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FACULTY OF SCIENCE

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Congo-São Francisco in the megacontinent Umkondia

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ACADEMY OF FINLAND

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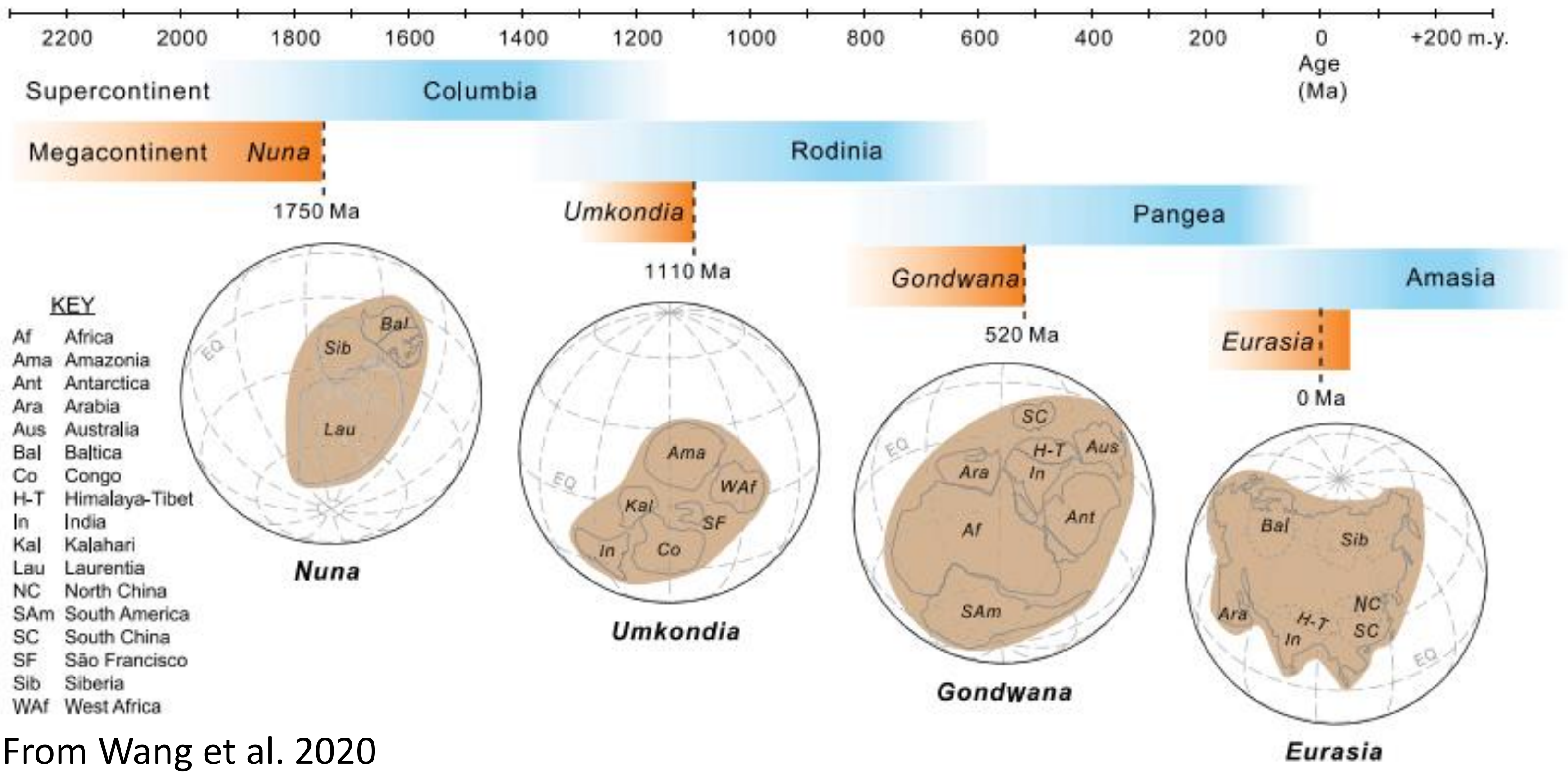
Motivation: The role of megacontinents in the supercontinent cycle?

