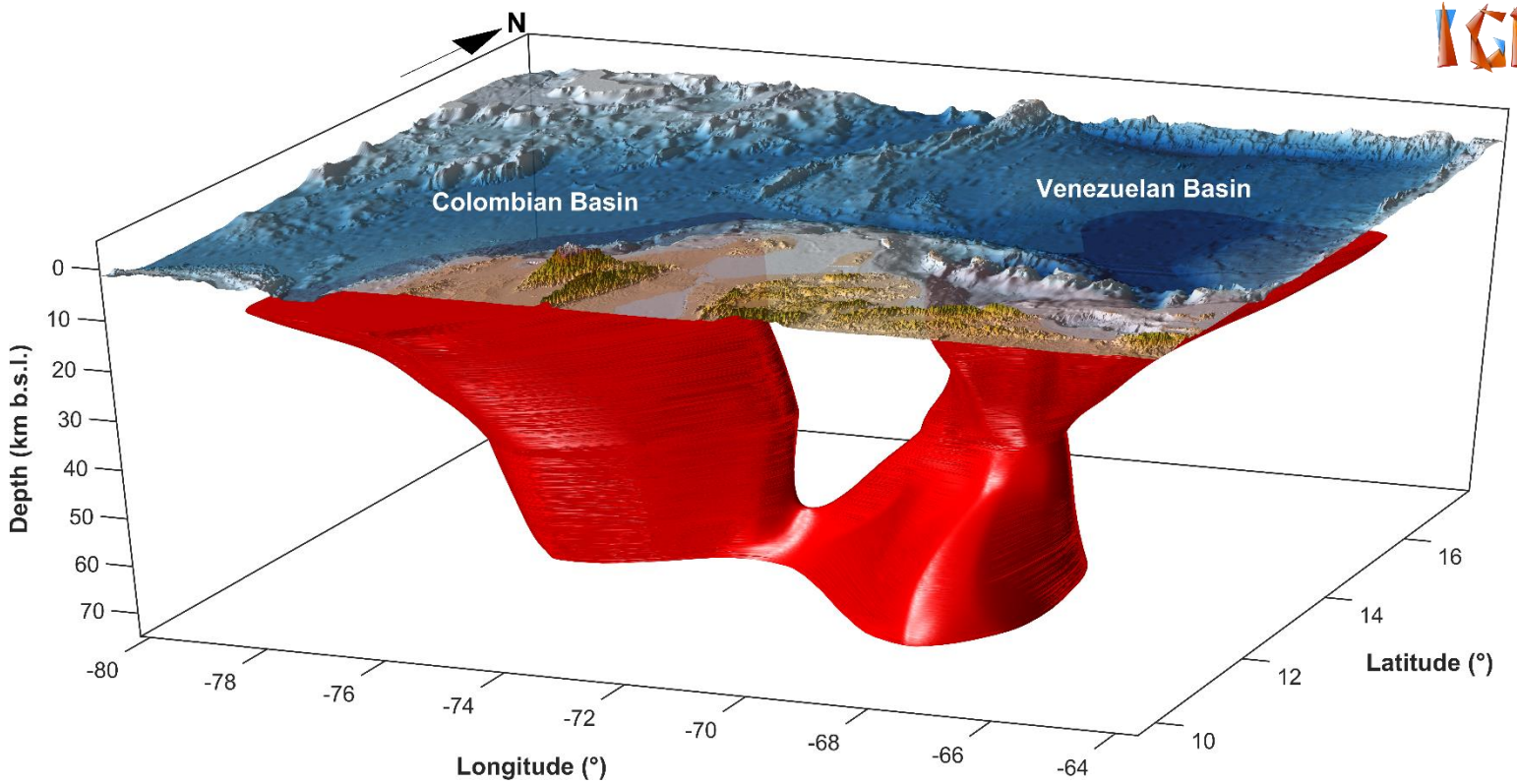
The preserved plume conduits of the Caribbean Large Igneous Plateau are revealed for the first time.



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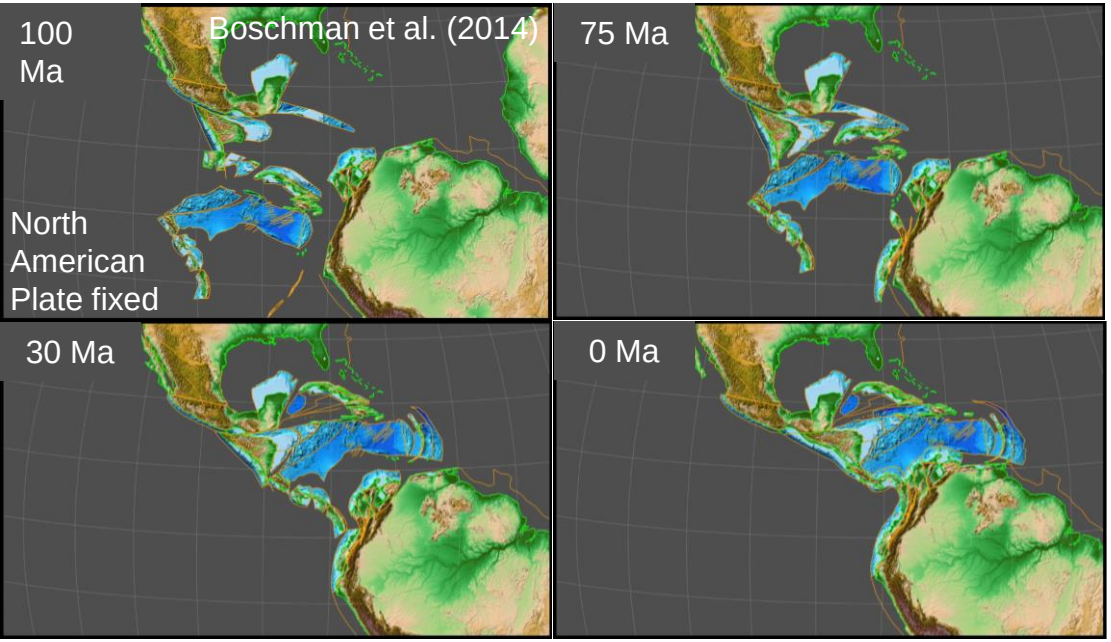
EGU General Assembly 2021

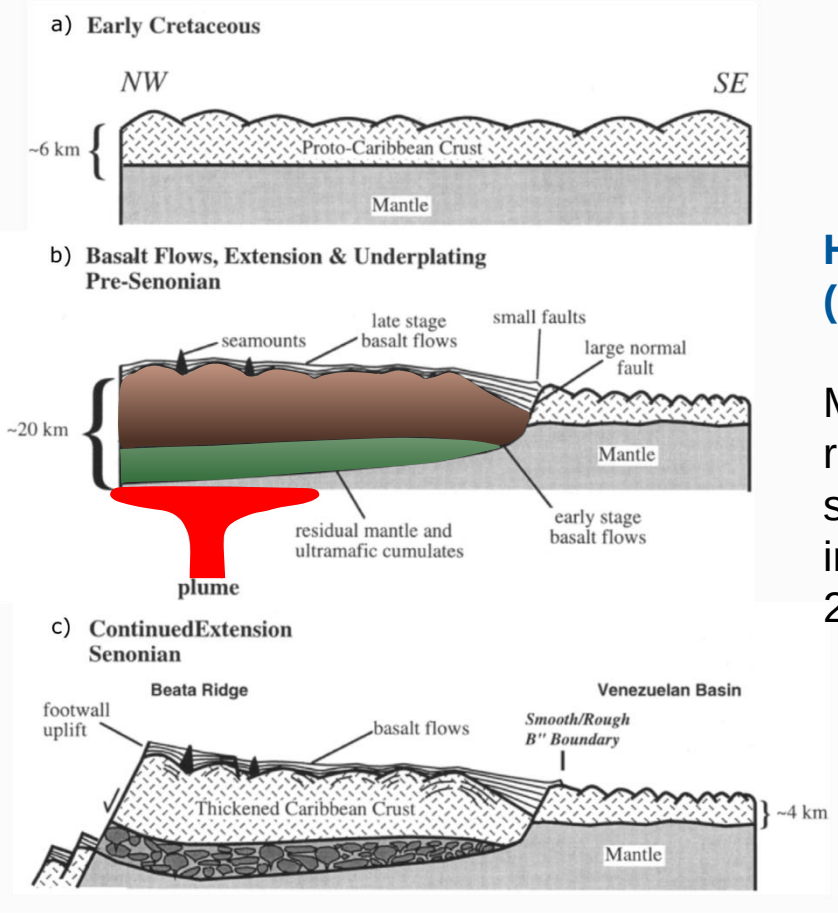
The Caribbean plate migrated from the Pacific while interacting with the Galapagos hotspot.



