

Deformable plate reconstructions of Atlantic Canada and its conjugates back to the Paleozoic

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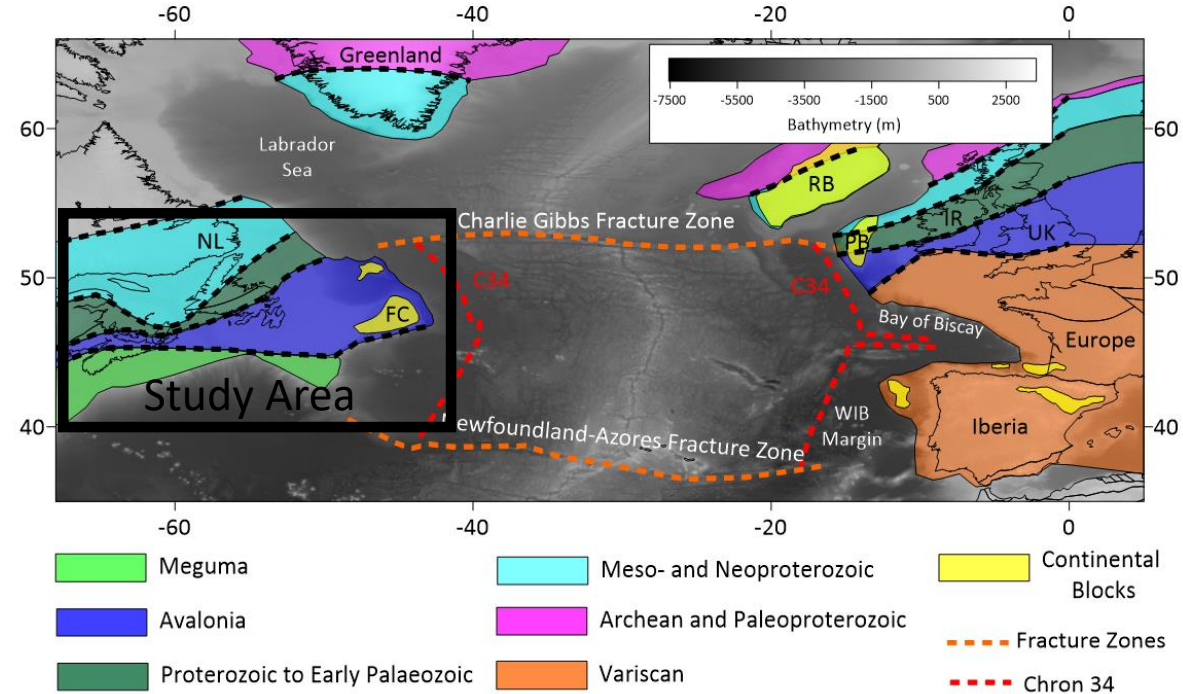
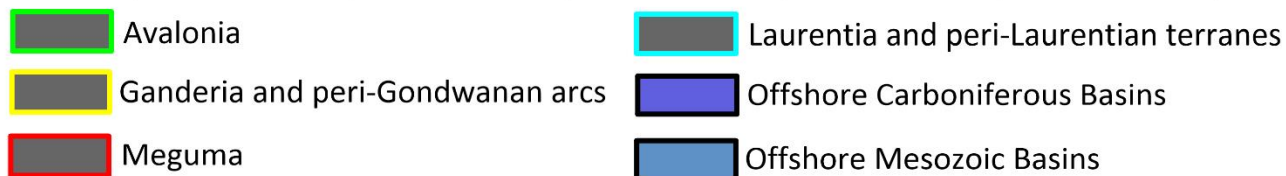
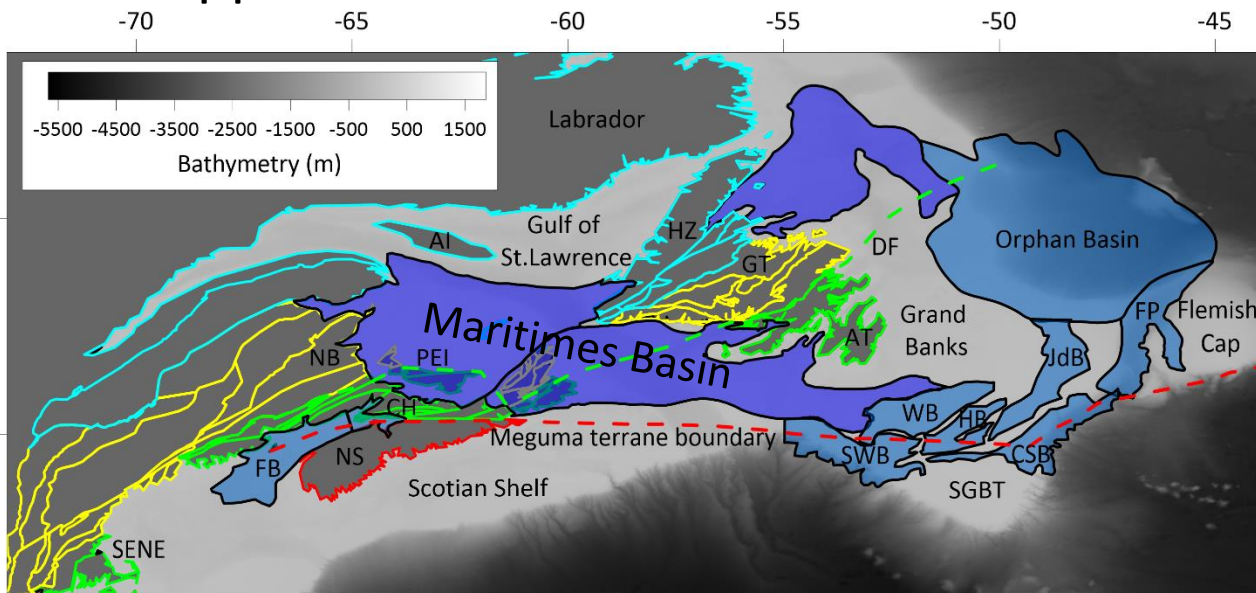
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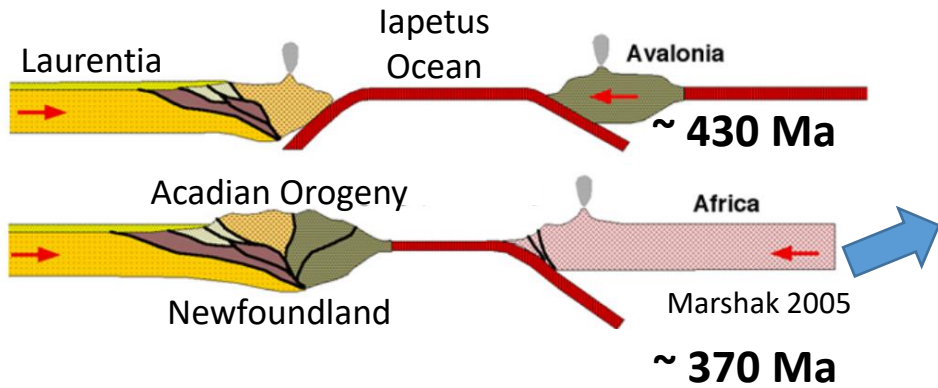
Motivation and Study Area