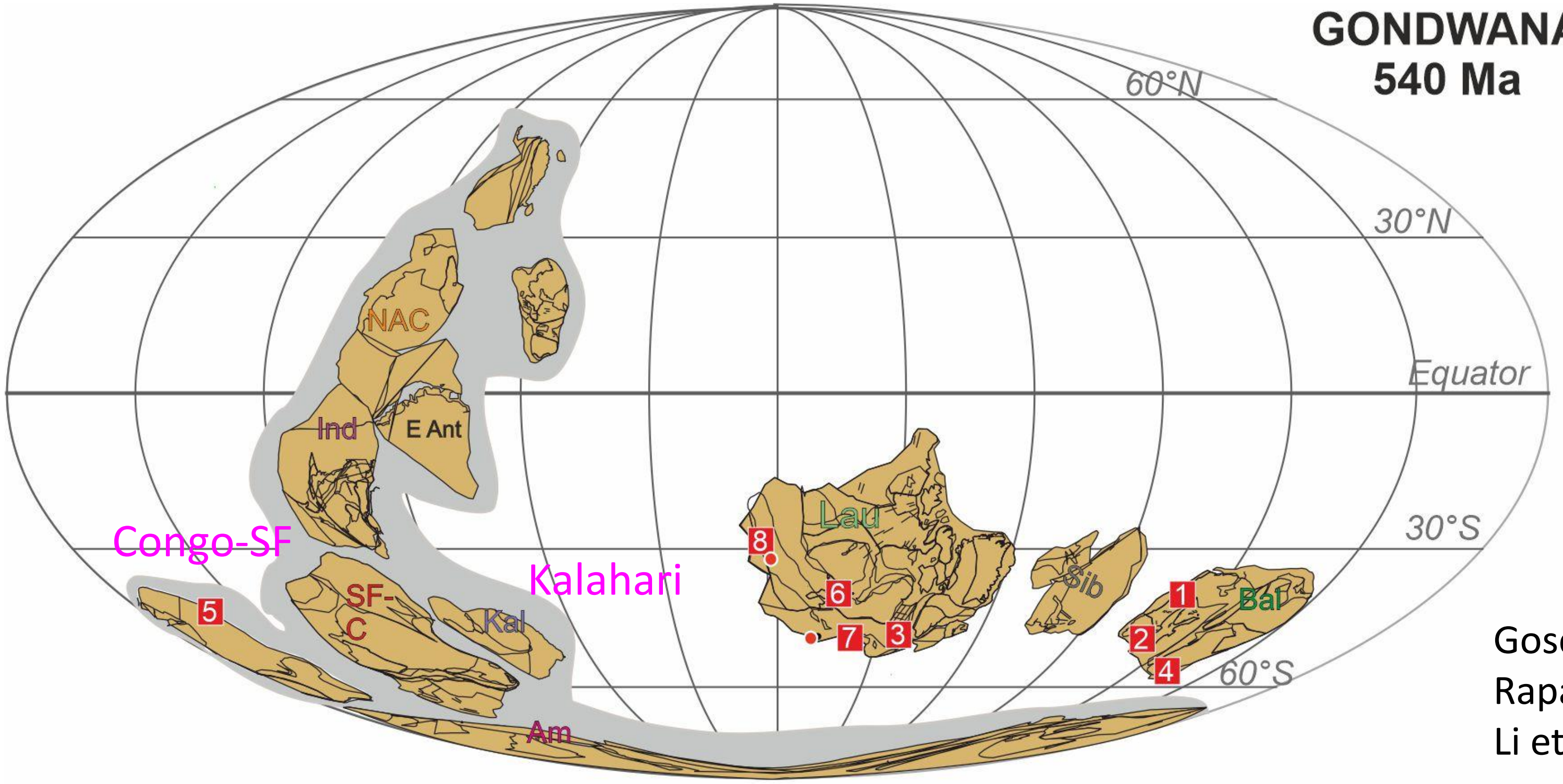


From Wang et al. 2020

Currently three supercontinent cycles have been identified and existed supercontinents named from youngest to oldest: Pangea, Rodinia and Nuna/Columbia (e.g. Mitchell et al. 2021).

Supercontinent amalgamation were each preceded by ~200 Myr by the assembly of a **megacontinent**, which **later collides with other continents to form a supercontinent** (Wang et al. 2020).

Introduction: The Congo-São Francisco craton is a main building block in Gondwana



ca. 620-540 Ma LIPs, dykes and sills 1

1 Baltoscandia (620)
2 Egersund (620)
3 Long Range (620)
4 Volyn (570)
5 Ouarzazate (570)
6 Sept Iles (560)
7 Catoctin (560)
8 Wichita (540)

Goscombe et al. 2018
Rapalini et al. 2018
Li et al. 2019

Was Congo-São Francisco part of Rodinia?

Results: Direct Mesoproterozoic connection of the Congo and Kalahari cratons in proto-Africa: Strange attractors across supercontinental cycles

Salminen et al 2018. Geology 46, 1011-1014

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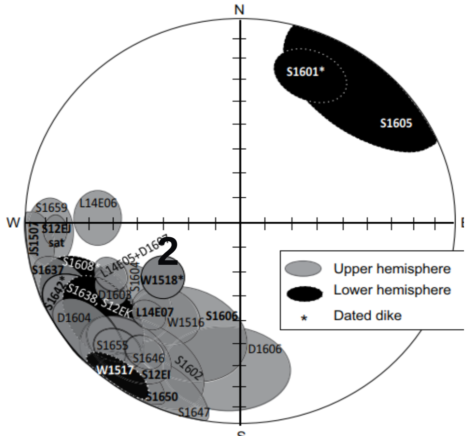
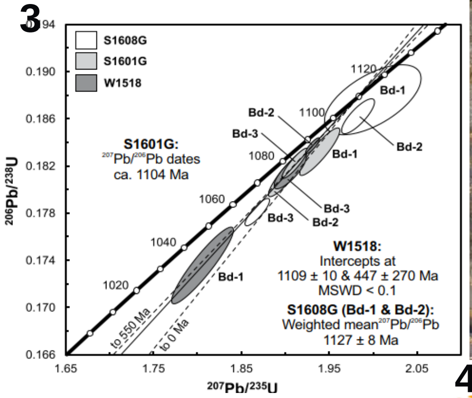
Sampling mafic dykes in Angola



