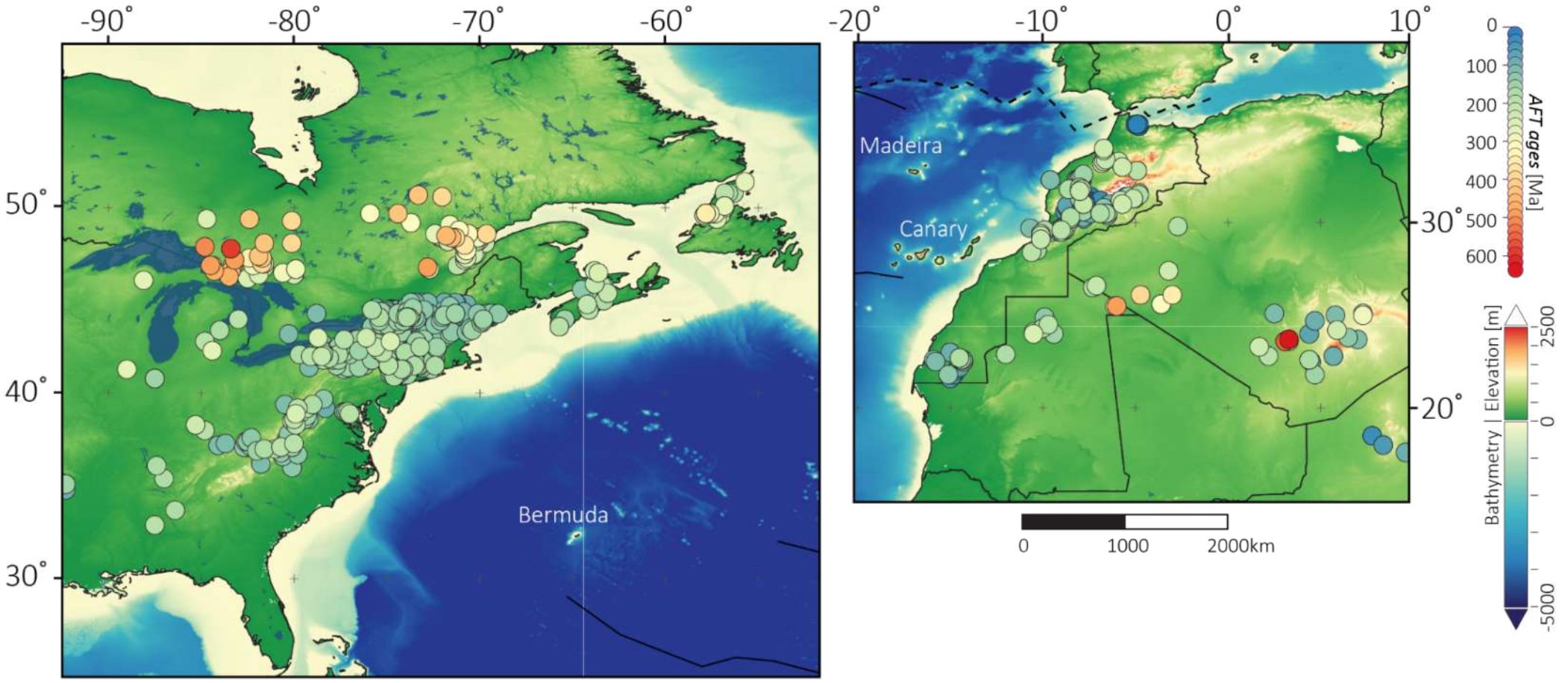
UNFOLDING THE UNEXPECTED: YET ANOTHER EXHUMING MARGIN ALONG NW AFRICA

M. Gouiza
R. Charton, G. Bertotti

Key

- LTT: low-temperature thermochronology
- AFT: apatite fission track
- Apatite-He: apatite (U-Th-Sm)/He

REMINDER: VERTICAL MOVEMENTS ALONG THE MOROCCAN MARGIN



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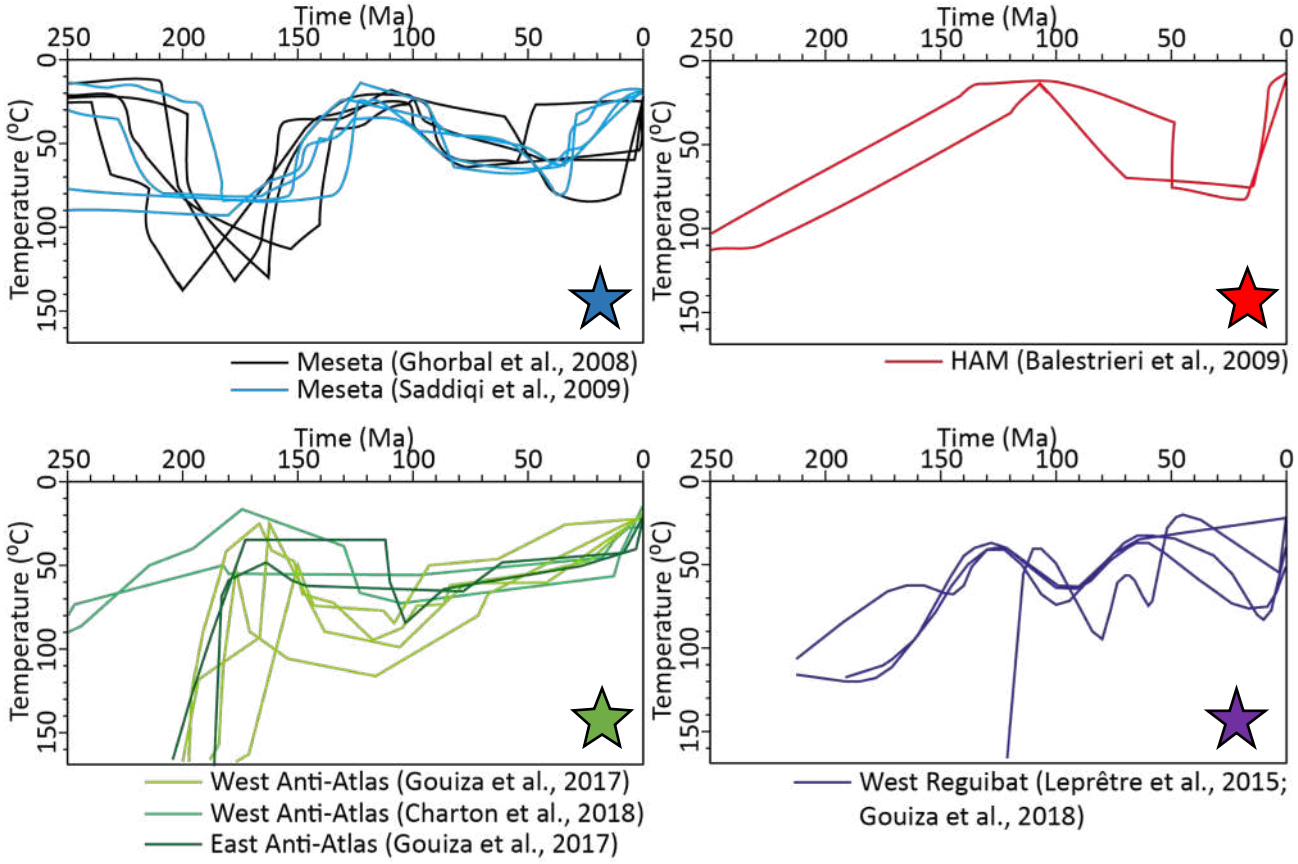

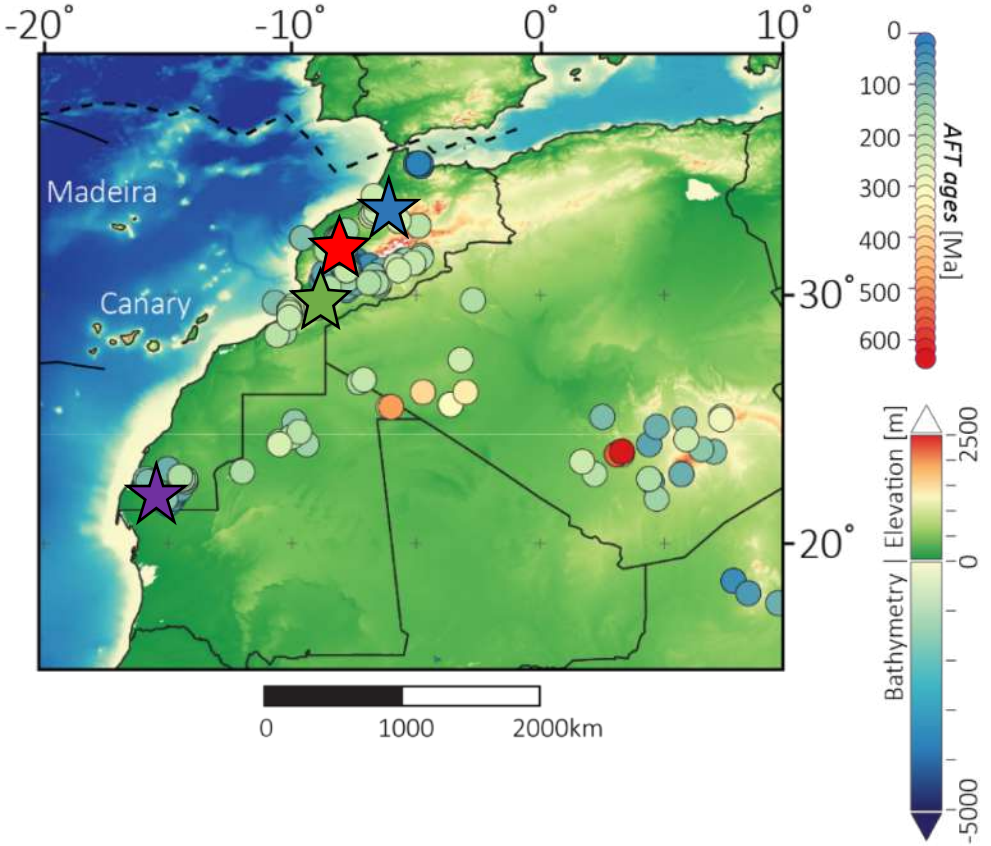

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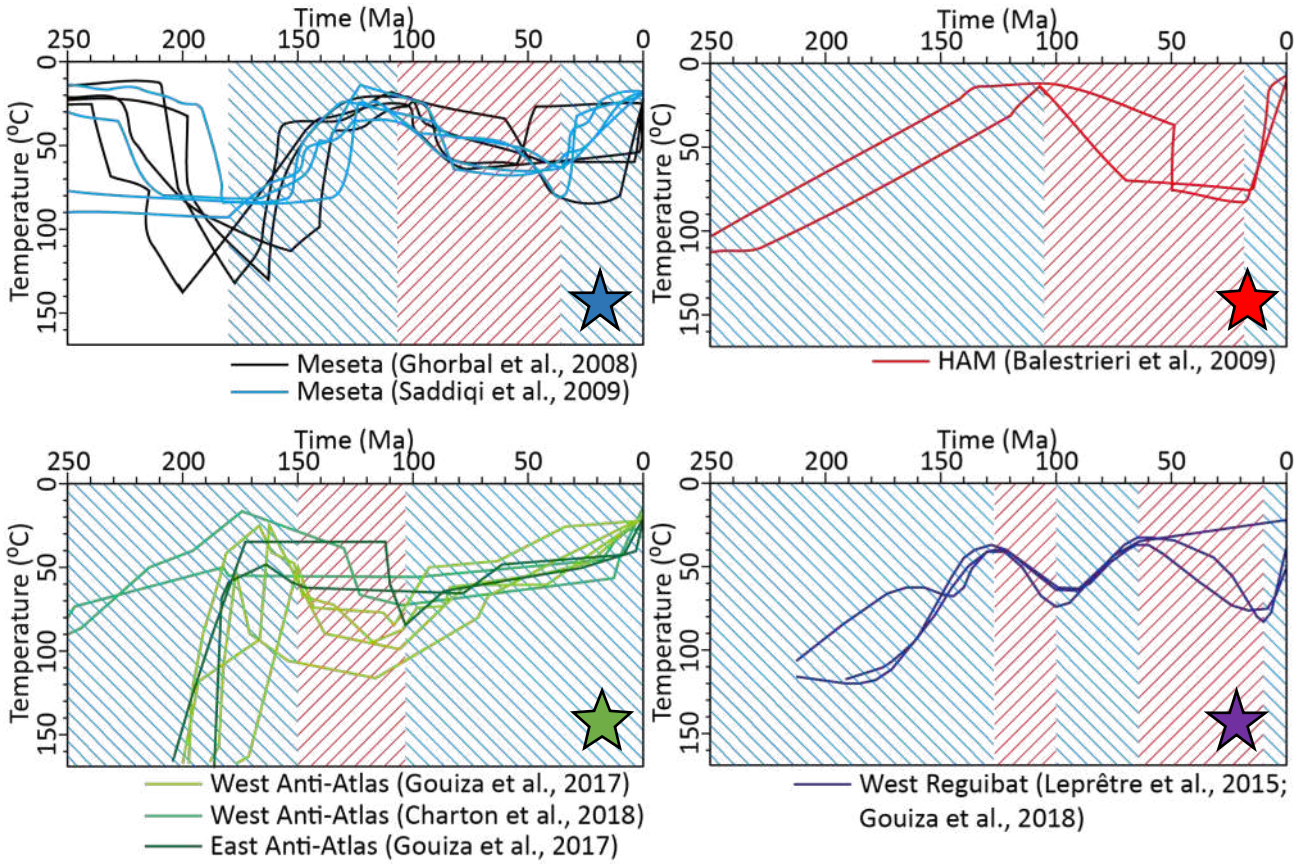

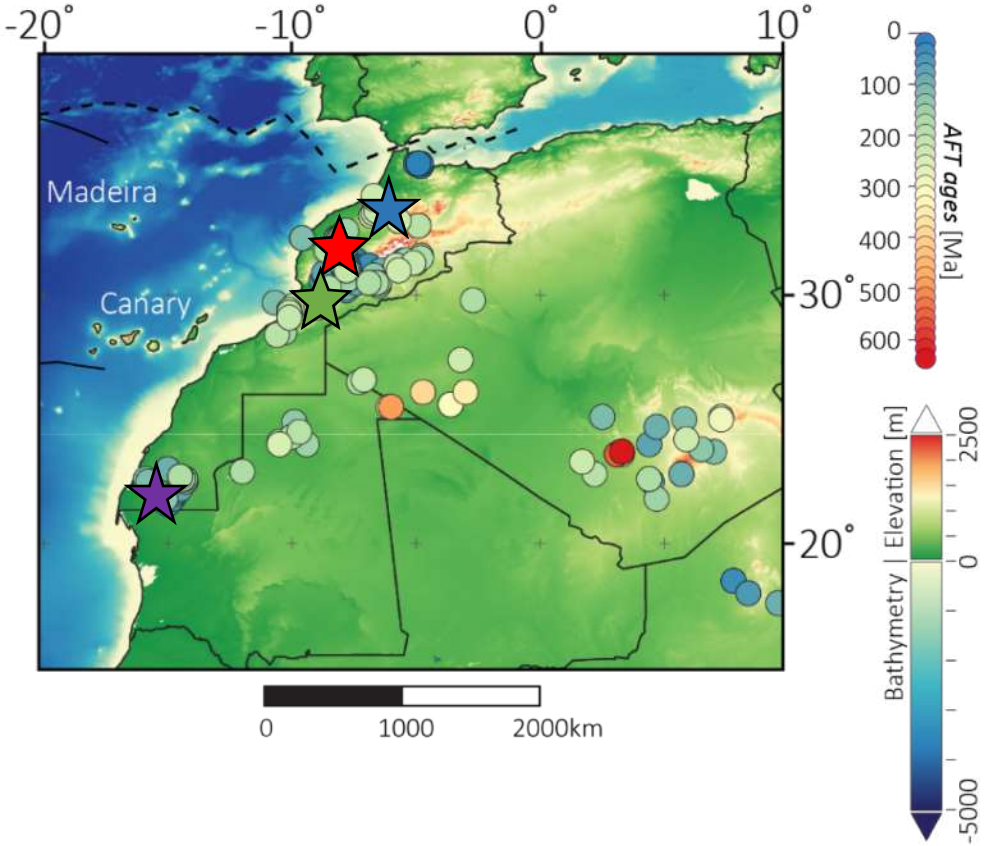

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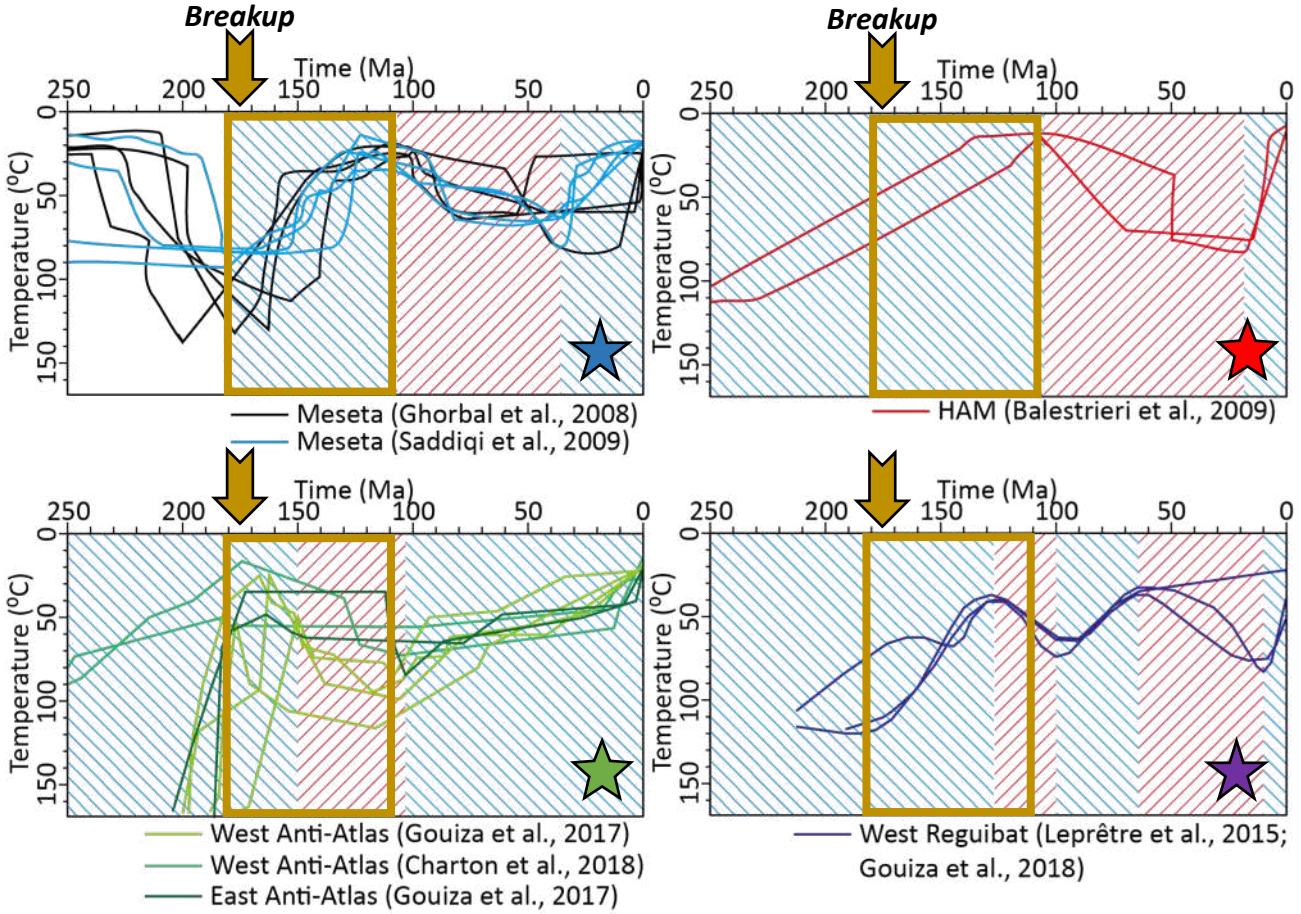

