Paleogeographic reconstructions using raw paleobiology data using GPlates[1]

Sabin Zahirovic
(sabin.zahirovic@sydney.edu.au)
EarthByte, University of Sydney, 2012

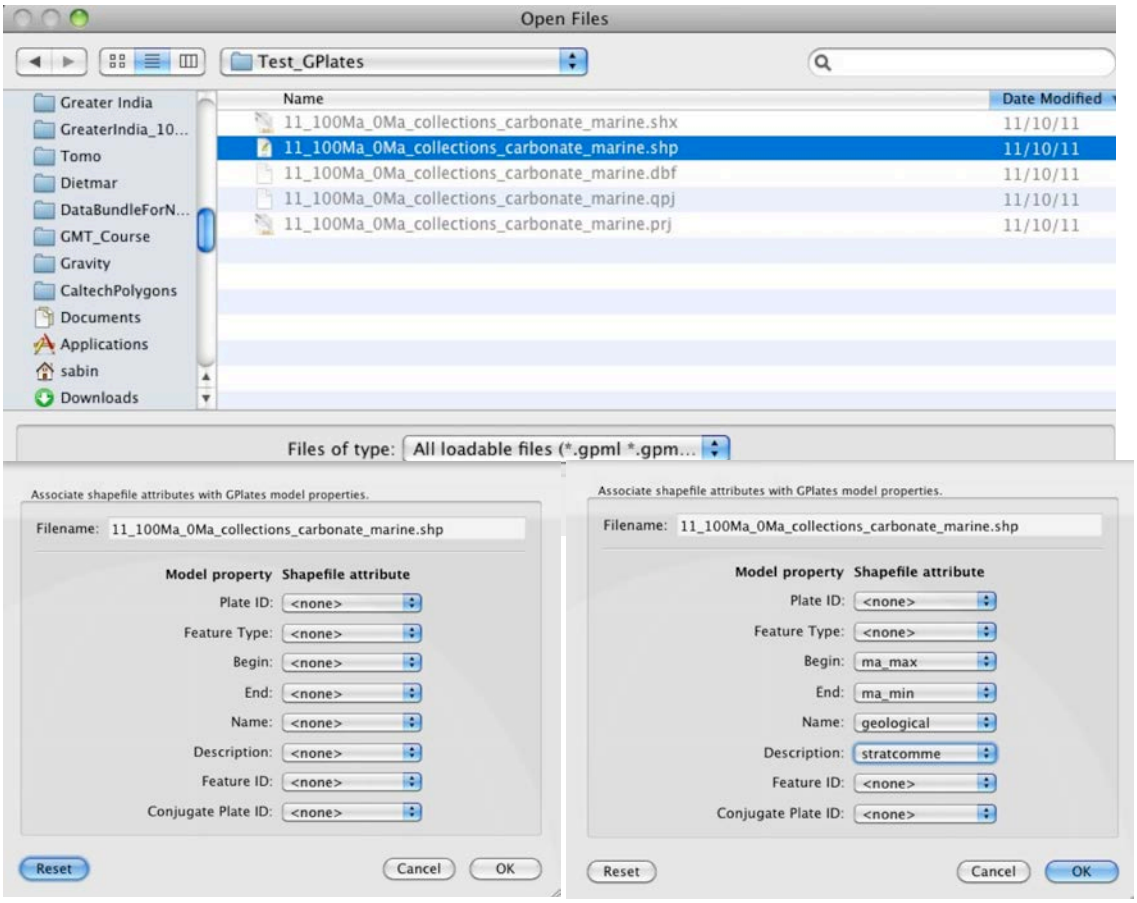
Note: The following instructions are to get raw data from the Paleobiology Database into GPlates. The data in the Supplementary material can be loaded straight into GPlates by following only Step 2a, as the Plate IDs and Begin/End Ages have been assigned.

1. Create a shapefile of your points representing your fossil data. You can do this in ArcGIS or the open-source equivalent QGIS[2] (which actually has a simpler facility to import xy data from text files, csv, etc.). It is important that your fossil data has a "Begin" and "End" age representing the age range. These fields will be important for GPlates in the next step.