Two pulses of magmatic activity (Sinton et al.,1998; Diebold and Driscoll, 1999):

- ~91–88 Ma
- ~76 Ma.

The classic model of the tectonic evolution of the Caribbean plate: plume centered below thicker crustal regions.



Driscoll and Diebold (1999)

Heterogeneous, high MgO (high-density) rocks:

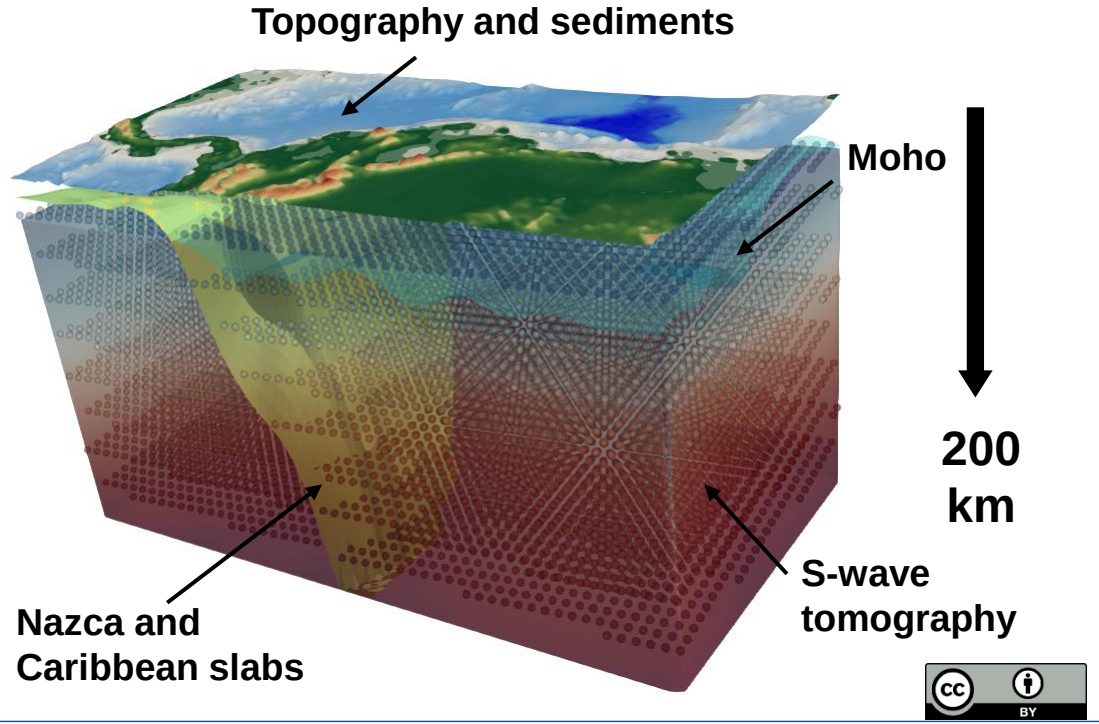
Magmas that migrated relatively quick from the source, without being stored in magma chambers (Kerr, 2014).

Global geophysical datasets were integrated.

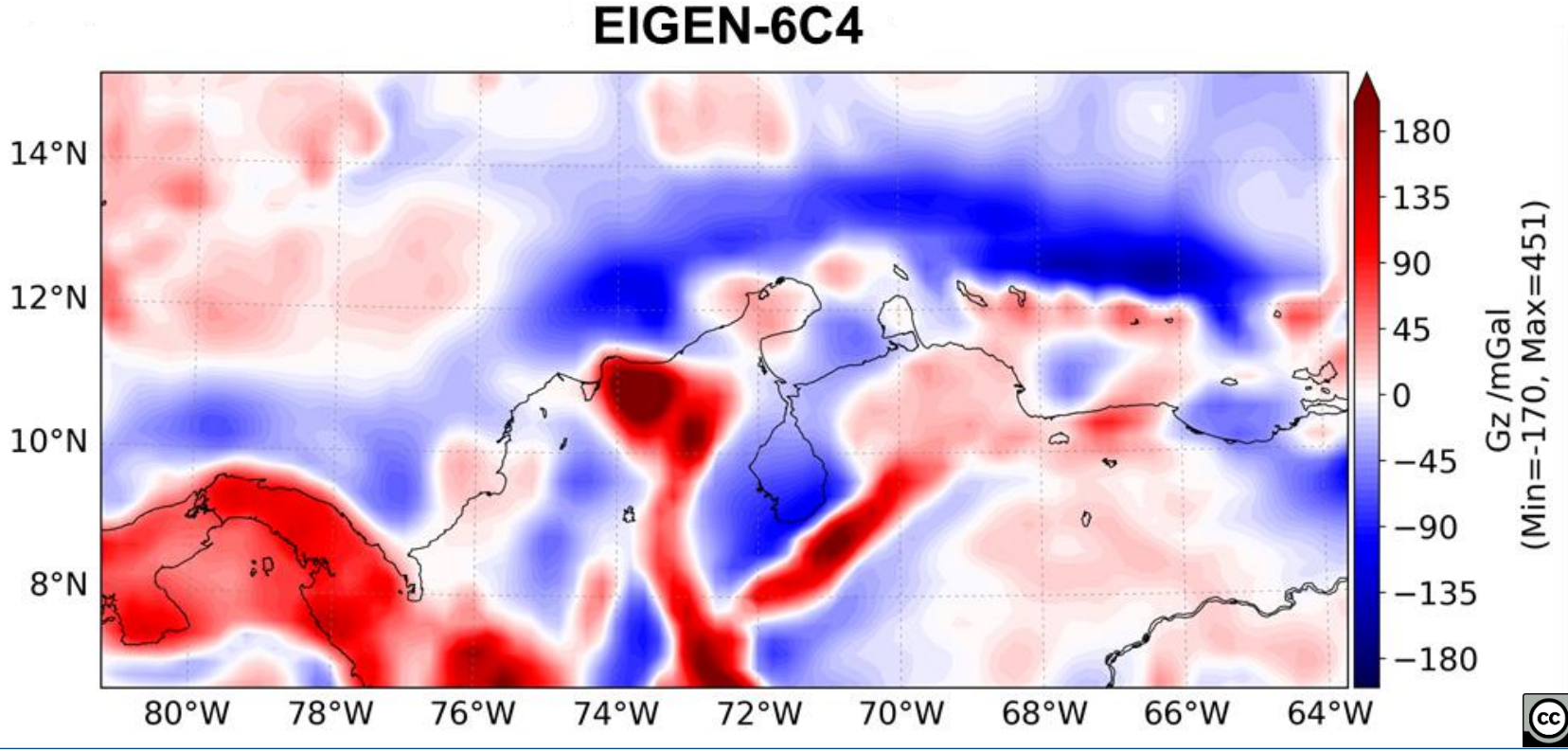
DATA

Lithospheric structure:

1. **Sediment thickness:**
   CRUST1.0 - 1deg
   (Laske et al., 2013)
2. **Bathymetry**:
   GEBCO - 30arcmin
   (Weatherall et al., 2015)
3. **Moho:**
   GEMMA - 0.5deg
   (Reguzzoni and Sampietro, 2015)
4. **Nazca and Caribbean slabs:**
   Slab2 (Hayes et al., 2018)
   Mora et al. (2017)
5. **Tomography**:
   SL2013 - Swave model
   (Schaeffer and Lebedev, 2013)



The gravity response of different mantle configurations was tested against the observed free-air gravity[1].