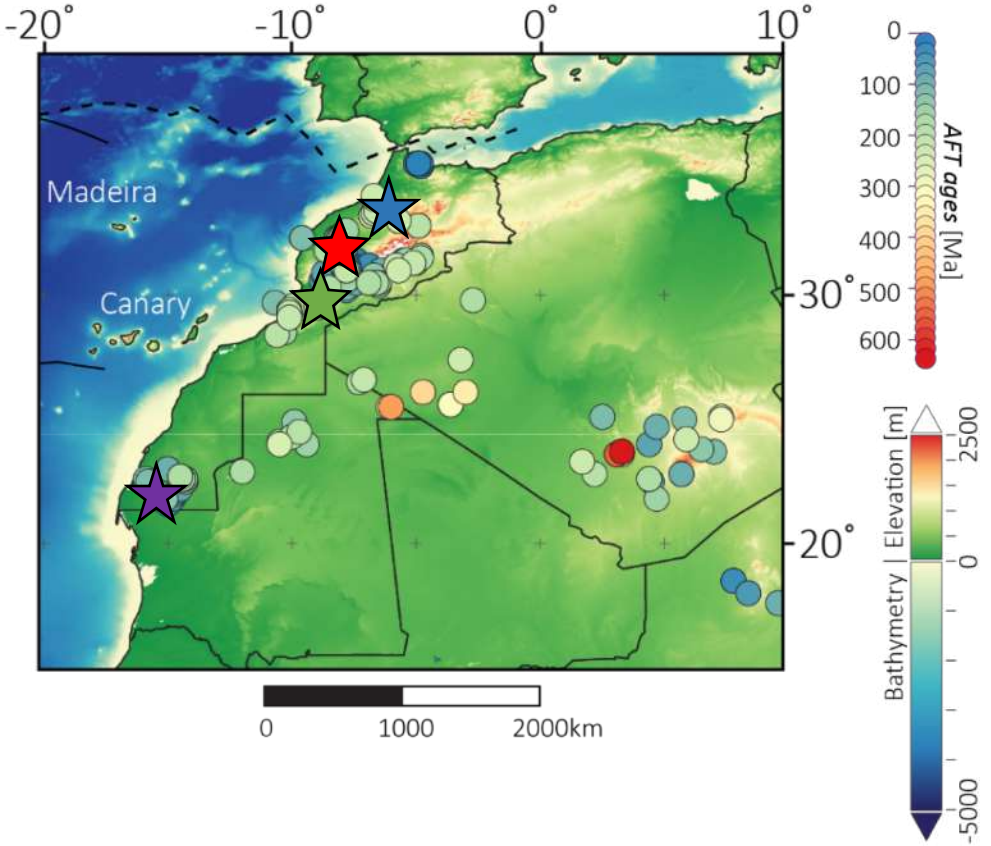

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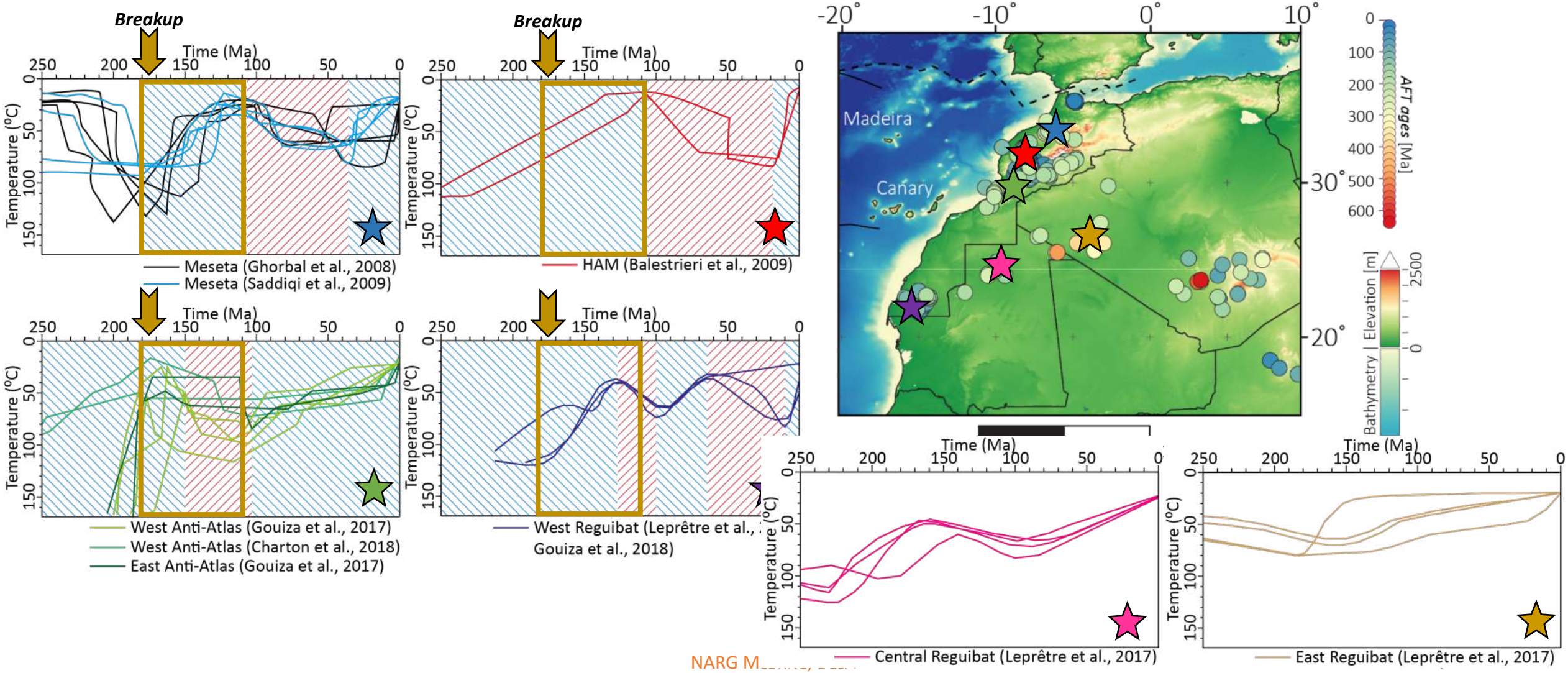

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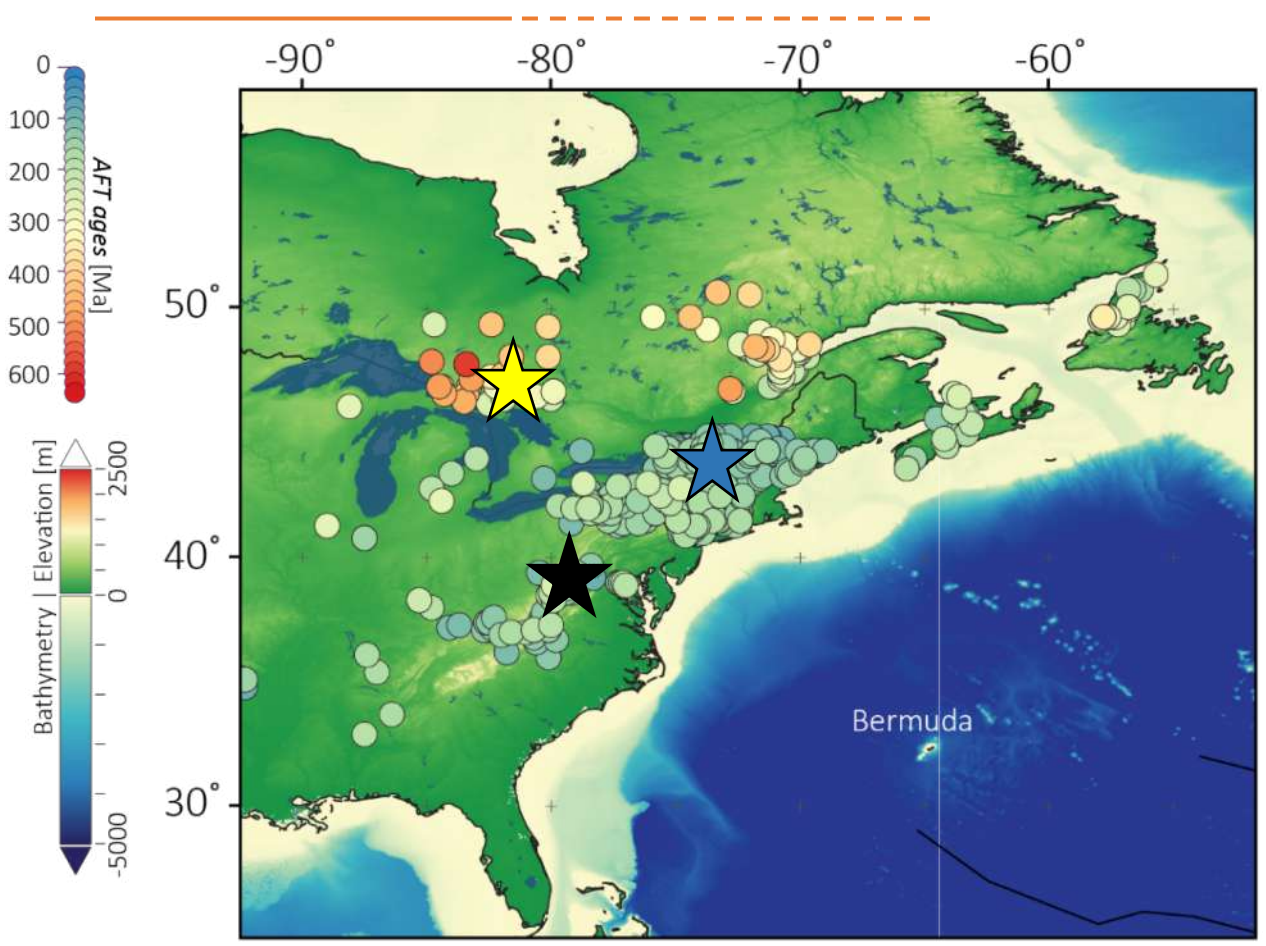

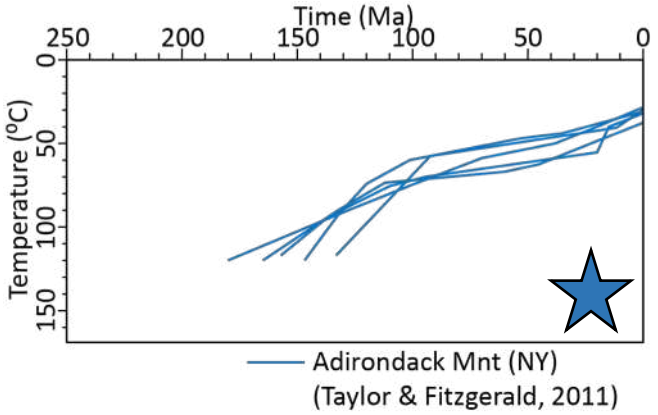

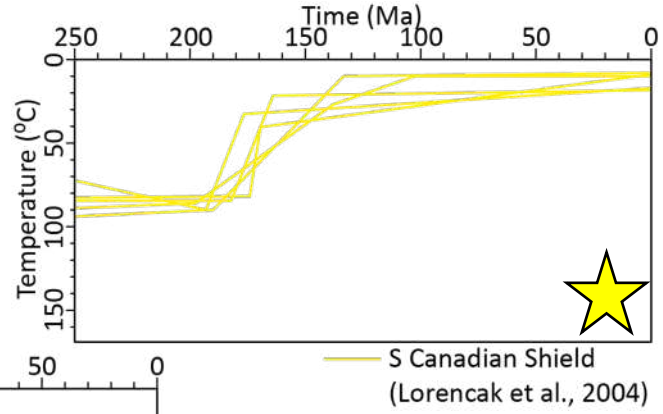

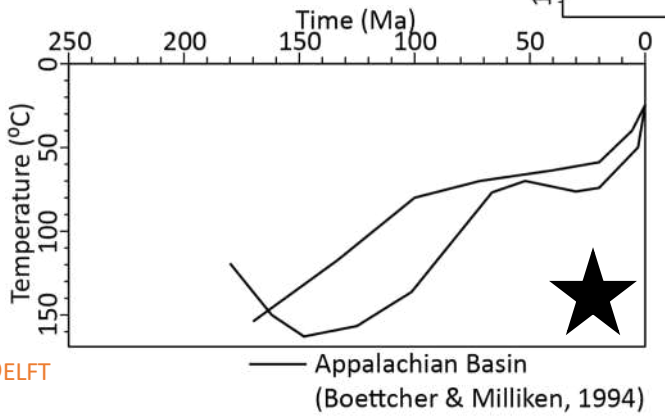

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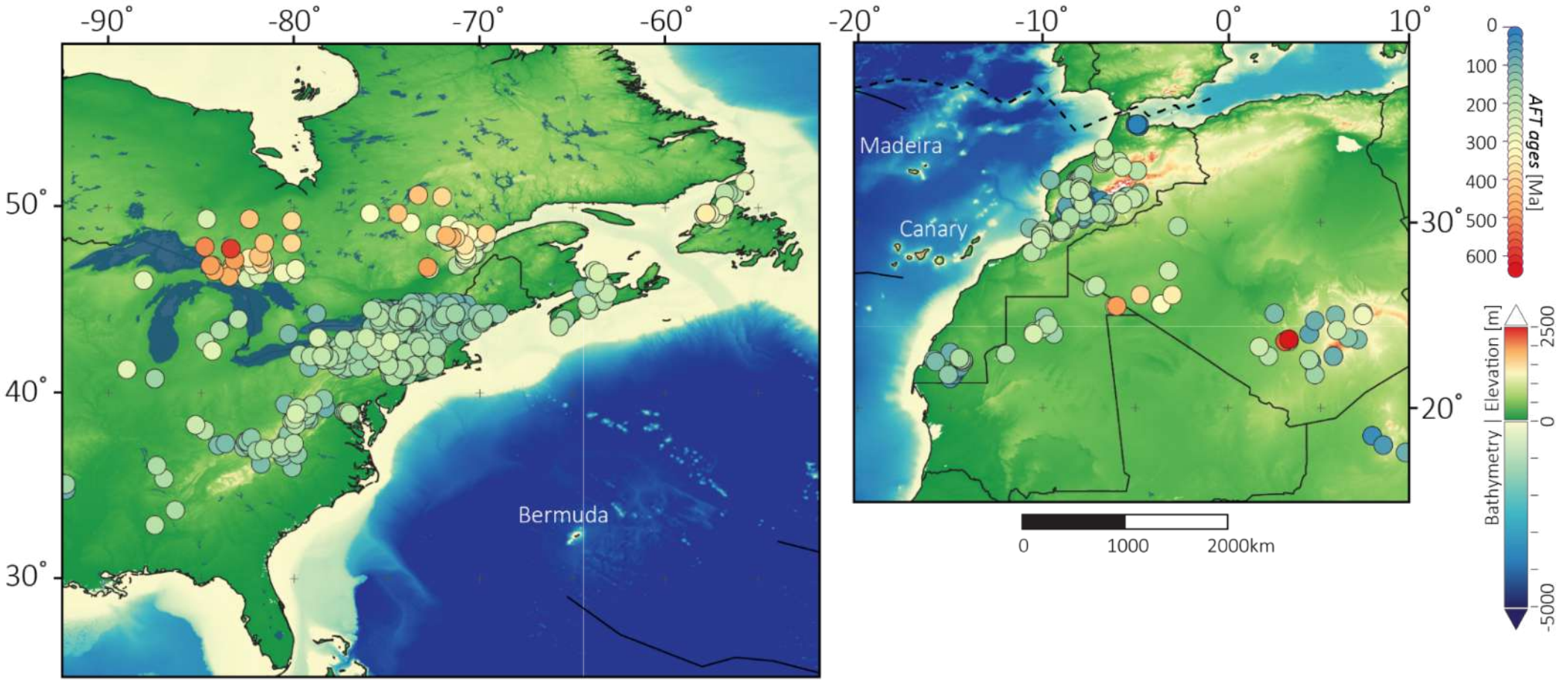
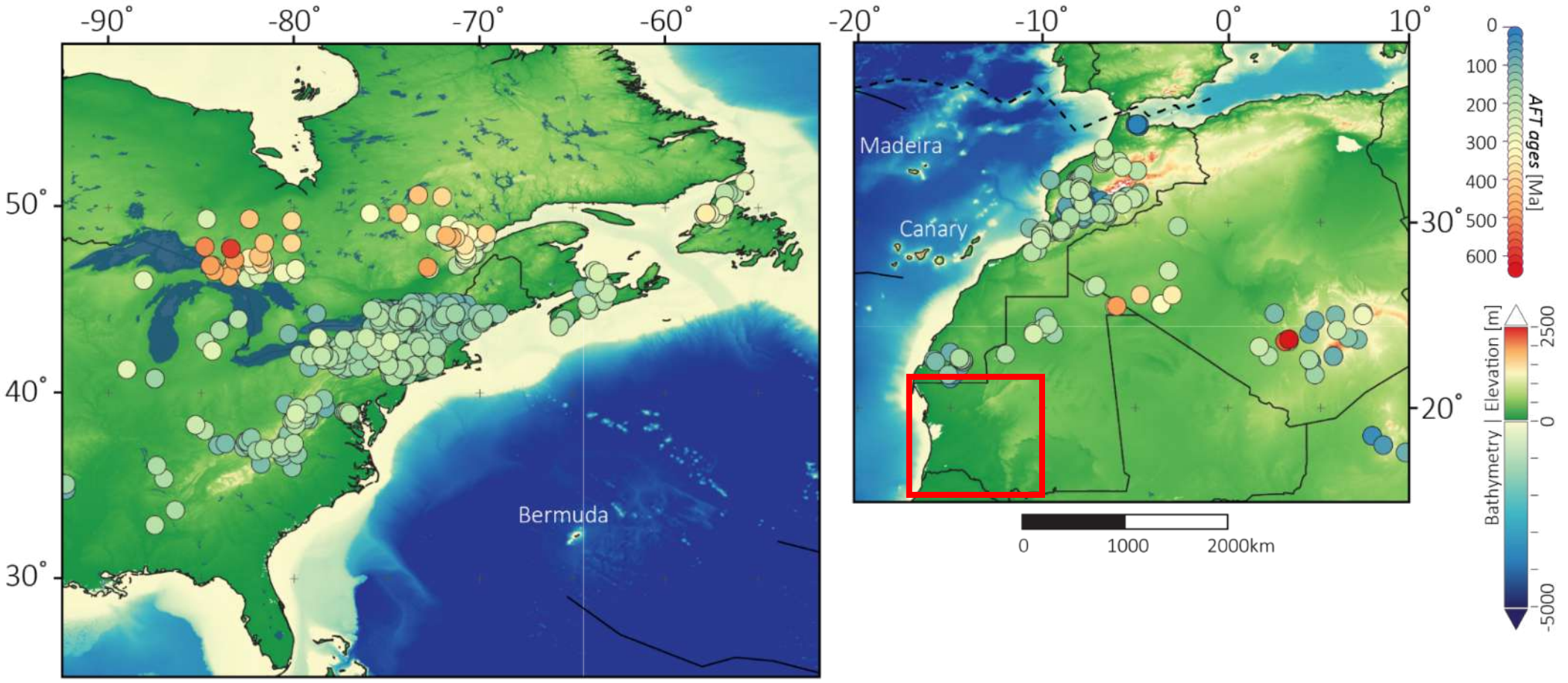