Paleomagnetism



U-Pb geochronology 1109±10M

4

Precambrian database PALEOMAGIA

SCRIPPS INSTITUTION OF OCEANOGRAPHY
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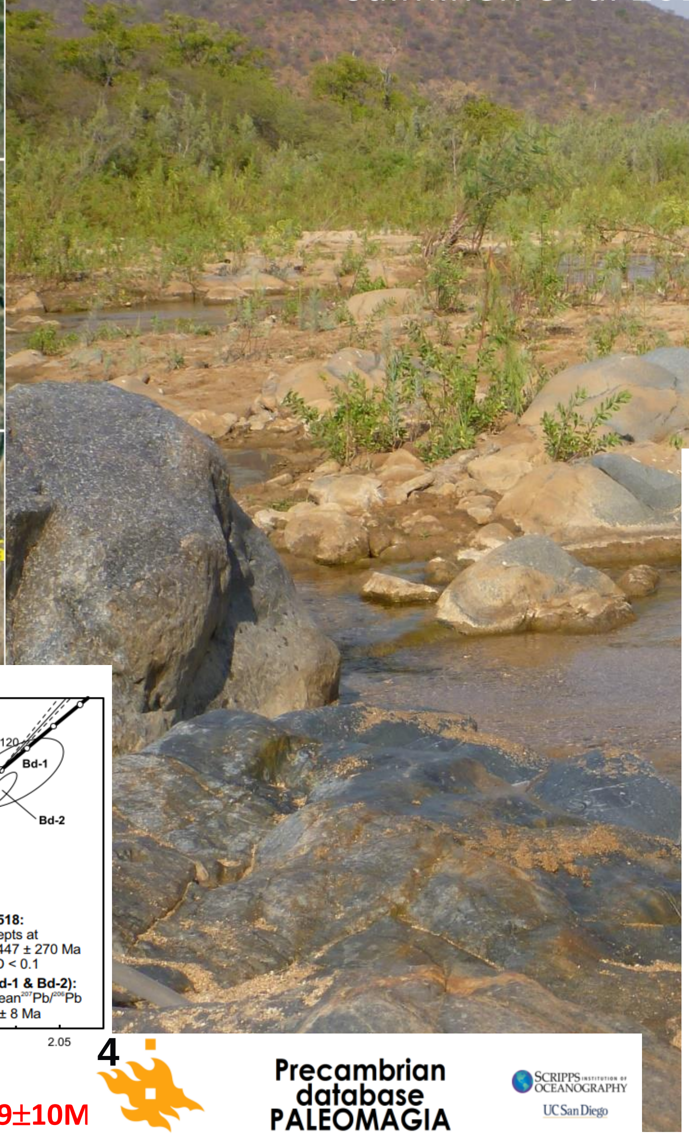
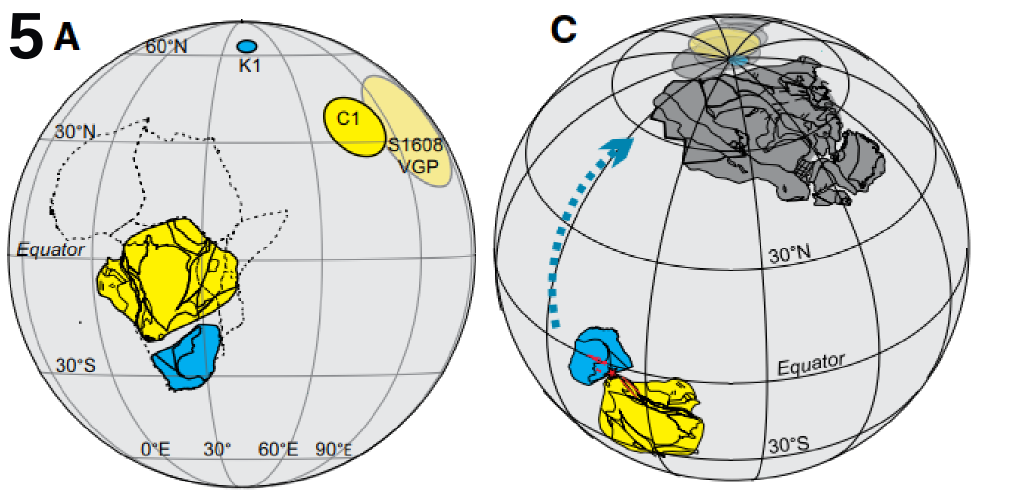
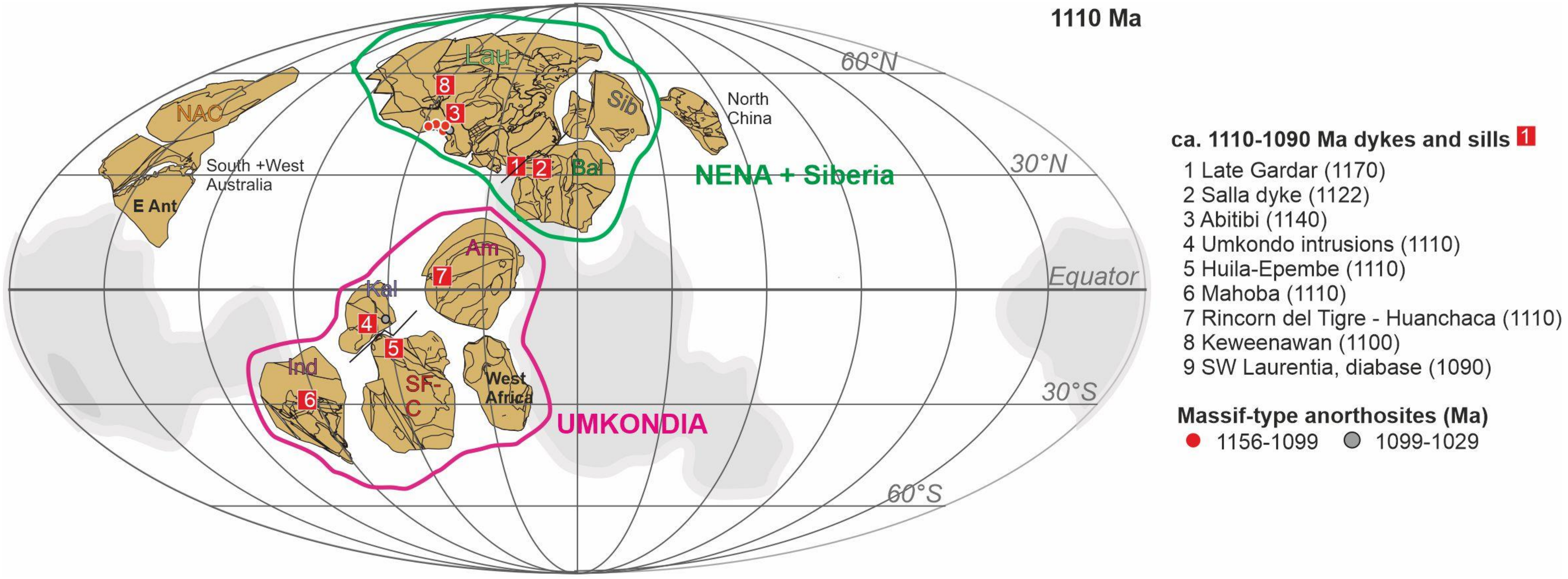




