

Methods for Producing a Reliable APWP

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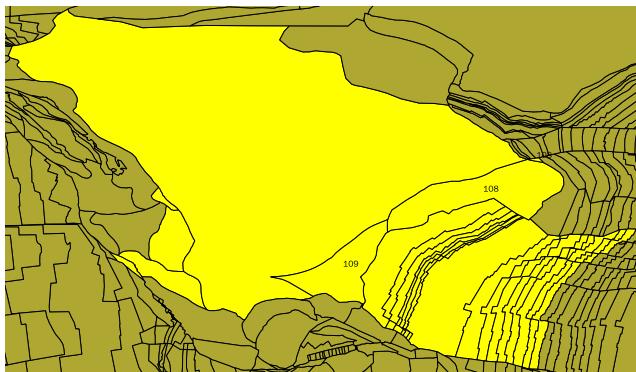


Figure 1. The Plate ID 101 polygons (yellow) with its children 108 and 109 (yellow with labels) used to constrain the 120–0 Ma data for North America.

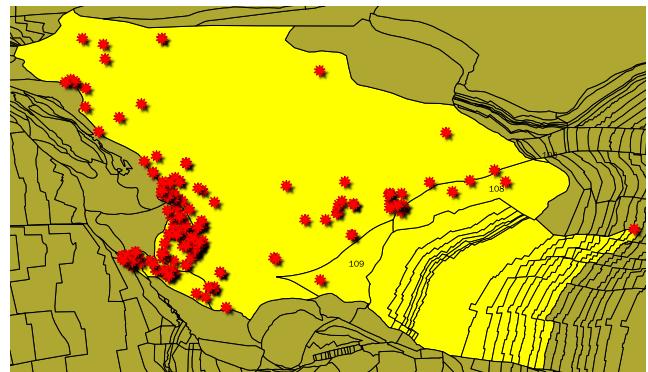


Figure 2. All the 120–0 Ma data constrained by the Plate ID 101, 108 and 109 polygons for North America.

1 SUPPLEMENTARY MATERIALS

1.1 How to Constrain Plate 101's Data

The data-constraining polygons are from the recently published plate model (Young et al. 2018) (Fig. 1). Plate ID 101 polygon in the recently published Plate Model (Young et al. 2018), including its children 108 (Avalon/Acadia block) and 109 (Piedmont block) polygons for 120–0 Ma, is used to select the sampling sites of the paleopoles for North America. According to the plate model rotation data (Young et al. 2018), 108 is fixed to 101 during the geologic period from Cretaceous to the present day. 109 is also fixed to 101 since about 300 Ma (Christeson et al. 2014). Then in order to be compared with the FHM (120–0 Ma) (Müller et al. 1993; Müller et al. 1999), the paleopoles with age ranging 120–0 Ma are further selected through constraining the lower magnetic age “LOMAGAGE ≤ 130 ” (here it is not 120 but 130, because for the lower resolution case when the window length is 20 Myr, the Age Position Picking method will include those data with their lower magnetic age between 120 Ma and 130 Ma). In addition, the RESULTNO=6007 dataset should also be included according to a published plate kinematic model (McQuarrie & Wernicke 2006) (Fig. 3), although it is in the PlateID=178 polygon. In the end, 191 datasets in total are extracted (Fig. 2).

Also based on this model of southwestern North America since 36 Ma (McQuarrie & Wernicke 2006) (Fig. 3), part of the paleopoles constrained by the four small western terranes whose Plate IDs are also 101 in fact had gone through regional rotations and here are removed. However, the poles with age younger than 10 Ma located within the largest western 101 terrane (on the south of the smallest western 101 terrane; corresponding to the RANGE.ID=74 polygon in the model (McQuarrie & Wernicke 2006)) should be included. So finally 133 of the 191 datasets remain (Fig. 4). Spatially

North American paleomagnetic data are mainly from the western and eastern margins of the plate.

1.2 How to Constrain Plate 801's Data

Plate ID 801 polygon in the recently published Plate Model (Young et al. 2018), including its children 675 (Sumba block) and 684 (Timor block) polygons for 120–0 Ma (Fig. 5), is used to select the sampling sites of the paleopoles for Australia (Fig. 6). According to the plate model rotation data (Young et al. 2018), 675 and 684 are fixed to 801 during the geologic period from c.145 Ma to the present.

