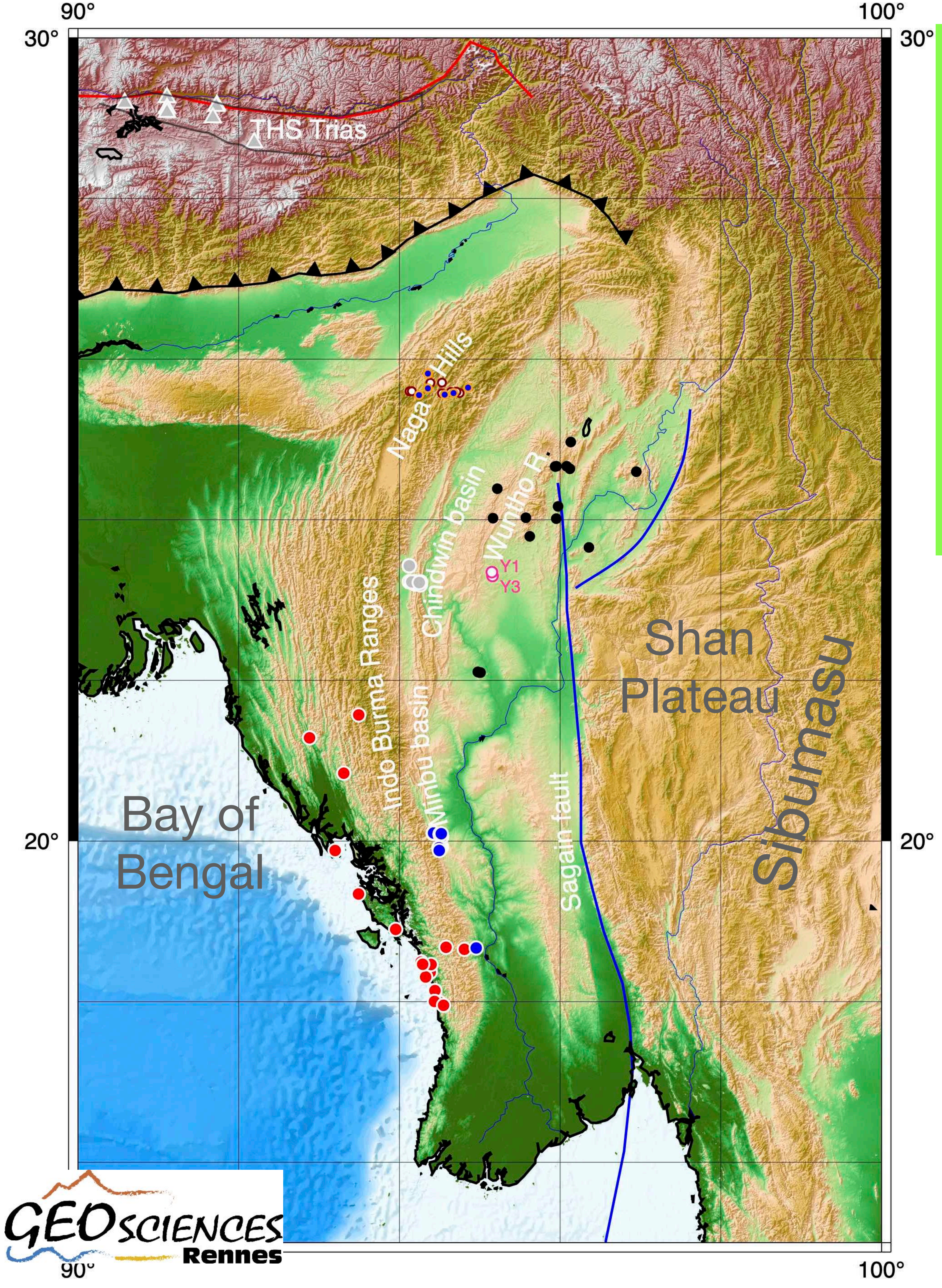

Northward motion of the Burma Terrane alongside India during the Cenozoic

Jan Westerweel [1], Pierrick Roperch [1], Guillaume Dupont-Nivet [1,2], Alexis Licht [3], Nathan Cogne [1], and Fernando Poblete [3]

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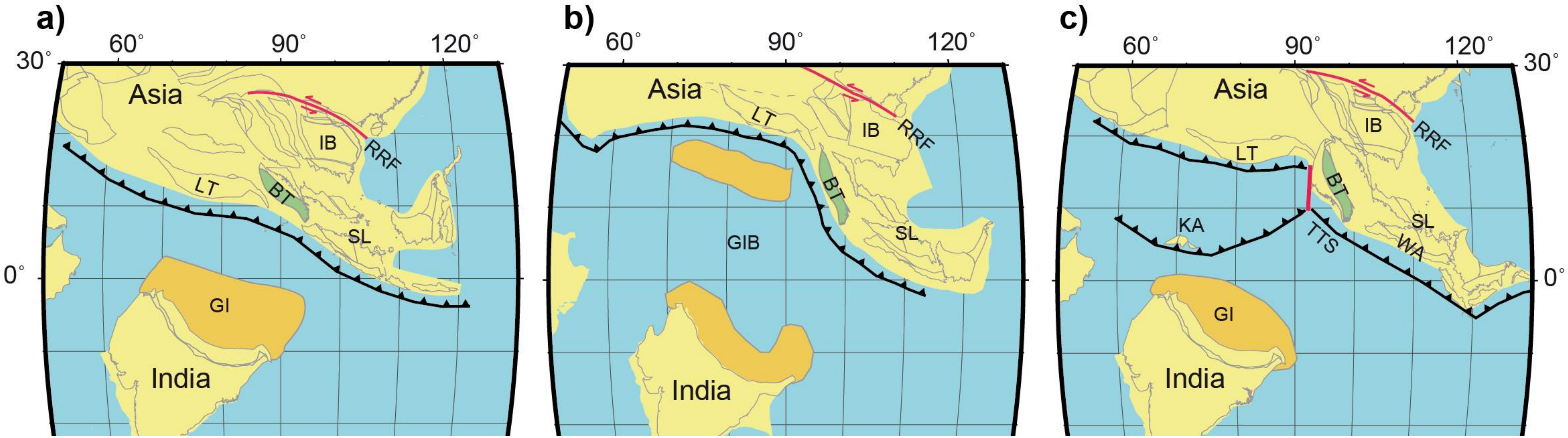
(2) Potsdam University, Germany
(3) Cerege, CNRS, Univ Aix-Marseille3
(4) Dep. Geology, Universidad de Chile

The Burma terrane (BT) is presently located west of the Sagaing fault and East of the Indo-Myanmar Ranges. The Indo-Myanmar ranges and Naga Hills constitute an other terrane that may have a slightly different paleogeography and tectonic history than the the BT. The India plate is subducting below the Indo-Burman ranges.

Position of Burma Terrane for 3 different scenarios of the India-Asia collision (60 Ma) as part of the Asian margin prior to Westerweel et al. (2019)



In all models, Burma was part of the Asian margin at 10 to 20°N

E-W subduction zone /

Significant extrusion Indochina

- Relatively high latitude
- Large clockwise rotation BT

(Cogne et al., 2013; Replumaz et al., 2010, 2013; Royden et al., 2008)

Greater India Basin (GIB)

- Relatively high latitude
- Little rotation BT

(Van Hinsbergen et al., 2012, 2018)

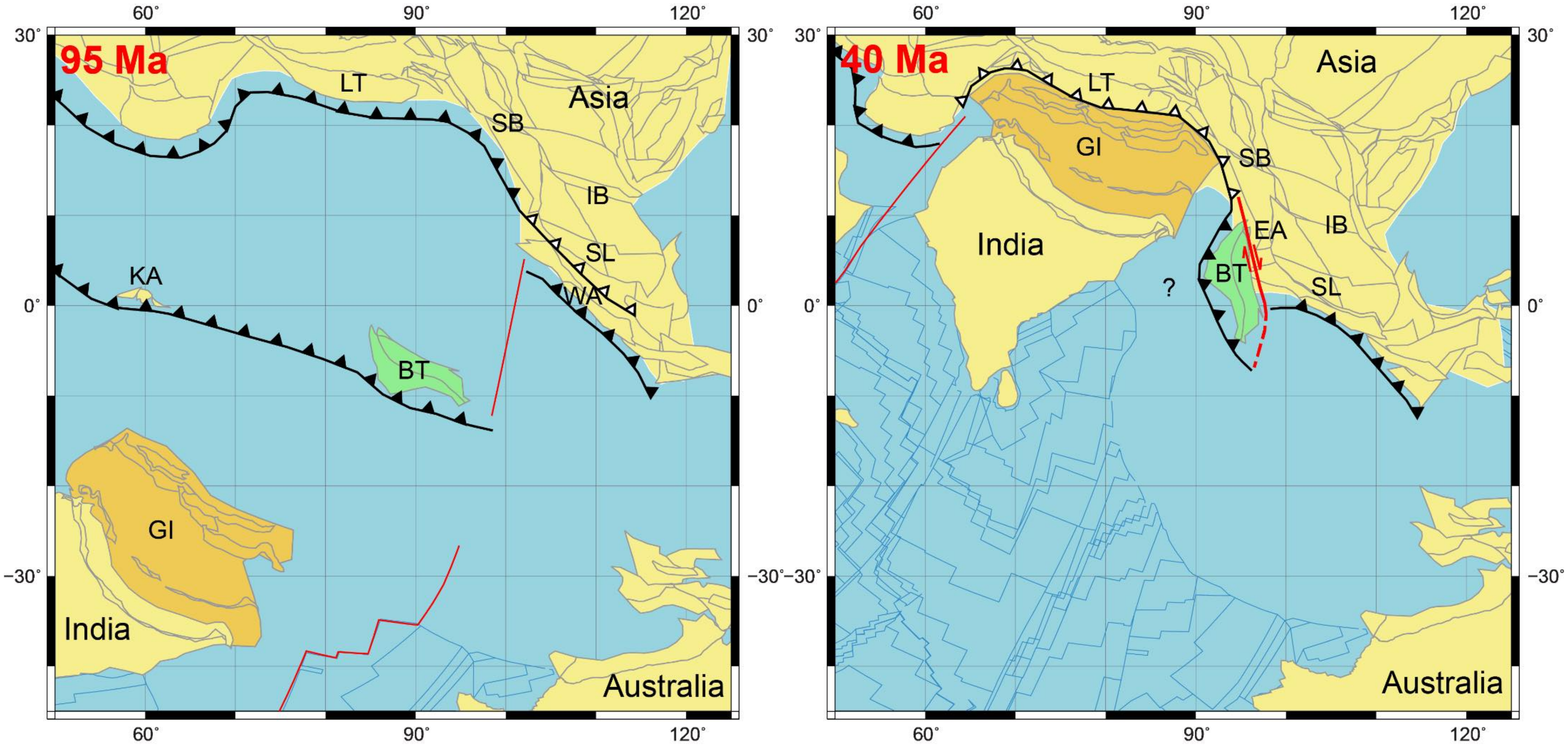
Trans-Tethyan Arc

- BT as part of Trans-Tethyan / Incertus Arc
- Paleolatitude less constrained, arc was potentially farther south

(Hall, 2012; Jagoutz et al., 2015, Zahirovic et al., 2016)

Westerweel et al. (2019) - Paleomagnetic results 95 and 40 Ma:

