Subduction Interface Processes

Seamount Chain - Subduction Zone Interactions:

Localised subduction accretion and erosion in response to subduction of high relief seafloor

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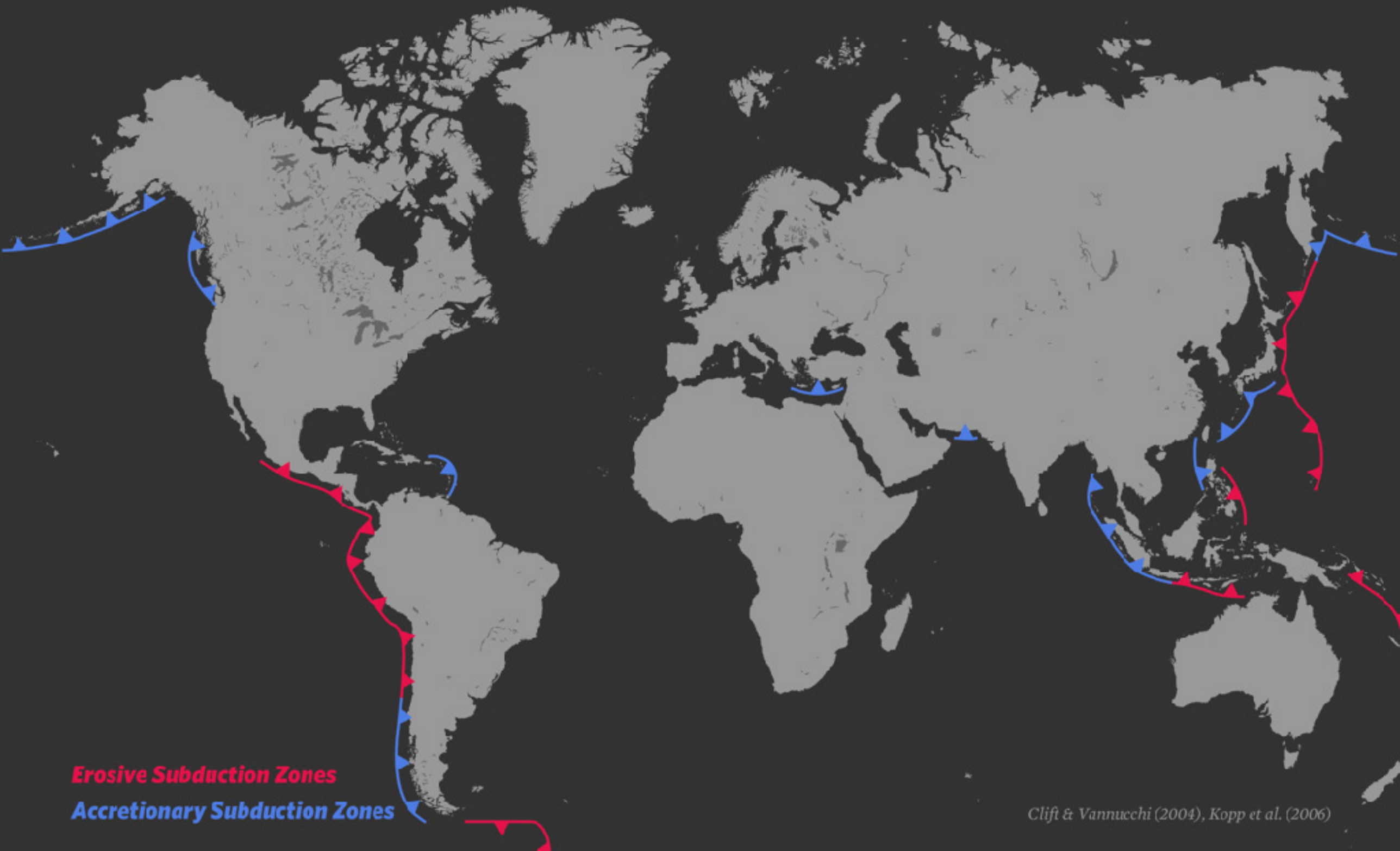
Erosive & Accretionary Subduction Zones



Clift & Vannucchi (2004), Kopp et al. (2006)

Erosive & Accretionary Subduction Zones

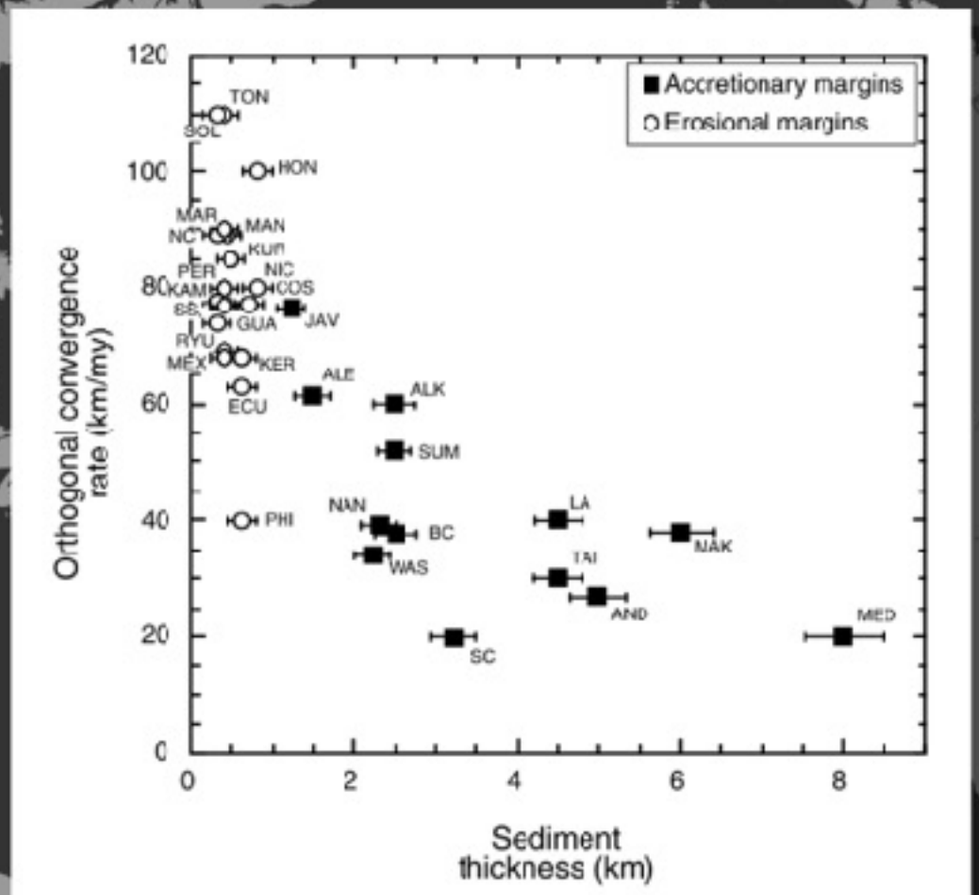


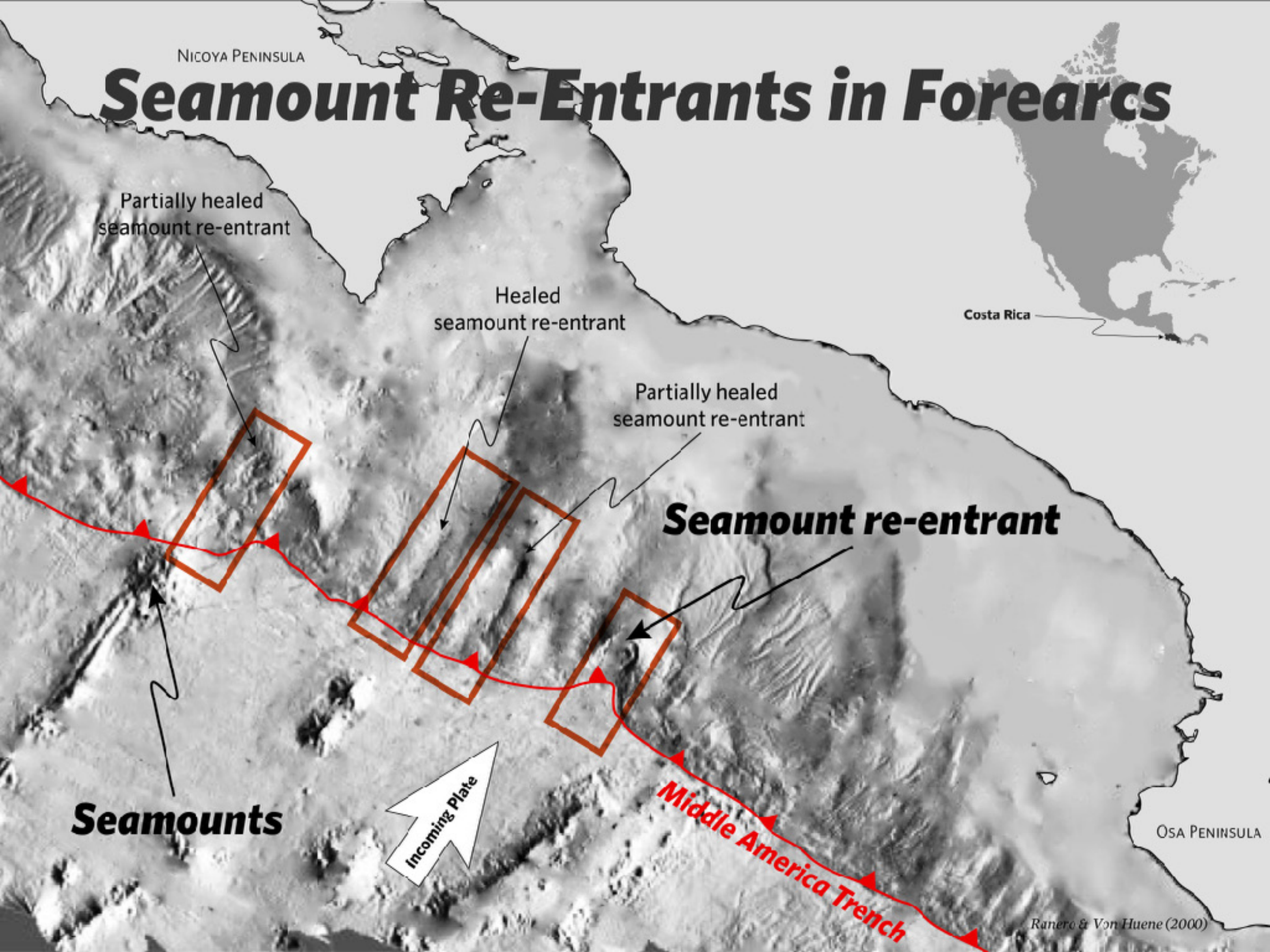
Figure 10. Plot of sediment thickness at the trench related to the velocity of the plate convergence.

