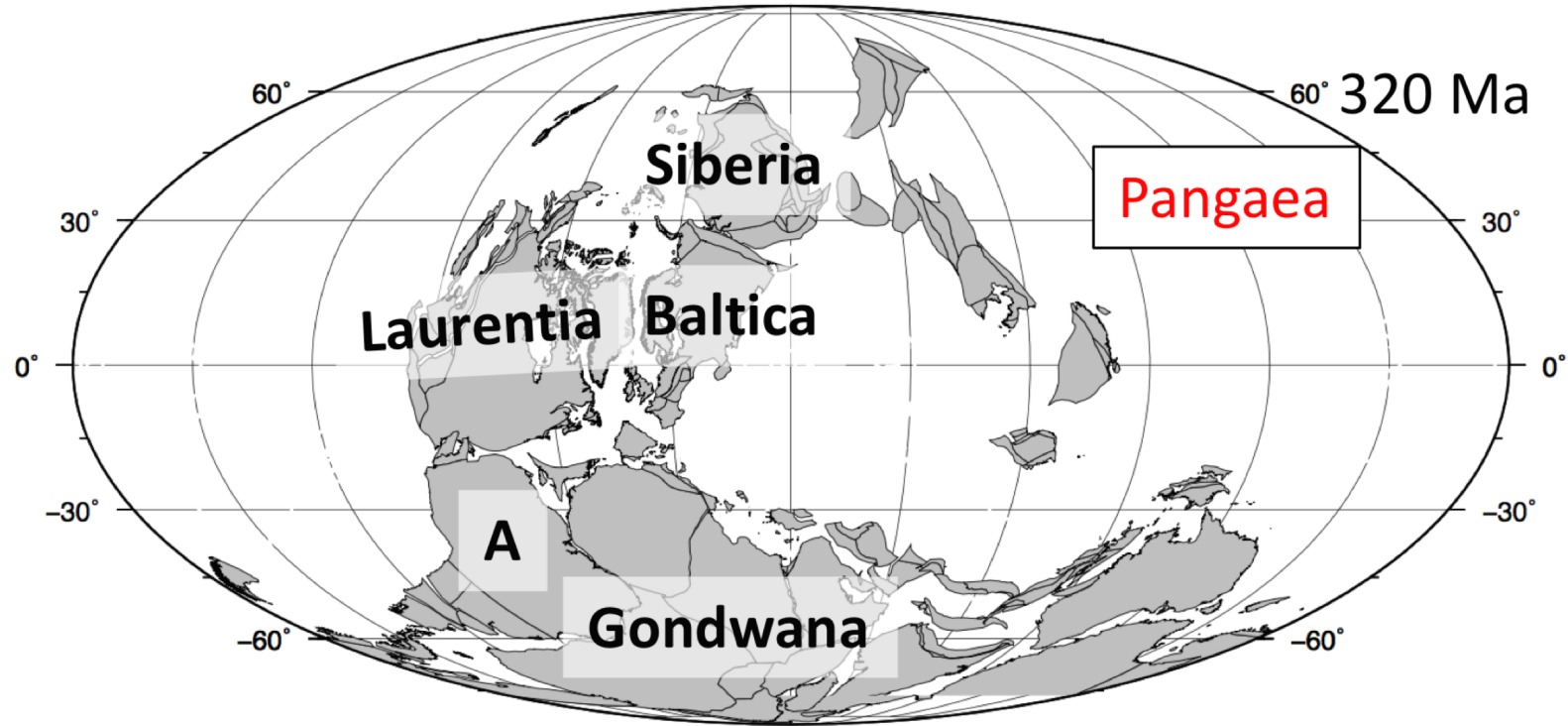


Can mantle dynamics aid supercontinent classification?

Phil Heron¹, J. Brendan Murphy²,
R. Damian Nance^{3,4} and
R. N. Pysklywec⁵



Heron et al., 2020:



1

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We don't have a formal definition of a supercontinent...

What makes a supercontinent 'super'?



Philip Heron
@philipheron



🌍 SUPERCONTINENTS 🌍 I'm giving a talk next week (@CGU_Solid_Earth) on supercontinent identification and thought it would be fun to open up a question on Twitter: "What makes a supercontinent 'super'?" Add comments to your answer in the Slido poll here: tinyurl.com/6rhuusm3.

It's size

It's impact

Both

Other

What makes a supercontinent 'super'?



