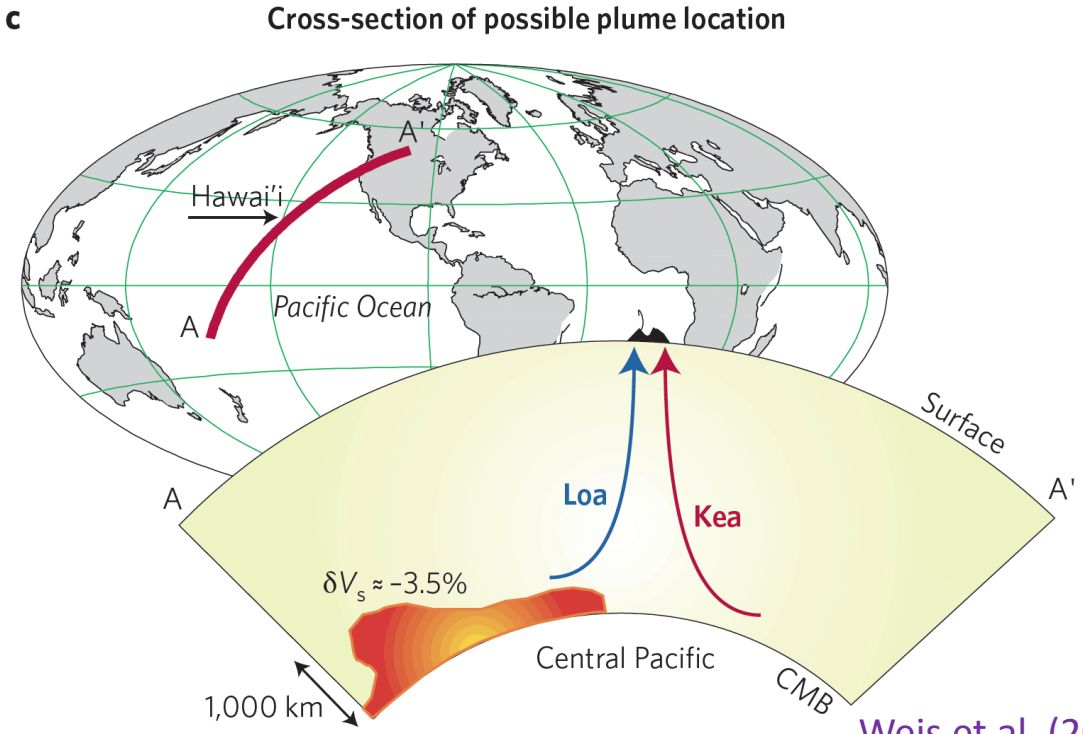
# <*Widely*>spaced *DDouble hotspot chains* due to *forked* *mantle plumes* can sample *lower-mantle geochemical structure*



# geochemical asymmetry: Hawaiian dual chain



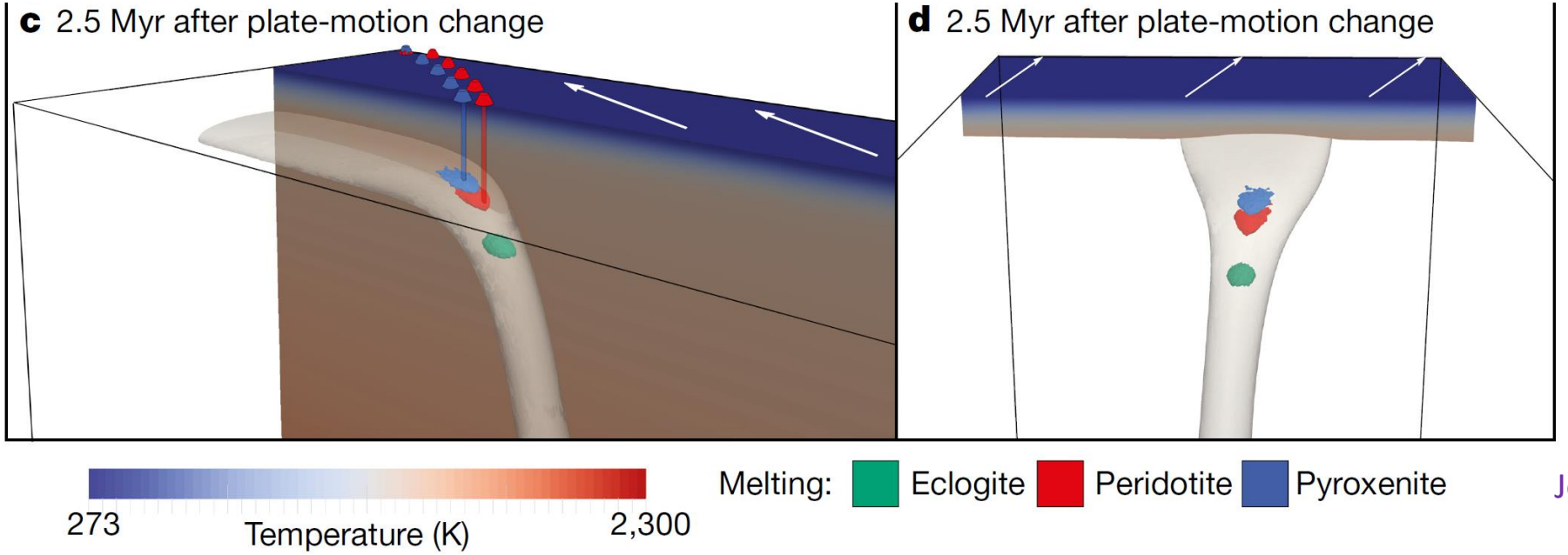




Map out the structure of the lowermost mantle ?

Weis et al. (2011)

# Geochemical asymmetry: alternative hypotheses

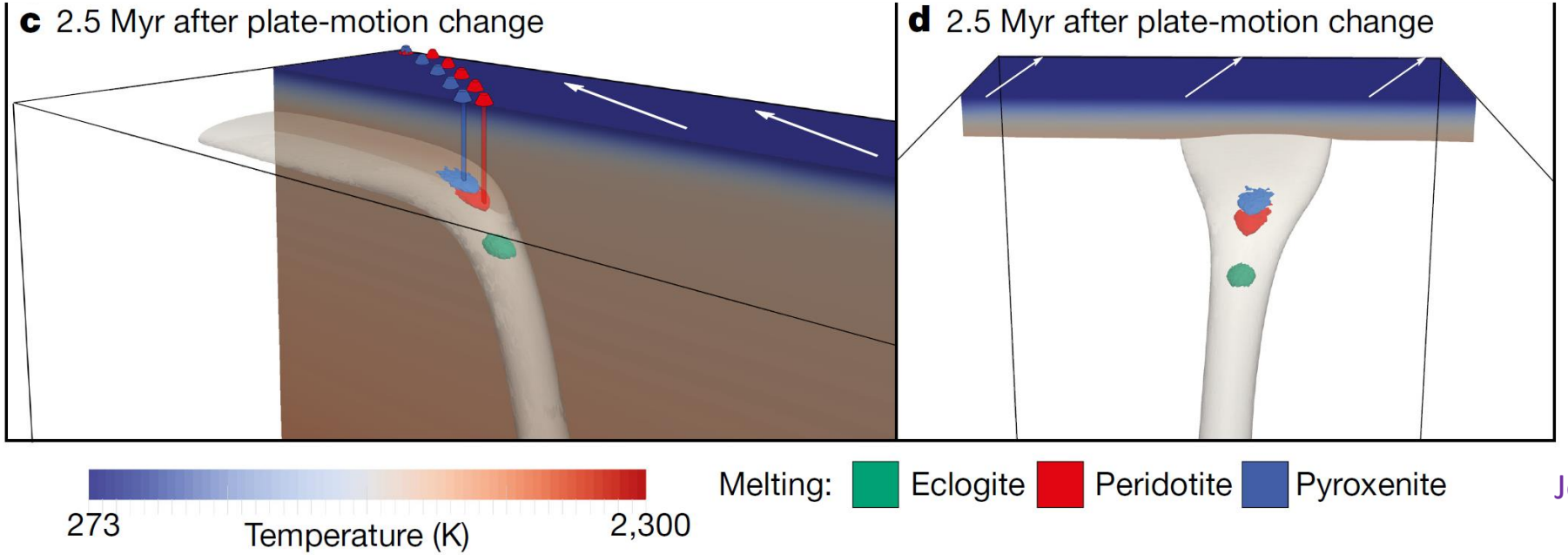
Tilted plume:
Displaced
Melting zones




Jones et al. (2017)

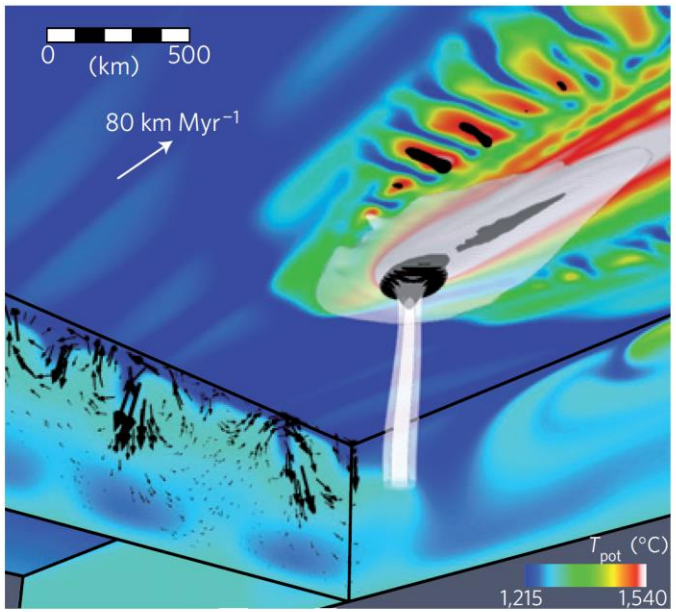
# Geochemical asymmetry: alternative hypotheses