Near-equatorial latitudes for Burma Terrane

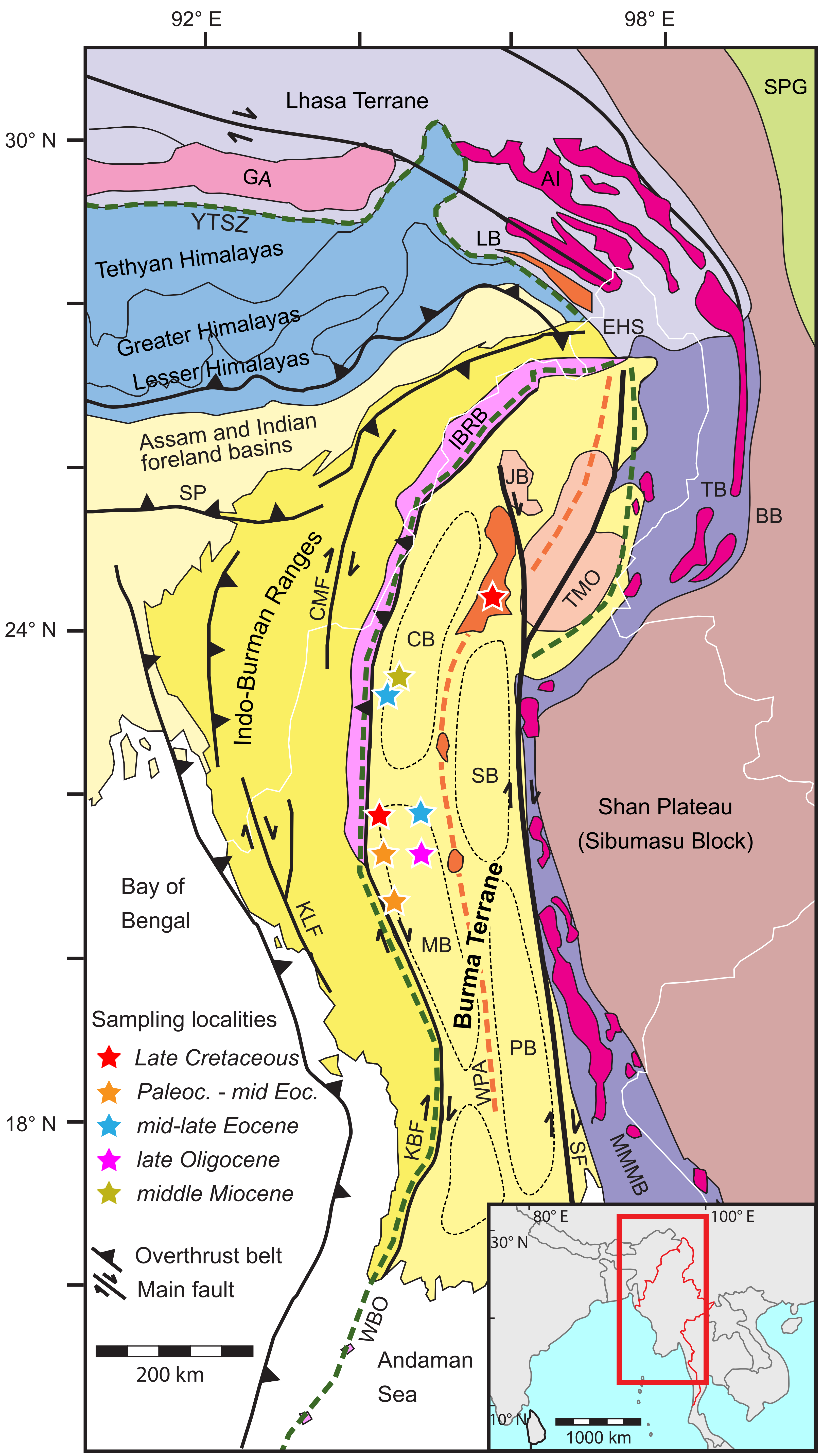


Trans-Tethyan island arc

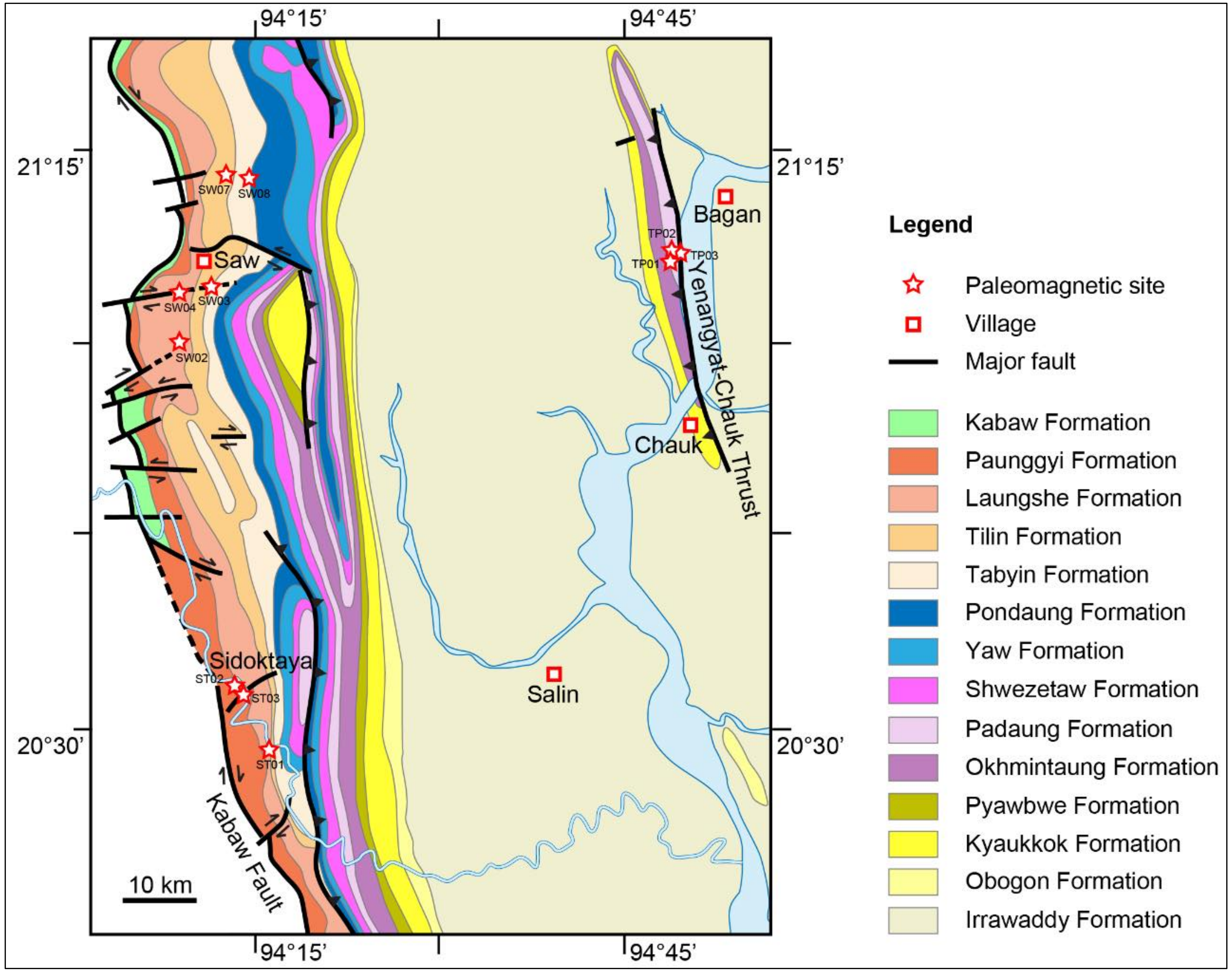
Andean-type volcanism

~60°C clockwise rotation

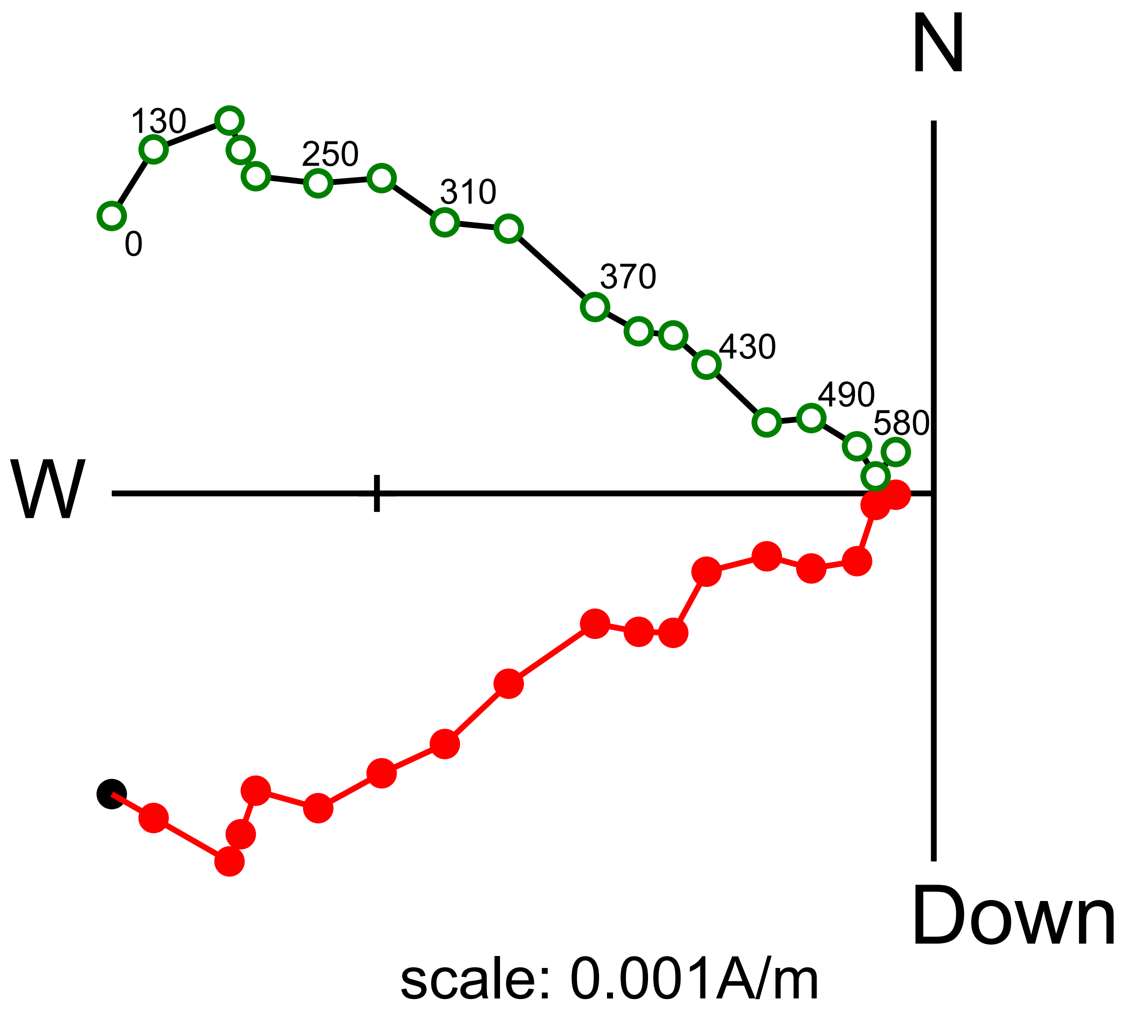
2000 km northward strike-slip motion



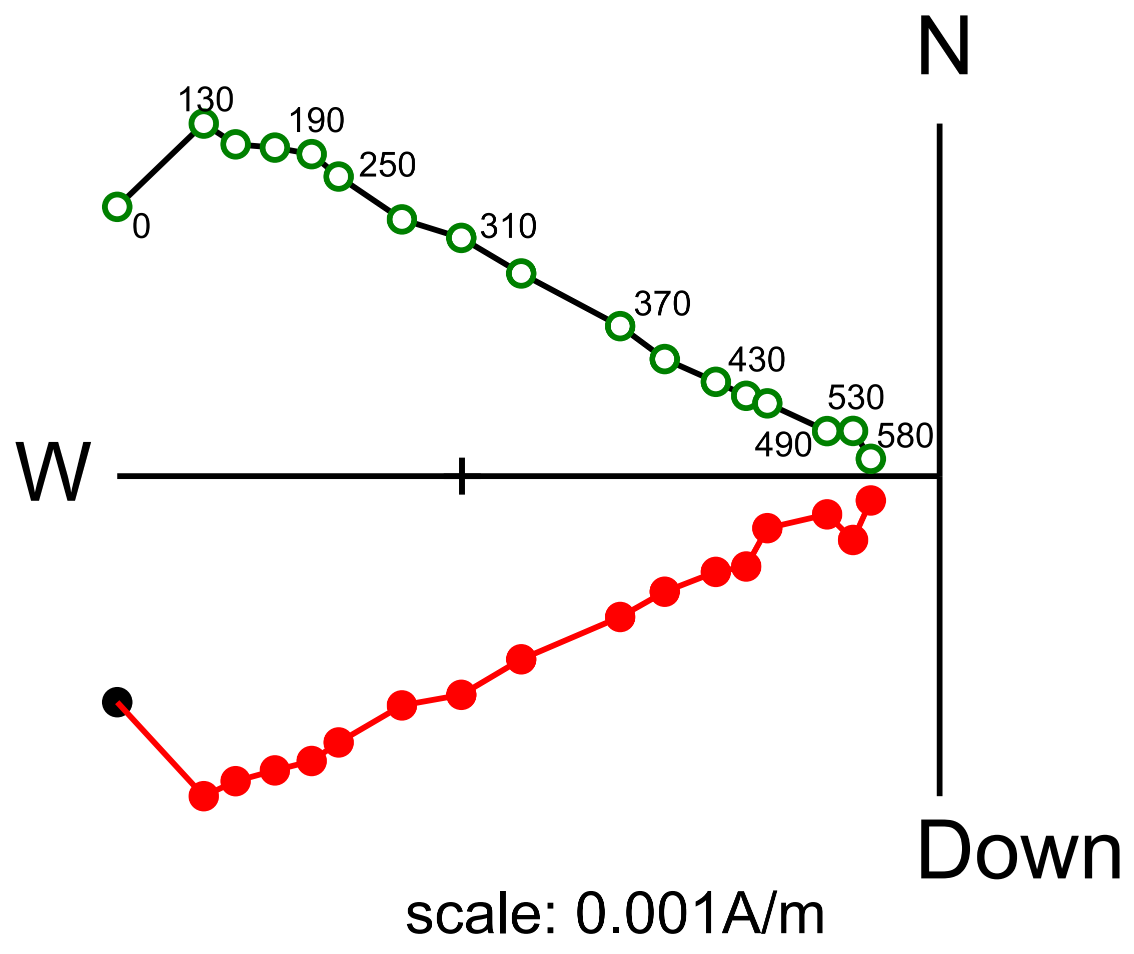