Erosive Subduction Zones

Accretionary Subduction Zones

Clift & Vannucchi (2004), Kopp et al. (2006)

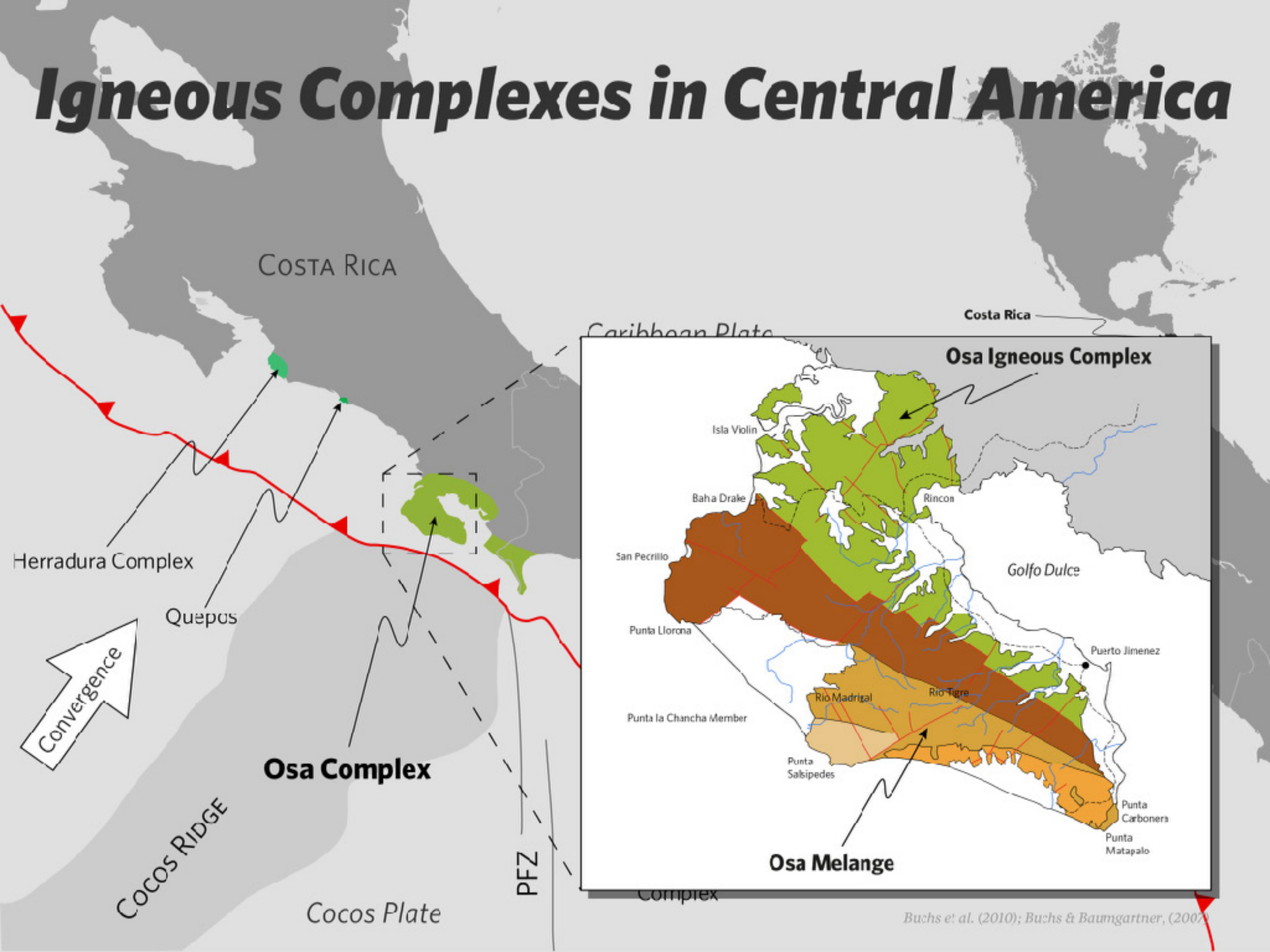
Seamount Re-Entrants in Forearcs



Igneous Complexes in Central America

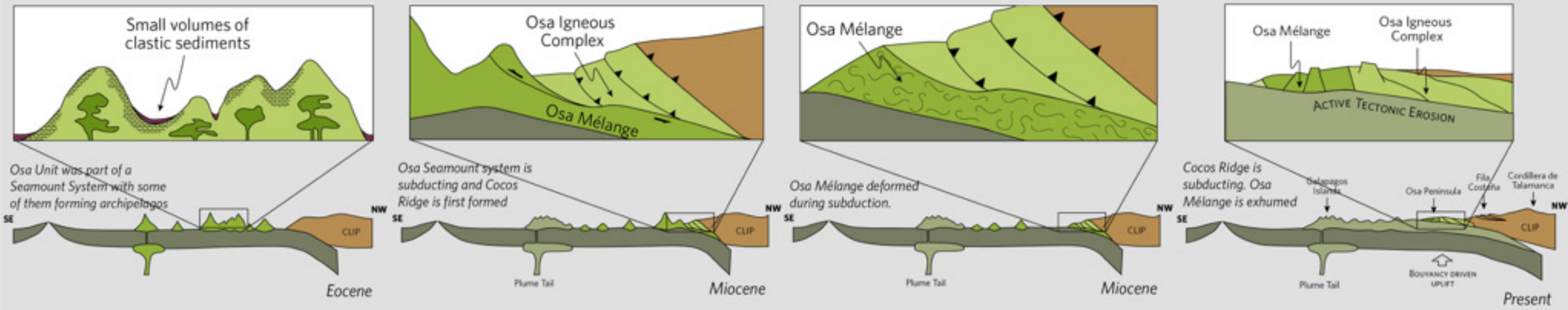
Buchs et al. (2010); Buchs & Baumgartner, (2007)

Igneous Complexes in Central America



Buchs et al. (2010); Buchs & Baumgartner, (2007)

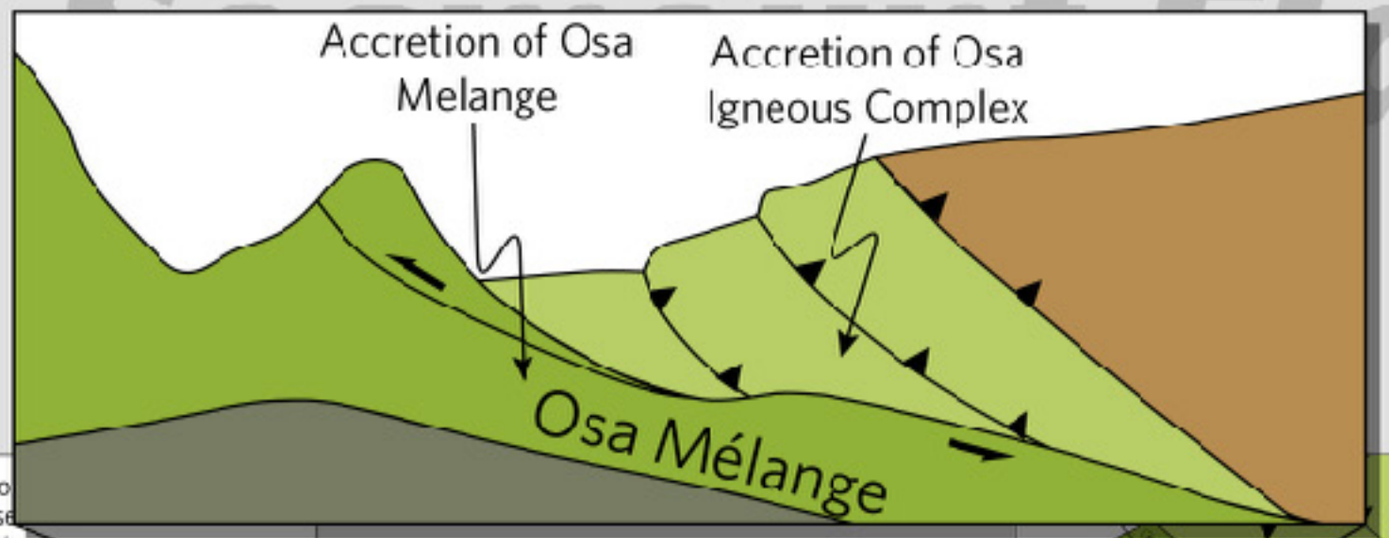
Mélange as Tectonised Seamount Flanks?

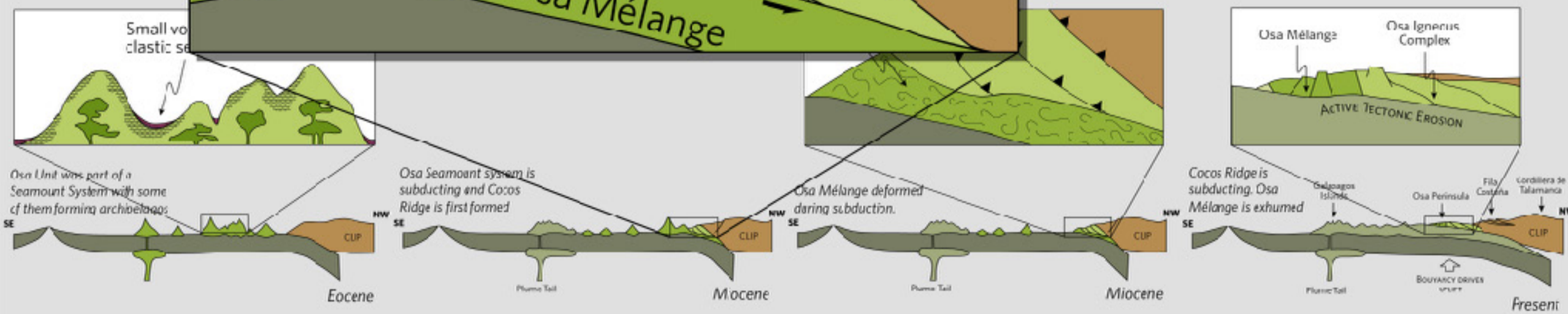


Vannucchi et al. (2006)

Mélange as Tectonised Seamount Flanks?