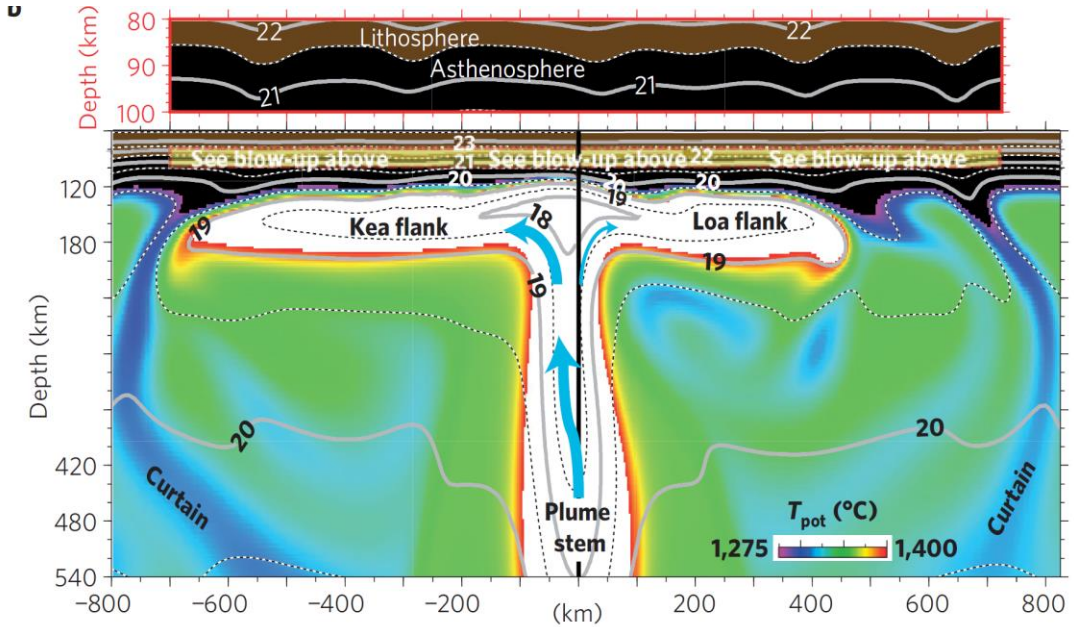
**Tilted plume:**
Displaced
Melting zones




Jones et al. (2017)

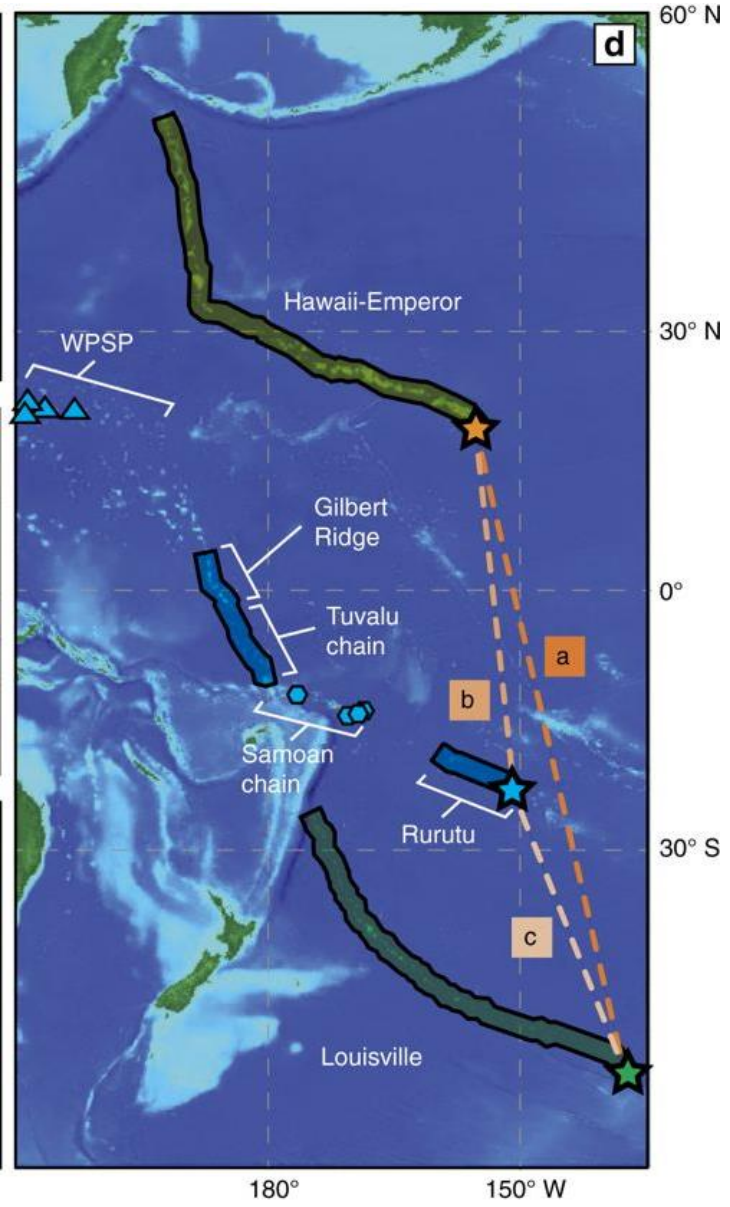
**Small-scale convection:**
T-gradient across Melting Zone



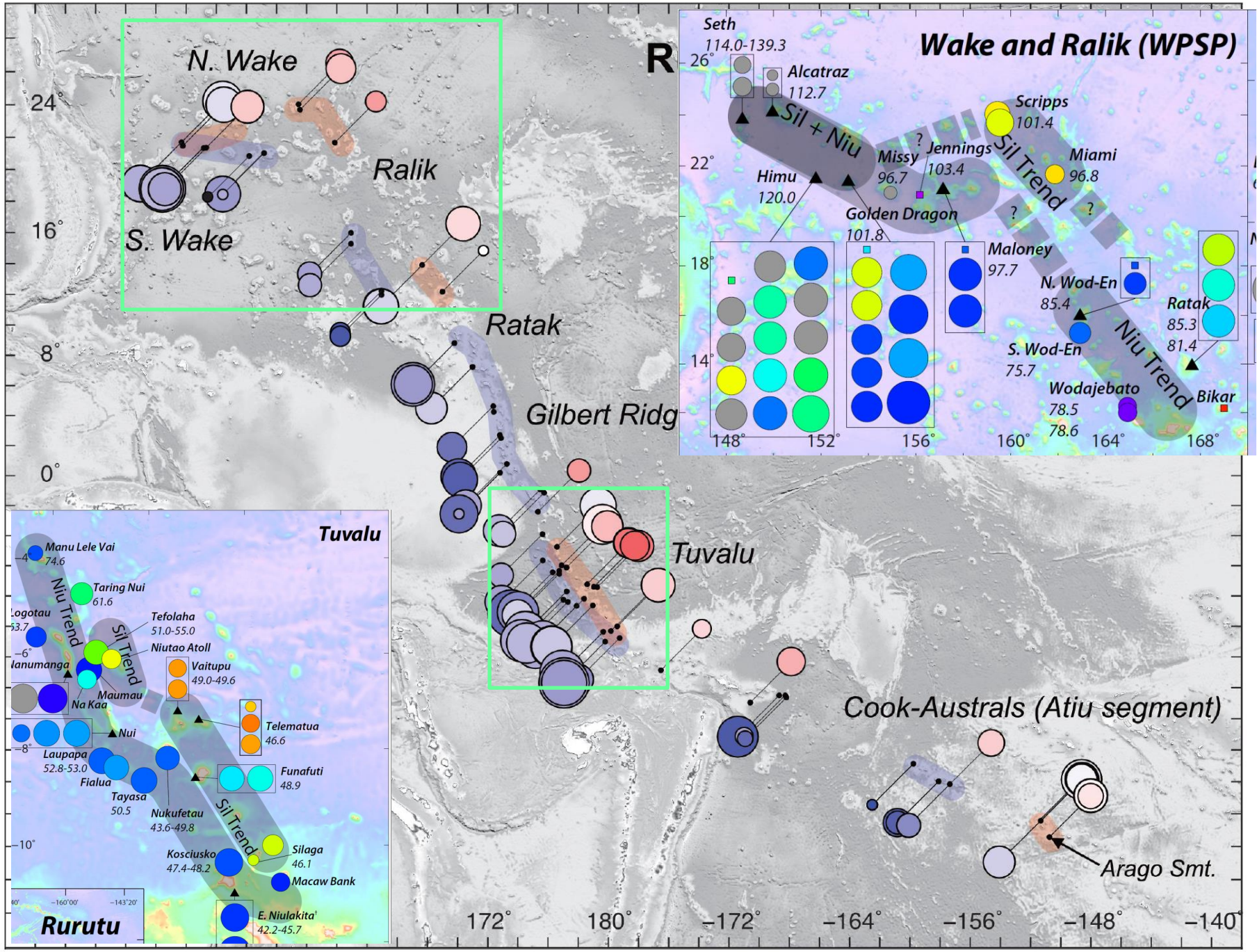




Ballmer et al. (2011; 2013; 2015)

# Motivation #2

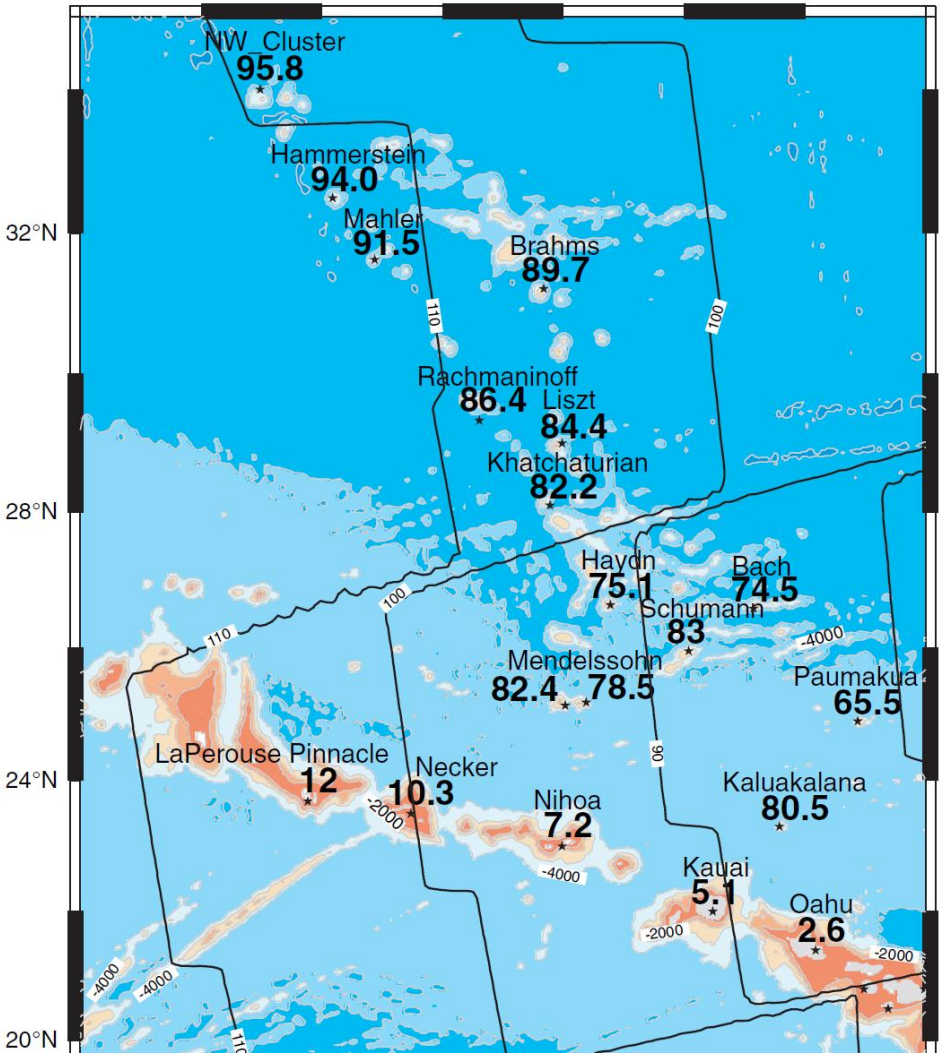



Konrad et al. (2018)