We have collected additional paleomagnetic data from Paleocene and Eocene sediments from the northern part of the Salin/Minbu basin, all located on the western side of the basin but in areas more likely to record local tectonic rotations near the nearby boundary of the IBR and the Kabaw fault.



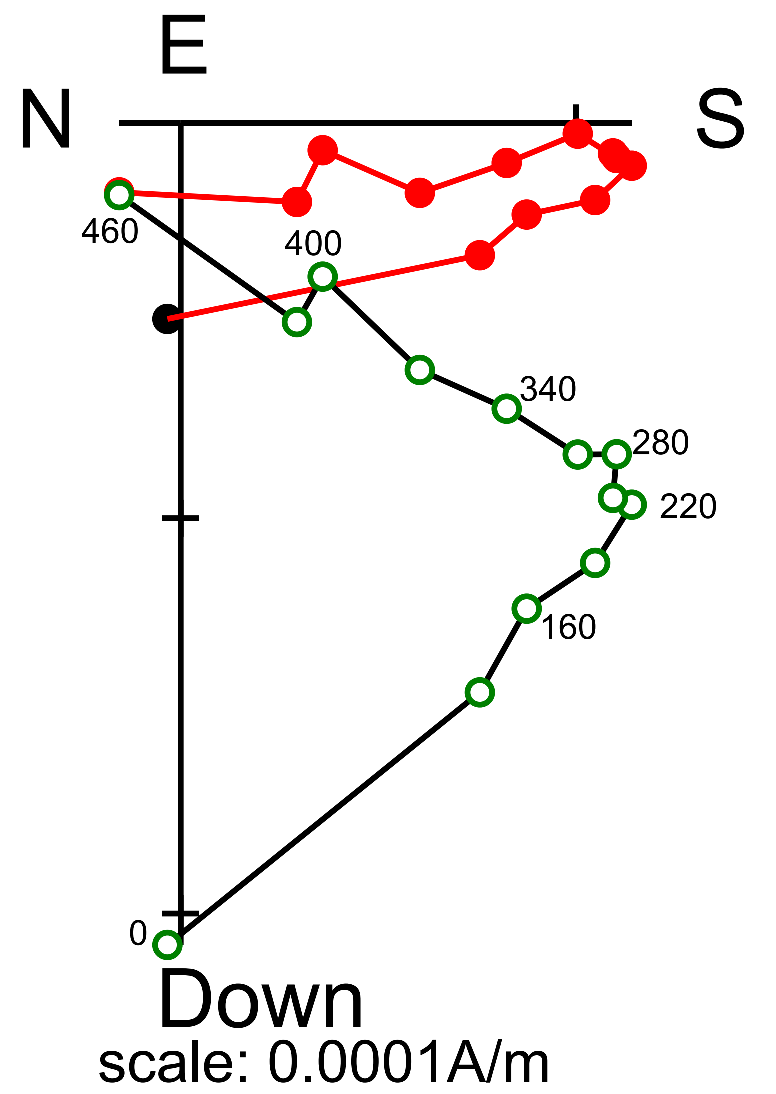
Characteristic directions were determined after progressive thermal demagnetization