- **Atlantic Canada onshore-offshore structure:**
 - Carboniferous and Mesozoic sedimentary basins.
 - Appalachian terranes and boundaries.

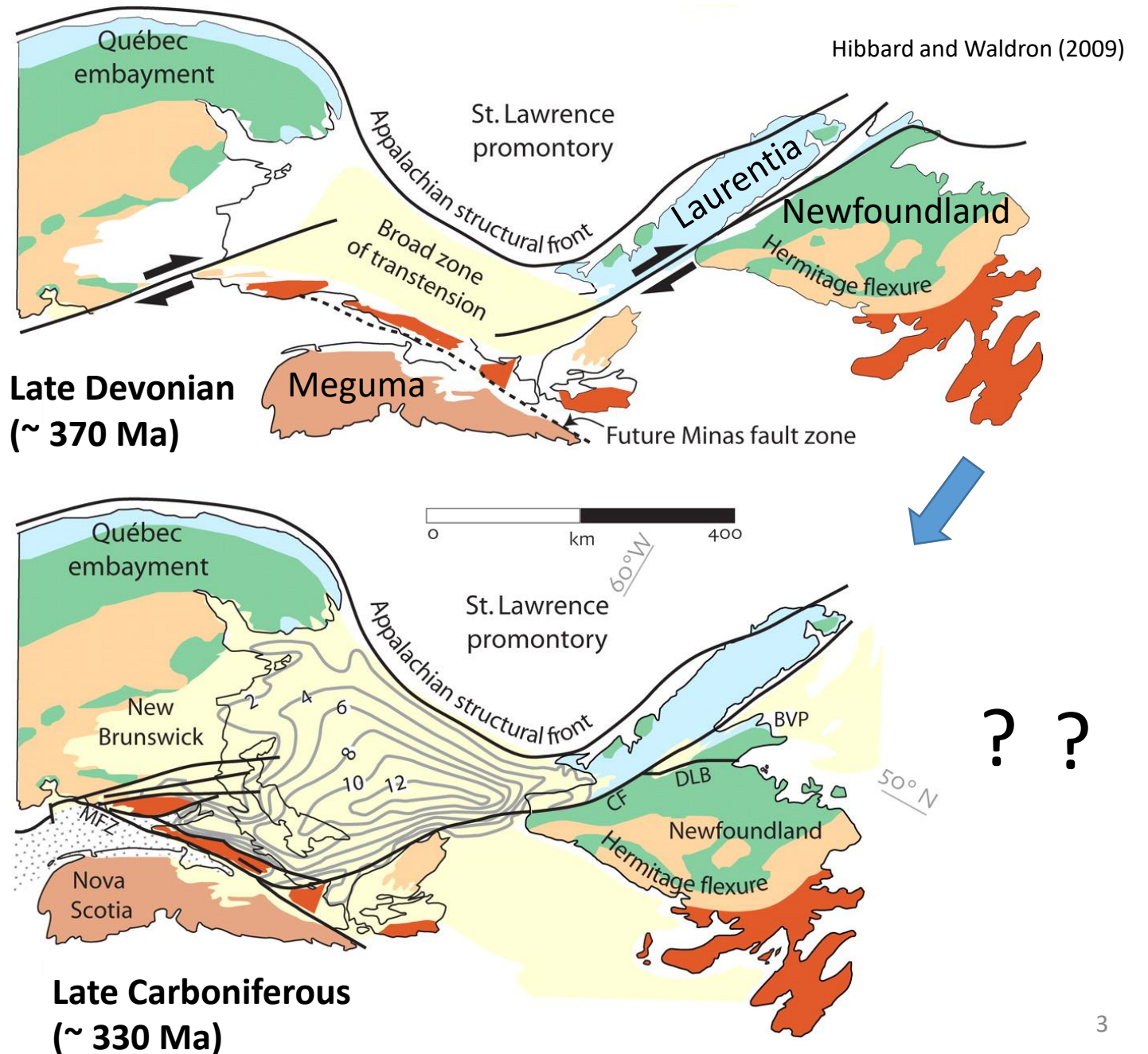


- **Assess the crustal evolution of Atlantic Canada through two Wilson cycles:**
 - Mesozoic rifted margins and Paleozoic terranes.
 - Onshore-offshore system relatively under explored.