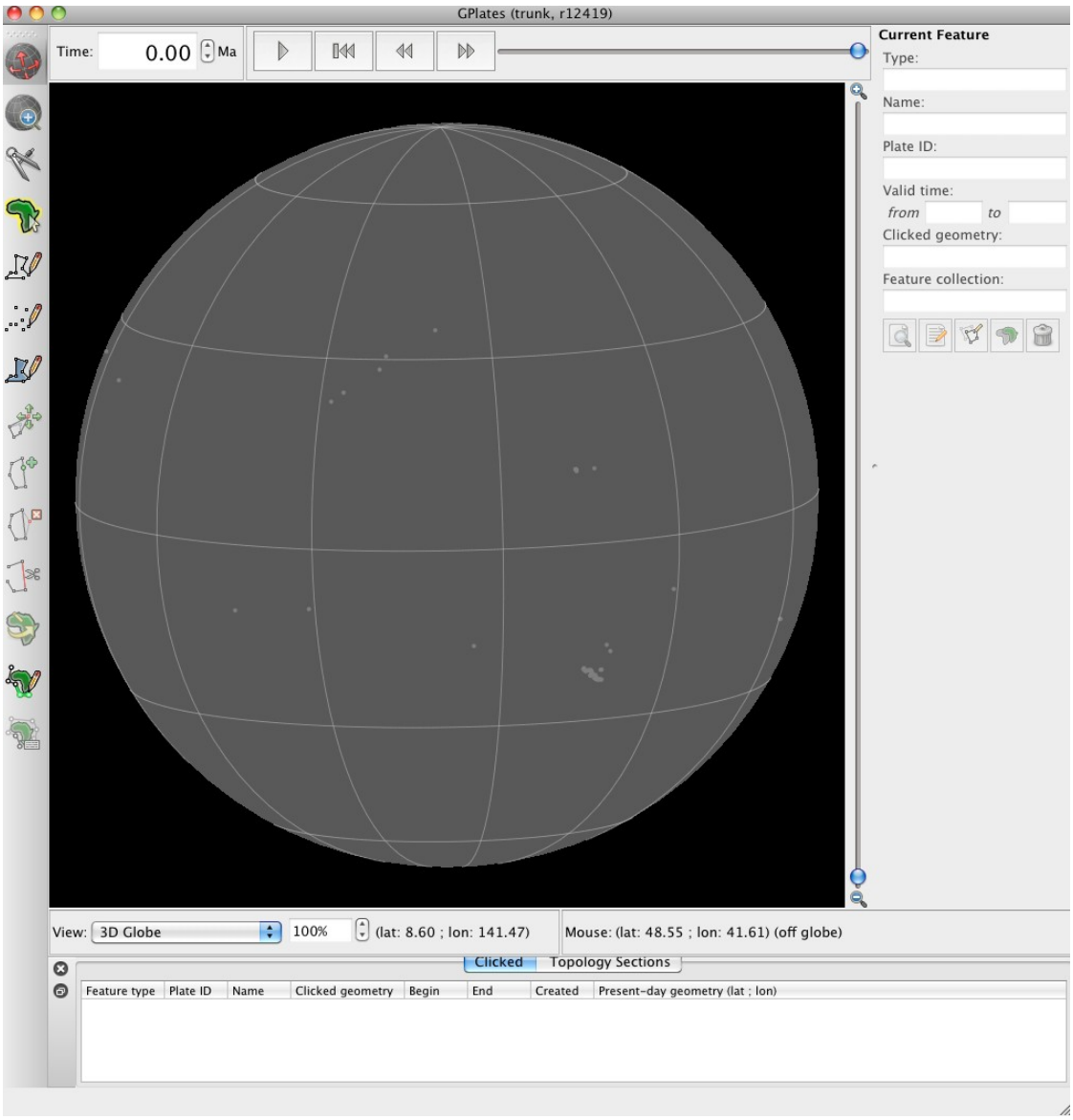
2a. You can now directly load that shapefile into GPlates. Open GPlates > Open Feature Collections > Navigate to your folder and select/open your shapefile.

2b. GPlates will ask you to "map" the shapefile fields. Make sure your "Begin" (ma_max) and "End" (ma_min) ages are assigned – this is crucial, as otherwise your fossil data will be reconstructed but will exist at all times.

You can also attach fields that represent the Name and Description of each datapoint. Click OK, and your points should load without a problem.