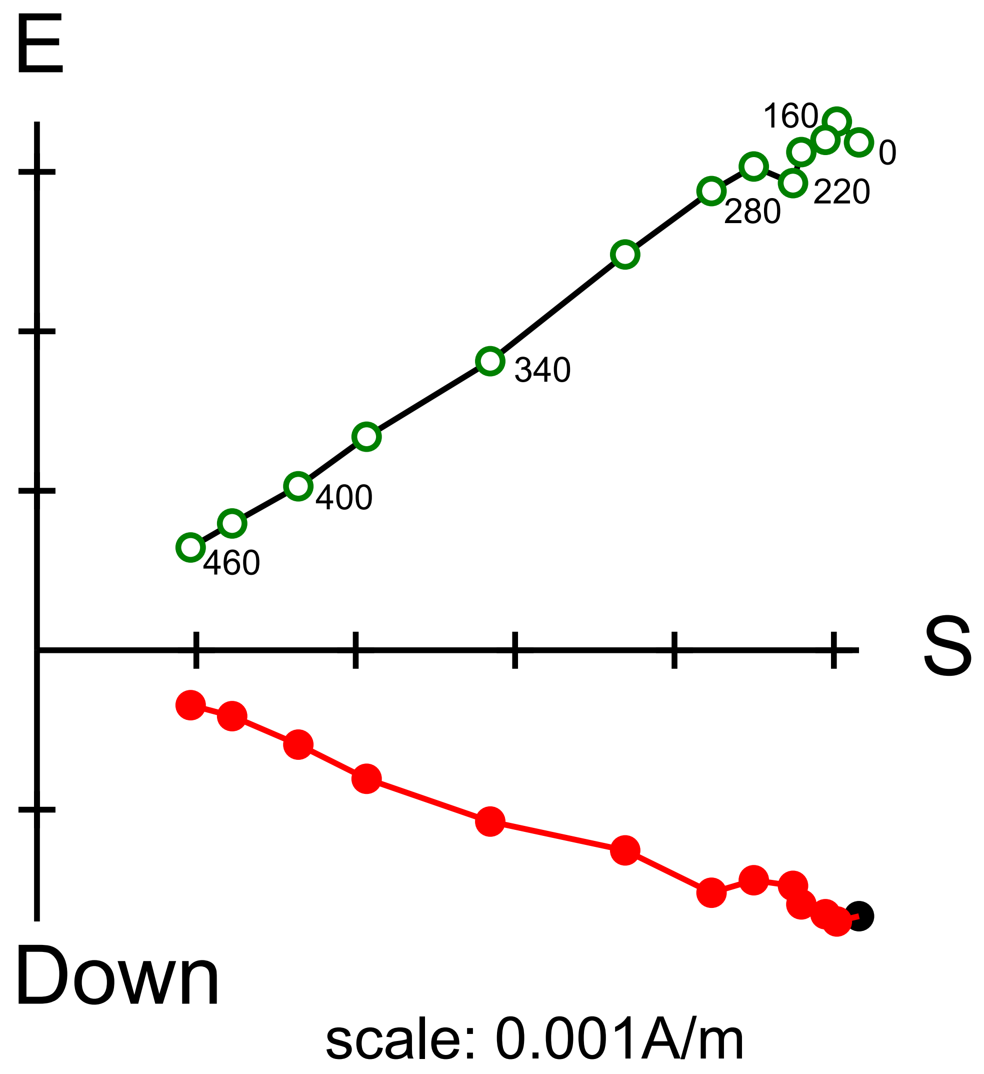
ST0132 *(Laungshe Fm. - mudstone)*



ST0124 *(Laungshe Fm. - mudstone)*

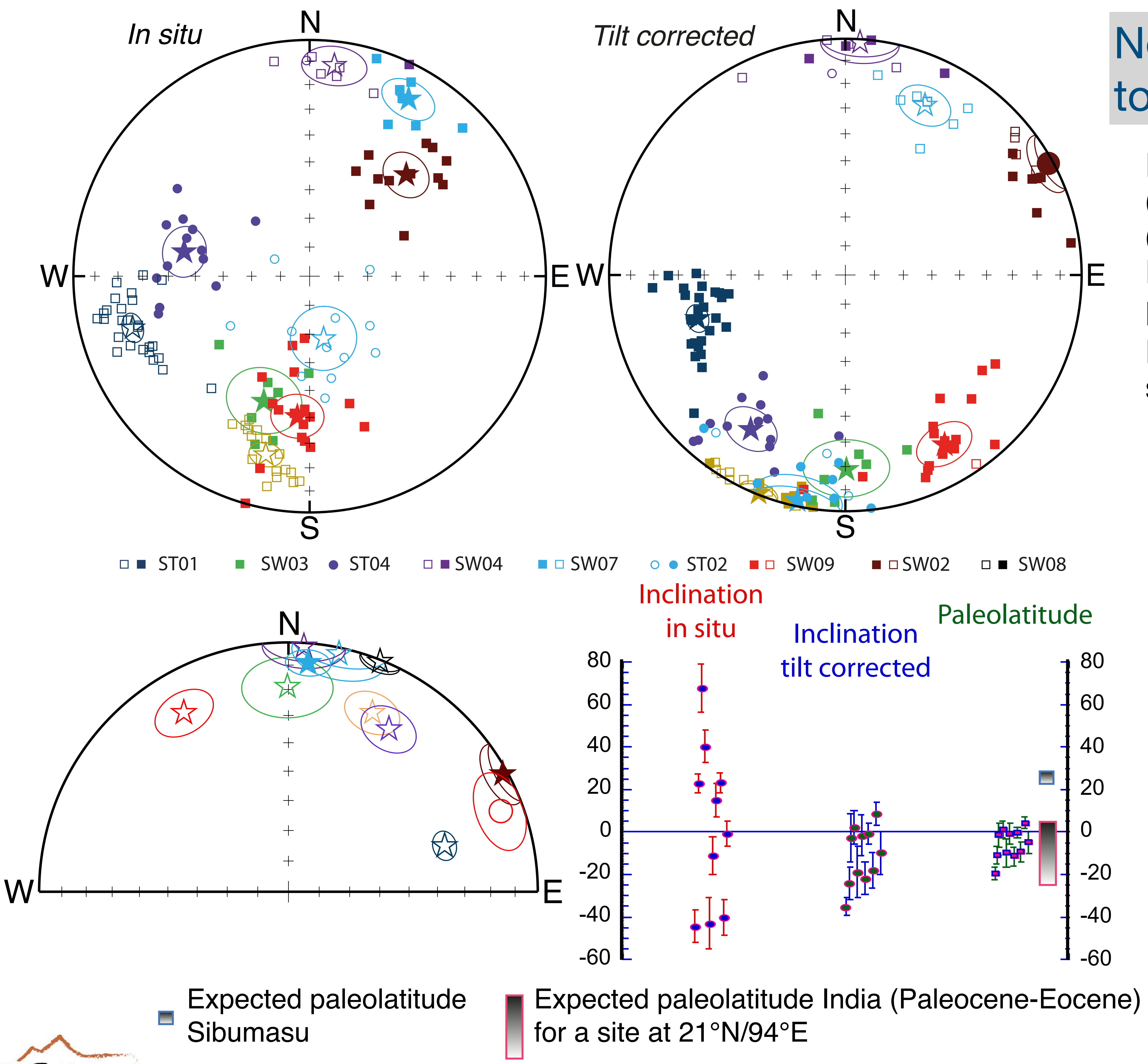


SW0913 *(Kabaw Fm. - mudstone)*



SW0812 *(Tabyin Fm. - mudstone)*

New paleomagnetic results in Late Cretaceous to mid Eocene sediments from the Salin basin



Paleomagnetic results were obtained in Late Cretaceous (Kabaw Fm.) Paleocene (Laungshe Fm.) to mid Eocene (Tawbyn Fm.) shales from the region of Sidoktaya and Saw. Paleocene siltstones farther south near Dakton/ Ngape do not provide accurate paleomagnetic results (Li et al., 2020).

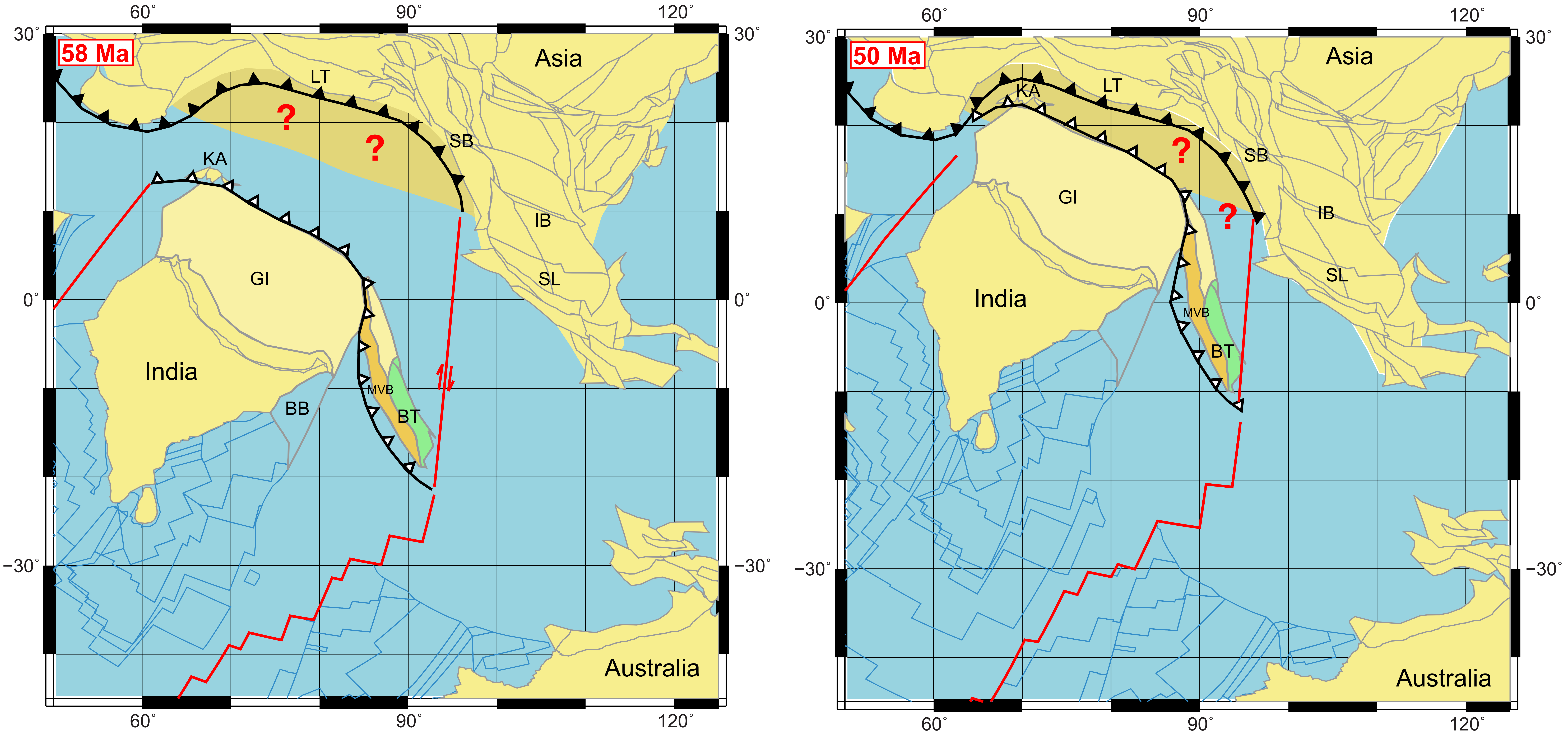
Normal and reverse polarity magnetisations are found. The scatter in inclination decreases after bedding correction.

After inverting the reverse polarity magnetizations into its equivalent normal polarity, the mean directions present some scatter in declination due to tectonic rotations and mainly negative inclination in normal polarity. The negative inclination indicates that the sediments were deposited in the southern hemisphere.

The paleolatitudes are of the same order of magnitude than those expected for a Burma terrane linked to India and systematically different from those expected for Sibumasu. The scatter in paleolatitude is in part explained by the northward motion during the Paleocene-Eocene.

Further work is needed for a precise dating of the sediments at each site and to better understand the distribution and timing of the tectonic rotations.

Paleomagnetic results in late Eocene sediments (Kalewa, Pondaung range) however indicate that the BT as a whole did not record significant rotation since the late Eocene.



The low paleolatitudes determined from the paleomagnetic inclinations in Paleocene to Eocene sediments support the previous results (Westerweel et al., 2019). We propose that the Burma terrane became part of the India plate with little or no relative motion during the Paleogene and did not collide with Sumatra as proposed in Westerweel et al. (2019).

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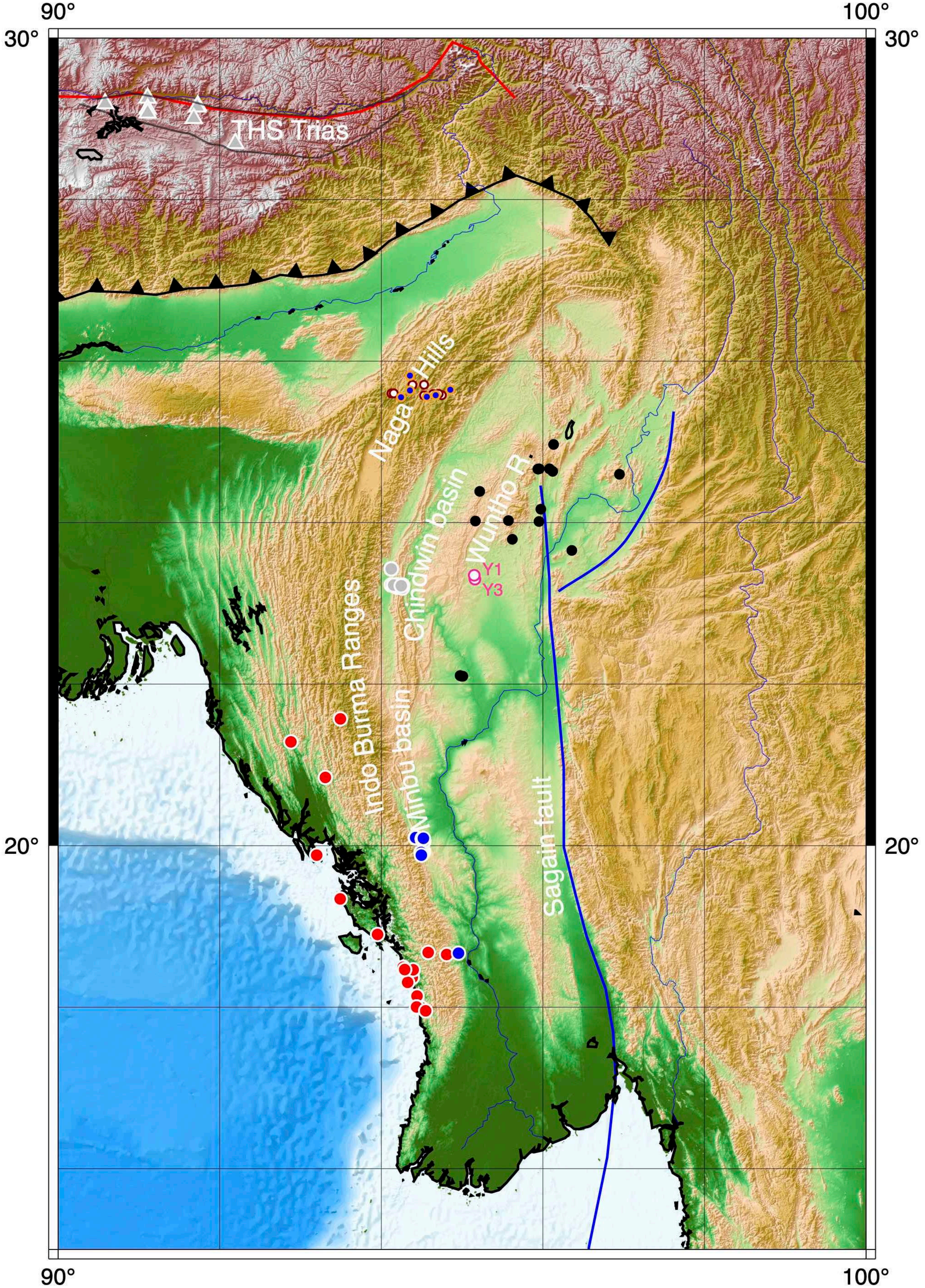
This model has strong implications for the understanding of the geology of Myanmar