[1] Förste et al. (2014); Ince et al. (2019)

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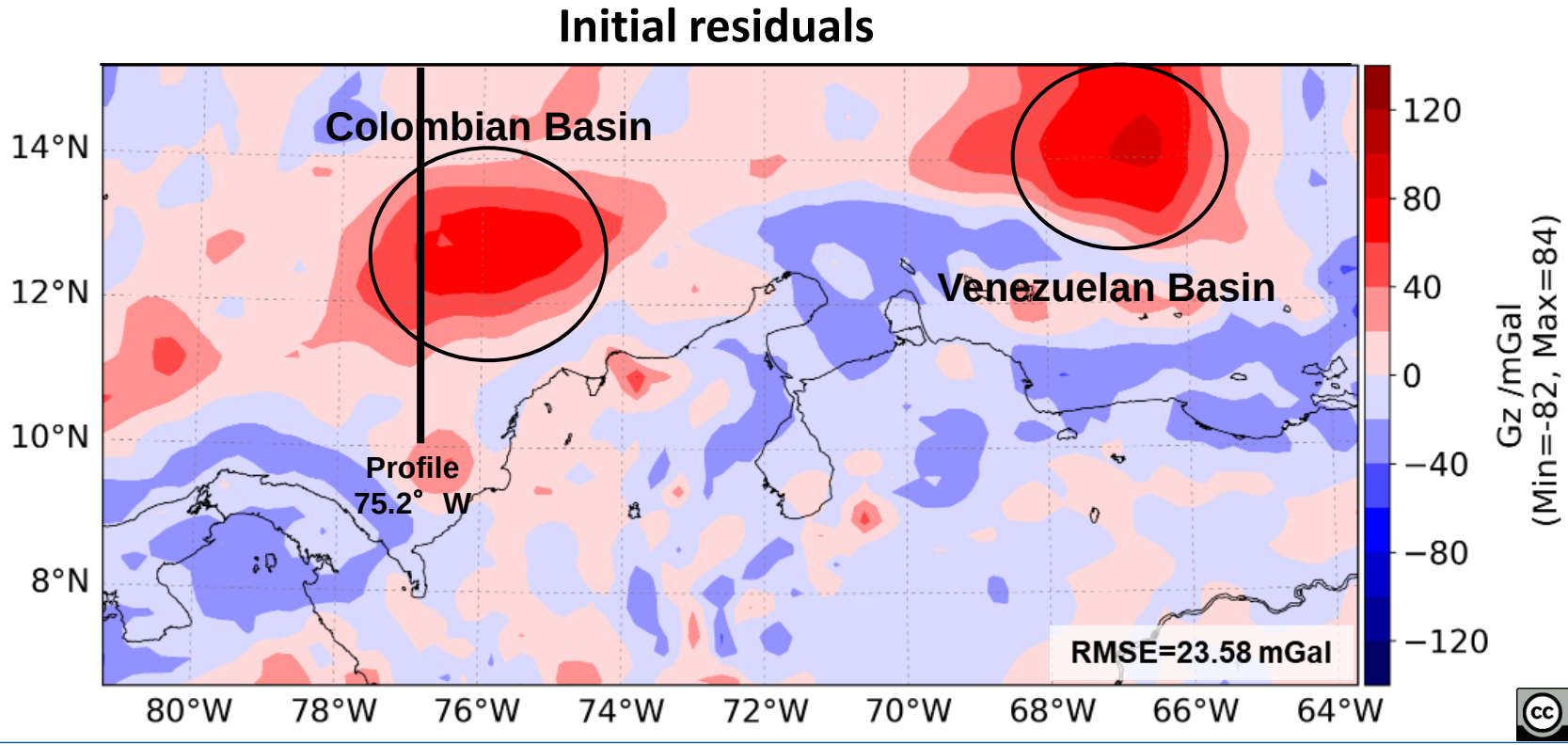
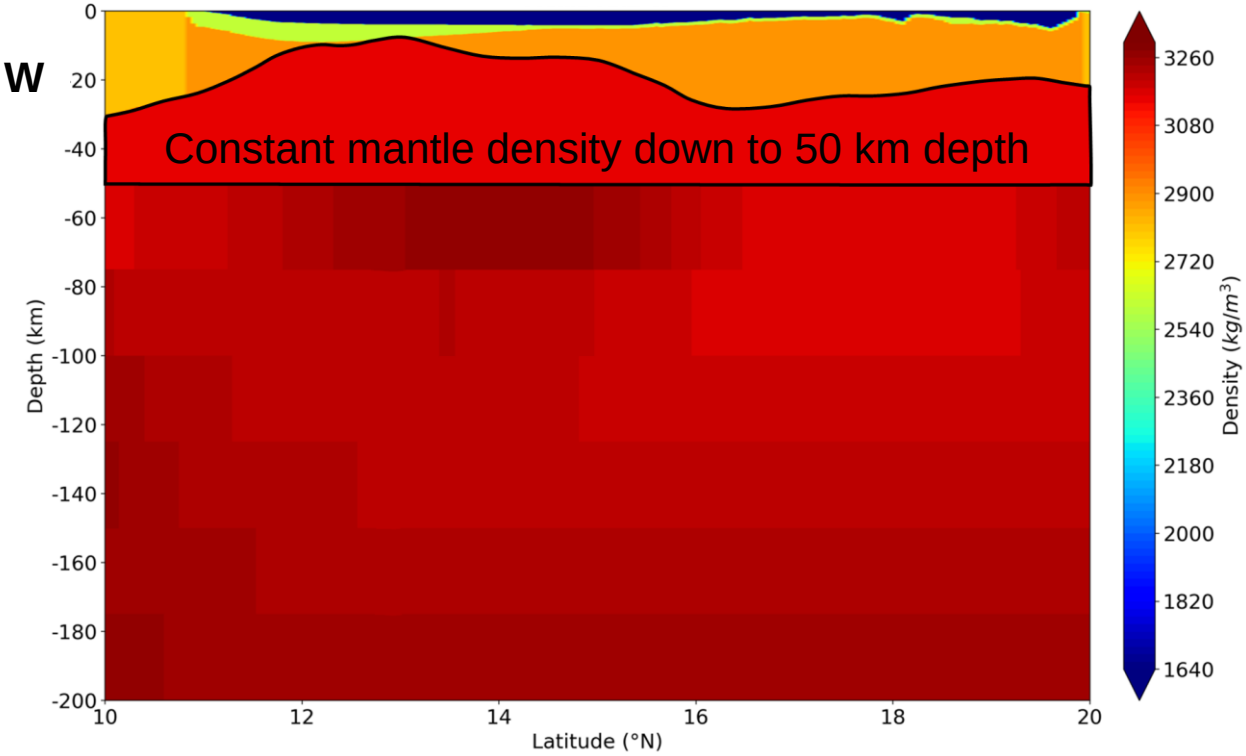
Long-wavelength residuals are still present after removing the signal of water, crust, and 3D mantle.