Study Objectives



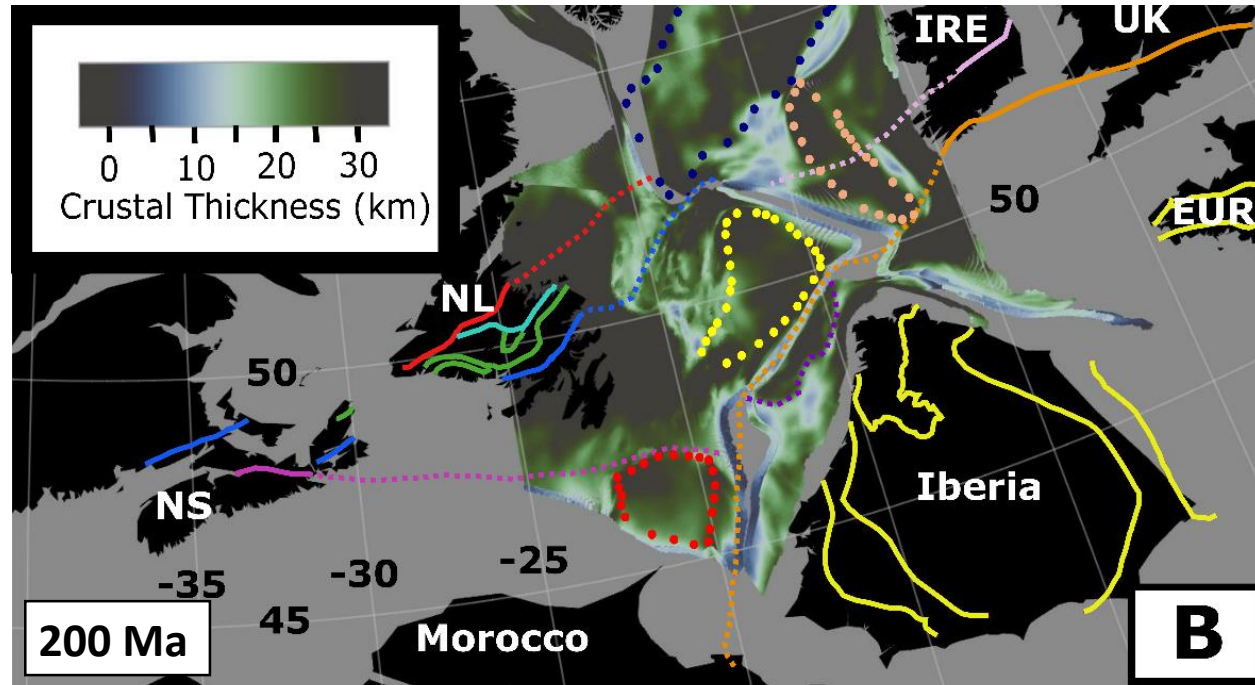
- Investigate the Late Paleozoic kinematics of Atlantic Canada.
- **Did this impact subsequent rifting along North Atlantic margins?**



Study Objectives

200 Ma to present-day

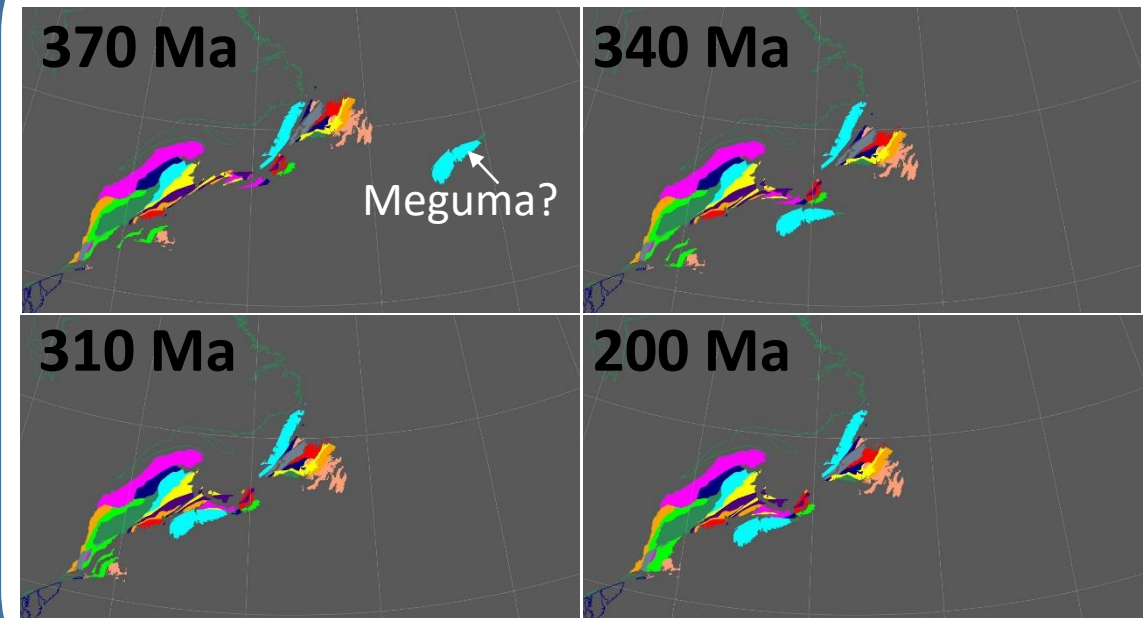
Deformable Mesozoic Reconstruction



- Meguma Suture
 - Variscan Boundaries
 - Galicia Bank Outline
 - Dover Fault
 - Variscan Front
 - Iapetus Suture
 - Ganderia Boundary
 - Iapetus Suture
 - Dog Bay Line
 - Mekwe'jit Line
- King and Welford (2022b)