Philip Heron @philipheron · Jun 16



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It's size

60.7%

It's impact

7.1%

Both

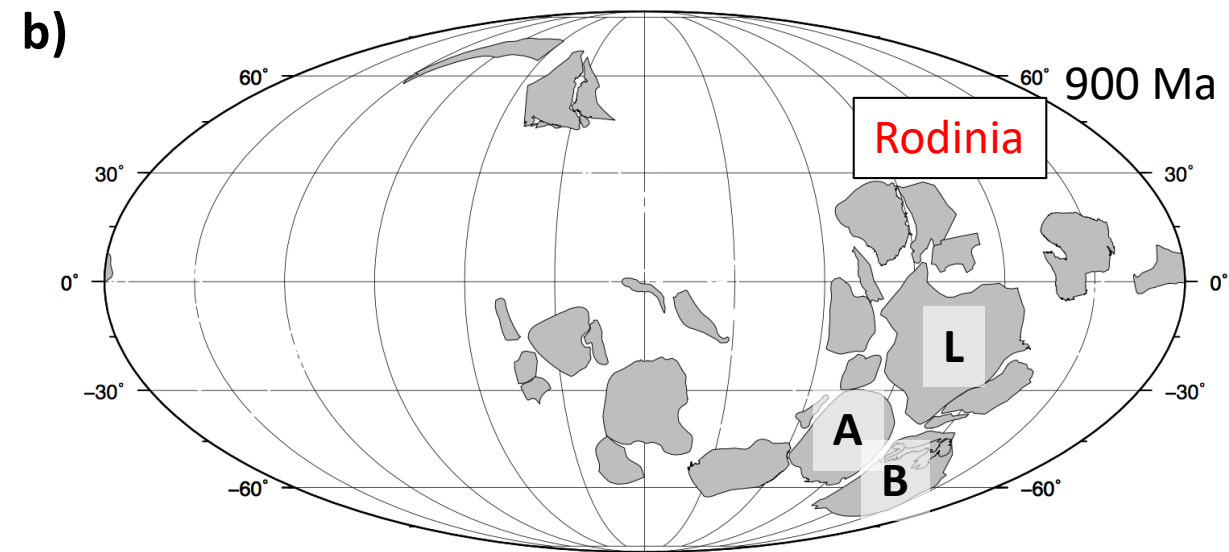
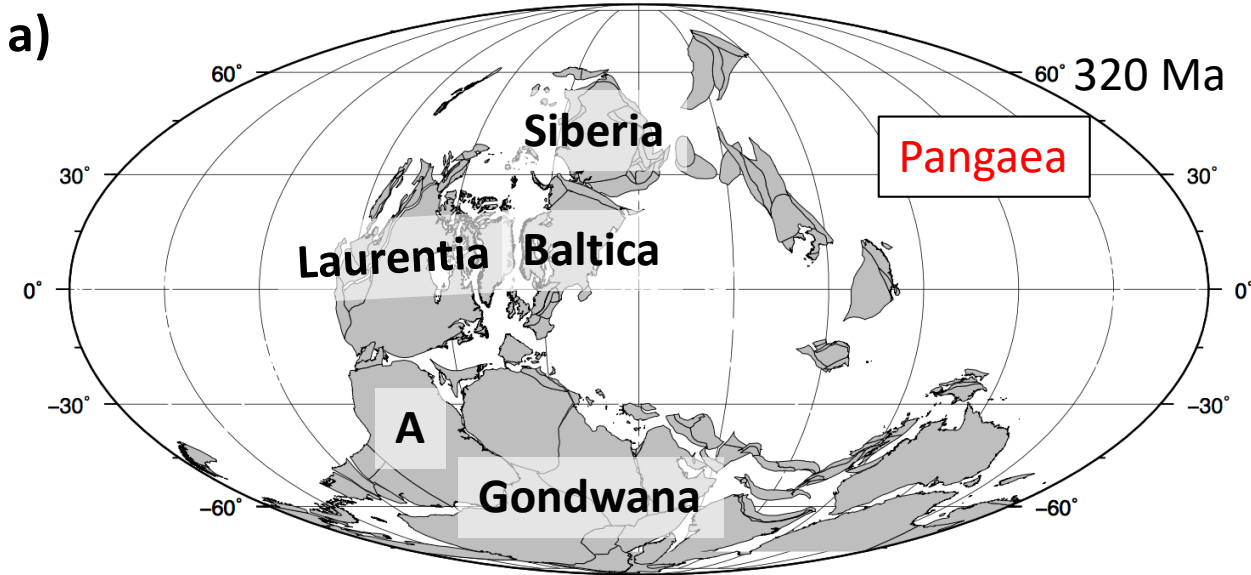
12.5%

Other

19.6%

56 votes · 1 day left

What makes a supercontinent 'super'?