A. Present-day configuration with paleomagnetic results

C. **1.1 Ga paleogeographic reconstruction of Congo, Kalahari, and Laurentia**

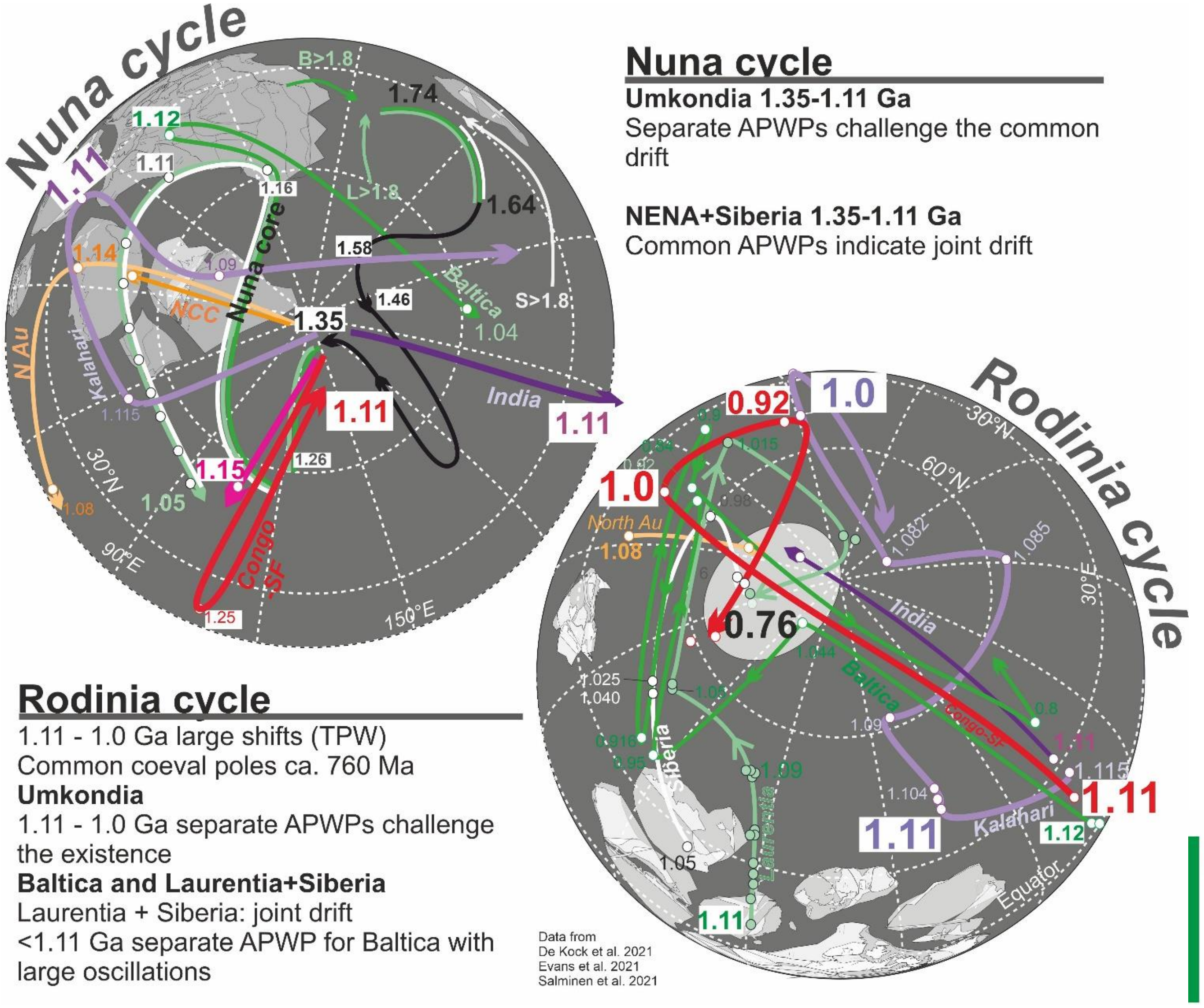
Discussion: Umkondia occupying intermediary “megacontinental” role in the Nuna-Rodinia transition?