- Sedimenta filling the basin cannot come from the east.
- Almost no E-W subduction during the Paleogene

>>Thus no really active magmatic arc

- Collision of "Greater Burma" with Asia contemporaneous of the collision of "Greater India" with Asia
- Collision with Sibumasu in the late Oligocene

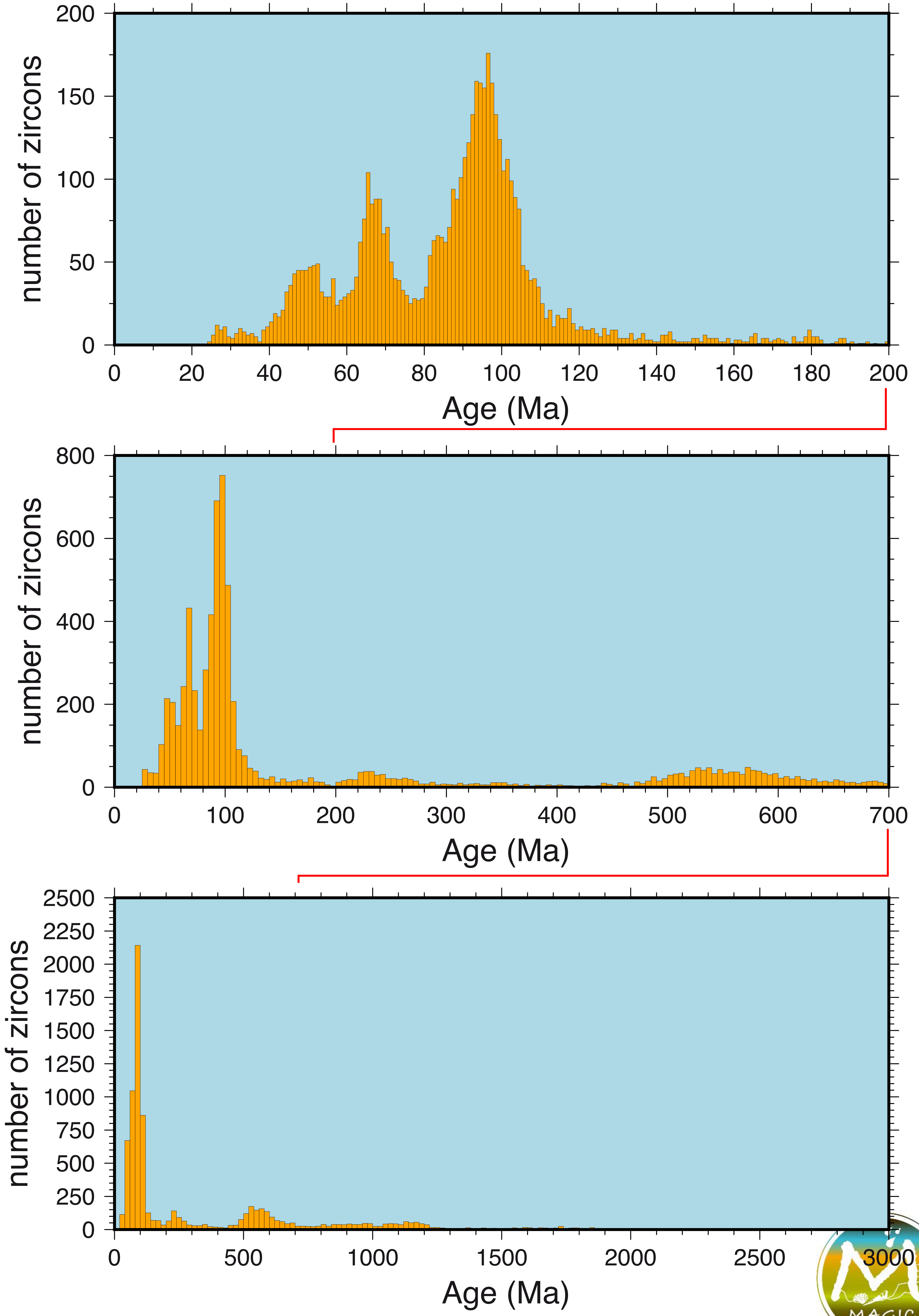
>> EW shortening and uplift of the Indo-Burman ranges and opening of the Andaman sea



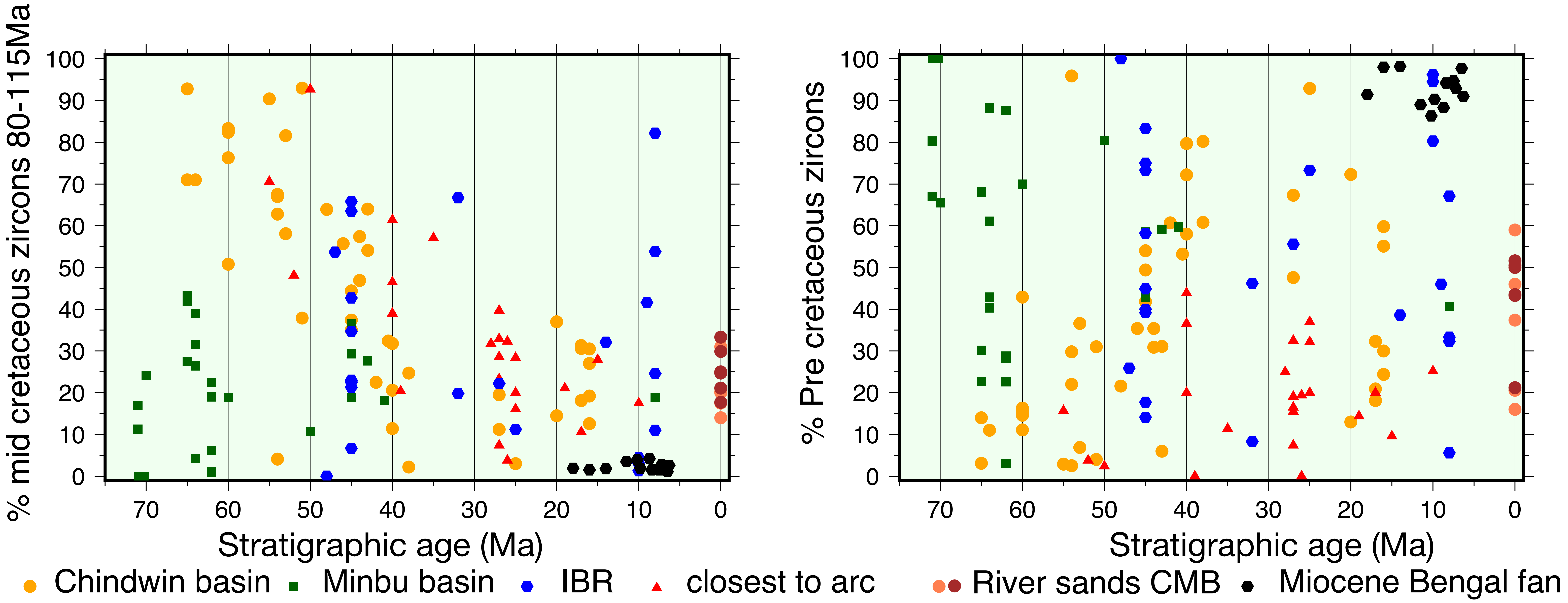
Several publications have reported detrital zircon ages in tens of samples from the Central Myanmar basins and the Indo-Burman ranges.

In Late Cretaceous and Paleogene sediments, the mid-Cretaceous population of zircons is so large that the focus in most studies is directed to this information.

>> however on average ~40% of the zircons have pre-Cretaceous ages

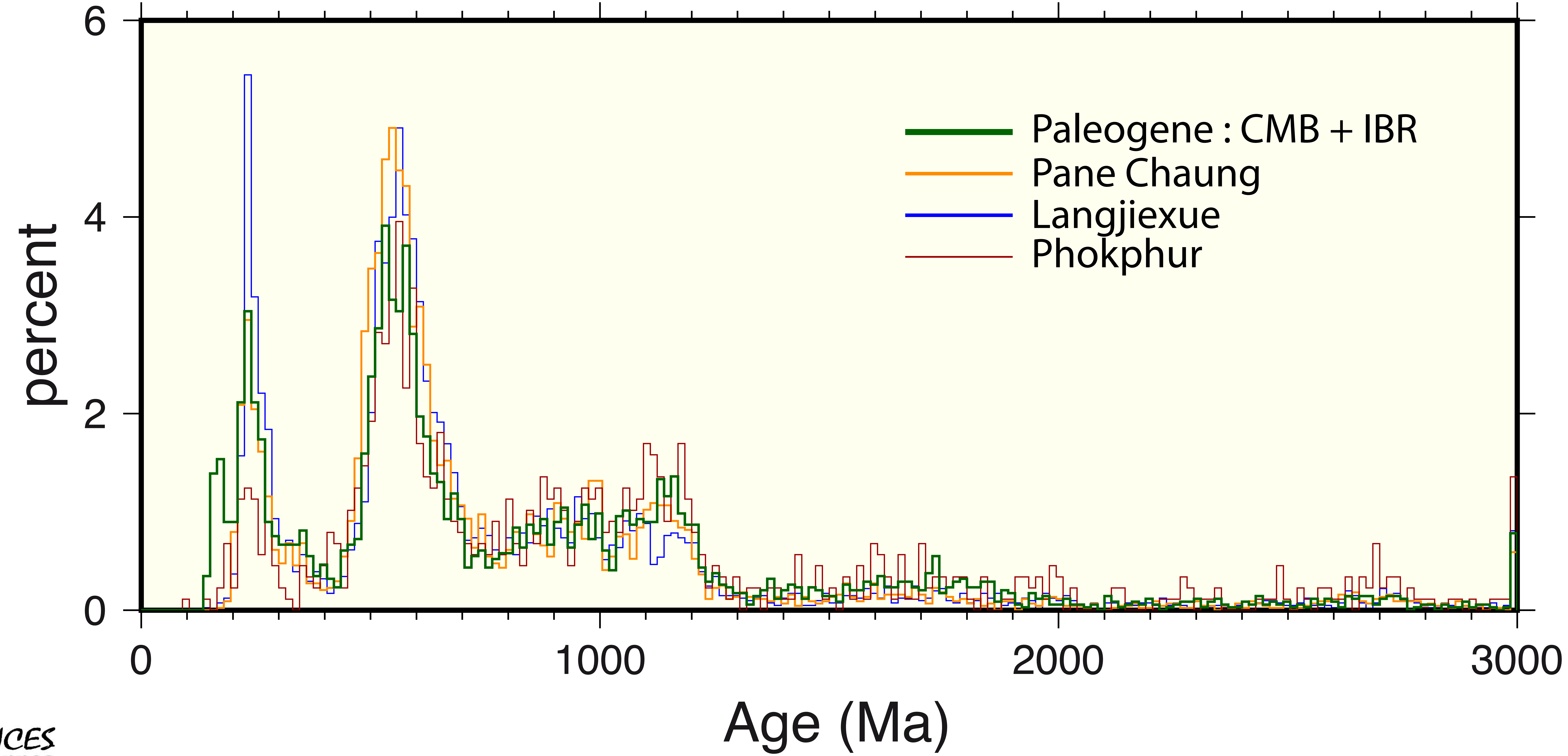


Most samples have a significant fraction of mid Cretaceous zircons but also pre-Cretaceous zircons.