Geomarkers in identification

Geomarker	Pangea	Rodinia
Global Scale Orogenesis	✓	✓
Crustal Growth	✓	✓
Rapid Climate swings	✓	✓
Major life and atmosphere events	✓	✓
Sea-level change	✓	✓
Large igneous provinces	✓	✓

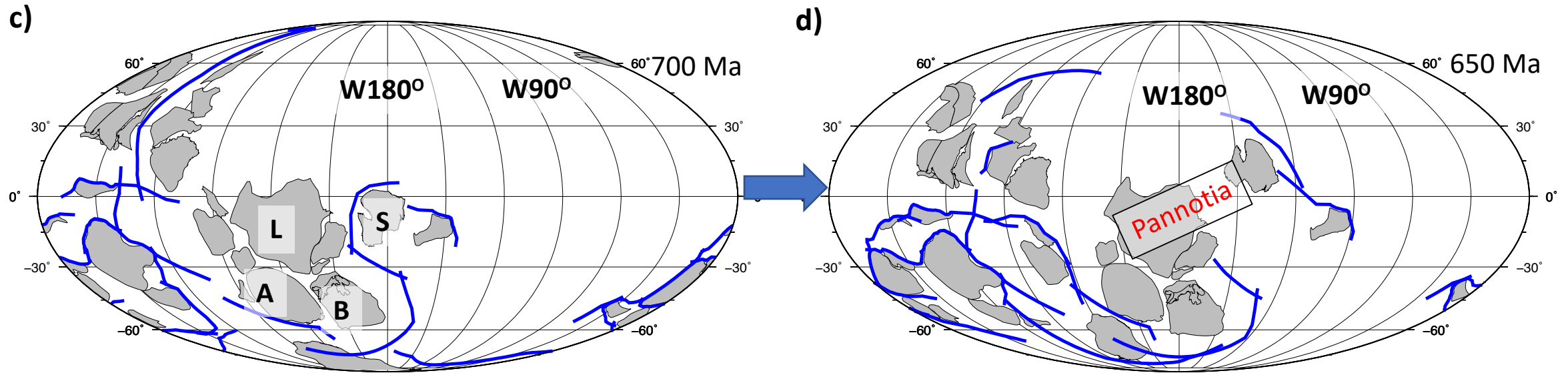
Sources: global-scale orogenesis (Nance et al. 1988; Santosh 2010a; Condie 2011; Müller et al. 2013, Dalziel 1991; Hoffman 1991; Moores 1991; Torsvik 2003; Li et al. 2004, 2008), crustal growth (Hawkesworth et al. 2010, 2016), rapid climate swings (Hoffman et al. 1998; Strand 2012; Young 2012), evolution of life and the atmosphere (Lindsay and Brasier 2002; Santosh 2010b; Knoll 2013; Melezhik et al. 2013), biogeochemical cycles (Nance et al. 1986), and profound sea-level change (Worsley et al. 1984; Nance and Murphy 2013).