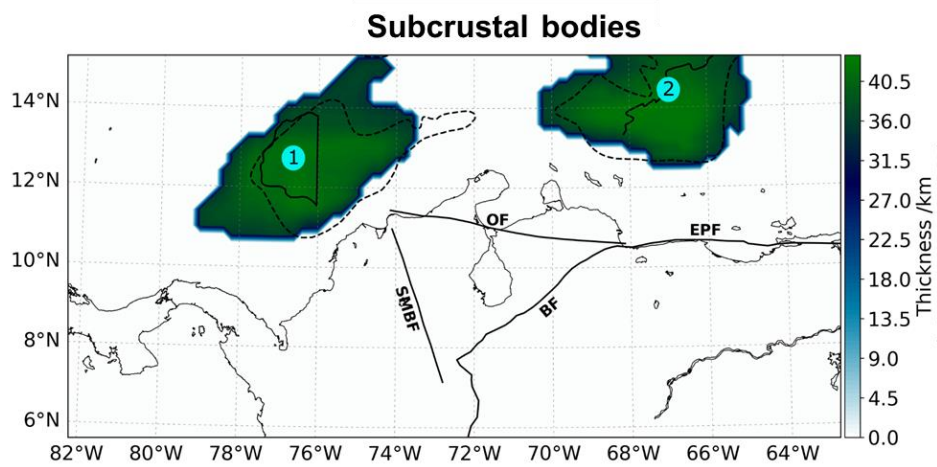


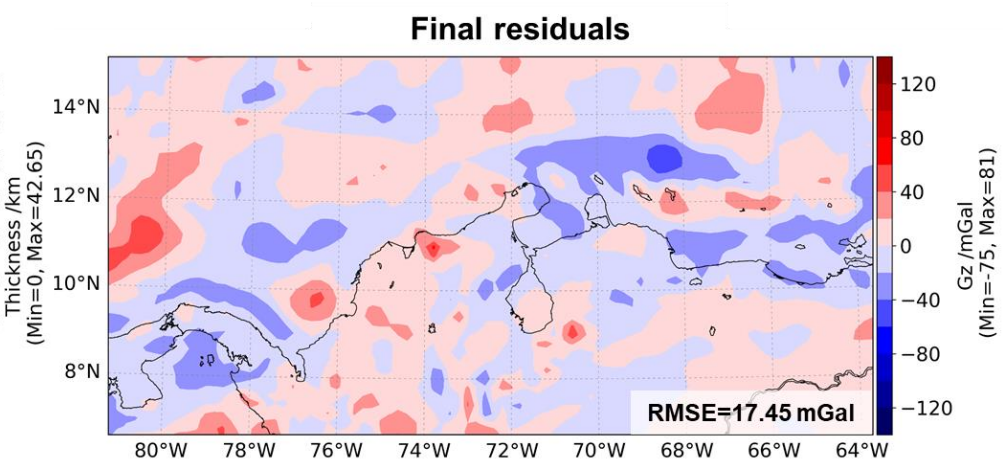
In this model, the uppermost 50 km of the mantle were modelled with a constant density.

Profile 75.2° W



In order to fit the observed gravity, two subcrustal bodies are required from the Moho down to 50 km.





--- Crustal thickness < 10 km (Mauffret and Leroy, 1997)

—— Extended Proto-Caribbean crust in:

1 Colombian Basin (Bowland and Rosencrantz, 1988)

2 Venezuelan Basin (Kroehler et al., 2011)

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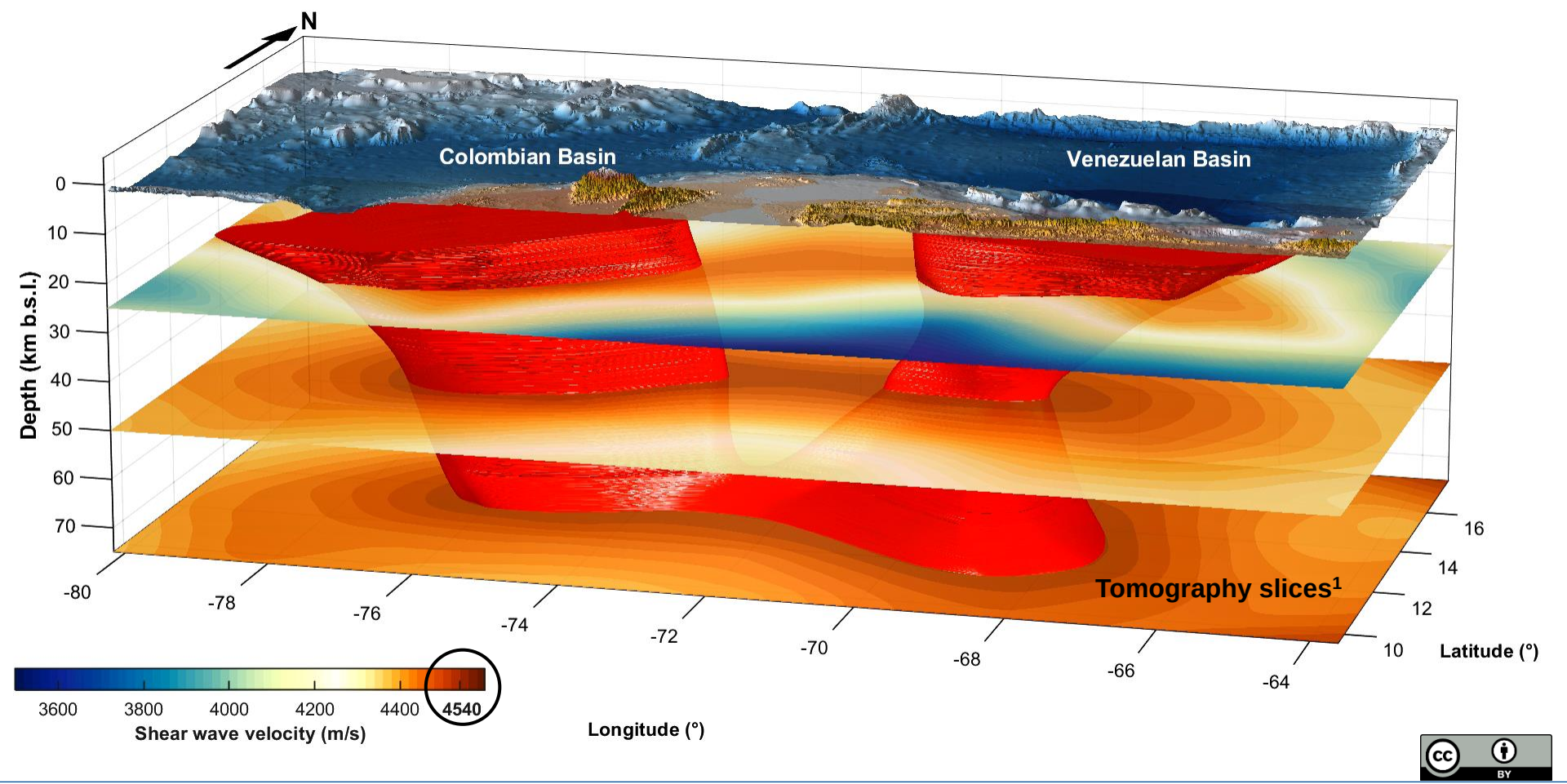

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[1] S-wave velocities from Schaeffer and Lebedev (2013)