370 to 200 Ma

Rigid Late Paleozoic Reconstruction

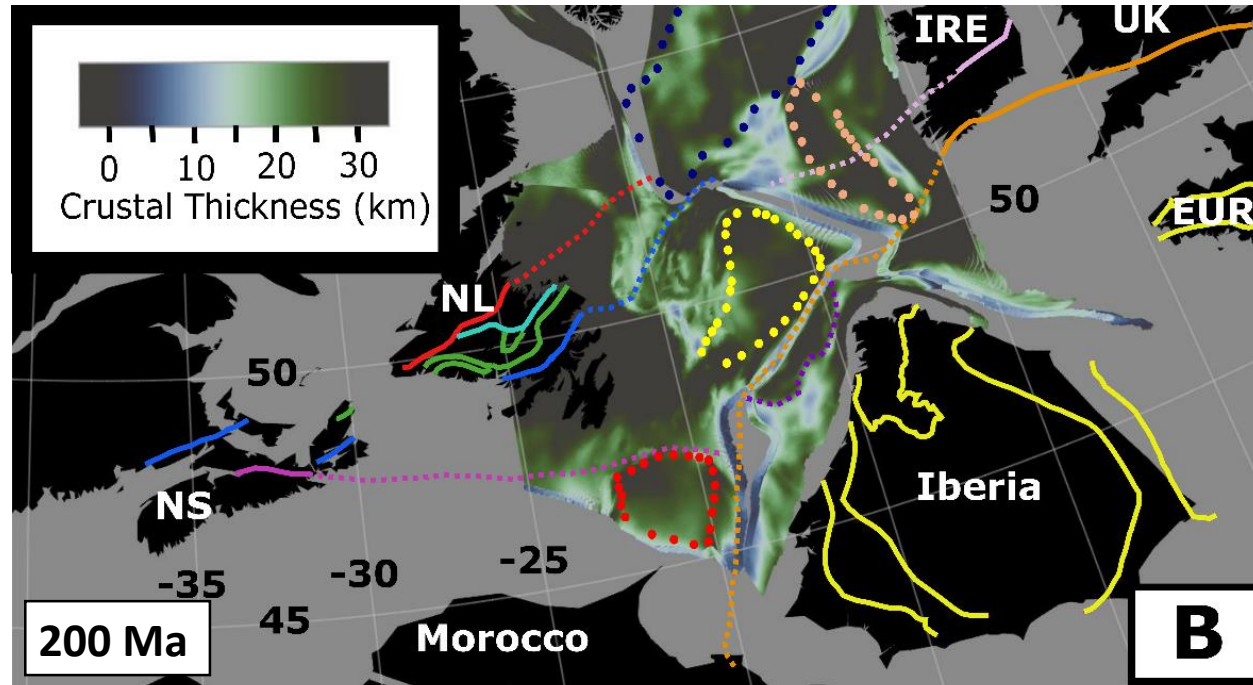


modified after Waldron et al. (2022)

Study Objectives

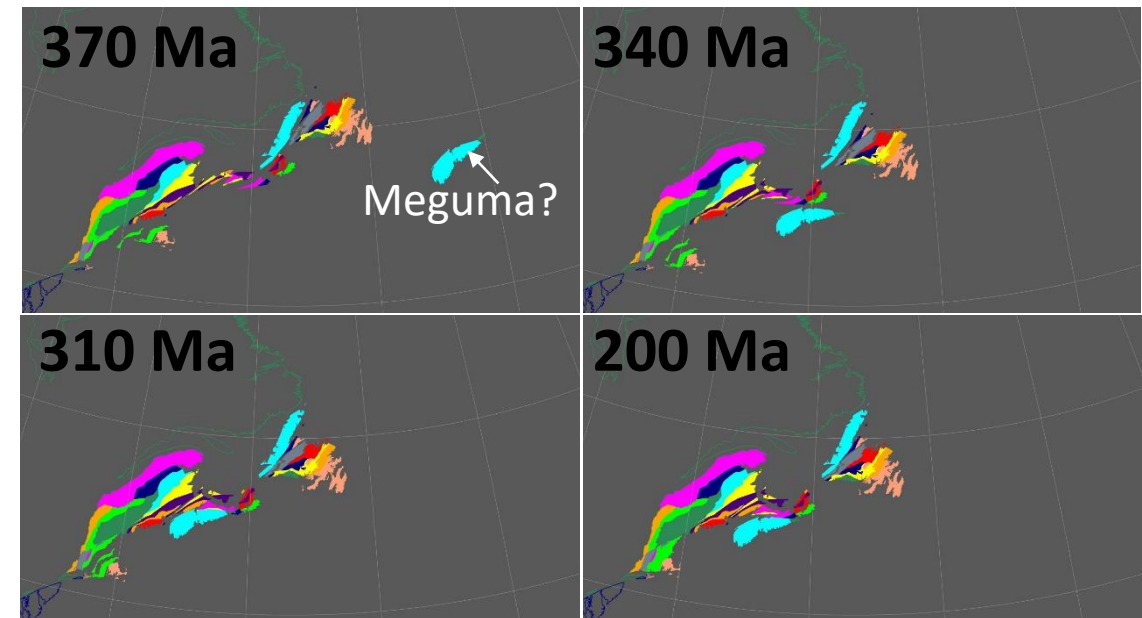
Create a deformable plate reconstruction of Atlantic Canada from 370 Ma to present-day

Deformable Mesozoic Reconstruction



- Meguma Suture
 ■ Variscan Boundaries
 ■ Galicia Bank Outline
 - Dover Fault
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Rigid Late Paleozoic Reconstruction