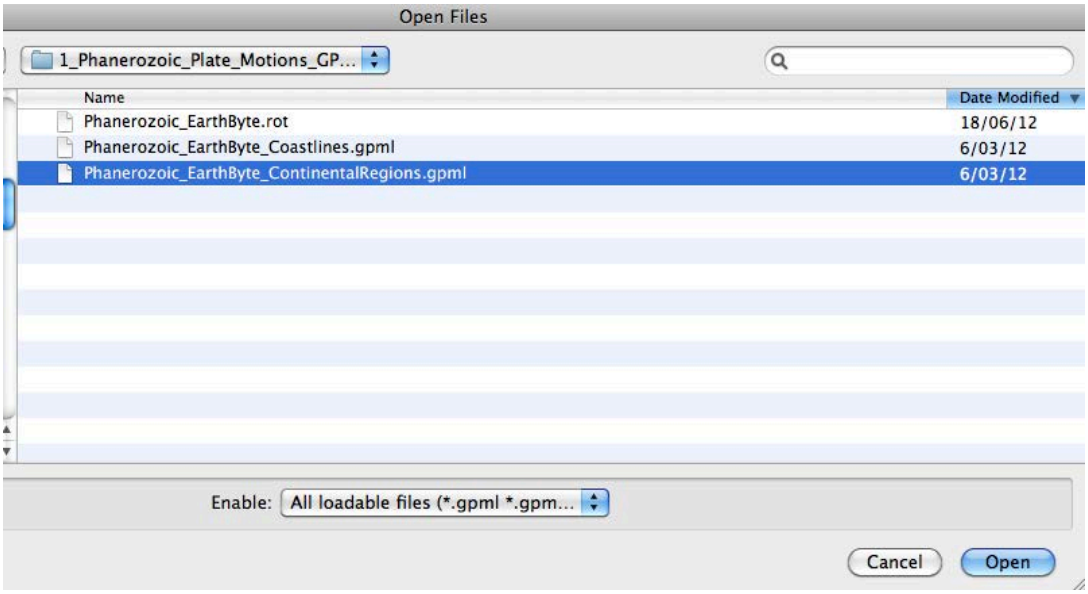
[1] www.gplates.org
[2] www.qgis.org

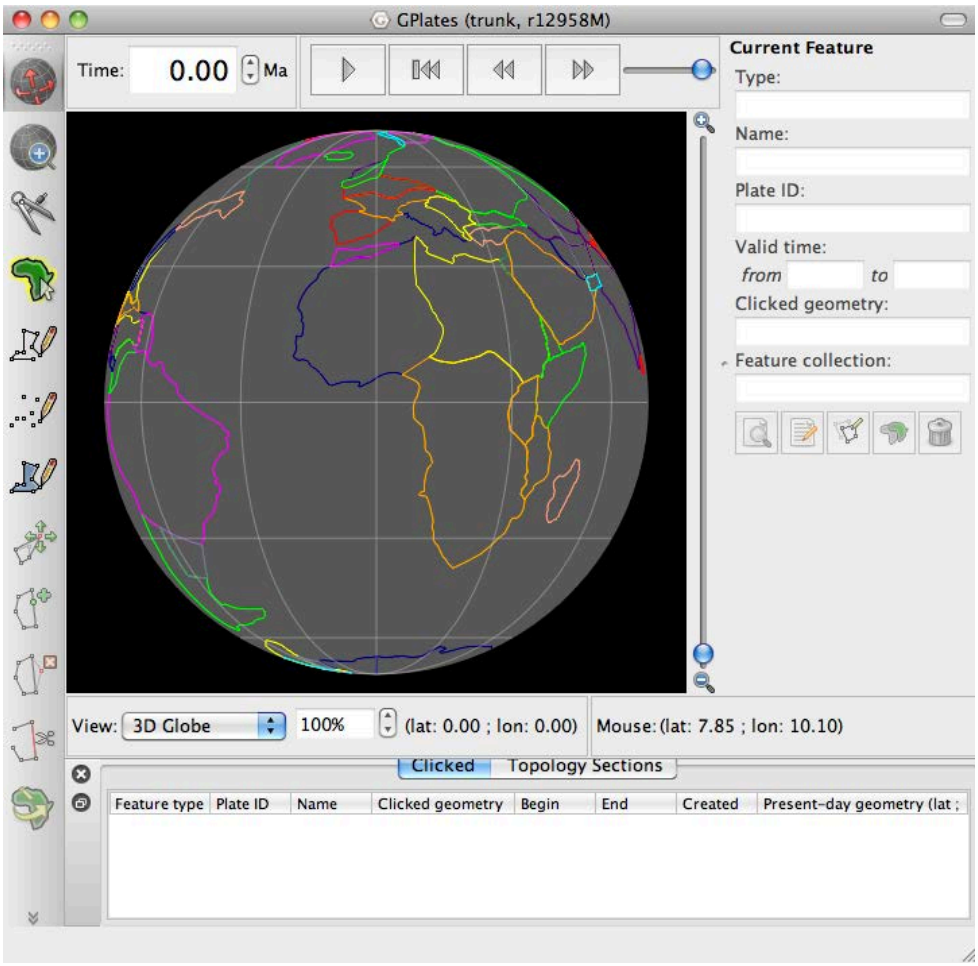

GPlates (trunk, r12419)
Time:
0.00
Ma
Current Feature
Type:
Name:
Plate ID:
Valid time:
from
to
Clicked geometry:
Feature collection:
View:
3D Globe
100%
(lat: 8.60 ; lon: 141.47)
Mouse: (lat: 48.55 ; lon: 41.61) (off globe)
Clicked
Topology Sections
Feature type
Plate ID
Name
Clicked geometry
Begin
End
Created
Present-day geometry (lat ; lon)

3. Now you will need to cookie-cut (i.e. Assign Plate ID) your fossil data. GPlates uses GPlates rotation files that you are likely to be familiar with, and so every geometry needs to have a Plate ID. Here you can use your own polygons that have a Plate ID associated with them, or you can use the one provided in the Sample Data that comes with GPlates.

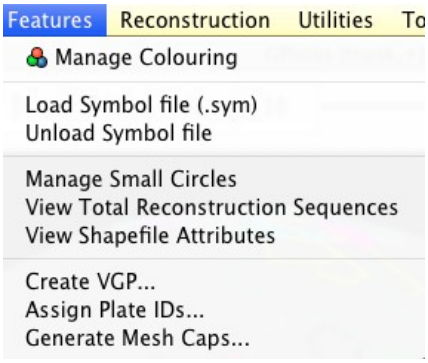
   You will need to load in the Continental Polygons from our Sample Data. Go to File > Open Feature Collection > Navigate to supplementary material, select and load: "Phanerozoic_EarthByte_ContinentalRegions.gpml"

   You will now see some coloured polygons in the main GPlates window.