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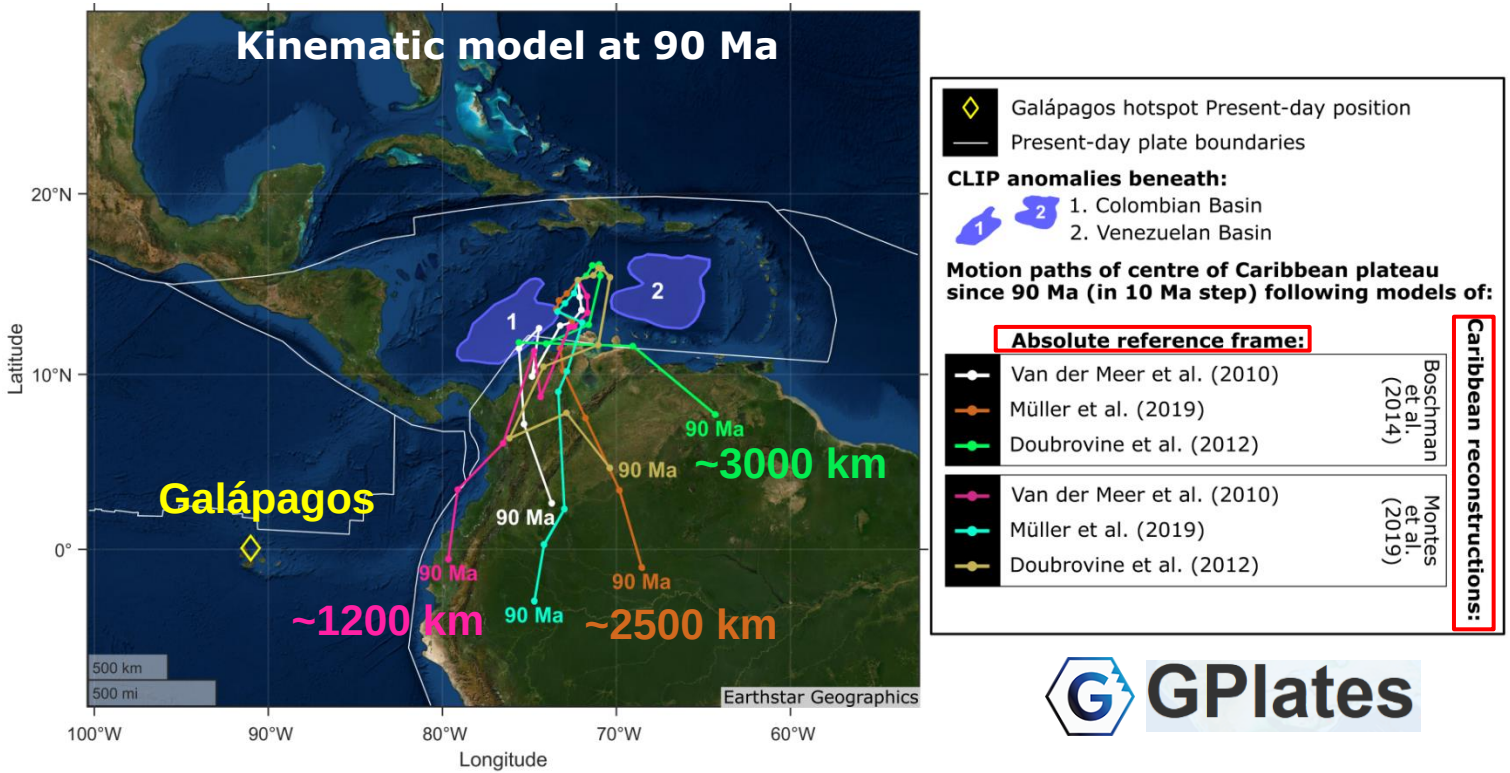
HELMHOLTZ

We evaluated the hypothesis of the Caribbean origin in the Galapagos hotspot.



All models have a **misfit with respect to Galapagos** back to 90 Ma

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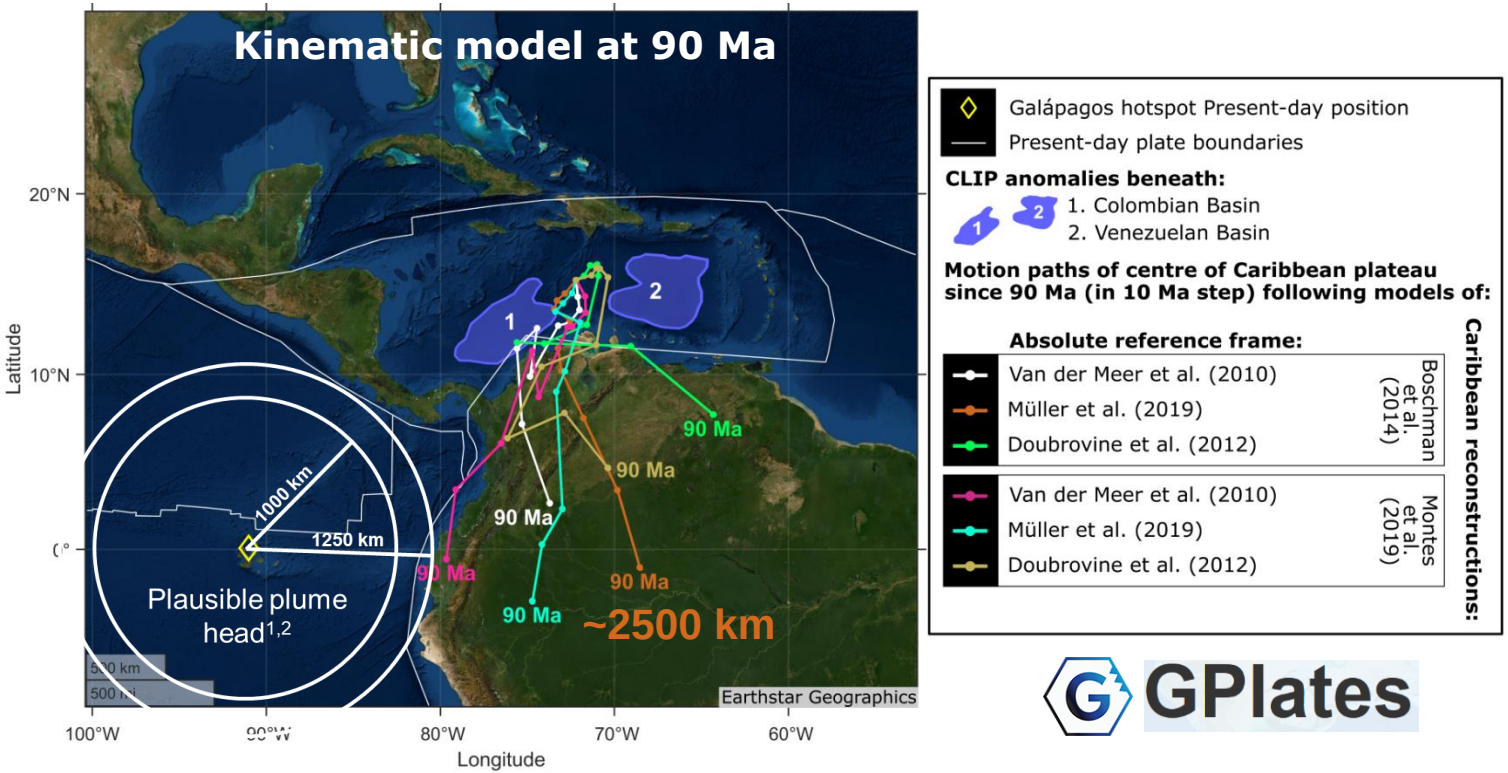
Plausible large plume head, of about 2000 to 2500 km in diameter.