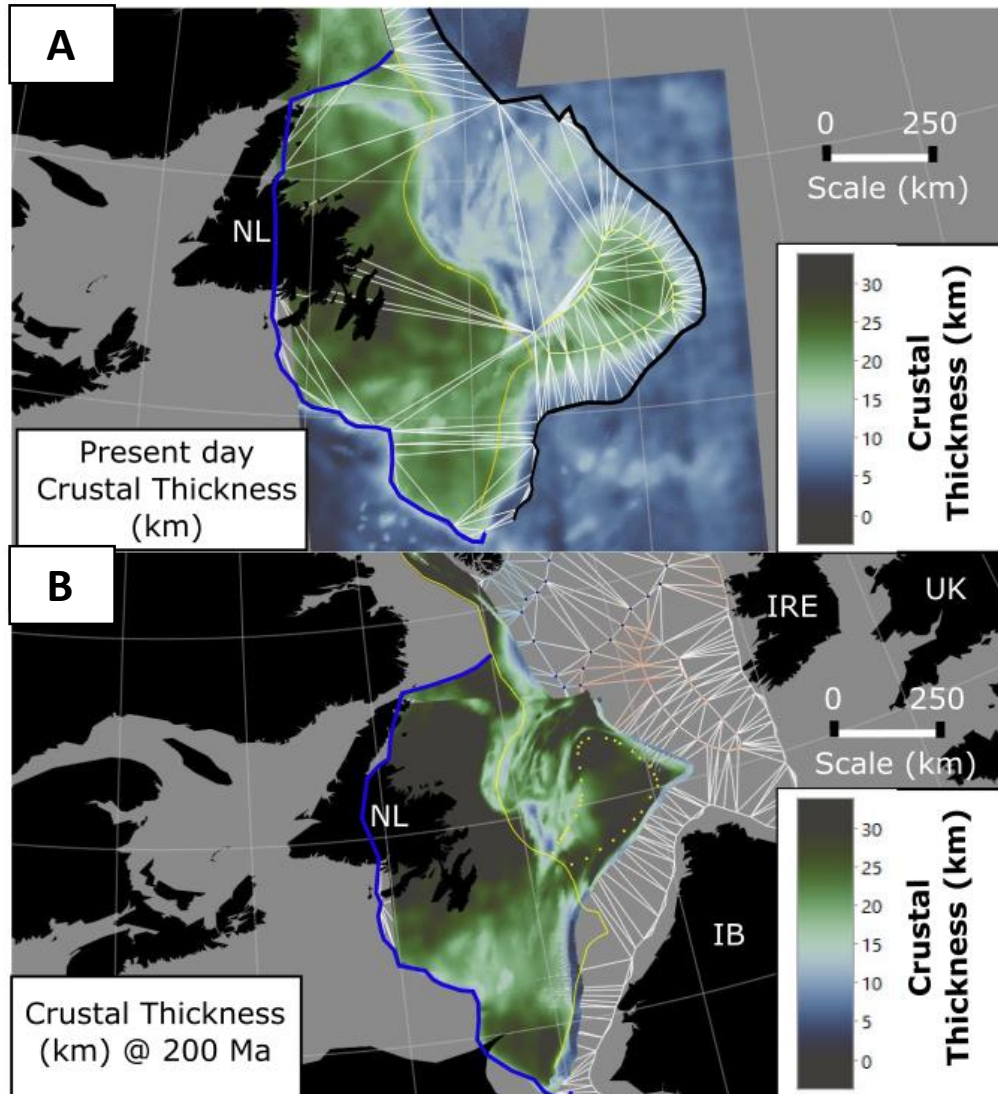


modified after Waldron et al. (2022)

Method - Deformable Plate Reconstructions

Crustal thicknesses and back through time

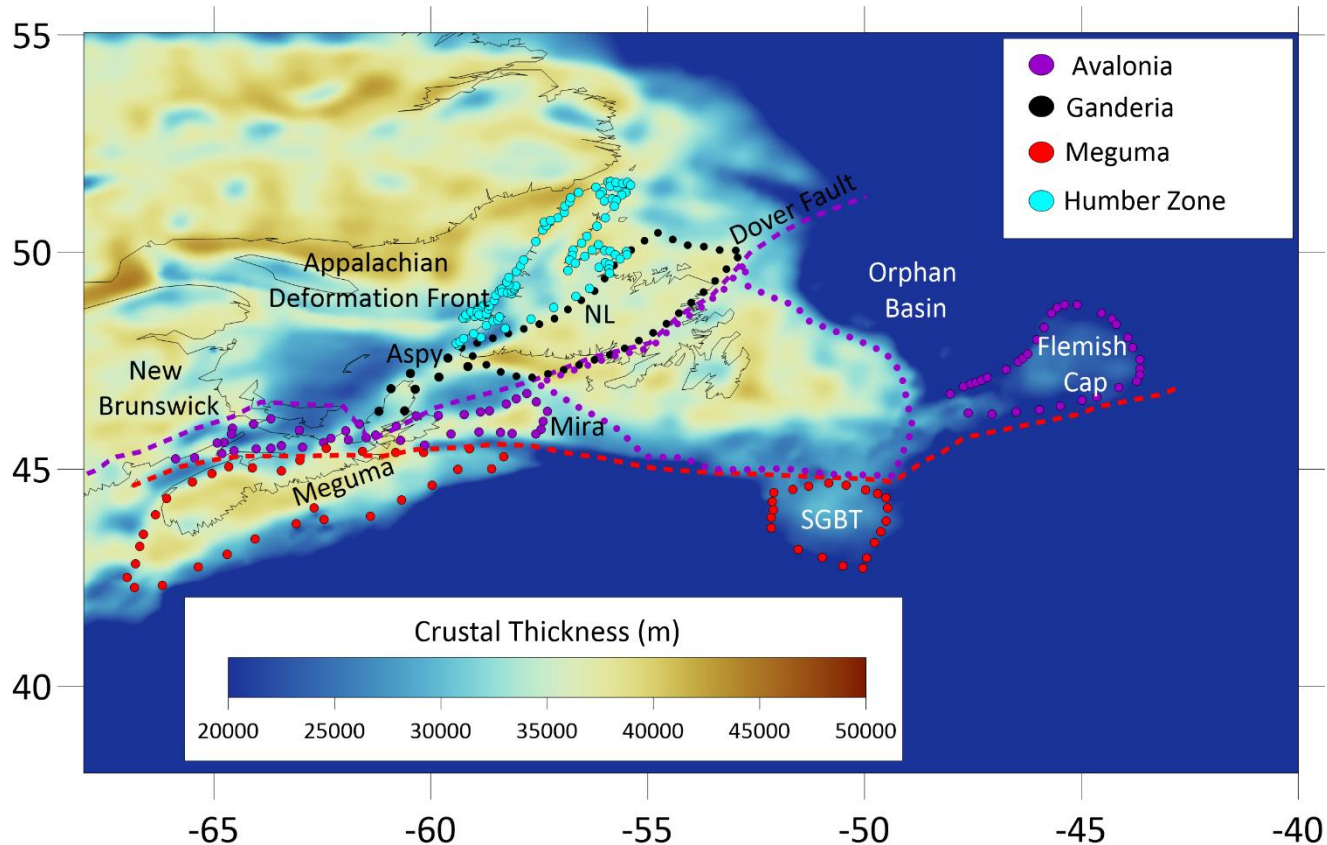
Modified after
King and
Welford
(2022a)



- Using **GPlates** and **pyGPlates** to reconstruct present-day crustal thickness estimates back through time:
 - Investigate plate kinematics and crustal stretching.
 - Reconstruct pre-rift templates
 - Assess deformation within continental blocks/terranes and sedimentary basins through time.