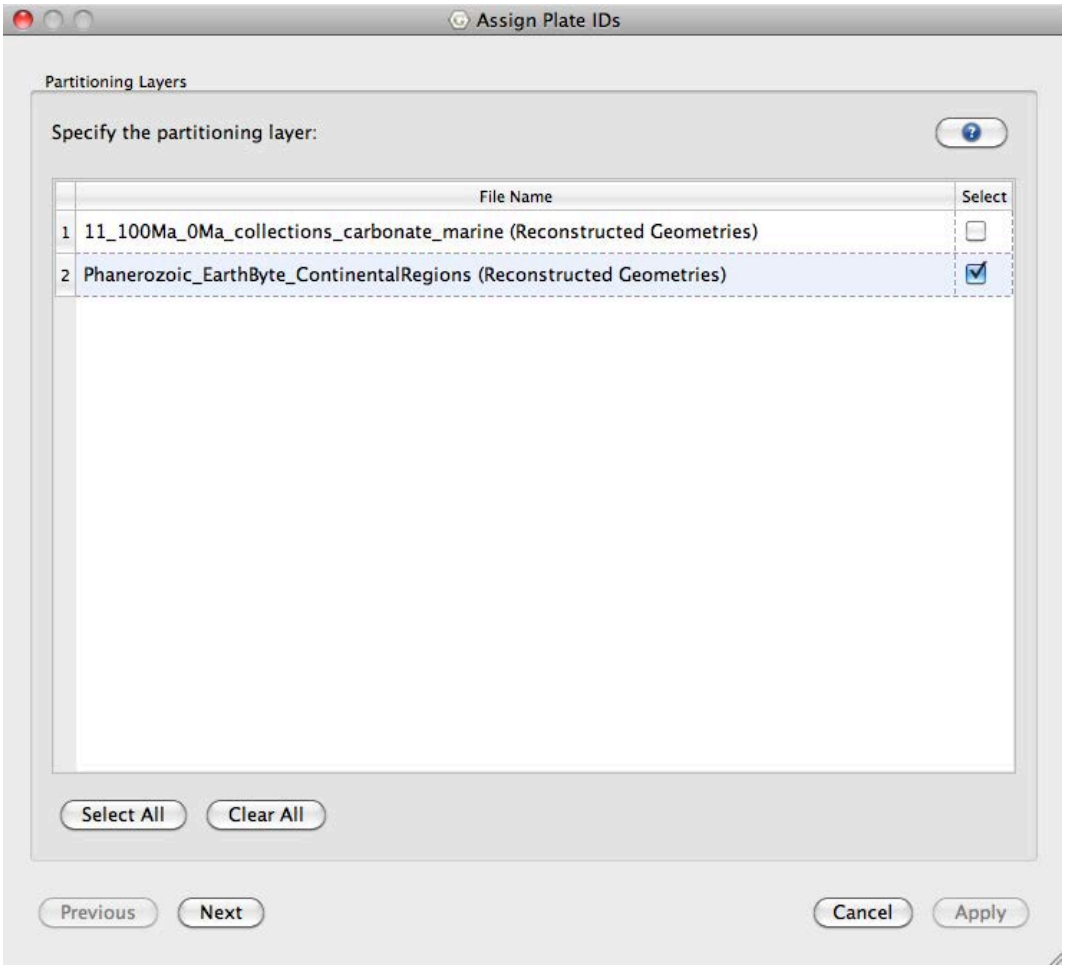




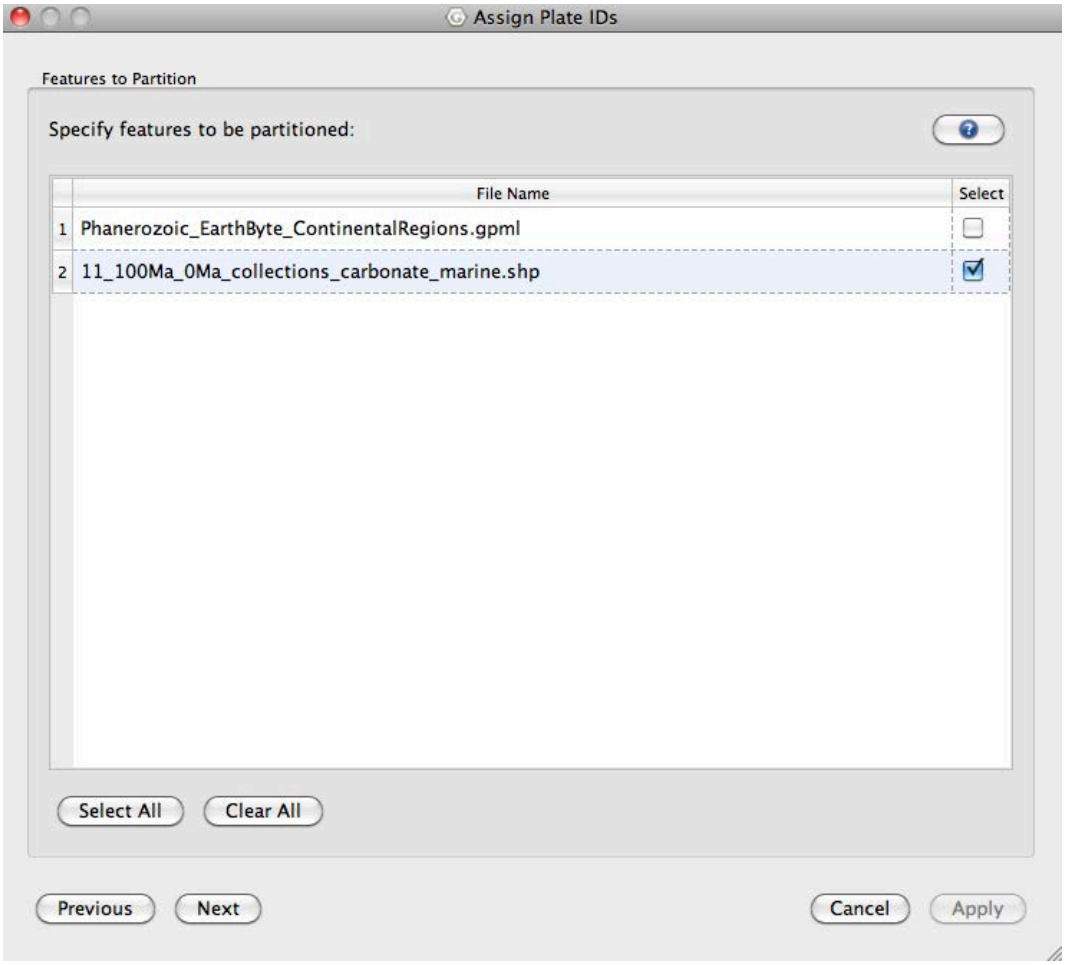
4. To assign Plate IDs, in the main GPlates window go to Features > Assign Plate IDs