Data from the Bengal fan (IODP site) are shown for comparison

The distribution of ages of Pre-Cretaceous zircons in the Central Myanmar Basins is similar to those found in the Triassic sediments from the Pane Chaung Formation (IBR) and Langjiexue group (North-East Tethyan Himalaya).
It si also not different from the one found in the Eocene Phokphur sediments from the Naga Hills (Northern Indo Burman Ranges)



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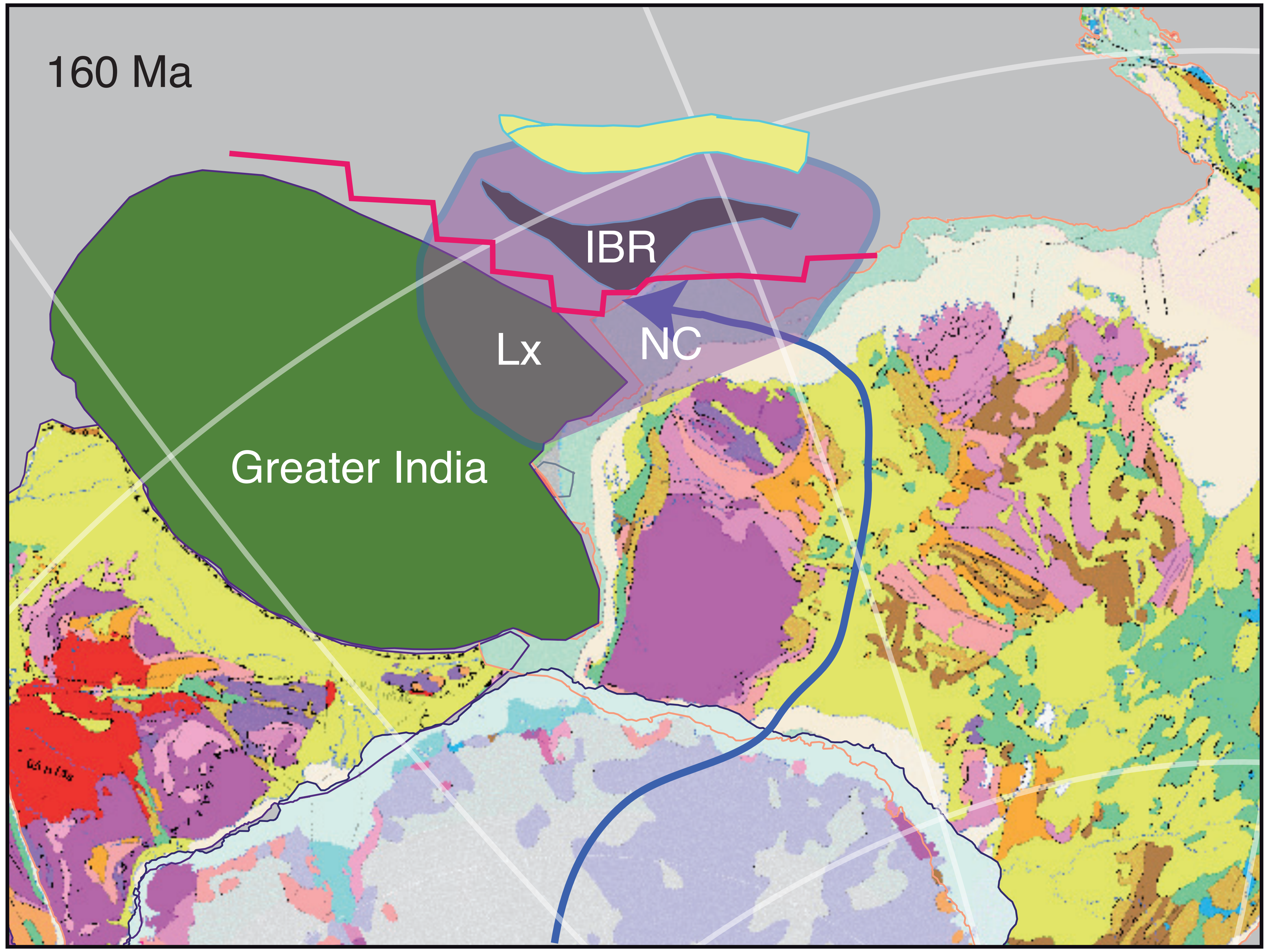
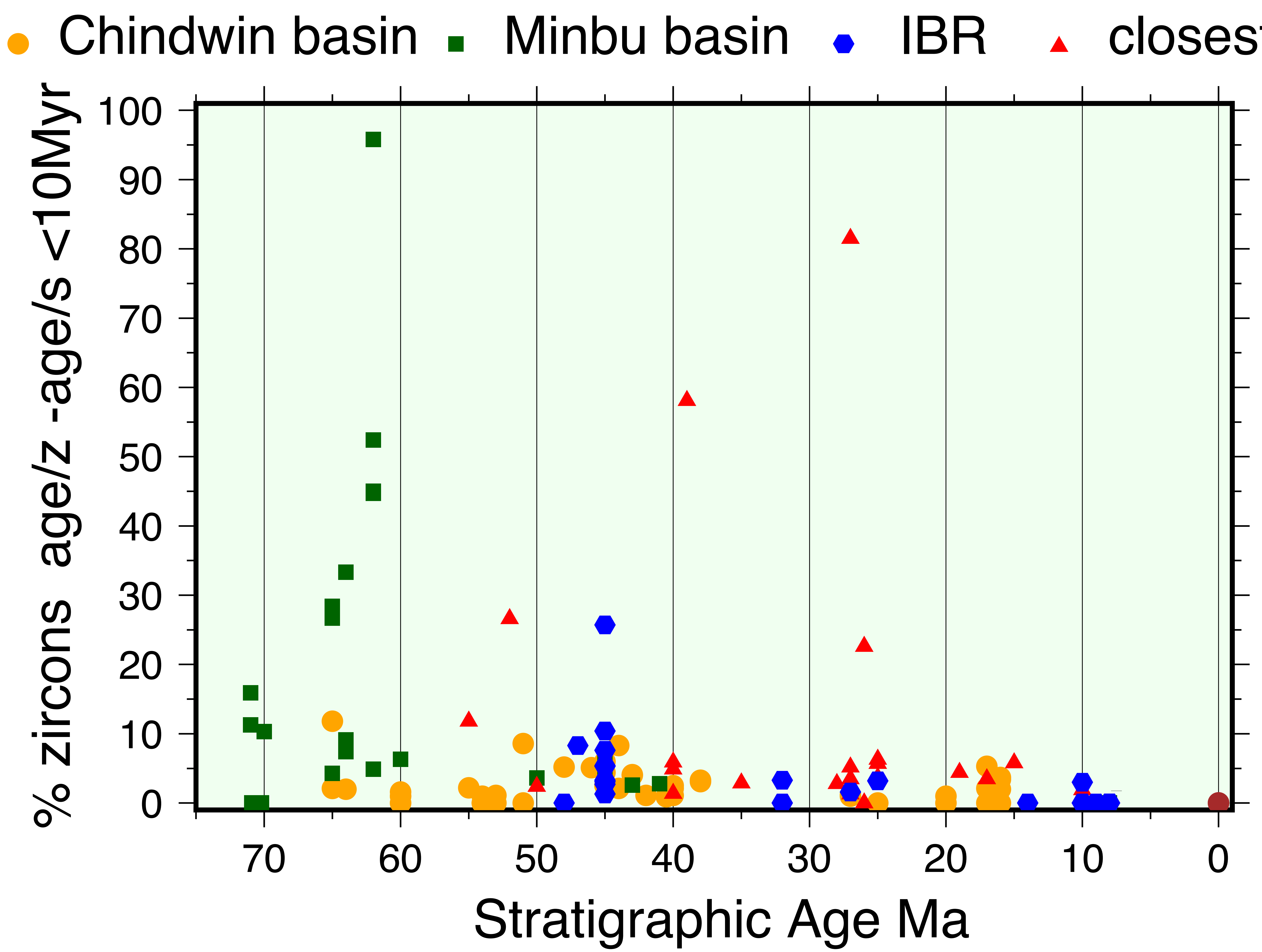


Possible Upper Jurassic paleogeography prior to the drift of the Burma terrane, part of Argoland. This paleogeography reconciles a common origin for Triassic sediments of the Langxiejue Formation of Greater India (Lx), the North Carnarvon (NC) basin of northwestern Australia and the Triassic Pane Chaung Formation of the Indo-Burma Range (IBR). The arrow indicates the drainage network from Antarctica during the Triassic. This reconstruction is made from a very tight fit between India, Antarctica, and Australia (Thompson et al, 2019). Then, the northern boundary of Greater India is not the Wallaby Fracture Zone but the northern edge of the Cuvier Basin.

In the plot below, few samples have zircons with ages close to the expected stratigraphic ages (ages less than 10 Myr below the stratigraphic age).

>> few evidence for erosion of a very active magmatic arc

>> Filling of the basins is mainly the result of erosion of basement rocks and Cretaceous magmatic rocks and not a Cenozoic active magmatic arc



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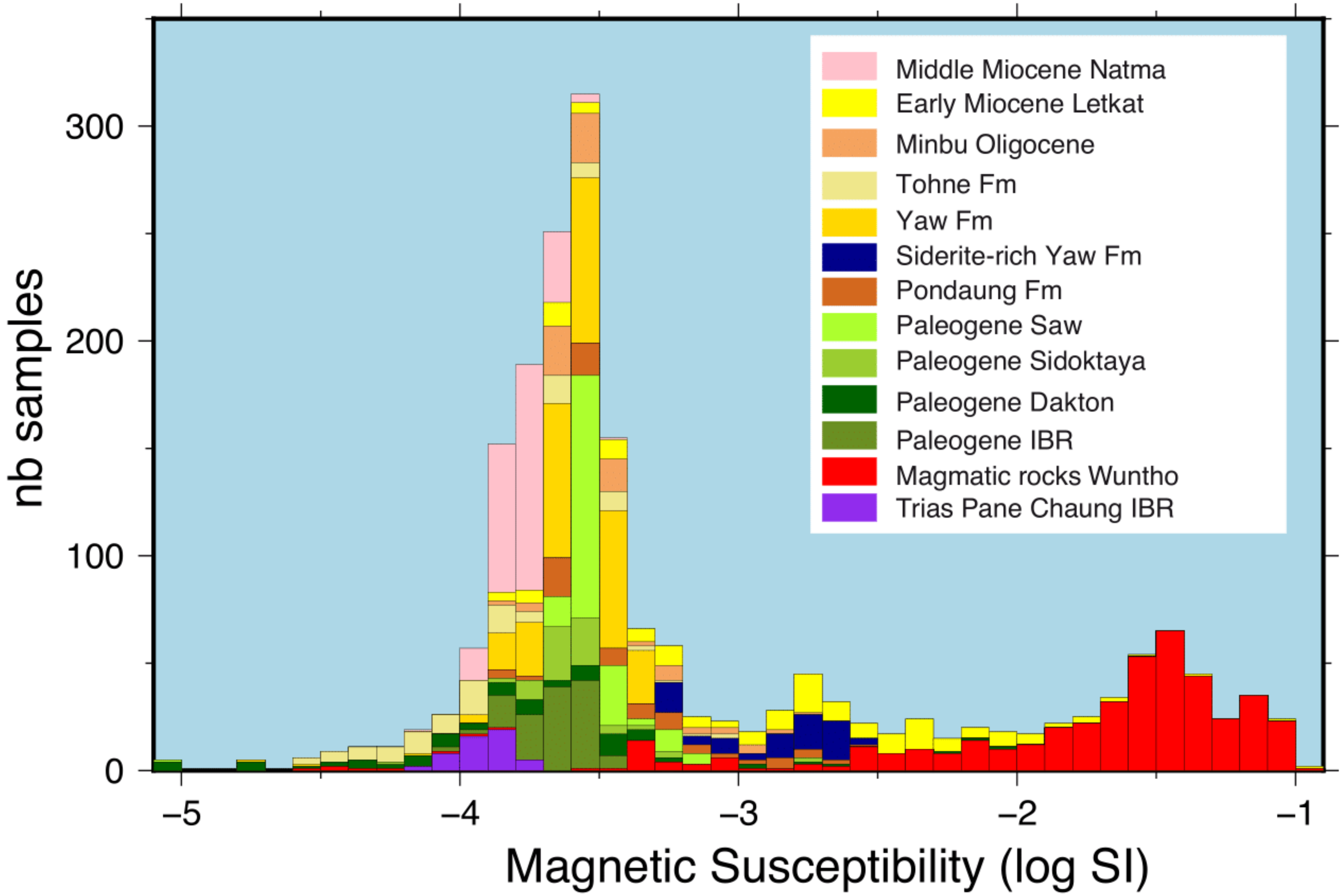