Deformable Plate Reconstruction Inputs



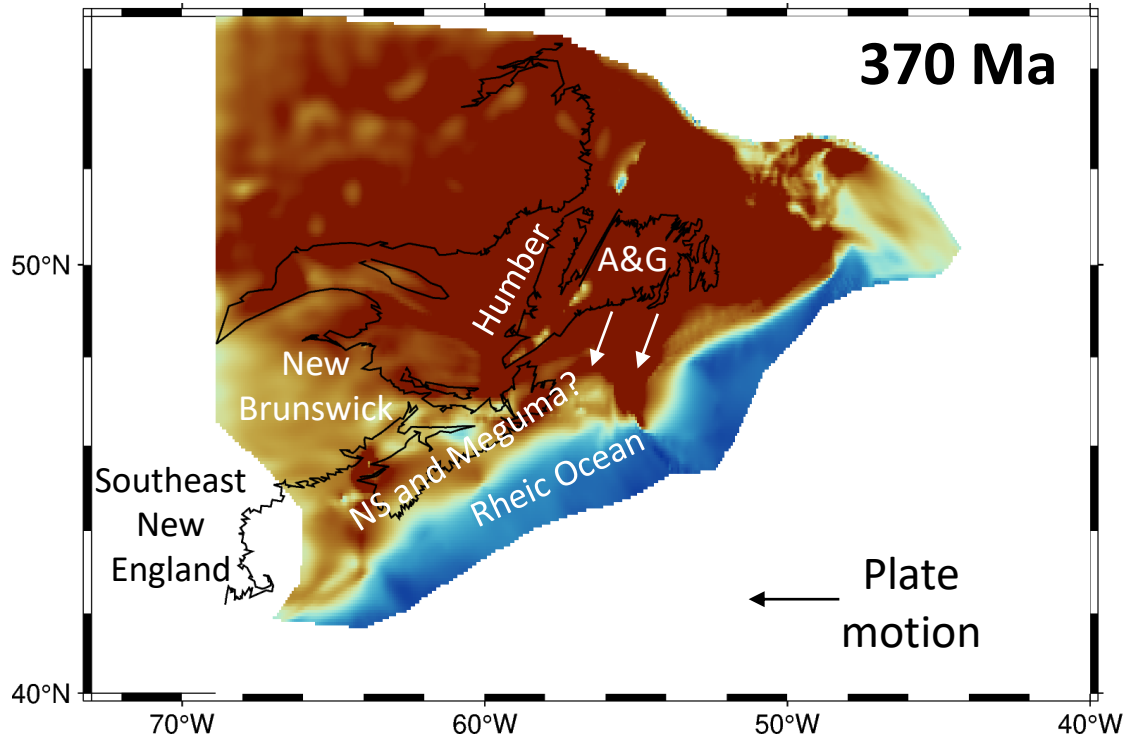
- **Newly-derived crustal thickness estimates:**

- Calculated using constrained 3-D gravity inversion.
- Used to interpret Paleozoic terrane geometries throughout Atlantic Canada.

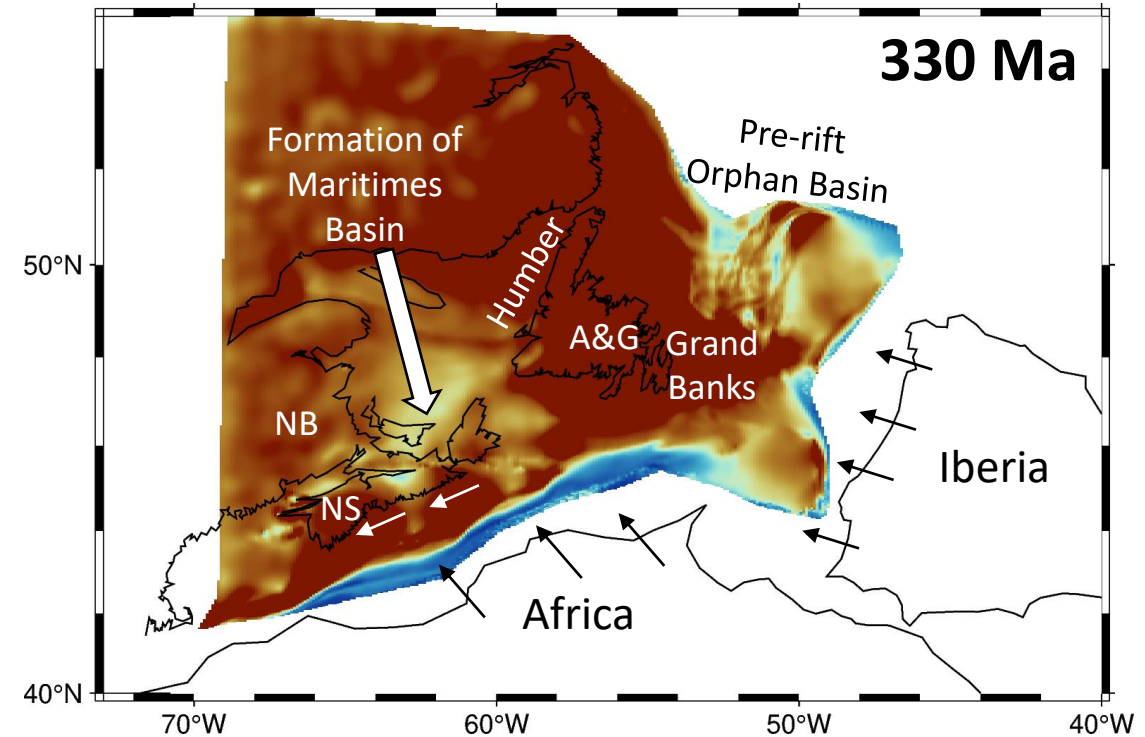
- **Plate Kinematic Inputs:**

- Appalachian terrane geometries interpreted from gravity inversion crustal thickness estimates and adapted from Waldron et al. (2022).
- Poles of rotation modified after:
 - Waldron et al. (2022) – Appalachian terranes from 370 to 200 Ma.
 - Meredith et al. (2021) – larger tectonic plates during the Paleozoic (ex. Africa and Iberia)
 - King and Welford (2022b) – North Atlantic plates and blocks from 200 Ma to present-day.
- Plate reconstructions assessed relative to North America.