On the southeast of the main Australia plate (the largest polygon in Fig. 5), there is a triangle-shaped polygon 850 (Tasmania block) which is fixed to 801 since c.100 Ma according to the (Young et al. 2018) rotation data. With that attribute, 805 con-

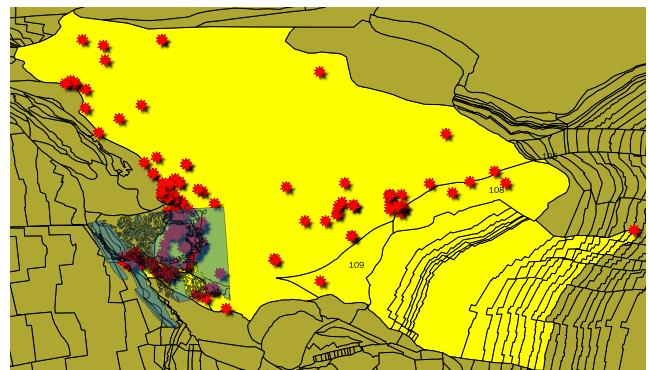


Figure 3. The west US polygons (blue) used to constrain the data that might be influenced by local tectonic rotations.

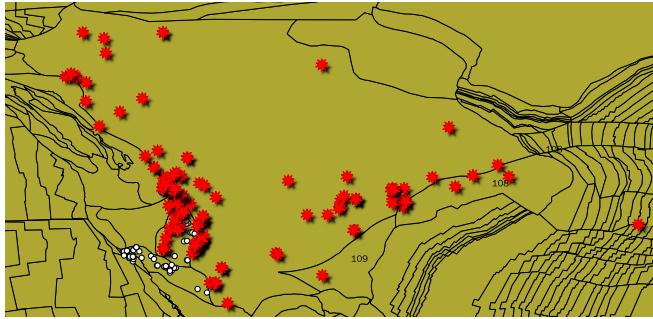


Figure 4. The final filtered datasets (red stars) for later analysis. Those poles that had been influenced by local tectonic rotations are shown as white dots.

tributes more data younger than c.100Ma for the later analysis. Ultimately the final 97 extracted datasets is shown in Fig. 7.

1.3 How to Constrain Plate 501's Data

Plate ID 501 polygons in the recently published Plate Model (Young et al. 2018) includes the two small polygons of the northern Lesser Himalayan pass margin Greater Indian Basin and Tethyan Himalayan microcontinent of Greater India (Fig. 8), is used to select the sampling sites of the paleopoles for India (Fig. 9).

Also based on this model of the tectonic interactions between India, Arabia and Asia since the Jurassic (Gaina et al. 2015) (Fig. 10), part of the paleopoles constrained by the north two small terranes whose Plate IDs are also 501 in fact had gone through regional rotations and here are removed. So finally 74 datasets are left (Fig. 11). Spatially Indian paleomagnetic data are more evenly distributed on the India plate than North American and Australian above.

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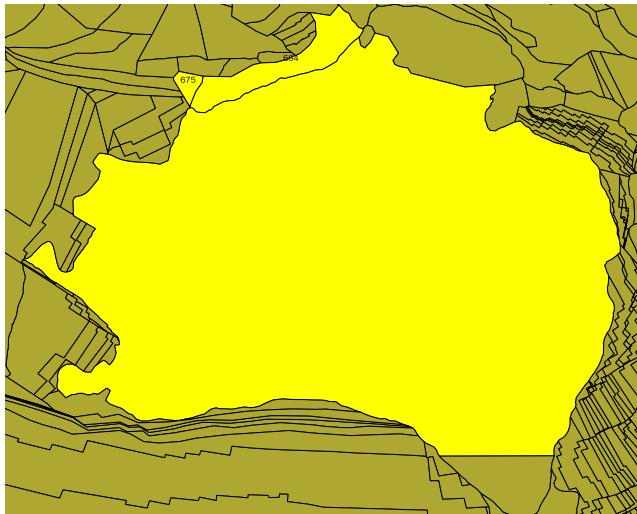


Figure 5. The Plate ID 801 polygons (yellow) with its children 675 and 684 (yellow with labels) used to constrain the 120–0 Ma data for Australia.

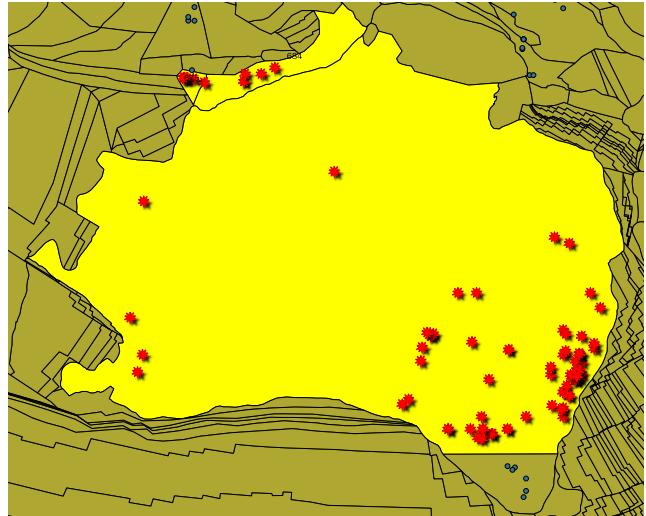


Figure 6. All the 120–0 Ma data constrained by the Plate ID 801, 675 and 684 polygons for Australia.