Direct seamount accretion





Vannucchi et al. (2006)

Map of San Pedrillo Unit

Charco Azul Group
- Almuelles Formation (E. Fleistocene)
- Burica Formation (L. Pliocene)
- Punta la Chancha Member (M. Pliocene)
- Peñita Formation (E. Pliocene)

Osa Mélange
- Salsipuedes Unit (Miocene)
- Cabo Matapalo Unit (L. Oligocene – E. Miocene)
- San Pedrillo Unit (L. Cretaceous – L. Eocene)
  - Las Caletas Sub-Unit
    - Drake Package
    - Cocolito-Caletas Package
    - Punta Marenco Package
  - Punta Campanario Sub-Unit
  - Punta San Pedrillo Sub-Unit
- **Osa Igneous Complex** (L. Cretaceous - L. Eocene)

Punta Aguijas
Playa Caletas
Punta Marenco
Bahia Drake
Rio Claro
Punta San José
Playa San Josecito
Punta Campanario
Punta San Pedrillo
San Pedrillo
Punta Llorona
Punta Salsipedes
Puerto Jimenez

Pelite & chert mélange

Pelitic mélange with basalt & carbonate blocks

Brecciated basalt & gabbro mega-blocks

Turbiditic sediments

Pelagic sediments

N

1 km

10 km

Vannucchi et al. (2006); Buchs & Baumgartner (2007)

Altered Mudrock Looks & Behaves like Basalt

Altered Mudrock Looks & Behaves like Basalt

Lenticular mudstone facoid

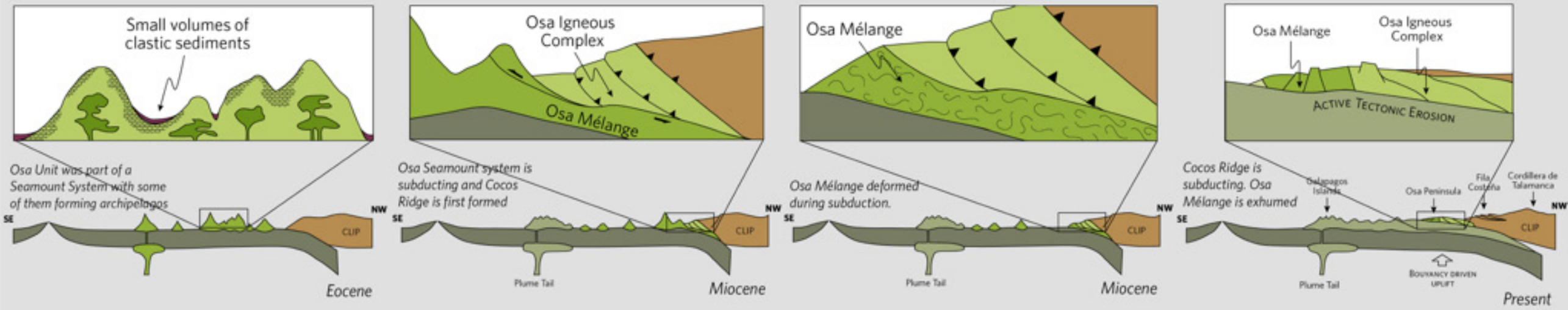
Sheared, brown clay-rich matrix

30 cm

1 mm

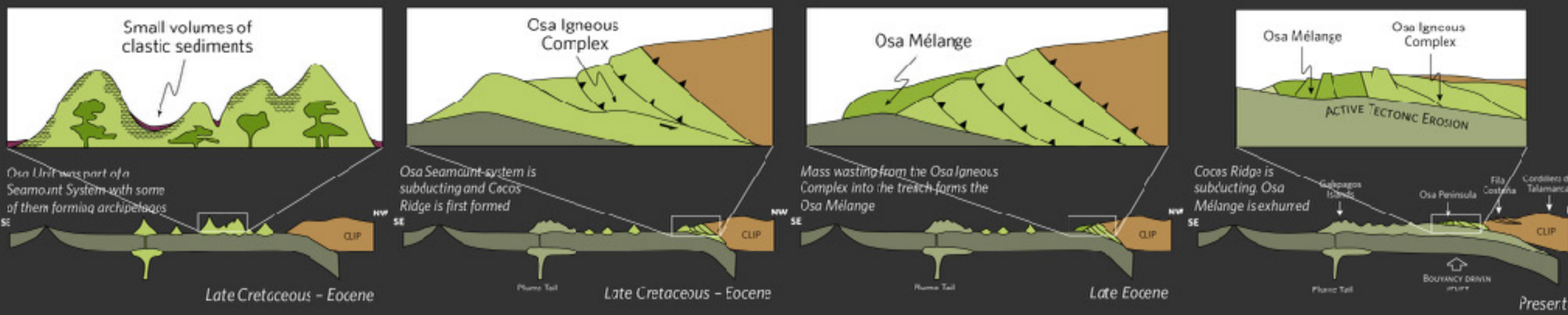
Mélange as Tectonised Seamount Flanks?

Problem: Too many sediments



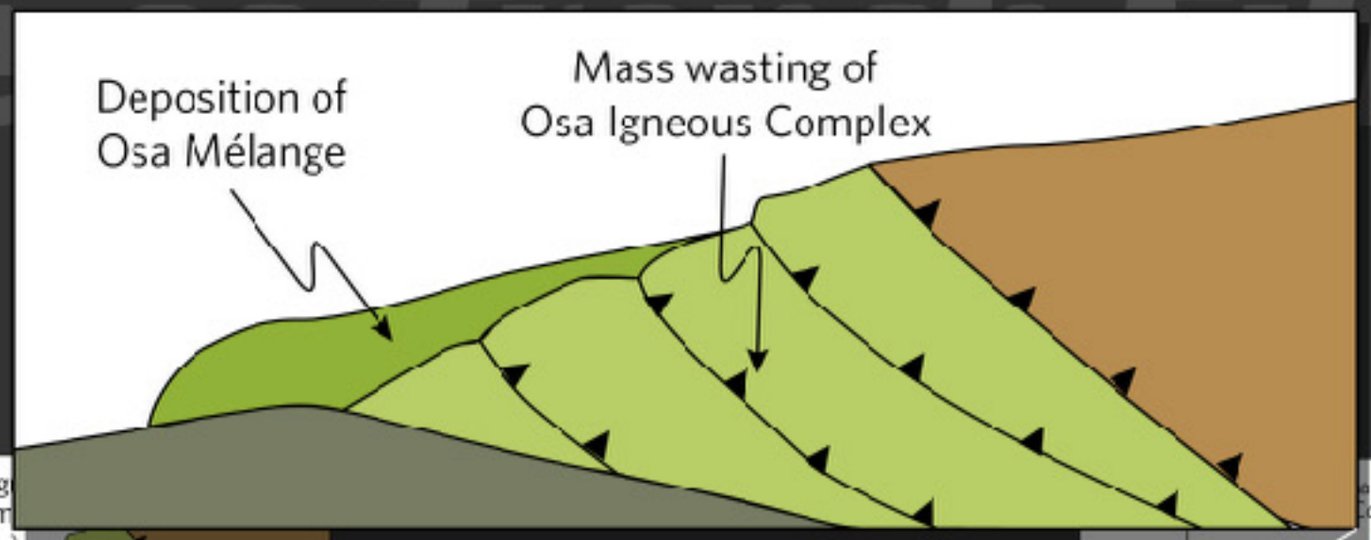
Vannucchi et al. (2006)

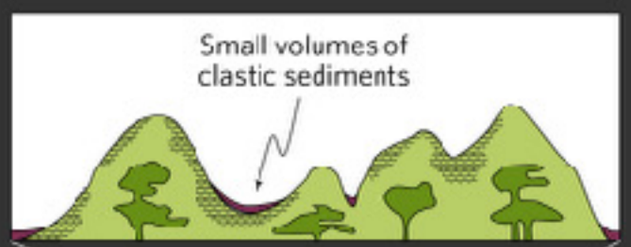
Mélange as Trench Fill?



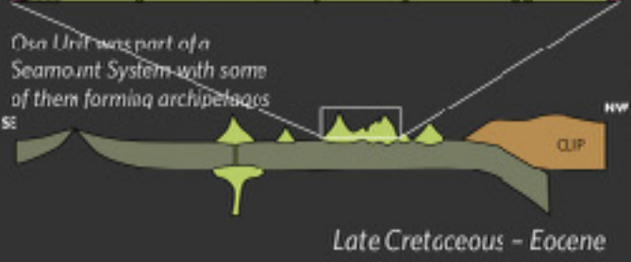
Buchs et al. (2008)

Mass Wasting into Trench & Subsequent Re-Accretion



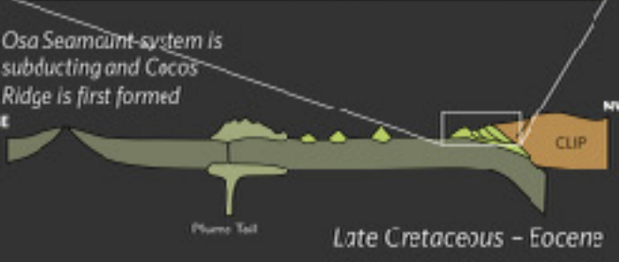


Osa Unit was part of a Seamount System with some of them forming archipelagos

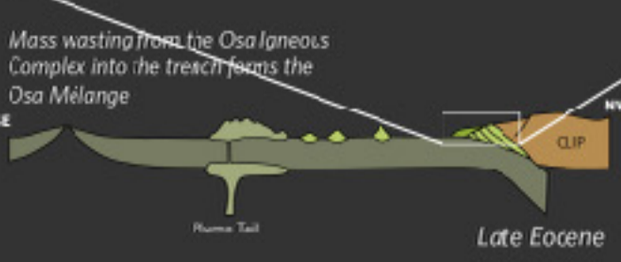


Late Cretaceous – Eocene

Osa Seamount system is subducting and Cocos Ridge is first formed

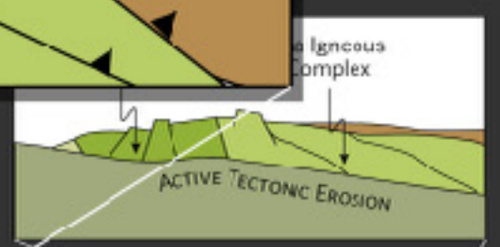


Late Cretaceous – Eocene

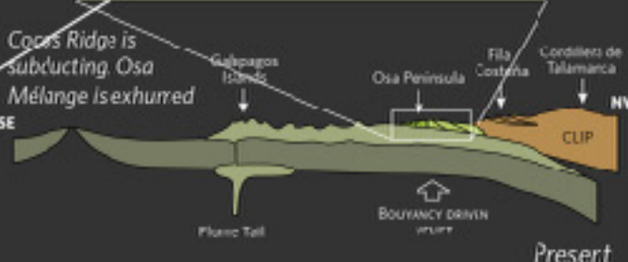


Mass wasting from the Osa Igneous Complex into the trench forms the Osa Mélange

Late Eocene



Cocos Ridge is subducting. Osa Mélange is exhumed



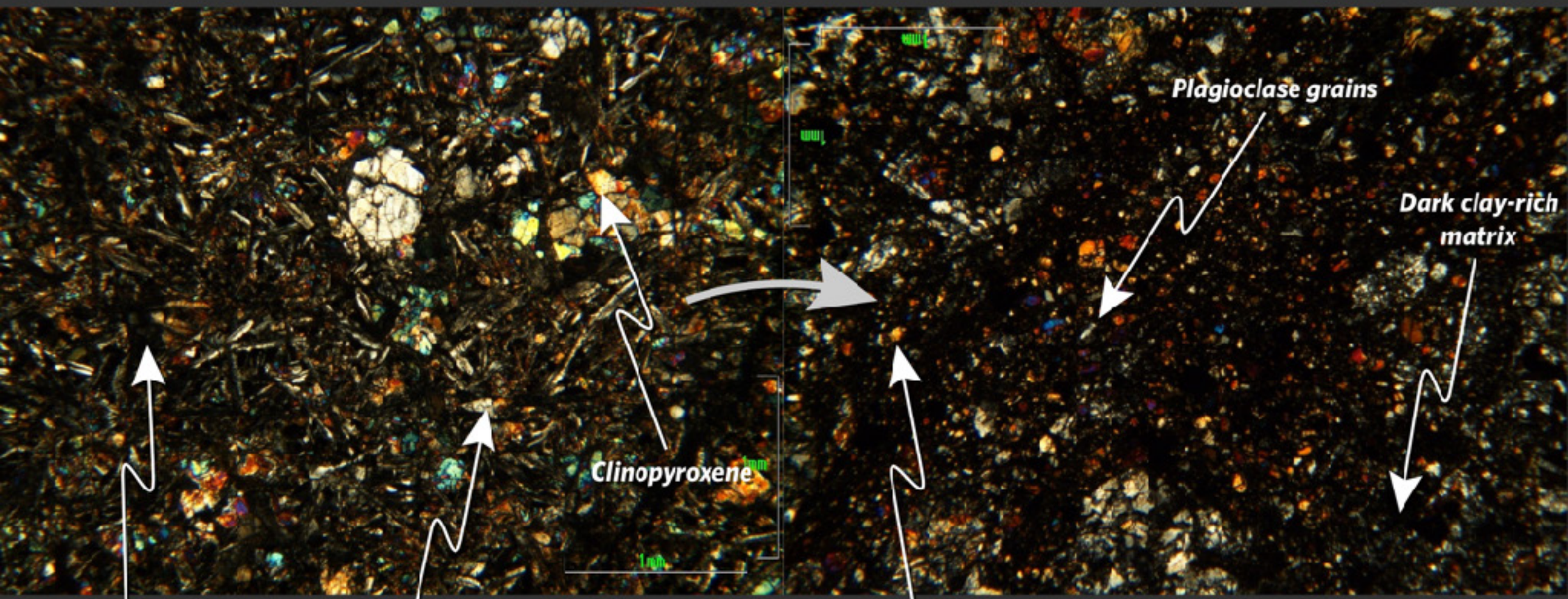
Present

Buchs et al. (2009)