Late Devonian to Carboniferous Reconstruction



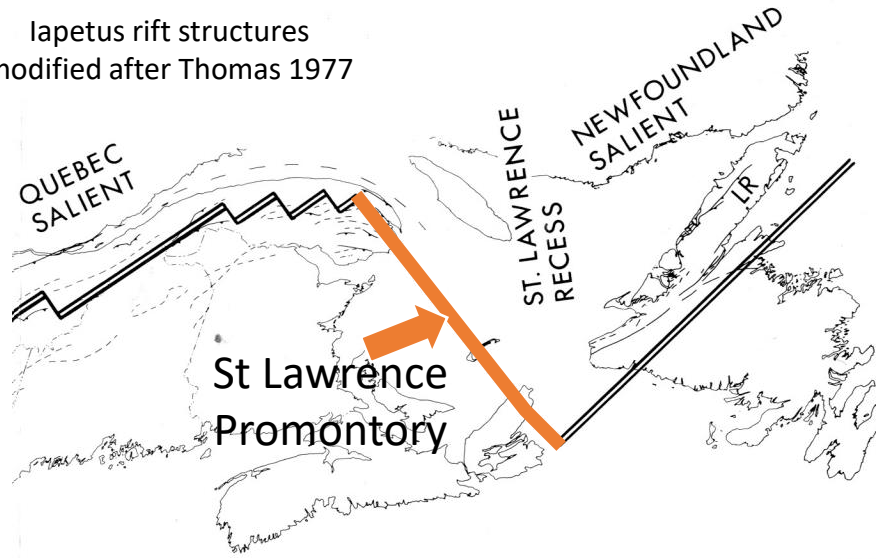
- Avalon and Gander (A&G) terranes located east of the Humber Zone.
- Nova Scotia (NS) and Meguma terrane situated south of Humber Zone.



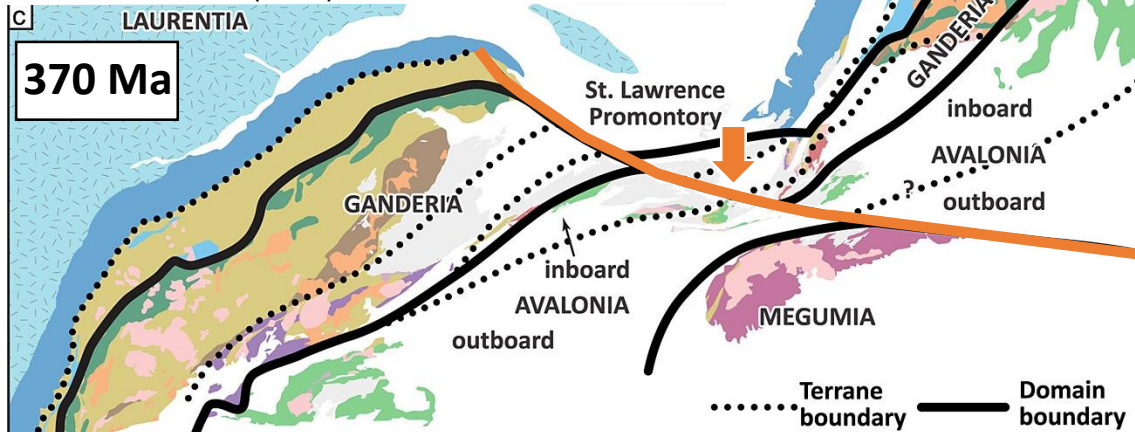
- Dextral strike slip continues within southern Atlantic Canada.
- Regional contraction caused by the Variscan Orogeny.

Two Wilson Cycles of Inheritance?

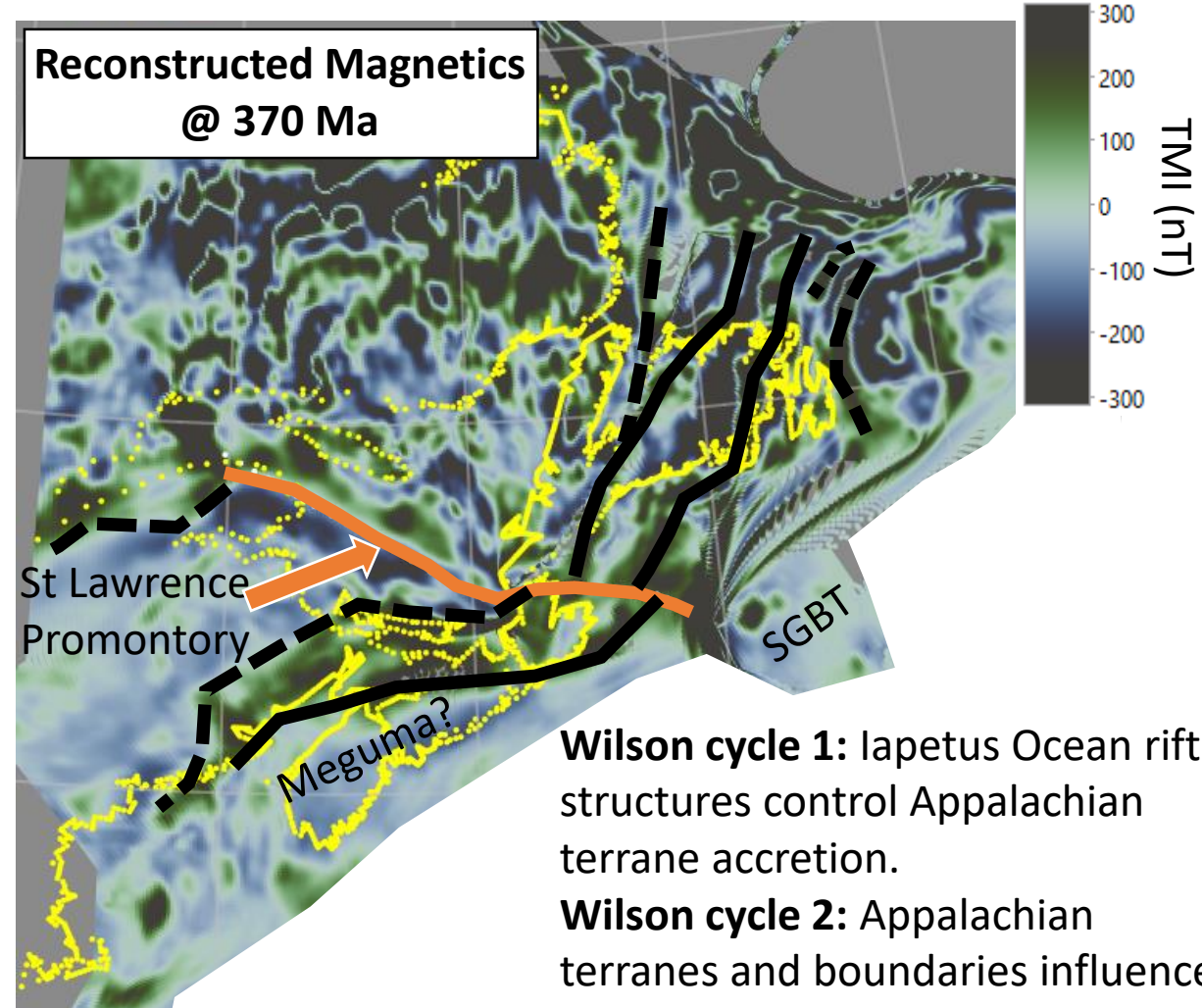
Iapetus rift structures
modified after Thomas 1977