# Widely-space double hotspot chains elsewhere

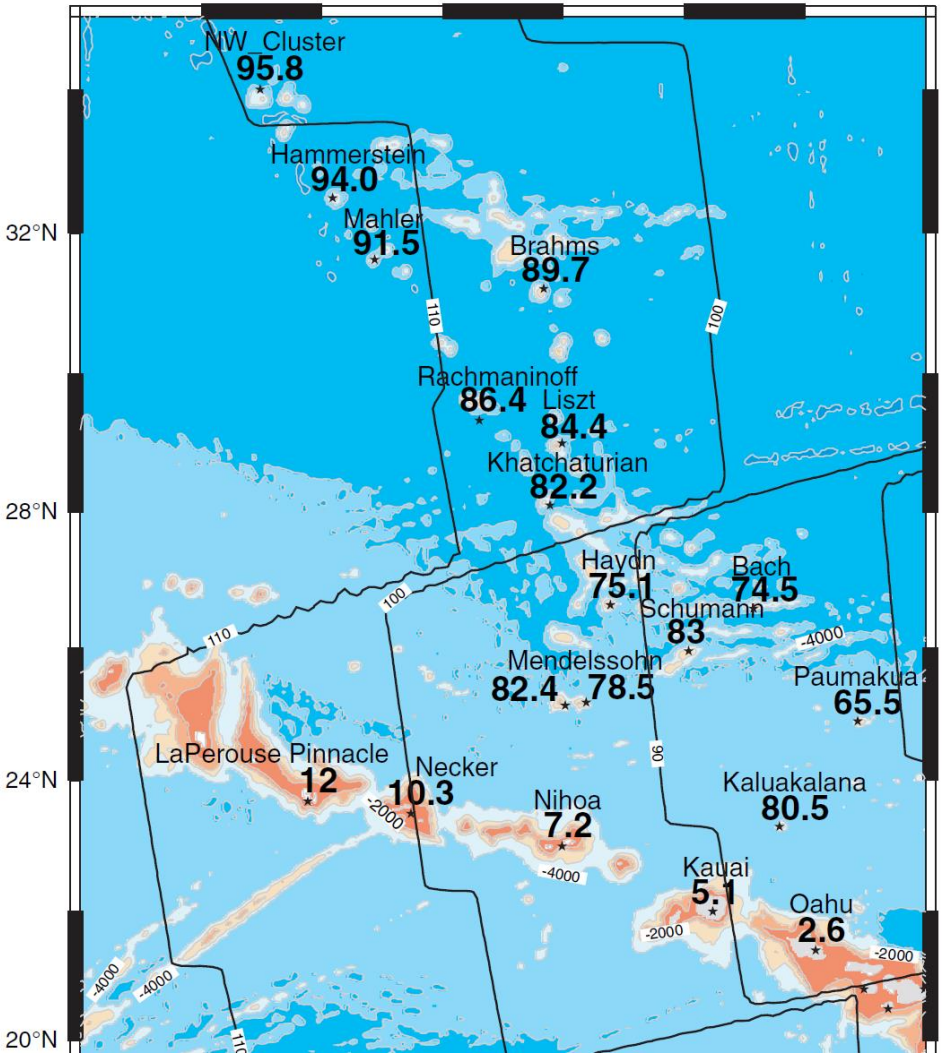
Clouard+05




Musician Seamounts

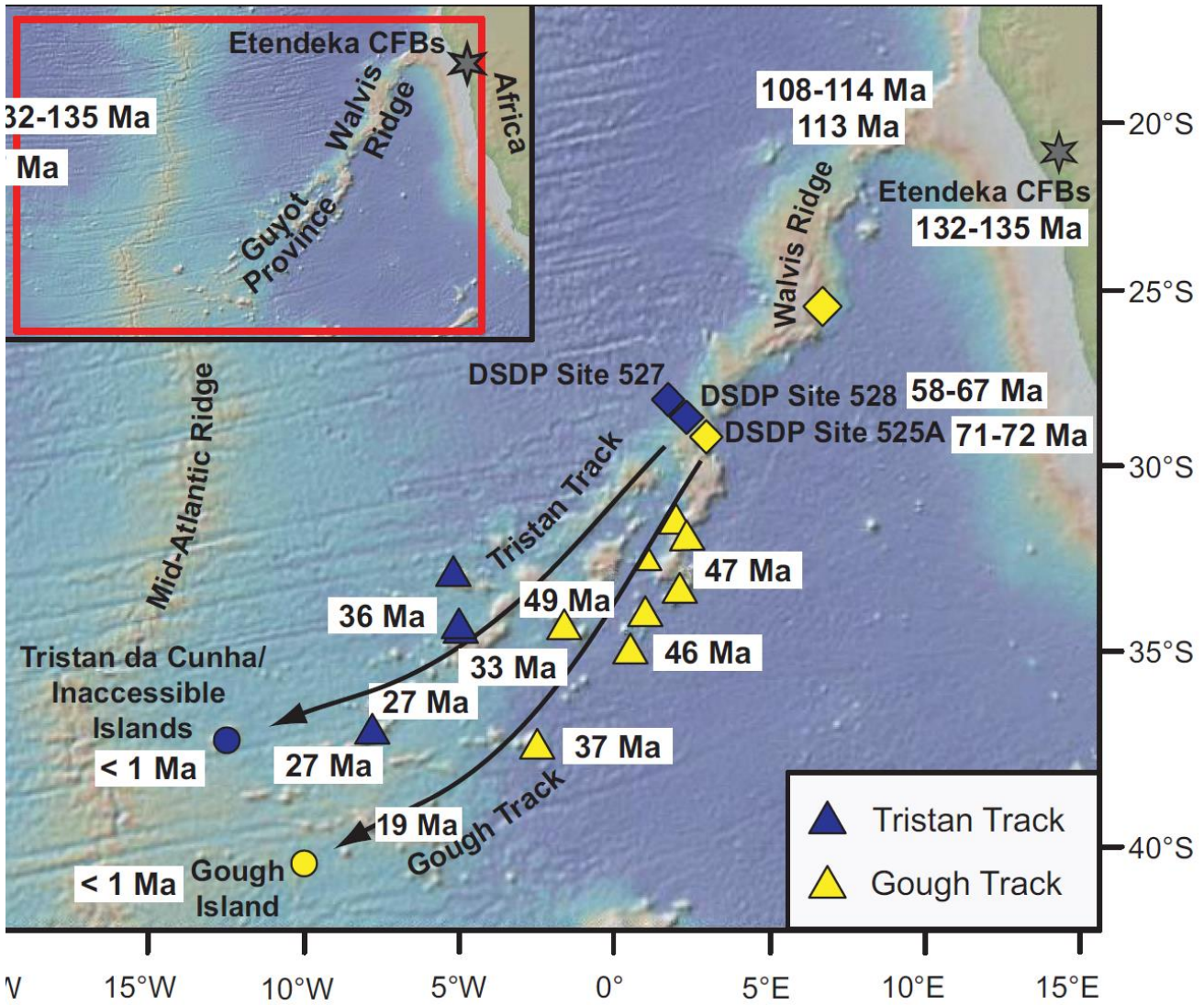
# Widely-space double hotspot chains elsewhere