Mantle impact

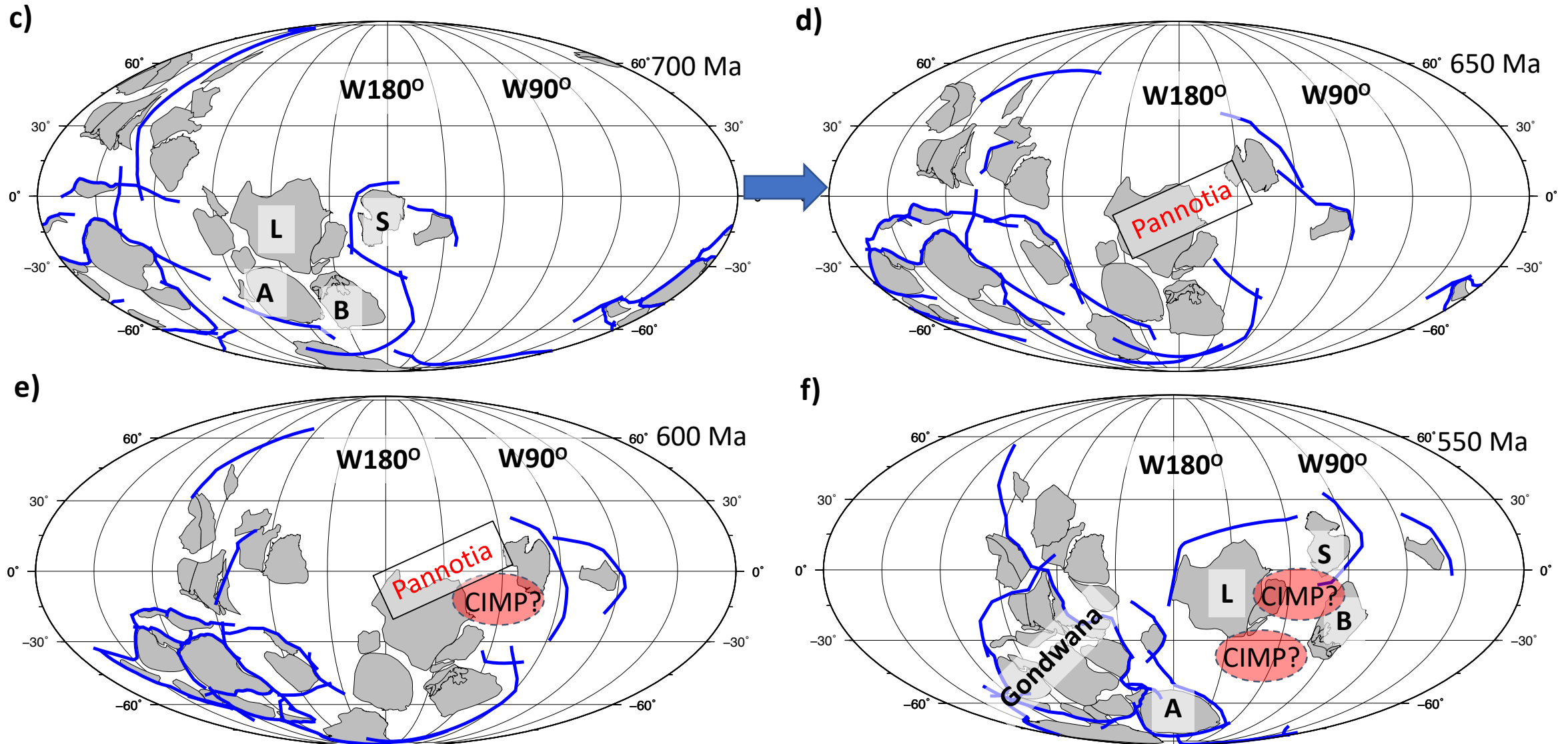
- **Pastor-Galan et al., 2018:**

"We suggest that a 'supercontinent' should be defined as a single continental plate with a size capable of modifying or controlling mantle dynamics and core–mantle boundary processes, altering convection cells and enhancing thermal activity"

Super Pannotia?



Super Pannotia?