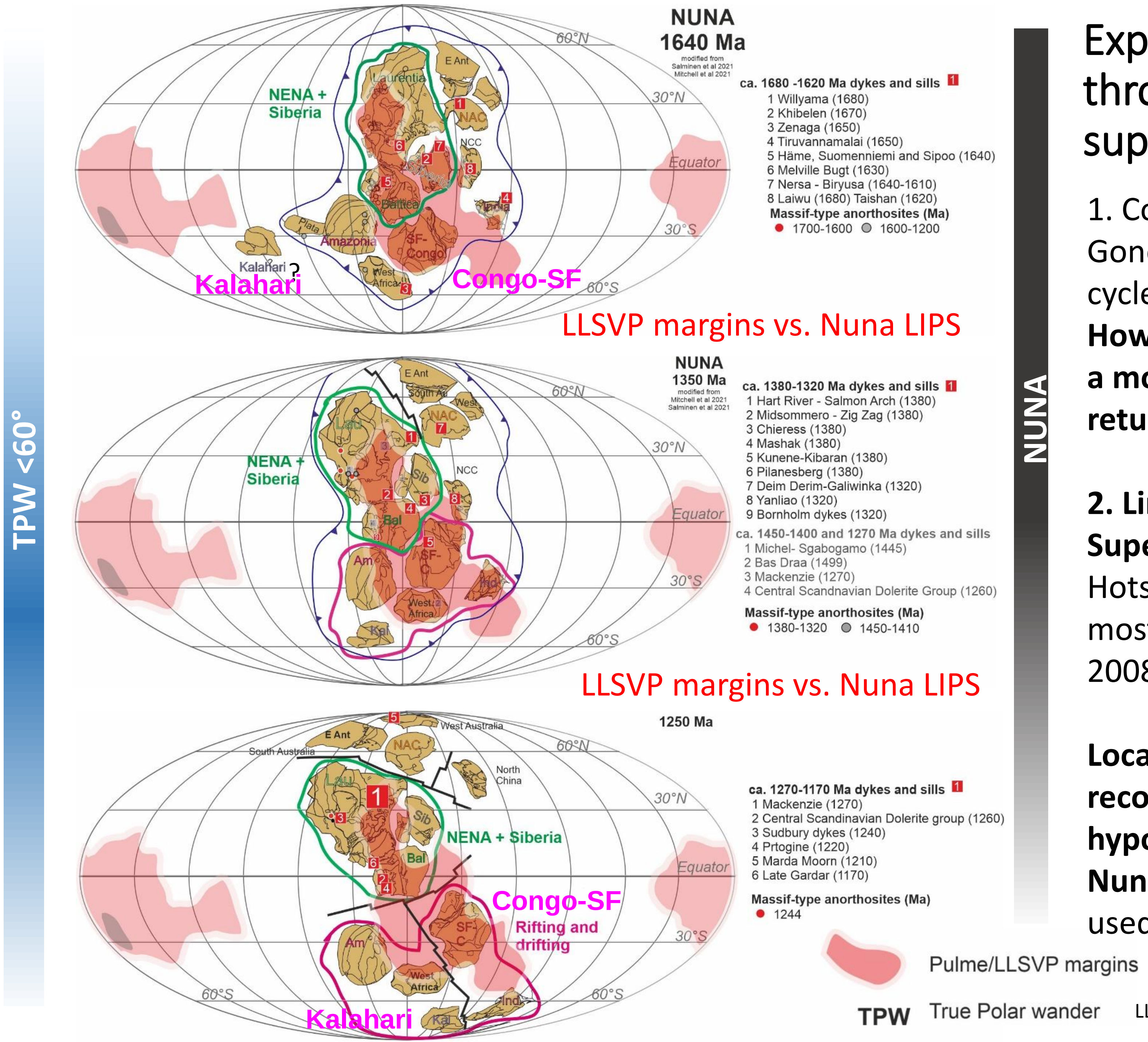
The 1.11 Ga paleomagnetic data permits a direct connection between Congo and Kalahari cratons. Similar to earlier qualitative comparisons (Ernst et al. 2003). Coeval mafic magmatism has been identified in Kalahari, Laurentia, India, Amazonia, and Antarctica (Grunehogna). **Congo-SF, Kalahari, India, and Amazonia-West Africa form the (megacontinent) Umkondia.**

Were these coeval provinces spatially linked at the time of emplacement during the amalgamation of Rodinia?

Discussion: Umkondia occupying intermediary “megacontinental” role in the Nuna-Rodinia transition?