Basalt-Derived Sediment

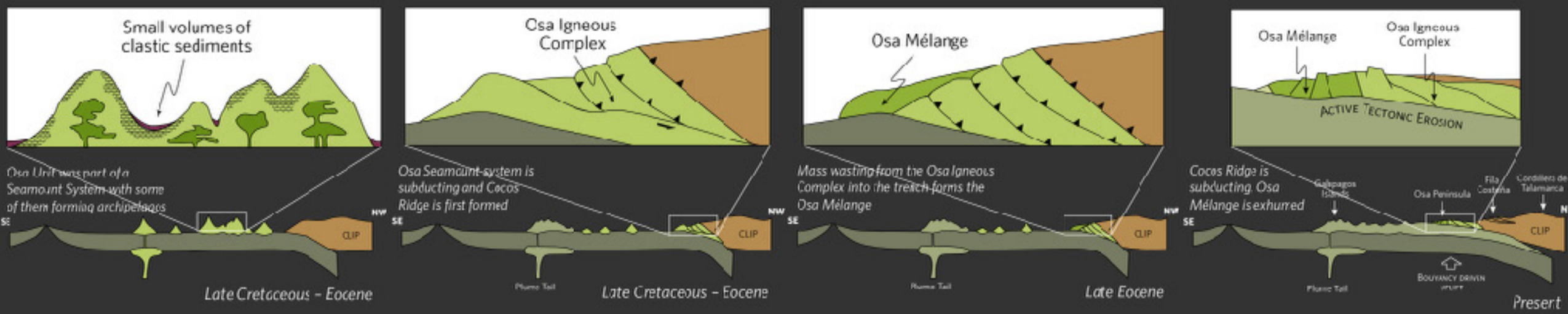
Altered Basalt

Px-rich Sandstone



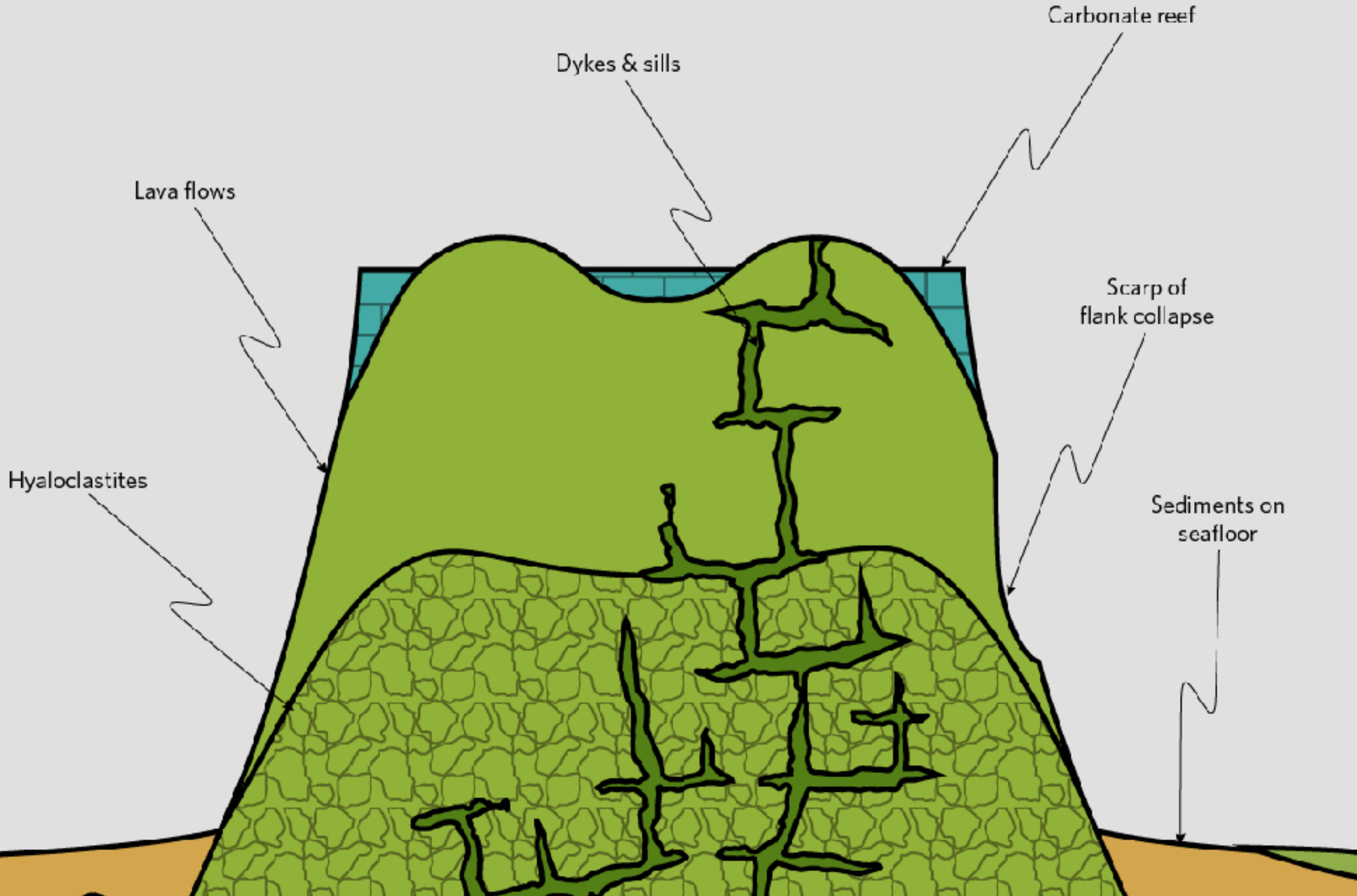
Mélange as Trench Fill?

Problem: No arc-derived material



Buchs et al. (2009)