Clouard+05




Musician Seamounts

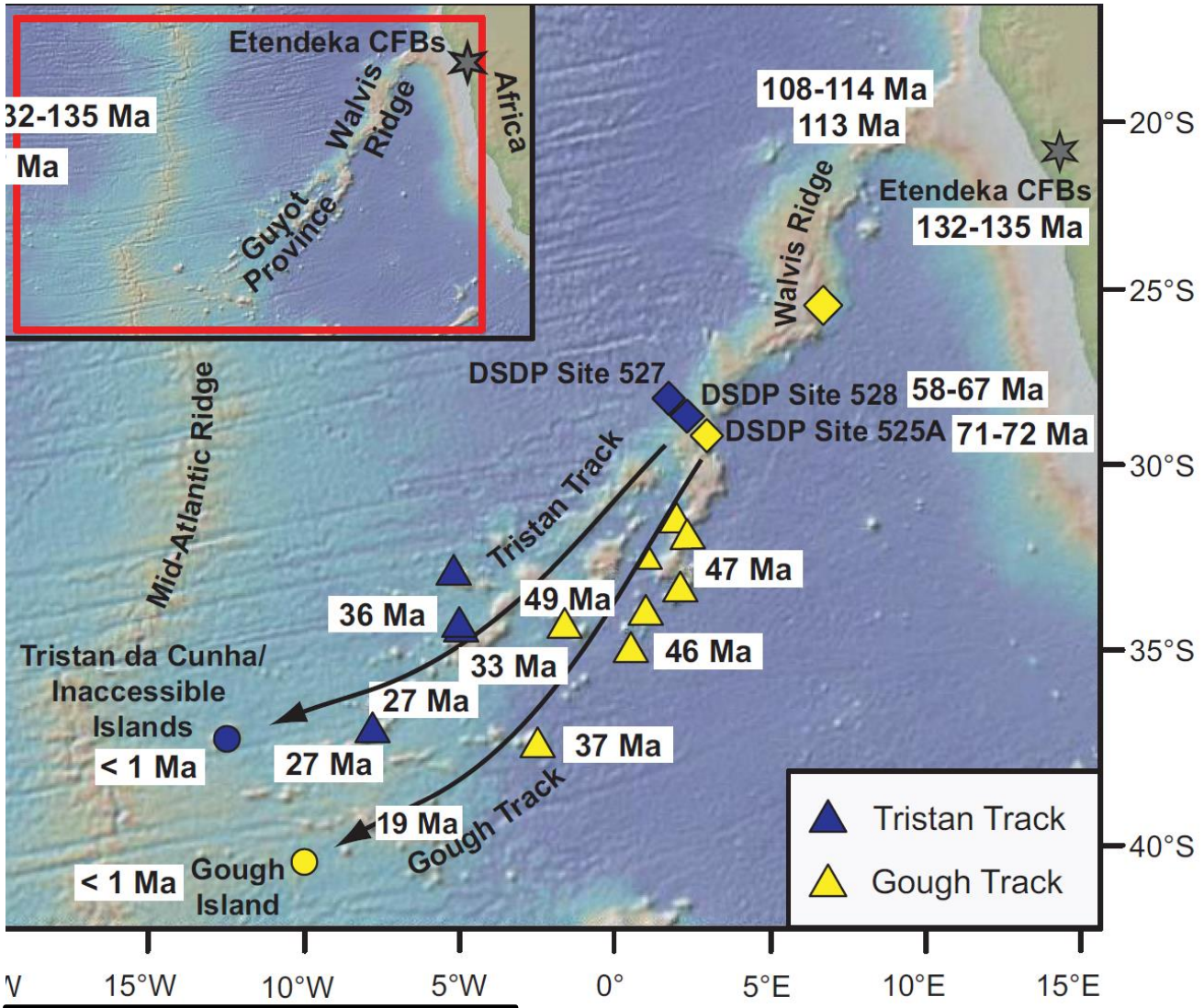
Rhode+13




Tristan-Gough

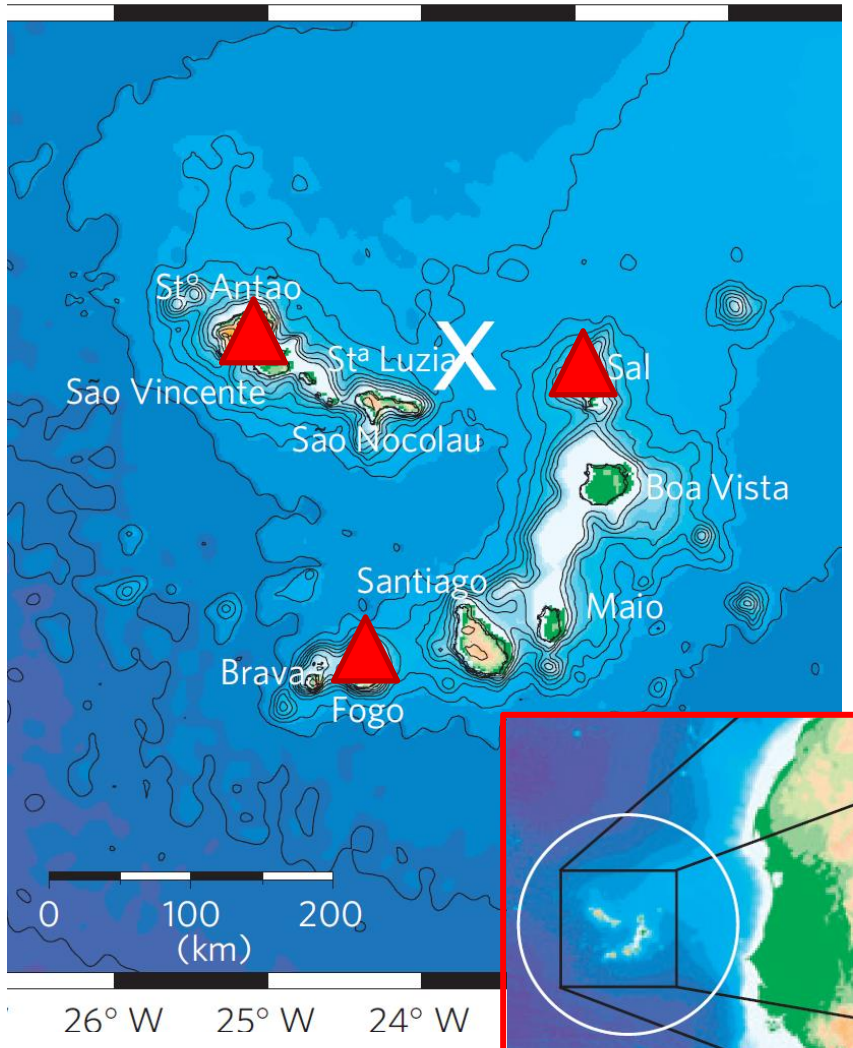
# Widely-space double hotspot chains elsewhere

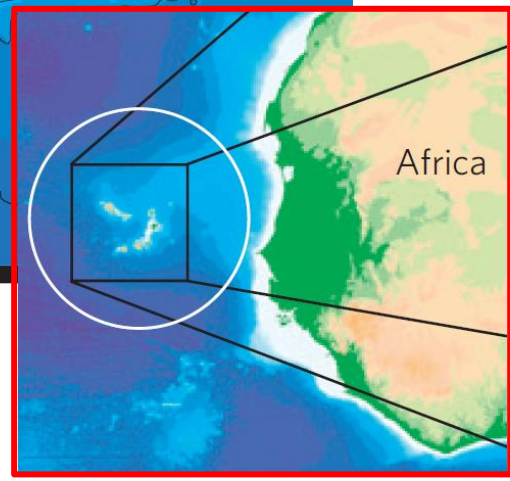
Rhode+13




Tristan-Gough

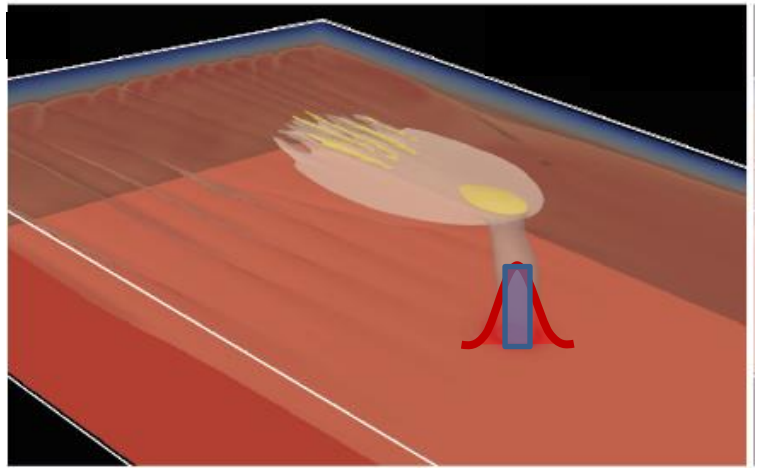
Ramalho+10



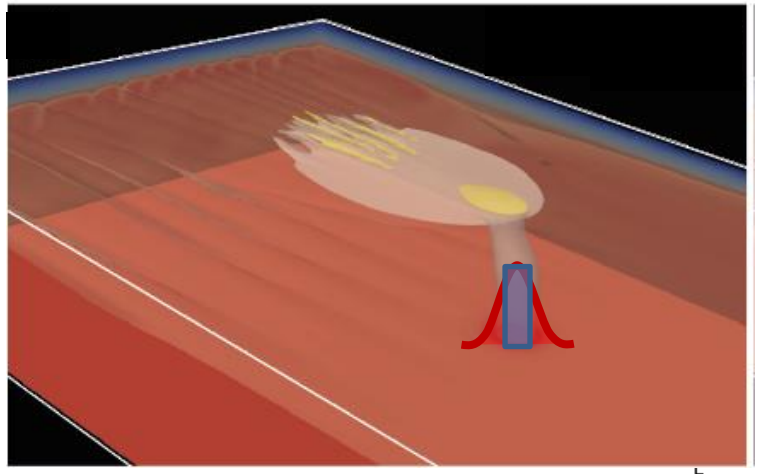

Cabo Verde

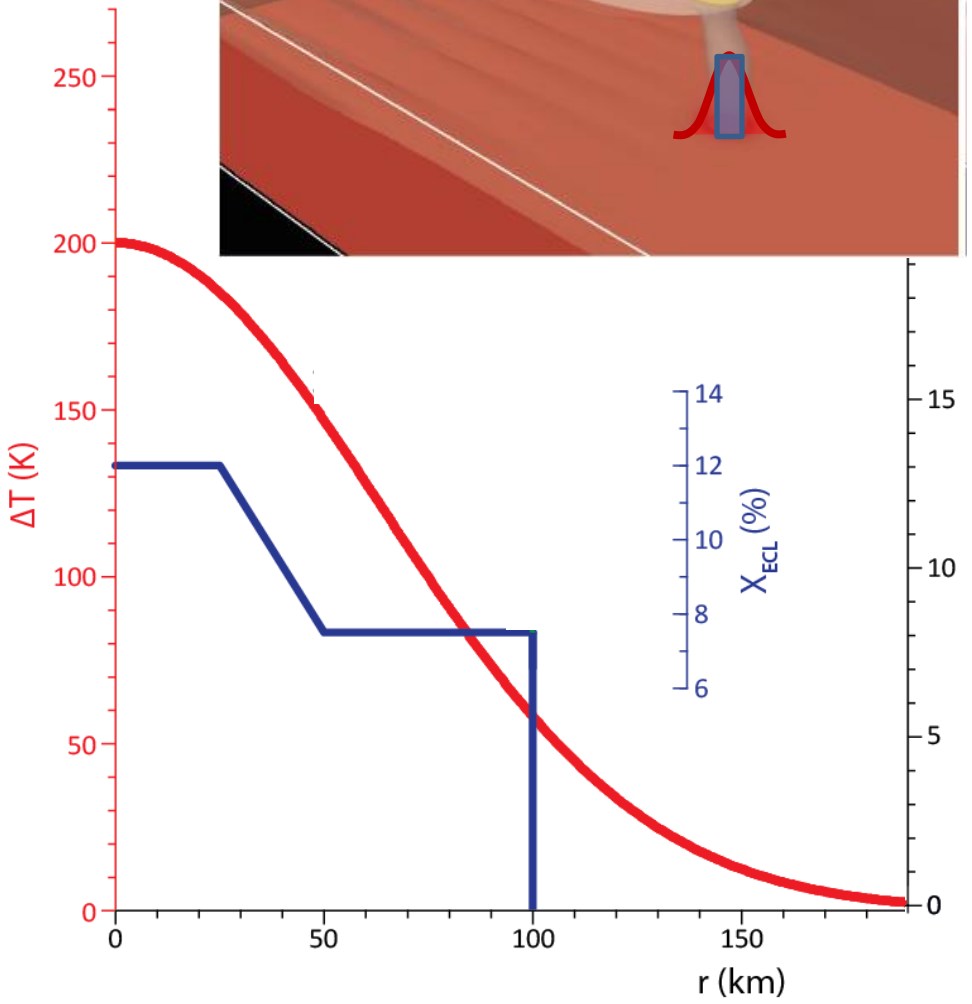
# Initial distribution of eclogite in the plume stem