Divergent coeval poles from Umkondia continents **challenge the existence of Umkondia through Nuna-Rodinia transition**



LLSVP, Large low-shear-velocity-provinces

Exploring Congo-SF and Kalahari through Nuna-Rodinia-Gondwana supercontinent cycles

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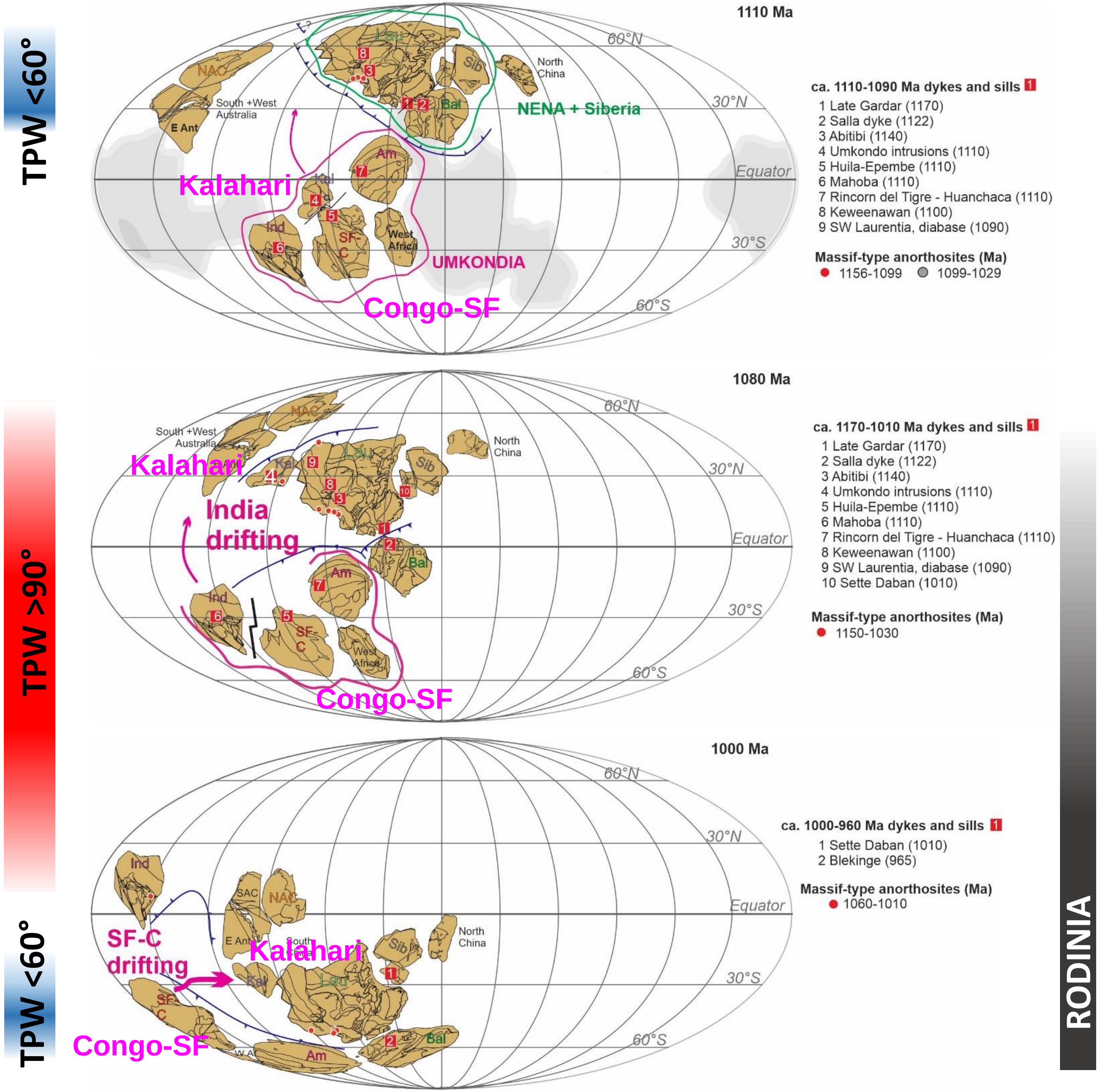
1. Congo vs. Kalahari similar coeval position in Gondwana and Rodinia, but not through the cycle

How can cratons separate over large distances in a mobilistic plate-tectonic scenario and then return to rejoin each other?

2. Links between surface and deep Earth? Supercontinent cycle vs. LLSVPs

Hotspots and large igneous provinces (LIPs) are mostly generated above LLSVPs (Burke et al. 2008; Douchet et al. 2019).

Location of fragments of LIPS in Nuna reconstruction correlate with the edges of hypothetical LLSVP beneath the supercontinent Nuna (shape of the present day African LLSVP used; Burke et al 2008).