THE CALL OF THE SOUTH: THE MAURITANIAN MARGIN

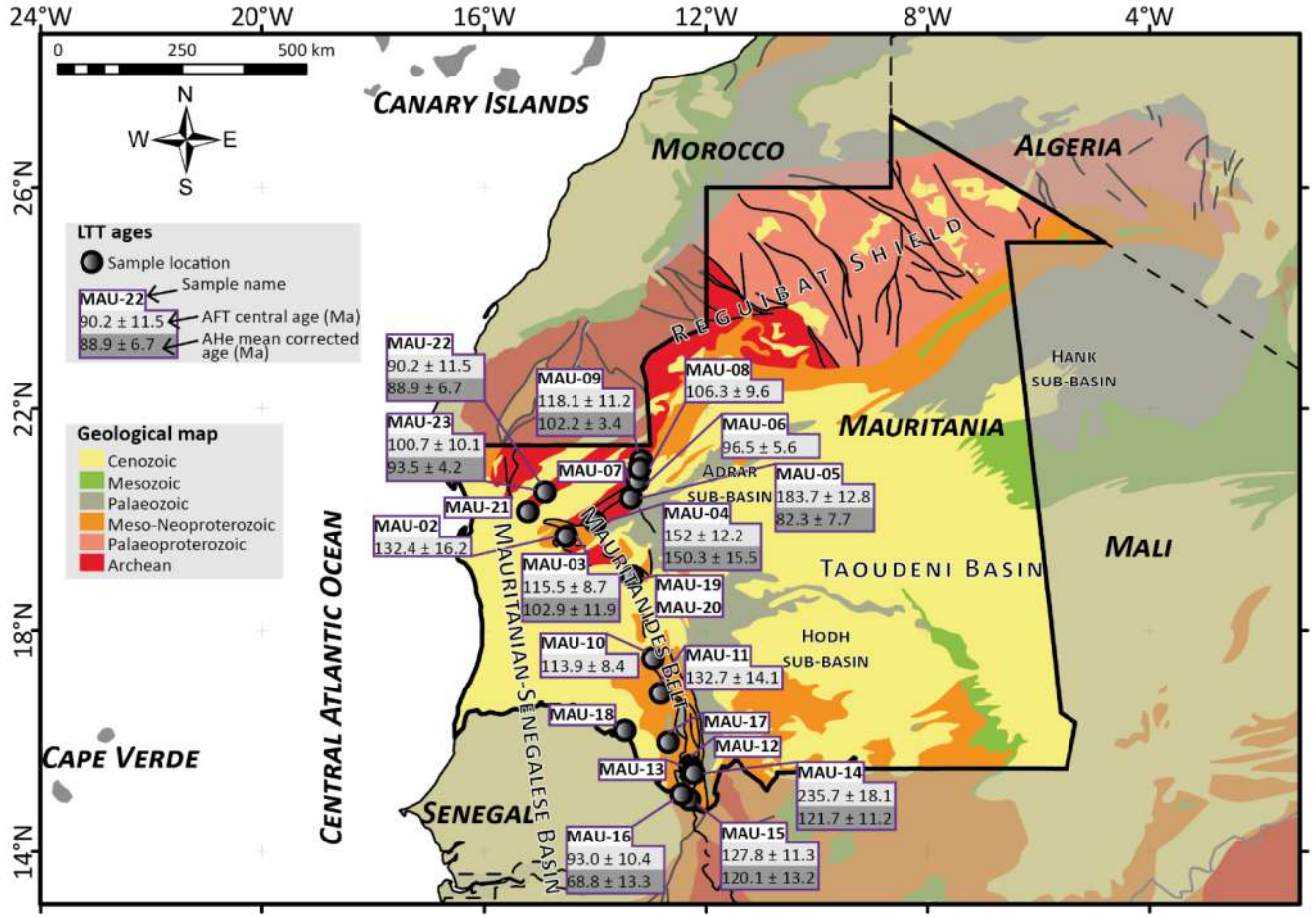


THE MAURITANIAN MARGIN

February-March 2017



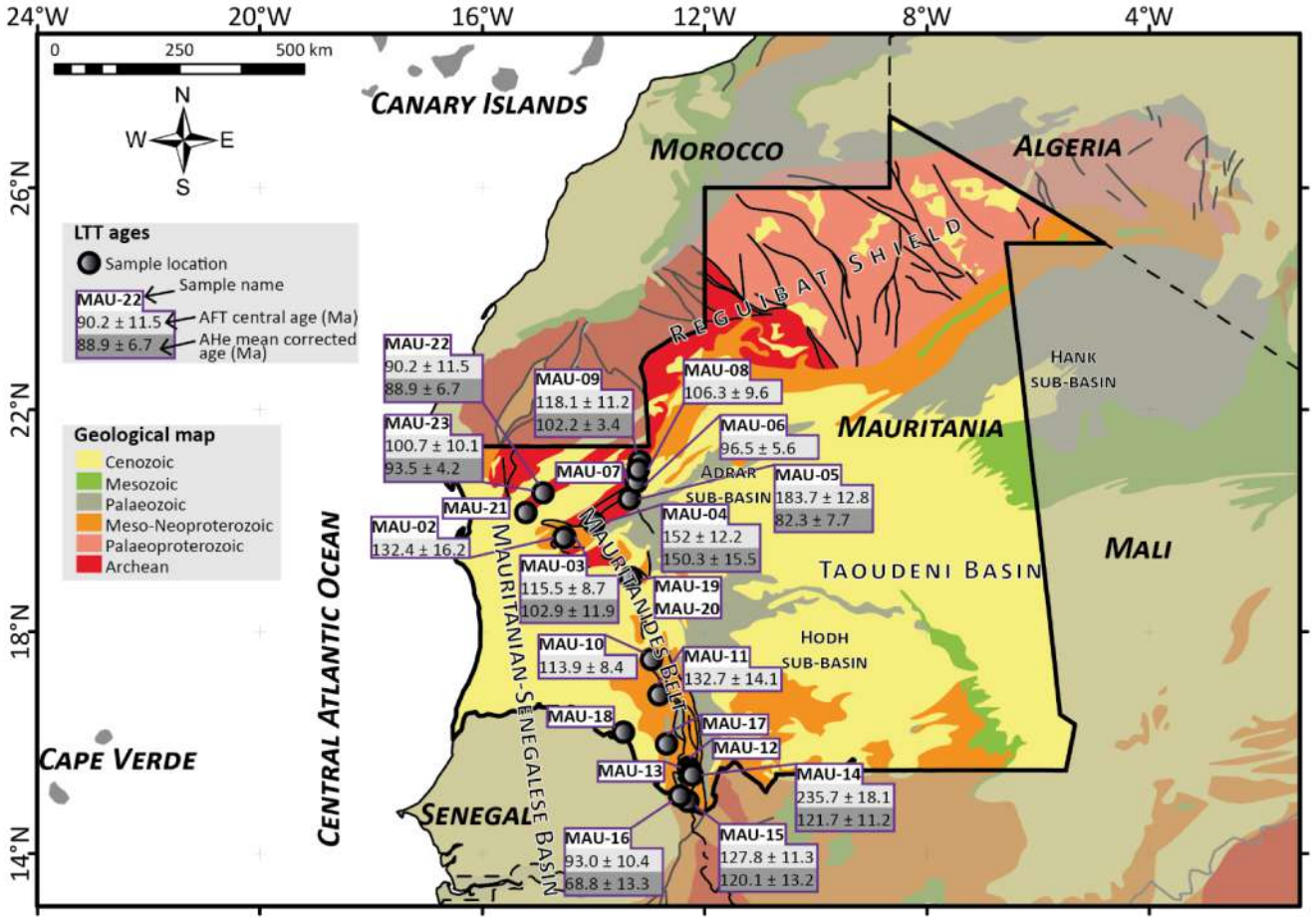


(Gouiza et al., under review/JGR)

The Mauritanian Margin

- 22 Samples:
  - SW Reguibat Shield
  - Variscan Mauritanides fold belt (~300 Ma)
- Central AFT ages: 236—90 Ma
- MTL: 11.22—12.81 µm
- Average AHe: 150.3—68.8 Ma



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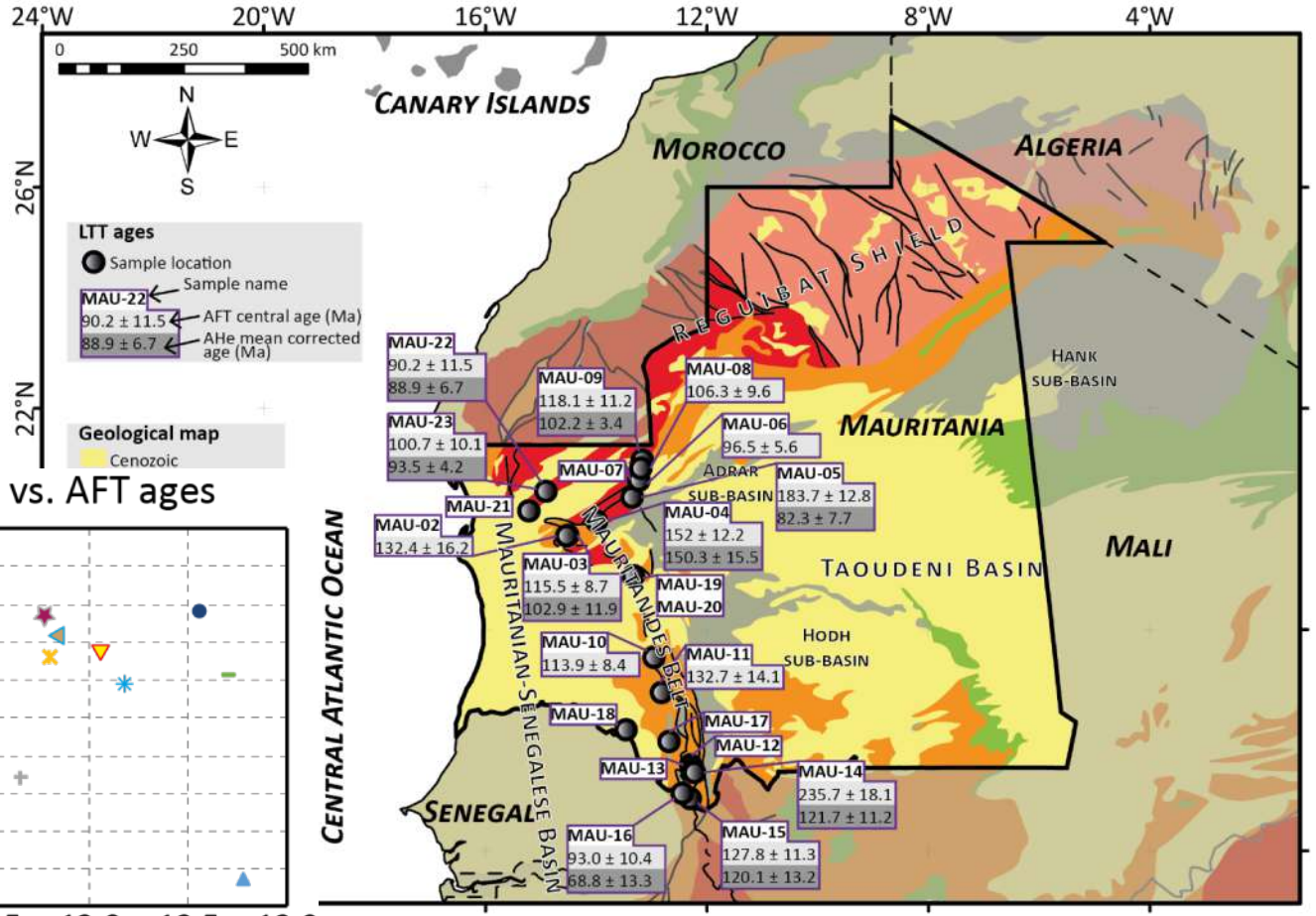

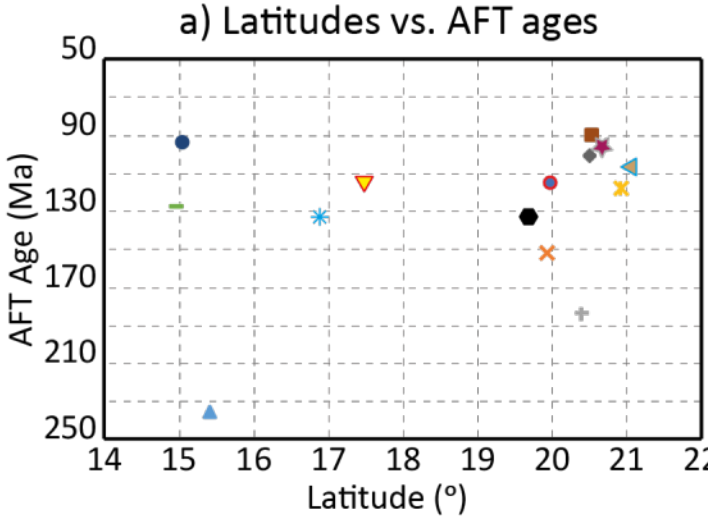

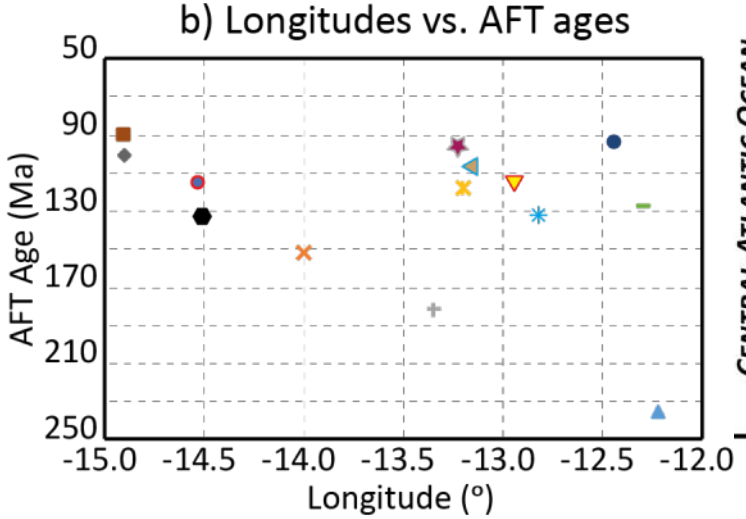

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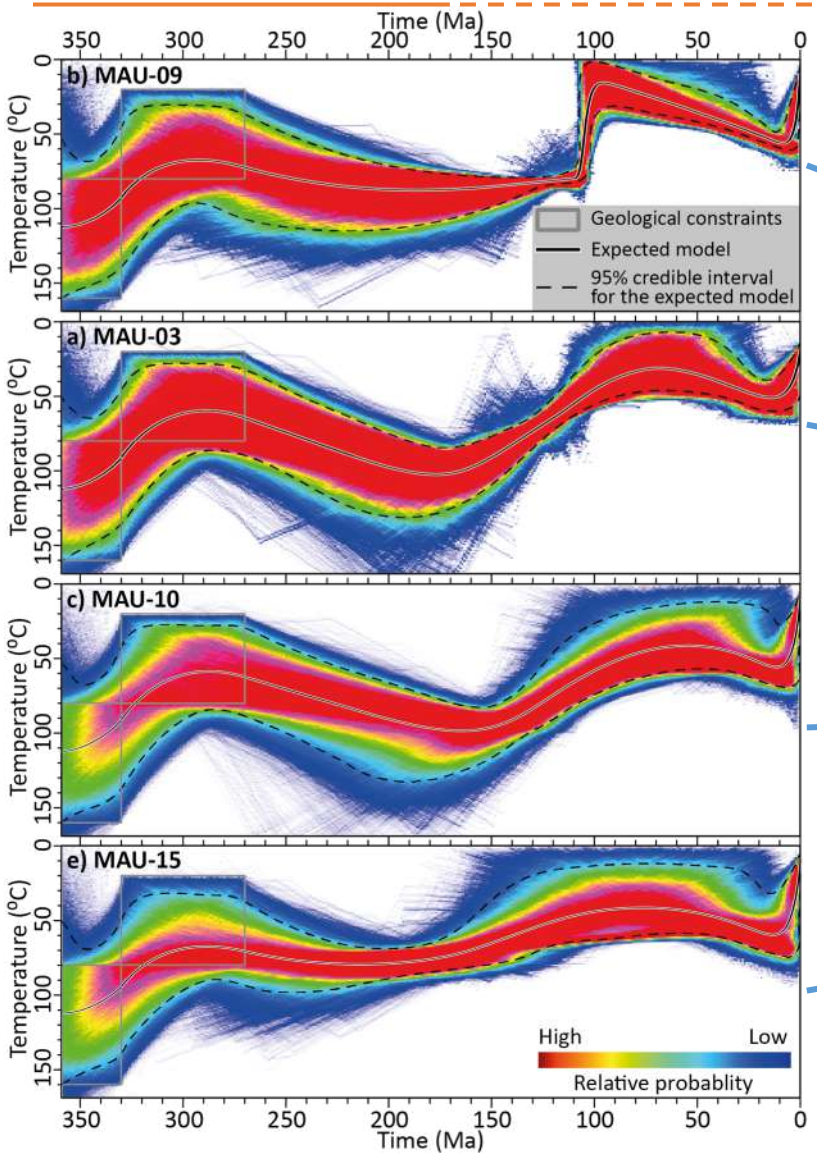