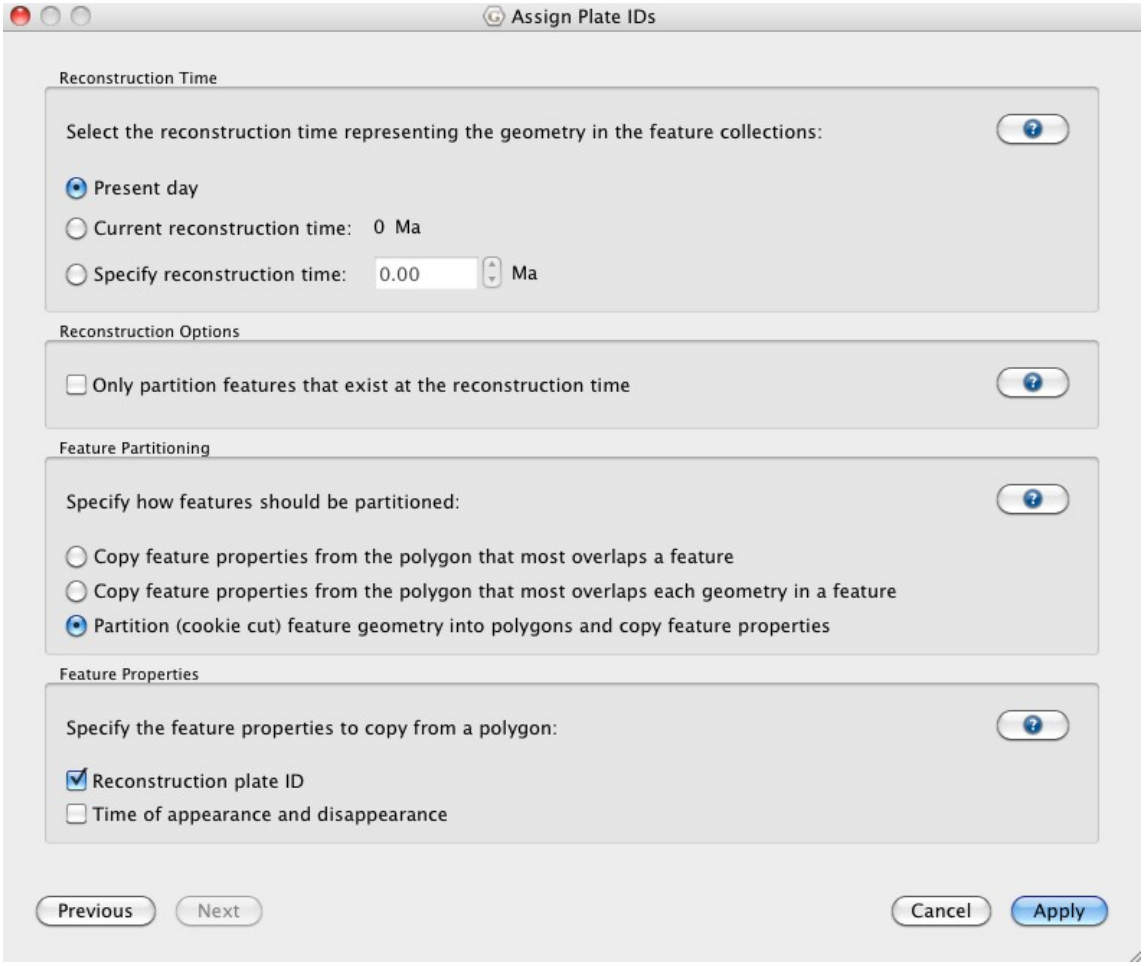
5. Specify the partitioning layer, which in this case are the Static Polygons. Click Next.