A Closer Look at Seamounts



Ocean Plate Stratigraphy

Sandstone

Mudstone

Pelagic Limestone

Chert

Volcanoclastics

Flexural Moat Sediments

Proximal debris avalanche deposits interbedded with lava flows

Distal debris flow deposits

Turbidite deposits

Pelagic sediments

Site of ODP leg 136 drilling

Mass-wasted megablock

Carbonate reef

Dykes & sills

Lava flows

Scarp of flank collapse

Hyaloclastites

Sediments on seafloor

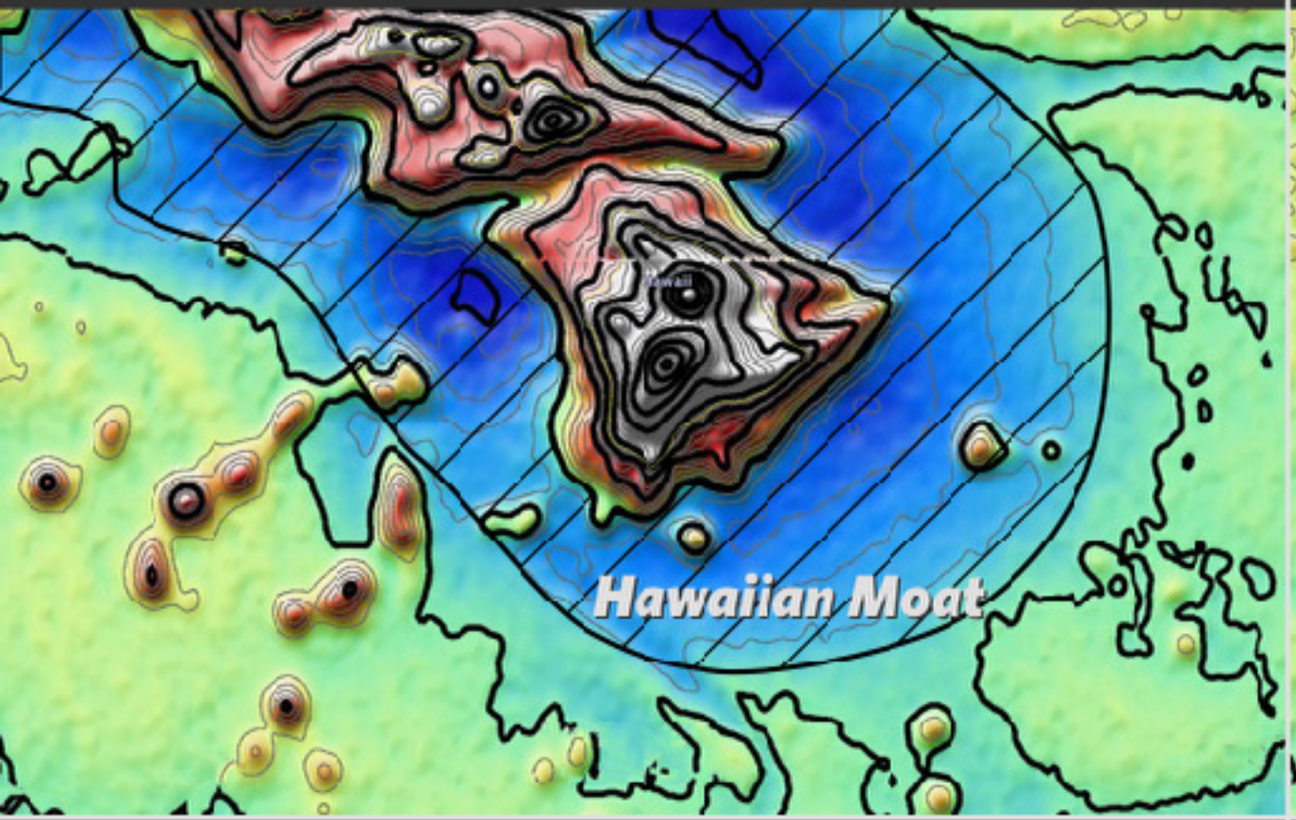
Background pelagic oceanic sediment

Crustal flexure

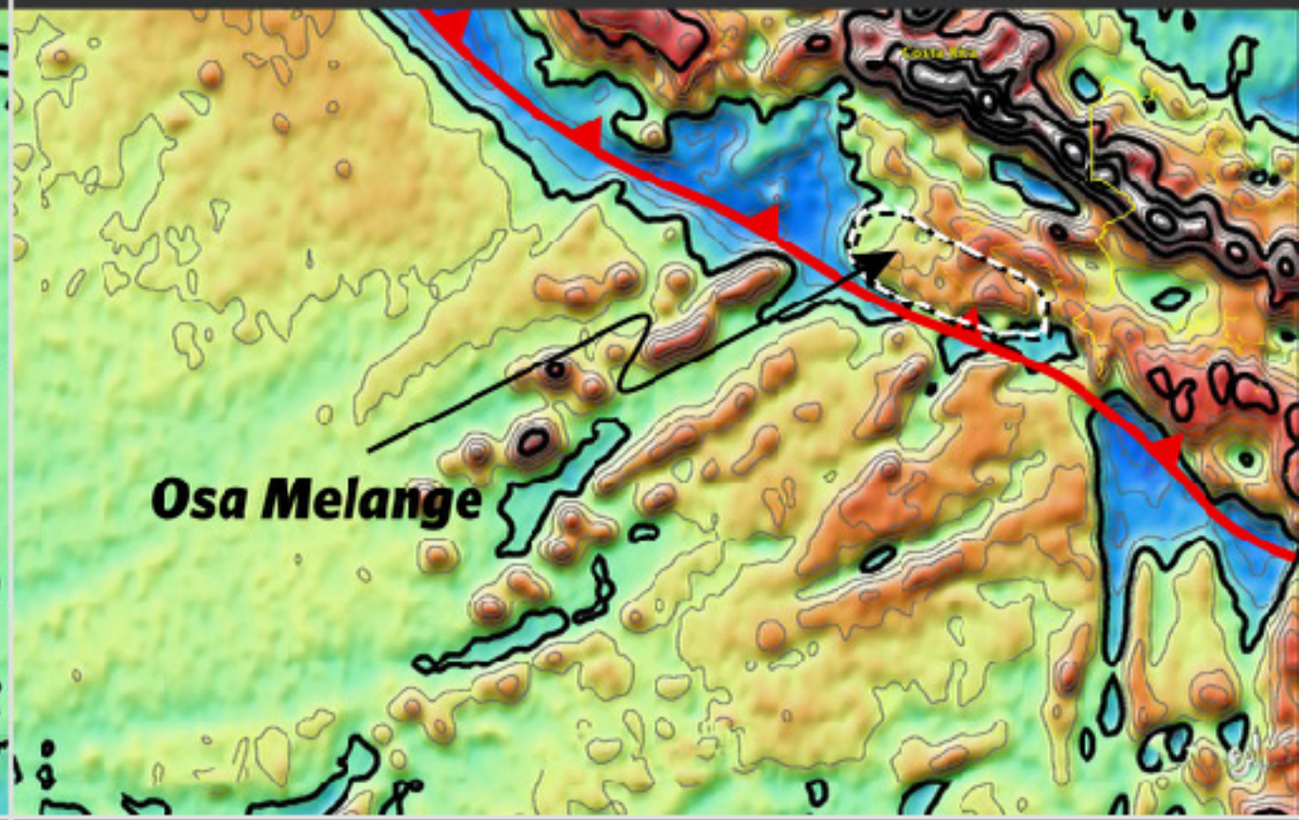
Altered oceanic crust

Isozaki et al. (2000); Tusky et al. (2013); Leslie et al., 2002; Tribble et al. (1993); Watts et al. (1985); Garcia & Davis (2001)