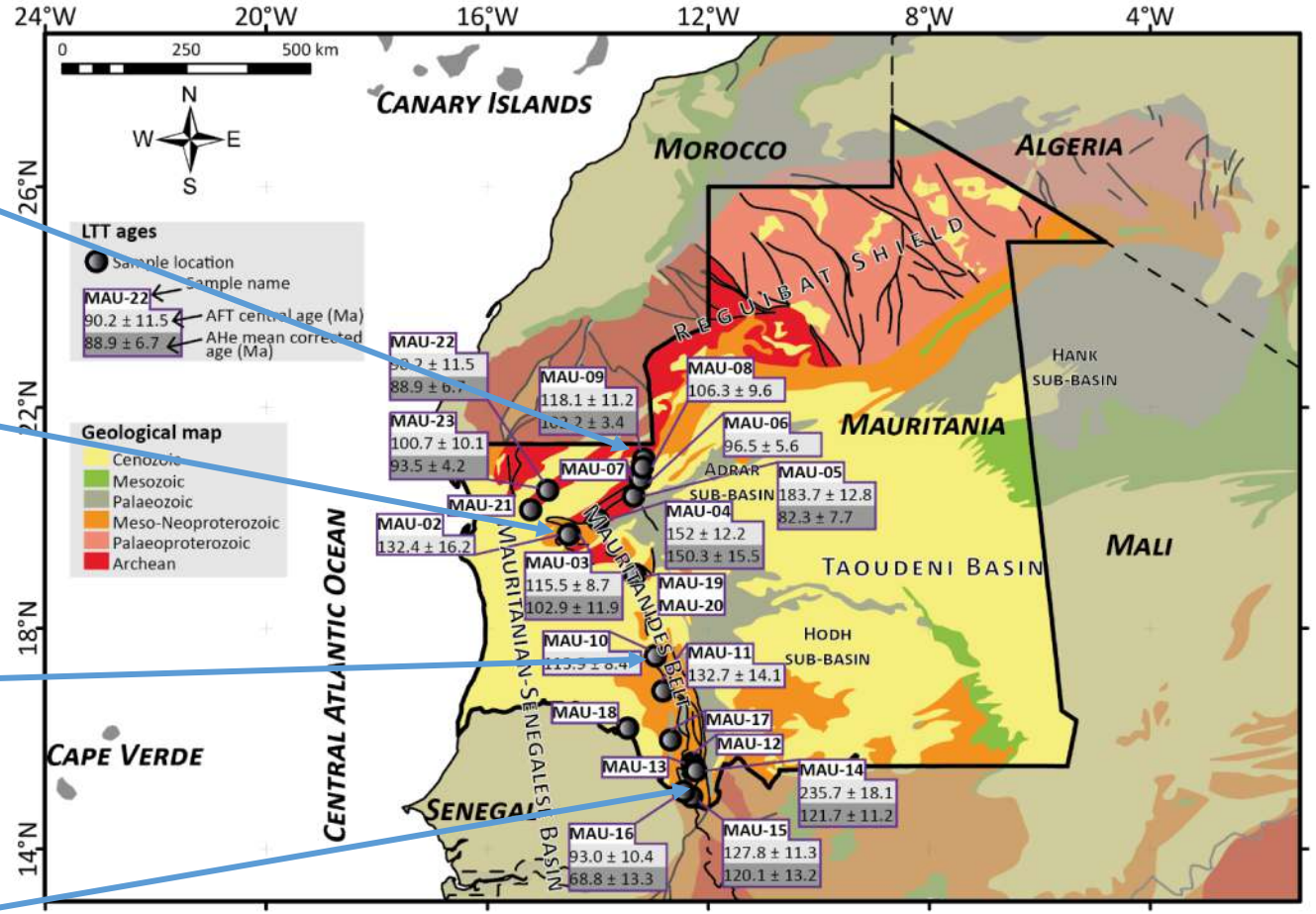

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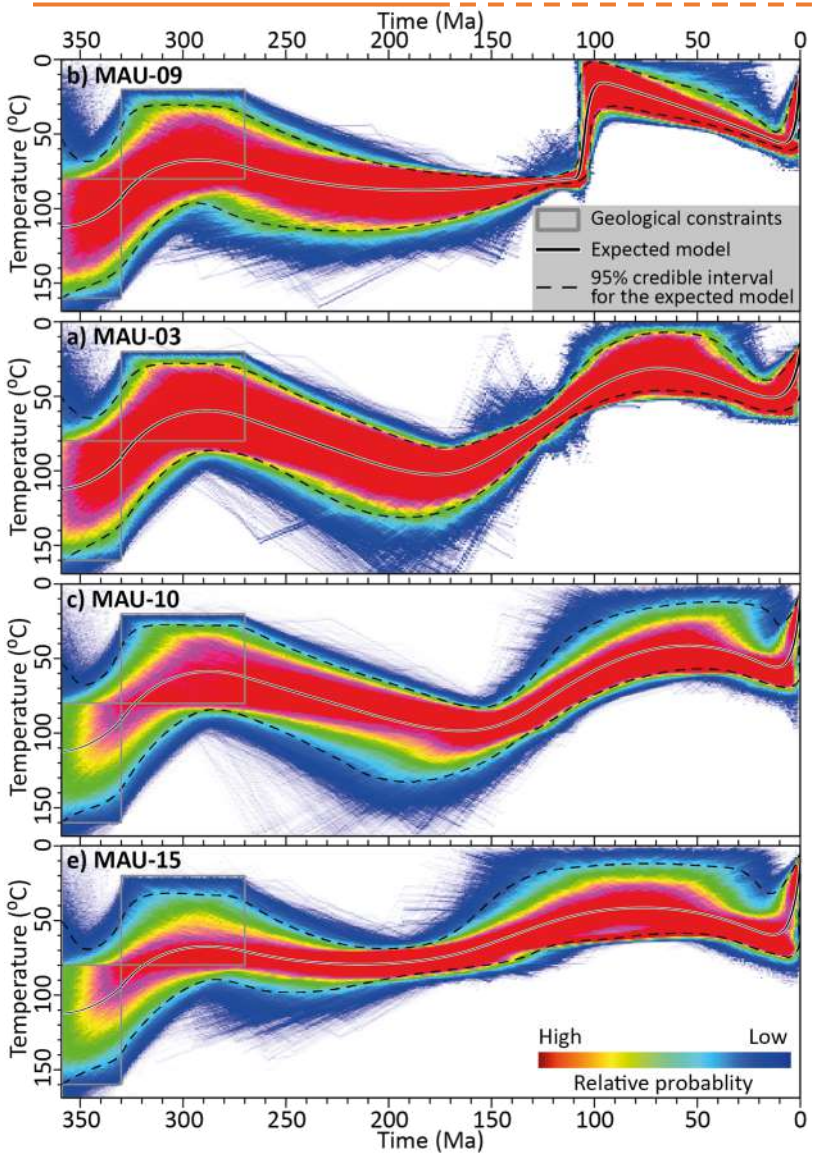

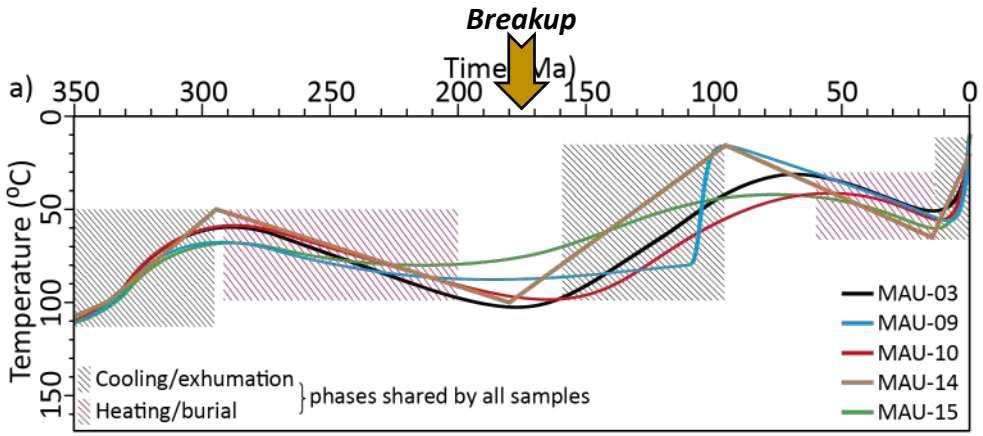

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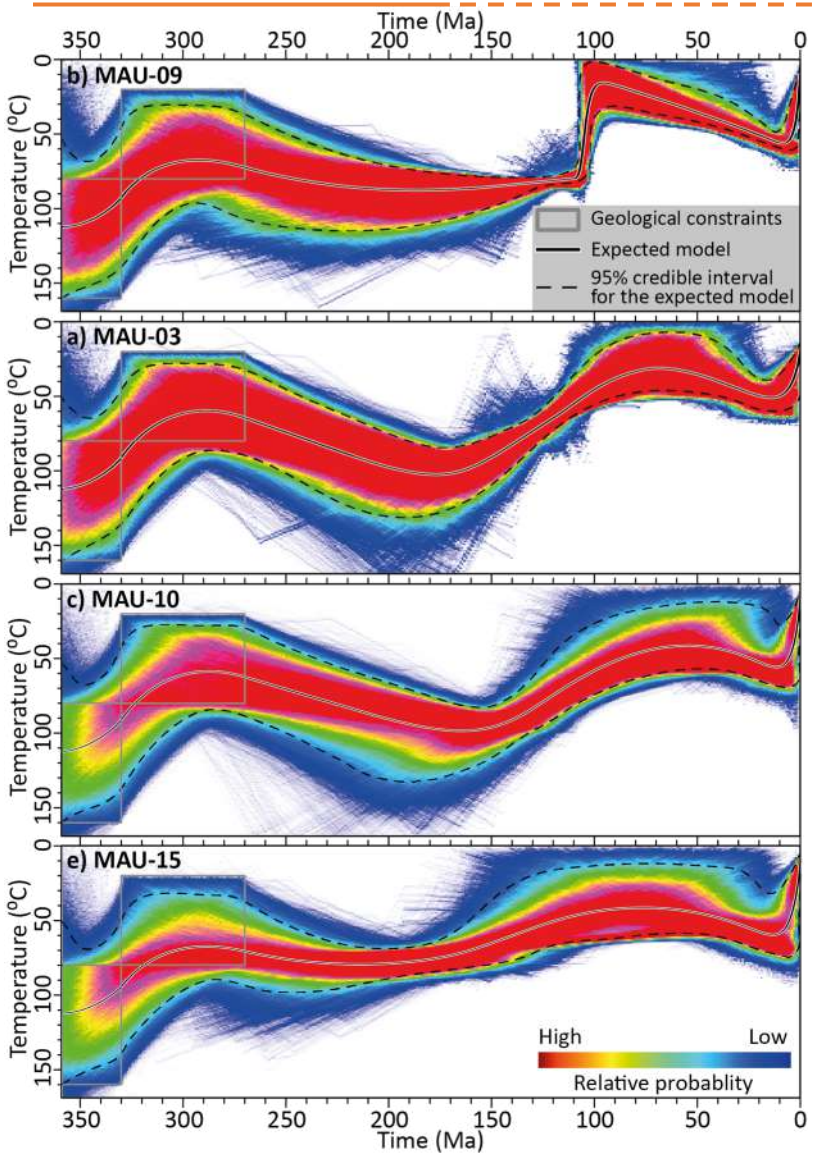

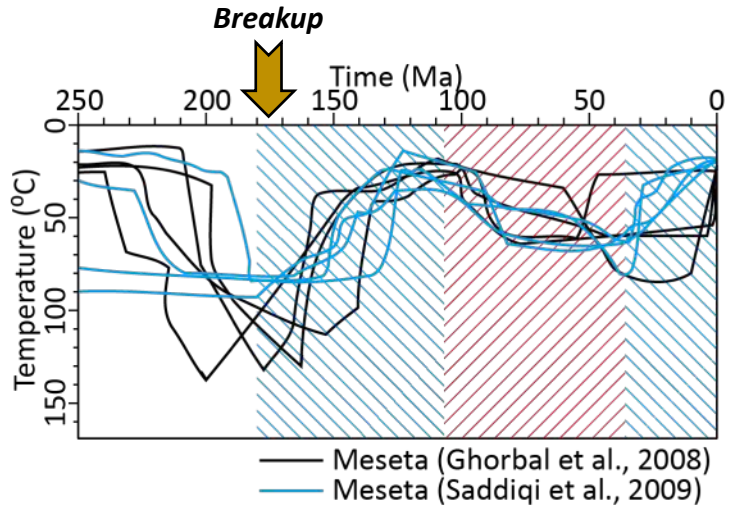

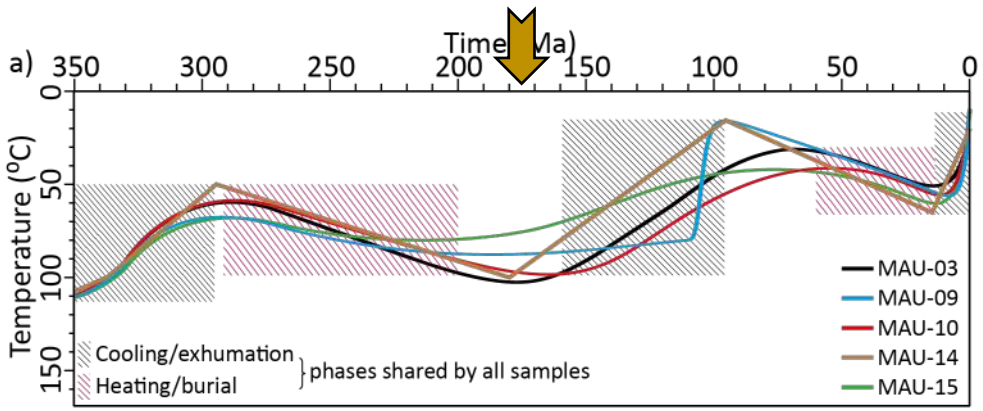

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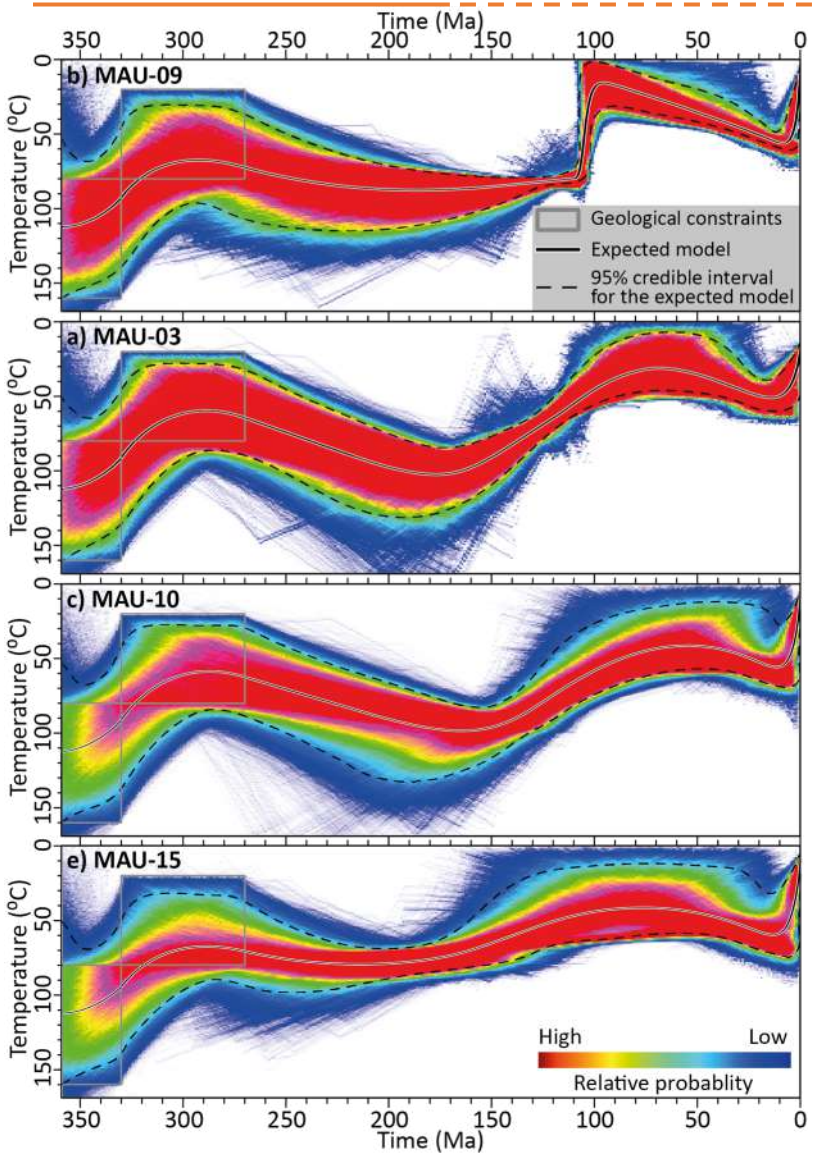