All models have a **misfit with respect to Galapagos** back to 90 Ma

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[1] Campbell (2005). [2] Mauffret et al. (2001)

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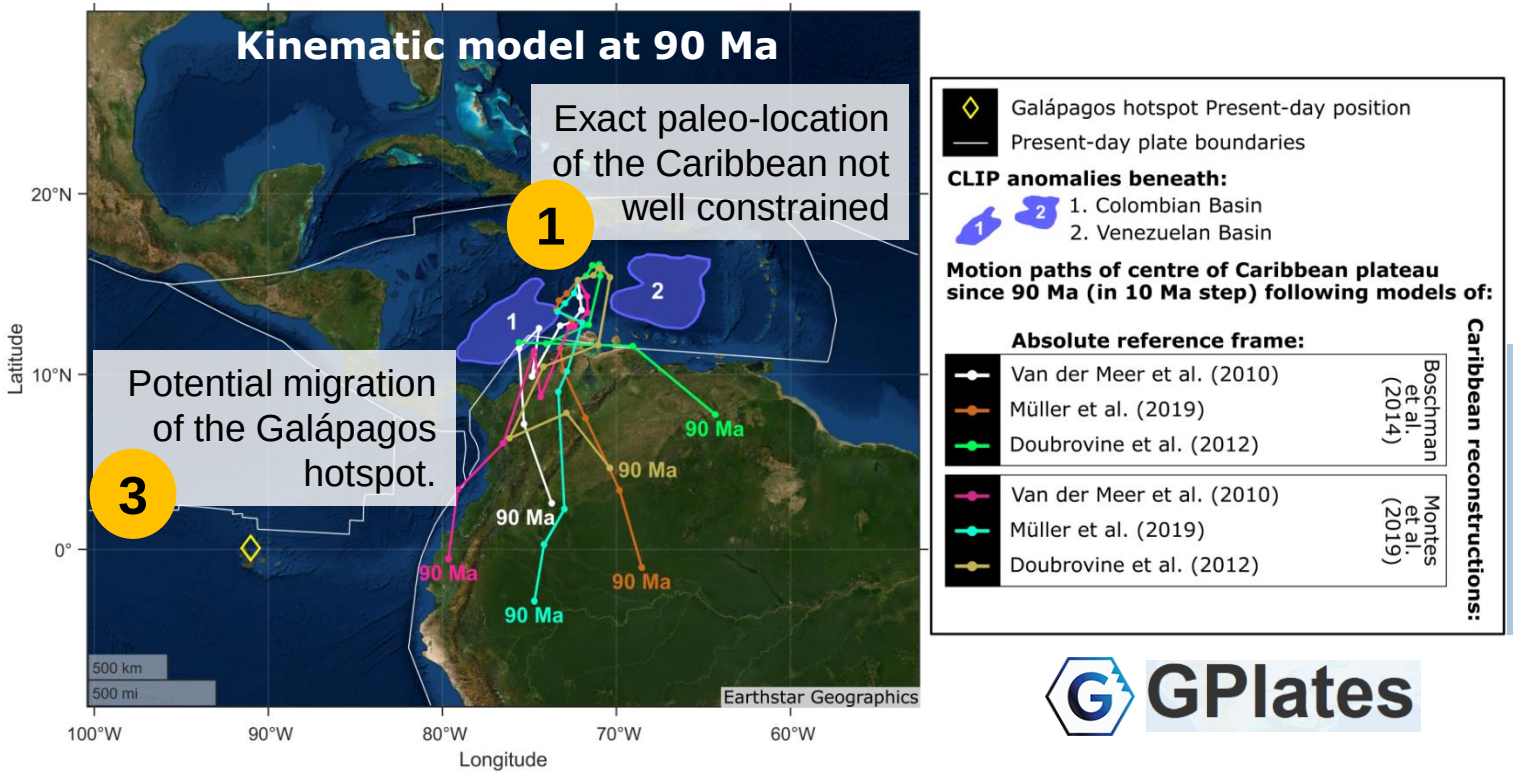
From this exercise we can conclude that there are 3 possible sources of error…



Motion of tectonic plates significantly change between models.