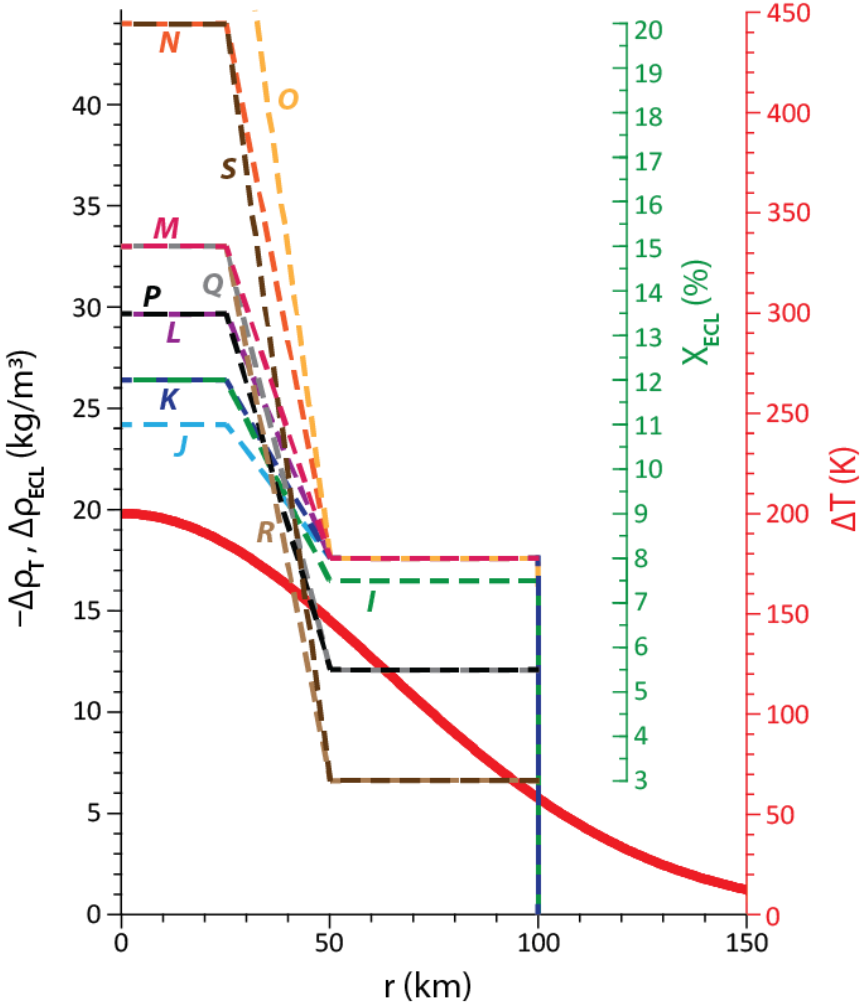


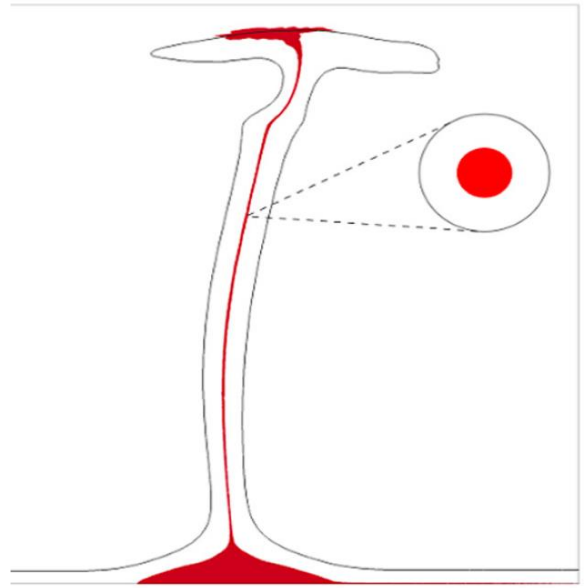
Model setup with thermal and compositional anomaly at the bottom of the box

# Initial distribution of eclogite in the plume stem





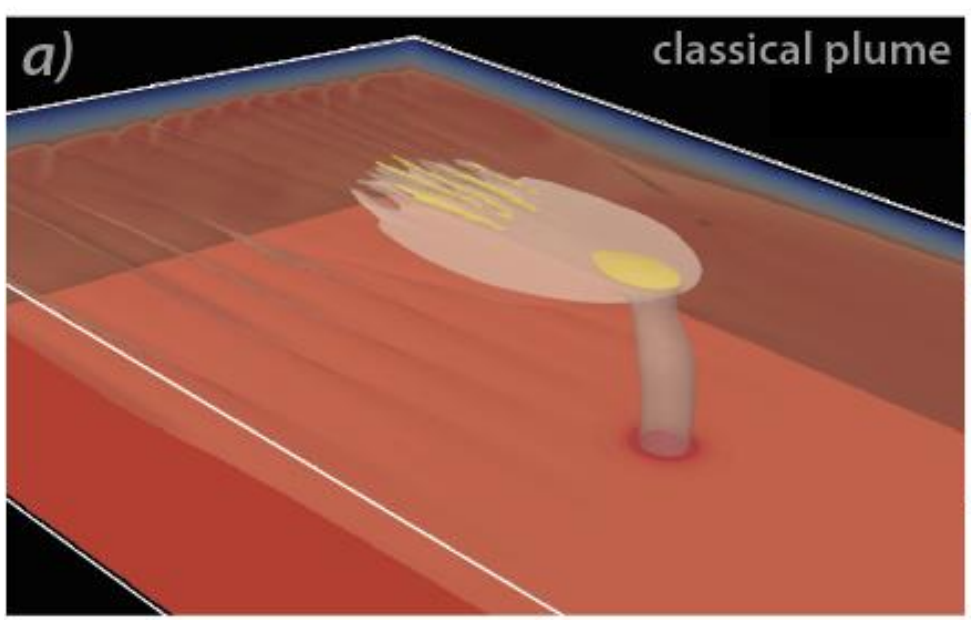



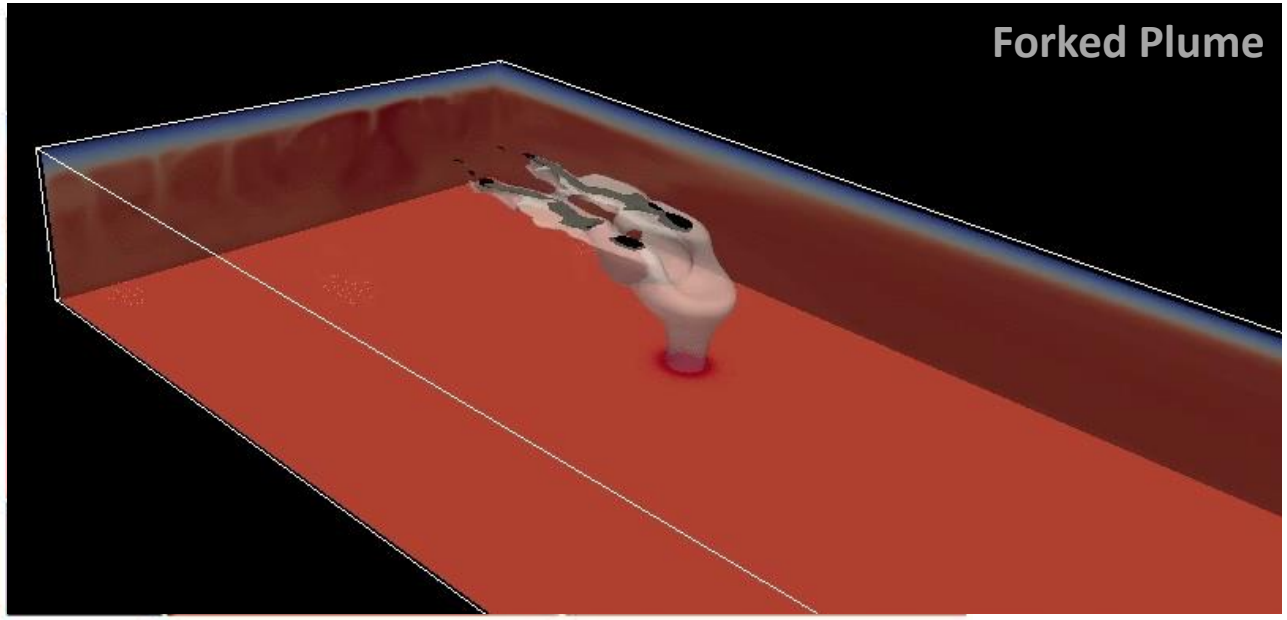



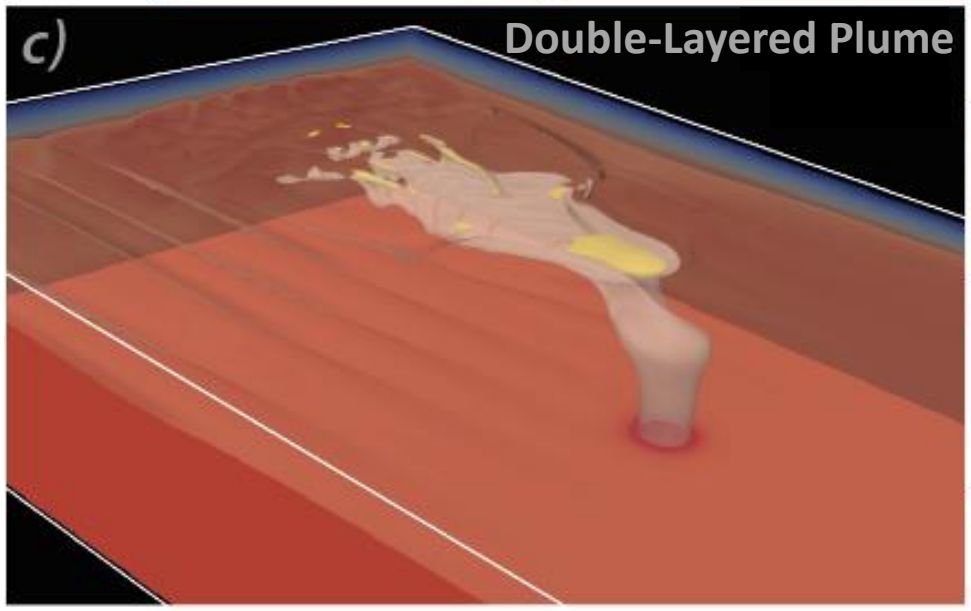
Jones et al. (2016)