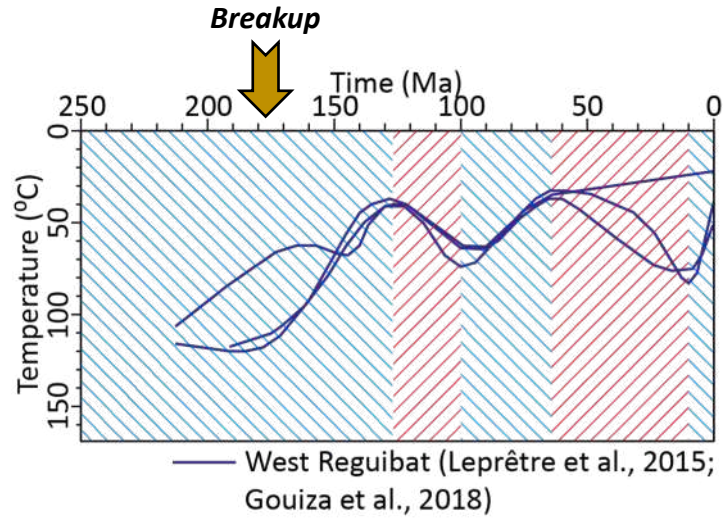

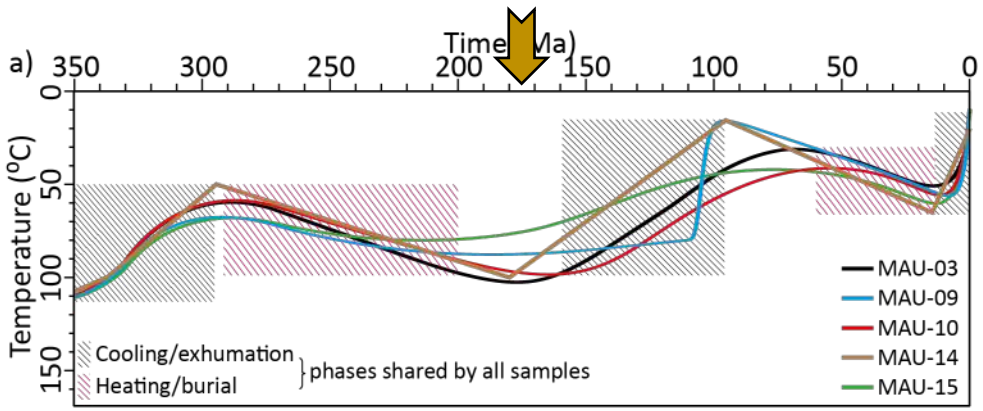

(Gouiza et al., under review/JGR)

THERMAL EVENTS VS. VERTICAL MOVEMENTS

- Constant geothermal gradient:
  - ∇T = 25 °C/km

- Dynamic:
  - ∇T corrected for the heat loss with time and the effect of erosion and sedimentation (Gouiza et al., 2017/IJES).

$$q_0(t) = 43.43e^{-7.210^{-3}t} + 44e^{-5.710^{-5}t}$$ (England and Richardson,1980/GJI)

$$T(z,t) = T_0 + \Gamma_b(z - vt) + \frac{1}{2}\Gamma_b \times \left[(z+vt)\exp\left(\frac{vz}{\alpha}\right)erfc\left(\frac{z+vt}{2(\alpha t)^{\frac{1}{2}}}\right) - (z-vt)\,erfc\left(\frac{z-vt}{2(\alpha t)^{\frac{1}{2}}}\right)\right]$$ (Ehlers, 2005/RMG)

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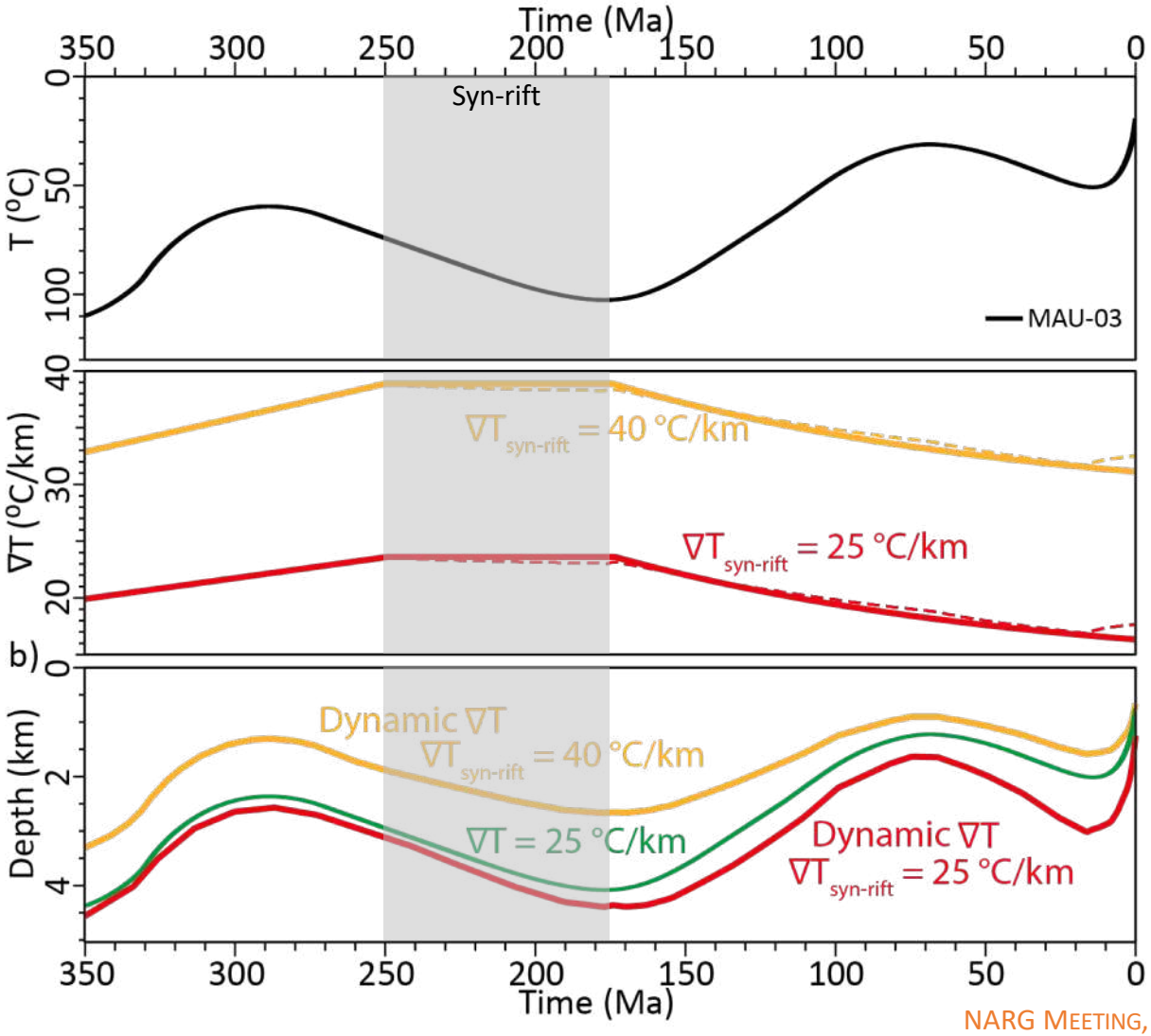

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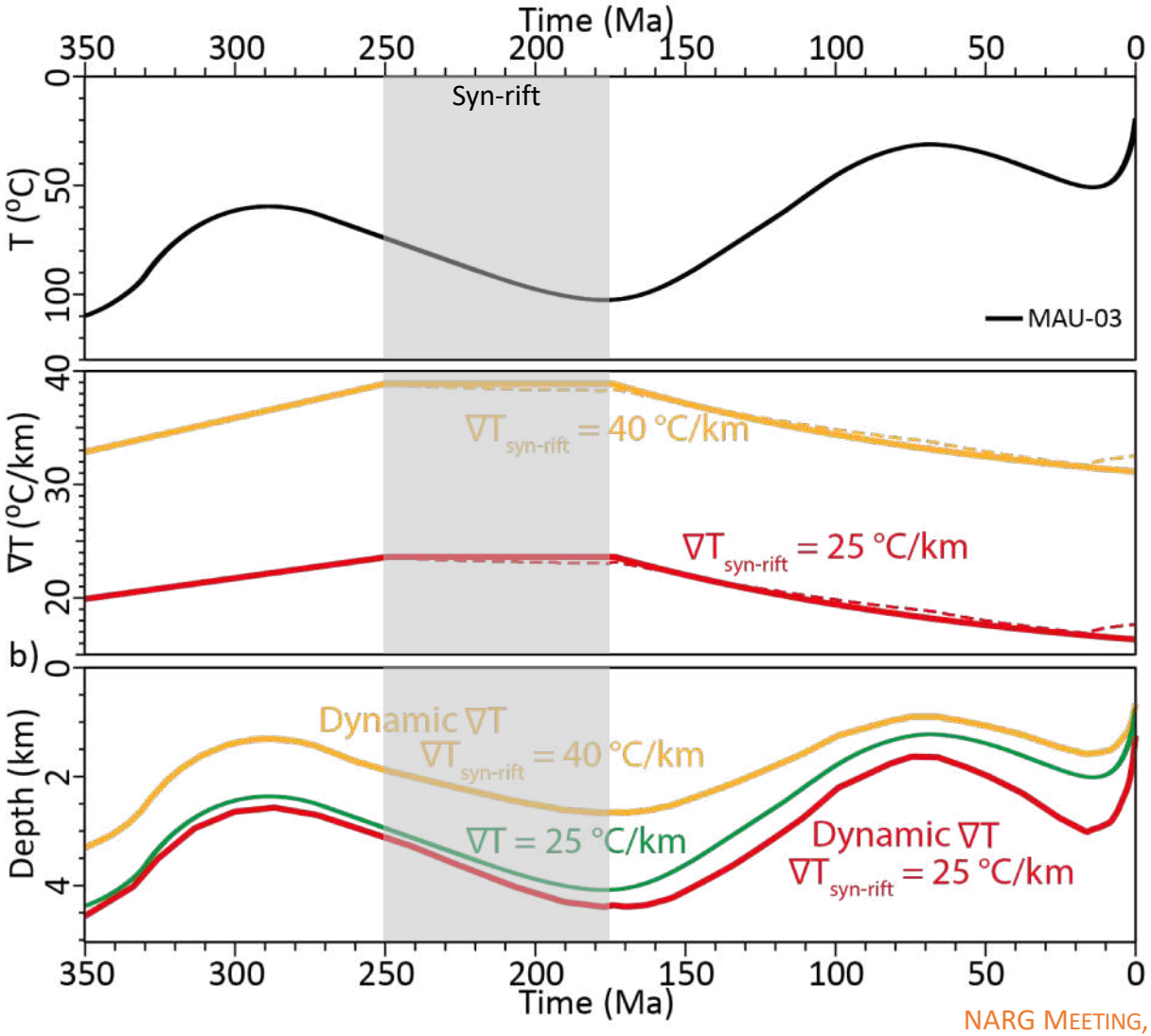

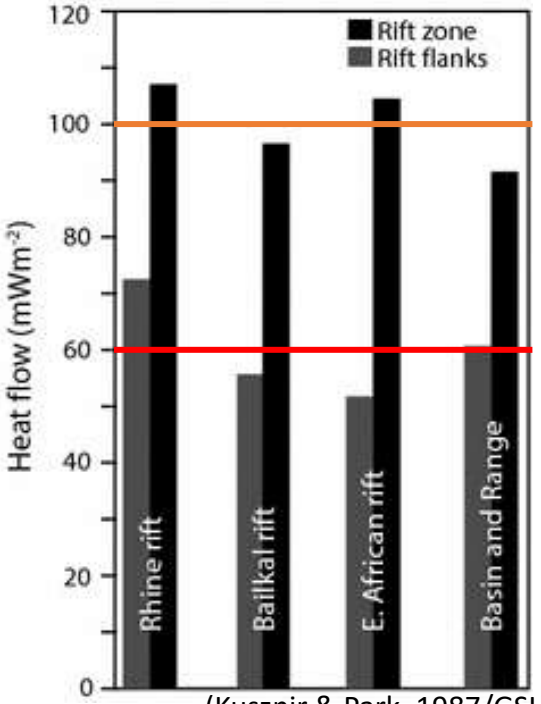

(Kusznir & Park, 1987/GSL)

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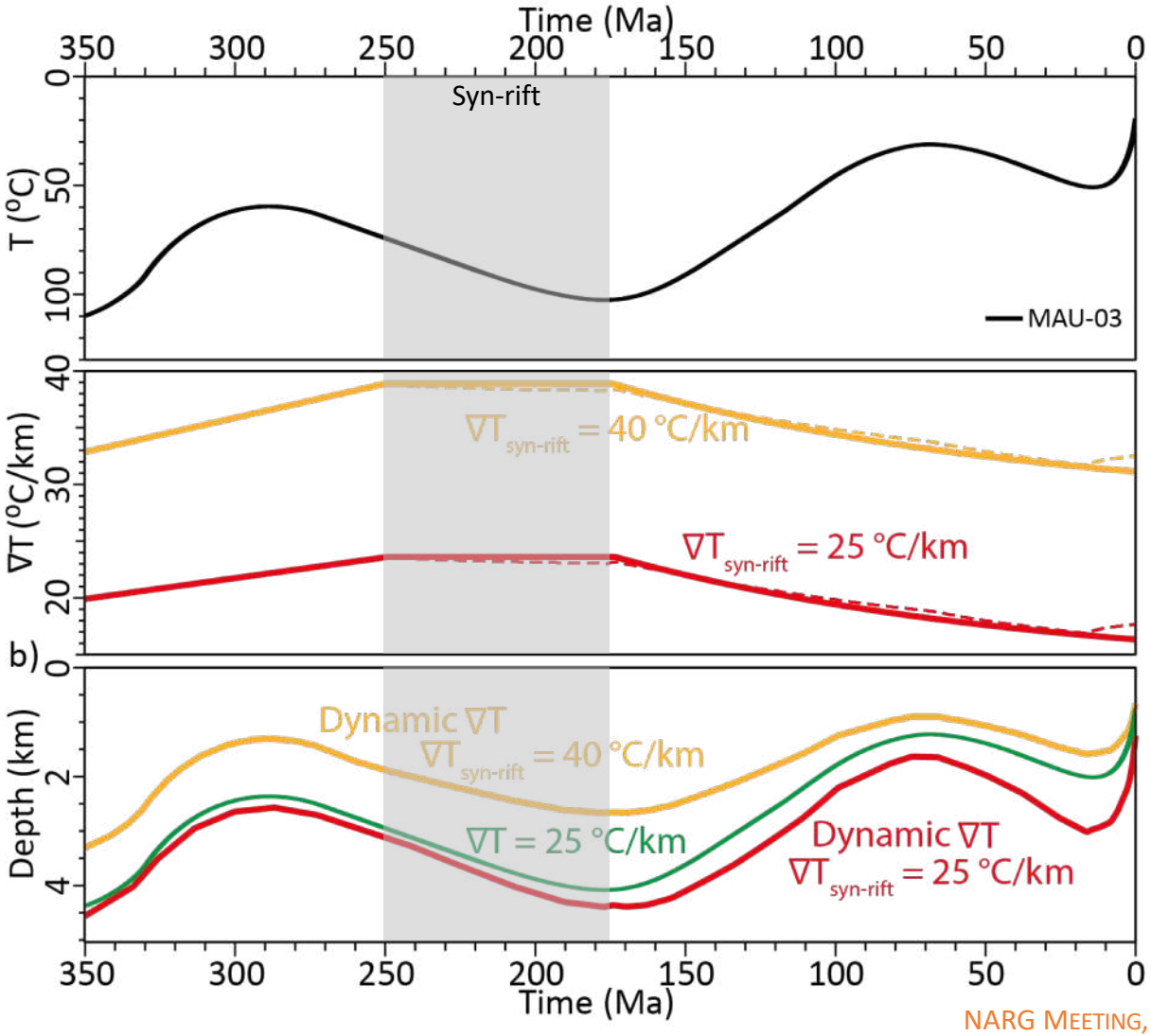

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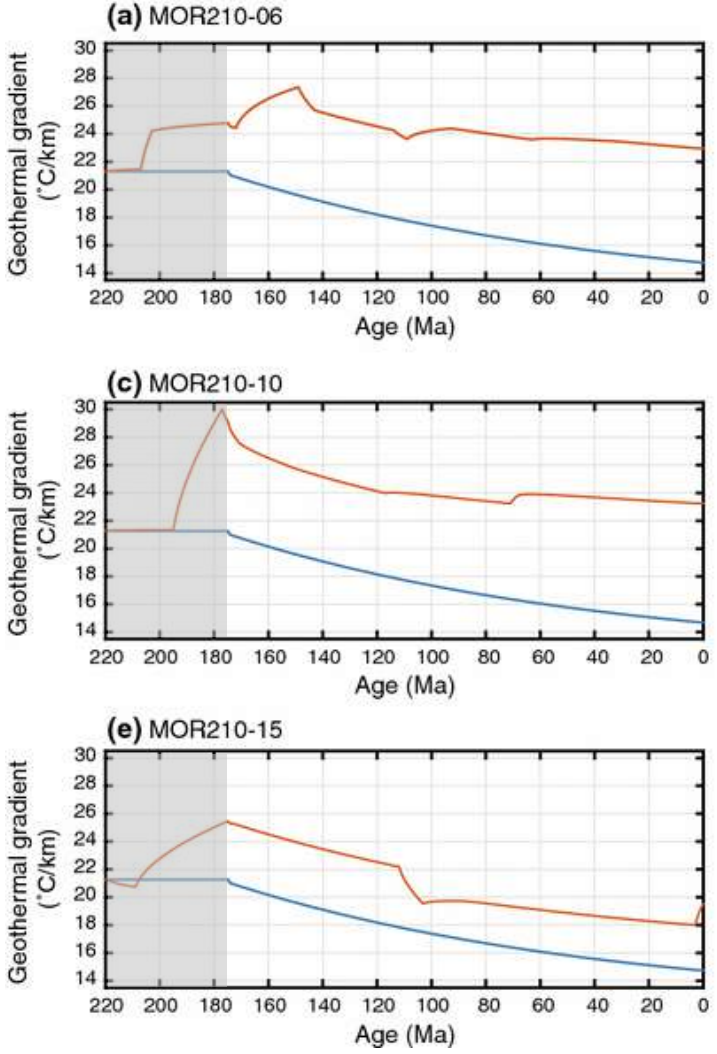