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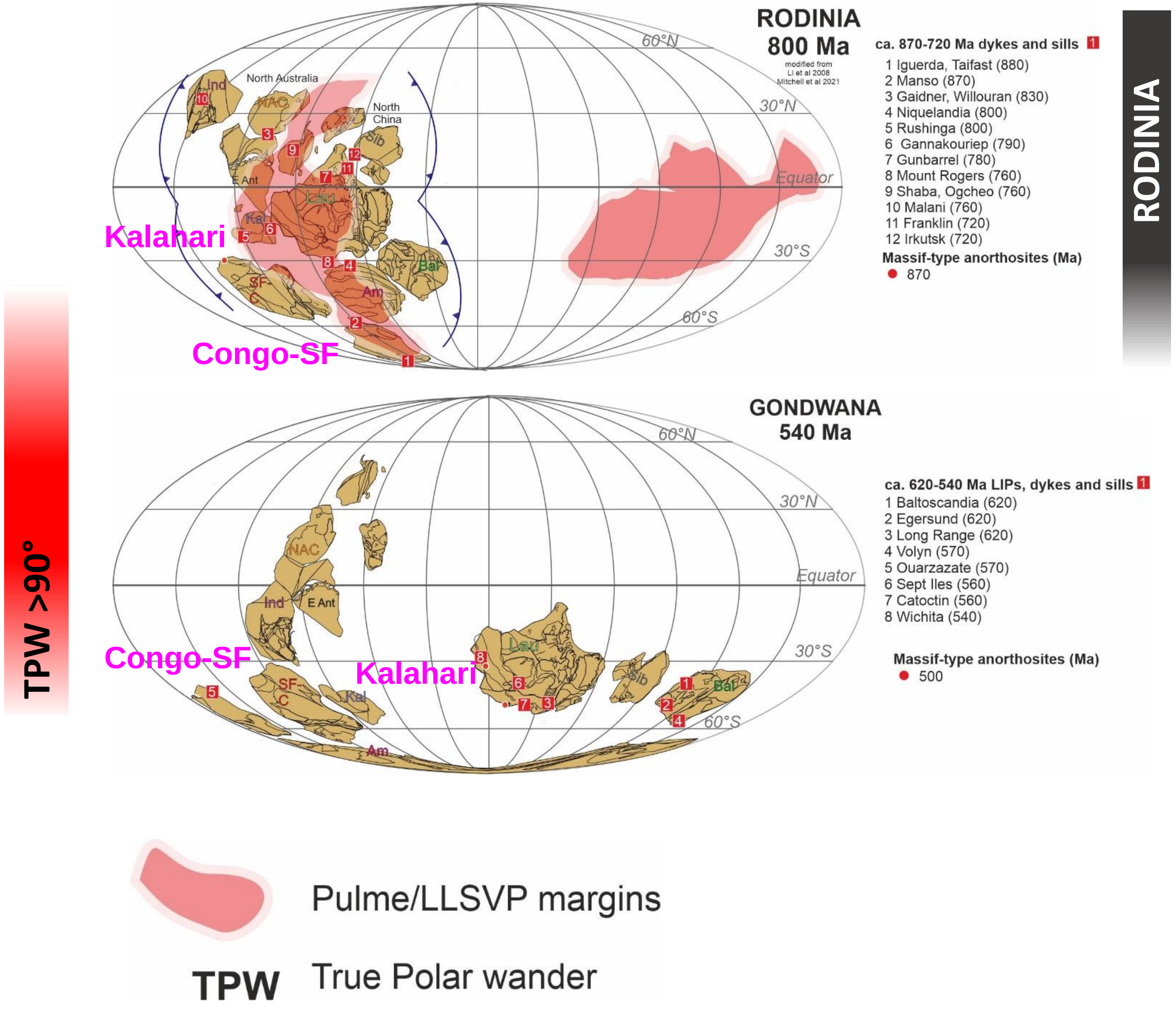