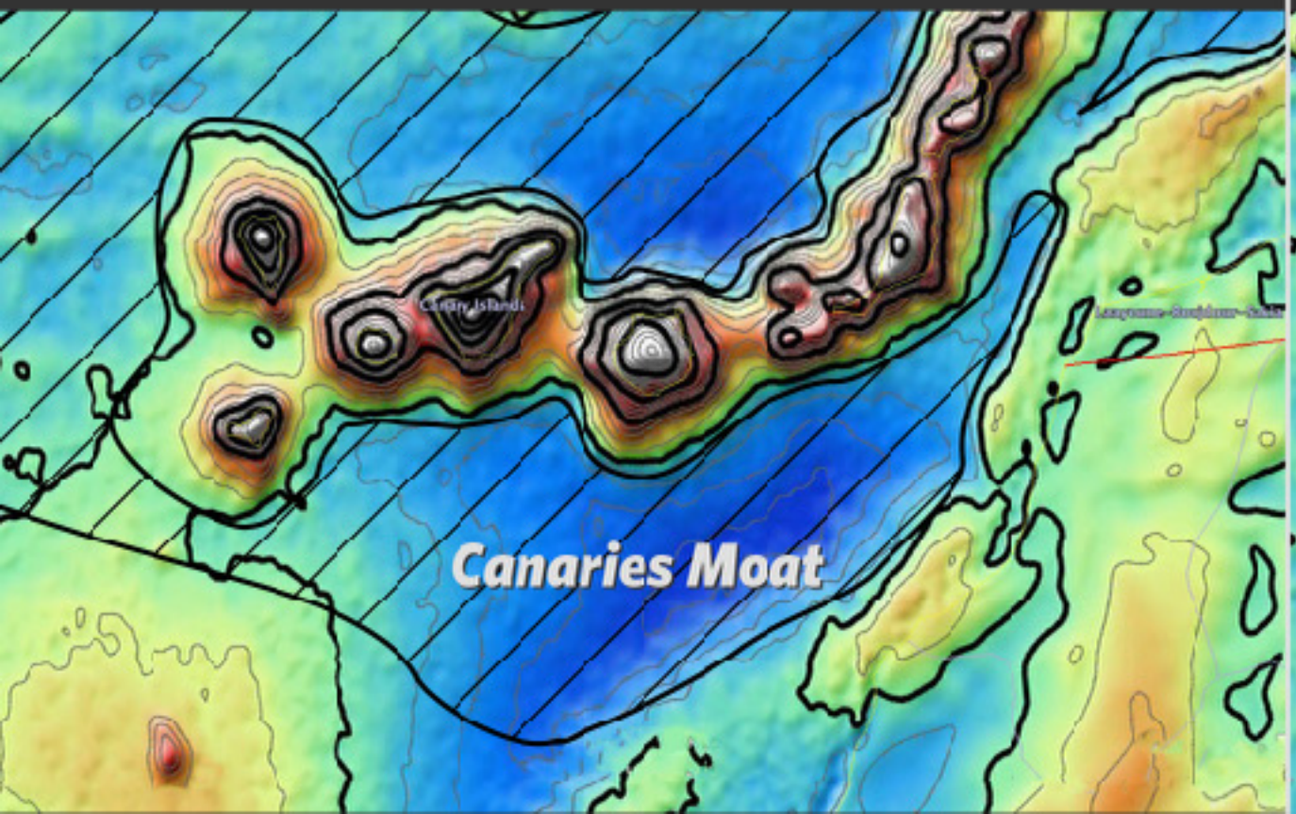
Hawaii



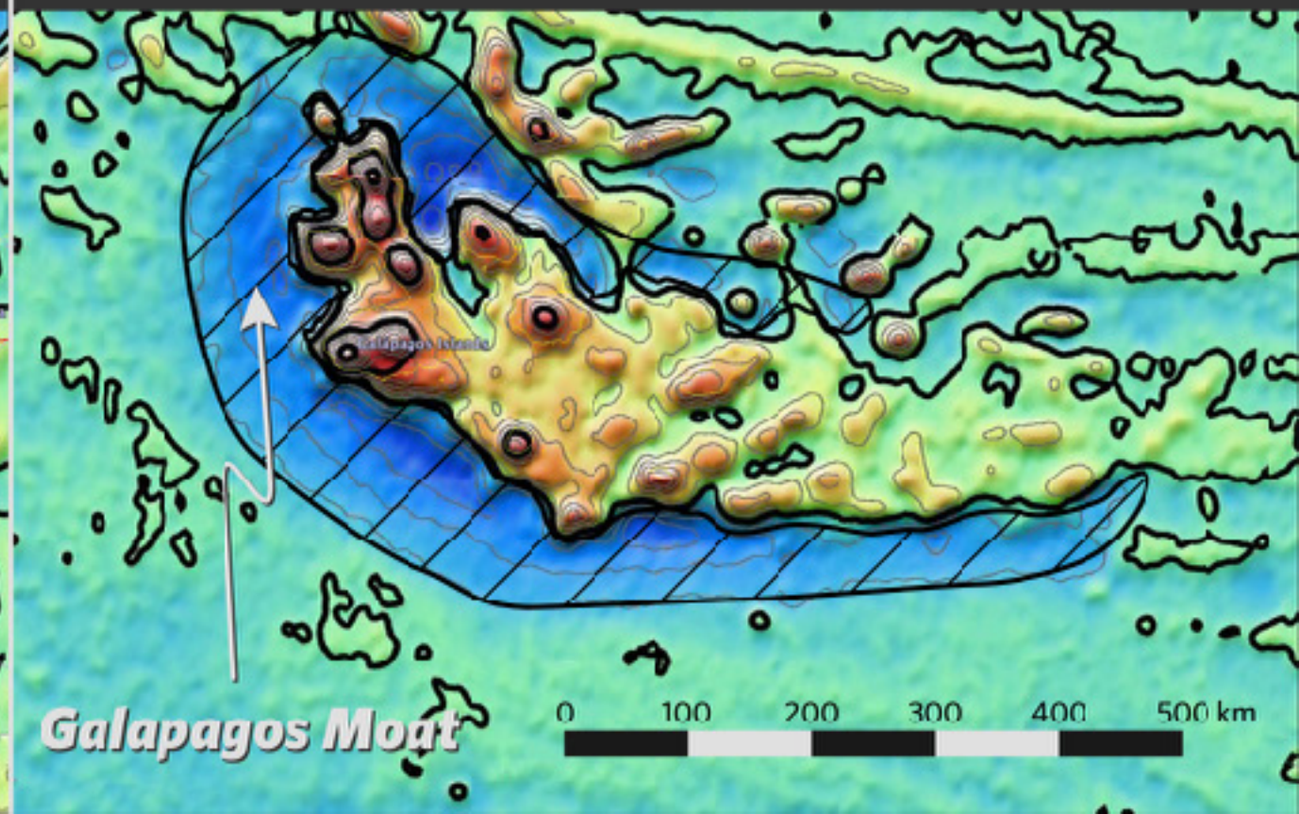
Costa Rica



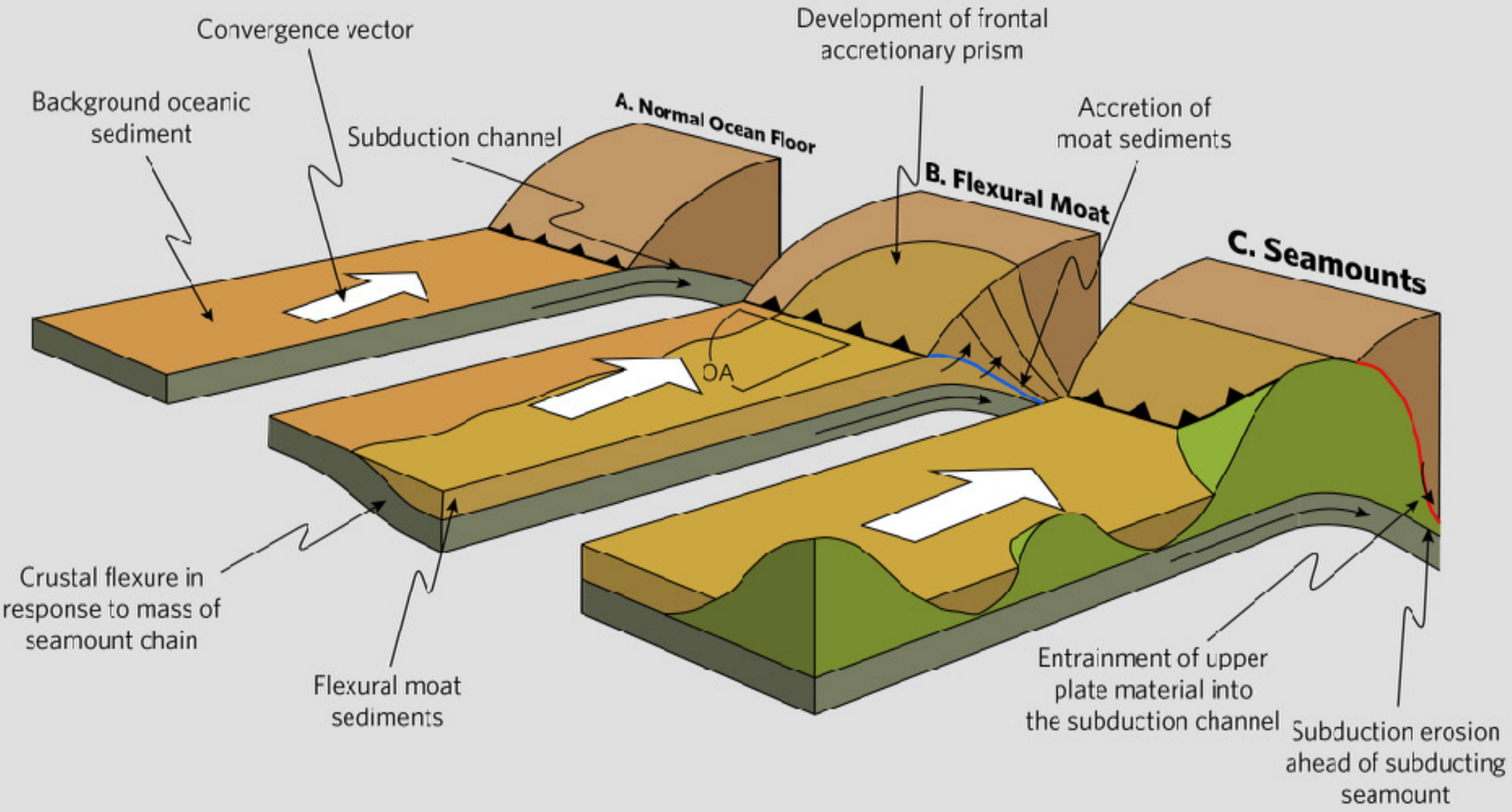
Canaries



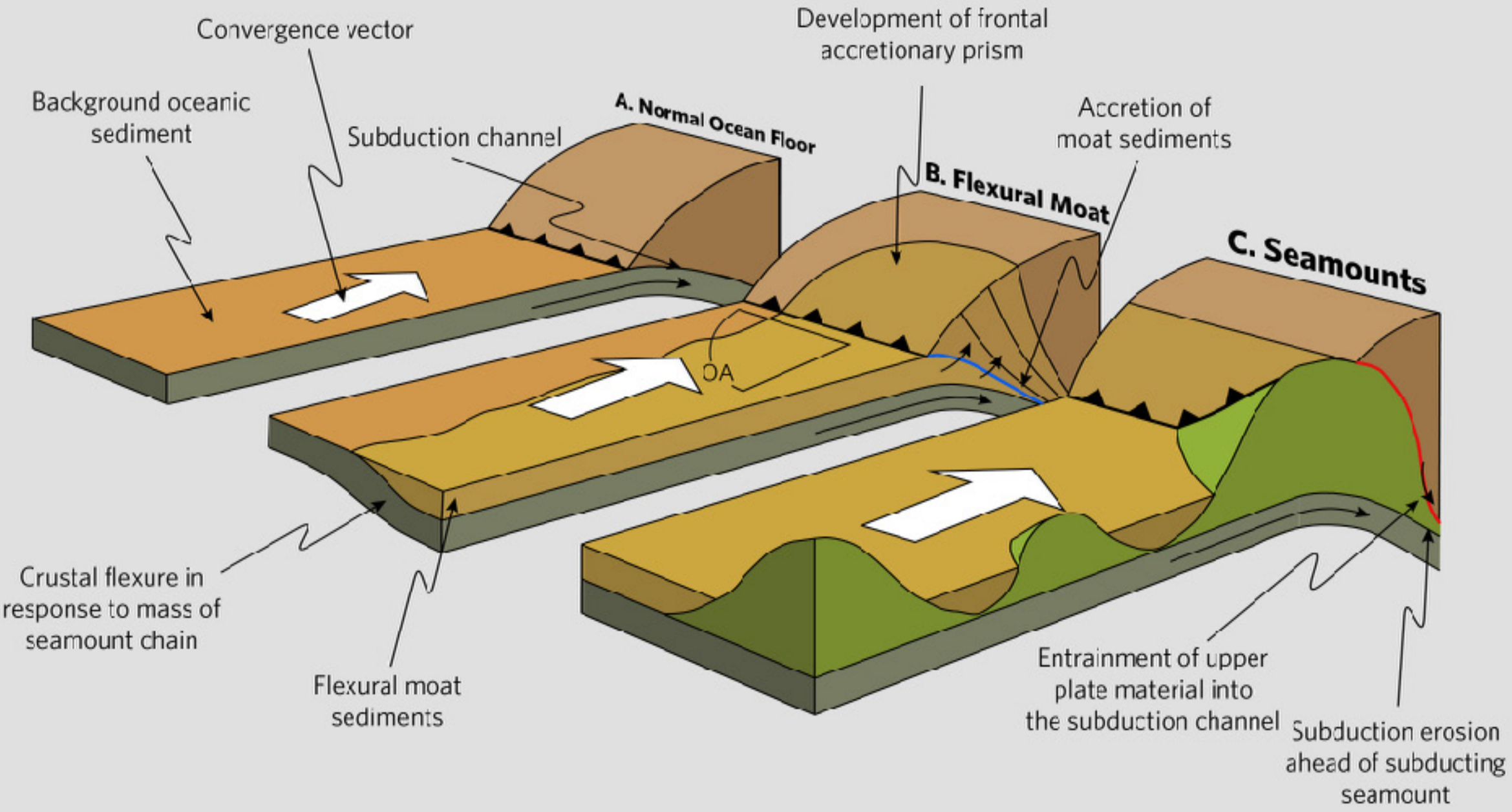
Galapagos



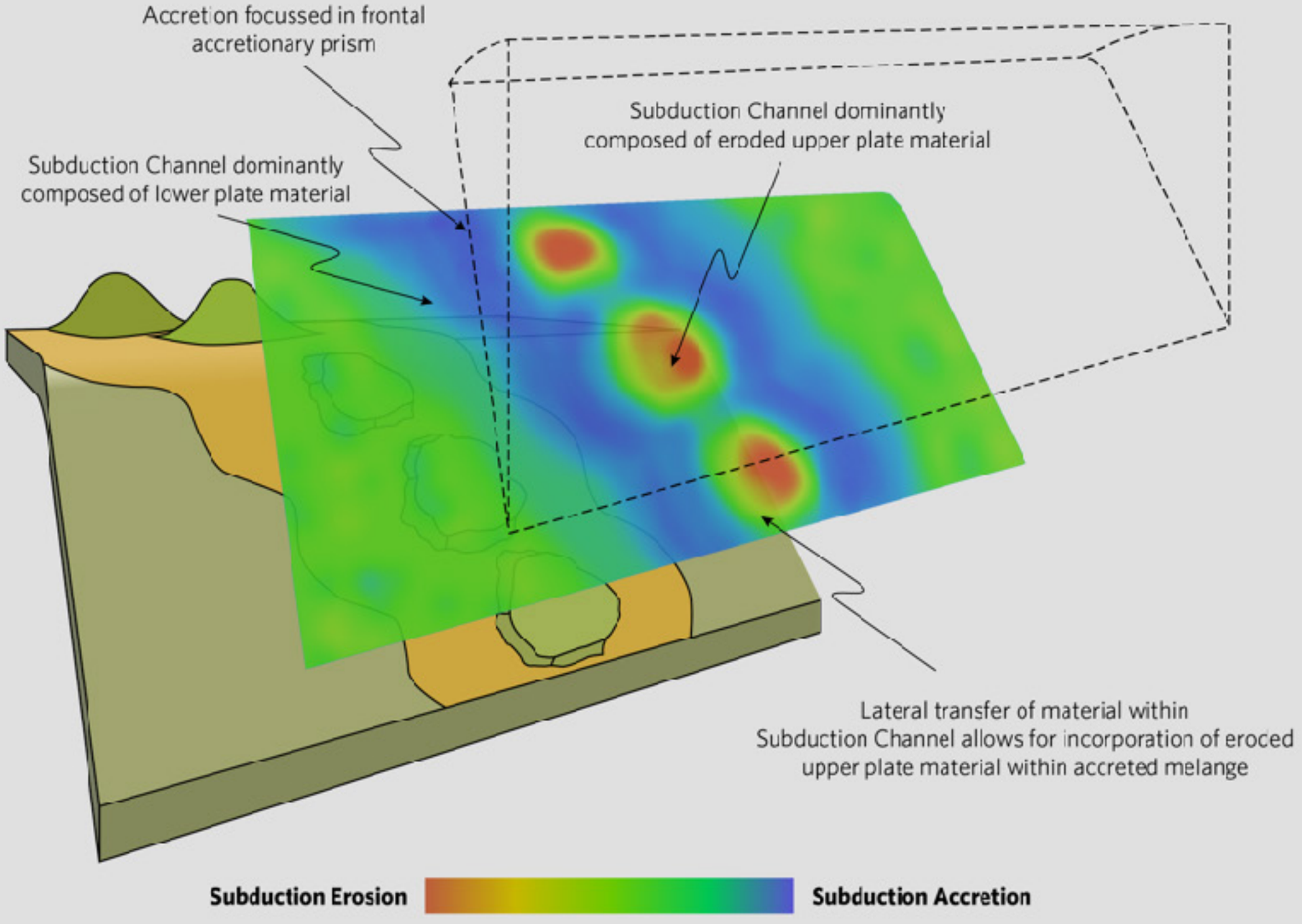
Seamount Subduction Driving Concurrent Accretion & Erosion