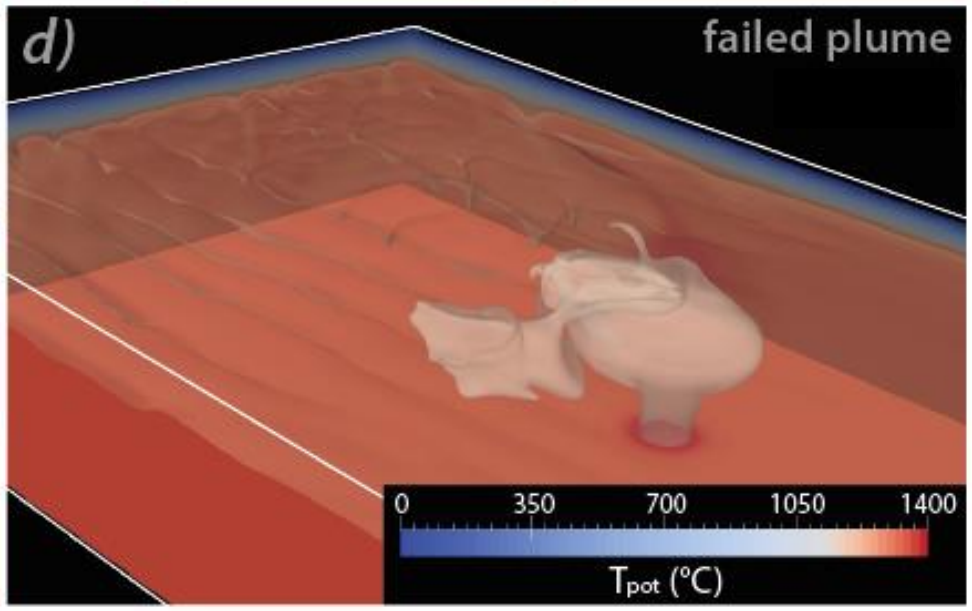
more eclogite in the center of the plume stem than at periphery