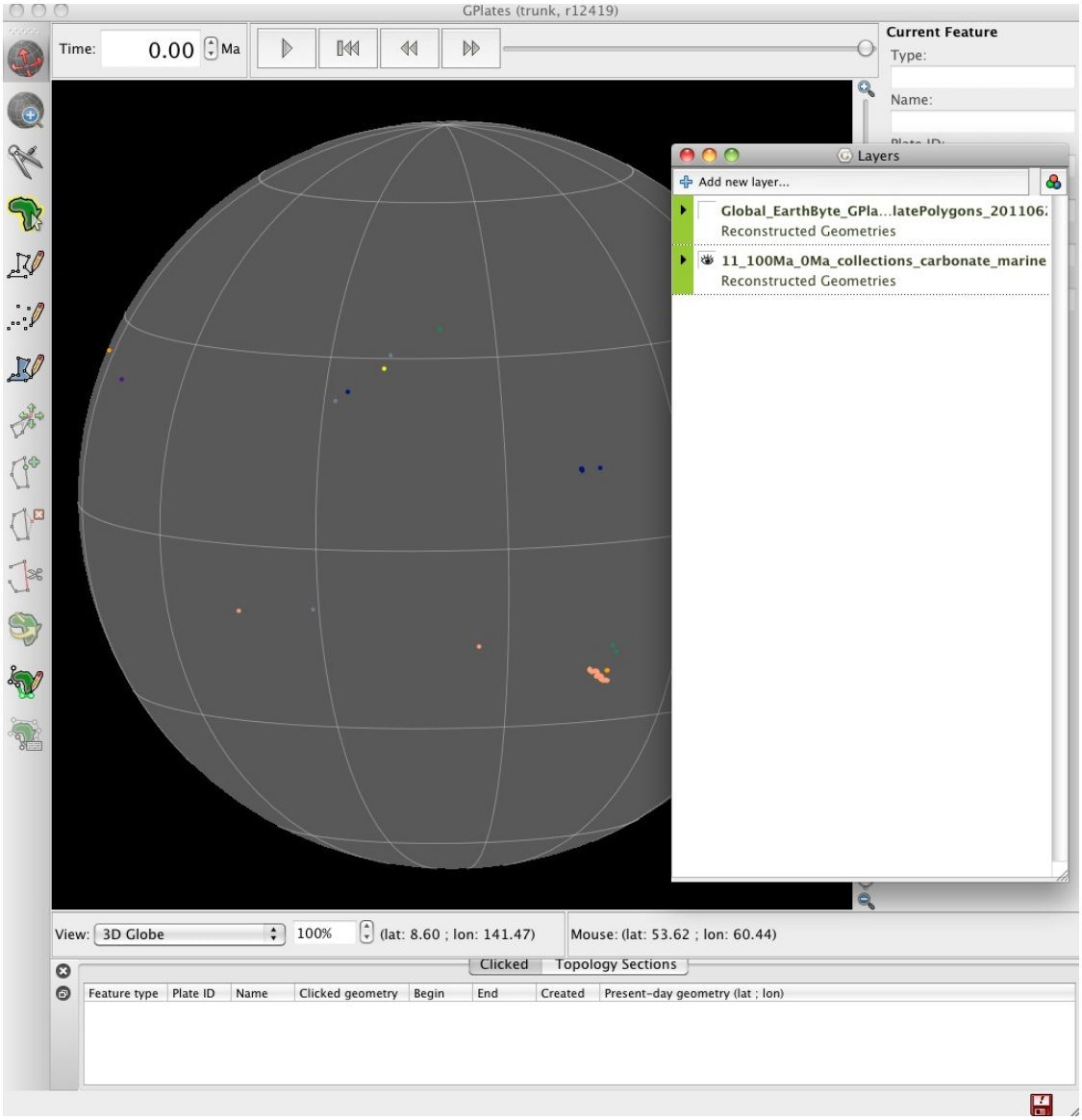
6. Specify the layer to be partitioned. In the example, it is the carbonates data from 100 to 0 Ma. Click Next.



7. The next screen allows you to make a choice whether you want to cookie-cut your data at the present-day or at some other reconstruction time. For the purposes of reconstructing fossils and other similar data, you would normally choose Present Day. Set the options as in the screen grab below and click Apply.