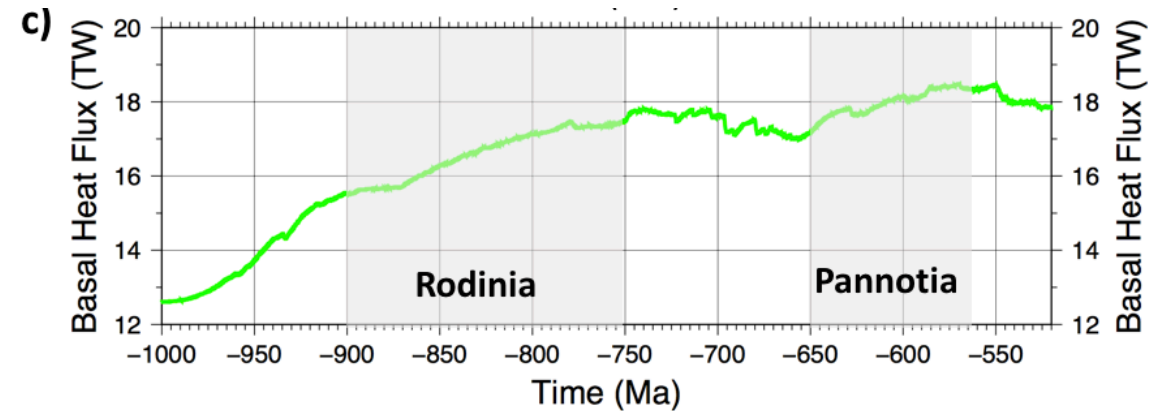
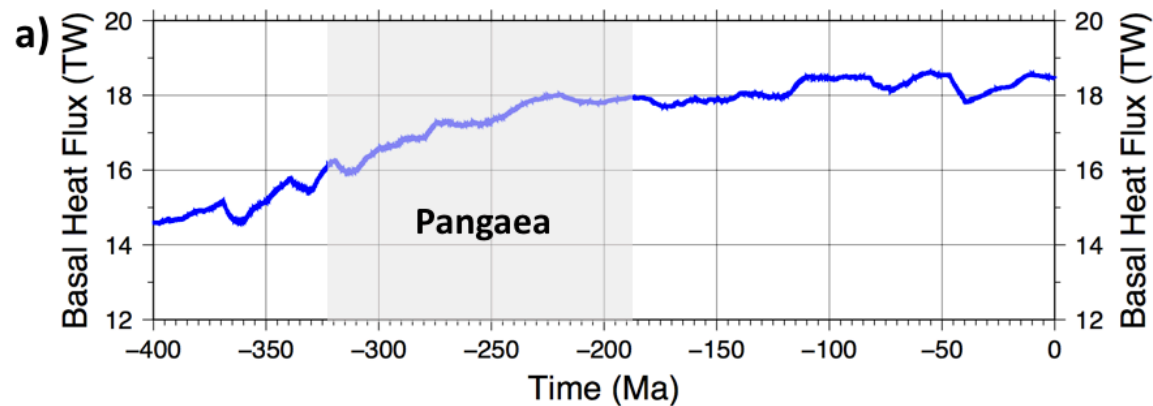
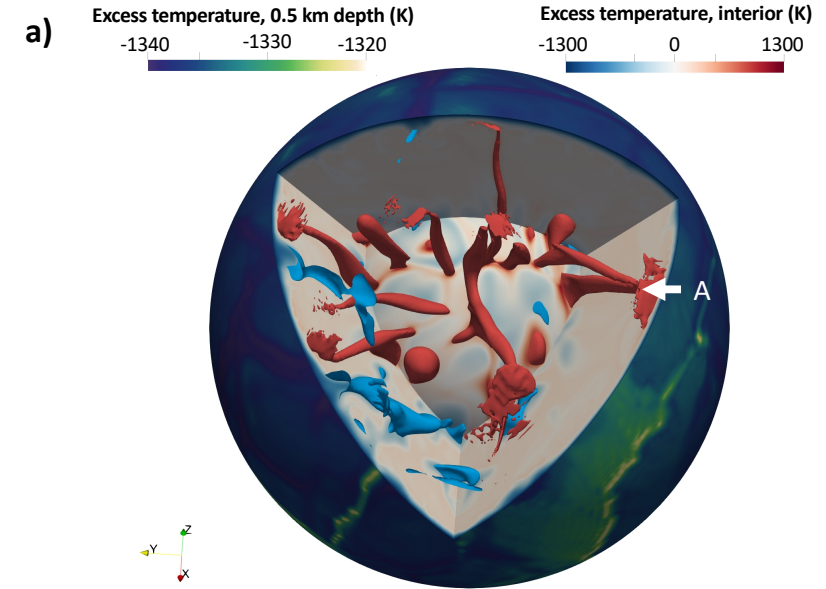
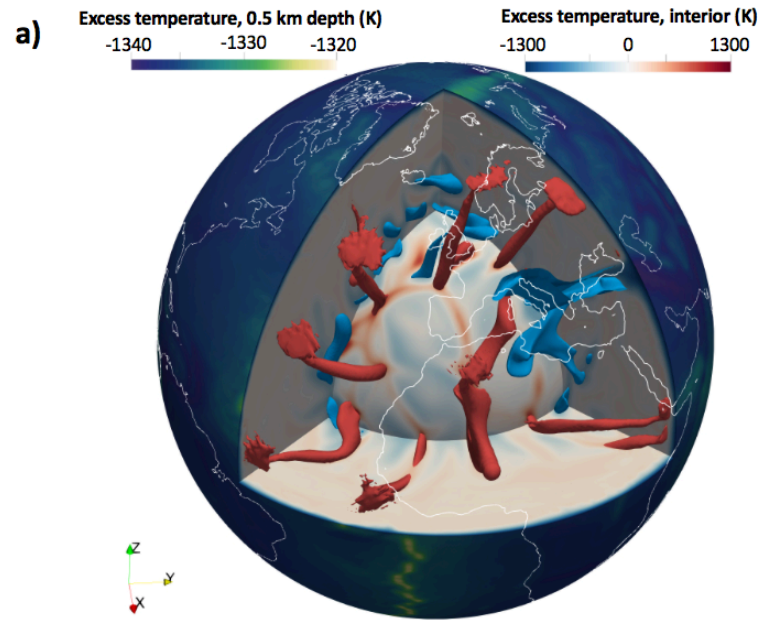