Bulk magnetic susceptibility:

Overall low magnetite content in BT sediments

Possibles causes:

- *initial low magnetite content of source lithologies*
- *intense chemical weathering of the sedimentary source*
- *sediment reworking*
- *prolonged sediment transport*

These data do not support an erosion of an active volcanic arc

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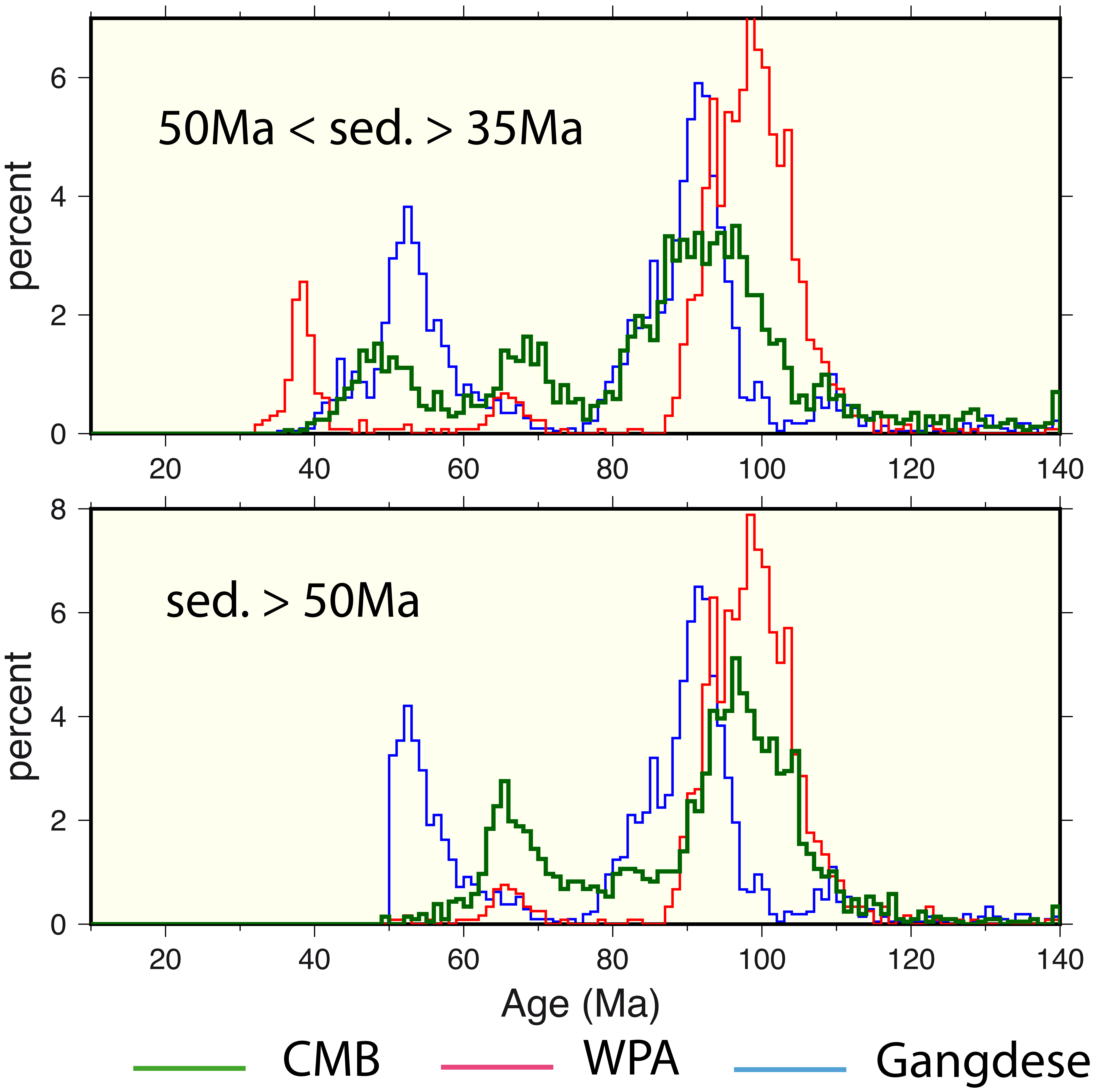


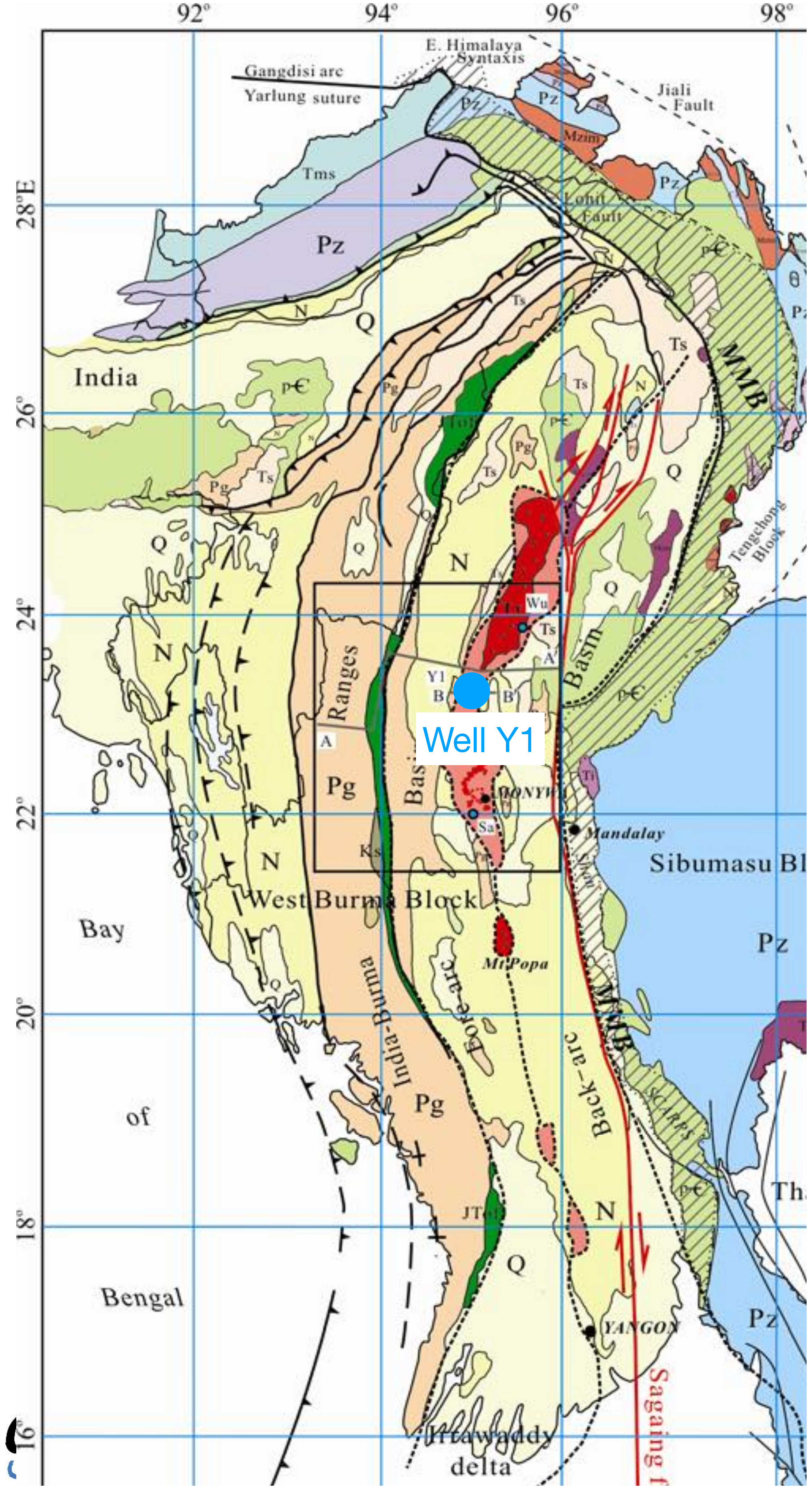
Here we compare the distribution of ages of zircons in sediments of the Paleogene basins (green curve) with a compilation of ages from the Gangdese (in blue) and from the Wuntho range (Licht et al. 2020) (red).