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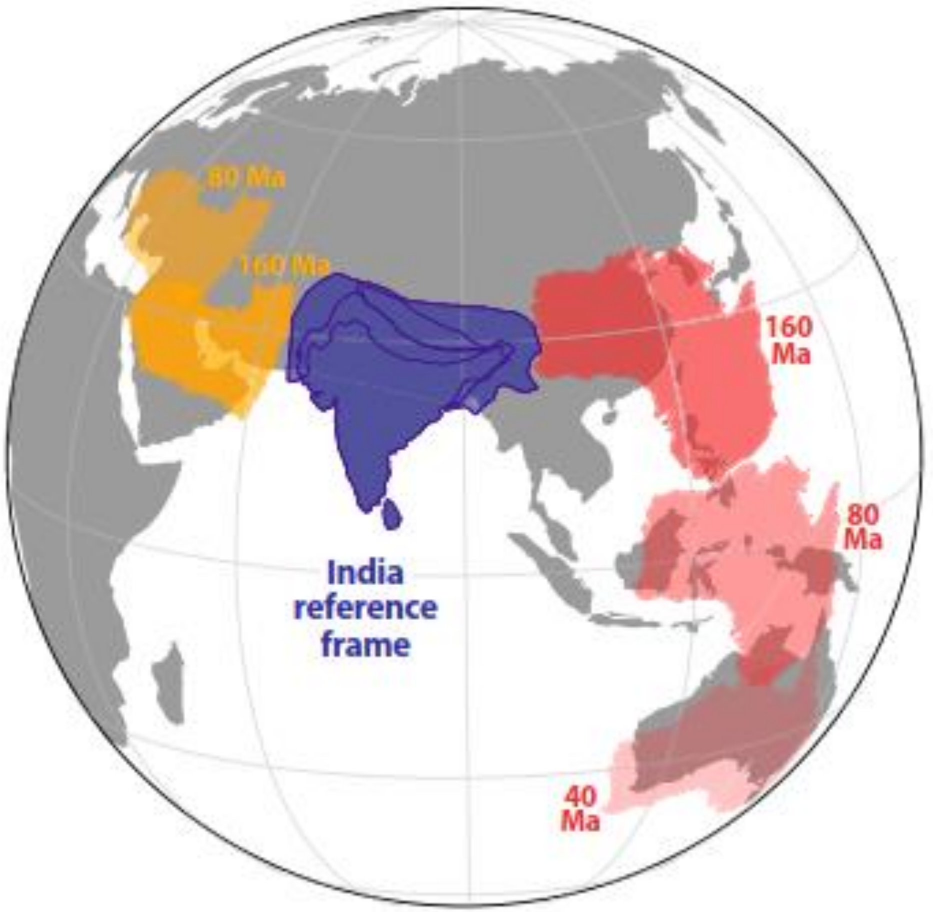
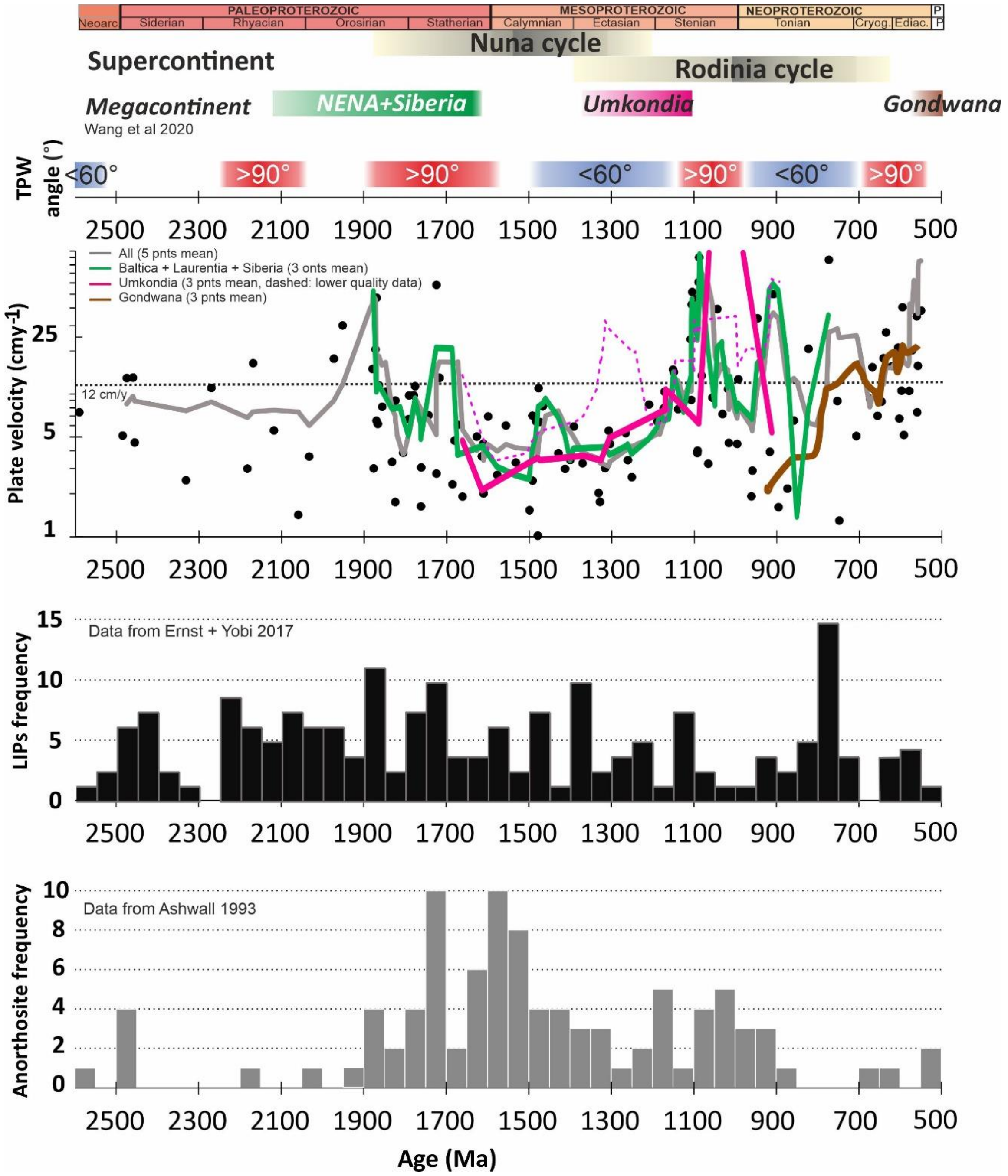


Reconstructed Gondwana-derived cratons in fixed-India reference frame, using rotation model of Seton et al. (2012). Orange—Arabia, purple—India, red—Australia.

1. **How can cratons separate over large distances in a mobilistic plate-tectonic scenario and then return to rejoin each other?**

Link between surface and deep Earth
A dynamic explanation for this process appeals to **long-term stability of circum-supercontinental subduction systems** , with that surrounding Pangea as the best understood example (Richards and Engebretson, 1992).



2. Manifestation of links between surface and deep Earth

Hotspots and large igneous provinces (LIPs) are mostly generated above LLSVPs (e.g. Ernst 2014)

LIPs frequency correlate with supercontinent cycles and peaks correlate with higher plate velocity.

Major anorthosite occurrence correlate with low plate velocity. Combined effect of LLSVP and insulation of a supercontinent offer a explanation for the formation of anorthosites linking the surface and deep Earth.

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