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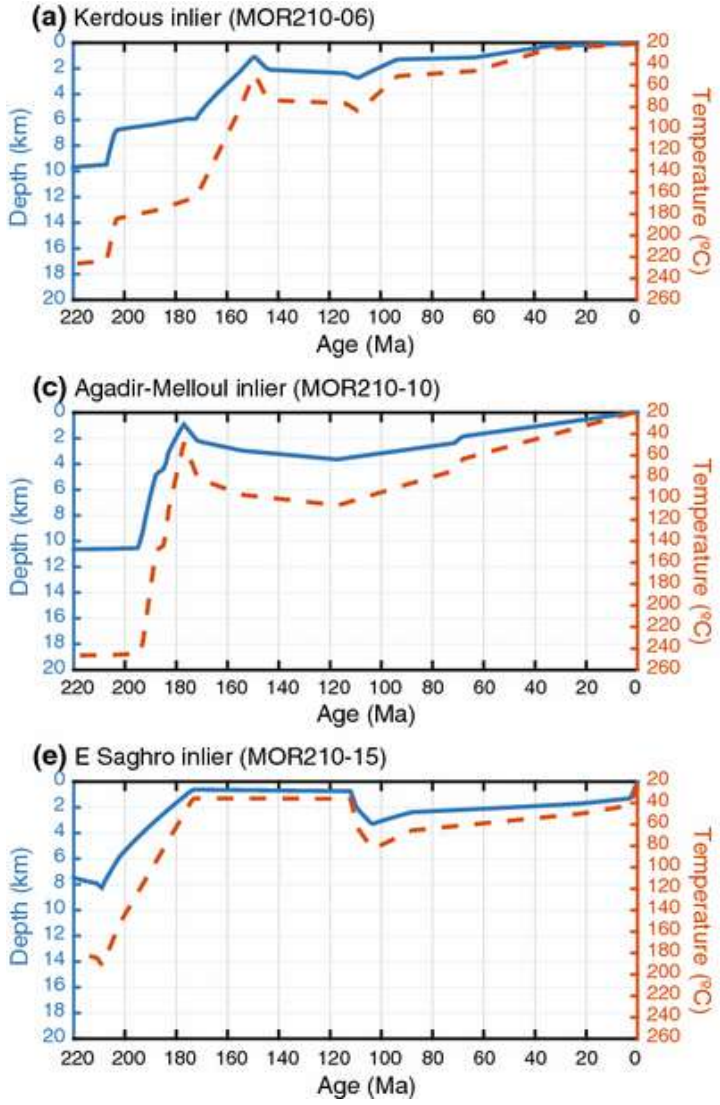

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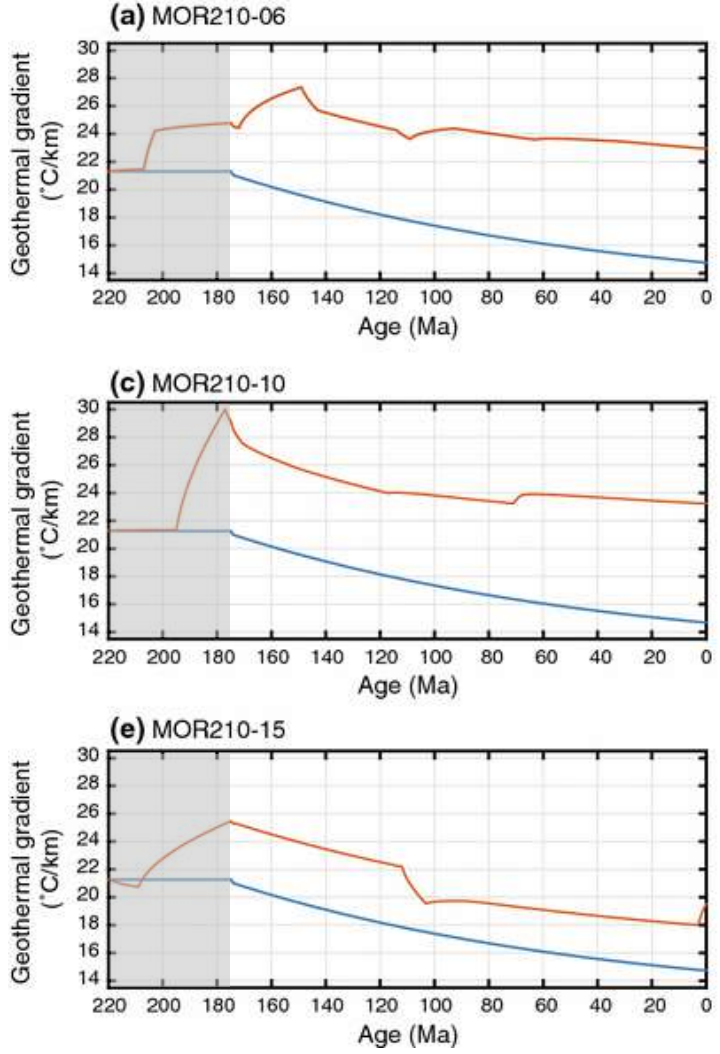

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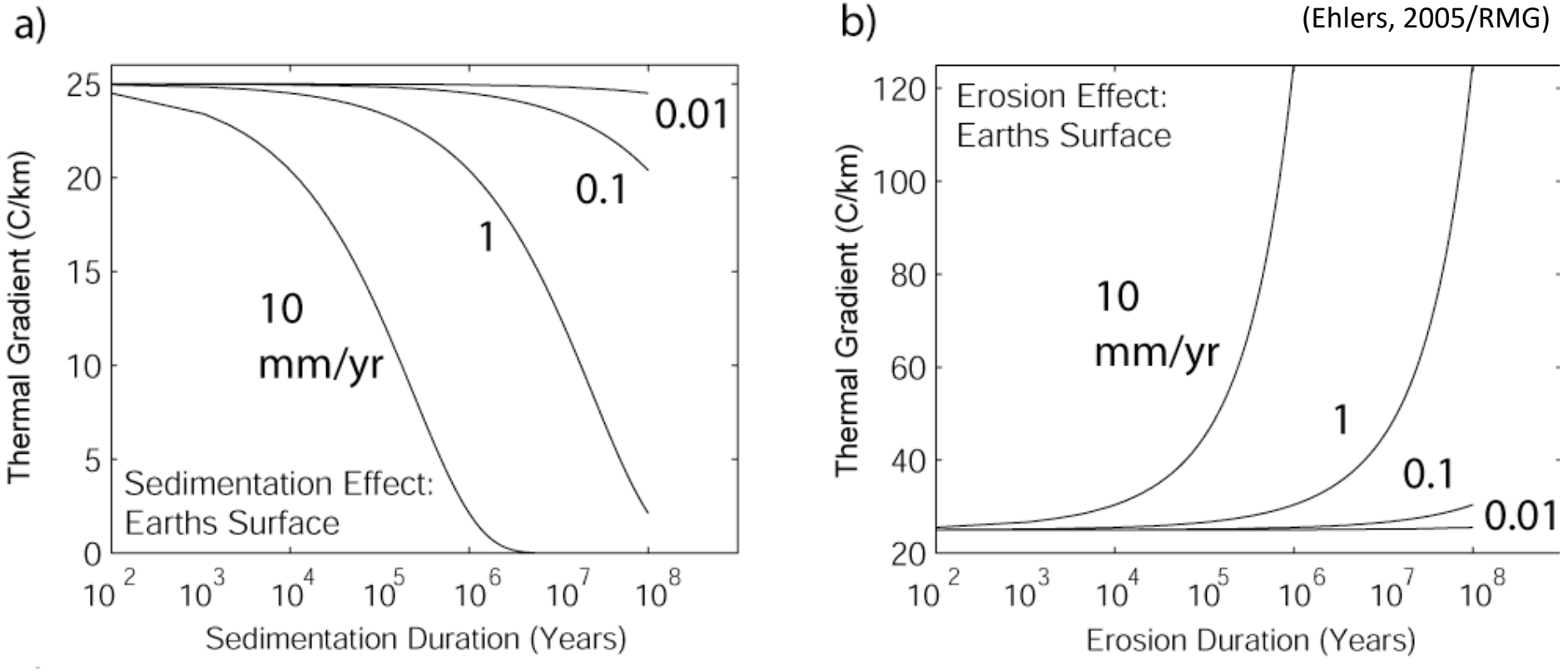
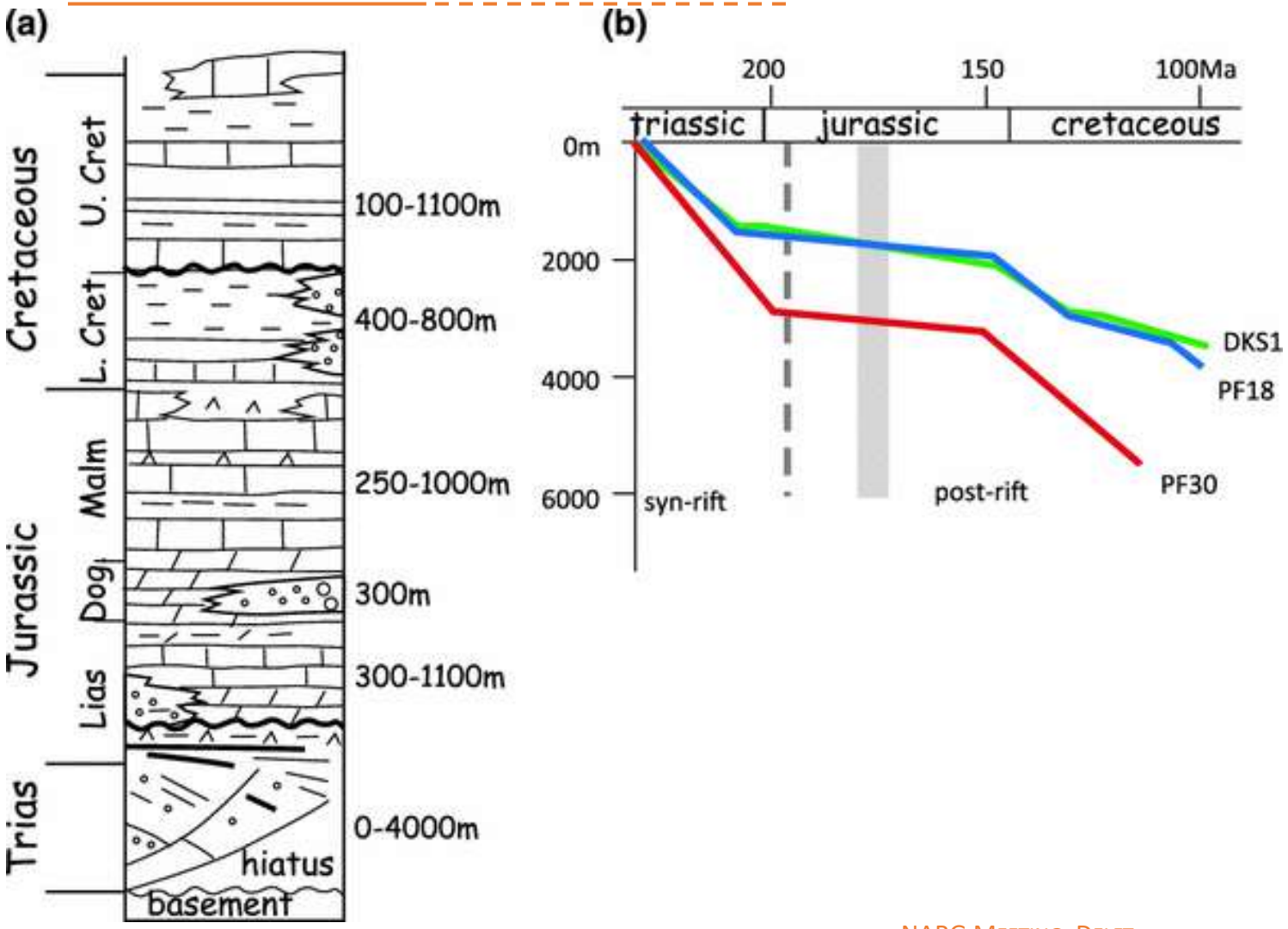
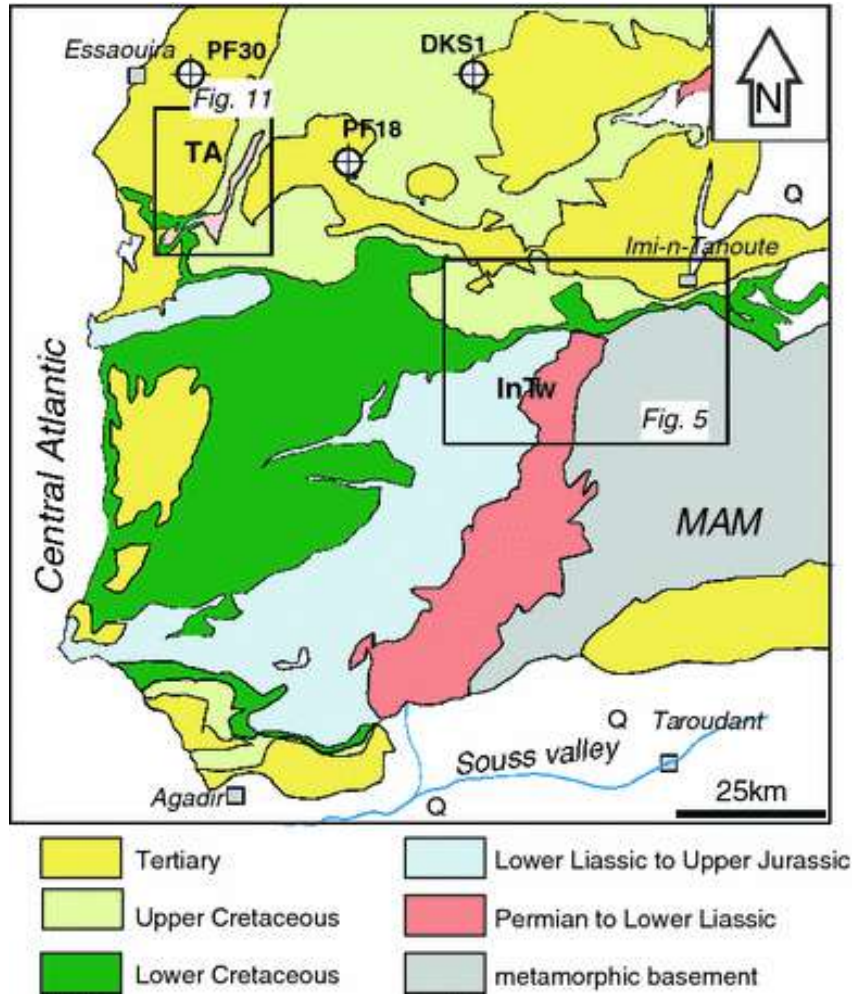
(Ehlers, 2005/RMG)



EXHUMATION VS. SUBSIDENCE





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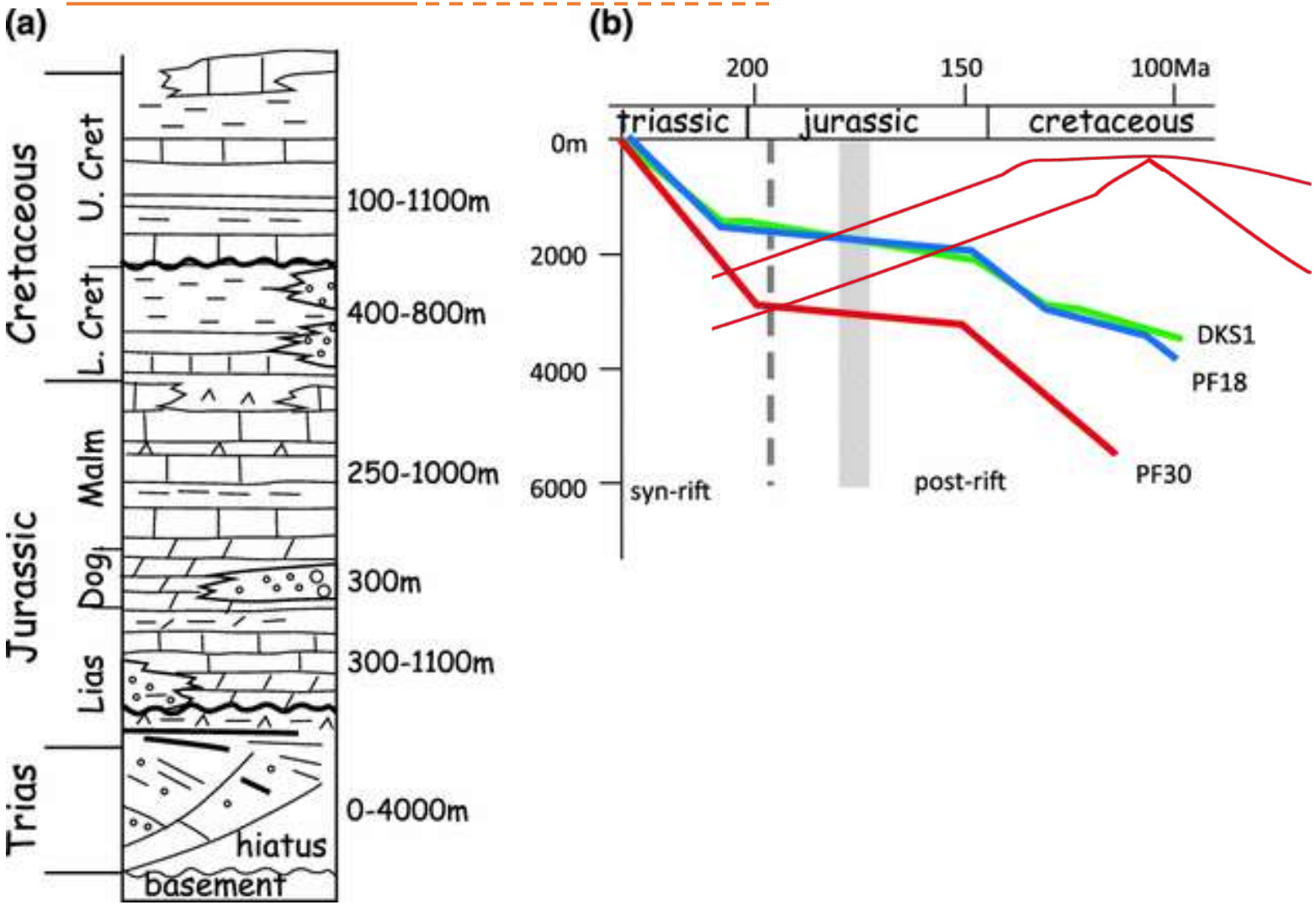