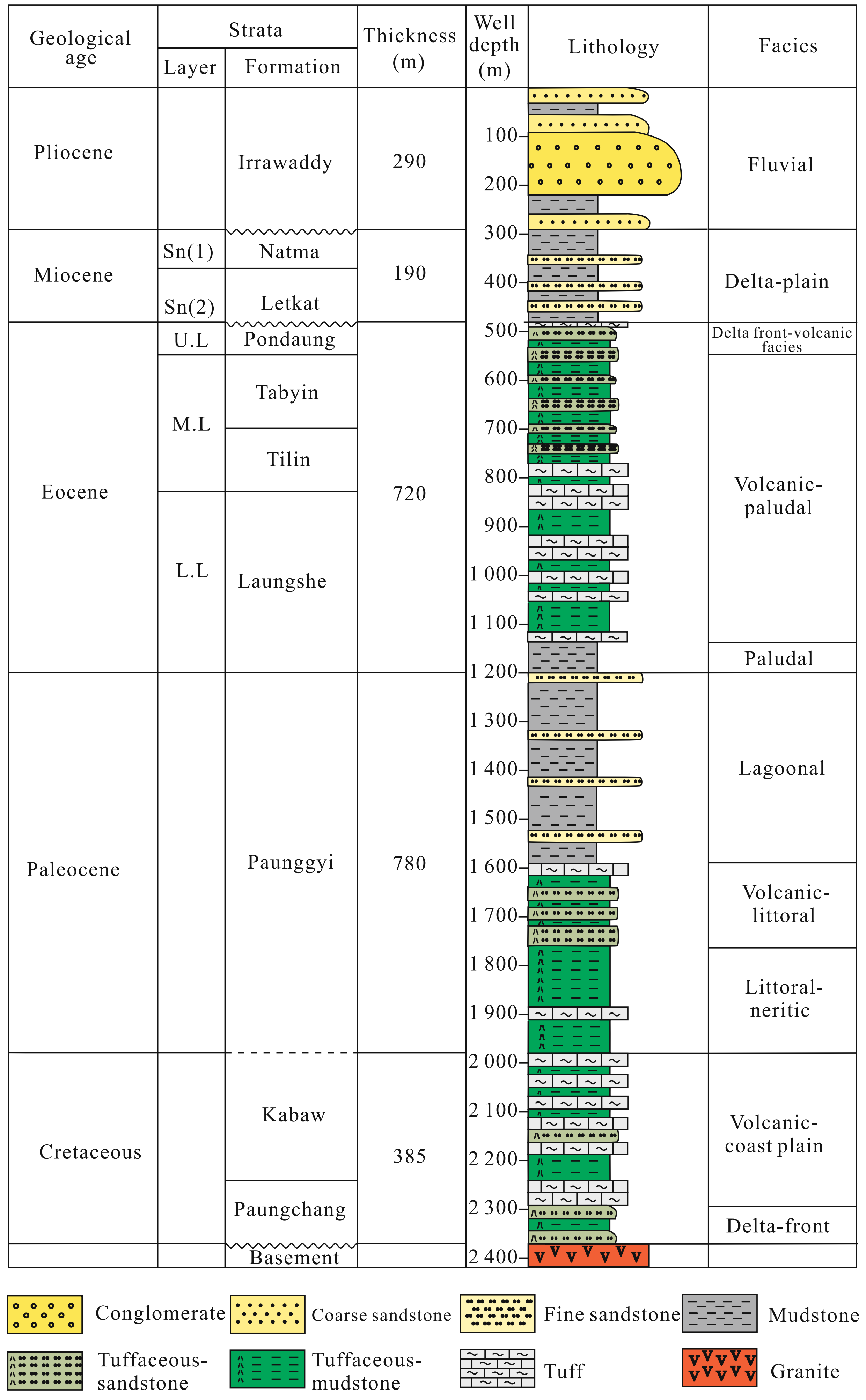
Sediments with stratigraphic ages older than ~50Ma have mid-Cretaceous zircons compatibles with a source from the Cretaceous Myanmar arc as in the Wuntho range while Late Eocene sediments contain younger Cretaceous zircons not found within the Wuntho range.

Taking into account the Hafnium data, a contribution from the Gangdese arc seems likely.

The Cretaceous Myanmar arc is also covered by thick Eocene sediments (Li et al., 2013; Zhang et al., 2017, 2021) suggesting that this arc was mainly subsiding and not in erosion during the Eocene.

From Li et al. (2013), nearly 2km of late Cretaceous and Paleogene sediments cover the Cretaceous magmatic basement, suggesting that large areas of the Myanmar arc were subsiding at that time and not supplying sediments to fill the Central basins.





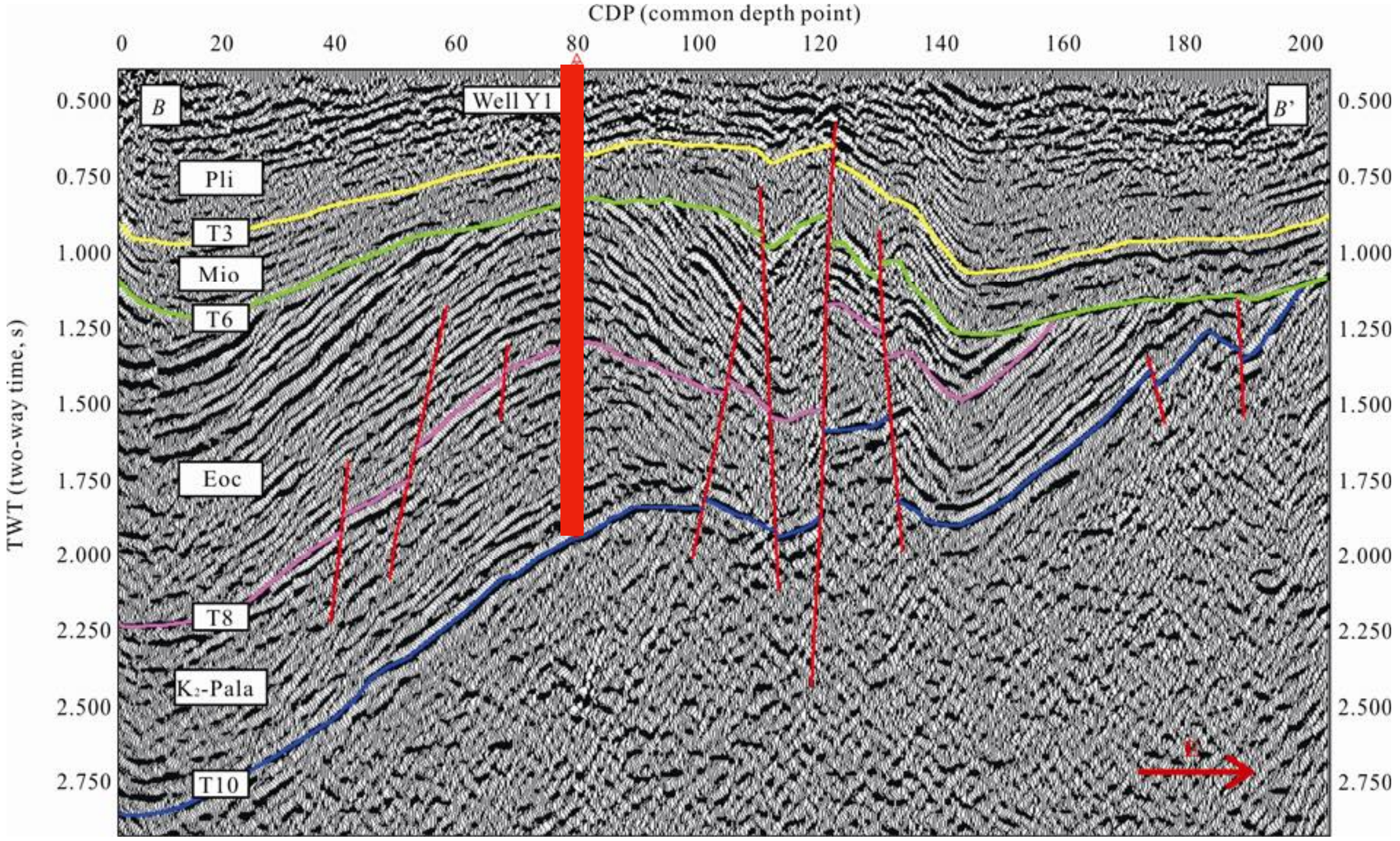
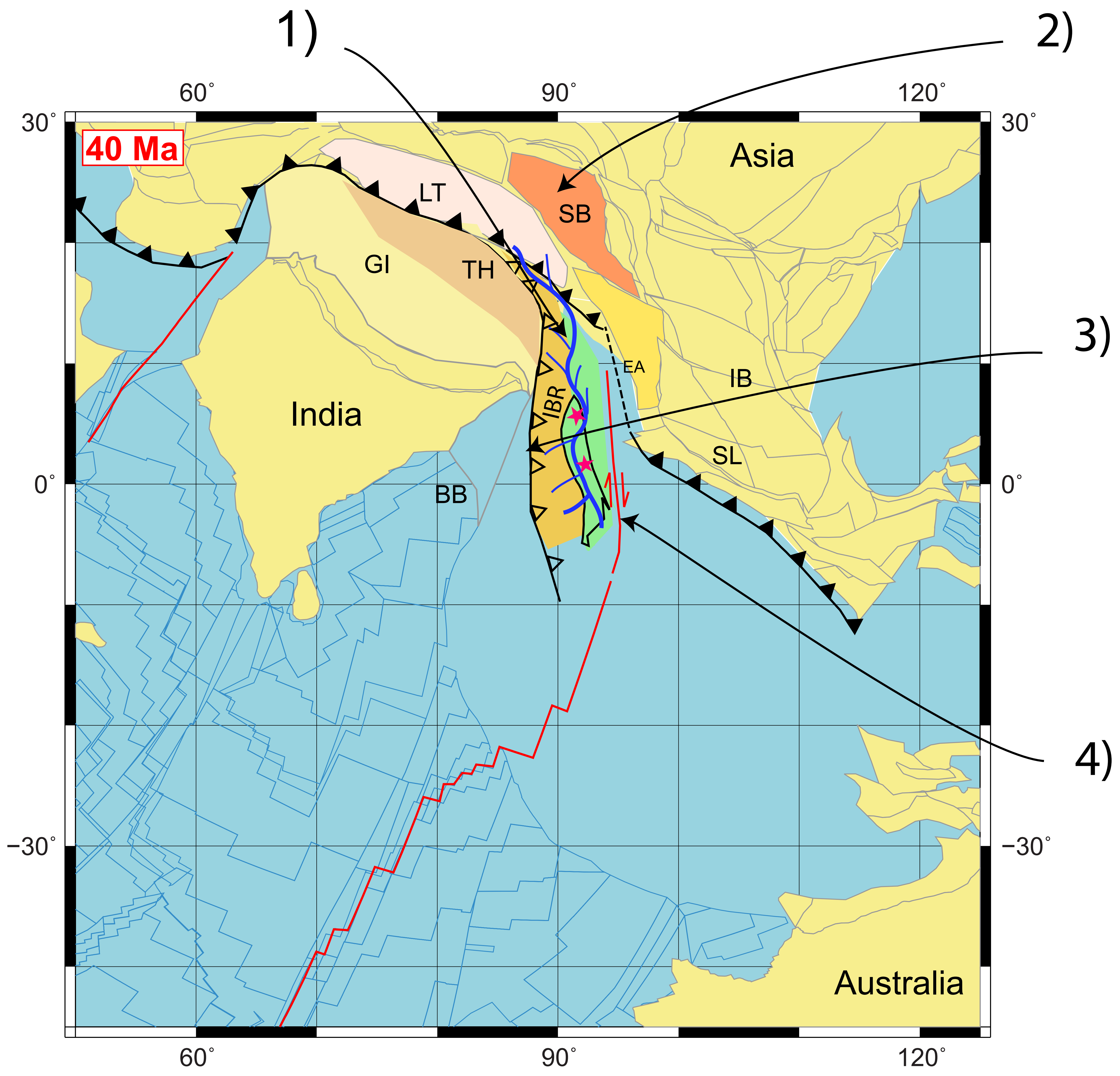


Figure 8. Position of seismic profile through volcanic arc in West Burma Block. Pli. Pilocene; Mio. Miocene; Eoc. Eocene; K_2–Pala. Late Cretaceous–Palaeocene; T3, T6, T8, T10. reflectors. Line of section is shown in Fig. 1 (*B-B'*).

Conclusions



1) During the mid to late Eocene, sources of sediments of the Central Myanmar basins may include the northern extension of the Burma Terrane (BT) and the IBR as well as the Cretaceous Gangdese magmatic arc.
2) Sibumasu is likely extruded during the collision and this may explain the granulite facies of the metamorphic rocks of the Mogok belt. The BT and Mogok belt were later juxtaposed across the Sagaing fault.
3) No significant relative motion between the BT and India during the Paleogene
4) The eastern border of the BT is difficult to constrain but was likely not interacting with Sibumasu before the Late Oligocene as there is no evidence of such deformation in the Mergui basin.

The new paleomagnetic results in early Paleogene sediments confirm the anomalous low paleolatitudes found in Cretaceous rocks and late Eocene sediments.

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We have not found geological evidence to discard these paleomagnetic data.

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