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- 44

1.4.0.1 Special cases 55

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REFERENCES

- Christeson, G. L., Van Avendonk, H. J. A., Norton, I. O., Snedden, J. W., Eddy, D. R., Karner, G. D. & Johnson, C. A., 2014. Deep crustal structure in the eastern Gulf of Mexico, *J. Geophys. Res. Solid Earth*, **401**, 183–195.

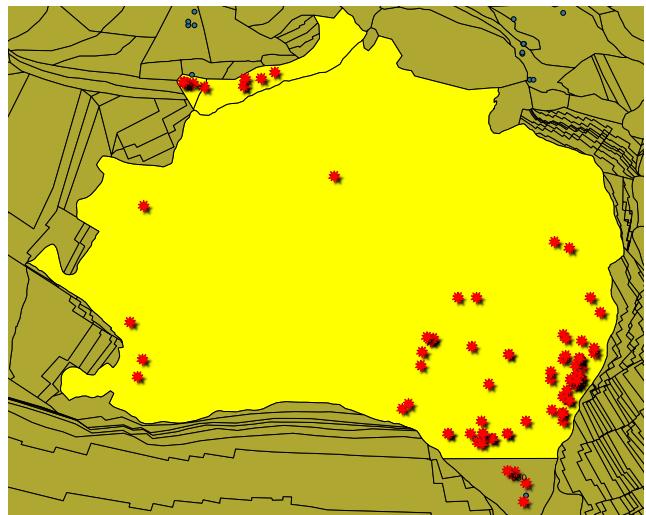


Figure 7. The final filtered datasets (red stars) for later analysis on Australia. The Plate ID 850 helps increase the amount of qualified datasets for 100–0 Ma.

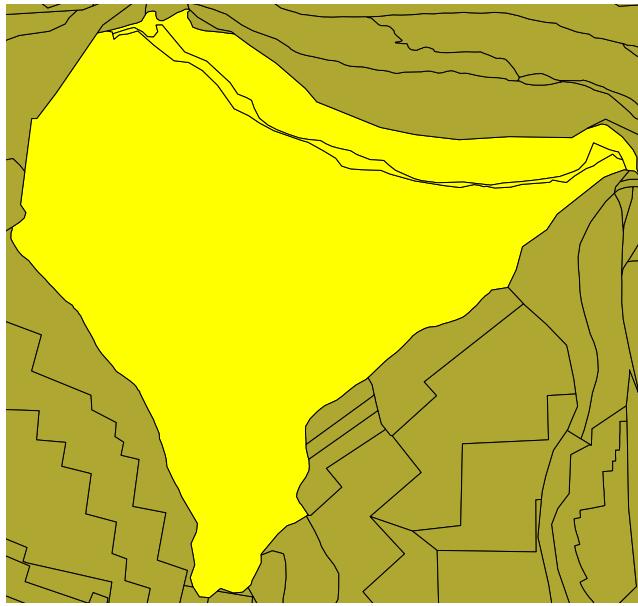


Figure 8. The Plate ID 501 polygons (yellow) used to constrain the 120–0 Ma data for India.

- Gaina, C., van Hinsbergen D. J. J. & Spakman, W., 2015. Tectonic interactions between India and Arabia since the Jurassic reconstructed from marine geophysics, ophiolite geology, and seismic tomography, *Tectonics*, **34**, 875–906.
- Müller, R. D., Royer, J. Y. & Lawver, L. A., 1993. Revised plate motions relative to the hotspots from combined Atlantic and Indian-Ocean hotspot tracks, *Geology*, **21**, 275–278.
- Müller, R. D., Royer, J. Y., Cande, S. C., Roest, W. R. & Maschenkov, S., 1999. New constraints on the Late Cretaceous/Tertiary plate tectonic evolution of the Caribbean, *Sedimentary Basins of the World*, **4**, 33–59.
- McQuarrie, N. & Wernicke, B. P., 2006. An animated tectonic reconstruction of southwestern North America since 36 Ma, *Geosphere*, **1**, 147–172.
- Young, A., Flament, N., Maloney, K., Williams, S., Matthews, K., Zahirovic, S. & Müller, D., 2018. Global kinematics of tectonic plates and subduction zones since the late Paleozoic Era, *Geosci. Front.*, **in press**, 000–000.