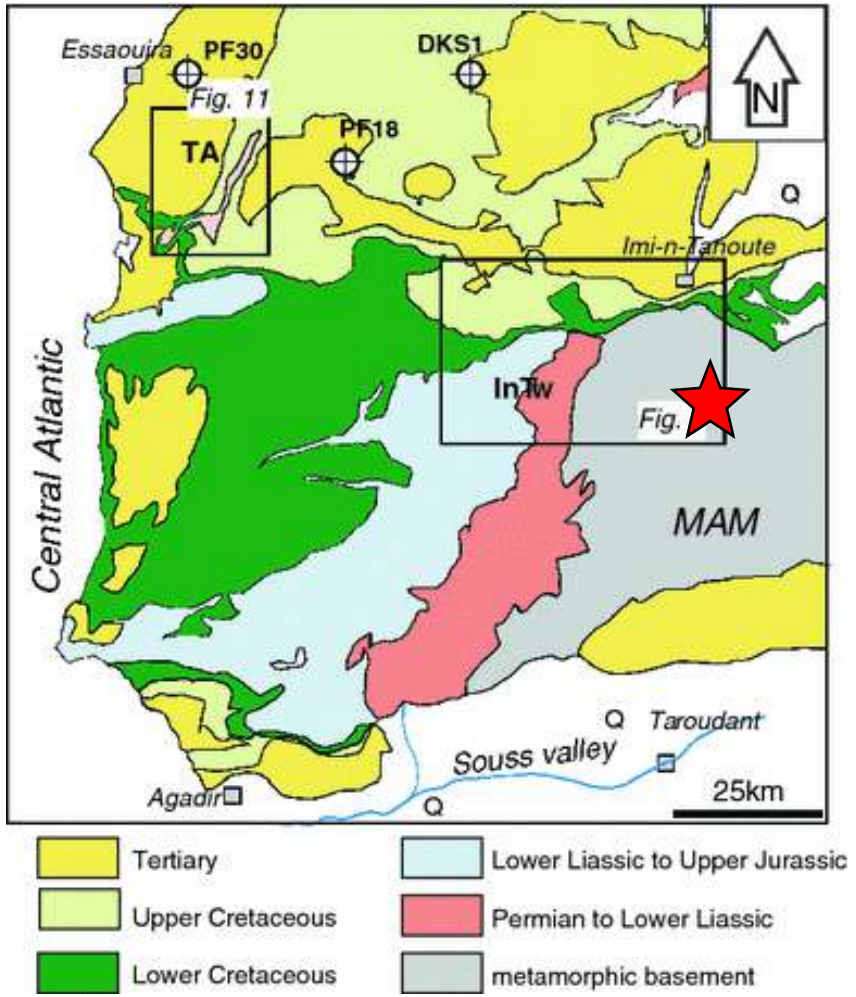

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THE BIG "?": PROCESSES

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Reconcile the variability in timing and wavelength

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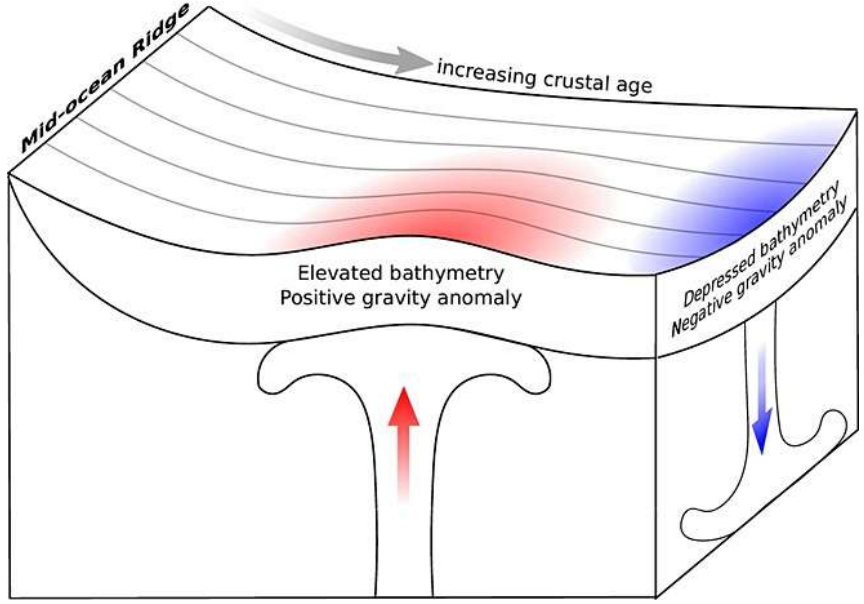
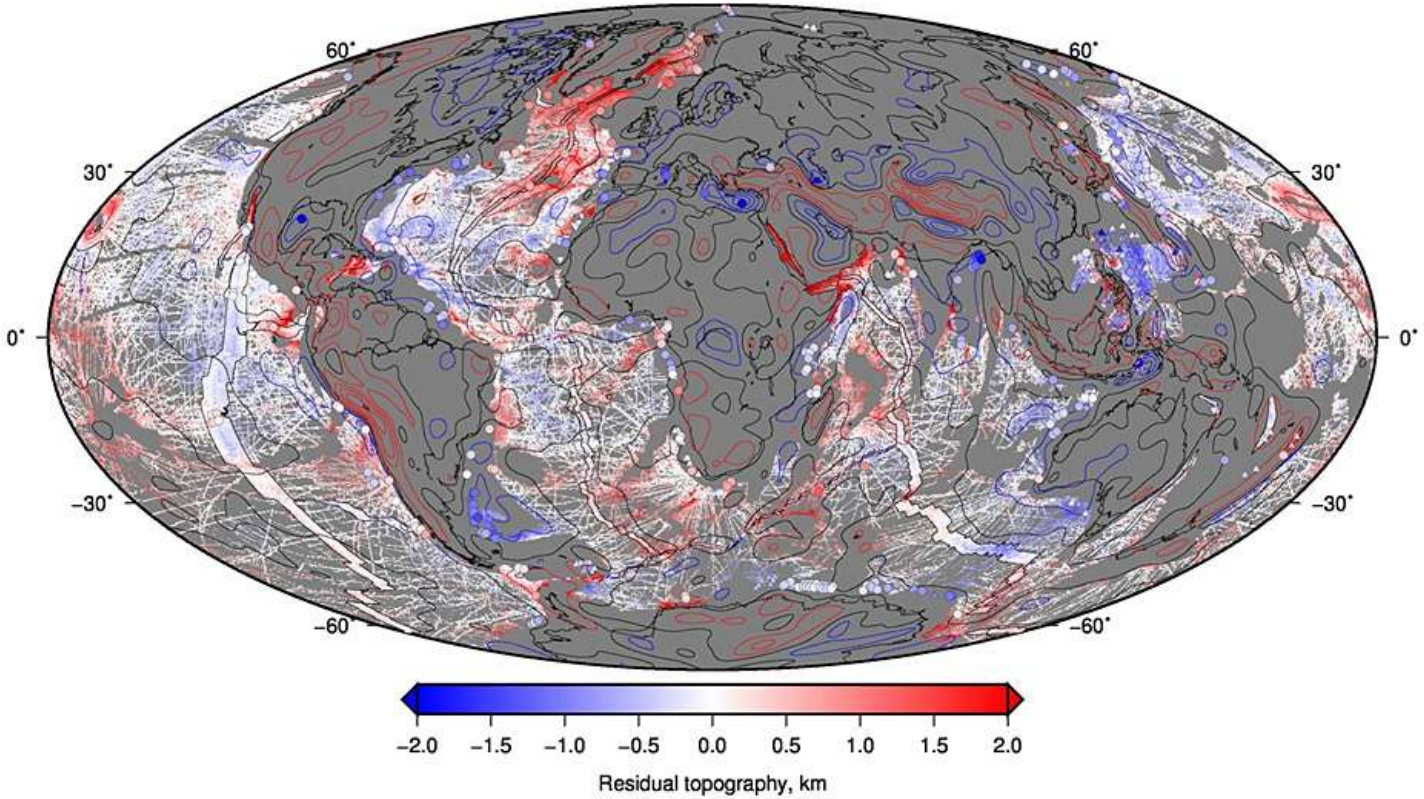
Reconcile the variability in timing and wavelength

- The usual suspects:
  - Dynamic topography
  - Rift shoulder uplift
  - Intraplate stress and geodynamics
  - Climate and surface processes

THE BIG "?": PROCESSES

- Dynamic Topography
  - Amplitude ± 1km
  - Wavelength 1000 km

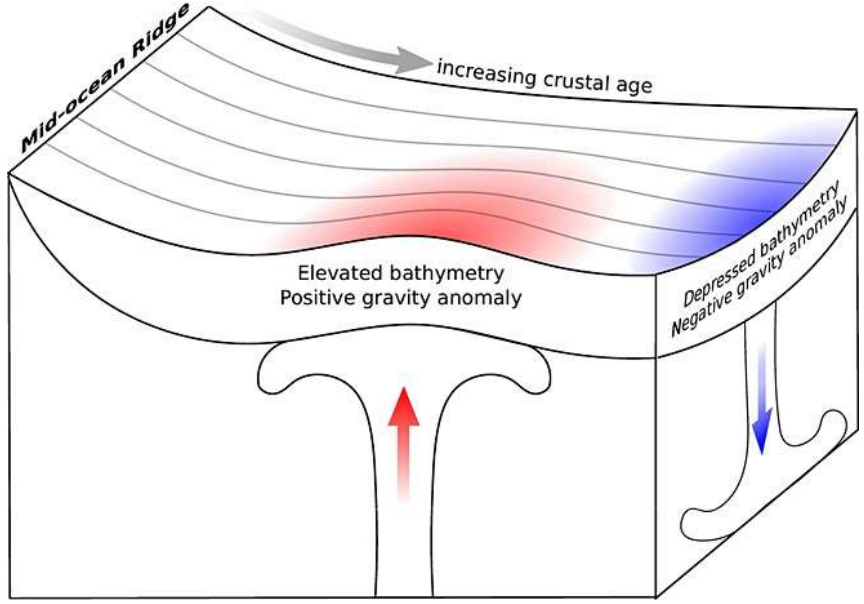


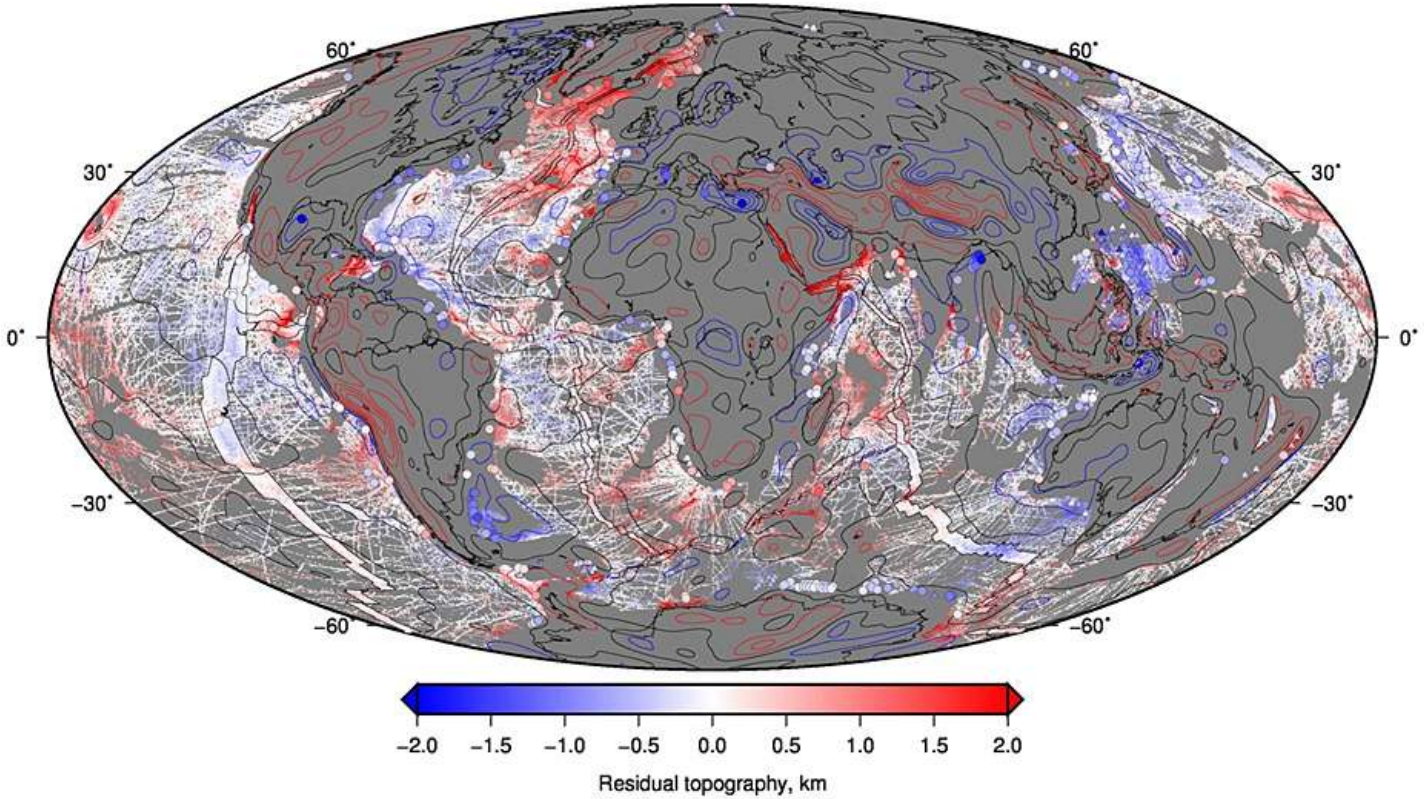


(Hoggard et al., 2017/JGR)

THE BIG "?": PROCESSES

- Dynamic Topography
  - Amplitude ± 1km # LTT ~2-4 km
  - Wavelength 1000 km # Subsidence





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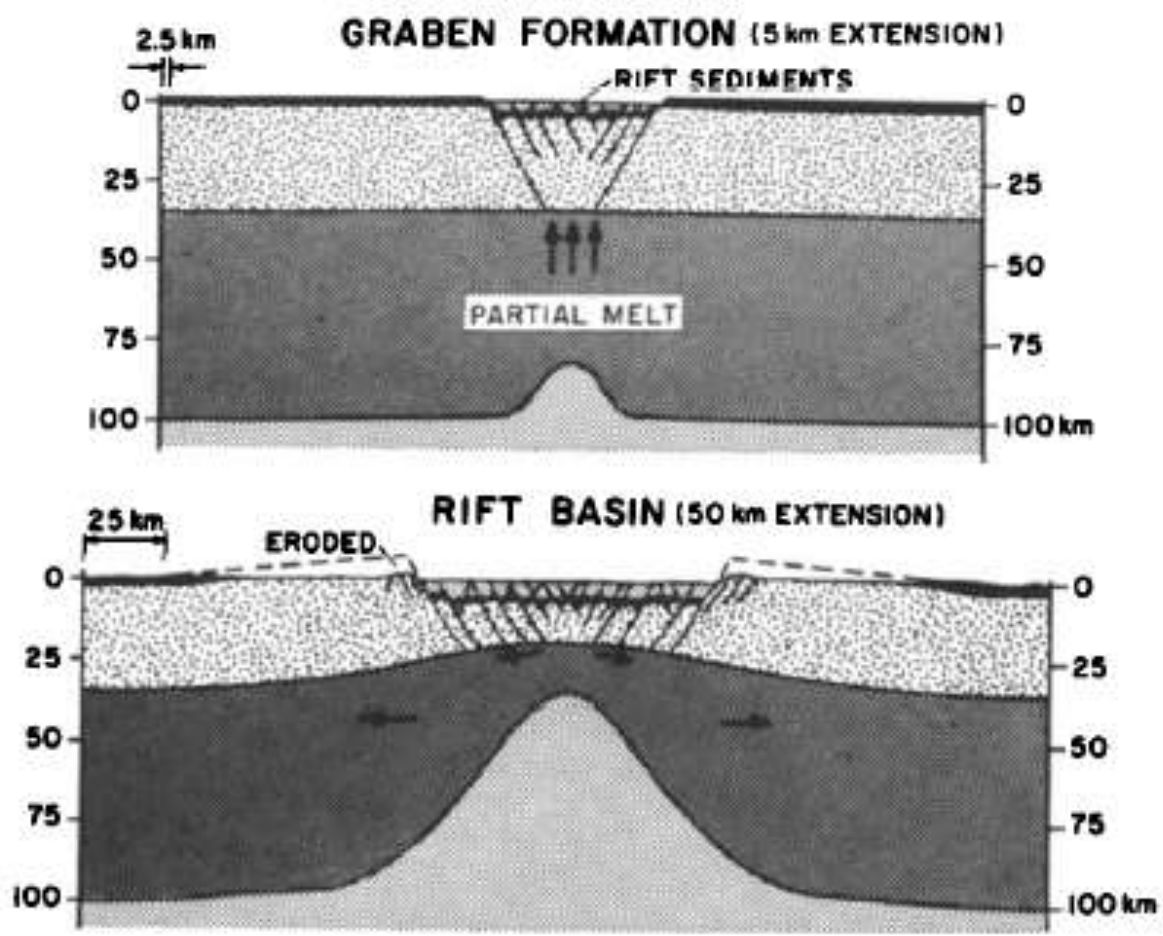
THE BIG "?": PROCESSES

- Rift Shoulder Uplift
  - Starts during the syn-rift



(Hellinger & Sclater, 1983/JGR)