Geomarkers in identification

Geomarker	Pangea	Rodinia	Pannotia
Global Scale Orogenesis	✓	✓	✓
Crustal Growth	✓	✓	✓
Rapid Climate swings	✓	✓	✓
Major life and atmosphere events	✓	✓	✓
Sea-level change	✓	✓	✓
Large igneous provinces	✓	✓	✓
Mantle and subduction dynamics			

Source: Nance et al. 1986; Hoffman 1991; Hoffman et al. 1998; Maruyama and Santosh 2008; Knoll 2013).

Mantle 'Fingerprint' of supercontinent?



Geomarkers in identification

Geomarker	Pangea	Rodinia	Pannotia
Global Scale Orogenesis	✓	✓	✓
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Major life and atmosphere events	✓	✓	✓
Sea-level change	✓	✓	✓
Large igneous provinces	✓	✓	✓
Mantle and subduction dynamics	✓	✓	✓

Source: Nance et al. 1986; Hoffman 1991; Hoffman et al. 1998; Maruyama and Santosh 2008; Knoll 2013).

What makes a supercontinent 'super'?



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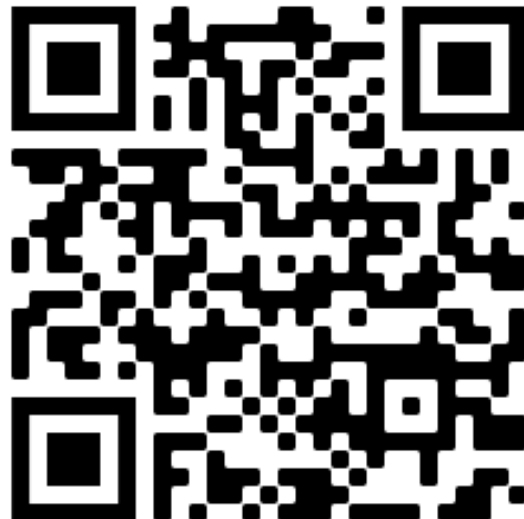
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What makes a supercontinent 'super'?

- Is a focus on **size** of a supercontinent distracting?
- Pastor-Galan et al., 2018: "We suggest that a 'supercontinent' should be defined as a single continental plate with a size capable of modifying or controlling mantle dynamics and core–mantle boundary processes, altering convection cells and enhancing thermal activity"
- Are numerical models useful in identification? Or are they too speculative?

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Pannotia's mantle signature: the quest for supercontinent identification

 Philip J. Heron, J. Brendan Murphy, R. Damian Nance and R. N. Pysklywec

Geological Society, London, Special Publications, 503, 41-61, 8 September 2020, <https://doi.org/10.1144/SP503-2020-7>

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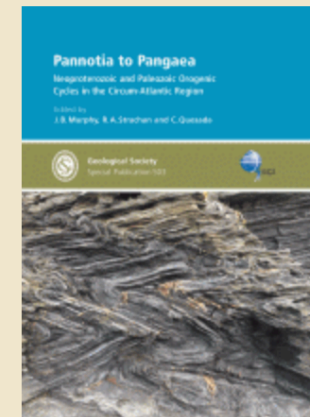
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Abstract

A supercontinent is generally considered to reflect the assembly of all, or most, of the Earth's continental lithosphere. Previous studies have used geological, atmospheric and biogenic 'geomarkers' to supplement supercontinent identification. However, there is no formal definition of how much continental material is required to be assembled, or indeed which geomarkers need to be present. Pannotia is a hypothesized

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