# Thermo-chemical Plume regimes



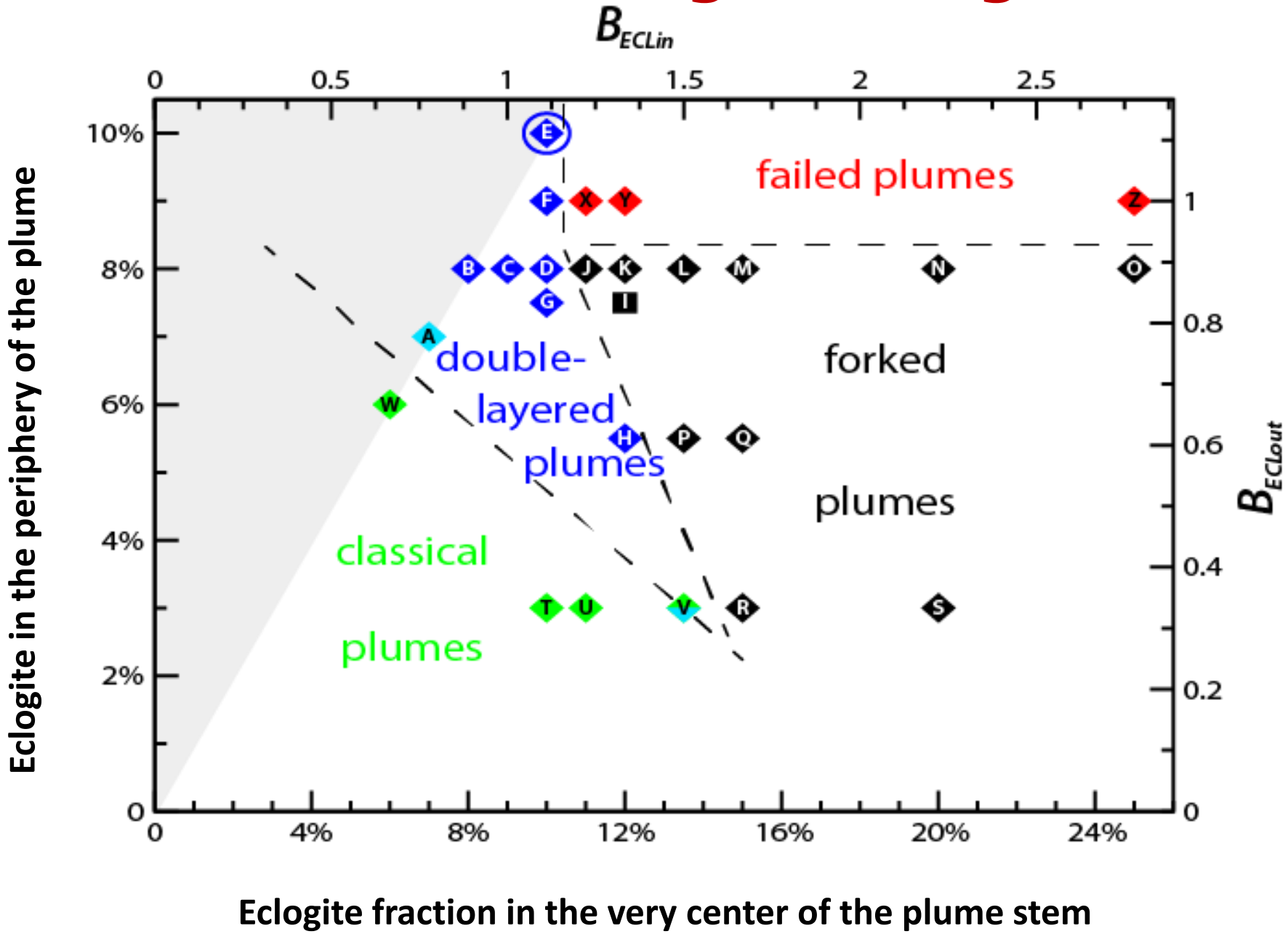



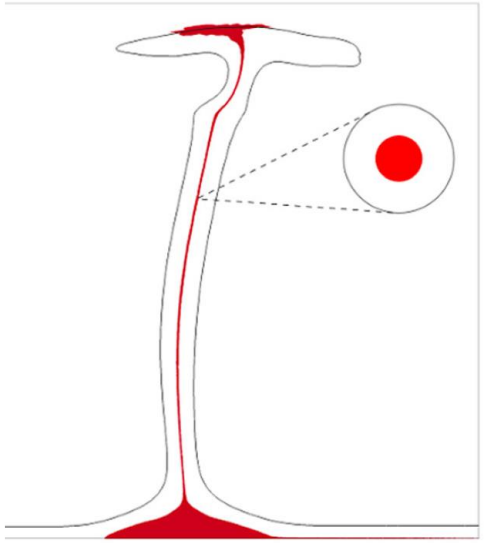




… as in Ballmer et al. 2013

mantle melting zone

# Regime Diagram

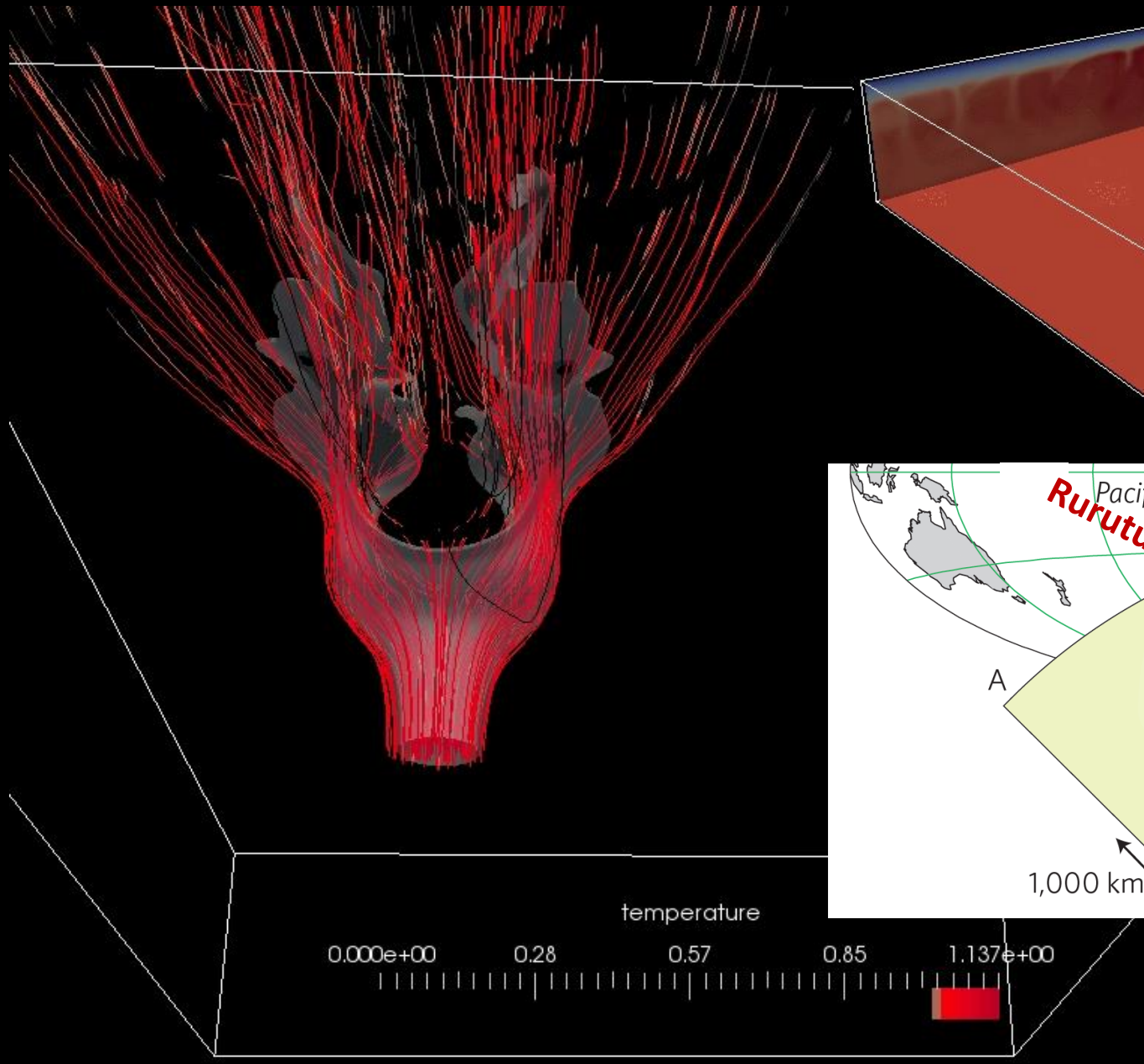


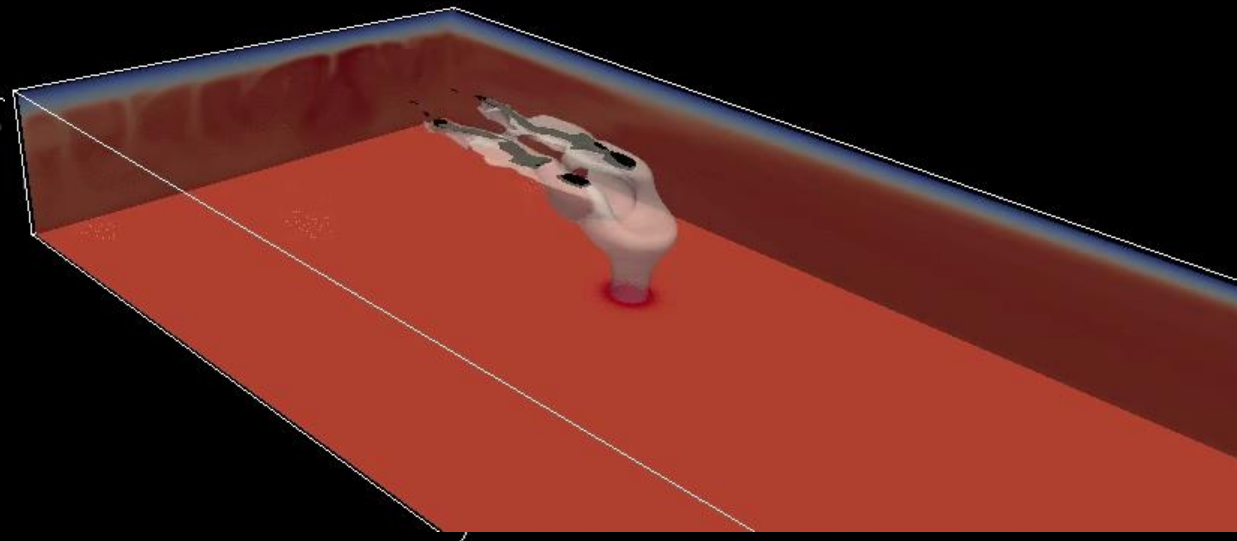



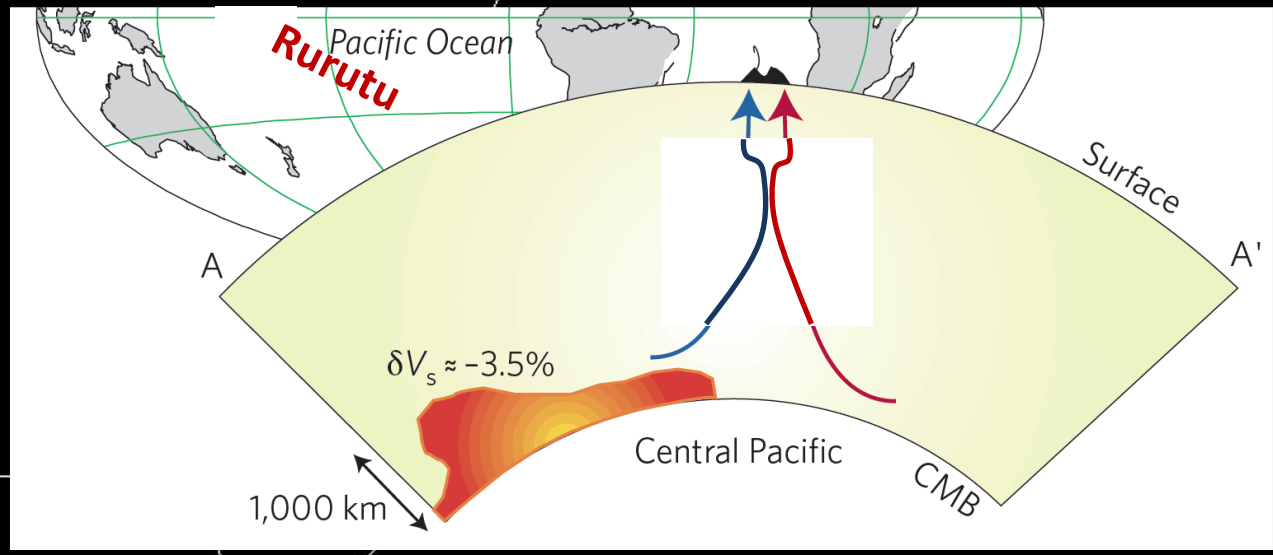
Jones et al. (2016)