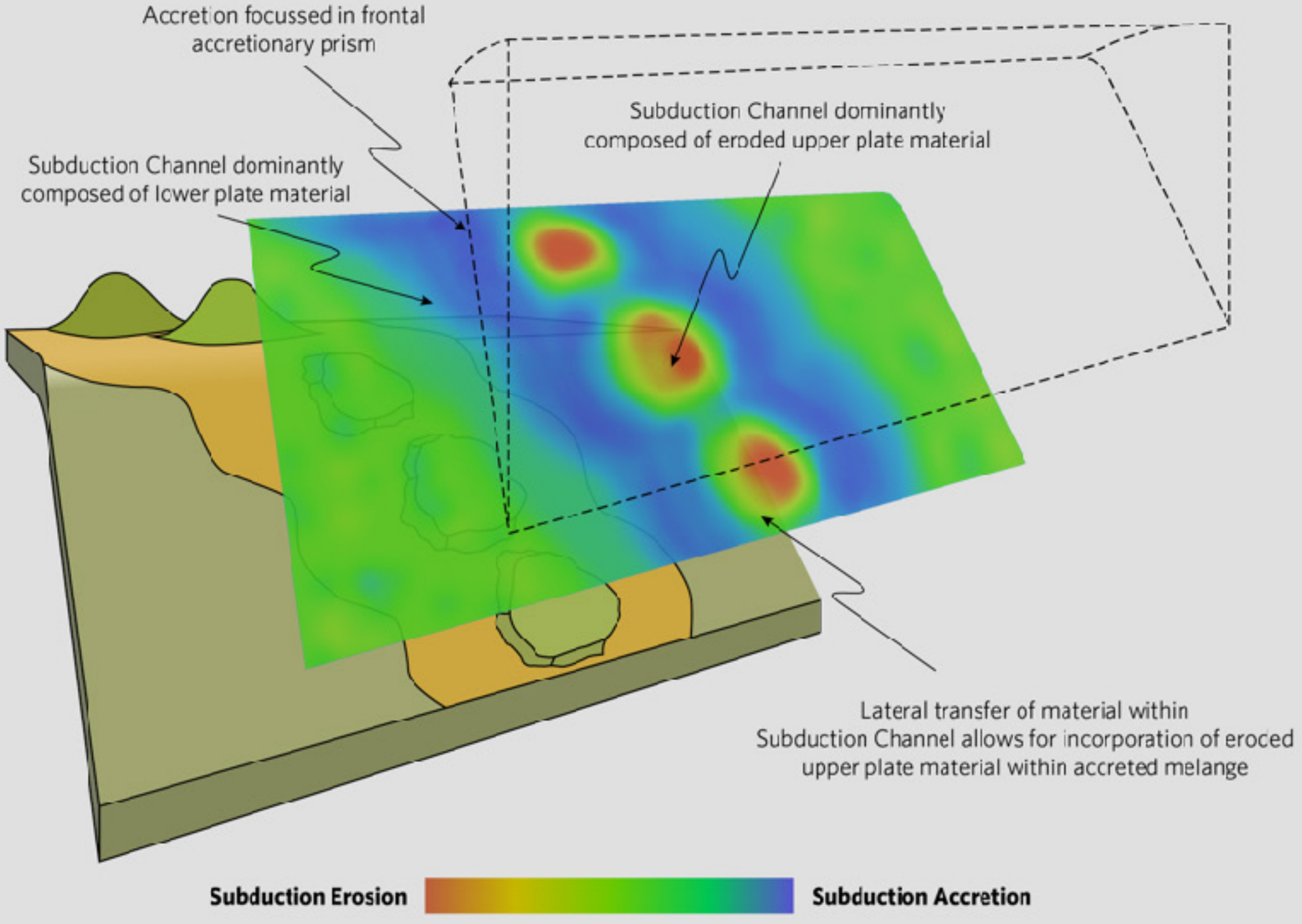
Seamount Subduction Driving Concurrent Accretion & Erosion



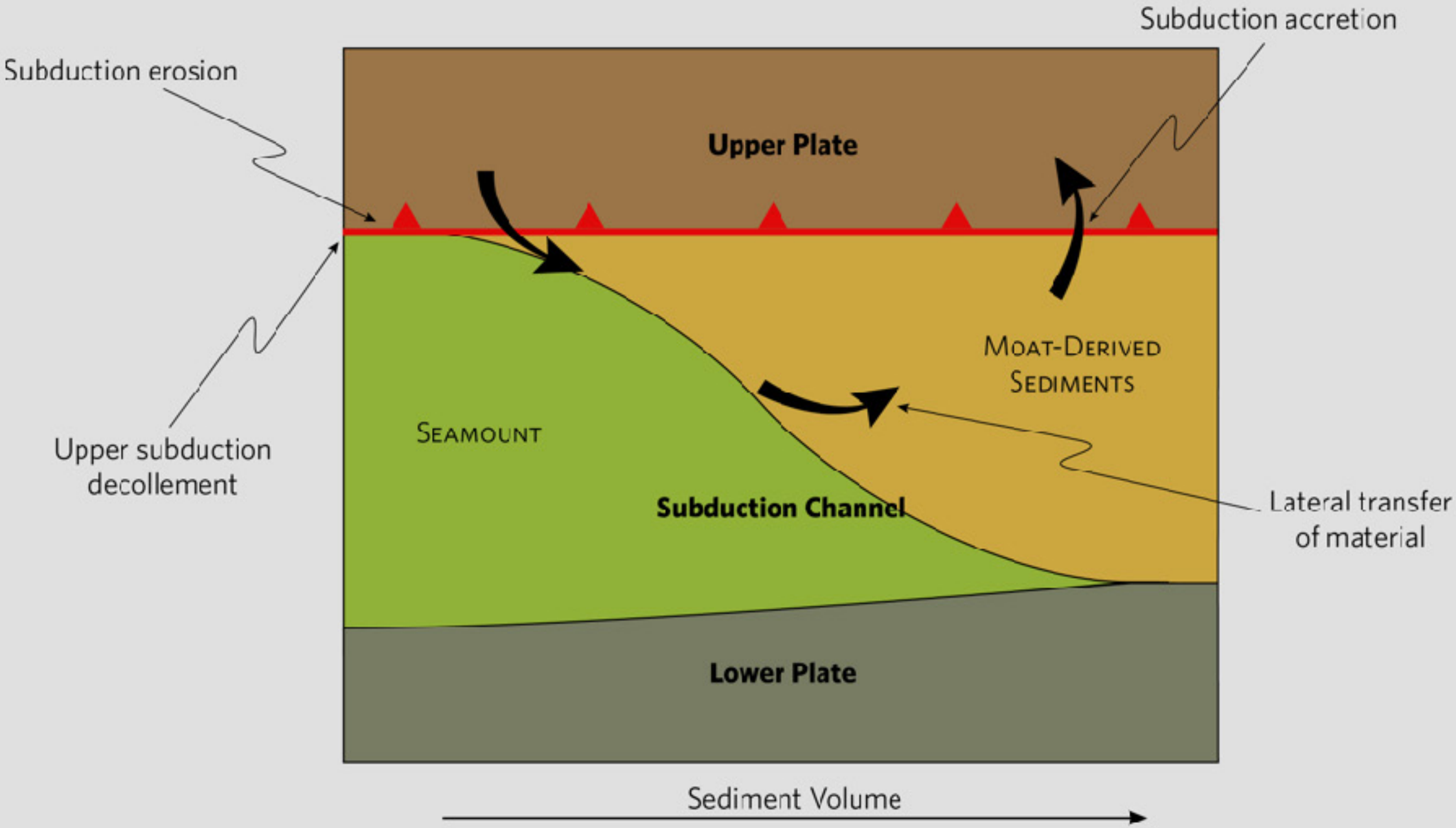
Heterogenous Subduction Channel Behaviour



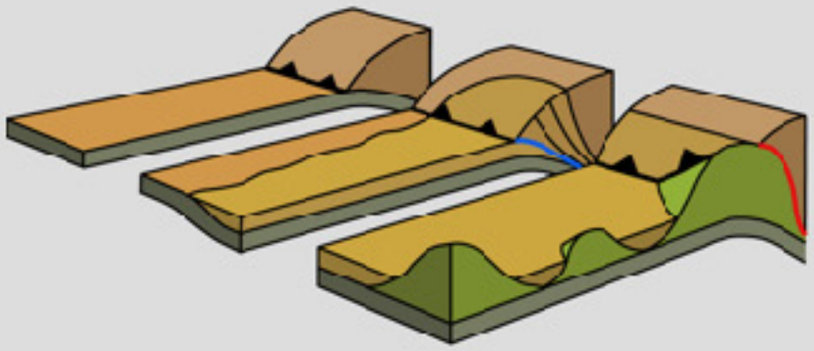
Heterogenous Subduction Channel Behaviour



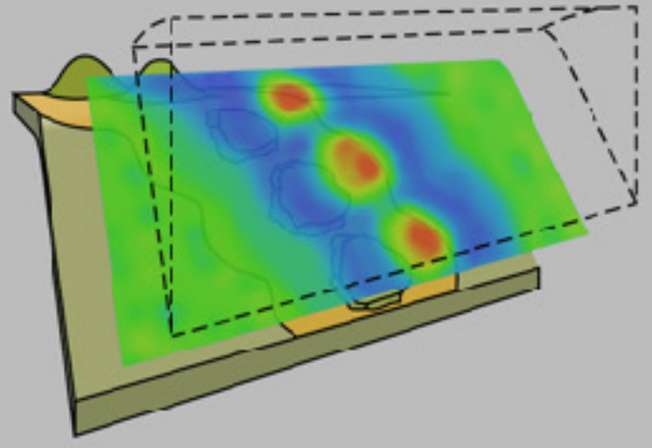
Lateral Transfer & Re-Accretion of Tectonically Eroded Material



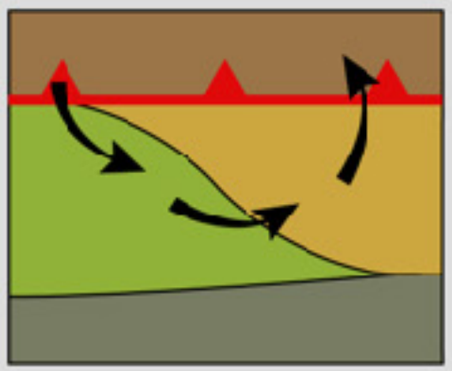
Conclusions



*High sediment volumes in **seamount moat** basins make these likely to be **preferentially accreted**.*



*Focussed **erosion & accretion occur adjacent to each other**, leading to a heterogenous subduction channel.*



***Upper plate material** may be **eroded** above seamounts, **mixed** with moat sediments, & **re-accreted**.*

Any Questions?

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Buchs, D.M., Baumgartner, P.O., Baumgartner-Mora, C., Bandini, A.N., Jackett, S.-J., Diserens, M.-O. & Stucki, J. 2009. Late Cretaceous to Miocene seamount accretion and melange formation in the Osa and Burica Peninsulas (Southern Coste Rica): episodic growth of a convergent margin. Geological Society, London, Special Publications, 328, 411–456, doi: 10.1144/SP328.17.