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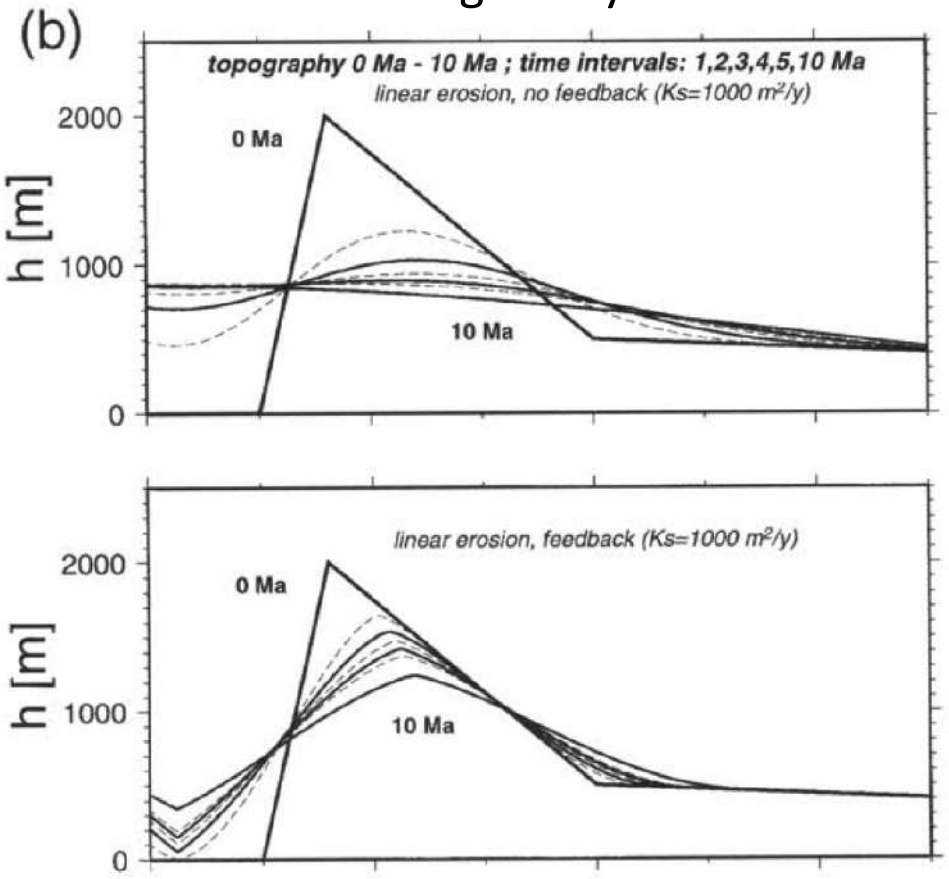
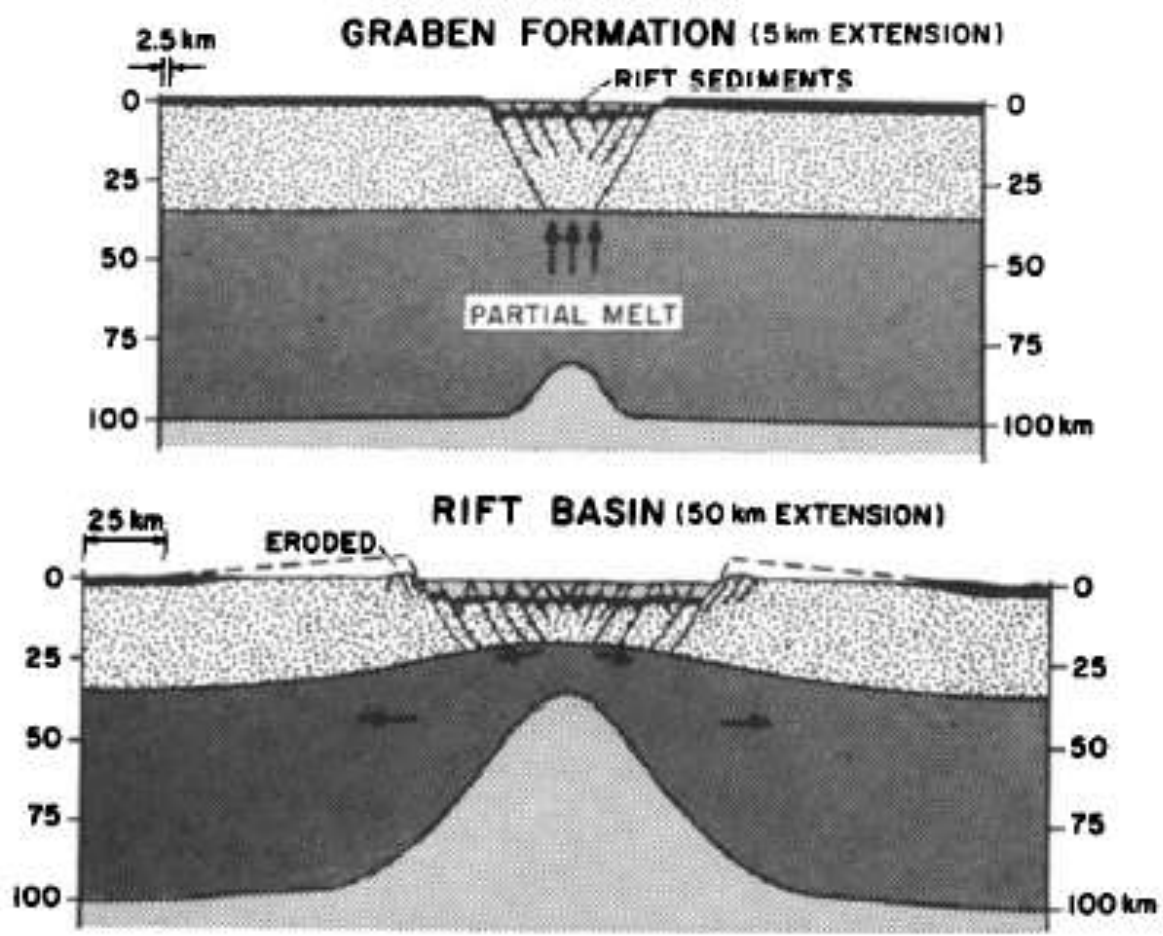


(Burov & Cloetingh, 1997/EPSL)



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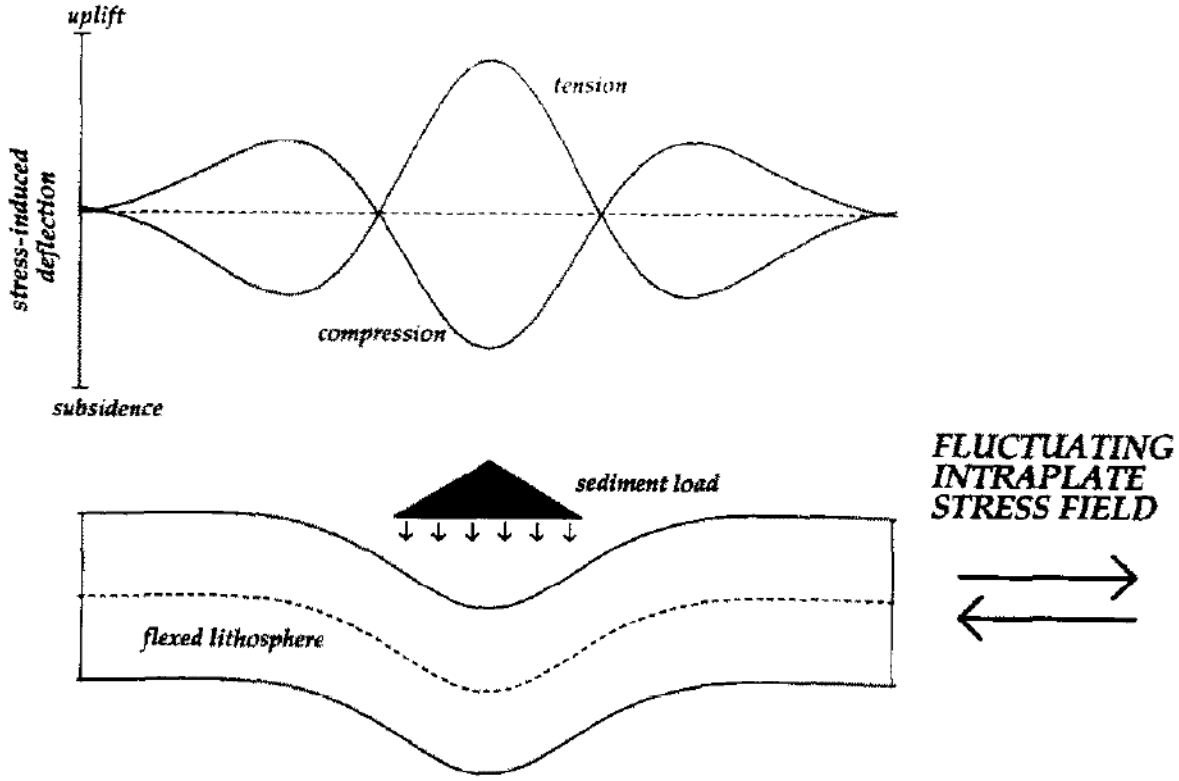
THE BIG "?": PROCESSES

- Intraplate Stress



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THE BIG "?": PROCESSES

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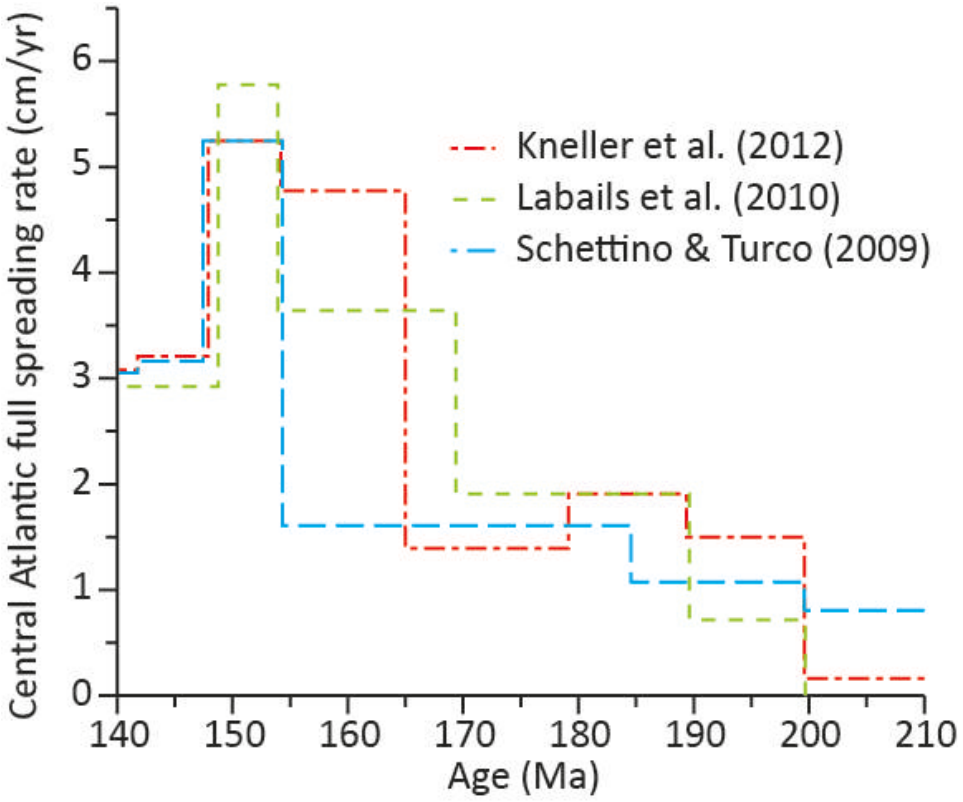

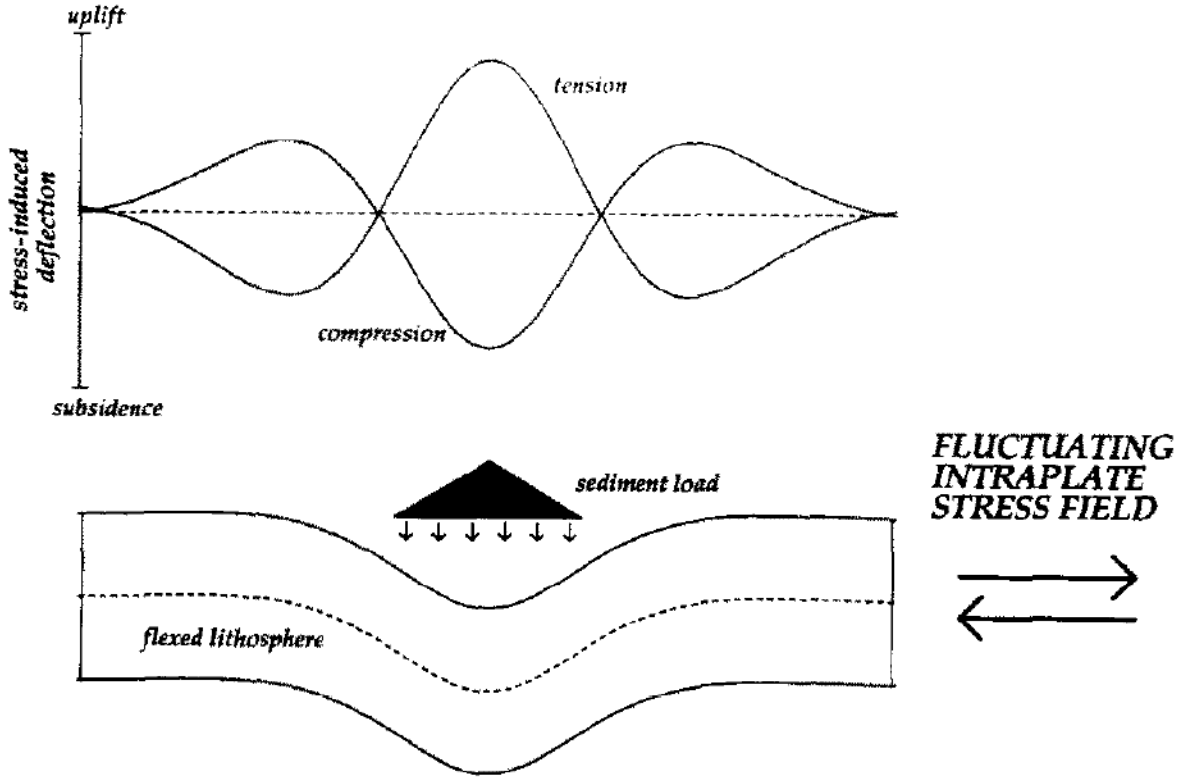

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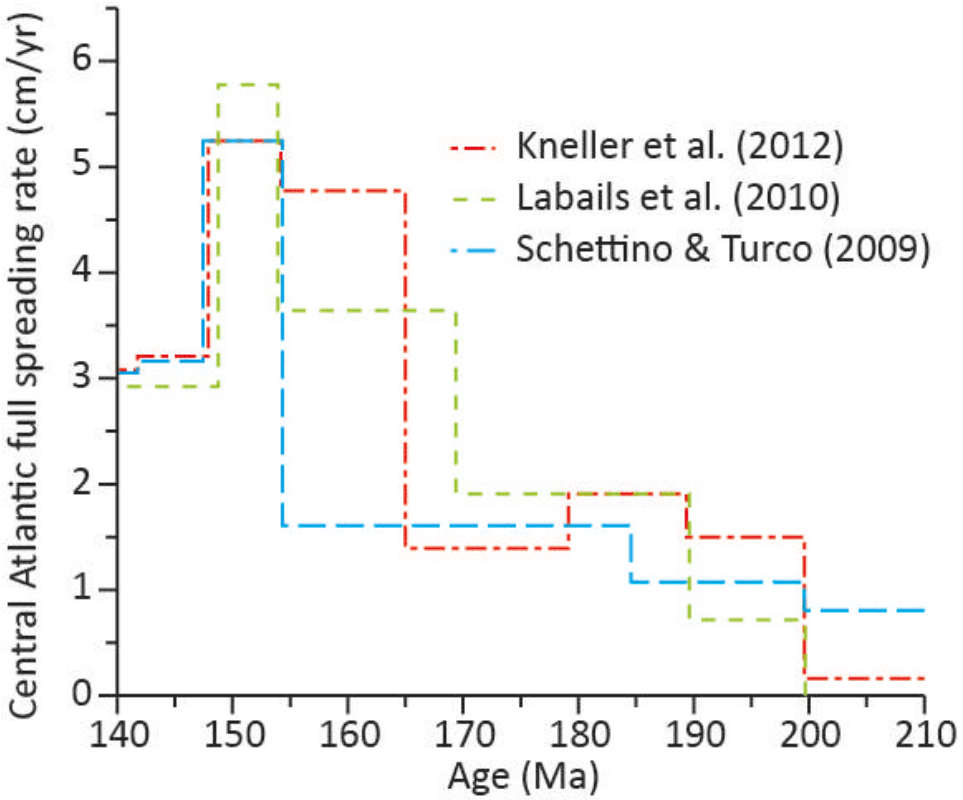
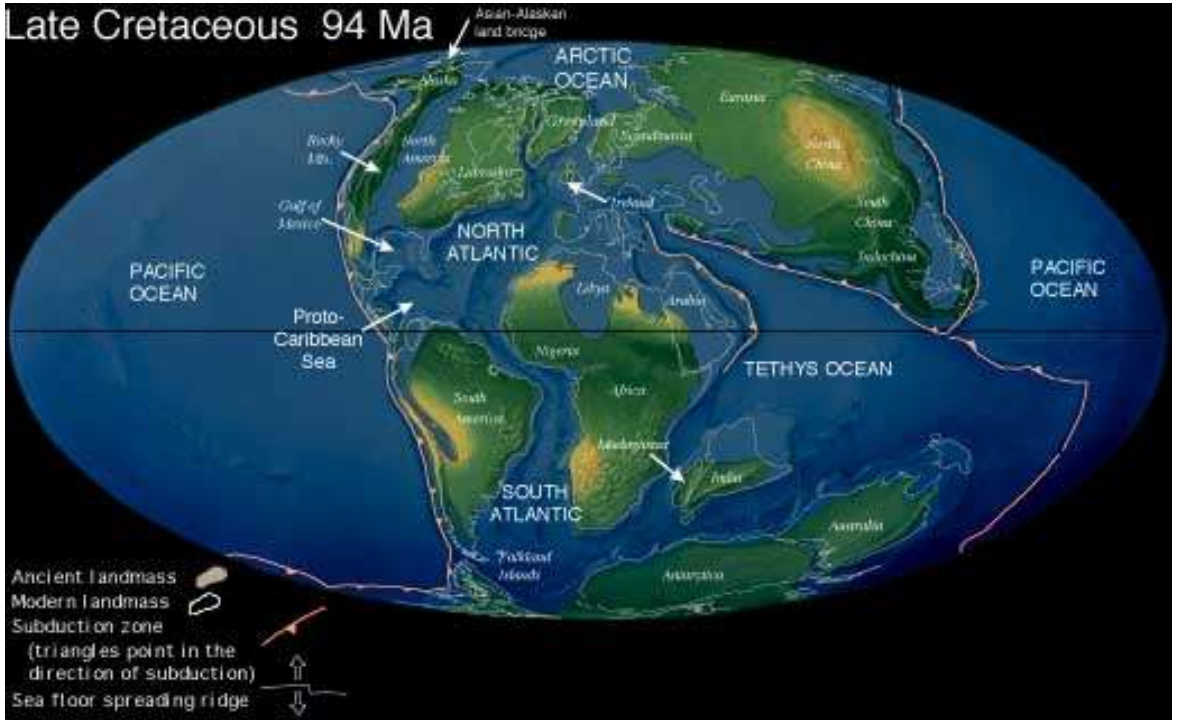


- Africa Plate Geodynamics



CONCLUSIONS

- LTT show major cooling/exhumation and heating/burial events.
- Timing and amplitude vary along the margins.
- Km-scale Jurassic-Cretaceous exhumation concurrent to excess subsidence.
- Combination of several processes: deep, surface, tectonic, geodynamic.


THE END