more eclogite in the center of the plume stem than at periphery

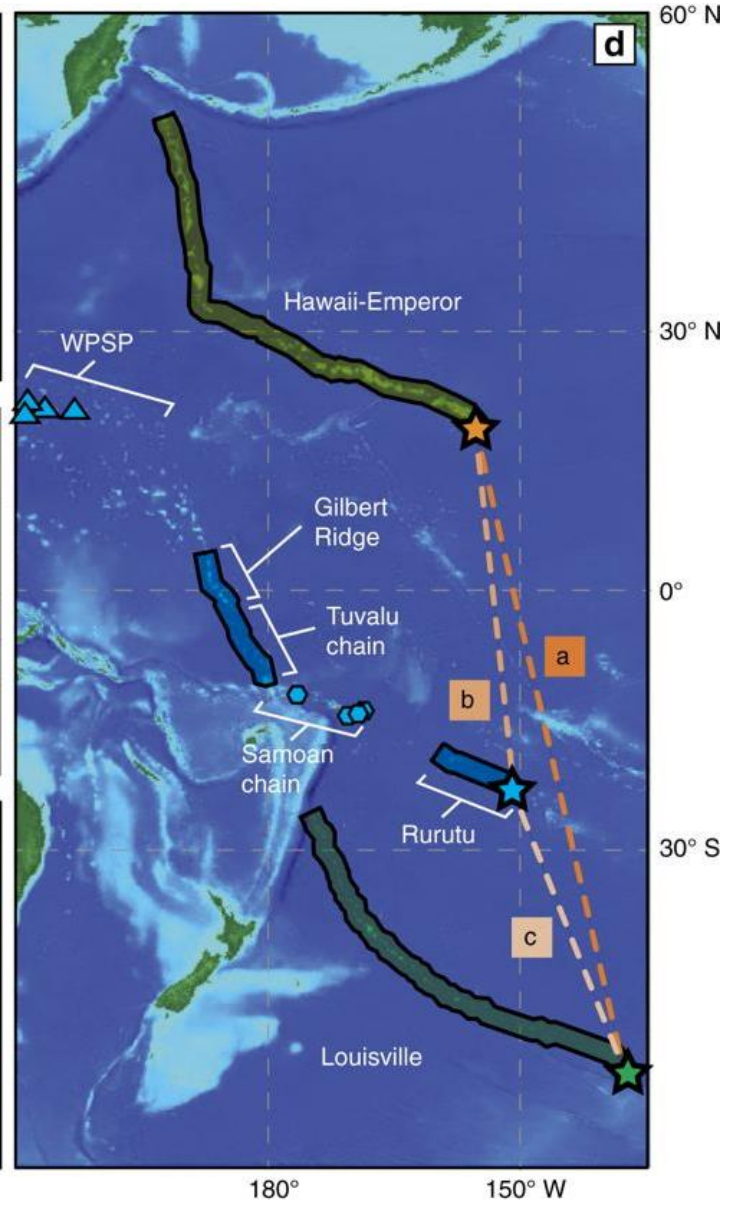
# forked thermochemical plumes

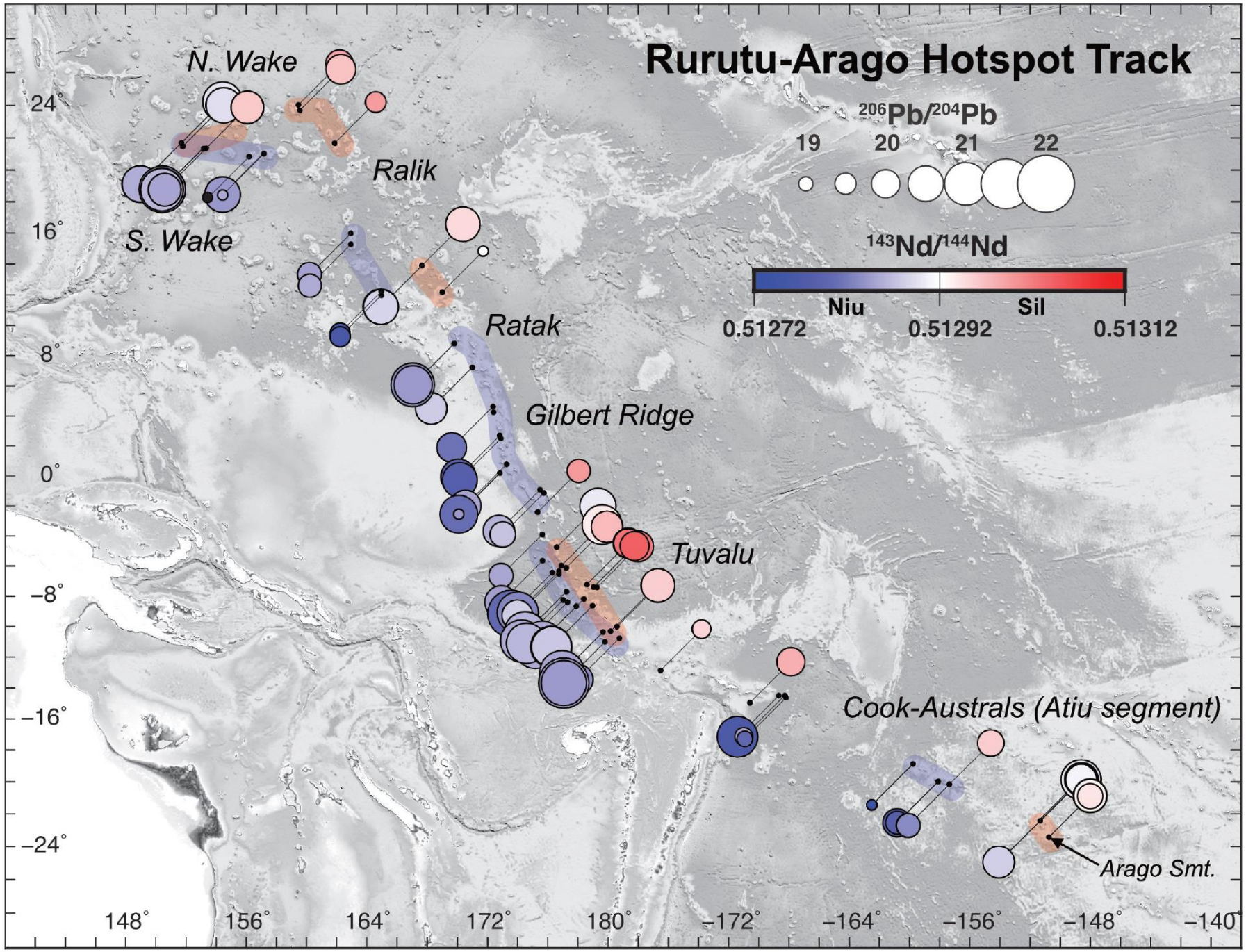




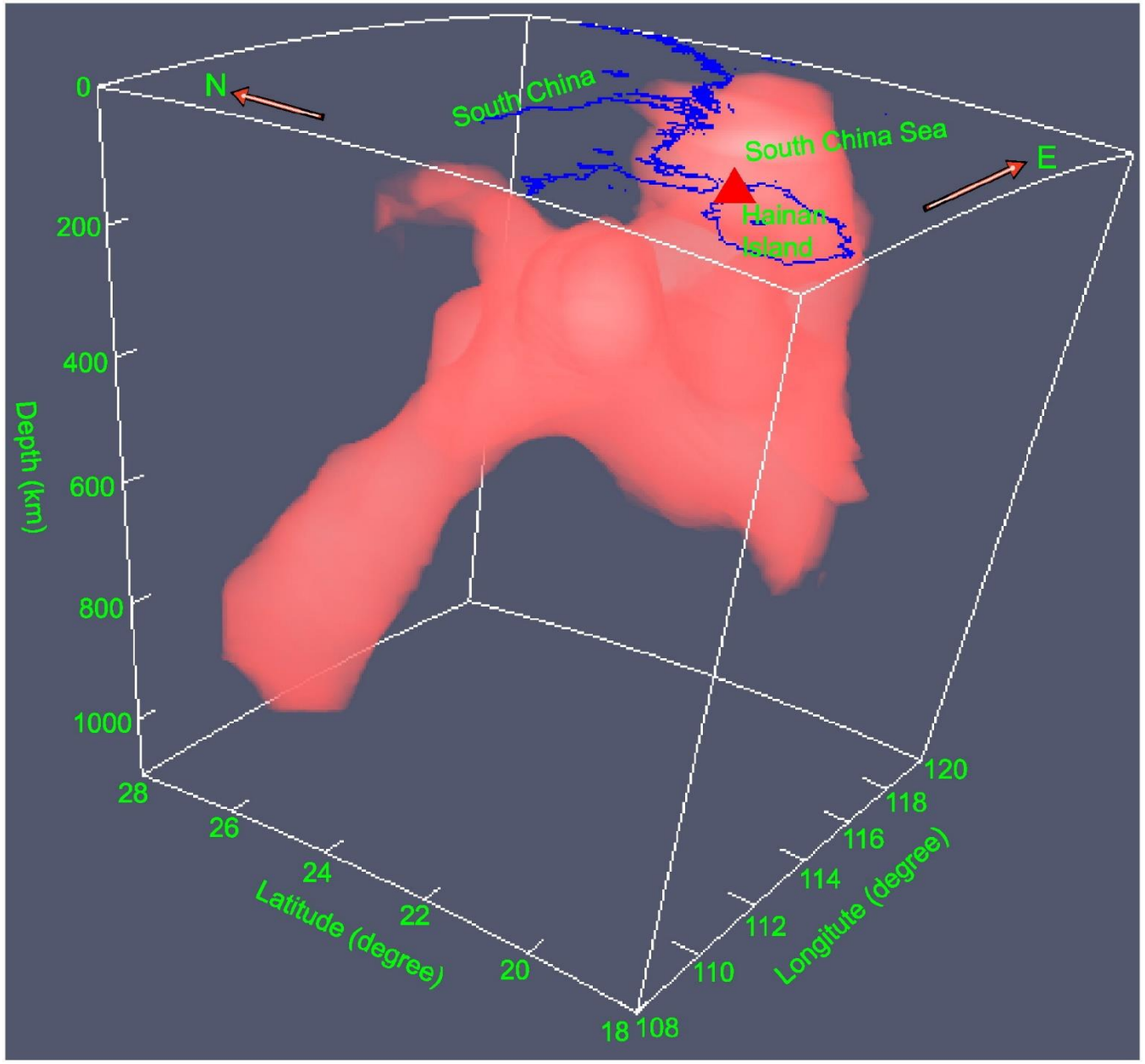
# Rurutu hotspot

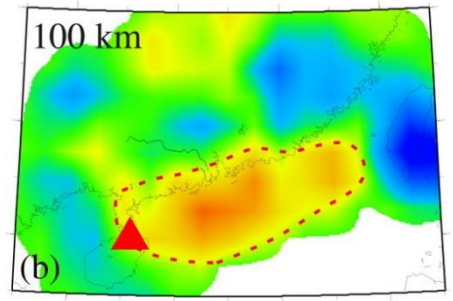


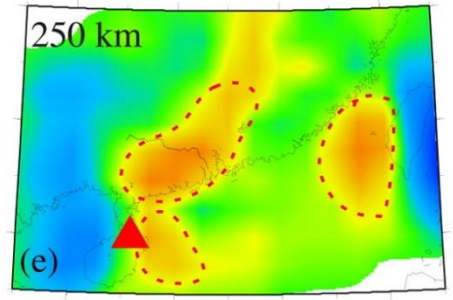



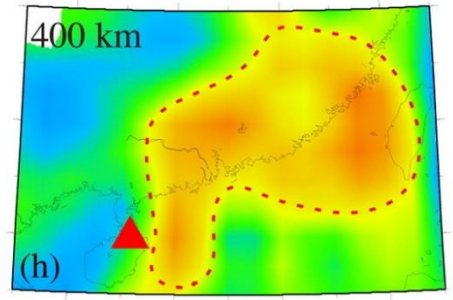

Konrad et al. (2018)

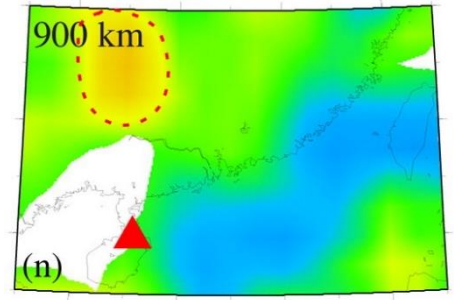
# Geophysical Evidence: Hainan Plume

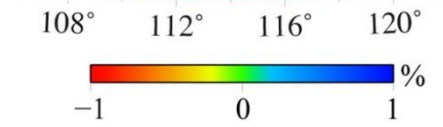


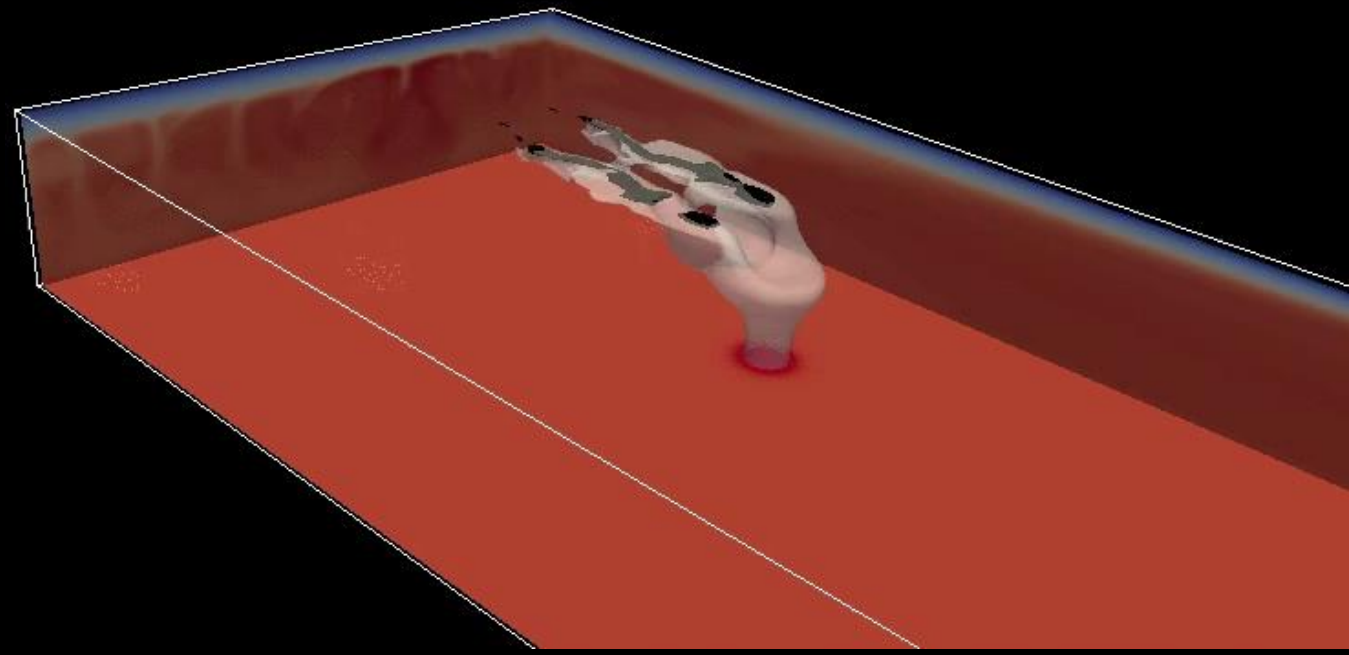




Xia et al. (2016)

# Conclusions



**Forked plumes:**

-- are geodynamically viable to occur
(wide parameter space)

-- explain double-hotspot chains

-- are consistent with geophysical observations (Hainan Plume)

-- provide an ideal opportunity to map out lower-mantle geochemical structure