2

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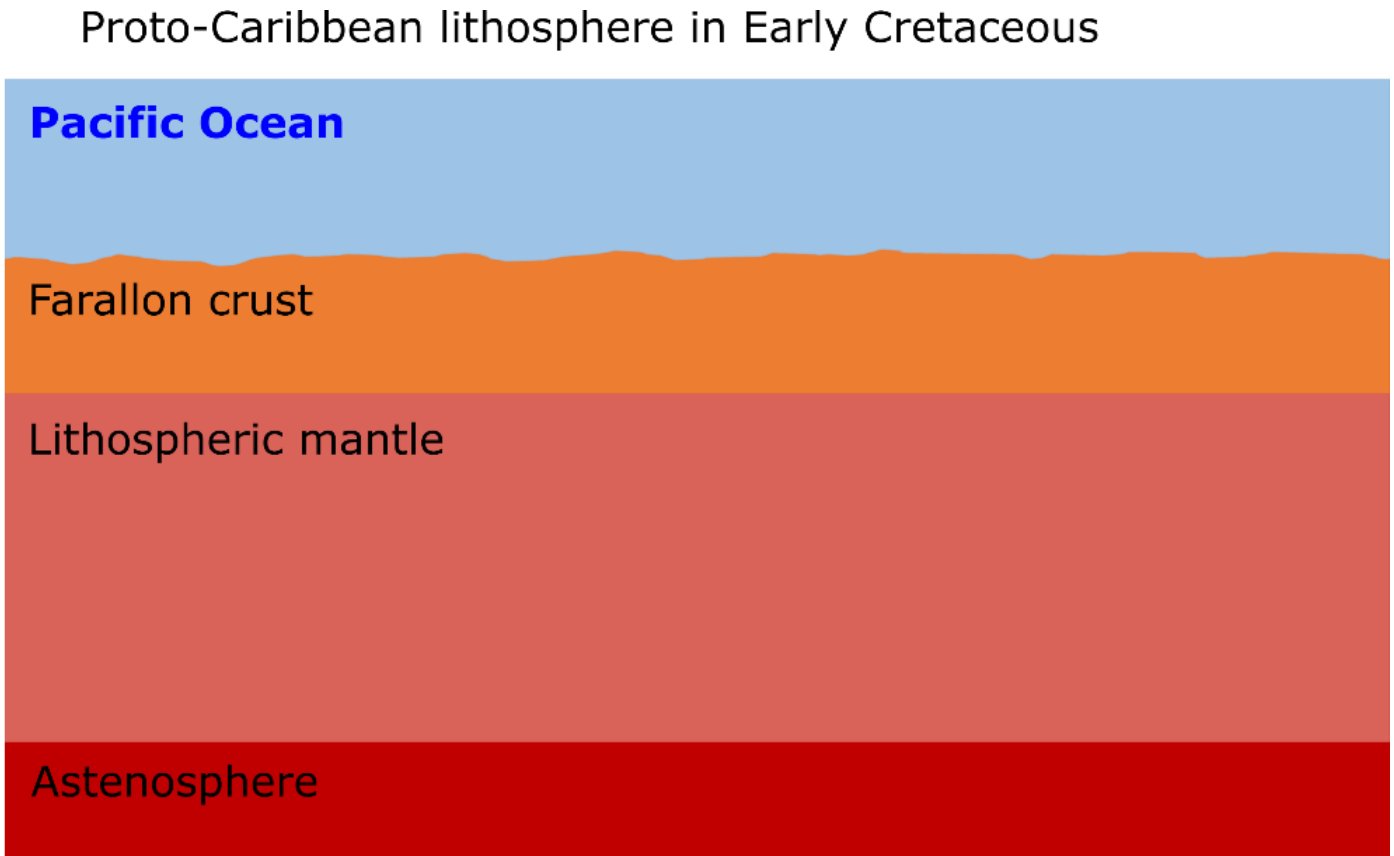
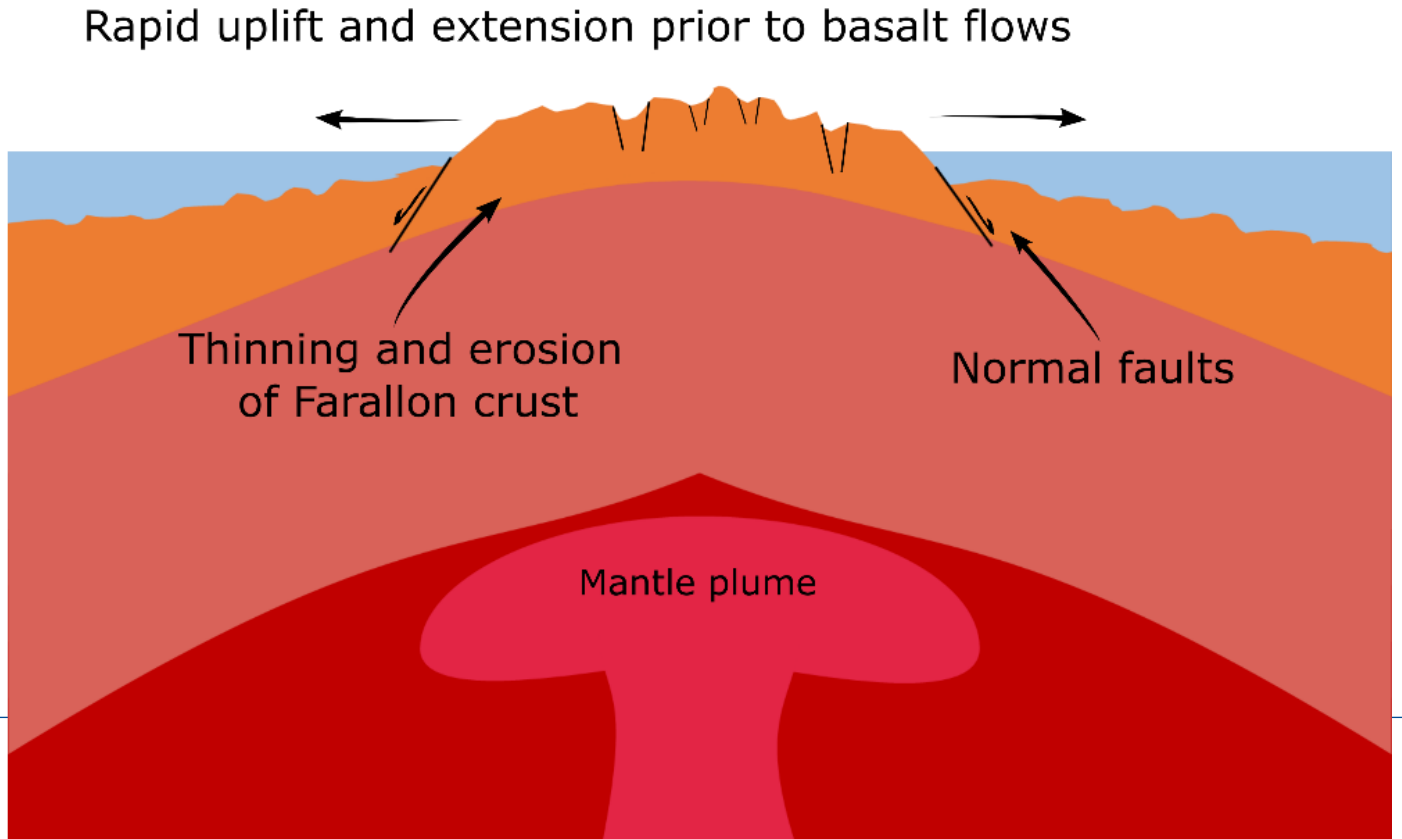
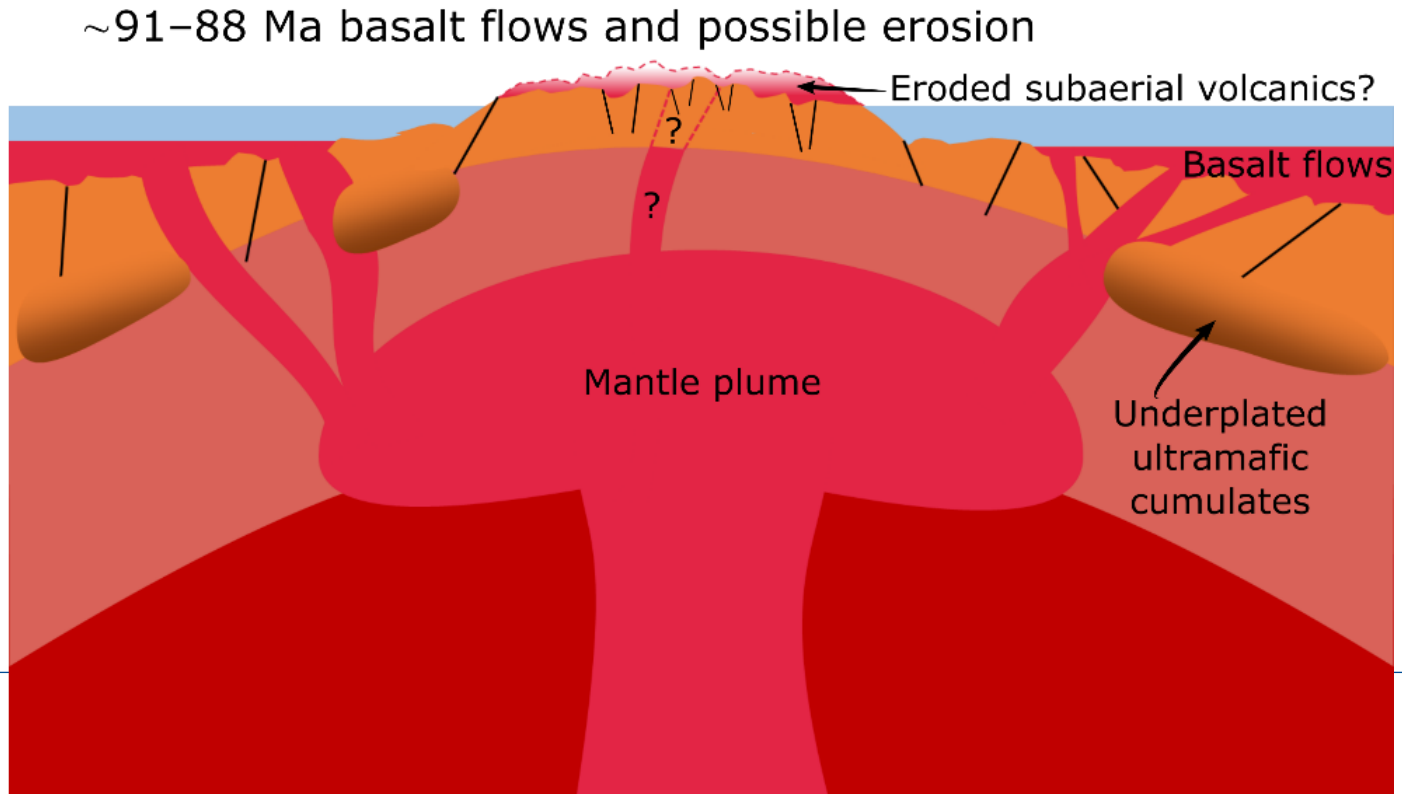
We propose a modification to the commonly accepted tectonic model of the Caribbean…



After the Farallon lithosphere interacted with the Galápagos hotspot, rapid uplift and extension took place…