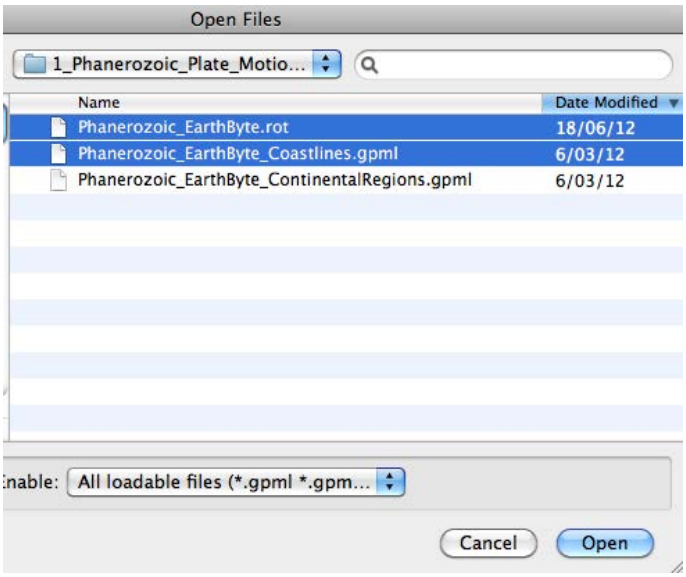


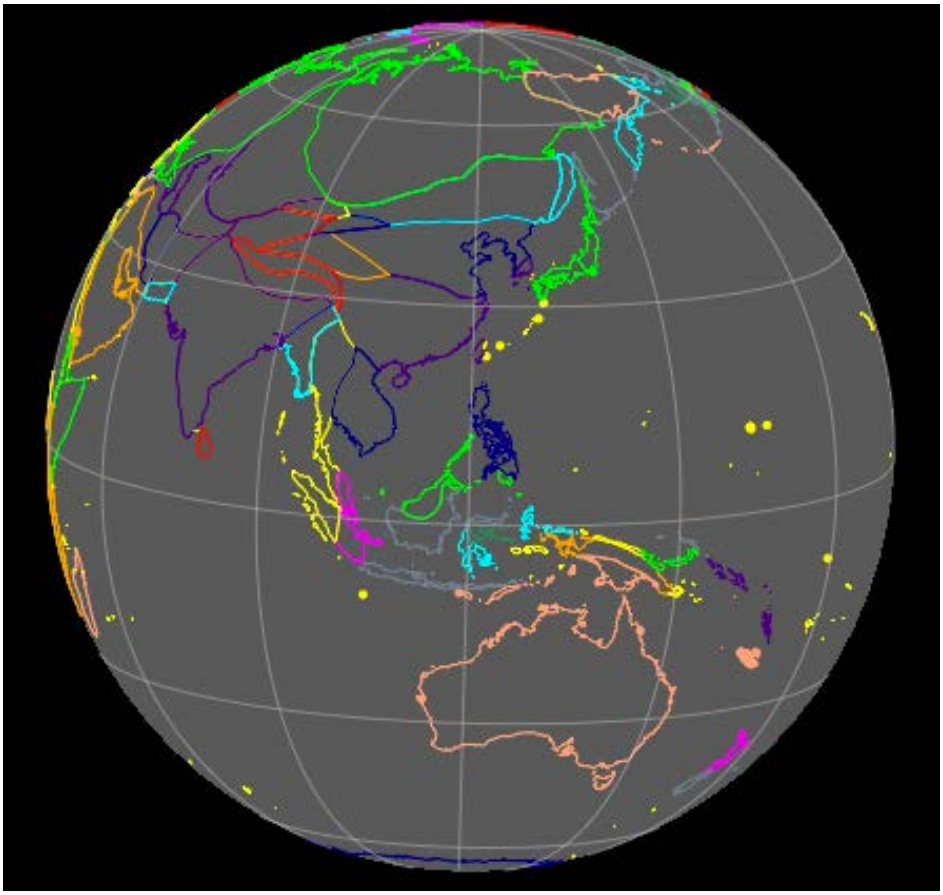
8. Your data is now ready to reconstruct. If you deactivate the Static Polygon layer visibility in the Layers window, you will see now that your data points have colours assigned based on the Plate ID. You can save the changes to your shapefile, or save out to a new shapefile or other format by going into File > Manage Feature Collections > “Save As” or “Save A Copy”



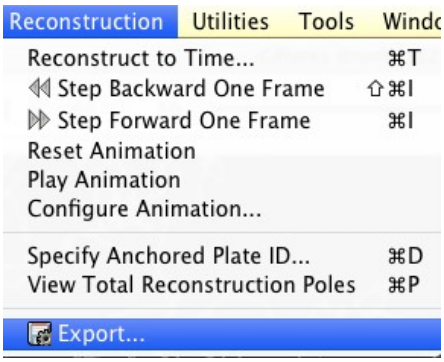
9. Load up the included plate motion model. Go to File > Open Feature Collection > Navigate to SampleData > DataBundleForNovices > Select the rotation (.rot) file and the coastline file for visual reference (.gpml).

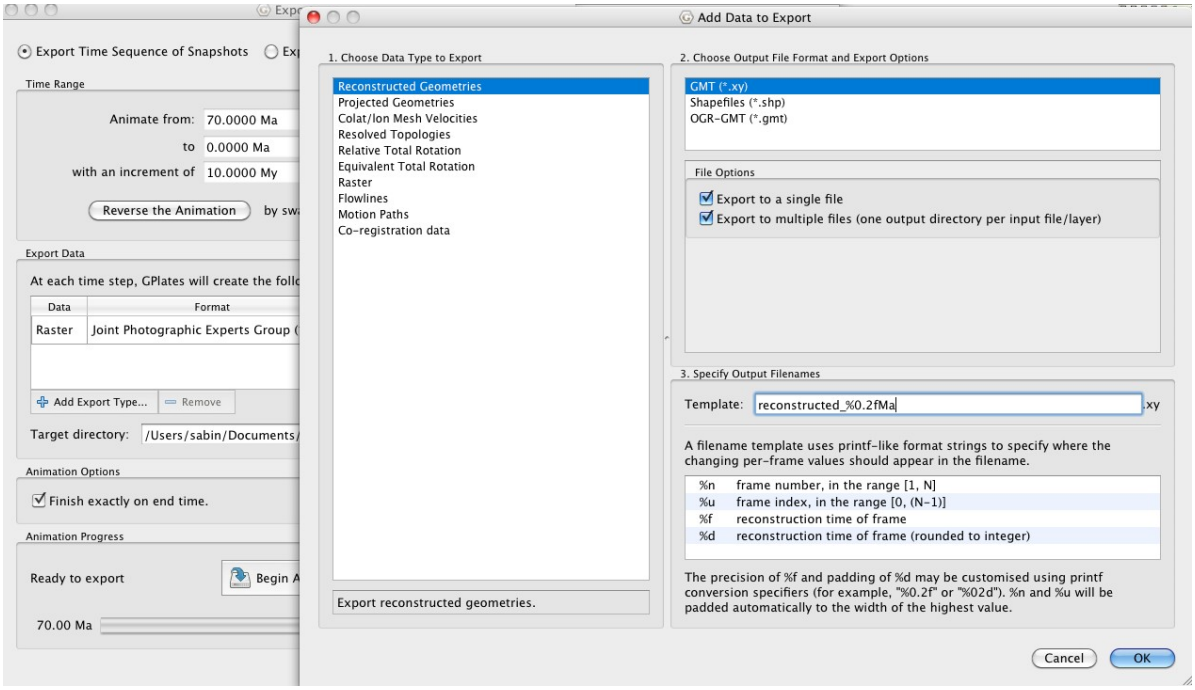
Phanerozoic_EarthByte_Coastlines.gpml
Phanerozoic_EarthByte.rot