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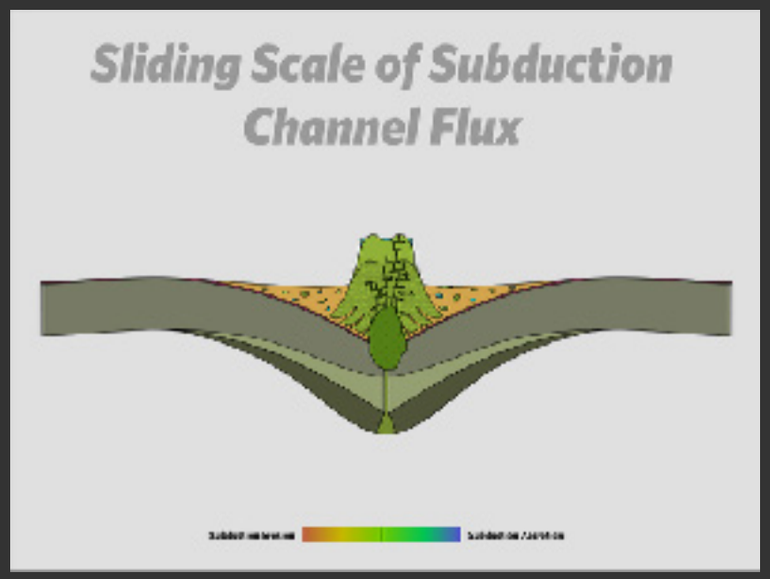
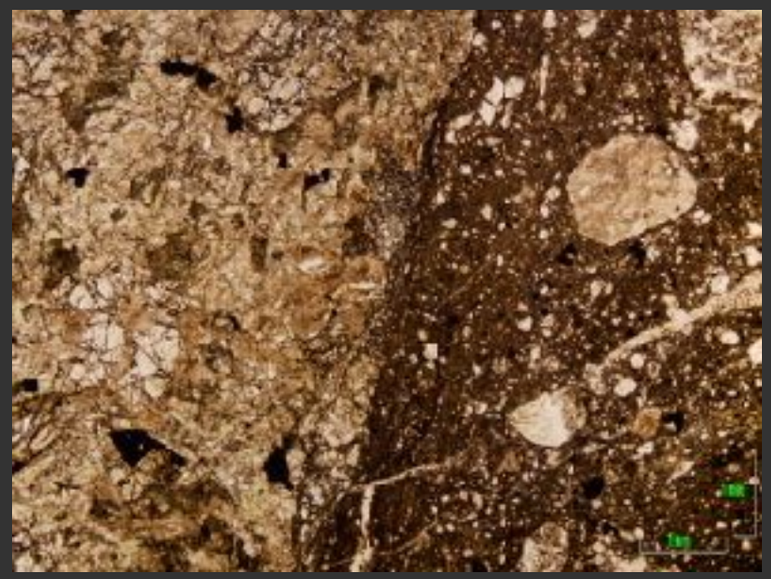
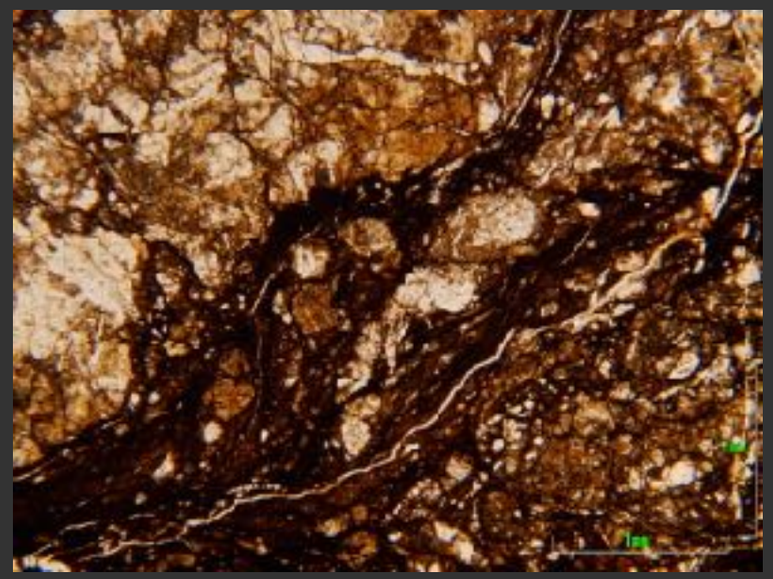
Extra Slides

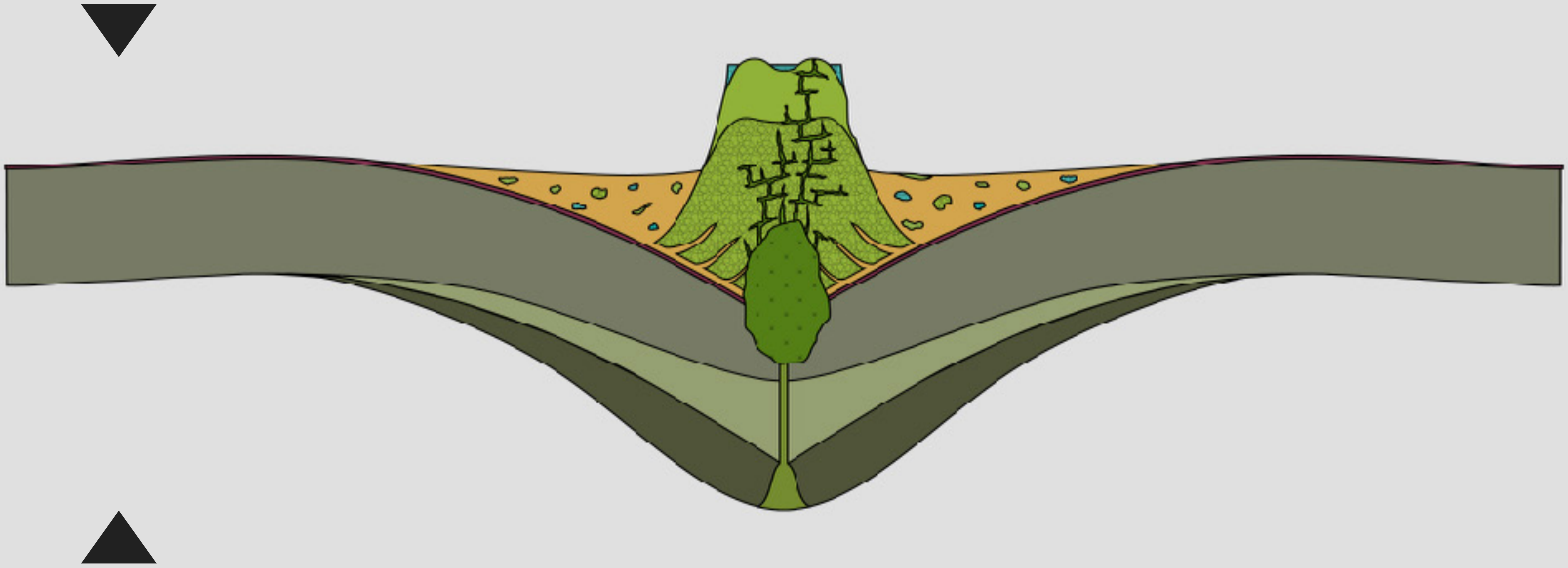


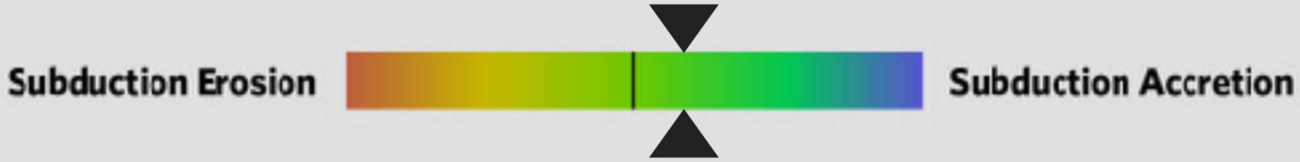




Sliding Scale of Subduction Channel Flux

NormaFSZubsedduAsureEtimsipMobtve Seamount



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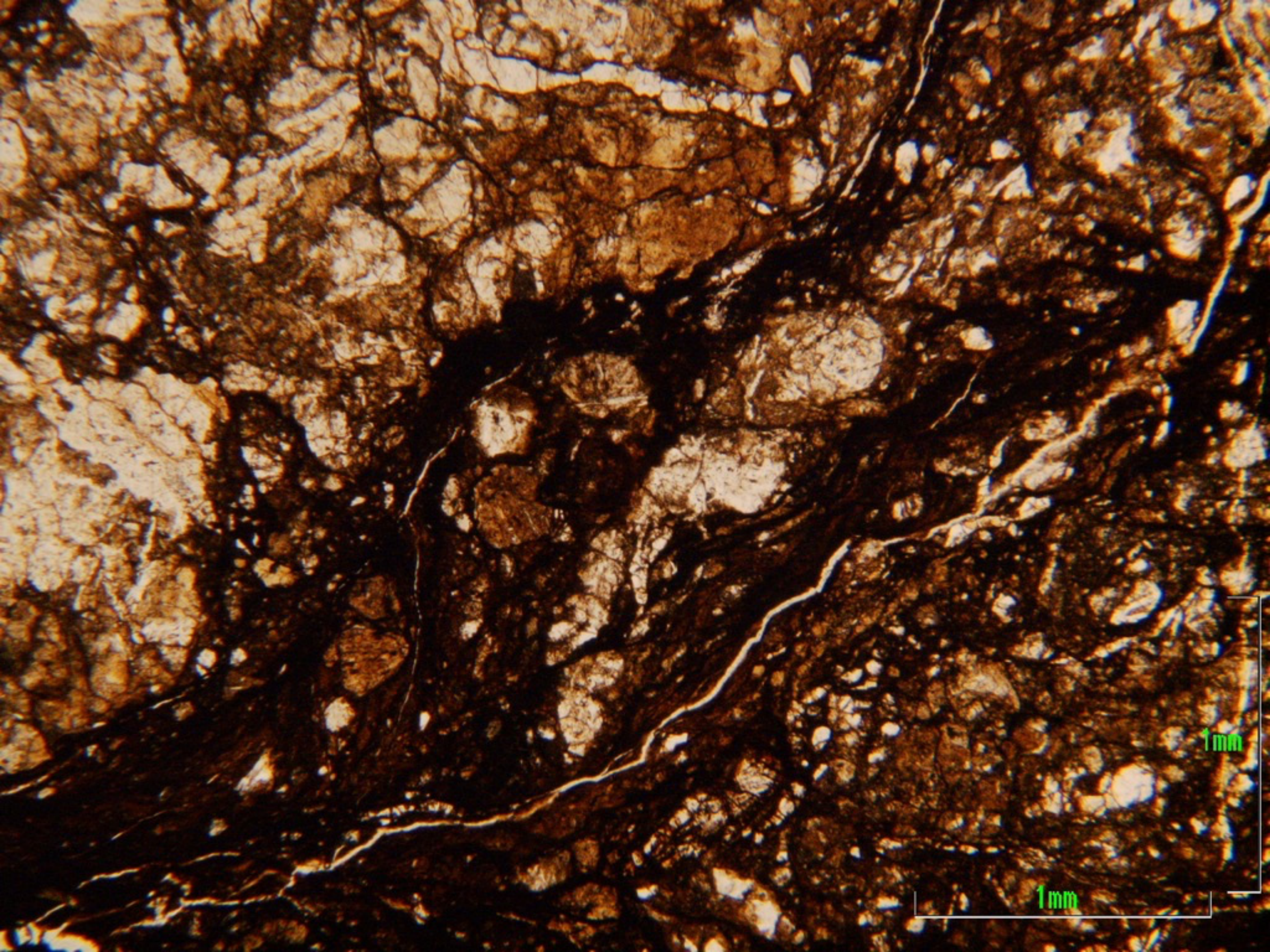
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