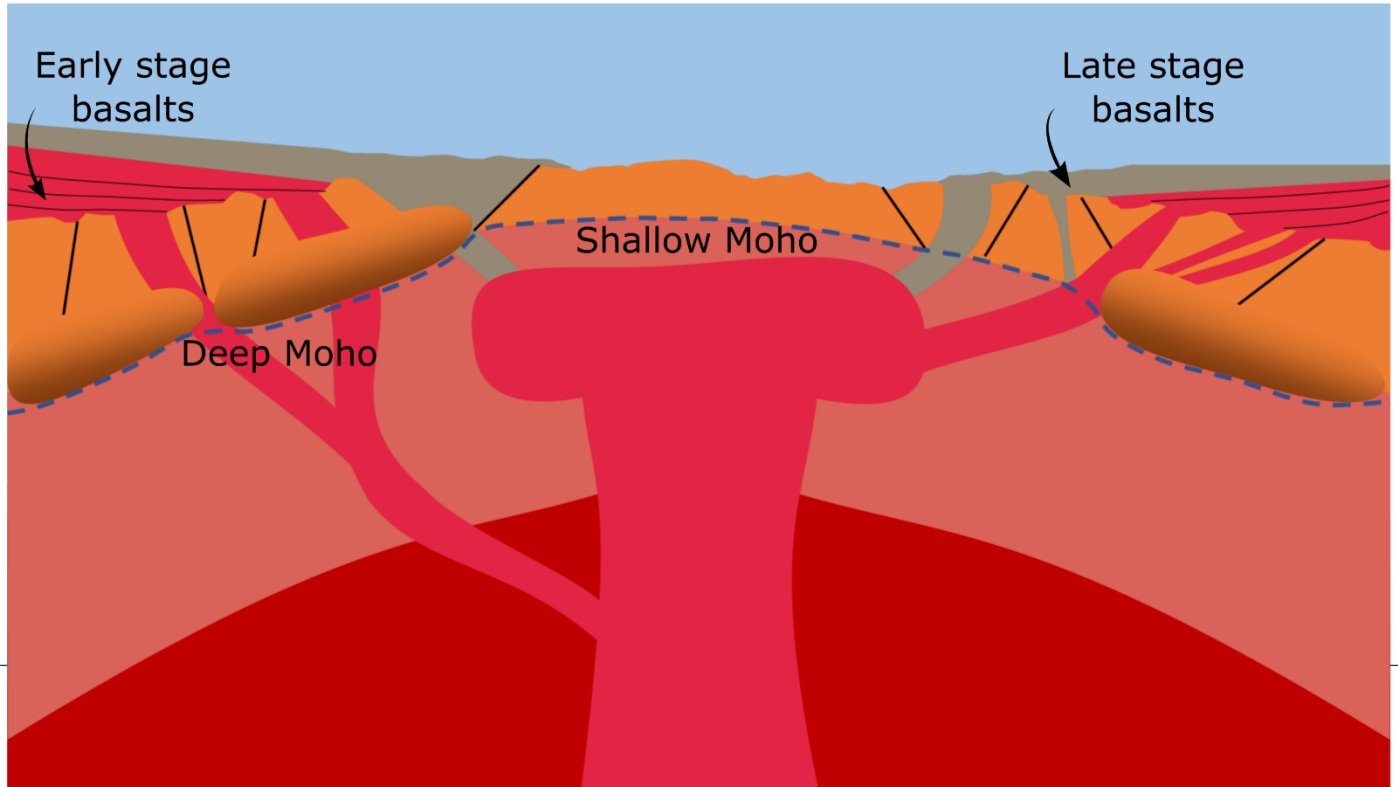


~90 Ma ago, the first basalts were spilled over the Farallon crust. Those that were spilled over the uplifted regions were probably eroded…

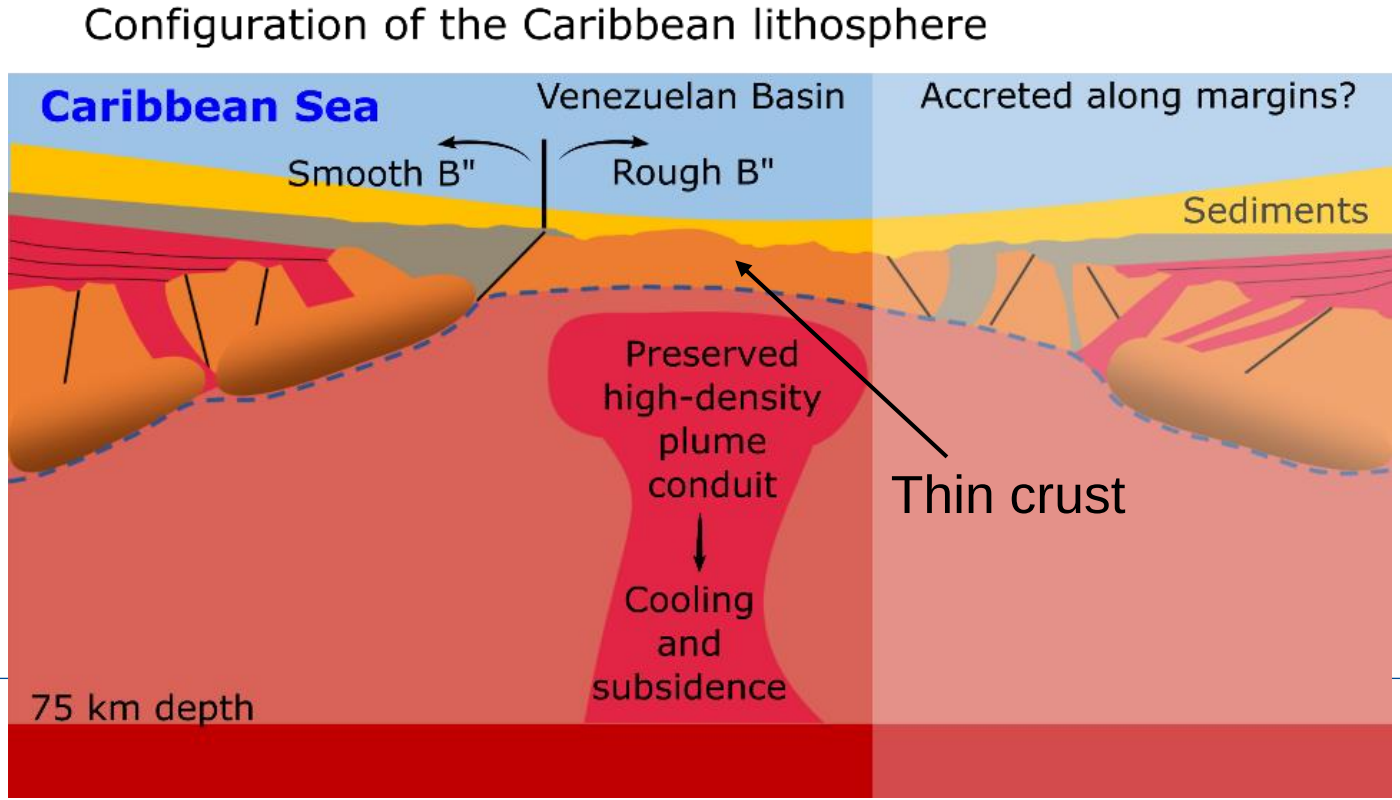


The second pulse of magmatic activity created the late stage basalts, with additional extension of the modified crustal configuration…

~76 Ma basalt flows, additional extension and subsidence



The present-day configuration preserves the thin-crust basins, interpreted as the centers of uplift, as they correlate with the high-density bodies.



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Solid Earth Open Access EGU

The preserved plume of the Caribbean Large Igneous Plateau revealed by 3D data-integrative models

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