Appendix S1 – Explanation of plate model, tectonic reconstruction files, and instructions for installing and loading them in GPlates

Plate Model Framework

1. The reconstruction utilizes the open-source freeware "GPlates" v. 2.0 (www.gplates.org).
2. The global plate model of Matthews et al. (2016) was used in both (Preferred and Minimum) reconstructions.
3. Plate polygons were adopted from Matthews et al. (2016). Few polygons were modified by breaking them into smaller blocks, but not changing their gross shape; deforming plate boundaries were not used.
4. Closure of the Greater Caucasus backarc basin as in Cowgill et al. (2016) and van der Boon et al. (2018).
5. Blocks of the Anatolian microplate (central and western Anatolia) are restored to account for at least 20° of documented post-Eocene counter-clockwise vertical-axis rotation based on paleomagnetic data (Piper et al., 2010; Gürer et al., 2018).
6. All crustal shortening restored along the southern and northern margins of Eurasia and Arabia, respectively, rather than along boundaries between blocks (see main text and Table 1 for details). Thus, while our models do not reconstruct intra-plate deformation in time and space, they illustrate the pre-collisional width of each margin and the timing of initial intersection and collision between Arabian and Eurasian continental lithosphere.

See main text for further details and discussion.

Reconstruction Tree

The diagram to the right shows the plate hierarchy arranged by Plate ID number, with 0 at the top of the hierarchy representing the Earth's spin axis, 701 representing the Africa plate, and so forth. For example, plate 338 moves relative to plate 319, which moves relative to plate 301; each plate within the box moves relative to plate 301. See reconstruction files for all other Plate ID numbers and plate references.
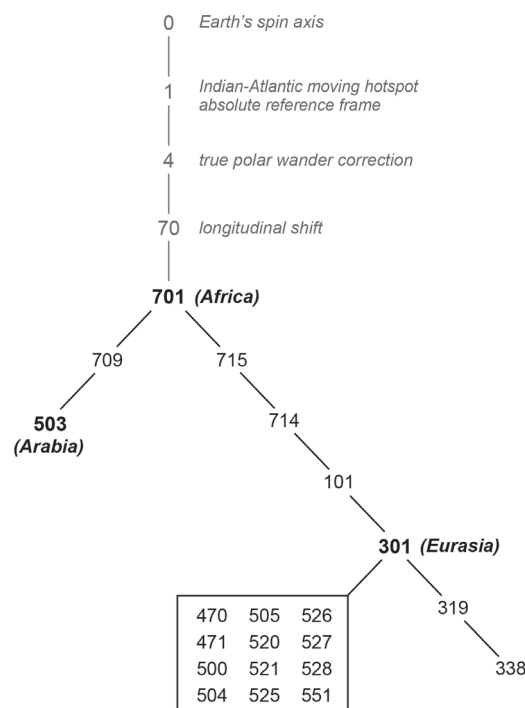
Explanation of Tectonic Reconstruction Files

Separate reconstruction files are included for the preferred and the minimum convergence models. Each folder contains all reconstruction files as described below, as well as a series of exported shapefiles at sequential, 6-Myr time-steps from 60–0 Ma for use in GIS. GPlates reconstruction files are identical for both models. For example, files included with the 'preferred' model include:

File Name	Explanation
Africa-Eurasia-motion-paths_65-0 Ma.gpml	Motion paths for Africa plate extracted from GPlates in 5 Myr time-steps.
Arabia-Eurasia-collision_Darin&Umhoefer_PREFERRED.gproj	GPlates project file. Opening this file in GPlates will load all related files, as long as the file path is chosen properly.
Arabia-Eurasia-collision_GPlates_polygons.gpmlz	Vector file containing plate polygons used in reconstruction.
Arabia-Eurasia-collision_mod-from-Matthews2016_PREFERRED.rot	Rotation file linking finite rotations of plates to each other and to the global reference frame. Essentially the instructions for how each block moves within the reconstruction.
Arabia-Eurasia-motion-paths_65-0 Ma.gpml	Motion paths for the Arabia plate extracted from GPlates in 5 Myr time-steps.
Restored-precollisional-Arabia-margin_PREFERRED.gpml	Vector file created by the authors containing polyline features representing the restored Arabian margin.
Restored-precollisional-Eurasia-margin_PREFERRED.gpml	Vector file created by the authors containing polyline features representing the restored Eurasia margin.

Installing GPlates Software & Loading Files

The current stable release at the time of this publication is GPlates v. 2.2 (released August, 2019). You can download GPlates for free for use Windows, Mac, or Linux operating systems at this link:

https://www.gplates.org/download.html

Once installed, following the instructions below to launch GPlates and load the reconstruction files, or review the tutorials and resources available at https://www.gplates.org/docs.html .

To load files into GPlates:
1. Launch the GPlates executable file (gplates-2.2.0.exe)
2. At the top menu, select "File>Open"
3. Navigate to one of the included GPlates project files (e.g., "*Arabia-Eurasia-collision_Darin&Umhoefer_PREFERRED.gproj*")
4. If file paths are broken, a dialog will open that will allow you to repair them
5. Alternatively, you can skip steps 2 through 4 above and instead load each file individually by selecting "File>Open Feature Collection", and navigating to the other included files. At the very least, you must load the .gpmlz and .rot files, but all files listed above (except for the .gproj file) should be loaded to view all reconstruction features.
6. To "fix" the Eurasia plate, select "Reconstruction>Specify Anchored Plate ID", and enter "301" in the Plate ID prompt.
7. To move through different time-steps in the reconstruction, enter a time in the "Time" bar at the top of the map window, then click the play button or drag the time slider.
8. You can also change the map view to Mercator or other projections by selecting an option from the "View" bar at the bottom-left of the map window.

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