Waldron et al. (2015)



Reconstructed Magnetics
@ 370 Ma

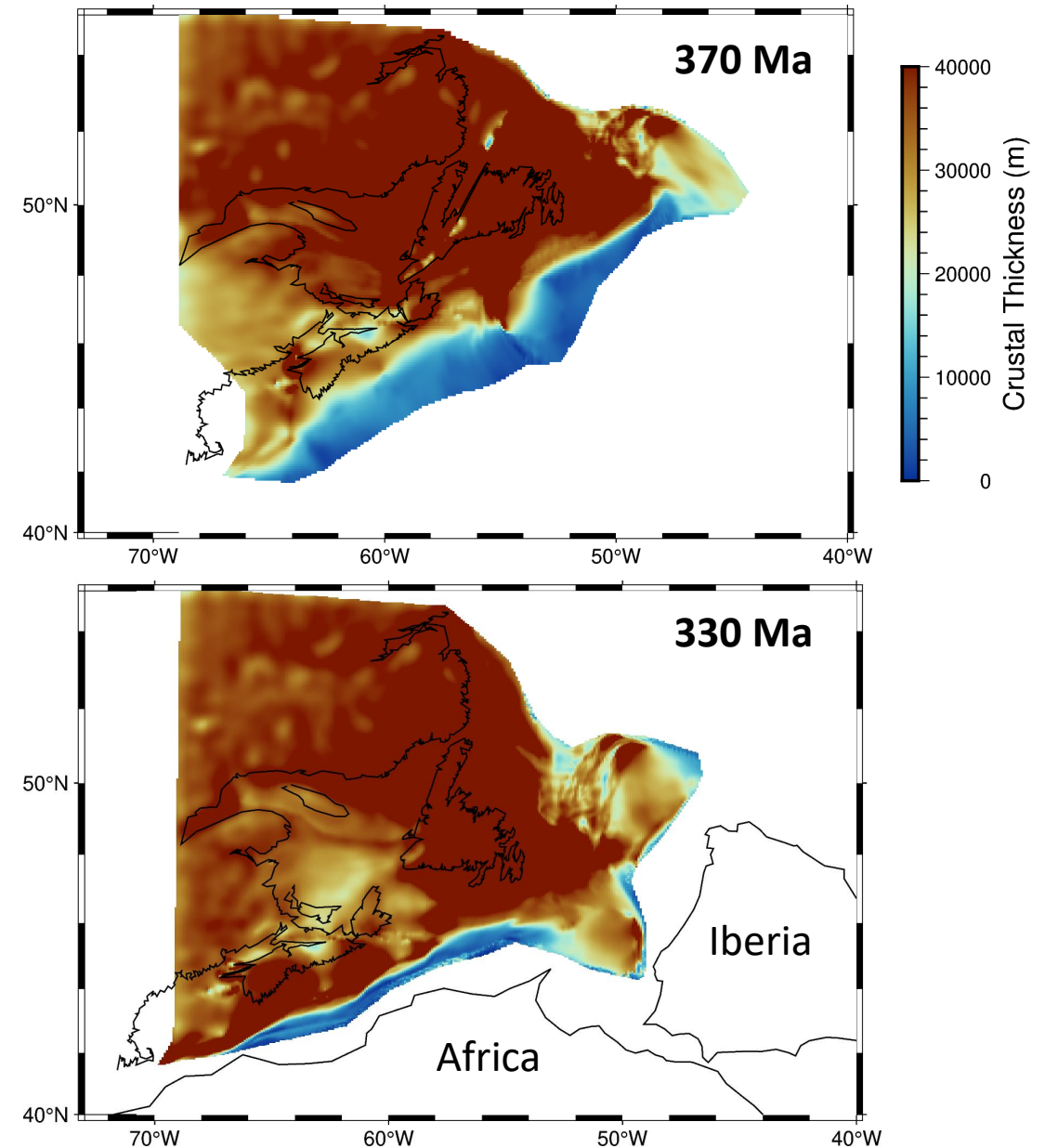


Wilson cycle 1: Iapetus Ocean rift structures control Appalachian terrane accretion.

Wilson cycle 2: Appalachian terranes and boundaries influence pre-rift template of the modern North Atlantic Ocean.

Key Points and Takeaways

- **Influence of Late Paleozoic strike-slip kinematics on Atlantic Canada sedimentary basins:**
 - Initiated along structures related to the opening and closing of the Iapetus Ocean.
 - Deformation partitioned by Appalachian terrane kinematics.
- **Interplay of Late Paleozoic strike-slip and Variscan deformation influenced the pre-rift crustal structure of the Newfoundland margin.**



References

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