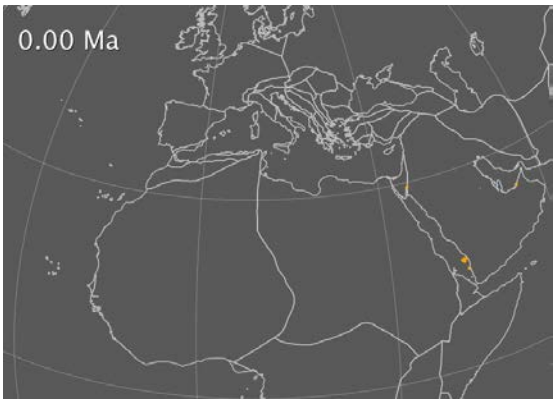


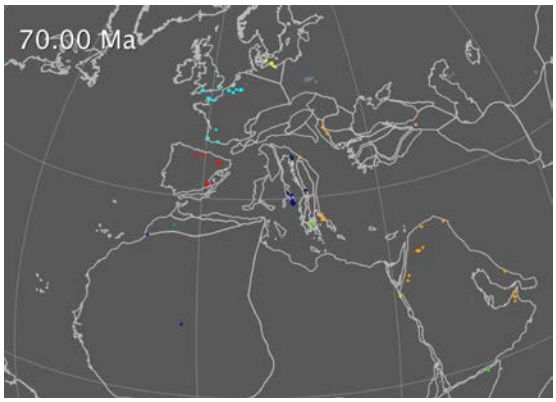


10. You can now reconstruct to any desired time, and choose to export animations as JPG files or other files. It is common to export Reconstructed Geometries as GMT XY or ESRI shapefile to create more detailed maps. Go to Reconstruction > Export > Select your time range > Click “Add Export Type” and choose Reconstructed Geometries > GMT (*.xy) (or any other type you want). Choose your export Target Directory. Click OK, and then click “Begin Animation”. GPlates will output your data into your desired directory.

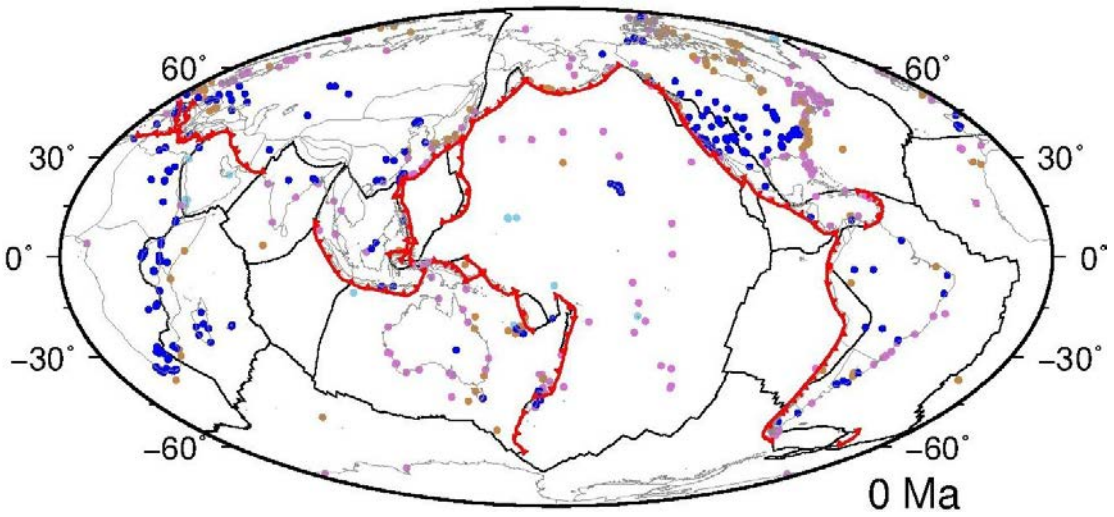








11. If exporting as GMT XY files, then you can write a script to extract header information from each data point. The example below shows a simple paleogeographical reconstruction exported from GPlates and plotted using GMT.



– General
– Terrestrial
– Siliciclastics
Carbonates