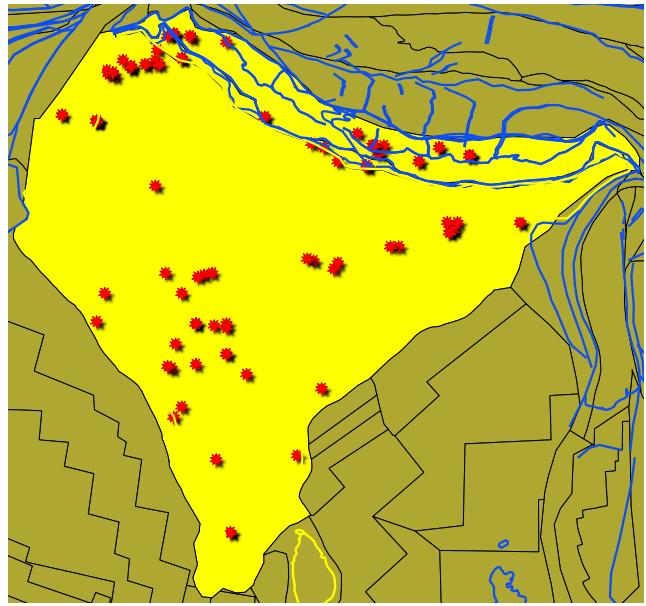


Figure 10. The rifts, faults and detachments (blue) around India, used to filter out those data that might be influenced by local tectonic rotations.

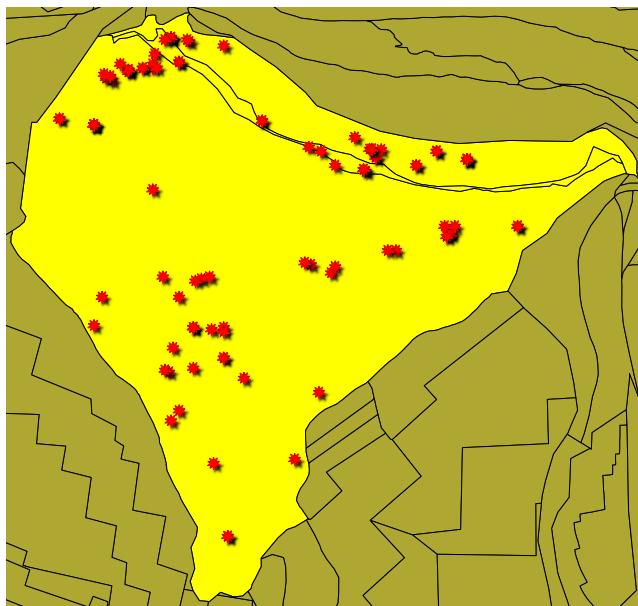


Figure 9. All the 120–0 Ma data constrained by the Plate ID 501 polygons for India.

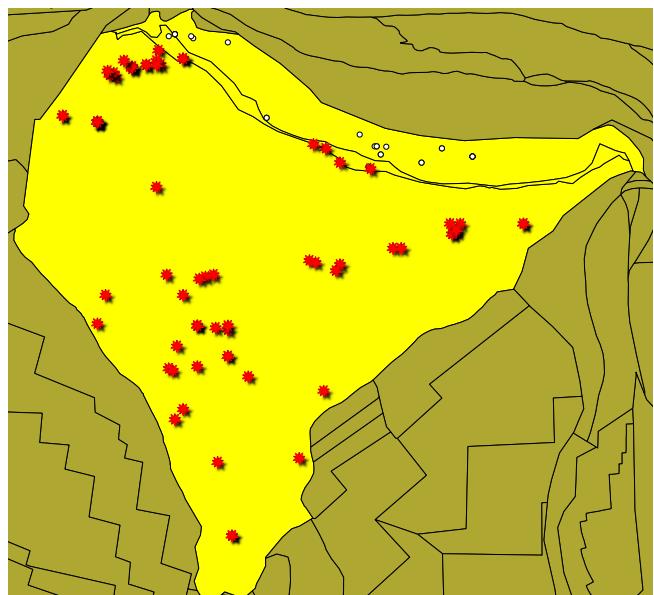


Figure 11. The final filtered datasets (red stars) for 120–0 Ma India. Those poles that had been influenced by local tectonic rotations are shown as white dots.